Appendix C

Historical Hydraulic Test Data

Appendix C-1

OWRC Pump Test in Goulais Wells (1968)

REPORT

Ontario Water Resources Commission

Municipality City of Sault Ste. Marie

Date of Inspection May 28, 1968
July 29-August 3, 1968
August 7, 1968
August 19, 1968

Re: Complaint of Well Interference

Field Inspection by E. Small, D. Wheeler, M. Corden, J. Miller

Report by J. Miller, Scientist

INTRODUCTION

On March 15, 16 and 17, 1963, staff members of the Ontario Water Resources Commission were present when two municipal wells, Goulais Avenue wells No. 1 and No. 2, owned by the Sault Ste. Marie Public Utilities Commission, were test pumped. It was determined that the operation of the wells interfered with numerous flowing domestic wells, but the extent of the interference could not be fully assessed during the testing period. The municipal wells were not put into production until the latter part of August, 1968; however, in the intervening years, they were occasionally operated for short periods of time. On each occasion when the wells were in operation, complaints of well interference were brought to the attention of the OWRC or the Public Utilities Commission. The Public Utilities Commission installed water mains in areas where it was anticipated that the greatest number of wells would be affected.

As a number of the complainants live in outlying areas which were still unserviced, arrangements were made to test pump the municipal wells so that the effect, if any, on the outlying domestic wells could be observed. During the latter part of July, 1968, staff members interviewed more than 80 persons who reside in the vicinity of the Goulais Avenue wells. The municipal wells were then put into operation for a period of 19 days during which time water levels were observed in a number of observation wells.

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HYDROGEOLOGY

According to the Department of Lands and Forests surficial geology map S465, the city of Sault Ste. Marie is located on a lacustrine clay plain which was deposited during the glacial lake stages of Lake Huron. The plain is bordered to the north by a Precambrian outcrop (see Drawing No. 1). Cross-sections compiled during the 1963 investigation show that the clay plain grades to the north into a predominantly sandy material (see Drawing No. 2).

As shown on bedrock geology map 2108 of the Ontario Department of Mines, the overburden is directly underlain by Cambrian sandstones of the Jacobsville formation, which abut against the Precambrian outcrop. The sandstone which is the main aquifer in the area, is probably recharged by infiltration through the coarser overburden from rainfall and direct runoff from the Precambrian upland.

The higher elevation of the terrain close to the Precambrian upland produces a positive piezometric head in the aquifer in the lower-lying areas of the clay plain. Ground-water movement is probably from north to south.

Most of the domestic wells in the area are predominantly 2-inch drilled wells and obtain water from the top of the sandstone or from lenses of sandy material within the clay overburden. Nearly all the wells in the lower-lying areas flow.

MUNICIPAL WELLS

The Goulais Avenue municipal wells were drilled at the intersection of Goulais Avenue and the Second Line in 1952, by the Public Utilities Commission. According to the original well records, both

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wells were drilled to a depth of 162 feet, through 160 feet of red and blue clay and two feet of sandstone bedrock. Both wells are 16 inches in diameter and were originally left unscreened. The completed wells had a piezometric head of 14.75 feet above ground level.

On March 15, 16 and 17, 1963, the Public Utilities Commission test pumped the Goulais Avenue No.2 well, presumably to evaluate the yield before incorporating the wells into the existing municipal system. Mr. V. R. Dixon, formerly of the Division of Water Resources, was present at the test. The well flowed before the test, but upon being pumped at 1000 gpm for 45 hours, the water level was 16.61 feet below the top of the casing. The height of the casing above ground is not known. A maximum drawdown of 1.53 feet was measured in a well located 8,500 feet northeast of the municipal wells.

During the test, 37 complaints of well interference were received from home owners. These were located on unserviced streets within 3,200 feet of the pumped well. The Sault Ste. Marie Public Utilities Commission delivered water until the problem of interference subsided.

It was found that nearly all the wells which were affected had flowed above ground level. It is likely that their piezometric heads were at approximately the same elevation as those of the municipal wells. For the most part, the persons who complained of interference did not have their wells equipped with pumps.

Subsequently, at the request of Mr. H. L. Harris, the Manager of the Sault Ste. Marie Public Utilities Commission, the Ontario Water

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Resources Commission's policy with regard to compensation for the restoration of water supplies to persons with flowing wells was outlined in a letter dated May 7, 1964. In brief, this letter stated, firstly, that the beneficial use of ground water should not be curtailed simply to preserve the flowing condition of a well. Secondly, the letter stated that compensation would be recommended for the owners of wells which were adequately constructed and had yielded an adequate supply, if the following modifications were required because of interference:

1. Changing from a shallow-well pump to a deep-well pump
2. Modification or replacement of a deep-well pump
3. Deepening a well
4. Drilling a new well.

Note that under this policy, no action was required on behalf of the owner of a flowing well unless the water level was lowered beyond the lifting capacity of a shallow-well pump, or approximately 22 feet.

Upon being informed of the OWRC's policy with regard to well compensation, the Public Utilities Commission further expanded upon it to comply with their own objectives. Under this policy the Public Utilities Commission would waive the normal $85.00 charge for a connection to this watermain in cases where a flowing well which was not equipped with a pump was affected. Nonetheless, it should be pointed out that any recommendations for compensation by the OWRC are based on its policies. In the meantime, the municipal water system was extended to provide service to areas where it was anticipated that the greatest number of wells would be affected.

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During August, 1966, Goulais Avenue well No. 1 was deepened to 183 feet, and well No. 2 was deepened to 179 feet, into gray and red sandstone and well screens were installed. The wells flowed at a rate of 60 gpm each.

It was necessary to lower water levels while the wells were being deepened and it was planned to have one of our staff in the area to observe these levels. A house-to-house survey was undertaken to obtain data on as many domestic wells as possible before the municipal wells were pumped but the proposed pumping was delayed, and our staff member was recalled to Toronto to fulfil previous commitments. As a result the extent of interference was not determined at that time.

On September 26, 1966, a letter was received from Mrs. James Burns of Asquith Street. Although her property was serviced by the municipal water system, Mrs. Burns complained about the loss of flow from her well during the deepening and testing of the Goulais Avenue wells during August and September, 1966. This office did not recommend that any action be taken on Mrs. Burns' behalf by the Sault Ste. Marie Public Utilities Commission.

During December, 1967, the Goulais Avenue wells were again operated briefly, with the result that additional complaints of interference were received by the Public Utilities Commission from numerous well owners. Pumping operations had stopped before any complaints were received at thisoffice and no investigation was carried out by OWRC.

On May 22, 1968, this office was informed by Mr. H. L. Harris, of the Sault Ste. Marie Public Utilities Commission, that well interference had been reported by three persons subsequent to operations of the Goulais

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Avenue wells during the first part of May, 1968.

An investigation was carried out on May 28, 1968, by a staff member. During the investigation it was learned that one of the Goulais Avenue wells had been pumped at 850 gpm from May 6 to May 13, then both wells had been pumped at a combined rate of 1400 gpm from May 13 to May 17. Upon receiving the complaints of interference on May 16 and 17, the Public Utilities Commission stopped pumping operations for approximately one week. Pumping operations were again resumed at a reduced rate of 850 gpm a few days before the investigation.

At the time of the investigation the interference problem no longer existed; however, the three complainants, Mr. Wm. Garson, Mr. T. Wilding, and Mr. A. Wilding, were interviewed (Nos. 64, 51, and 68, respectively, on Drawing No. 3). None of the three complainants had access to the municipal water system.

Mr. Thomas Wilding complained of a considerable reduction in the rate of flow from his well, which normally flows at approximately 25 gpm. Mr. Wm. Garson complained of a loss of flow from his well, which normally flows at a low rate. The OWRC's policy with regard to flowing wells was outlined to Mr. T. Wilding and Mr. Garson but as their wells were again flowing normally at the time of the investigation, no definite conclusions concerning their complaints could be reached.

Mr. Alex Wilding complained that during the operation of the municipal wells, his pump had broken suction, and he had had to lower the intake from 21 to 31 feet below the top of the well casing. Although all the complainants had an adequate water supply at the time of the investigation, it was thought that the complaints could possibly be valid, but the extent of any interference which may have occurred could not then

be determined. Shortly after the investigation, the Public Utilities Commission settled privately with Mr. A. Wilding and also connected a pump to Mr. Garson's well.

On June 21, 1968, a petition to permanently stop the operation of the municipal wells so that private wells would not be affected, was received at this office from Mrs. William Garson. The petition was signed by 107 persons, 29 of whom were alleged to have experienced interference.

During July, 1968, arrangements were made with the Public Utilities Commission for our staff to test pump the Goulais Avenue wells in order to determine which wells were seriously affected so that steps could be taken to ensure that the owners had an adequate water supply when the municipal wells were put into operation.

