REPORT

Basis of Design
Interim Remedial Measures

Owego Heat Treat, Inc.
Apalachin, New York

October 1992

O'BRIEN & GERE
ENGINEERS, INC.

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BASIS OF DESIGN
INTERIM REMEDIAL MEASURES

OWEGO HEAT TREAT
APALACHIN, NEW YORK

OCTOBER 1992

O'BRIEN & GERE ENGINEERS, INC.
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SECTION 1 - INTRODUCTION

1.01 Project Background

The Owego Heat Treat (OHT) facility is located approximately 1000 feet south of the Susquehanna River in the Town of Owego, Tioga County, New York (Figure 1). The OHT property is bounded by the Susquehanna River to the north and Route 17 to the south. The land surface in the immediate vicinity of the site is relatively flat with elevations ranging from 810 to 850 feet above mean sea level. Two ponds are present on the southern side of the property. Current OHT personnel indicated that these ponds are the result of past sand and gravel mining on the property.

Heat treating operations began at the OHT facility in 1953 and were confined to one building. Subsequent buildings were added as the company grew. Currently, six buildings comprise the OHT operations as shown on Figure 2. Five of these buildings (B-1, B-2, B-3, B-5, and B-6) are associated with the actual operations. Building B-4 is used for offices. Three residences are also located on the property, all of which are owned by OHT or occupied by members of the OHT Board of Directors. These residences are designated H-1, H-2, and H-3 on Figure 2. All of the residences use ground water obtained from wells as a source of potable water. These wells are similarly designated H-1, H-2 and H-3 and are shown on Figure 2. Two ground water supply wells supply water to the OHT buildings for sanitary and non-contact cooling water uses. These wells are designated B-3 and B-5 based on the building they are located adjacent to.

In general, the heat treating operations performed at the facility involve heating of prefabricated parts to specified temperatures and then controlling the rate of cooling through the use of oil quenching techniques. Once the quenching operation is completed, the oils are removed from the cooled parts by placing them in degreasing baths. Historically, the facility has used tetrachloroethylene (PCE) as a degreasing agent. However, the use of this chemical was discontinued in 1992. In addition to PCE, OHT personnel have indicated that there were limited trial uses of trichloroethylene (TCE) within Building 5 during 1982 and 1984. Following the trial uses, spent TCE was disposed off-site. Presently, degreasing activities in Building 2 use an alkaline process and 1,1,1 trichloroethane is used in Building 5.

Both the oil quenching and PCE tanks were made of stainless steel located in concrete-lined pits inside of the process buildings. These pits were primarily used to facilitate access to the tops of the tanks and also served as secondary containment areas to prevent material (oil and solvent) loss. The PCE tanks were cooled by circulating non-contact cooling water which was obtained from the two on-site ground water supply wells. After the non-contact cooling water passed around the tanks, it was discharged via outfall to a drainage ditch on the southern side of the site. This ditch discharges to the large pond located on the southern side of the property (Figure 2). This discharge was regulated by a SPDES permit. In the summer of 1991, the non-contact cooling water system was reconfigured to recirculate and thus eliminate discharge to the pond. The SPDES permit was subsequently withdrawn.

During renovation of Building B-2 in December 1987, water was found in the concrete pit under the PCE tank and a noticeable odor was observed emanating from the soil underlying the floor in the southeast corner of the building. The standing water was pumped into 55-gallon drums and then, following characterization, disposed of at an appropriate off-site facility. OHT subsequently removed two 55-gallon drums of soil containing volatile organic compounds (VOCs) from this area for similar disposal at an appropriate landfill. Analysis of this soil revealed the presence of 13 ppm of VOCs, primarily PCE. The remainder of the soils removed from the excavation were placed near the small pond on the southern side of the site (Figure 2). Analysis of a sample collected from the soil left in place indicated that less than 0.05 ppm of VOCs were present.

To assess if the VOCs found in the soil had entered the ground water system, OHT sampled the two on-site supply wells (B-3 and B-5) and the three residential wells (H-1, H-2, H-3) located on the property (Figure 2). These wells were sampled and analyzed on two occasions, once in January 1988 and once in February 1988. The analyses were completed by Southern Tier Analytical (STA) and Friend Laboratory Inc. (FLI), both of Waverly, New York. The results of these analyses revealed the presence of VOCs in the ground water in supply well B-3 and residential well H-1. The New York State Department of Environmental Conservation (NYSDEC) was notified of the findings.

Based on the findings of the sampling and analysis, NYSDEC requested that OHT undertake a hydrogeologic investigation to evaluate whether the source of the VOCs was still present and also to assess the extent of VOCs in the ground water. As an interim measure to prevent further exposure, carbon filters were placed on the residential wells and bottled water was brought in for drinking water at the facility. A replacement well for residential well H-1 was installed within the bedrock aquifer at a later date. OHT then retained O'Brien & Gere Engineers, Inc (OBG) to assist in completion of a site investigation.

A series of site investigation tasks have been completed to date. An initial investigation consisting of monitoring well installations, ground water sampling and analysis, and completion of a soil gas survey was completed in 1988. The findings of this initial investigation are included in the Site Investigation Report dated February 1989, a copy of which was previously provided to Frank Trent of NYSDEC under cover of a February 3, 1989 letter. OHT and OBG subsequently completed additional investigations as part of a scope agreed upon with NYSDEC as a result of additional discussions with the Department. A summary of the additional investigations is included in Section 2 of the Interim Remedial Measures (IRM) Work Plan dated October 1991.

As a result of the investigations completed at the site, a recovery well (RW-1) was installed in the vicinity of Building B-2 for the purpose of minimizing further migration of VOCs from the suspected source area. To facilitate initiation of a ground water recovery and treatment program, Owego Heat Treat entered into an Administrative Order on Consent (Order) with NYSDEC, effective August 29, 1991. The IRM Work Plan describes the work completed in conjunction with the ground water recovery and treatment program.

The purpose of the Work Plan was to detail the work efforts to be conducted in association with the aquifer testing. Included in the Work Plan was a summary of the work efforts completed and a discussion of the existing conditions. Additionally, details pertaining to the temporary treatment system design and operating parameters were also presented.

This document summarizes results of the aquifer performance test and presents the basis of design for the final treatment system to be installed at the facility. It is submitted in compliance with Paragraph IV of Consent Order Index Number A7-0267-91-05 between NYSDEC and OHT. Section 2 includes a discussion of the ground water treatment system. Section 3 presents the results of the system performance and Section 4 presents the rationale for the conceptual design of the final treatment system.

SECTION 2 - GROUND WATER TREATMENT SYSTEM

2.01 Test Recovery System

The test recovery and treatment system as specified in the IRM Work Plan used a ground water recovery well (RW-1) equipped with a submersible pump to collect the ground water. The collected ground water was piped to an air stripping tower (Figure 3) and, after treatment, discharged to a pond located on the southern side of the property. Effluent limits for this discharge were specified by NYSDEC in correspondence dated November 22, 1991 as follows:

Tetrachloroethylene	5 μg/L
Trichloroethylene	5 μg/L
Trans-1,2-Dichloroethylene	5 μg/L
Vinyl chloride	2 μg/L

2.02 Air Stripper Design

The air stripper introduces water into the top of the tower while air is added to the bottom. The pilot scale air stripping tower design consisted of a vertical, cylindrical tower 10 feet high, 3 feet in diameter filled with 2-inch Tripack® structured PVC packing, and operating at atmospheric pressure. The tower was constructed of fiberglass reinforced plastic. A 1000 cubic foot per minute (CFM) blower supplied the necessary air. The exhausted air passed through a mist eliminator prior to discharge to the atmosphere. The water distribution system located at the top of the stripper was constructed of 3-inch schedule 40 PVC (main inlet) and four 1-inch schedule 40 PVC spray nozzles. Water was distributed by four non-clog PVC spray nozzles to provide uniform water loading to the packing surface at the required flow rates.

Prior to use, the effectiveness of air stripper available for this pilot study was evaluated using Chem Cad computer modeling techniques. The modeling process considered two, three, four and five theoretical stages (Appendix A). However, analyses of the modeling results suggested that two theoretical stages would be required for effective VOC removal. The modeling was able to identify the height of the packing through Height of an Equivalent Theoretical Plate (HETP) values. Assuming standard reference values for HETPs tower packing height of 6 feet was calculated to be adequate for VOC removal.

2.03 Test System Operation

System operation was driven by a submersible ground water recovery pump with an approximate flow of 23 gallon per minute (gpm) from recovery well RW-1. Ground water was collected in an 1100-gallon Nalgene®, temporary holding/flow equalization tank and then delivered to the top of the air stripper with a separate feed pump where it discharged through a multi-pore distribution nozzle and was allowed to flow down over the packing (Figure 3). The holding tank served two purposes: 1) provide flow equalization to the air stripping tower using recirculated water from the air stripper discharge pump, if deemed necessary and 2) to provide a safety mechanism, using a float switch, to reduce possible overflow due to equipment failure. An air line was placed within the holding tank for mixing purposes. Treated water from the air stripper discharge pump was divided into two streams; a portion of the flow was recirculated to the tank to augment flow to the air stripper as necessary, while the remaining flow discharged to the outfall. Treatment system effluent was passed through carbon polishing canisters prior to discharge to the outfall. Four carbon units were placed in a parallel configuration to provide final treatment prior to discharge as a precautionary measure. Given the design of the polishing system, flow would have theoretically been divided equally through the four canisters. This final treatment was added to the system configuration included in the IRM Work Plan. A more detailed discussion of this modification is presented in Section 3.04.

The first test conducted was a step drawdown test. During the step drawdown test, the well pumping rates varied from 4.8 gpm to 19.5 gpm. The pump providing water to the tower was operated at approximately 20 gpm, therefore, the recirculation pump operated to recirculate water to the holding tank as needed to provide the 20 gpm flow to the tower.

During the aquifer performance test, the tower system pump was operated at approximately 20 gpm while the recirculation pump was operated to discharge 20 gpm through four carbon polishing units prior to entering the storm sewer.

SECTION 3 - SYSTEM PERFORMANCE

3.01 Aquifer Performance Tests

Prior to completing the continuous yield aquifer performance test, a step drawdown test was completed to examine the performance of RW-1 by pumping the well at variable, successively higher flow rates. The step test was completed on April 27, 1992 using average flow rates of 4.8 gpm, 9.5 gpm, 14.9 gpm, and 19.5 gpm. The well was pumped at each of the four flow rates for a 1-hour period. The water level was allowed to recover to the static level between each step. Based on the specific capacities observed at each of the pumping rates, it was estimated that the well was capable of producing greater than 50 gpm. It was, therefore, recommended that the aquifer performance test be conducted at the maximum flow rate produced by the submersible pump.

Aquifer performance testing was conducted on RW-1 to evaluate the hydrogeologic characteristics of the sand and gravel aquifer. The test was started on May 12, 1992 at 1300 hours and was completed on May 13, 1992 at 1500 hours for a total of 26 hours. The discharge rate during the test averaged 22.3 gpm.

A complete round of static water levels were collected prior to initiating the test and two additional sets of water levels were subsequently collected during the test period. The purpose of this effort was to evaluate daily ground water level fluctuations and correct pumping water level data for notable trends, if necessary. Wells used to evaluate trends were beyond the limits of the expected cone of depression and included MW-1, MW-3, MW-4, MW-5, MW-7, and MW-8. No notable trends were observed during the 26-hour test.

Maximum drawdown measured in the recovery well and nearby monitoring wells and piezometer during the test were: RW-1 (2.35 ft); PZ-1S (0.23 ft); PZ-1D (0.38 ft); MW-2 (0.39 ft); MW-6 (0.69 ft); and MW-9 (0.39 ft).

Data collected from the test were analyzed using the Cooper-Jacob straight line method and the Neuman type curve matching method. Recovery data were analyzed by plotting the ratio of time since the pump started (t) to the time since the pump stopped (t') versus the residual drawdown (s'). The test data and calculations are included in Appendix B.

Table 1 summarizes the aquifer transmissivities calculated during the aquifer performance test of RW-1. A review of the data indicates that average transmissivity (T) values ranged from 53,972 gpd/ft to 118,184 gpd/ft. The geometric mean transmissivity value, excluding T values calculated from RW-1, is 77,653 gpd/ft. Transmissivity values from RW-1 were not used because pumping well transmissivities are generally lower and not representative of the aquifer because of well inefficiency.

3.02 Monitoring Points

To evaluate the effectiveness of the air stripping tower to remove volatile organics, water samples were collected from three locations within the ground water recovery and treatment system during the test. The first sampling location was at the well head prior to water entering the holding tank (influent). The second location was at the discharge from the air stripping tower (effluent) to evaluate the effectiveness of the stripper. To assess whether the effluent met the discharge limits established by NYSDEC, a third sample was collected after ground water passed through the carbon canisters. The locations are designated as 'ST' on Figure 3. The third sampling point was added to the sampling program presented in the IRM Work Plan as the carbon canisters were added to the proposed system. Analytical results are summarized on Table 2. The analytical data packages including trip blank samples are in Appendix C. Modifications to the proposed sampling events were made during the test based on field conditions and the shortened duration of the aquifer performance test.

To evaluate compatibility of the water with the treatment system components and address future, long-term operation and maintenance considerations, a sample of the influent was collected after 24 hours of pumping and submitted to the laboratory for the following analyses:

Parameter	Method
Calcium	6010
Magnesium	6010
Iron	6010
Manganese	6010
Total Alkalinity	310.1
Hardness	6010
Total Suspended Solids	160.2
Total Dissolved Solids	160.1
pH	9040
Langlier Index of Corrosivity	203
Nitrogen, Nitrate	353.2
Nitrogen, Nitrite	353.2
Total Kjeldahl Nitrogen (TKN)	351.2
Chloride	9251
Sulfide	375.2
Oil & Grease	3540
Total Recoverable Petroleum Hydrocarbons (TRPH)	418.1

Results of these analyses are presented on Table 3.

Inorganic analysis (Table 3) reveal that the ground water is considered hard (Chemistry for Environmental Engineers, Sawyer and McCarty, 1987). Therefore, the design of the permanent treatment system will include a tower cleaning system. This is further discussed in Section 4.03.

3.03 System Effectiveness

As stated previously, the pilot treatment system incorporated a holding tank for flow equalization prior to water being pumped to the stripper. An oily sheen was observed on the water surface within this tank at the onset of pumping during completion of the step test. Analytical results of the effluent sample collected during the step test indicated trichloroethylene was present at a level of 83 ppb which exceeded the permitted effluent limit of 5 ppb established by NYSDEC for the test. It was postulated that the nozzle did not support full water distribution to the entire packing surface and as such, channeling of water in the packing resulted, which significantly decreased the air strippers removal efficiency. Because of the possibility of flow channeling, carbon polishing units were installed at the effluent to remove volatile organics before discharging from the system during the performance test.

Samples collected during the aquifer performance test VOC removal effectiveness of 91 to 99 percent for individual VOC compounds and between 95 and 97 percent for total VOC removal (Table 4). Except for one sample collected after the carbon polishing units, no organics were observed in the effluent. The detection of tetrachloroethylene at 5 ppb in one of the samples collected after the carbon polishing units was possibly because of a least frictional resistance path taken by the flow through the four polishing units which effectively reduced the contact time. Additionally, upon completion of the treatment system demobilization, it was observed that a small volume of carbon in one polishing unit was partially depleted. This may have contributed to the reduced contact time. After further inspection, the missing volume of carbon was observed to have collected in the discharge sump; however, no carbon was found in the conveyance system or the final discharge outlet. Carbon which was found in the sump was removed and placed in the appropriate carbon canister for temporary use during system start up.

SECTION 4 - CONCEPTUAL DESIGN

4.01 Capture Zone Analysis

Parameters derived from the aquifer performance test were used to calculate the discharge rate necessary to create a capture zone for RW-1 which would extend beyond the limits of the VOC plume which originates within Building 2. Using the width of Building 2, it was estimated that the maximum width of the VOC plume in the vicinity of RW-1 is the length of Building 2 or approximately 60 feet. The ground water computer program QUICKFLOW, developed from the Theis transient flow equation by the Illinois State Water Survey, was used to evaluate radius of inflow for RW-1. The Todd equation was also utilized to confirm the radius of inflow calculations. The aquifer coefficients utilized and the calculated radii of inflow are included in Appendix D. Results of the ground water modeling are represented on Figure 4.

The ground water modeling data reveal that by using a discharge rate of 11 gpm at RW-1, the radius of the zone of capture is approximately 50 ft. which corresponds to a capture zone width of about 100 ft. This zone of capture will extend beyond the ends of Building 2 and presumably the boundaries of the VOC plume and therefore, minimize further migration from the source area.

The downgradient extent of the cone of inflow with a well yield of 11 gpm would be 16 feet. Given that monitoring well MW-2, located approximately 50 feet downgradient of the recovery well, has generally contained the highest concentrations of VOCs, it is proposed that the recovery rate be increased on a temporary basis to attempt to initially capture more of the VOC plume in the downgradient direction. Using a well yield of 20 gpm, the downgradient radius of inflow will be on the order of 29 feet which is 13 feet closer to MW-2. The flow rate would be subsequently be lowered to 10 or 11 gpm to control the source after 3 or 4 months depending upon results of ground water samples collected from the monitoring wells. The treatment system should, therefore, be designed to treat a flow of up to 20 gpm.

4.02 Ground Water Collection

Based on the information obtained from the aquifer performance test, the location and design of RW-1 will be adequate for use as the final recovery well to control the source area. A submersible, multiple-stage pump installed within RW-1 can be used for ground water recovery and water table depression. The submersible pump should be capable of pumping 20 gpm against a static head of no less than 250 feet. Given the correct nozzle sizing for the air stripper, it would not be necessary to include a recirculation tank and/or recirculation pump and associated equipment.