Pumping Test of August, 1968

Prior to test pumping, staff members interviewed all the petitioners that could be reached, particularly those persons who were reported to have experienced interference with their water supplies. It was found that approximately 31 of the petitioners already had access to city water. Although the petition requested that the municipal wells not be put into operation, many of the petitioners had signed for other reasons, and still others were confused about the actual issue. A few of the petitioners' names appeared twice and some others did not own wells. A list of the petitioners and complainants who were interviewed during the investigation is presented in Table 1. Their locations are shown on Drawing No. 3.

The two municipal wells were put into operation at 9:00 a.m. on Wednesday, July 31, at a combined rate of 1570 gpm. This rate was reduced

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to 1210 gpm at approximately 2:00 p.m. on Thursday, August 1, because of difficulty in maintaining the proper level in the municipal reservoir. The wells were pumped continuously until 1:00 p.m. on August 19, 1968.

A number of representative private wells and two test holes were used as observation wells during the test. A list of these wells is presented in Table 2, and their locations are shown in Drawing No. 3.

Time-drawdown curves have been prepared from the water-level measurements taken in the two pumped wells and from test holes 1-65 and 1-66 (see Drawings No. 4 to 7). Note that all the drawdown measurements that are plotted on the graphs for the two pumped wells and test well 1-65 have a correction factor of eleven feet added to them to allow for the positive hydrostatic head.

ANALYSIS OF PUMPING TEST DATA

As shown on Drawing No. 4, the drawdown measurements obtained during the first hour in well No. 1 were rather erratic, because of the difficulty in operating the air line gauge. These measurements are not considered to be accurate. Maximum drawdown in well No. 1 during the test was approximately 83 feet. Drawdown in well No. 2, as shown on Drawing No. 5, was 62 feet at the end of the pumping period. Similarly, maximum drawdown in test hole 1-65 was 45 feet, as shown on Drawing No. 6.

One minute after the pumps were shut off, the water level in well No. 1 had recovered 50 feet. The water level in the well reached ground level approximately 105 minutes or 1 3/4 hours after pumping had ceased. Similarly, the water level in well No. 2 recovered 30.5 feet, in the first minute after the pumping had stopped and reached ground level approximately 110 minutes afterwards. Difficulty was encountered in

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measuring the water level in test hole No. 1-65 immediately after pumping stopped because of the rapid recovery; however, after eight minutes, the water level had recovered 19 feet. The well began to flow approximately 325 minutes after pumping had ceased. Note that it took much longer for the water level in the test hole to recover to ground level than in the pumped wells. This is possibly due to a considerable variation in the efficiency of the wells. Interference observed in domestic wells is dealt with in the following paragraphs. The complainants are grouped together according to localized areas.

Goulais Avenue and Cooper Street

During the pumping test, interference was observed in Mr. P. Ironside's well(No. 37). Mr. Ironside has a 2-inch drilled well with the pump intake set at 17 feet. Before the municipal wells were pumped, Mr. Ironside's well flowed, but it ceased to flow almost immediately after the municipal wells were put into operation. At the end of the test, the water level in the well was approximately 17.5 feet below ground level. Mr. Ironside stated that he would try to lower his intake to the maximum operational depth of his shallow-well pump, rather than connect to the water main which runs in front of his property, as he intended to move his house.

Mr. J. Lennox, (No. 38) of Cooper Street, complained of a loss of flow from his well, together with silty water. His well is equipped with a pump connected to the top of the casing. No measurements could be taken, but the water level in the well was not lowered beyond the reach of the pump. Mr. Lennox's property is serviced with city water, but like a number of others in the area, he prefers to use his own well when possible.

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Borden and Laurier Streets

The water level in Mr. P. Carbone's well (No. 36) was lowered to ground level three days after pumping started. On August 16, the water level in the well was 3.25 feet below the top of the casing, or approximately 4 feet below ground level. The wells of Mr. R. Campbell (No. 31) and Mr. G. Oceti (No. 27) also responded in a similar way.

Mr. J. E. McCullough (No. 29) complained to the Public Utilities Commission of interference after the field investigation was completed. Mr. McCullough was contacted by this office, and he reported that on September 2, 1968, the water level in the well was 2 to 2.5 feet below ground level. The Goulais Avenue wells were being pumped at that time. Mr. McCullough stated that his well was originally equipped with a shallow-well pump connected directly to the casing; however, to obtain water, he was obliged to install a length of intake pipe into the well.

Mr. H. Avery (No. 23), whose property is located approximately 2000 feet west of the Borden and Laurier Streets area, owns a flowing well which supplies a number of houses. Shortly before test pumping ceased, the well stopped flowing; however, it was not made accessible for measurements. At the time of the investigation, Mr. Avery had access to the municipal water system, but would not have his houses serviced as he objected to paying for the water.

Chippewa Street

In the vicinity of Chippewa Street, the wells of Messrs. B. Bridge (No. 42), H. Schors (No. 43), A. Suriano (No. 46), T. Telford (No. 49) and Thomas Wilding (No. 51), who complained of interference during May, 1968, were used as observation wells.

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Mr. A. Suriano complained to this office on July 24, 1968, concerning the stoppage of flow from a well on a property which he owns on Chippewa Street. The property is rented by Mr. C. Grozelle (No. 46). Muddy water was reported to have flowed from the well on occaions during the year prior to it becoming plugged in July, 1968. Mr. Suriano thought this was caused by the pumping of the municipal wells. Subsequently, a new well was drilled which also flowed.

Mr. T. Telford (No. 49) reported that his flowing well began producing dirty water during the spring of 1968. Subsequently, the well became plugged and a new well was drilled during the summer of 1968. Mr. Telford also felt that the operation of the municipal wells was responsible for the problem.

None of the wells on or near Chippewa Street, including the new wells of Messrs. Suriano and Telford and that of Mr. T. Wilding showed any noticeable change in the rate of flow throughout the pumping test.

Allen's Side Road

The drawdown and recovery curves for test well No. 1-66, which is located 1.05 miles west of the pumped wells, are shown in Drawing No. 7. The static level of this well was approximately seven feet below the top of the casing before the pumping test commenced. At the end of the test, the water level in the well was approximately 18 feet below the top of the casing. Recovery of the water level did not start until approximately 90 minutes after pumping had stopped.

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Complaints were received from three persons living near the intersection of the Second Line and Allen's Side Road. These were Messrs. A. Rebellato, J. King and J. Taillefer.

Mr. A. Rebellato (No. 16) complained that he was without water on August 19, 1968. According to the driller's report, the well was drilled in 1965 to a depth of 137 feet. The static level of the completed well was reported to be ten feet. On the day that Mr. Rebellato complained, the water level in the well was 23.15 feet below ground level. The well was equipped with a shallow well pump with the intake set at approximately 24 feet below ground level.

The amount of drawdown in Mr. Rebellato's well corresponded closely with the drawdown measured in test hole No. 1-66, which is located approximately 700 feet to the east. At the time of the investigation, the Public Utilities Commission acknowledged responsibility for the lowering of the water level in Mr. Rebellato's well, and as he did not have access to the municipal water system, he was advised to install a deep-well pumping system. Mr. Rebellato has submitted a completed Affidavit of Claim to this office for the costs involved in the restoration of his water supply.

A complaint was also received from Dr. J. King (No. 21), whose drilled well supplies a number of houses. The static level in Dr. King's well was measured prior to the end of the test, by Mr. K. Wallenius, of the Public Utilities Commission, and it was found that the water level in the well was approximately three feet below ground level. Dr. King does not have access to the municipal water system.

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Mr. J. Taillefer (No. 1) complained that water from his well had been silty since the early spring of 1968. Two water-level measurements were obtained from the well on August 1, 1968, but no interference could be determined. Silt could be felt at the bottom of the well when it was measured with the tape. No further measurements were obtained as the well head had to be dismantled and the drop pipe removed in order to make the well accessible. It was reported that the well stopped flowing a number of years ago.

Mr. B. Yeaman, who is located on the Second Line approximately 1 3/4 miles west of the Goulais Avenue wells, complained of obtaining silty water from his drilled well. No shortage of supply was reported. The silty water was alleged to be caused by the operation of the Goulais Avenue municipal wells. Mr. Yeaman was interviewed during the pumping test and he stated that the well water had been silty at various times since the winter of 1967-1968. During a personal visit to this office on November 19, 1968, Mr. Yeaman reported that the well was partially constructed by himself, by drilling a 4-inch hole approximately 83 feet to bedrock. The well was completed by a drilling contractor who sunk a 2-inch casing to a depth of 170 feet.

Moss Road

Mr. Wm. Garson (No. 64), who complained during May, 1968, said that the flow from his well had stopped approximately two days after the pumping test was started. The shallow-well pump which was connected directly to the casing occasionally pumped sandy water from the well; however, when the well was pumped steadily, the water became clear.

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Approximately three days before the end of the test, Mr. Garson measured the water level in the well as 18 inches below ground level. On the same day, Mr. Garson pumped the well for a period of time, presumably long enough to fill the pressure tank, and measured the water level in the well to be seven feet below ground level. This measurement was not taken immediately after pumping stopped, for it would have taken some time for Mr. Garson to walk approximately 300 feet from the house to the well and to open the well.