4.03 Basis of Air Stripper Design

Based on the results obtained from the aquifer testing program as supported by computer simulation, an air stripping tower with a total packed height of 6 feet and a diameter of 3 feet filled with 2-inch Tripack® packing using an air flow rate of 1100 cfm will be capable of removing the VOCs such that the effluent concentrations specified for the test system can be met. It should be noted that because of the wide variety of commercial packing available, the height of the air stripping tower, its diameter, and the air flow rate may vary if 2-inch Tripack® is not used. Because of the anticipated variable flow rate (11 to 20 gpm), it will be necessary to size a dish spray nozzle or equivalent to obtain proper water distribution over the tower packing and minimize the potential for channeling.

Since ground water at the facility was is hard, a tower cleaning package will be required. Maintenance of the system will consist of periodically checking the air stripping tower for the buildup of scale and iron oxide precipitate. Once the scale and precipitate buildup has been identified, it is recommended that a cleaning program be instituted. Such a program would consist of recirculating an acid solution through the tower until the buildup of scale and precipitate has been removed. The waste acid wash solution generated would be collected in 55-gallon drums for disposal. A detailed Basis of Design is included in Appendix E.

4.04 Electrical and Operating System

Based on existing area power distribution capacity, it is recommended that the recovery and treatment system specified above be powered from a single 240 volt, three phase power source. In this configuration, power for the submersible pumps and the air stripper fan would be drawn from a 240 volt secondary power circuit.

The process piping and pumping system to the air stripper was designed under the premise that it was not feasible to excavate and bury such equipment between RW-1 and the proposed air stripper location. As such, an evaluation was conducted into the requirements of heat tracing process piping for the treatment system. From this evaluation, it was determined that 1.5 inch process piping carrying 42°F water exposed to - 18°F air would typically require insulation of exposed pipes with 2 inches of insulation. Given the variable weather conditions in the northeast, it is recommended that heat tracing be used in conjunction with pipe insulation to protect sections of pipe which will be exposed to potential freezing conditions. The installation of a heat exchanger will also be used to increase the water temperature and minimize the potential of water freezing in process equipment. These issues, as well as the feasibility for pipeline burial, will be further evaluated during the final design process.

4.05 Permitting Requirements

OHT will not be required to obtain permits form the NYSDEC for water discharges or air emissions associated with the operation of the final treatment system as these are covered by the existing Consent Order. It is anticipated that the water discharge limits will be those specified by NYSDEC for the test system as follows:

Tetrachloroethylene	5 μg/l
Trichloroethylene	5 μg/l
1,2-trans-Dichloroethylene	5 μg/l
Vinyl Chloride	2 μg/l

With respect to air emissions, all application forms filed in the normal course for a certificate to operate a process, exhaust or ventilation system under 6 NYCRR Part 201 will be prepared and submitted to NYSDEC for review and approval. Calculation work sheets for the proposed air containment emission rates will also be provided.

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Tables

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TABLE 1
AQUIFER PERFORMANCE TEST RESULTS

OWEGO HEAT TREAT
APALACHIN, NEW YORK

	Duration of Pump Test/ Flow Rate	Transmissivity (T) in gpd/ft				Source of Data	Hydraulic Conductivity (gpd/ft²)
		Cooper-Jacob	Recovery Data	Neuman Curves - Matching	Geometric Mean		
RW-1 Test	1560	58,793	83,990	NA	70,273	RW-1	1,405
	Minutes	106,896	130,651	NA	118,184	MW-2	2,364
	at	73,491	69,168	NA	71,296	MW-6	1,426
	22.27 gpm	73,491	117,586	NA	92,958	MW-9	1,859
		58,792	48,994	54,550	53,972	PZ-1S	1,079
		97,988	78,390	38,620	66,625	PZ-1D	1,332

NA - Not Applicable

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TABLE 2

TREATMENT SYSTEM MONITORING DATA
OWEGO HEAT TREAT
APALACHIN, NEW YORK

Date Collected	AFTER TOWER SAMPLE TAP 4/27/92	INFLUENT SAMPLE TAP 5/2/92	AFTER TOWER SAMPLE TAP 5/2/92	EFFLUENT AFTER CARBON SAMPLE TAP 5/2/92
Benzene	<1	<10	<1	<1
Benzyl chloride	<10	<100	<10	<10
Bis(2-chloroethoxy)methane	<500	<50,000	<5,000	<5,000
Bromobenzene	<5	<50	<5	<5
Bromodichloromethane	<1	<10	<1	<1
Bromoform	<10	<100	<10	<10
Bromomethane	<1	<100	<10	<10
Carbon tetrachloride	<1	<10	<1	<1
Chlorobenzene	<1	<10	<1	<1
Chloroethane	<1	<10	<1	<1
2-Chloroethylvinyl ether	<10	<100	<10	<10
Chloroform	<1	<10	<1	<1
1-Chlorohexane	<10	<100	<10	<10
Chloromethane	<1	<100	<10	<10
Chloromethylmethyl ether	<100	<1,000	<100	<100
2-Chlorotoluene	<5	<50	<5	<5
4-Chlorotoluene	<5	<50	<5	<5
Dibromochloromethane	<1	<10	<1	<1
Dibromomethane	<10	<100	<10	<10
1,2-Dichlorobenzene	<5	<50	<5	<5
1,3-Dichlorobenzene	<5	<50	<5	<5
1,4-Dichlorobenzene	<5	<50	<5	<5
Dichlorodifluoromethane	<10	<100	<10	<10
1,1-Dichloroethane	<1	<10	<1	<1
1,2-Dichloroethane	<1	<10	<1	<1
1,1-Dichloroethylene	<1	<10	<1	<1
1,2-Dichloroethylene(total)	13	79	4	<1
Dichloromethane	<1	15	<1	<1
1,2-Dichloropropane	<1	<10	<1	<1
cis-1,3-Dichloropropylene	<1	<10	<1	<1
trans-1,3-Dichloropropylene	<1	<10	<1	<1
Ethylbenzene	<1	<10	<1	<1
1,1,2,2-Tetrachloroethane	<1	<1,000	<100	<10
1,1,1,2-Tetrachloroethane	<1	<10	<1	<1
Tetrachloroethylene	83	840	26	<1
Toluene	<1	<10	<1	<1
1,1,1-Trichloroethane	<1	<10	<1	<1
1,1,2-Trichloroethane	<1	<10	<1	<1
Trichloroethylene	3	17	<1	<1
Trichlorofluoromethane	<1	<10	<1	<1
1,2,3-Trichloropropane	<1	<10	<1	<1
Vinyl chloride	<1	<10	<1	<1
Xylene(total)	<3	<30	<3	<3

NOTE: All values reported in μg/l (ppb).

TABLE 2

TREATMENT SYSTEM MONITORING DATA
OWEGO HEAT TREAT
APALACHIN, NEW YORK

Date Collected	INFLUENT SAMPLE TAP 5/13/92	AFTER TOWER SAMPLE TAP 5/13/92	EFFLUENT AFTER CARBON SAMPLE TAP 5/13/92
Benzene	<10	<1	<1
Benzyl chloride	<100	<10	<10
Bis(2-chloroethoxy)methane	<5,000	<500	<500
Bromobenzene	<50	<5	<5
Bromodichloromethane	<10	<1	<1
Bromoform	<100	<10	<10
Bromomethane	<10	<1	<1
Carbon tetrachloride	<10	<1	<1
Chlorobenzene	<10	<1	<1
Chloroethane	<10	<1	<1
2-Chloroethylvinyl ether	<100	<10	<10
Chloroform	<10	<1	<1
1-Chlorohexane	<100	<10	<10
Chloromethane	<10	<1	<1
Chloromethylmethyl ether	<1,000	<100	<100
2-Chlorotoluene	<50	<5	<5
4-Chlorotoluene	<50	<5	<5
Dibromochloromethane	<10	<1	<1
Dibromomethane	<100	<10	<10
1,2-Dichlorobenzene	<50	<5	<5
1,3-Dichlorobenzene	<50	<5	<5
1,4-Dichlorobenzene	<50	<5	<5
Dichlorodifluoromethane	<100	<10	<10
1,1-Dichloroethane	<10	<1	<1
1,2-Dichloroethane	<10	<1	<1
1,1-Dichloroethylene	<10	<1	<1
1,2-Dichloroethylene(total)	88	8	<1
Dichloromethane	<10	<1	<1
1,2-Dichloropropane	<10	<1	<1
cis-1,3-Dichloropropylene	<10	<1	<1
trans-1,3-Dichloropropylene	<10	<1	<1
Ethylbenzene	<10	<1	<1
1,1,2,2-Tetrachloroethane	<10	<1	<1
1,1,1,2-Tetrachloroethane	<10	<1	<1
Tetrachloroethylene	680	28	5
Toluene	<10	<1	<1
1,1,1-Trichloroethane	<10	<1	<1
1,1,2-Trichloroethane	<10	<1	<1
Trichloroethylene	33	2	<1
Trichlorofluoromethane	<10	<1	<1
1,2,3-Trichloropropane	<10	<1	<1
Vinyl chloride	<10	<1	<1
Xylene(total)	<30	<3	<3

TABLE 3

TREATMENT SYSTEM MONITORING DATA
OWEGO HEAT TREAT
APALACHIN, NEW YORK

Date Collected	INFLUENT SAMPLE TAP 5/13/92
Calcium	67
Magnesium	12
Iron	0.30
Manganese	0.15
Total Alkalinity	170
Hardness	220
Total Suspended Solids	<1
Total Dissolved Solids	280
Nitrite Nitrogen	<0.05
Total Kjeldahl Nitrogen	2.7
Chloride	6
Sulfate	21
Oil & Grease	<5
pH (Laboratory) Std. units	7.6
Corrosivity	-0.14
Nitrate Nitrogen	4.1
Total Petroleum Hydrocarbon (by IR Spectrophotometer)	<1

NOTE: All values reported in mg/L (ppm), Unless otherwise noted.

Table 4

Air Stripper Performance Test Results

Owego Heat Treat, Inc.
Apalachin, New york

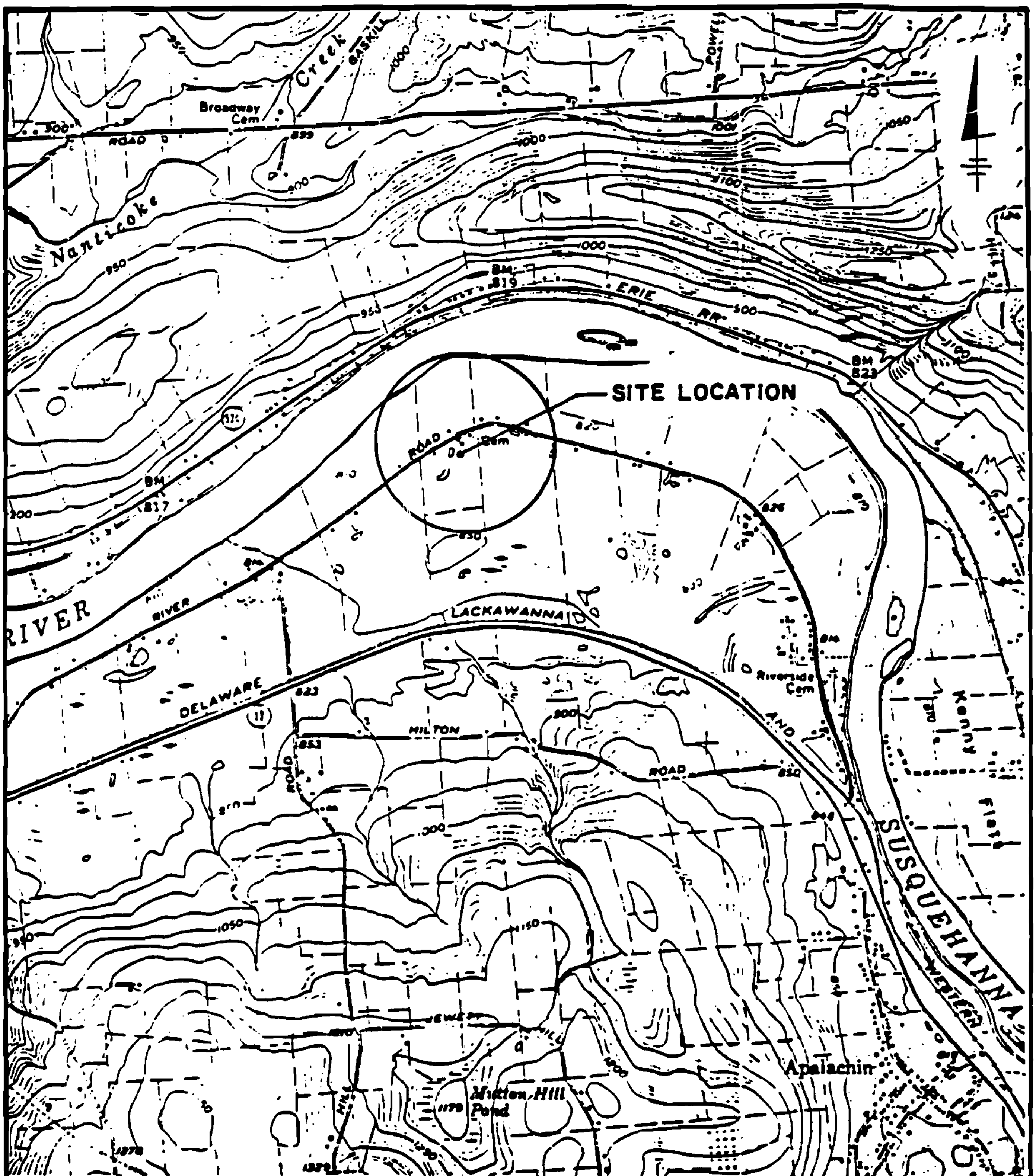
Test	Air Flow (cfm)	Water Flow (gpm)	Air:Water Ratio	Chemical	Influent Concentration	Effluent Concentration	Percent Removal	Concentration After Carbon
May 2, 1992	1100	15	73.3:1	1,2-Dichloroethylene	79	4	95%	<1
				Tetrachloroethylene	840	26	97%	<1
				Trichloroethylene	17	≤1	99%	<1
				Total	936	30	97%	
May 13, 1992	1100	22.3	49.3:1	1,2-Dichloroethylene	88	8	91%	<1
				Tetrachloroethylene	680	28	96%	5
				Trichloroethylene	33	2	99%	<1
				Total	801	38	95%	

Note: Concentrations in ug/l

Figures

O'BRIEN & GERE ENGINEERS, INC.

FIGURE 1



SITE LOCATION MAP
OWEGO HEAT TREAT, INC.

0 2000 4000

1" = 2000'

SCALE IN FEET

ADAPTED FROM U.S.G.S APALACHIN N.Y. QUADRANGLE

O'BRIEN & GERE ENGINEERS, INC.

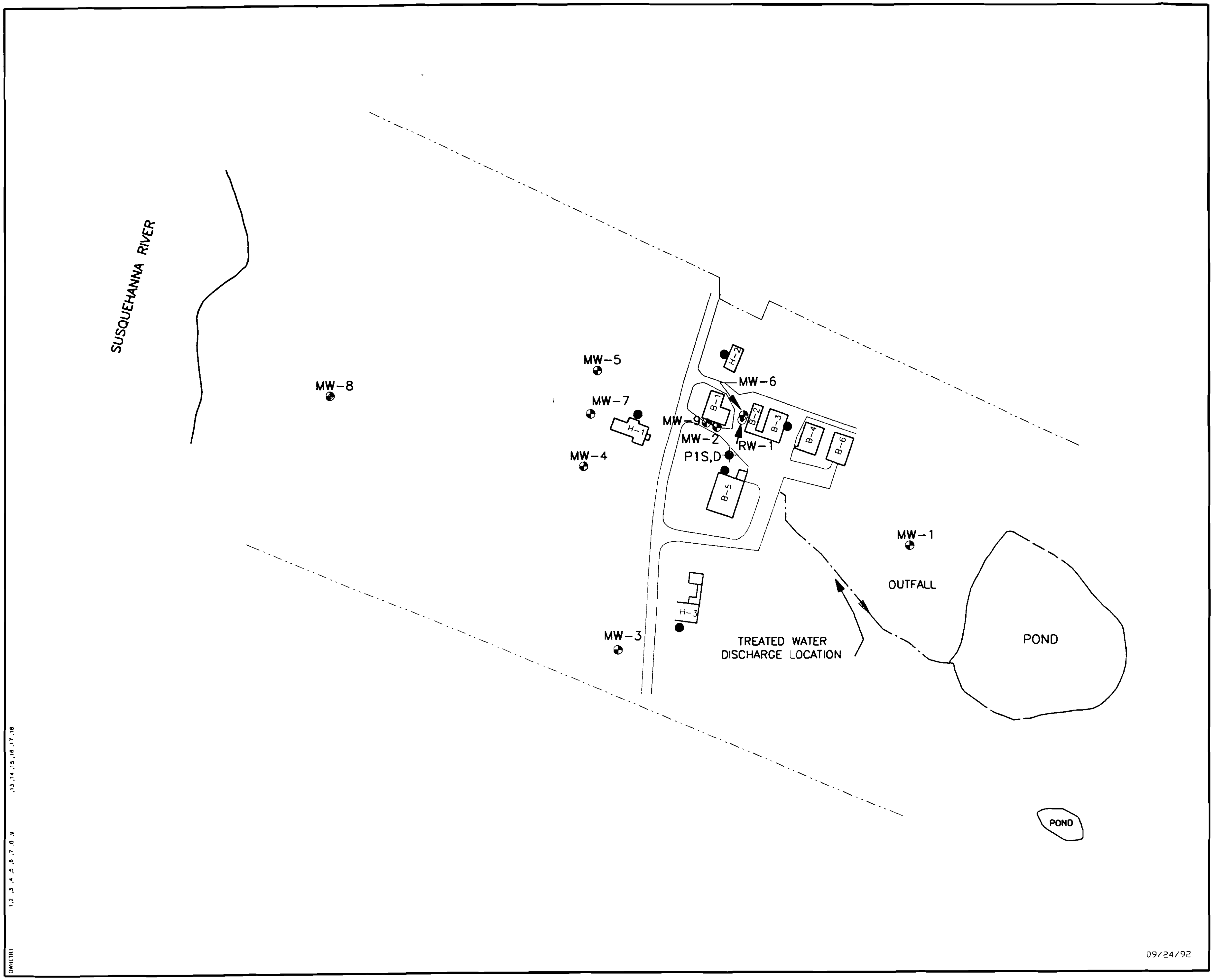


FIGURE 2

OWEGO HEAT TREAT
APALACHIN, NEW YORK

LEGEND

- MONITORING WELL
- RECOVERY WELL
- PIEZOMETER
- SUPPLY WELL
- B-6 MANUFACTURING FACILITY AND WELL ID.
- H-1 HOUSEHOLD AND WELL ID.
- PROPERTY BOUNDARY