CONCLUSIONS

From the information obtained during the pumping test it was observed that the taking of water from the Goulais Avenue municipal wells had an effect on the water levels in private wells over a widespread area. Generally the lowering was not large.

No interference with wells on or in the vicinity of Chippewa Street was detected; therefore, the complaints of Messrs. Suriano, Telford and Wilding are considered to be invalid.

In the vicinity of Laurier and Borden Avenues, water levels were lowered to about four feet below ground level, as measured in Mr. Carbone's well. Wells in this area could have continued to supply water had they been equipped with properly-installed shallow well pumps. This is also true in the case of Dr. King's well. It is concluded, therefore, that the supplies of Messrs. McCullough, Avery and King do not require restoration under OWRC policy. City water is available to these complainants with the exception of Dr. King.

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Interference to Mr. Lennox's well was not sufficiently serious to render his shallow-well pump inoperable. The silty water which his well produced when his pump was operated is due to the construction of his well and the physical properties of the aquifer rather than a direct result of the operation of the municipal wells. The silty water produced by Mr. Yeaman's and Mr. Taillifer's wells is also due to the same causes. There did not appear to be any lowering of the water level in either of the latter wells.

Mr. Ironside's water supply was significantly affected; however, it may be possible for Mr. Ironside to obtain an adequate supply of water by lowering his intake to the maximum lift of his pump. If prolonged operation of the municipal wells lowers the water level in Mr. Ironside's well below the reach of his pump, it may be necessary to connect to the municipal system.

Mr. Garson's well was slightly interfered with, but an adequate water supply was obtained with a shallow-well pump which the Public Utilities Commission connected to the well. On the basis of OWRC policy regarding interference with flowing wells, restoration of Mr. Garson's supply would not be required.

To date, one valid claim of interference warranting the payment of compensation has been found, that of Mr. A. Rebellato. From information gathered during the investigation it is concluded that the pumping of the Goulais Avenue wells lowered the level of Mr. Rebellato's well, thereby necessitating the conversion from a shallow-well pumping system to a deep-well pumping system.

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Action Taken To Date

During September, 1968, letters were sent to the main complainants, Messrs. King, McCullough, Rebellato, Ironside and Garson and to the Public Utilities Commission advising them of our conclusions. Affidavit of Claim forms were forwarded to Mr. Rebellato. The completed forms have been returned to us along with invoices for the work done.

RECOMMENDATIONS

It is recommended that:

(1) A copy of this report be forwarded to the Sault Ste. Marie Public Utilities Commission.

(2) Mr. Rebellato's claim be processed and forwarded to the Sault Ste. Marie Public Utilities Commission with our recommendation for payment.

All of which is respectfully submitted,

Prepared by: J. A. Miller,
Scientist.

Supervised by: R. C. Hore,
Supervisor,
Water & Well Management Branch.

April 14/69

dm

for K. E. Symons,
Director,
Division of Water Resources.

TABLE 1

WELL OWNERS - SAULT STE. MARIE, ONTARIO

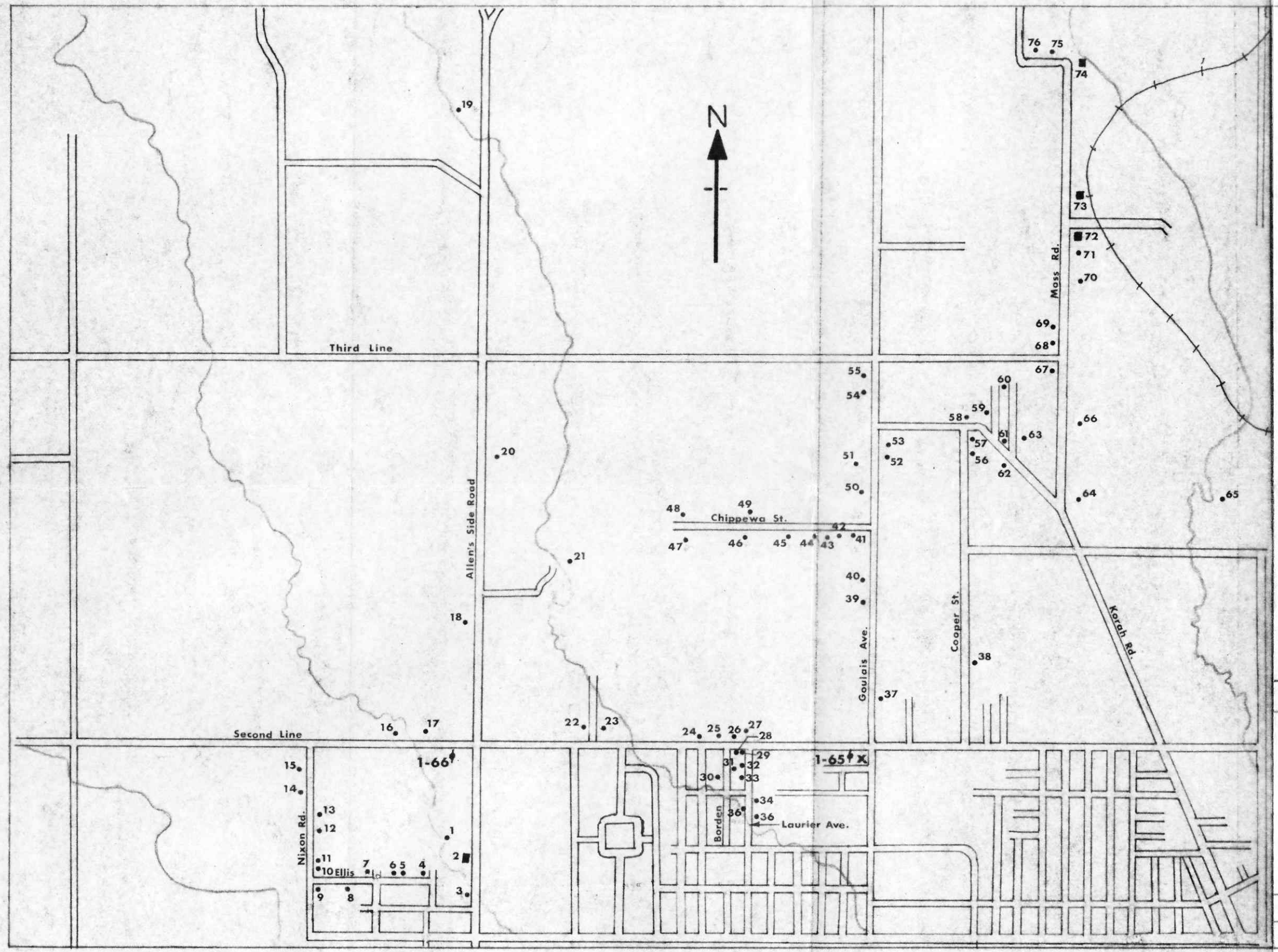
1 9 6 8

1. J. Taillefer
2. J. Baker
3. A. Porter
4. D. Snider
5. N. Butterworth
6. G. Jordan
7. R. Mills
8. J. Horsepool
9. L. Burch
10. P. Stewart
11. A. Gunn
12. W.Solonika
13. C. Thompson
14. A. Paciocco
15. M. North
16. A. Rebellato
17. C. Bovingdon
18. E. Hay
19. H. Avery (Bar-X Trailer Park)
20. G. Miller
21. J. King
22. T. Mirkdale
23. H. Avery
24. T. Hurley
25. H. Miskiw
26. A. Holbrook
27. G. Oceti
28. H. Thomas
29. J. McCullough
30. G. Palombi
31. R. Campbell
32. G. Charette
33. J. Deschenes
34. R. Bye
35. R. McMenemy
36. P. Carbone
37. P. Ironside
38. J. Lennox
39. F. Trembinski
40. S. Oliver
41. C. Stearns
42. B. Bridge
43. H. Schors
44. L. Long
45. S. Dyni
46. C. Grozelle (Owner - A. Suriano)
47. H. Case
48. F. Taylor
49. T. Telford
50. J. Telford
51. T. Wilding
52. G. Jurich
53. H. Tammela
54. L. Sharp
55. J. Myers
56. W. Willis
57. R. Lefave
58. A. Bolduc
59. D. Wilson
60. G. Campbell
61. E. Erickson
62. W. Archibald
63. L. Chamberlain
64. Wm. Garson
65. J. Garson
66. W. O'Neill
67. W. Pearse
68. E. Palmer
69. A. Wilding
70. A. Gallagher
71. H. McMillan
72. A. King
73. J. Beurkle
74. R. Masters
75. M. Oja
76. A. Oja