SITE MAP

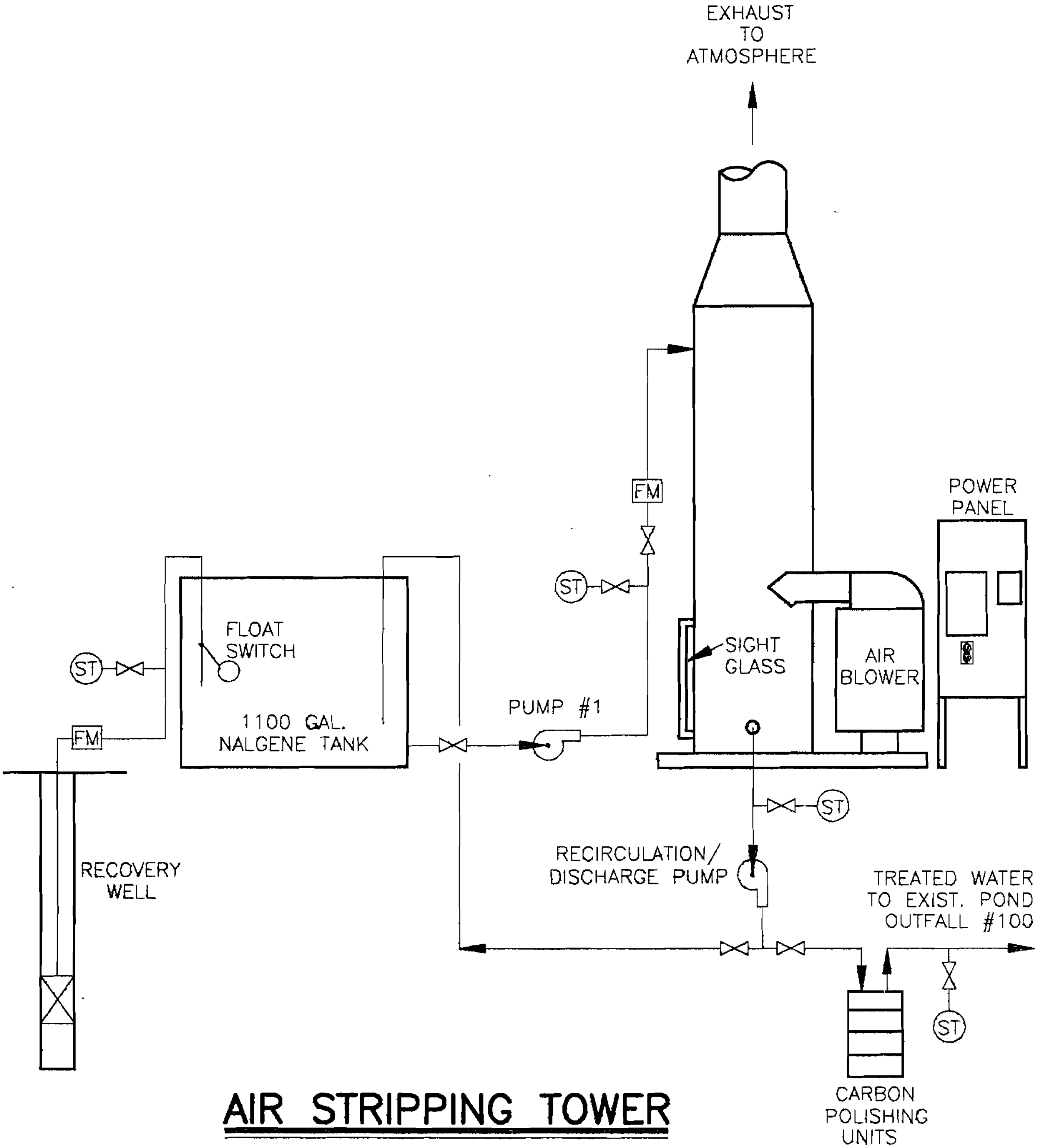
200 0 200

SCALE IN FEET

4100.001.876

O'BRIEN & GERE
ENGINEERS, INC.

FIGURE 3



AIR STRIPPING TOWER FLOW SCHEMATIC

LEGEND:

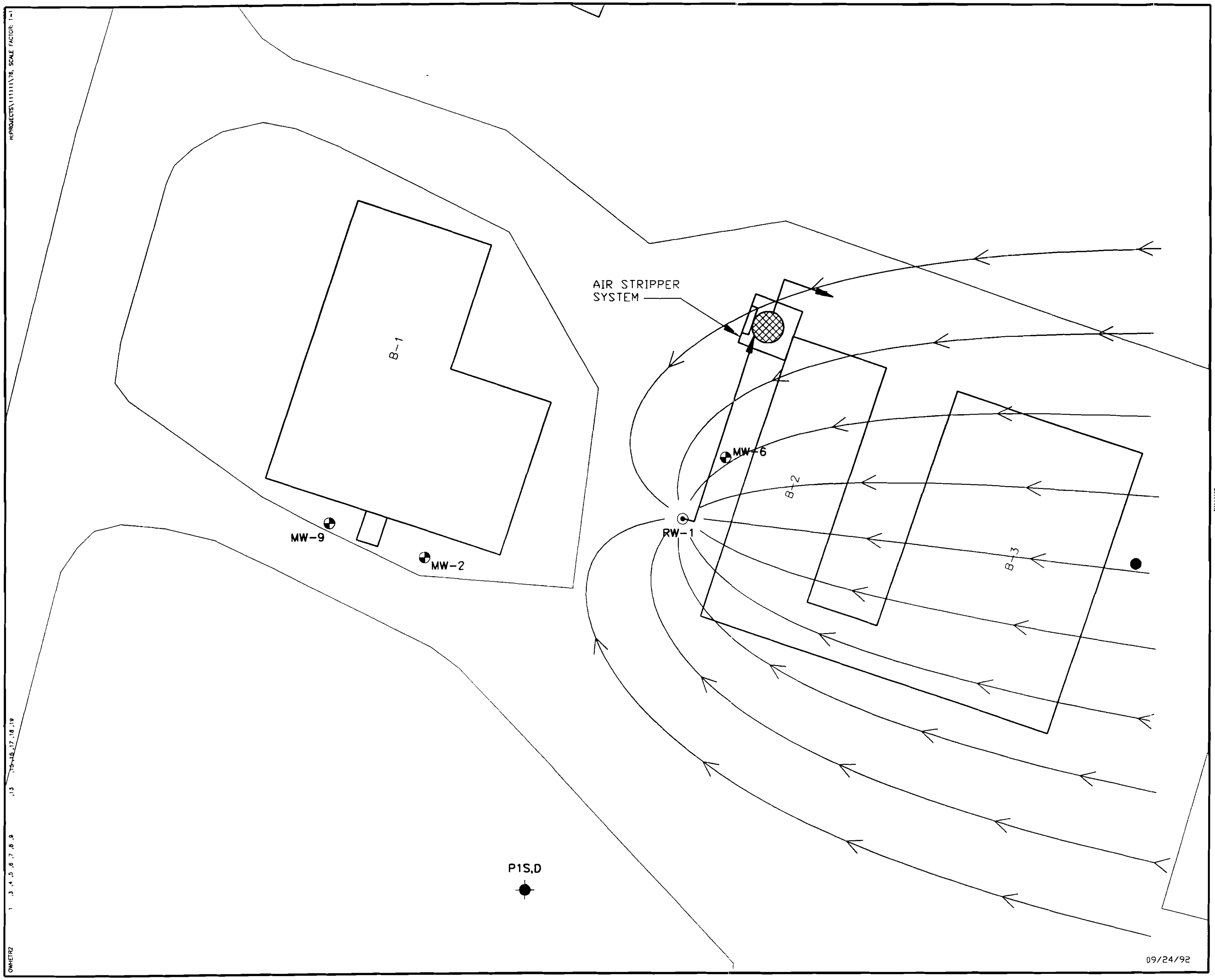
FM FLOW METER

ST SAMPLE TAP

FILE No. 4100.001.808

FIGURE 4

OWEGO HEAT TREAT
APALACHIN, NEW YORK



LEGEND

- MONITORING WELL
- RECOVERY WELL
- PIEZOMETER
- SUPPLY WELL
- B-6 MANUFACTURING FACILITY AND WELL ID.
- PROPERTY BOUNDARY
- ESTIMATED CAPTURE ZONE
- GROUND WATER FLOW PATH

AIR STRIPPER LOCATION AND CAPTURE ZONE MAP

20 0 20
SCALE IN FEET

4100.001.876

O'BRIEN & GERE ENGINEERS, INC.

Appendices

O'BRIEN & GERE ENGINEERS, INC.

APPENDIX A

ChemCAD PILOT SYSTEM MODELING RESULTS

O'BRIEN & GERE

Quick Note

Message

To: John Rinko

Date: November 26, 1991

Re: Owego Air Stripper

ChemCad has been used to model the air stripper designed for the Owego Heat Treatment System to determine if the discharge limits ~~will be~~ are expected to be exceeded. The ChemCad process flow schematics are attached for 2, 3, 4 and 5 stages, respectively. It is expected that 2 theoretical stages will be required for the removals. Height of an Equivalent Theoretical Plate (HETP) values of 2.3 to 3.0 ft. are generally found as stated in Perry's. Our calculations show a wide range of HETP values as found in the attached calculations. For this reason, HETP has fallen out of favor as far as relating packing to trays. However, assuming the HETP values from Perry's (similar to those for TCE and 2" Stedman packing), a packing height of 6 ft. is expected to yield the required removals. Thus, the given towers for the two cases (D = 3', Z = 10' and D = 2', Z = 12', respectively) appear to be able to achive the required removals, however, a pilot scale study is recommeded to corroborate the conclusion.

Signed: Will Wile   cc: M. Traistor

Reply

Date:

Signed:

INSTRUCTIONS TO SENDER:
1. KEEP PINK COPY. 2. SEND WHITE AND CANARY COPIES.

INSTRUCTIONS TO RECEIVER:
1. WRITE REPLY. 2. KEEP CANARY COPY, RETURN WHITE COPY TO SENDER.

Owego Heat Treat System

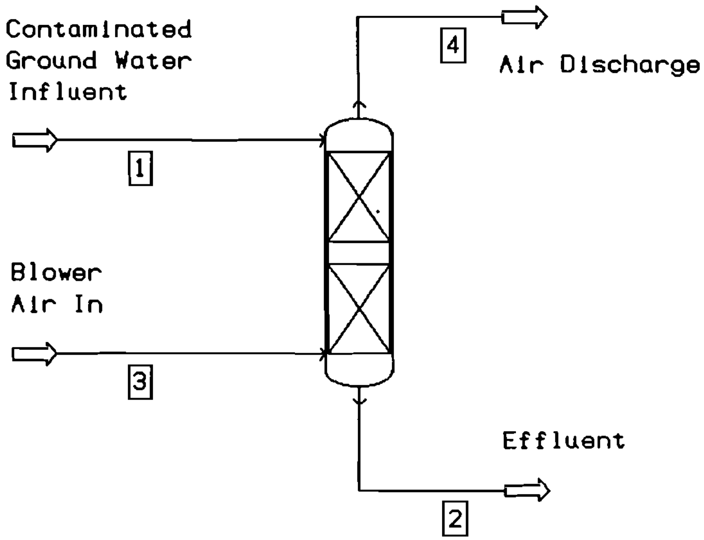
Air Stripper Schematic

System (2)

TCE : 1.46 ppb

PCE : 0,37 ppb

2 stages



Stream ID	1	2	3	4
Stream label	Influent	Effluent	Air In	Air Out
Mass flow rate (lbmol/hr)	556	554.6	96	97.4
Temperature (deg F)	55	53.32	70	54.67
Pressure (psia)	14.7	15.35	14.7	14.7
Enthalpy (MM BTU)	-5.576	-5.578	0.8307	0.8332
V fraction	0	0	1	1
-- Component Flow Rates (lbmol/hr) --				
Water	556	554.6	0	1.409
Air	0	0.008414	96	95.99
4Cl-Ethylene	0.0002713	2.246e-008	0	0.0002713
Tri-Cl-Ethylene	0.0004567	1.109e-007	0	0.0004566

Owego Heat Treat System

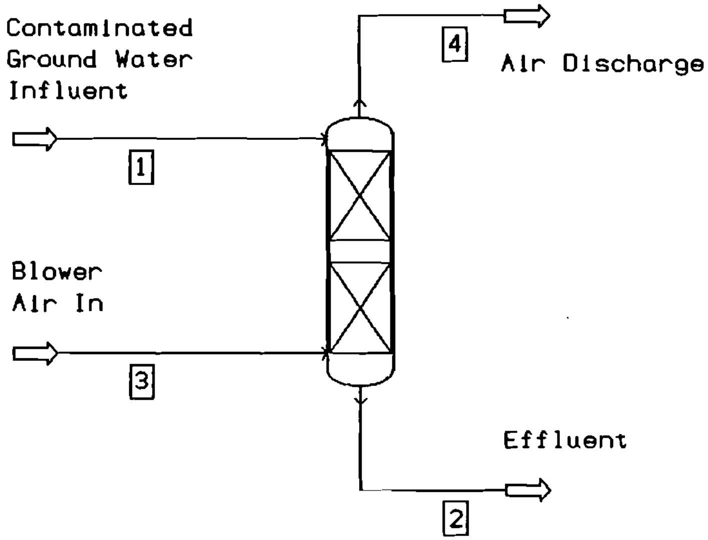
Air Stripper Schematic

System (2)

TCE : .0225 ppb

PCE : .00332 ppb

3 stages



Stream ID	1	2	3	4
Stream label	Influent	Effluent	Air In	Air Out
Mass flow rate (lbmol/hr)	556	554.6	96	97.41
Temperature (deg F)	55	53.3	70	54.9
Pressure (psia)	14.7	15.35	14.7	14.7
Enthalpy (MM BTU)	-5.576	-5.578	0.8307	0.8335
V fraction	0	0	1	1
-- Component Flow Rates (lbmol/hr) --				
Water	556	554.6	0	1.421
Air	0	0.008345	96	95.99
4Cl-Ethylene	0.0002713	1.999e-010	0	0.0002713
Tri-Cl-Ethylene	0.0004567	1.707e-009	0	0.0004567

Owego Heat Treat System

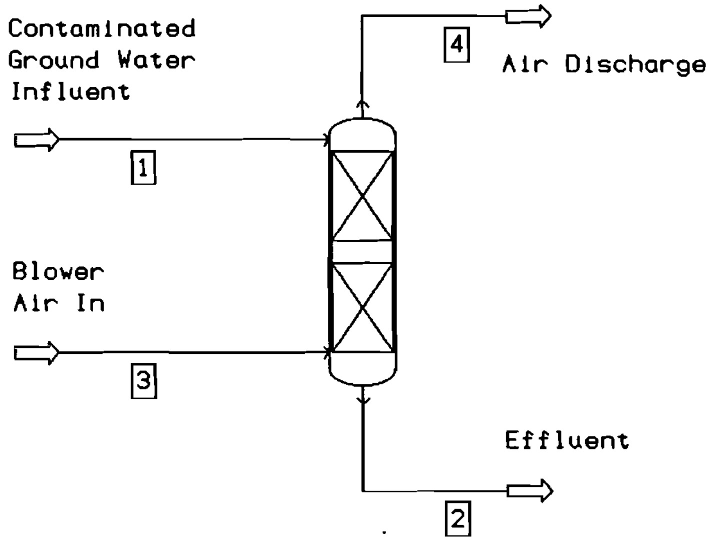
Air Stripper Schematic

System ②

TCE .000345 pph

PCE: 2.94×10^{-5} pph

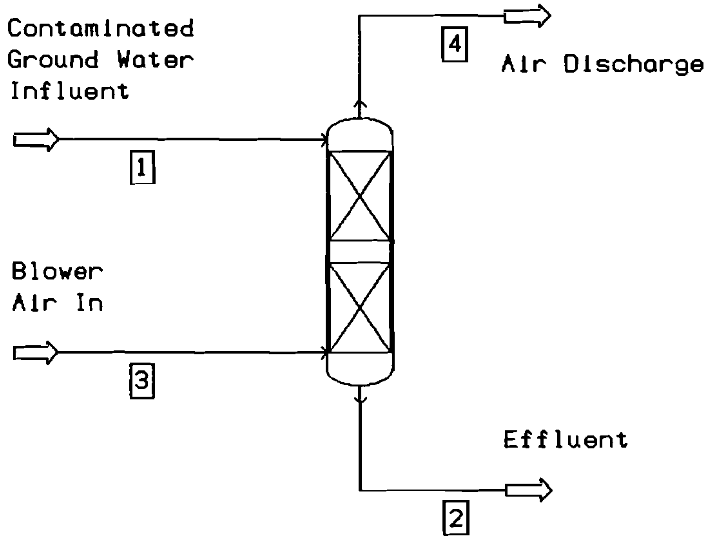
4 stages



Stream ID	1	2	3	4
Stream label	Influent	Effluent	Air In	Air Out
Mass flow rate (lbmol/hr)	556	554.6	96	97.42
Temperature (deg F)	55	53.33	70	54.96
Pressure (psia)	14.7	15.35	14.7	14.7
Enthalpy (MM BTU)	-5.576	-5.578	0.8307	0.8335
V fraction	0	0	1	1
-- Component Flow Rates (lbmol/hr) --				
Water	556	554.6	0	1.424
Air	0	0.008335	96	95.99
4Cl-Ethylene	0.0002713	1.773e-012	0	0.0002713
Tri-Cl-Ethylene	0.0004567	2.619e-011	0	0.0004567