TABLE 2

Wells Observed During Pumping Test

Well	Static Level Before Pumps Started	Level at End of Pumping	Length of Time Before Well Ceased to Flow
Well No. 1	Flow (approximately 11 ft. above ground level)	72 ft. below ground level	-
Well No. 2	Flow (approximately 11 ft. above ground level)	50.5 ft. below ground level	-
Well No. 1-65	Flow (approximately 11 ft. above ground level)	33.6 ft. below ground level	-
Well No. 1-66	7 ft.	18 ft.	-
H. Avery (23)	Flow	Near Ground Level	-
B. Bridge (42)	Flow	Flow	-
R. Campbell (31)	Flow	3 ft. approximately	2 days
P. Carbone (36)	Flow	3 ft. approximately	2 days
W. Garson (64)	Flow	2 ft. approximately	2 days
P. Ironside (37)	Flow	17.5 ft.	-
J. King (21)	Flow	3 ft.	16 days, approximately
G. Oceti (27)	Flow	3 ft. approximately	2 days
A. Rebellato (16)	10 ft. approximately	20 ft.	-
H. Schors (43)	Flow	Flow	-
J. Taillefer (1)	6 ft.	No measurement	-
T. Telford (49)	Flow	Flow	-
T. Wilding (51)	Flow	Flow	-
J. Lennox (38)	Flow	No measurement	1 day, approximately



LEGEND

x - MUNICIPAL WELLS

⧫ - TEST WELLS

● - DRILLED OR DRIVEN WELLS

■ - DUG WELLS

ONTARIO WATER RESOURCES COMMISSION

CITY OF SAULT STE. MARIE

GOULAIS AVE. WELLS

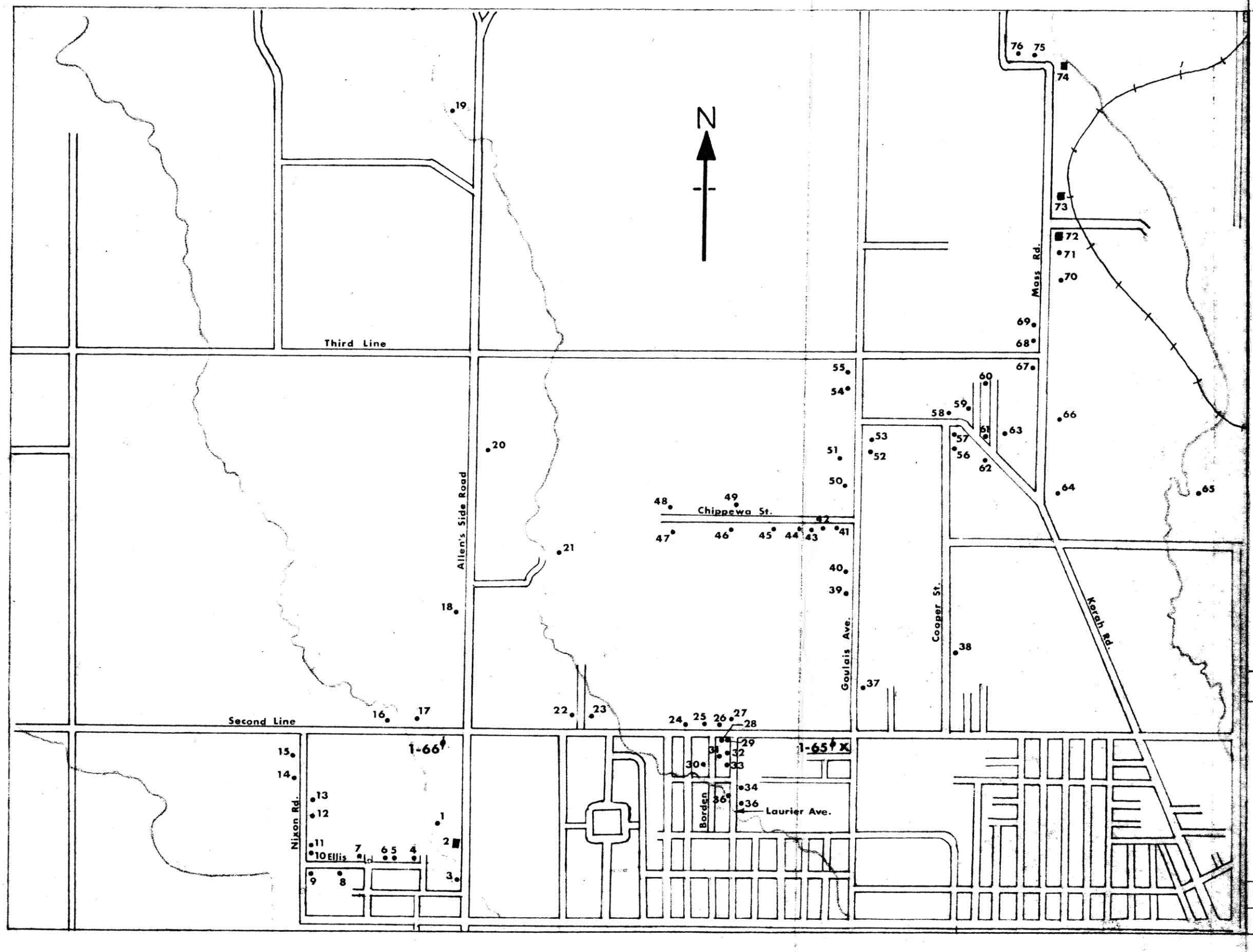
COMPLAINT OF WELL INTERFERENCE

DATE: AUG 11/68	SCALE: 1" = 1400'	DRAWING NO. 3
BY: M.A.J.C.		

1102166
NEAL T
1102540
SPADAFORA T
1102867
COTE G
1100377
LEMMING R
1103722
LAMMING C
1102888
TESSARIOL B
1104333
E., NACCARATO
1103531
KINGHORN K
1105188
SDAO, STANO
1102889
WEINBERGER J
1103546
DAWSON G
1103752
ENZO, PAGNOTTA
1100439
SHARP C
1100432
PELFORD T1101845
FYFE M
1100440
SHARP C
1102890
SAR GIM DEVT
1100409
TWP OF KORAH
1100405
AHO A
1100402
AHO R
1100410
AHO E
1100407
CHAMBERLAIN J
1100401
PRENTICE F
1100408
THIBODEAU B A
1100435
LAMMING DIARY
1100447
NACCARATO, ANGELO
1100443
TURKO W
1100403
GUICK A
1100404
TAMMALA A
1100406
MCINTYRE S
1100436
WILDING T
1101210
TELFORD T
1100438
TAYLOR F
1101215
SURIANO L
1100437
TAYLOR F
1100441
CASE H
Chippewa St
1100445
WEAVER D
1100433
TELFORD T
1100442
SCHORS H
1100434
OLVER S
1100400
GARSON W
1100423
CURRIE D
1100964
MCKAY A
1100431
MCINTANNERY G
1100429
SILMG J
Goulais
1100424
LABA
1100420
ELLIOTT H
1100412
TOMET A

1:7,500

1-65 — 160' clay, 2' sandstone
— ▽ B 14.73' above ground level; flowed B GOGAR.