Owego Heat Treat System

Air Stripper Schematic



Stream ID	1	2	3	4
Stream label	Influent	Effluent	Air In	Air Out
Mass flow rate (lbmol/hr)	556	554.6	96	97.42
Temperature (deg F)	55	53.34	70	54.97
Pressure (psia)	14.7	15.35	14.7	14.7
Enthalpy (MM BTU)	-5.576	-5.578	0.8307	0.8336
V fraction	0	0	1	1
-- Component Flow Rates (lbmol/hr) --				
Water	556	554.6	0	1.425
Air	0	0.008334	96	95.99
4Cl-Ethylene	0.0002713	1.569e-014	0	0.0002713
Tri-Cl-Ethylene	0.0004567	4.009e-013	0	0.0004567

System (2)

TCE 5.28×10^{-6} ppb

PCE: 2.61×10^{-7} ppb

5 stages

O'BRIEN & GERE

SUBJECT	SHEET	BY	DATE	JOB NO
	1/3	WTW		

Case 1: $HETP = K_1 G^{K_2} D'^{K_3} Z^{1/3} \alpha \mu_L' / \rho_L'$

HETP = height equivalent to a theoretical plate, in.
K_1, K_2, K_3 = empirical packing constants
G = superficial gas mass flow rate, lb/(hr-ft²)
D' = column diameter, in
Z = packing height, ft
α = relative volatility of contaminant to water
μ_L' = liquid viscosity, cp
ρ_L = liquid density, g/cc

For 2" ring packing, $K_1 = 0.42$, $K_2 = 0$, $K_3 = 1.24$

$$G = \frac{600\ ft^3}{min} \left| \frac{0.077\ lb}{ft^3} \right| \frac{4}{\pi\ (3 ft)^2} \left| \frac{60\ min}{hr} \right| = 392.2 \frac{lb}{hr\text{-}ft^2}$$

$$D' = 3\ ft \left| \frac{12\ in}{ft} \right| = 36\ in.$$

$$Z = 10'$$

$$\alpha = \frac{60\ mm\ Hg}{17.5\ mm\ Hg} = 3.429 \quad \text{(for TCE)}$$

$$\mu_L' = 0.1\ cp$$

$$\rho_L' = 1.0\ g/cm^3$$

so, $HETP = (0.42)(392.2)^0(36)^{1.24}(10)^{1/3}(3.429)(1.0)/(1.0)$

HETP = 264 in (22 ft) [Case 1, 2" rings, TCE]

O'BRIEN & GERE

SUBJECT	SHEET	BY	DATE	JOB NO
	2/3	WTW		

[Case 1, 2" rings, PCE]

$$\alpha = \frac{14 \text{ mm Hg}}{17.5 \text{ mm Hg}} = 0.8$$

$$HETP = (0.42)(392.2)^{0}(36)^{1.24}(10)^{1/3}(0.8)(1.0)/(1.0)$$

HETP = 61.6 in (5.1 ft)

[case 1, 2" stedman, TCE]

$K_1 = 0.077$, $K_2 = 0.48$, $K_3 = 0.24$

$$HETP = (0.077)(392.2)^{0.48}(36)^{0.24}(10)^{1/3}(3.429)(1.0)/(1.0)$$

HETP = 23.6 in (2.0 ft)

[case 1, 2" stedman, PCE]

$$HETP = (0.077)(392.2)^{0.48}(36)^{0.24}(10)^{1/3}(0.8)(1.0)/(1.0)$$

HETP = 5.51 in

O'BRIEN & GERE

SUBJECT	SHEET	BY	DATE	JOB NO.
	3/3	WTW		

Case 2:

$Z = 12'$

$$G = \frac{600\ ft^3}{min}\left|\frac{0.077\ lb}{ft^3}\right|\frac{60\ min}{hr}\left|\frac{4}{\pi}\frac{}{(2ft)^2}\right| = 882.4\ \frac{lb}{hr\text{-}ft^2}$$

$$D = 2\ ft\left|\frac{12\ in}{ft}\right| = 24\ in.$$

[Case 2, 2" rings, TCE]

$$HETP = (0.42)(882.4)^0(24)^{1.24}(12)^{1/3}(3.429)(1.0)/(1.0)$$

HETP = 170 in (14 ft)

[case 2, 2" rings, PCE]

$$HETP = (0.42)(882.4)^0(24)^{1.24}(12)^{1/3}(0.8)(1.0)/(1.0)$$

HETP = 39.6 in (3.3 ft)

[case 2, 2" stedman, TCE]

$$HETP = (0.077)(882.4)^{0.48}(24)^{0.24}(12)^{1/3}(3.429)(1.0)/(1.0)$$

HETP = 33.6 in (2.8 ft)

[case 2, 2" Stedman, PCE]

$$HETP = (0.077)(882.4)^{0.48}(24)^{0.24}(12)^{1/3}(0.8)(1.0)/(1.0)$$

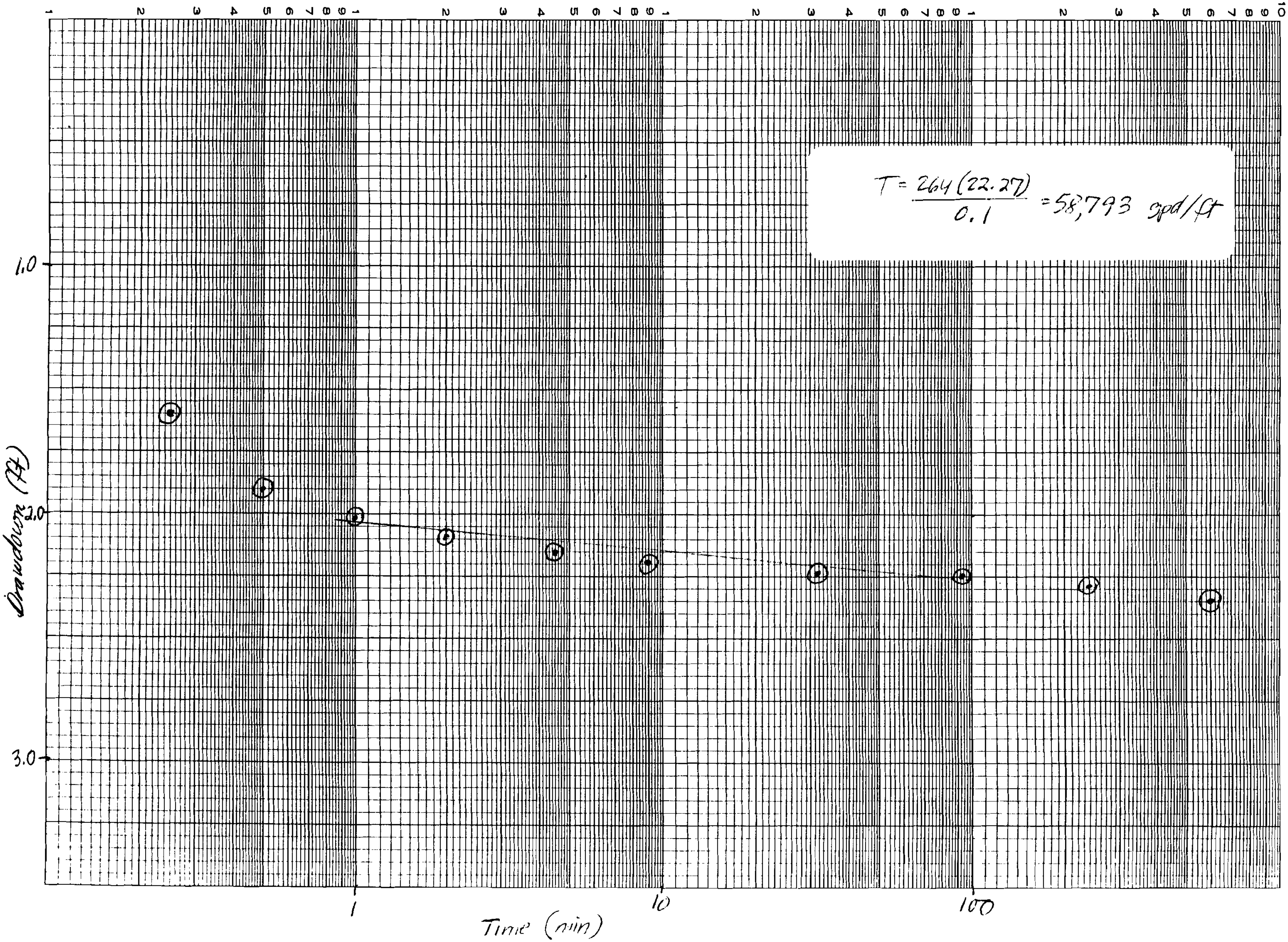
HETP = 7.84 in

APPENDIX B

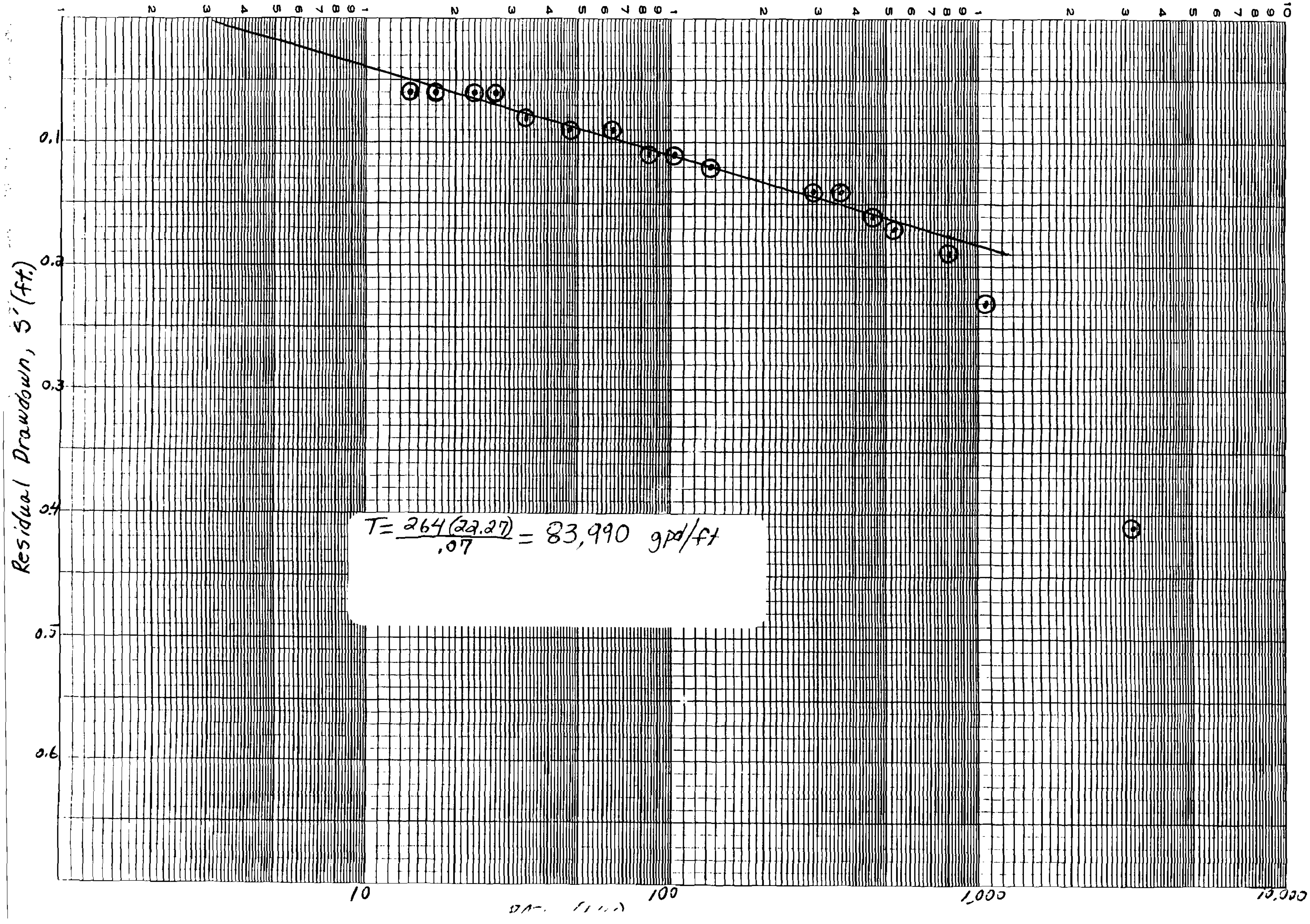
AQUIFER PERFORMANCE TEST DATA

KW-1

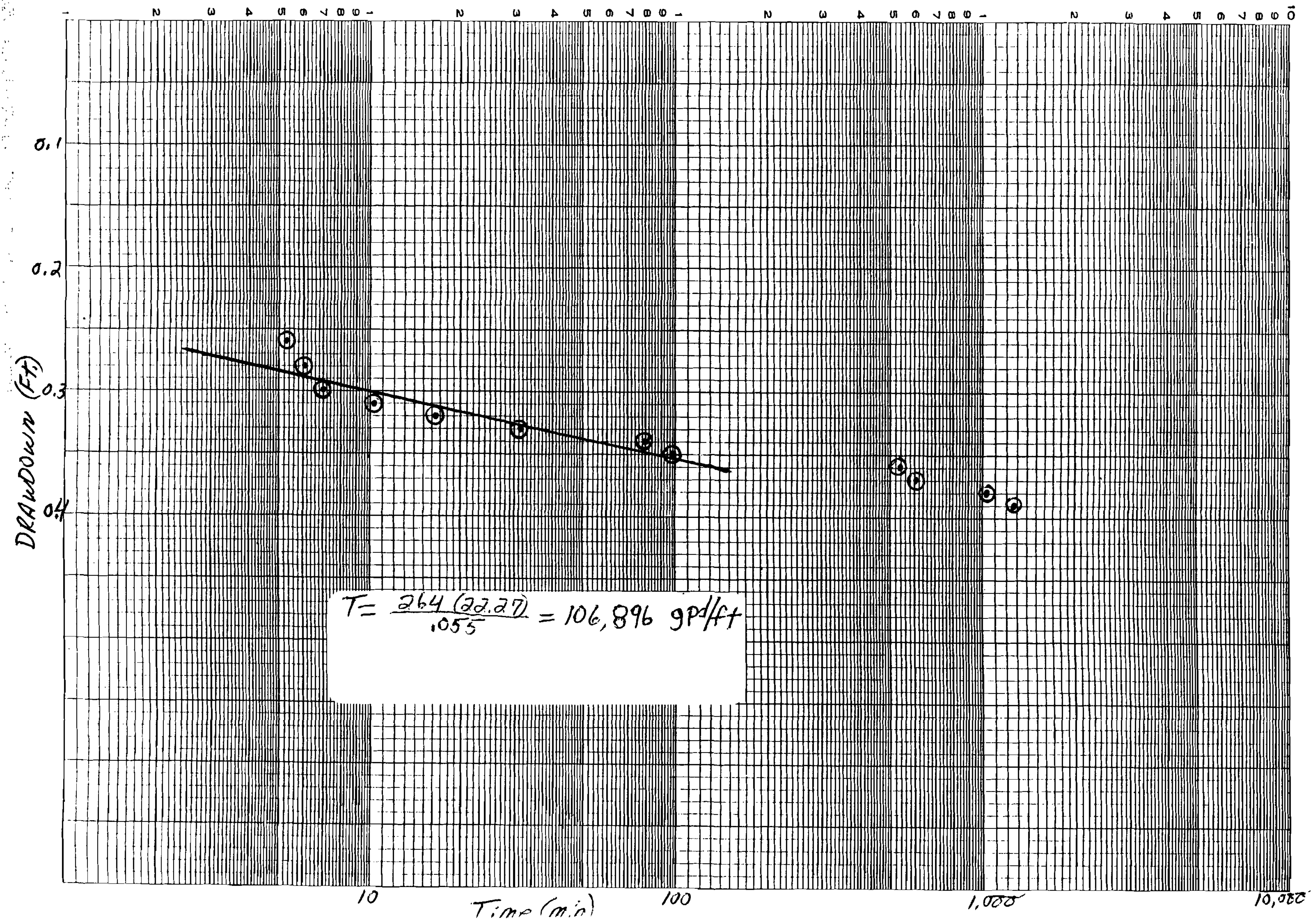
OWEGO HEAT TREAT



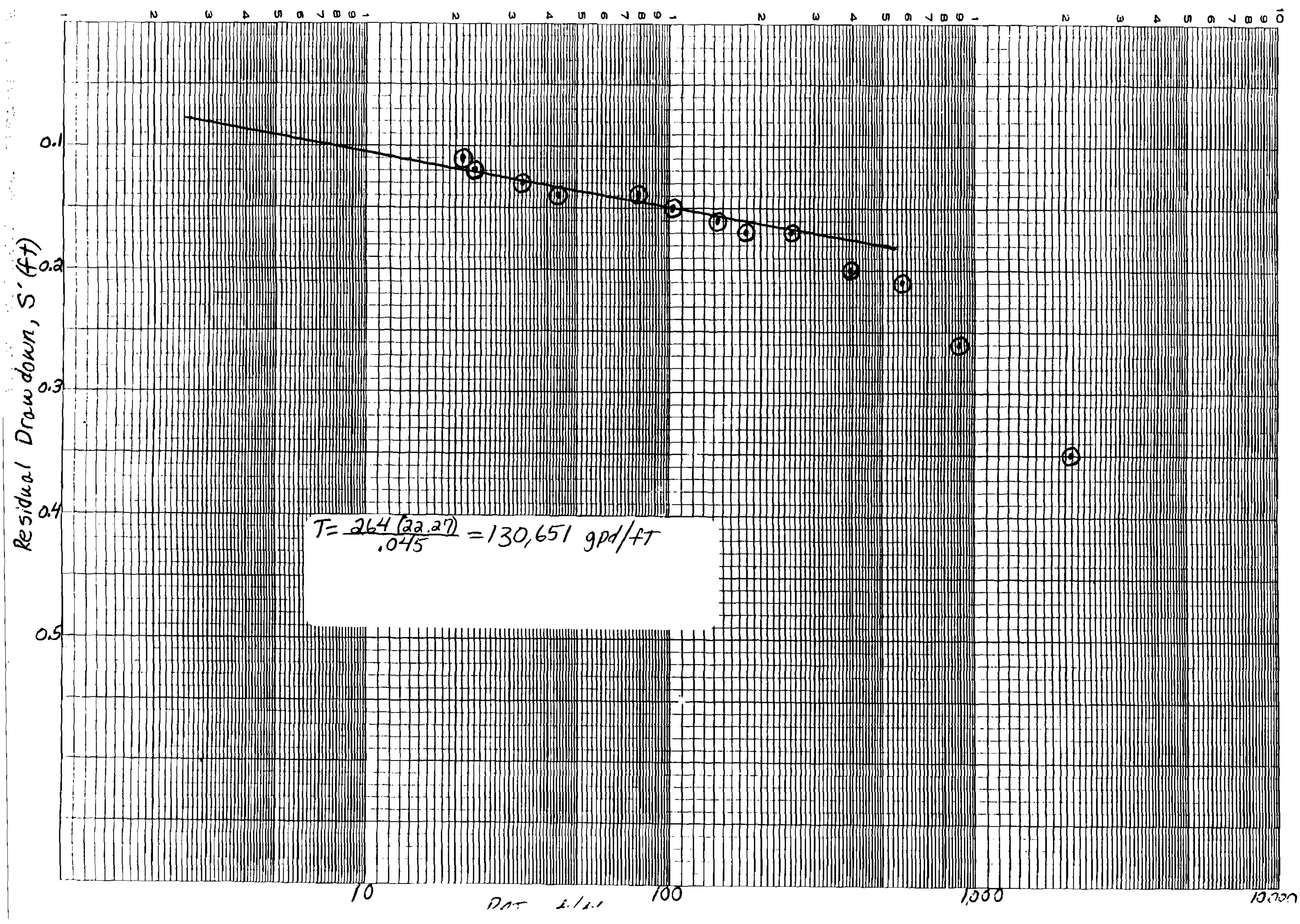
OWEGO W-1 HEAT TREAT



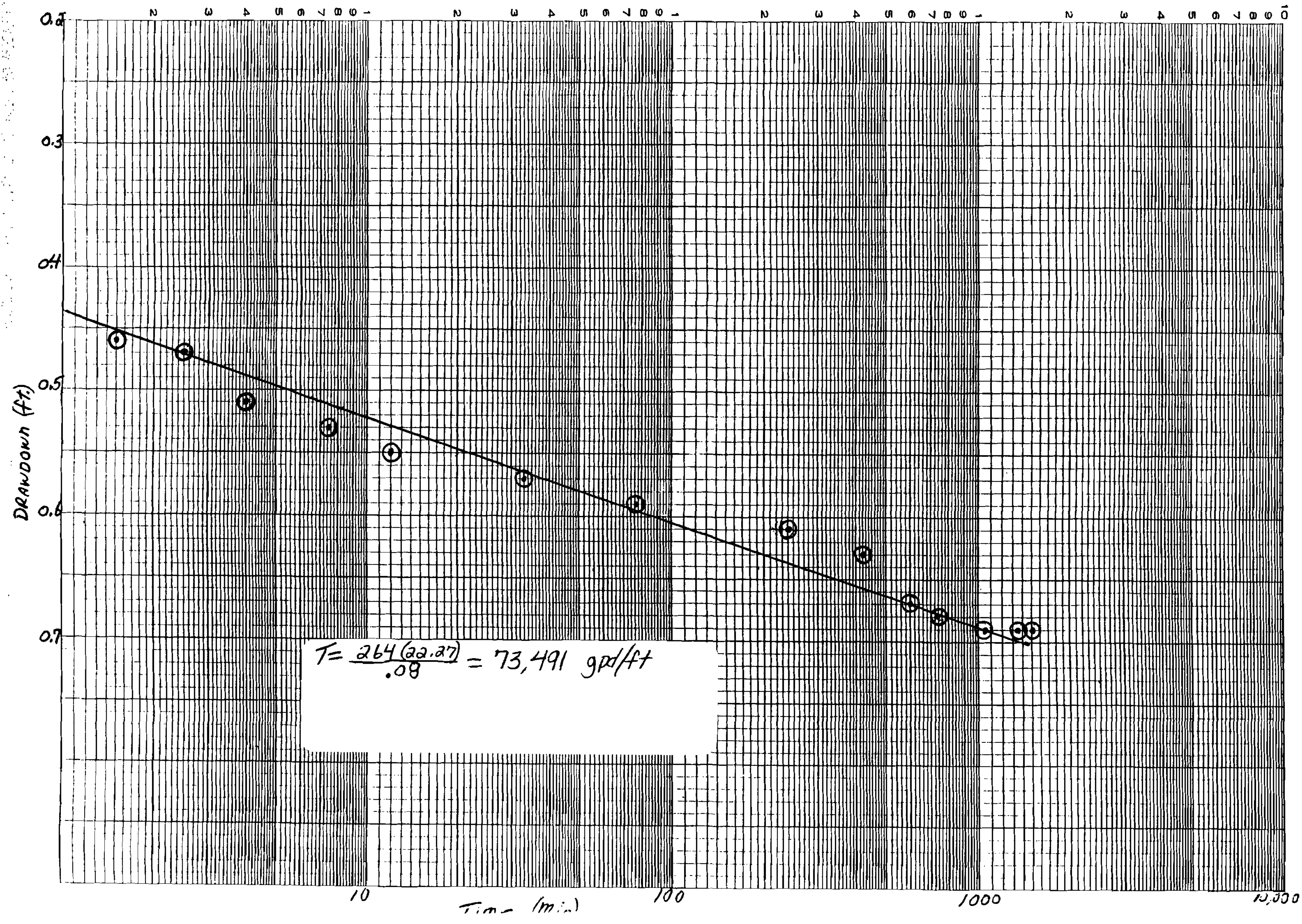
MW-2
OWEGO HEAT TREAT



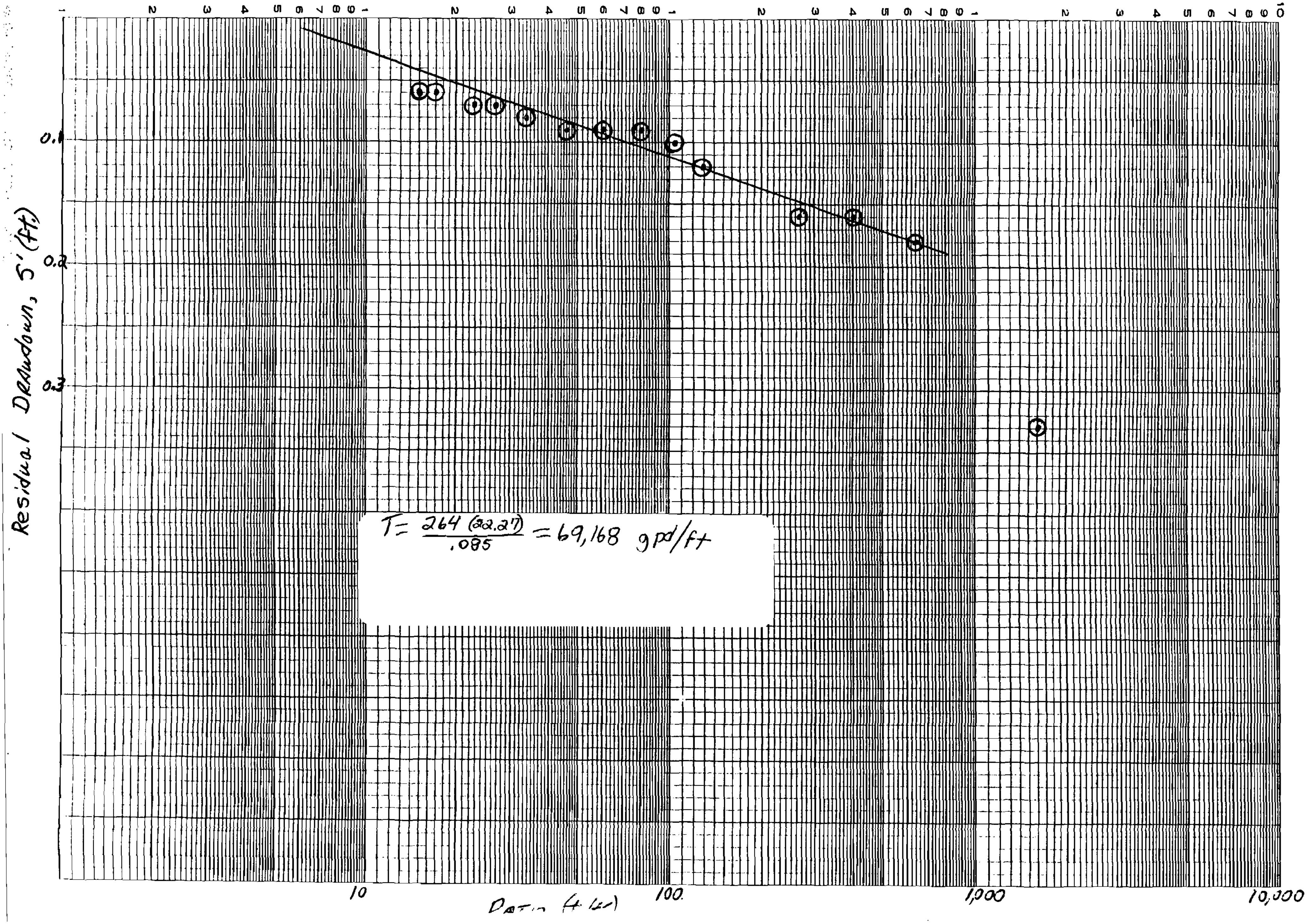