LEGEND

x - MUNICIPAL WELLS

⧫ - TEST WELLS

● - DRILLED OR DRIVEN WELLS

■ - DUG WELLS

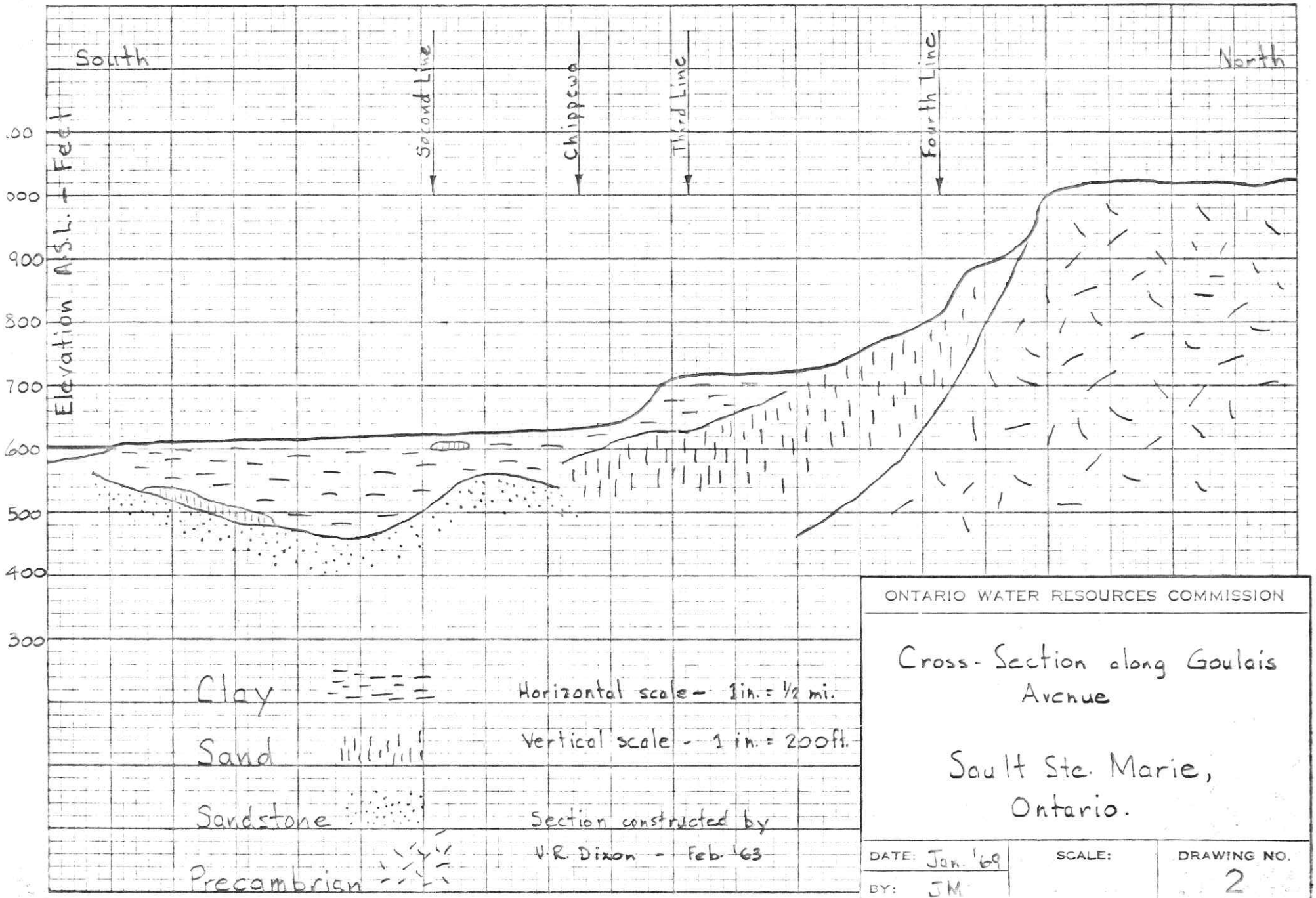
ONTARIO WATER RESOURCES COMMISSION

CITY OF SAULT STE. MARIE

GOULAIS AVE. WELLS

COMPLAINT OF WELL INTERFERENCE

DATE: AUG 11/68	SCALE: 1" = 1400'	DRAWING NO. 3
BY: M.A.J.C.		



Horizontal scale – 1 in. = ½ mi.

Vertical scale - 1 in. = 200 ft.

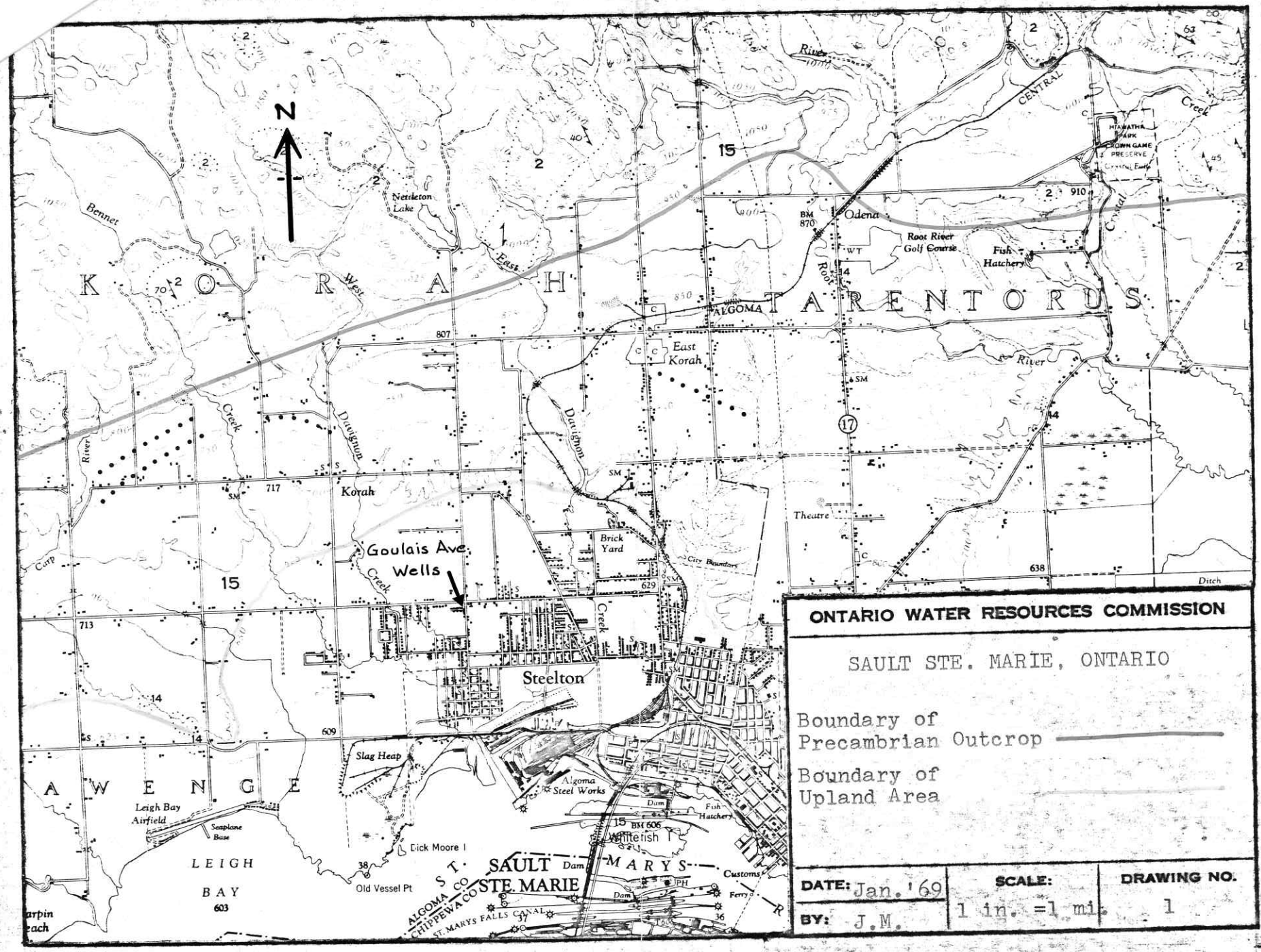
Section constructed by
V.R. Dixon - Feb. '63

ONTARIO WATER RESOURCES COMMISSION

Cross-Section along Goulais Avenue

Sault Ste. Marie, Ontario.

DATE: Jan. '69	SCALE:	DRAWING NO.
BY: JM		2



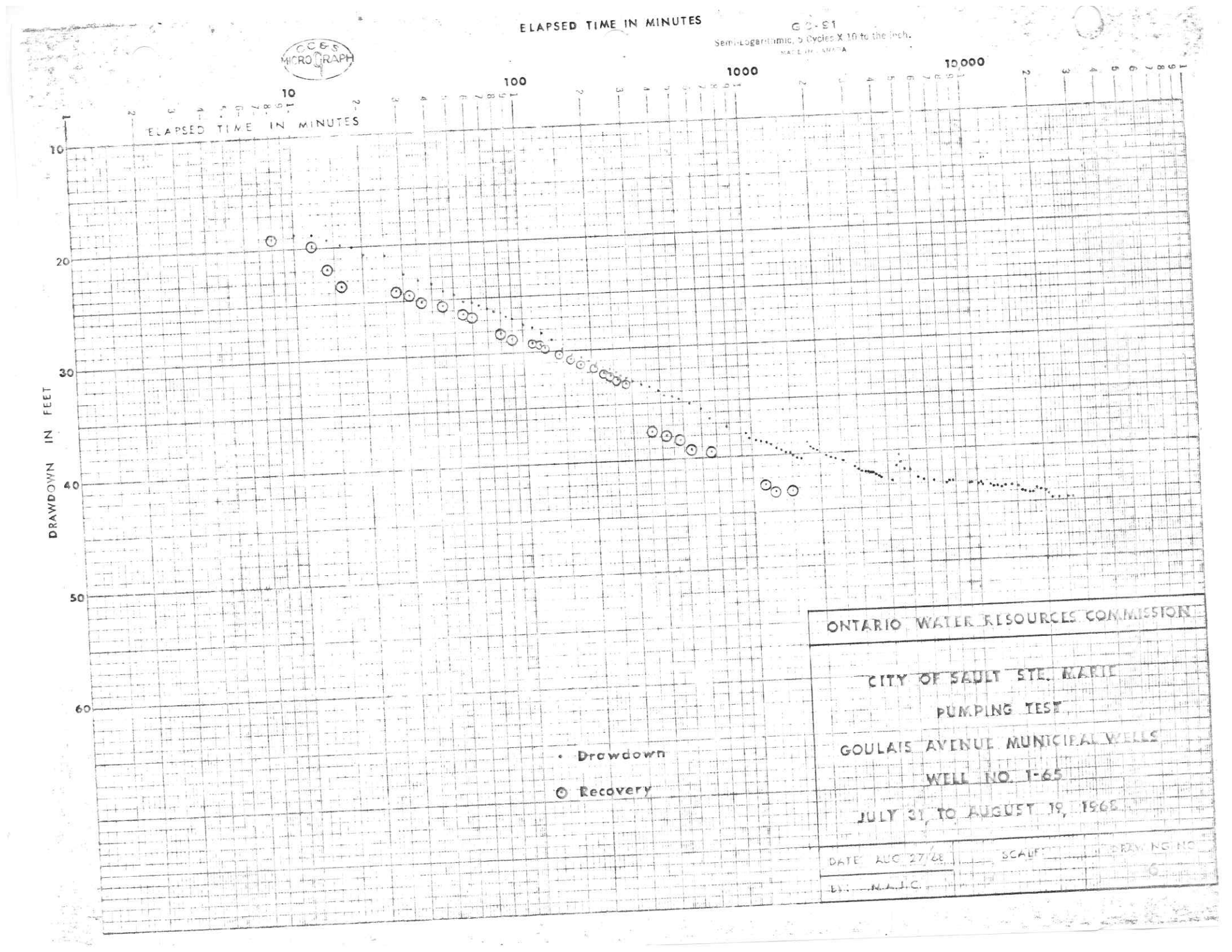
ONTARIO WATER RESOURCES COMMISSION

SAULT STE. MARIE, ONTARIO

Boundary of Precambrian Outcrop

Boundary of Upland Area

DATE: Jan. '69	SCALE: 1 in. =1 mi.	DRAWING NO. 1
BY: J.M.		


ELAPSED TIME IN MINUTES
C-S-1
Semi-Logarithmic, 5 Cycles X 10 to the Inch.
MADE IN U.S.A.
C.C.S. MICROGRAPH
10
100
1000
10,000
ELAPSED TIME IN MINUTES
DRAWDOWN IN FEET
10
20
30
40
50
60
• Drawdown
⊙ Recovery
ONTARIO WATER RESOURCES COMMISSION
CITY OF SAULT STE. MARIE
PUMPING TEST
GOULAIS AVENUE MUNICIPAL WELLS
WELL NO. T-65
JULY 31, TO AUGUST 19, 1968
DATE AUG 27/68
SCALE
DRWG NO
6
DR. N.A.J.C.

ELAPSED TIME IN MINUTES

CCCS MICROGRAPH

G8-91
Semi-Logarithmic, 5 Cycles X 10 to the Inch.
MADE IN CANADA

10 100 1000 10,000

ELAPSED TIME IN MINUTES

DRAWDOWN IN FEET

20
30
40
50
60

• Drawdown

○ Recovery

ONTARIO WATER RESOURCES COMMISSION

CITY OF SAULT STE. MARIE

PUMPING TEST

GOULAIS AVENUE MUNICIPAL WELLS

WELL NO. 2

JULY 31 TO AUGUST 19, 1963

DATE: AUG. 24/63	SCALE	DRAWING NO.
BY: M.A.J.C.		3

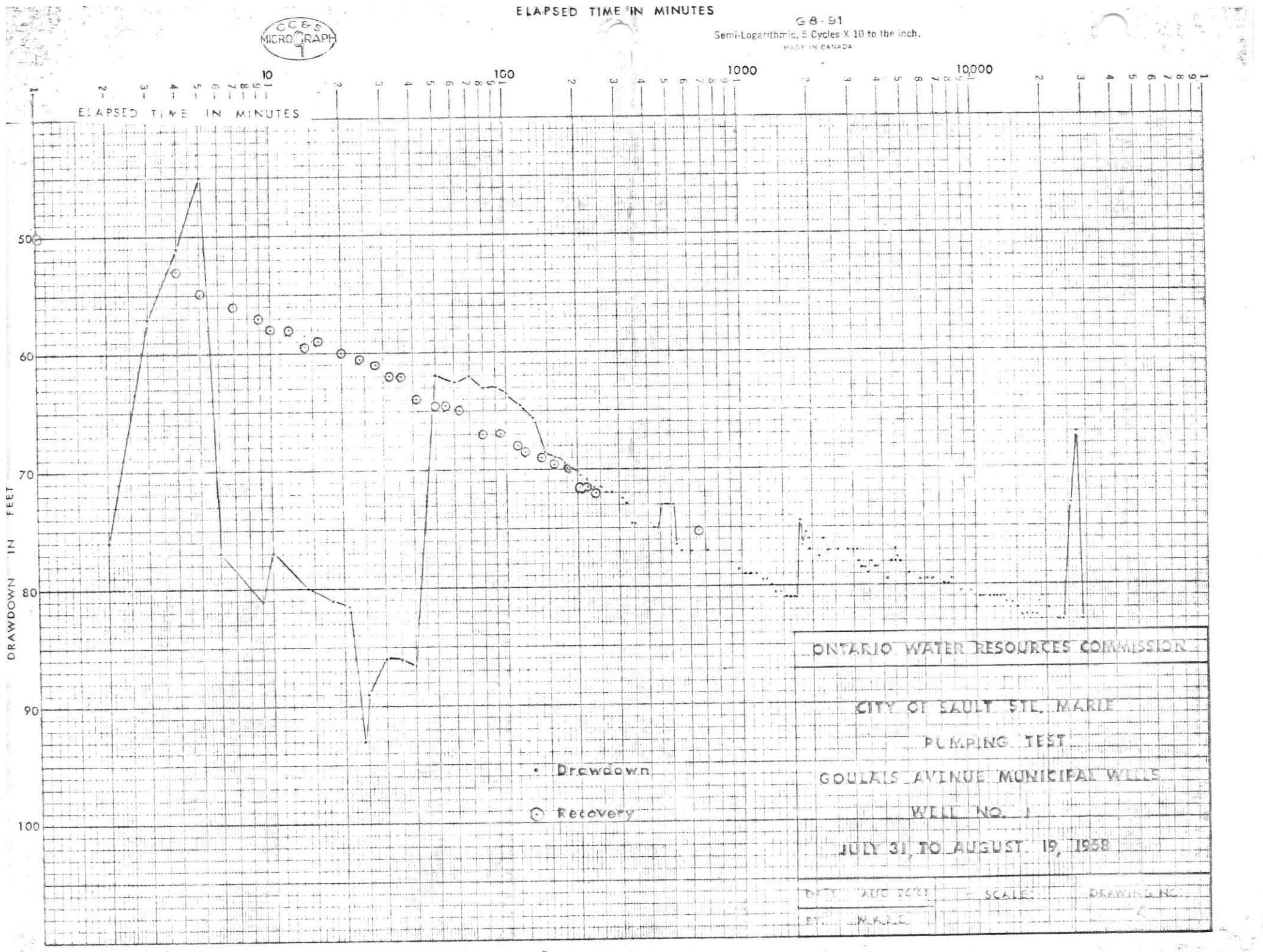
ELAPSED TIME IN MINUTES

G8-91

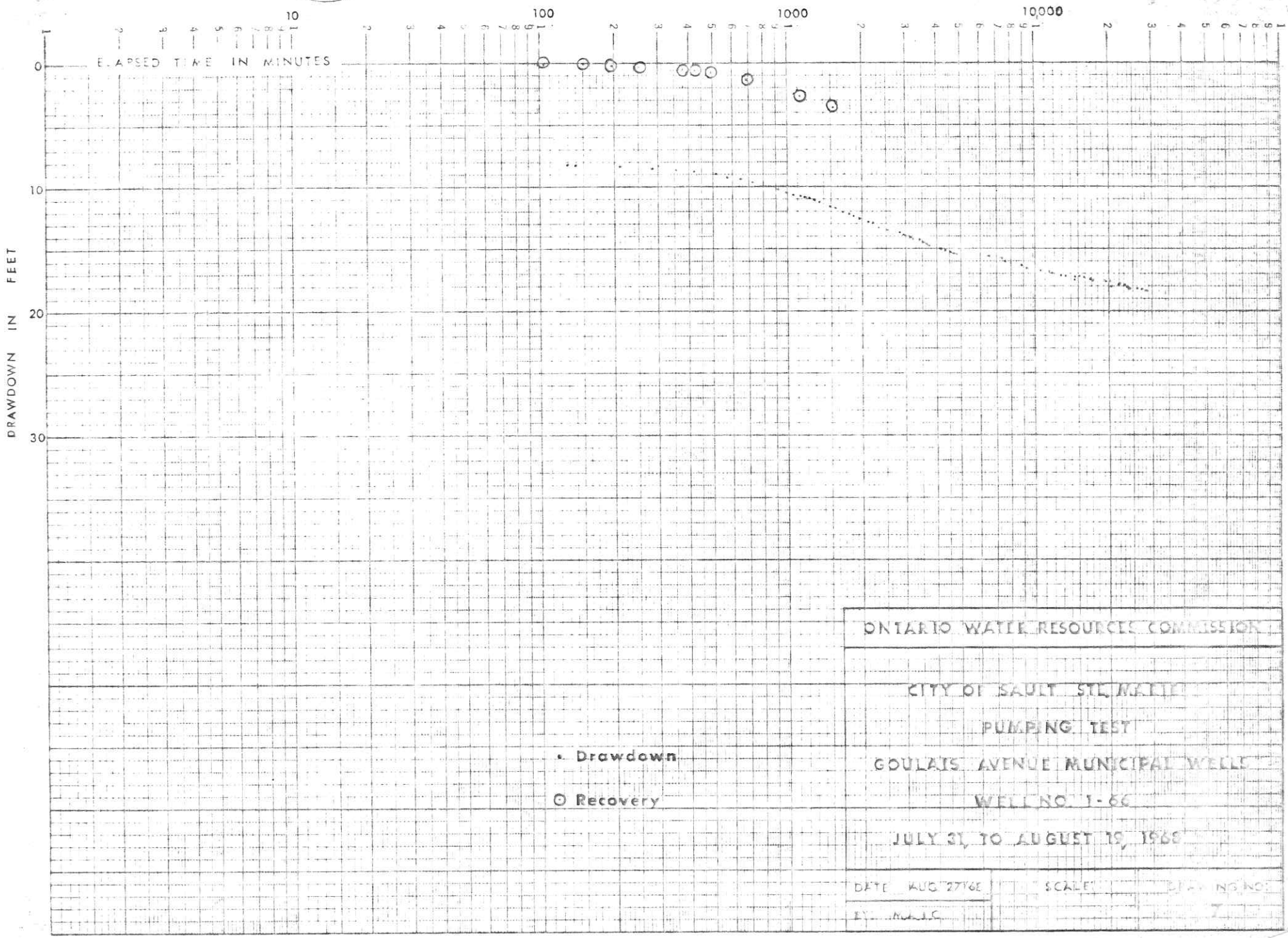
Semi-Logarithmic, 5 Cycles X 10 to the inch.