OWEGO HEAT TREAT



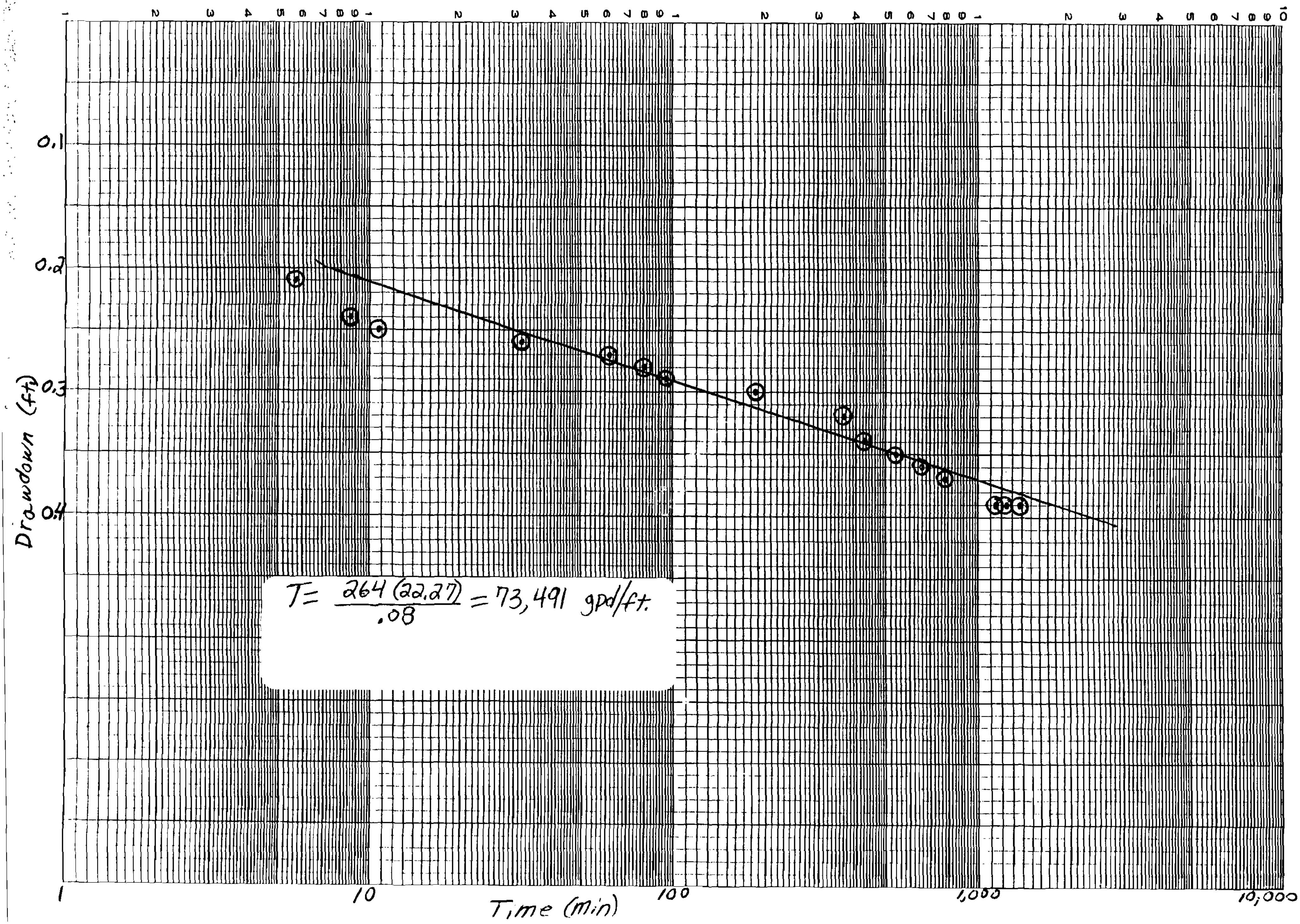
MW-6
OWEGO HEAT TREAT



MW-6
OWEGO HEAT TREAT

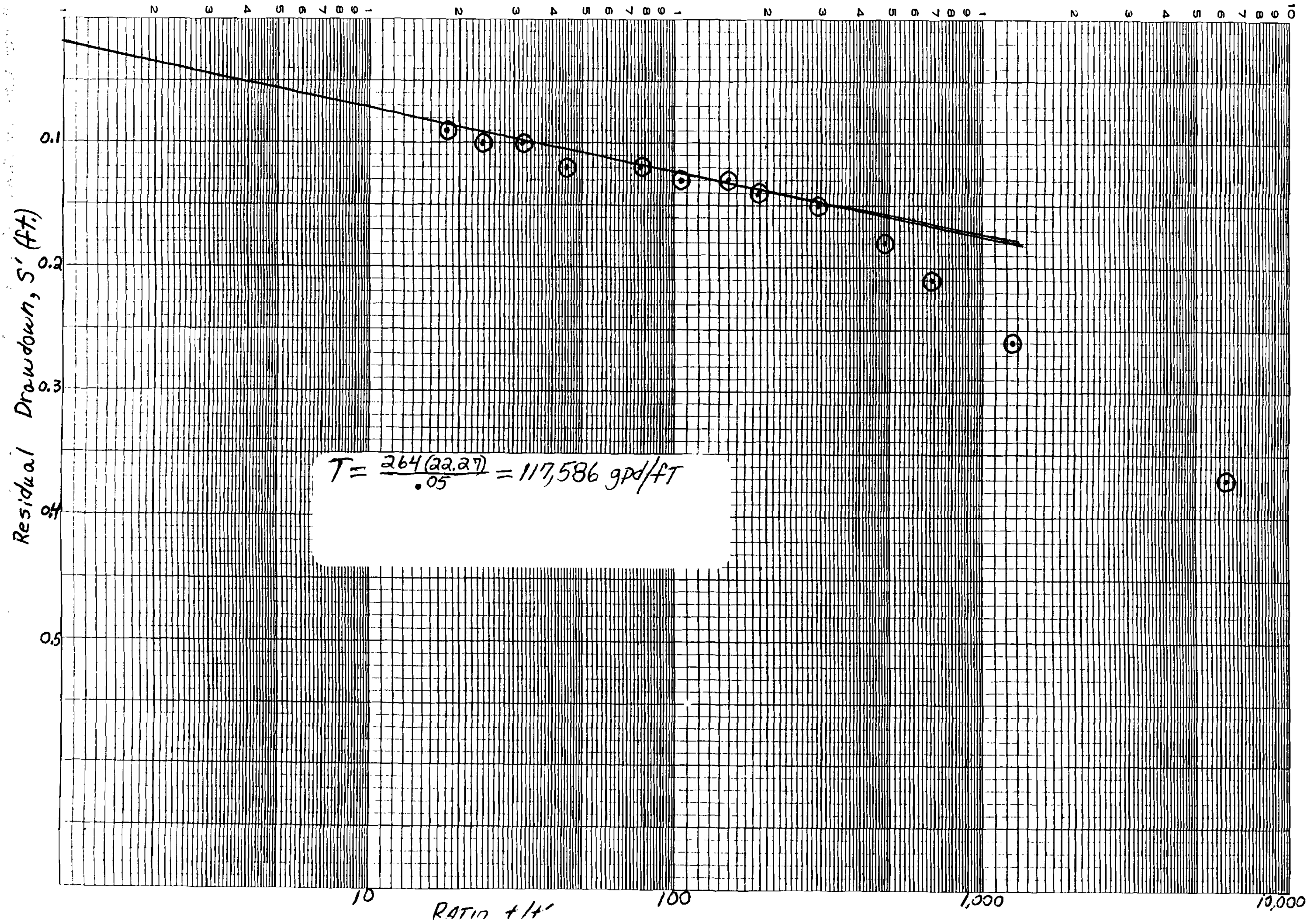


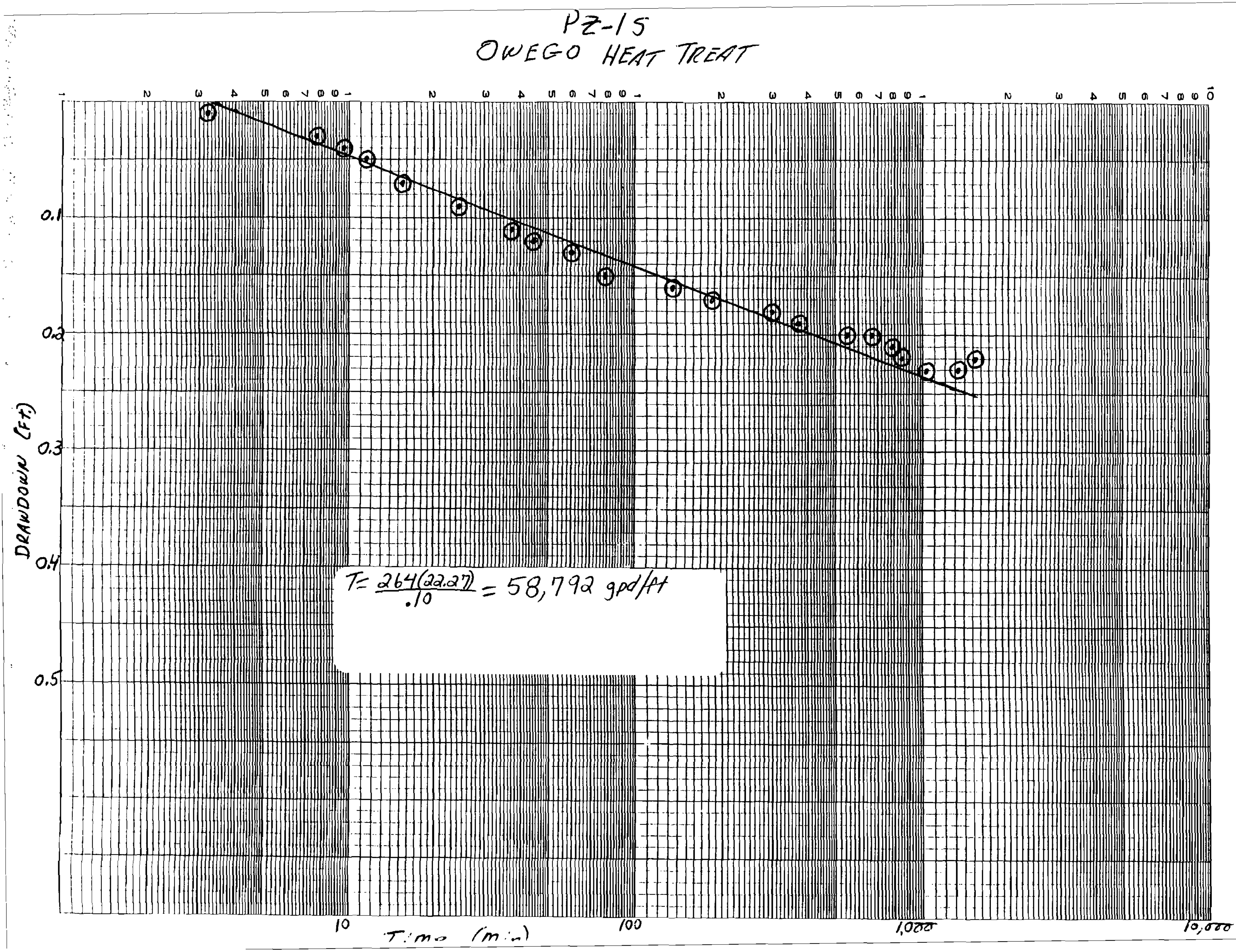
MW-9
OWEGO HEAT TREAT



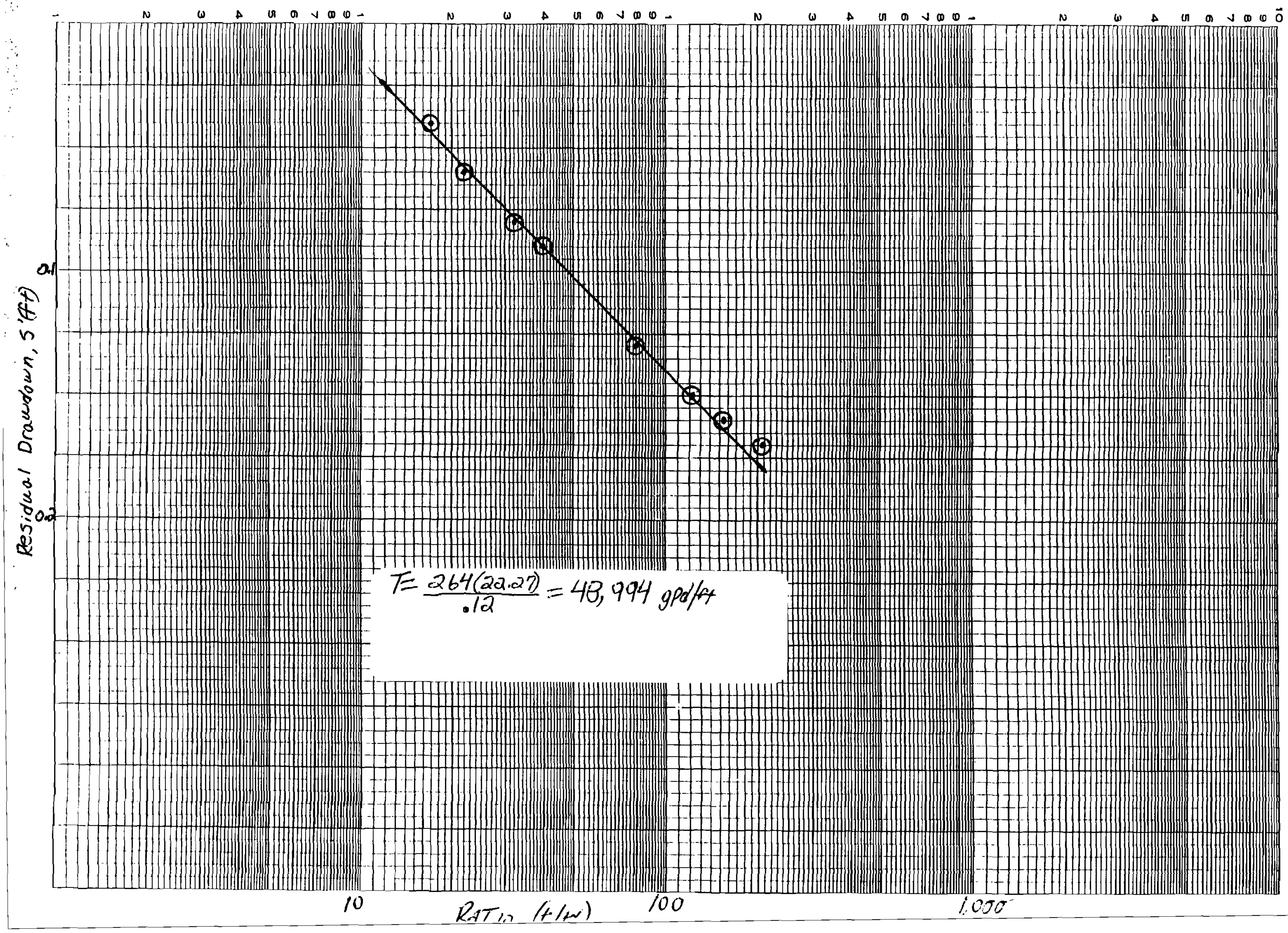
MW-4

OWEGO HEAT TREAT

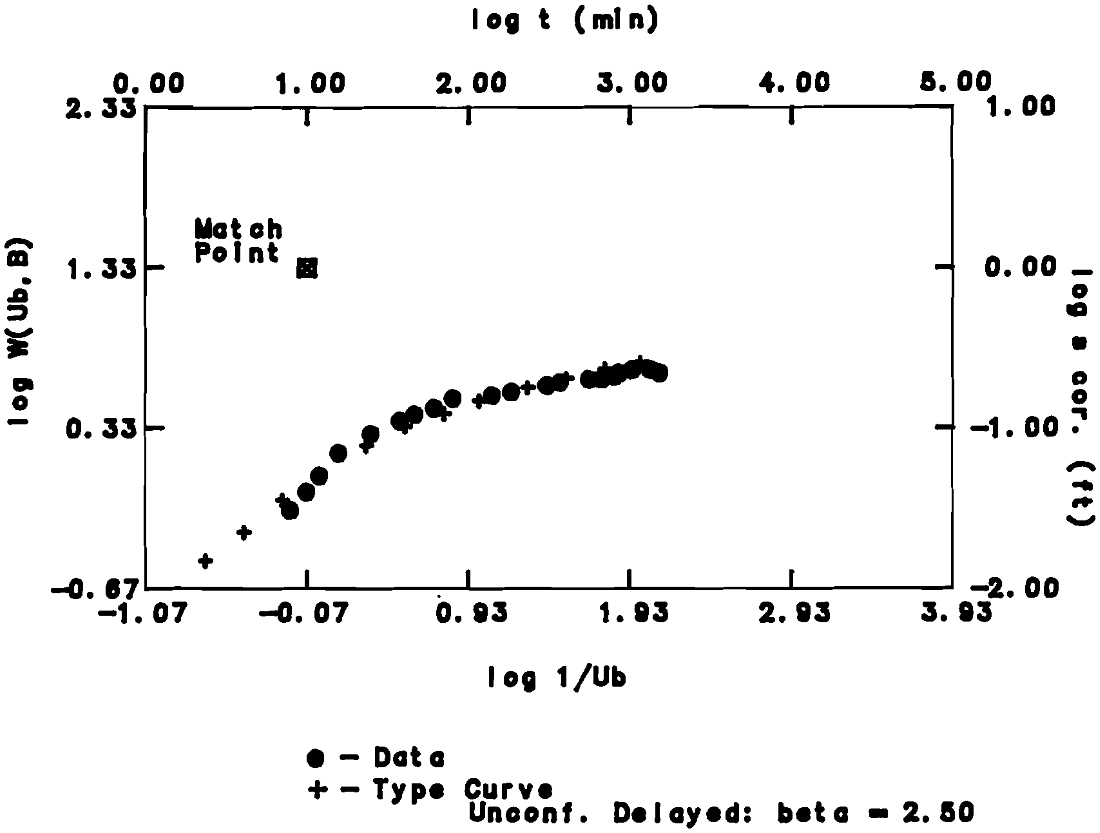



PZ-15
OWEGO HEAT TREAT
T= 264(22.27) / .10 = 58,792 gpd/ft
DRAWDOWN (Ft)
0.1
0.2
0.3
0.4
0.5
10
100
1,000
10,000
Time (min)