MADE IN CANADA

CCS MICROGRAPH

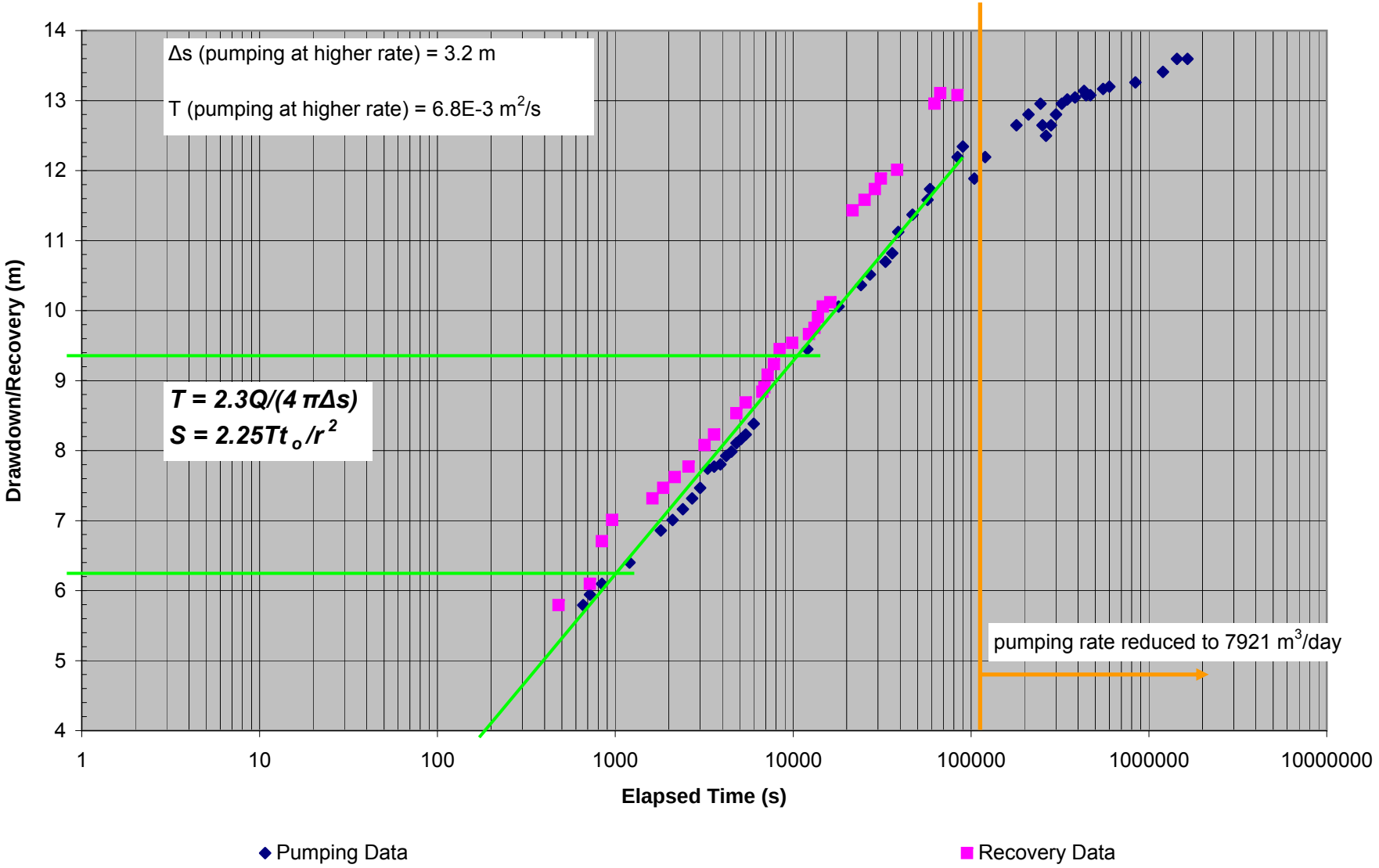


Semi-Logarithmic, 5 Cycles X 10 to the inch.
MADE IN CANADA

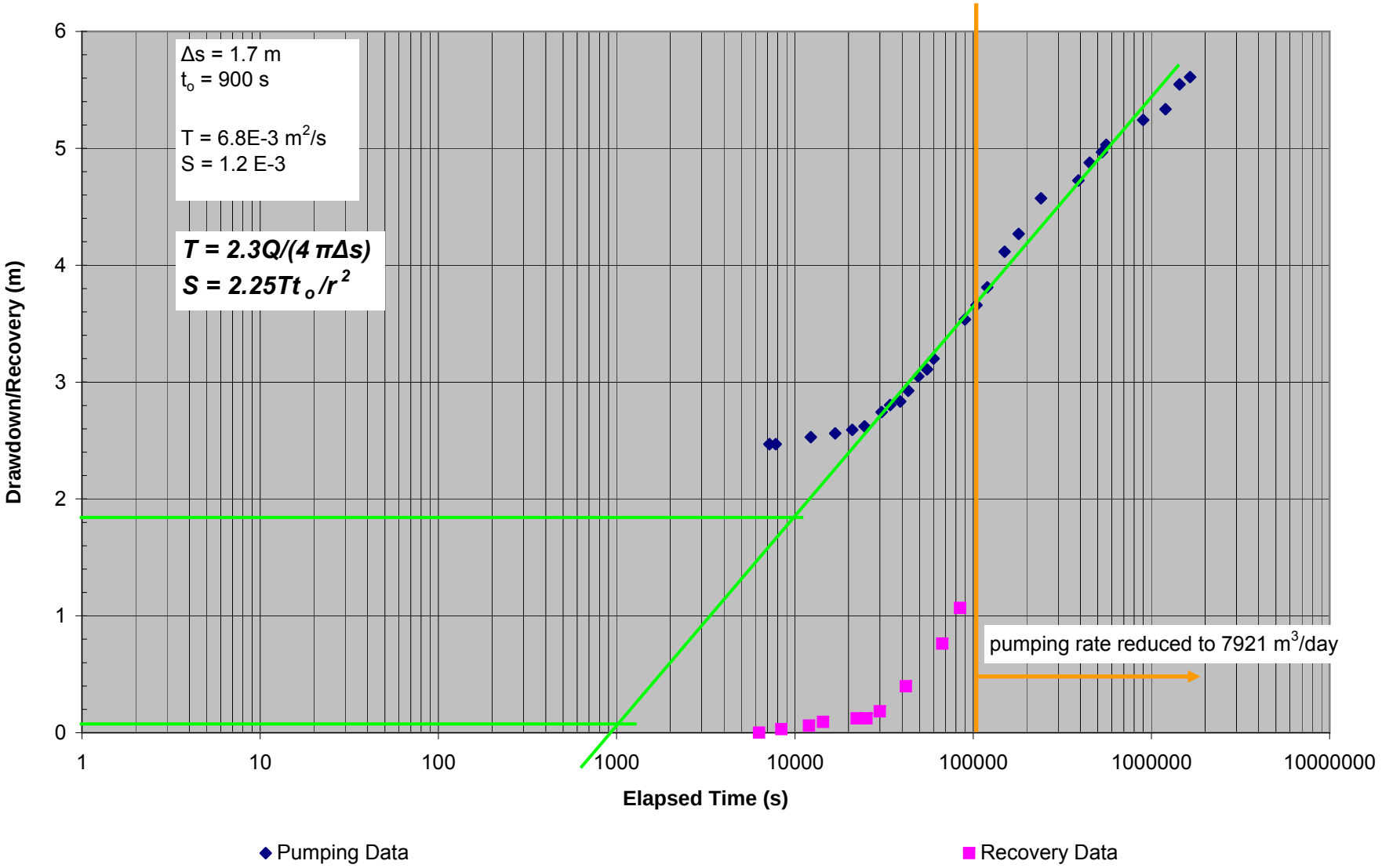


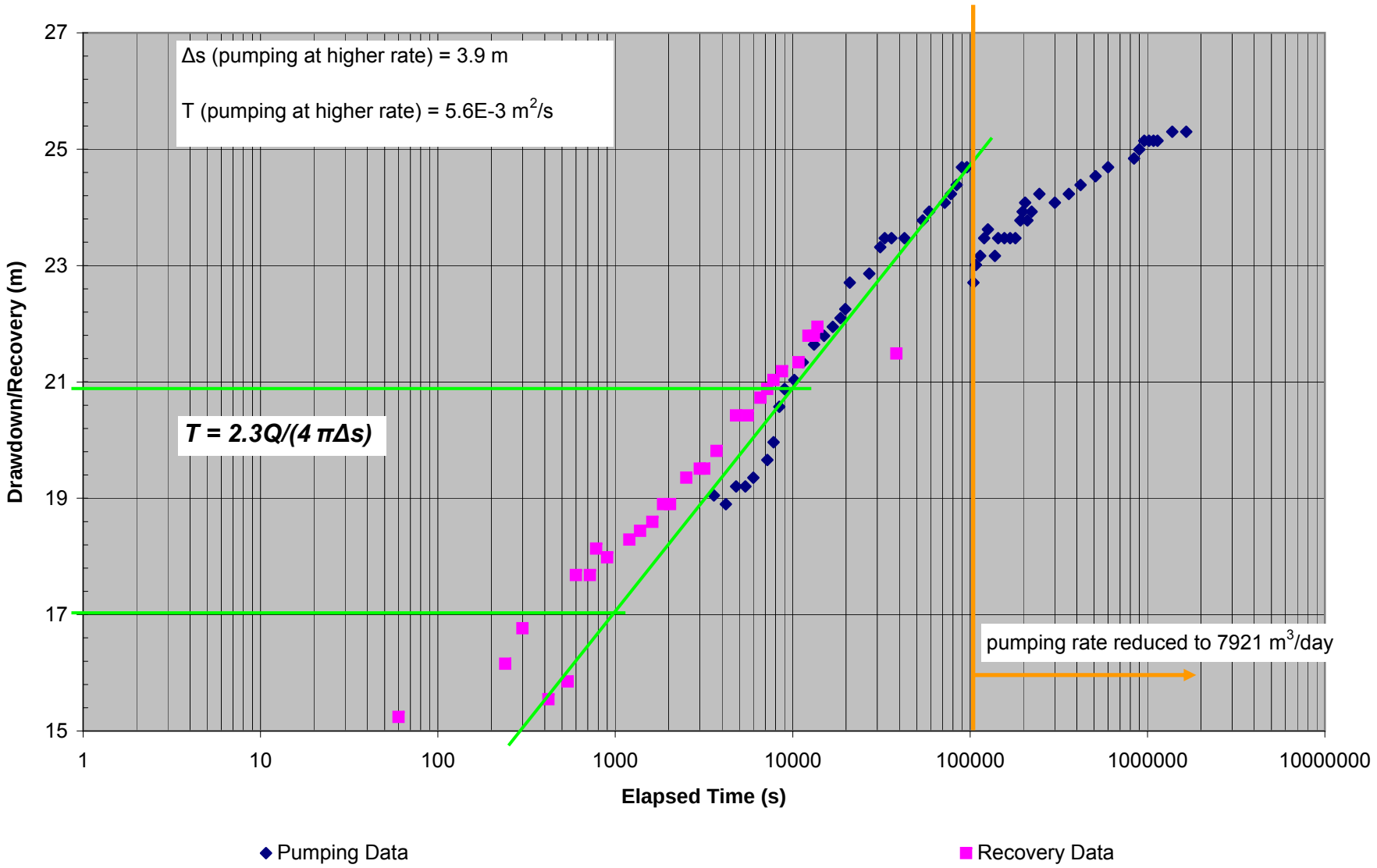
Analysis

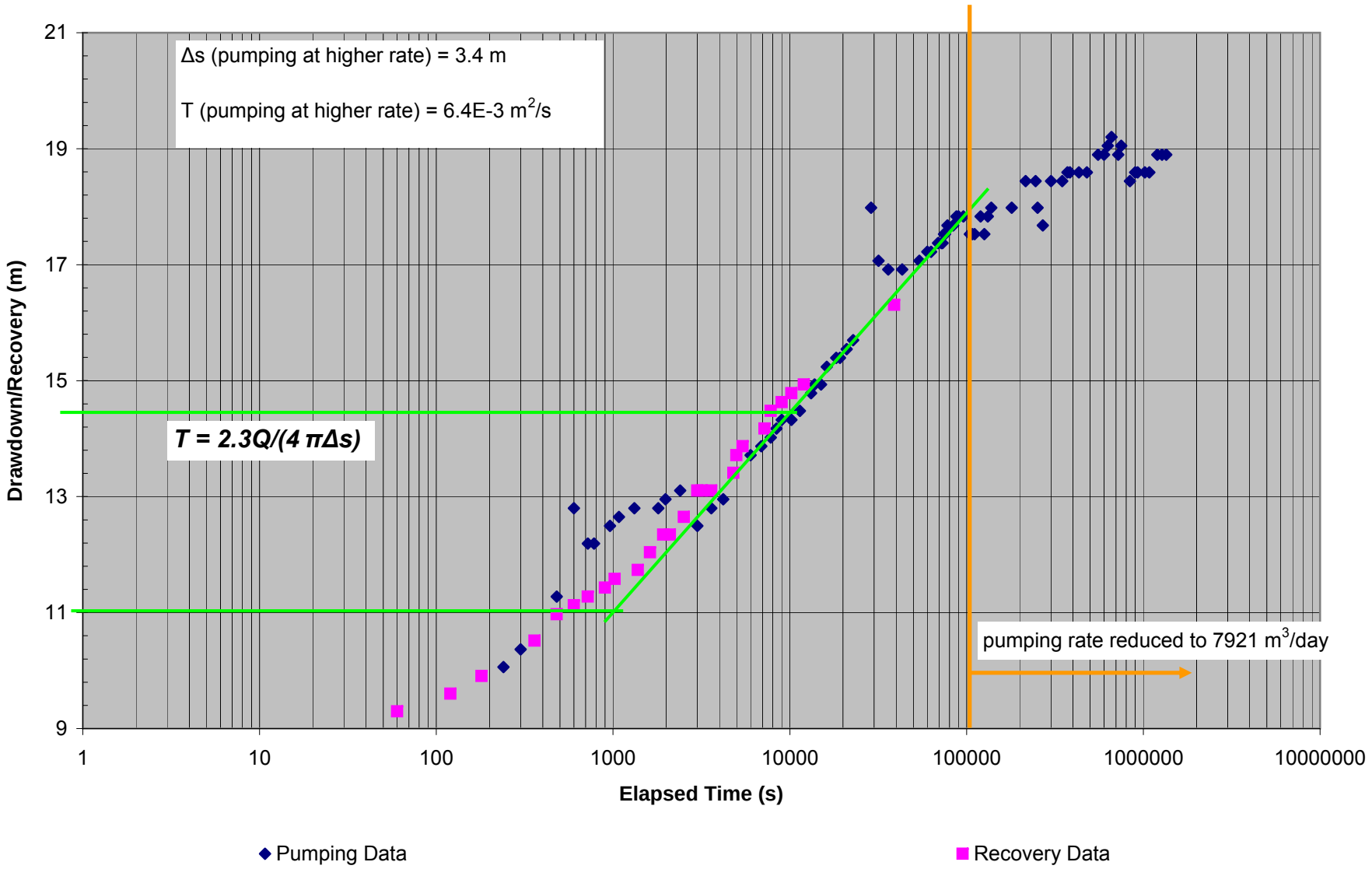
Semi-Log Time-Drawdown Analysis, TW1/65



Semi-Log Time-Drawdown Analysis, TW1/66




Semi-Log Time-Drawdown Analysis, Goulais PW1
Δs (pumping at higher rate) = 3.9 m
T (pumping at higher rate) = 5.6E-3 m2/s
T = 2.3Q/(4 πΔs)
pumping rate reduced to 7921 m3/day
Drawdown/Recovery (m)
Elapsed Time (s)
27
25
23
21
19
17
15
1
10
100
1000
10000
100000
1000000
10000000
Pumping Data
Recovery Data


Semi-Log Time-Drawdown Analysis, Goulais PW2
Δs (pumping at higher rate) = 3.4 m
T (pumping at higher rate) = 6.4E-3 m2/s
T = 2.3Q/(4 πΔs)
pumping rate reduced to 7921 m3/day
Drawdown/Recovery (m)
Elapsed Time (s)
21
19
17
15
13
11
9
1
10
100
1000
10000
100000
1000000
10000000
Pumping Data
Recovery Data

Semi-Log Distance-Drawdown Analysis, OWRC 1969 Goulais Wells Pumping Test