PZ-15
OWEGO HEAT TREAT



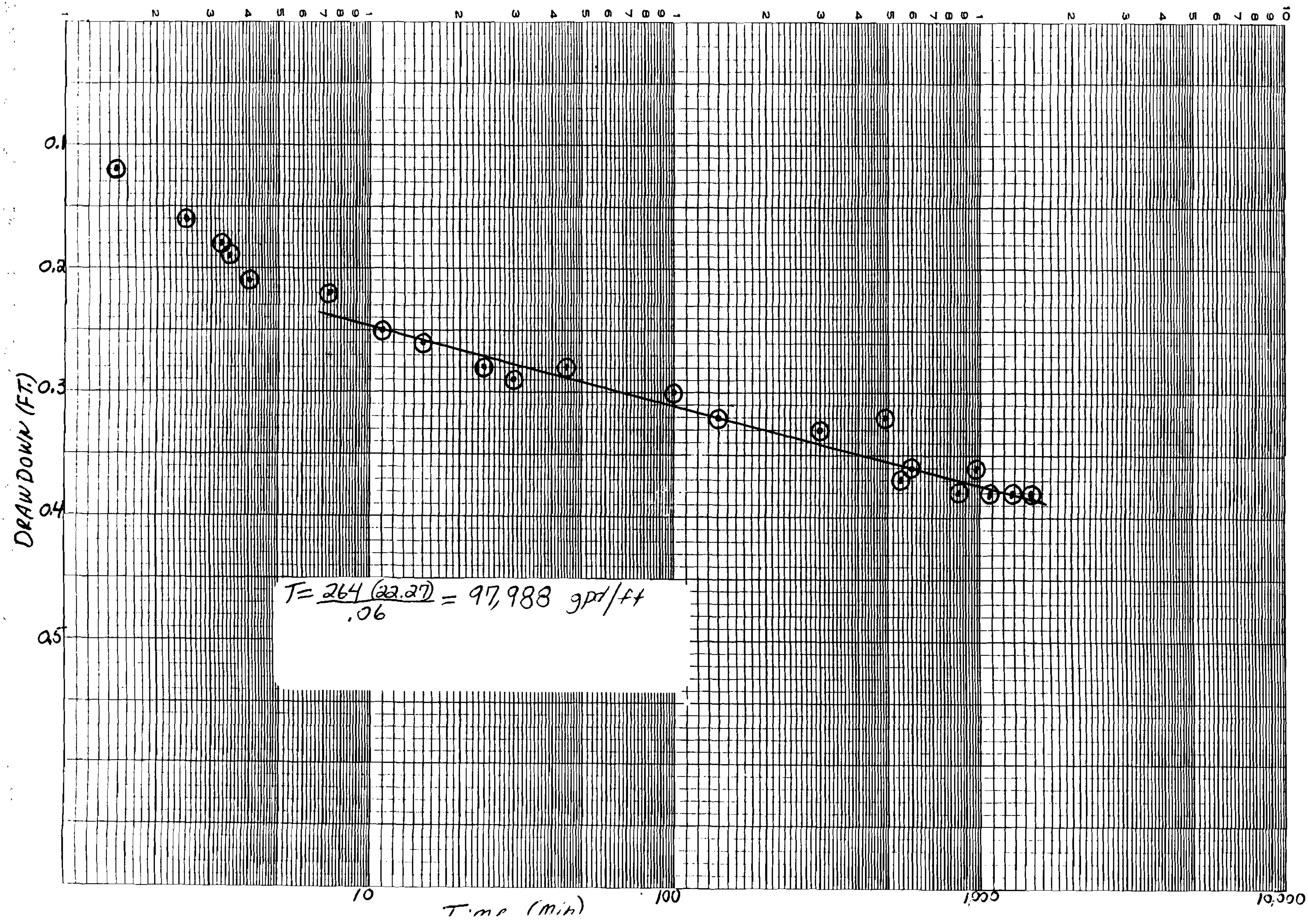
PIEZOMETER PZ-1S



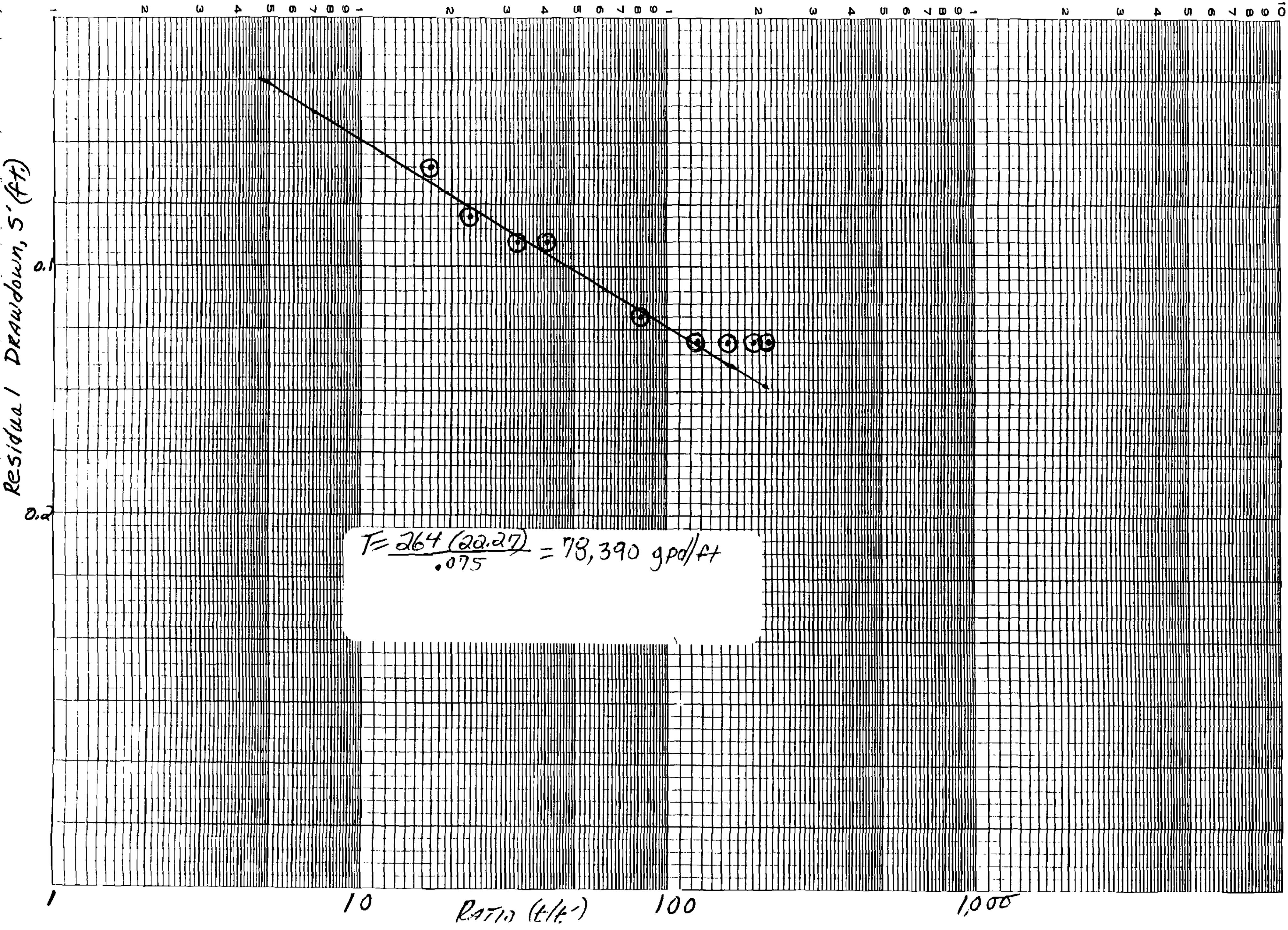
MATCH POINT			SOLUTION		
t	=	1.000E+0001	Transmissivity	=	5.455E+0004 gpd/ft
s	=	1.000E+0000	Hydraulic. Cond.	=	1.091E+0003 gpd/sq ft
1/Ub	=	8.511E-0001	Specific Yield	=	8.236E-0003
W(Ub,B)	=	2.138E+0001			

WELL INFORMATION		
WELL IDENTIFICATION	:	PZ-1S
DATE OF AQUIFER TEST	:	5/12/92
AQUIFER THICKNESS (b)	:	5.000E+0001 ft
DISCHARGE RATE (Q)	:	2.227E+0001 gpm
PUMPING WELL RADIUS (r)	:	2.500E-0001 ft
DISTANCE OF OBS. WELL FROM PUMPING WELL (d)	:	8.500E+0001 ft

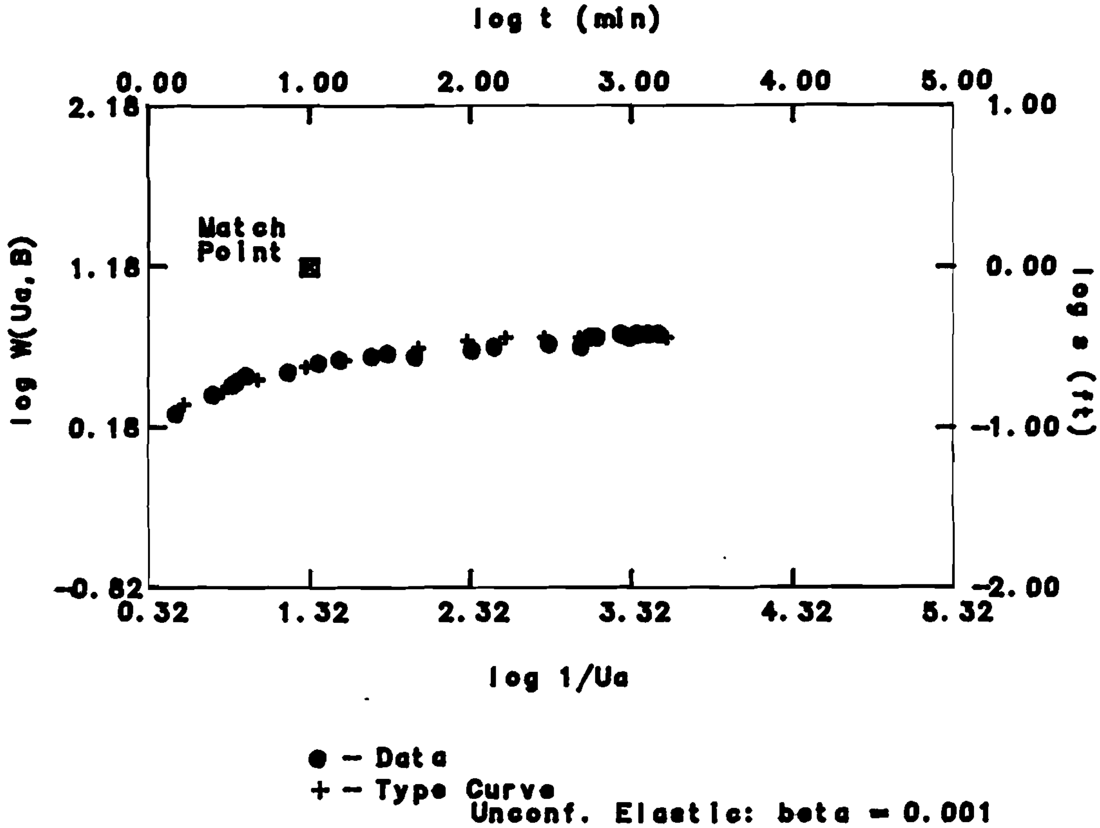
PL 1D
OWEGO HEAT TREAT



PZ-1D
OWEGO HEAT TREAT



PIEZOMETER PZ-1D



MATCH POINT		SOLUTION	
t	= 1.000E+0001	Transmissivity	= 3.862E+0004 gpd/ft
s	= 1.000E+0000	Hydraulic. Cond.	= 7.724E+0002 gpd/sq ft
1/Ua	= 2.089E+0001	Storativity	= 2.375E-0004
W(Ua,B)	= 1.514E+0001		

WELL INFORMATION	
WELL IDENTIFICATION	: PZ-1D
DATE OF AQUIFER TEST	: 5/12/92
AQUIFER THICKNESS (b)	: 5.000E+0001 ft
DISCHARGE RATE (Q)	: 2.227E+0001 gpm
PUMPING WELL RADIUS (r)	: 2.500E-0001 ft
DISTANCE OF OBS. WELL FROM PUMPING WELL (d)	: 8.500E+0001 ft

APPENDIX C

COMPATIBILITY ASSESSMENT/MONITORING LABORATORY DATA

LABORATORIES, INC.

Volatile Organics
Method 8010/8020

CLIENT: OWEGO HEAT TREAT

JOB NO. 4100.001.517

DESCRIPTION: Apalachin, NY

MATRIX: Water

DATE COLLECTED: 4-27-92 DATE RECEIVED: 4-28-92 DATE ANALYZED: 4-28-92

DESCRIPTION:	After Tower	QC Trip Blank
SAMPLE NO.:	P7437	P7438
Benzene	<1.	<1.
Benzyl chloride	<10.	<10.
Bis (2-chloroethoxy) methane	<500.	<500.
Bromobenzene	<5.	<5.
Bromodichloromethane	<1.	<1.
Bromoform	<10.	<10.
Bromomethane	<1.	<1.
Carbon tetrachloride	↓	↓
Chlorobenzene	↓	↓
Chloroethane	↓	↓
2-Chloroethylvinyl ether	<10.	<10.
Chloroform	<1.	<1.
1-Chlorohexane	<10.	<10.
Chloromethane	<1.	<1.
Chloromethylmethyl ether	<100.	<100.
2-Chlorotoluene	<5.	<5.
4-Chlorotoluene	<5.	<5.
Dibromochloromethane	<1.	<1.
Dibromomethane	<10.	<10.
1,2-Dichlorobenzene	<5.	<5.
1,3-Dichlorobenzene	↓	↓
1,4-Dichlorobenzene	↓	↓
Dichlorodifluoromethane	<10.	<10.

Authorized:

Date: May 8, 1992

OBG Laboratories, Inc., *an O'Brien & Gere Limited Company*
5000 Brittonfield Parkway / Suite 300, Box 4942 / Syracuse, NY 13221 / (315) 437-0200

LABORATORIES, INC.

Volatile Organics
Method 8010/8020

CLIENT OWEGO HEAT TREAT JOB NO. 4100.001.517

DESCRIPTION Apalachin, NY

MATRIX: Water

DATE COLLECTED 4-27-92 DATE RECEIVED 4-28-92 DATE ANALYZED 4-28-92

DESCRIPTION:	After Tower	QC Trip Blank
SAMPLE NO.:	P7437	P7438
1,1-Dichloroethane	<1.	<1.
1,2-Dichloroethane		
1,1-Dichloroethylene	↓	
1,2-Dichloroethylene (total)	13.	
Dichloromethane	<1.	
1,2-Dichloropropane		
cis-1,3-Dichloropropylene		
trans-1,3-Dichloropropylene		
Ethylbenzene		
1,1,2,2-Tetrachloroethane		
1,1,1,2-Tetrachloroethane	↓	
Tetrachloroethylene	83.	
Toluene	<1.	
1,1,1-Trichloroethane		
1,1,2-Trichloroethane	↓	
Trichloroethylene	3.	
Trichlorofluoromethane	<1.	
1,2,3-Trichloropropane		
Vinyl chloride	↓	↓
Xylene (total)	<3.	<3.

Comments:

Methodology: USEPA,SW-846, November 1986, 3rd Edition

Certification No.: 10155

Units: µg/l

Page 2 of 2

Authorized: [signature]

Date: May 8, 1992

OBG Laboratories, Inc., *an O'Brien & Gere Limited Company*
5000 Brittonfield Parkway / Suite 300, Box 4942 / Syracuse, NY 13221 / (315) 437-0200

O'BRIEN & GERE ENGINEERS, INC.

Job No. 4001004 80E
Sheet 1 of 1

Office: Div. 76
Address: Dennis Thorsett
Phone: Ext 2475

CHAIN OF CUSTODY

CLIENT: Owego Heat Treat LOCATION: Apalachin, N Y	COLLECTED BY: Paul Gottler (Signature) Paul F. Gottler

SAMPLE DESCRIPTION	Date	Time	Sample Matrix[1]	Sample Type[2]	No. of Containers	ANALYSIS REQUESTED
After Tower	4/27/92	1500	water	Grab	2	8010/8020
Trip Blank	–	–	"	"	2	" / "

24 hr turnaround

[1] Matrix = water, wastewater, air, sludge, sediment, etc.
[2] Type = grab, composite

Relinquished by	Date	Time	Received by	Date	Time
Relinquished by: Paul F. Gottler of: Div 76 OB&G	4/27/92	1738	Received by: Wendy Smith of: OBG Laboratories, Inc	4-28-92	07:10
Relinquished by: of:			Received by: of:		
Relinquished by: of:			Received by: of:		
Use this space if shipped via courier (e.g., Fed Ex) Relinquished by: of:			Courier Name: *Attach delivery/courier receipt to Chain of Custody		
Relinquished by: of:			Received by: of:		

o/wpC

September 17, 1990

CASE FILE

Survey: Owego Heat Treat Date Collected: 4-27-92

Sampler: Paul Gottler Date Received: 4-28-92

Client Name and Ref. #: OB&G Engineers # 4001.001.808

OBG Laboratory Client #: 4100.001.517

CONDITION OF SHIPMENT: Satisfactory

RADIOACTIVITY SCREENING*:

___ The sample cooler(s) were screened for radioactivity and found safe for handling.

✓ The samples come from a safe source and do not need to be screened.

Signed: Wendy [signature]
Sample Coordinator

****

DISPOSAL PROCEDURE**: Routine

Signed: [signature]

Date: 5-11-92

*The radioactivity screen is performed to alert our employees of unexpected radioactivity at hazardous waste sites.

**Samples are disposed of four (4) weeks after a typed report is signed and mailed to the client. The routine method of disposal is: water samples are filtered through carbon to a sanitary sewer, solid samples are sent to a sanitary landfill.

OBG LABORATORIES, INC.

Volatile Organics
Method 8010/8020

CLIENT: OWEGO HEAT TREAT JOB NO. 4100.001.517

DESCRIPTION: Owego, NY

MATRIX: Water

DATE COLLECTED: 5-2-92 DATE RECEIVED: 5-4-92 DATE ANALYZED: 5-4,5-92

DESCRIPTION:	Stripper Influent @ 16:00	Between Stripper & Carbon	QC Trip Blank	Carbon Effluent @ 16:05		
SAMPLE NO.:	P7983	P7984	P7985	P7988		
Benzene	<10.	<1.	<1.	<1.		
Benzyl chloride	<100.	<10.	<10.	<10.		
Bis (2-chloroethoxy) methane	<50,000.	<5000.	<5000.	<5000.		
Bromobenzene	<50.	<5.	<5.	<5.		
Bromodichloromethane	<10.	<1.	<1.	<1.		
Bromoform	<100.	<10.	<10.	<10.		
Bromomethane	<100.	<10.	<10.	<10.		
Carbon tetrachloride	<10.	<1.	<1.	<1.		
Chlorobenzene	↓	↓	↓	↓		
Chloroethane	↓	↓	↓	↓		
2-Chloroethylvinyl ether	<100.	<10.	<10.	<10.		
Chloroform	<10.	<1.	<1.	<1.		
1-Chlorohexane	<100.	<10.	<10.	<10.		
Chloromethane	<100.	<10.	<10.	<10.		
Chloromethylmethyl ether	<1000.	<100.	<100.	<100.		
2-Chlorotoluene	<50.	<5.	<5.	<5.		
4-Chlorotoluene	<50.	<5.	<5.	<5.		
Dibromochloromethane	<10.	<1.	<1.	<1.		
Dibromomethane	<100.	<10.	<10.	<10.		
1,2-Dichlorobenzene	<50.	<5.	<5.	<5.		
1,3-Dichlorobenzene	↓	↓	↓	↓		
1,4-Dichlorobenzene	↓	↓	↓	↓		
Dichlorodifluoromethane	<100.	<10.	<10.	<10.		

Authorized: [signature]

Date: May 12, 1992

OBG Laboratories, Inc., *an O'Brien & Gere Limited Company*
5000 Brittonfield Parkway / Suite 300, Box 4942 / Syracuse, NY 13221 / (315) 437-0200

LABORATORIES, INC.

Volatile Organics
Method 8010/8020

CLIENT: OWEGO HEAT TREAT JOB NO. 4100.001.517

DESCRIPTION: Owego, NY

MATRIX: Water

DATE COLLECTED: 5-2-92 DATE RECEIVED: 5-4-92 DATE ANALYZED: 5-4,5-92

DESCRIPTION:	Stripper Influent @ 16:00	Between Stripper & Carbon	QC Trip Blank	Carbon Effluent @ 16:05		
SAMPLE NO.:	P7983	P7984	P7985	P7988		
1,1-Dichloroethane	<10.	<1.	<1.	<1.		
1,2-Dichloroethane	↓	↓	↓	↓		
1,1-Dichloroethylene	↓	↓	↓	↓		
1,2-Dichloroethylene (total)	79.	4.	↓	↓		
Dichloromethane	15.	<1.	↓	↓		
1,2-Dichloropropane	<10.	↓	↓	↓		
cis-1,3-Dichloropropylene	↓	↓	↓	↓		
trans-1,3-Dichloropropylene	↓	↓	↓	↓		
Ethylbenzene	↓	↓	↓	↓		
1,1,2,2-Tetrachloroethane	<1000.	<100.	<10.	<10.		
1,1,1,2-Tetrachloroethane	<10.	<1.	<1.	<1.		
Tetrachloroethylene	840.	26.	↓	↓		
Toluene	<10.	<1.	↓	↓		
1,1,1-Trichloroethane	↓	↓	↓	↓		
1,1,2-Trichloroethane	↓	↓	↓	↓		
Trichloroethylene	17.	↓	↓	↓		
Trichlorofluoromethane	<10.	↓	↓	↓		
1,2,3-Trichloropropane	↓	↓	↓	↓		
Vinyl chloride	↓	↓	↓	↓		
Xylene (total)	<30.	<3.	<3.	<3.		

Comments:

Methodology: USEPA,SW-846, November 1986, 3rd Edition

Certification No.: 10155

Units: µg/1

Page 2 of 2

Authorized: [signature]

Date: May 12, 1992

OBG Laboratories, Inc., *an O'Brien & Gere Limited Company*
5000 Brittonfield Parkway / Suite 300, Box 4942 / Syracuse, NY 13221 / (315) 437-0200

LABORATORIES, INC.

CHAIN OF CUSTODY RECORD

SURVEY: OWEGO [illegible] [illegible]

LOCATION: OWEGO, NY

SAMPLED BY: Timothy [illegible]

ORGANIZATION: O'Brien & Gere Engineers, Inc.

STATION NUMBER	SAMPLE LOCATION	DATE COLLECTED	TIME COLLECTED	SAMPLE MATRIX	COMP. OR GRAB	NO. OF CONTAINERS	ANALYSIS REQUIRED
	STRIPPER INFLUENT	5/3/92	1505	H2O	GRAB	2	8010/8020 Hold
	CARBON EFFLUENT	5/3/92	1507	H2O	GRAB	2	8010/8020 Hold
	STRIPPER INFLUENT	5/3/92	1600	H2O	GRAB	7	SEE ATTACHED SHEET 24 H. Turn
	Between STRIPPER + CARBON	5/3/92	1603	H2O	GRAB	7	8010/8020
	CARBON EFFLUENT	5/3/92	1605	H2O	GRAB	2	8010/8020 Hold
	Duplicate	5/3/92	[illegible]	H2O	GRAB	2	8010/8020 Hold

Relinquished By:	DATE	TIME	Received By:	DATE	TIME
Timothy [illegible]	5/3/92	1400	S/O [illegible] D'Evolita 5-3-92		1400
Relinquished By:	DATE	TIME	Received By:	DATE	TIME
Relinquished By:	DATE	TIME	Received by Laboratory: [illegible] Barnes	5/4/92	090[illegible]

COMMENTS:

METHOD OF SHIPMENT:

OBG Laboratories, Inc., an O'Brien & Gere Limited Company
5000 Brittonfield Parkway / Suite 300 / PO Box 4942 / Syracuse, NY 13221 / (315) 437-0200

CASE FILE

Survey: Owego Heat Treat. Date Collected: 5/2/92

Sampler: T. Eddy. Date Received: 5/4/92.

Client Name and Ref. #: O'Brien & Gere Eng.

OBG Laboratory Client #: 4100.001.517.

CONDITION OF SHIPMENT: Stripper Influent @ 16:00 to have 8048020 only. All other analysis Hold until further notice. Per. Paul Cotter of O'Brien & Gere Eng.

RADIOACTIVITY SCREENING*:

X The sample cooler(s) were screened for radioactivity and found safe for handling.

___ The samples come from a safe source and do not need to be screened.

Signed: A. Barnes
Sample Coordinator

****

DISPOSAL PROCEDURE**: Routine

Signed: DAP
Date: 5-14-92

*The radioactivity screen is performed to alert our employees of unexpected radioactivity at hazardous waste sites.

**Samples are disposed of four (4) weeks after a typed report is signed and mailed to the client. The routine method of disposal is: water samples are filtered through carbon to a sanitary sewer, solid samples are sent to a sanitary landfill.

OBG
LABORATORIES, INC.

Volatile Organics
Method 8010/8020

CLIENT OWEGO HEAT TREAT JOB NO. 4100.001.517

DESCRIPTION Apalachin, NY

MATRIX: Water

DATE COLLECTED 5-13-92 DATE RECEIVED 5-14-92 DATE ANALYZED 5-19-92

DESCRIPTION:	Influent @ 13:15	After Tower	Effluent	QC Trip Blank
SAMPLE NO.:	P8918	P8919	P8920	P8921
Benzene	<10.	<1.	<1.	<1.
Benzyl chloride	<100.	<10.	<10.	<10.
Bis (2-chloroethoxy) methane	<5000.	<500.	<500.	<500.
Bromobenzene	<50.	<5.	<5.	<5.
Bromodichloromethane	<10.	<1.	<1.	<1.
Bromoform	<100.	<10.	<10.	<10.
Bromomethane	<10.	<1.	<1.	<1.
Carbon tetrachloride	↓	↓	↓	↓
Chlorobenzene	↓	↓	↓	↓
Chloroethane	↓	↓	↓	↓
2-Chloroethylvinyl ether	<100.	<10.	<10.	<10.
Chloroform	<10.	<1.	<1.	<1.
1-Chlorohexane	<100.	<10.	<10.	<10.
Chloromethane	<10.	<1.	<1.	<1.
Chloromethylmethyl ether	<1000.	<100.	<100.	<100.
2-Chlorotoluene	<50.	<5.	<5.	<5.
4-Chlorotoluene	<50.	<5.	<5.	<5.
Dibromochloromethane	<10.	<1.	<1.	<1.
Dibromomethane	<100.	<10.	<10.	<10.
1,2-Dichlorobenzene	<50.	<5.	<5.	<5.
1,3-Dichlorobenzene	↓	↓	↓	↓
1,4-Dichlorobenzene	↓	↓	↓	↓
Dichlorodifluoromethane	<100.	<10.	<10.	<10.

Authorized: [signature]

Date: June 12, 1992

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OBG LABORATORIES, INC.

Volatile Organics
Method 8010/8020

CLIENT: OWEGO HEAT TREAT JOB NO. 4100.001.517

DESCRIPTION: Apalachin, NY

MATRIX: Water

DATE COLLECTED: 5-13-92 DATE RECEIVED: 5-14-92 DATE ANALYZED: 5-19-92

DESCRIPTION:	Influent @ 13:15	After Tower	Effluent	QC Trip Blank
SAMPLE NO.:	P8918	P8919	P8920	P8921
1,1-Dichloroethane	<10.	<1.	<1.	<1.
1,2-Dichloroethane	↓	↓	↓	↓
1,1-Dichloroethylene	↓	↓	↓	↓
1,2-Dichloroethylene (total)	88.	8.	↓	↓
Dichloromethane	<10.	<1.	↓	↓
1,2-Dichloropropane	↓	↓	↓	↓
cis-1,3-Dichloropropylene	↓	↓	↓	↓
trans-1,3-Dichloropropylene	↓	↓	↓	↓
Ethylbenzene	↓	↓	↓	↓
1,1,2,2-Tetrachloroethane	↓	↓	↓	↓
1,1,1,2-Tetrachloroethane	↓	↓	↓	↓
Tetrachloroethylene	680.	28.	5.	↓
Toluene	<10.	<1.	<1.	↓
1,1,1-Trichloroethane	↓	↓	↓	↓
1,1,2-Trichloroethane	↓	↓	↓	↓
Trichloroethylene	33.	2.	↓	↓
Trichlorofluoromethane	<10.	<1.	↓	↓
1,2,3-Trichloropropane	↓	↓	↓	↓
Vinyl chloride	↓	↓	↓	↓
Xylene (total)	<30.	<3.	<3.	<3.

Comments:

Methodology: USEPA,SW-846, November 1986, 3rd Edition

Certification No.: 10155

Units: µg/l

Authorized: [signature]

Date: June 12, 1992

OBG Laboratories, Inc., *an O'Brien & Gere Limited Company*
5000 Brittonfield Parkway / Suite 300, Box 4942 / Syracuse, NY 13221 / (315) 437-0200

CHAIN OF CUSTODY RECORD

OBG LABORATORIES, INC.

SURVEY: Owego Heat Treat

LOCATION: Apalachin, NY

SAMPLED BY: P. Gottler

ORGANIZATION: OB&G Engineers

STATION NUMBER	SAMPLE LOCATION	DATE COLLECTED	TIME COLLECTED	SAMPLE MATRIX	COMP. OR GRAB	NO. OF CONTAINERS	ANALYSIS REQUIRED
1	Influent	5/13/92	1315	W	G	2	8010/8020
2	After Tower	↓	1320	W	G	2	8010/8020
3	Effluent	↓	1325	W	G	2	8010/8020
-	Trip Blank	-	-	W	-	1	8010/8020
1	Influent	5/13/92	1330	W	G	1	See
1	Influent	↓	↓	W	G	1	Container
1	Influent	↓	↓	W	G	1	request
1	Influent	↓	↓	W	G	1	for analyses

Relinquished By:	DATE	TIME	Received By:	DATE	TIME
Relinquished By: Paul F Gottler	5/14/92	0820	Received By:		
Relinquished By:			Received By:		
Relinquished By:			Received by Laboratory: [signature] Barnes	5/14/92	0820

COMMENTS:

METHOD OF SHIPMENT:

OBG Laboratories, Inc., an O'Brien & Gere Limited Company
5000 Brittonfield Parkway / Suite 300 / PO Box 4942 / Syracuse, NY 13221 / (315) 437-0200

CASE FILE

Survey: Oswego Heat Treat Date Collected: 5-13-92

Sampler: P. Cottles. Date Received: 5-14-92

Client Name and Ref. #: O'Brien & Gere Eng

OBG Laboratory Client #: 4100.001.577.

CONDITION OF SHIPMENT: Satisfactory

RADIOACTIVITY SCREENING*:

___ The sample cooler(s) were screened for radioactivity and found safe for handling.

X The samples come from a safe source and do not need to be screened.

Signed: [signature]
Sample Coordinator

****

DISPOSAL PROCEDURE**: Routine

Signed: [signature]

Date: 6-17-92

*The radioactivity screen is performed to alert our employees of unexpected radioactivity at hazardous waste sites.

**Samples are disposed of four (4) weeks after a typed report is signed and mailed to the client. The routine method of disposal is: water samples are filtered through carbon to a sanitary sewer, solid samples are sent to a sanitary landfill.

LABORATORIES, INC.

Laboratory Report

CLIENT OWEGO HEAT TREAT JOB NO. 4100.001.517

DESCRIPTION Apalachin, NY

MATRIX: Water

DATE COLLECTED 5-13-92 DATE RECEIVED 5-14-92

Description:	Influent @ 13:30			
Sample #	P8917			
Total Metals:				
CALCIUM	67.			
MAGNESIUM	12.			
IRON	0.30			
MANGANESE	0.15			
Other Analyses:				
TOTAL ALKALINITY	170.			
HARDNESS	220.			
TOTAL SUSPENDED SOLIDS	<1.			
TOTAL DISSOLVED SOLIDS	280.			
NITRITE NITROGEN	<0.05			
TOTAL KJELDAHL NITROGEN	2.7			
CHLORIDE	6.			
SULFATE	21.			
OIL & GREASE	<5.			
PH, LABORATORY std. units	7.6			
CORROSIVITY	-0.14			
NITRATE NITROGEN	4.1			
TOTAL PETROLEUM HYDROCARBON*	<1.			

Comments: *By IR Spectrophotometer.

Certification No.: 10155

Units: mg/l unless otherwise noted

Authorized: [signature]

Date: June 12, 1992

OBG Laboratories, Inc., *an O'Brien & Gere Limited Company*
5000 Brittonfield Parkway / Suite 300, Box 4942 / Syracuse, NY 13221 / (315) 437-0200

APPENDIX D

CAPTURE ZONE CALCULATIONS

APPENDIX D

Radius of Inflow Calculations using Todd's Equation

Todd's Equation:

$$y = \frac{Q}{2Kbi}$$

AND

$$x = \frac{Q}{2\pi Kbi}$$

Where:
y = radius of inflow perpendicular to the ground water flow direction in feet
x = radius of inflow in the downgradient direction in feet
Q = well yield in gallons per day (gpd)
K = hydraulic conductivity = 1,553 gpd/ft^2
b = aquifer thickness = 50 ft
i = average hydraulic gradient = 0.002 ft/ft

Using a Well Yield of 11 gpm = 15,840 gpd, then:

$$y = \frac{15{,}840}{2(1553)(50)(0.002)}$$

y = 51 ft

$$x = \frac{15{,}840}{2\pi(1553)(50)(0.002)}$$

x = 16 ft

Using a well yield of 20 gpm = 28,800 gpd, then:

$$y = \frac{28{,}800}{2(1553)(50)(0.002)}$$

y = 93 ft

$$x = \frac{28{,}800}{2\pi(1553)(50)(0.002)}$$

x = 29.5 ft

APPENDIX D

Input Parameters for GWPATH Model

```
UNCONFINED AQUIFER
 1)   NUMBER OF COLUMNS(X-AXIS)=   30
 2)   NUMBER OF ROWS(Y-AXIS)=      30
 3)   GRID SCALE =                10  FT
 4)   STORAGE=                    .15
 5)   INITIAL HEAD=               100  FT
 6)   TRANSMISSIVITY=             77650  GPD/FT
 7)   HYDRAULIC CONDUCTIVITY=     1553  GPD/FT^2
 9)   AQUIFER THICKNESS=          50 FT
10)   HYDRAULIC GRADIENT=         .002 FT/FT
                                   0 DEGREES FROM X-AXIS
```

WELL #	LOCATION (X,Y)	RADIUS (FT)	Q (GPM)	TIME (DAYS)
1	20,10	0.33	11.00	365.00

APPENDIX E

BASIS OF DESIGN

APPENDIX E

Basis of Design

The following represents the basis of design for the ground water remediation system. It is the intent of this document to present sufficient information for the final system to be engineered, installed and operated.

The basis of design is divided into three sections:

I. Conceptual Engineering: Describes the engineering concepts applied to the system design and provides the basis for completion of the final and installation engineering.

II. Equipment/Materials Specifications: Provides the specifications and requirements for the major system components. Specifications are intended to serve as the basis for selection and procurement of the system components.

III. Performance/Operational Specifications: Provides the general specifications to be followed during the installation, start-up and operation of the system.

Each of these sections is presented in detail below:

I. Conceptual Engineering

The recovery system was based on the following engineering concepts:

A. Collection Method

1. Depress ground water via recovery pump to ensure collection of contaminated water.

2. Ground water collection shall be accomplished within the recovery wells.

3. Operation of the ground water recovery pump determined by the depth of ground water within the recovery well.

B. Treatment Technologies

1. Ground water VOC remediation through air stripping

C. System Arrangement

1. Because of vehicle traffic within the collection area, a concrete pad will be designed for the system. All piping and utilities will be above ground and heated by appropriate means. A heat exchanger will be used to heat collected ground water before entering the air stripper. This may be accomplished by using an existing heat source/exchanger on-site. Valving and controls will be centrally located and accessible.

2. An air stripper will be located adjacent to the process building, utilizing a heat exchanger for ground water heating.

3. Treated ground water will be discharged via the existing storm water system. Permitting issues will be addressed as required.

D. System Operation

1. The system is intended to generally operate in an automatic mode with the pump operations controlled via level probes within the recovery well.

2. The air stripper operation will be dependent on well operation to ensure sufficient flow through the stripper. The ground water collection pump shall be controlled over a sufficient depth to ensure nearly continuous operation. An alarm indication is to be provided to the operator if the air stripper is taken off line due to loss of water flow, loss of air flow, or high effluent level in the stripper sump.

II. **Equipment/Materials Specifications**

A. Ground Water Collection System

1. Submersible Pump

a. Submersible multiple-stage pump capacity to develop 20 gpm at least 250 feet of head (Grundfos model 25S30-15 or equal).

2. Piping to air stripper shall be Schedule 40 galvanized steel pipe of appropriate diameter.

a. Discharge piping shall include a pitless well adaptor to facilitate removal of the pump from the well. Electrical connections shall include local terminations within the well manhole to allow pump removal.

C. Packed Column Air Stripper

1. Air Stripper

a. Treatment capacity of 20 gpm (max.), 11 gpm (min.)

b. VOC content of effluent is to be below 0.005 mg/l for TCE, PCE, and 1,2-DCE and 0.002 mg/L for vinyl chloride with expected influent levels as follows:

4.1 mg/l of TCE
2.2. mg/l of PCE

c. Packing height in tower should be at least 6 feet, 3 feet in diameter packed with 2-inch Tripack packing.

d. Airflow rate shall be 1100 cfm.

e. The cleaning package shall include a pump and associated piping for circulation of the acidic solution.

f. Influent water temperature 40-50° F

D. Electrical and Control Systems

1. Electrical power shall be supplied for this job at 240 volt, 3 phase with a capacity of 80 amps at a location to be coordinated with the OHT facilities engineer. Equipment shall operate on 230 volt, 3 phase and 115 volt single phase power. Submersible pumps and air stripper shall operate on 230 volt, 3 phase power.

2. Controls shall be designed for use in a solvent environment and shall include:

a. Well water level measurements

b. Well water pump controls

c. Air stripper sump pH sensor

d. Air stripper intake air filter differential pressure gauge

III. Performance/Operational Specifications

1. Electrical Work

A. All electrical design, materials and installation shall conform to the latest versions of:

i. ANSI - American National Standard Institute
ii. ISA - Instrument Society of America
iii. NFPA - National Fire Protection Association
iv. NEC - National Electric Doe
v. NEMA - National Electric Manufacturers Association
vi. UL - Underwriters Laboratories
vii. OHT Electrical Standards

2. ASPHALT-Concrete

A. Replacement concrete work shall be 5000 psi test concrete.

B. Work and materials shall conform to ACI standard 837.

C. Replacement to match existing slab thickness.

3. Piping

A. All piping design, materials and installation shall comply with the latest version of:
   i. Fuel oil piping shall conform to ASTM standard B31.
   ii. All water piping shall conform to ASTM standards A53 and A120.

4. All designs and installations shall be designed to comply with all applicable Federal, State and Local regulations including but not limited to:

   A. Air Quality

   B. SPDES

   C. All other regulations deemed applicable by the DEC

5. The construction activities shall be performed in accordance with Owego Heat Treat Safety standards. The Contractor shall be solely responsible for worker safety. The Contractor shall comply with all OSHA requirements.

6. The Contractor shall be responsible for coordination of construction activities with the Owner to prevent production delay. The Owner shall arrange for regular coordination meetings to be attended by key project and plant personnel for this purpose. The Contractor shall develop the design and perform the construction such as to take advantage of shutdowns and minimize forced downtime.

7. The design, materials and installation shall conform with all applicable building standards including, but not limited to:

   A. NYS Building Code
   B. Factory Mutual

DYW:ers/owego.12