

1980

REMEDIAL ACTION PLAN

FOR
CHROMIUM CONTAMINATION

BETTER BRITE, INC.
DE PERE, WISCONSIN

SOIL TESTING SERVICES OF WISCONSIN, INC.
9055 North 51st St. 540 Lambeau St.
Brown Deer, WI 53223 Green Bay, WI 54303



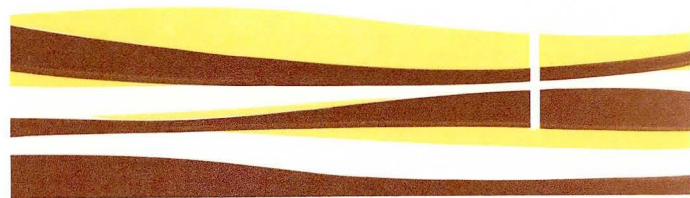
CONSULTING ENGINEERS
Geotechnical Services
Materials Testing & Quality Control

APR 17 1980 *sp*

REMEDIAL ACTION PLAN

FOR
CHROMIUM CONTAMINATION

BETTER BRITE, INC.
DE PERE, WISCONSIN



SOIL TESTING SERVICES OF WISCONSIN, INC.

540 LAMBEAU ST.

GREEN BAY, WIS. 54303

April 15, 1980

Better Brite, Inc.
315 South 6th Street
De Pere, Wisconsin 54115

Attention: Mr. Everett Hintz

STS Job 9879

RE: Remedial action plan for the chromium contamination at the Better Brite, Inc. Facility in De Pere, Wisconsin.

Gentlemen:

Our recommendations for remedial action at the above referenced project are enclosed. Test results and analysis of the contamination problems were submitted in separate reports dated September 5, October 11, and December 10, 1979. Three copies of this report have been sent to the above address. Four copies have also been delivered to the Department of Natural Resources, Lake Michigan District, P. O. Box 3600, Green Bay, Wisconsin, 54306, Attention: Mr. Doug Rossberg.

To control and collect the contamination described in the previous reports, we recommend that a ground water extraction system and surface runoff control system be provided at the plating facility. The proposed installations will be capable of collecting both on-site and off-site contamination which was observed in the preliminary testing program. Both surface and ground water which has greater than 0.5 mg/l total chromium will be discharged to the De Pere sanitary sewer. Chromium concentrations below 0.5 mg/l will be discharged to the storm sewer. Design details for the installations are included in the attached report.

We also recommend that contaminated garden soils on the Konrath property be replaced to a depth of 3 feet with a fertile garden topsoil.

AFFILIATE OF SOIL TESTING SERVICES, INC.

GREEN BAY PHONE (414) 494-9656
WAUSAU, WISCONSIN - 715-845-8386
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Better Brite, Inc.
Page 2

We appreciate the opportunity to be of service to you on this project. We would be pleased to provide assistance during construction or possibly prepare construction specifications and bid documents, if you desire.

If you have any questions with regard to the enclosed, please contact us at your convenience.

Yours very truly,

SOIL TESTING SERVICES OF WISCONSIN, INC.

Douglas J. Hermann
Douglas J. Hermann, P. E.
Senior Project Engineer

William M. Perpich/cs
William M. Perpich, P. E.
President

DJH/cs

Encl:

cc: Department of Natural Resources (4)
Lake Michigan District
P. O. Box 3600
Green Bay, Wisconsin 54306
Attn: Mr. Doug Rossberg

Foth & Van Dyke & Associates, Inc.
P. O. Box 3000
Green Bay, Wisconsin 54306
Attn: Mr. Jerry Berg

CHROMIUM DISTRIBUTION AND REMEDIAL ACTION AT THE BETTER BRITE, INC.
FACILITY, DE PÈRE, WISCONSIN

CHROMIUM DISTRIBUTION

Background

Chromium has two oxidization states, trivalent and hexavalent. The latter is prepared at the Better Brite, Inc. plating facility and used for metal plating of a variety of metal products. The dominant species in natural soil is trivalent chromium, however, its concentration in the soil moisture is limited by adsorption on organic matter, clay minerals and hydrous oxides of iron, manganese and aluminum. Trivalent chromium precipitates readily with hydroxides, carbonates and sulfides. Precipitation is probably not a major mechanism for chromium attenuation in soils except at high pH values.

Chromic acids utilized at the Better Brite, Inc. plating facility are mostly in the hexavalent form. At acidic pH values, the hexavalent form of chromium is typically dichromate ($Cr_2O_7^{2-}$). In this form, it is a powerful oxidizing agent and is commonly used to plate metal products. When spilled on soil, hexavalent chromium can rapidly oxidize the organic matter leaving trivalent chromium. The conversion from hexavalent to trivalent will proceed more rapidly under acidic conditions. These conditions may be related to soil pH and plant toxicity.

To date, the chromium encountered in contaminated ground water samples has been predominantly hexavalent, ranging from 50 to 100 percent. It is likely that the hexavalent form will be gradually reduced to the trivalent form due to the neutral soil pH and other reaction mechanisms.

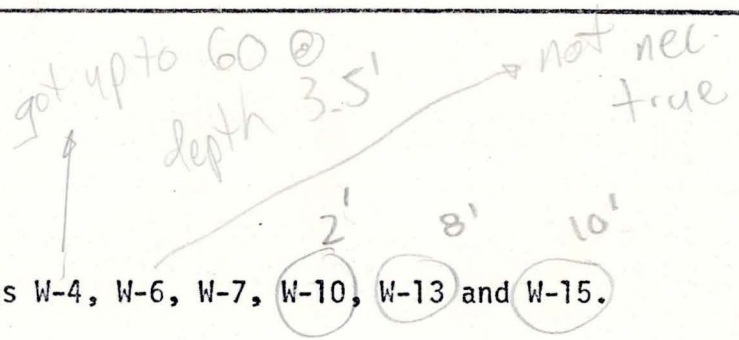
Soil Contamination

The maximum soil concentration of total chromium encountered in the testing program was 1400 (dry soil basis) ppm (Sample S-1, Boring W-1). The average total chromium concentration in the contaminated zone is approximately 190 mg/kg dry soil basis. Chromium contamination may only be recognized at the site by a comparison to background levels. In a DNR letter dated February 10, 1980, the natural chromium background level was set at 60 mg/kg on a dry soil basis.

All borings at the site penetrated a reddish brown silty clay at depth. This unit contains on the order of 45 to 50 ppm total chromium using an aggressive hydrofluoric acid digestion procedure. For purposes of our analysis, we have assumed that any material containing in excess of 60 ppm total chromium reflects a contaminated condition. The use of a 60 ppm background level for definition of contamination in the reddish brown silty clay seems appropriate. On the other hand, surface soils containing organics may have higher natural background levels.

Contamination of surface soils with total chromium appears to have occurred both south and west of the existing plating facility. Specifically, Borings W-1, W-2, W-3, W-5, W-11, W-12, W-16 encountered chromium contamination. The vertical extent of the contamination in late summer, 1979 varied with location. Borings W-3 and W-16 were contaminated to a depth up to 12 feet; borings W-1, W-2 to a depth up to 8 feet; Borings W-5, W-8 and W-12 to a depth of 6 feet and borings W-9, W-11 and W-14 were contaminated to a depth of 2 to 3 feet. No significant chromium

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contaminants
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stand
map



contamination was encountered at borings W-4, W-6, W-7, W-10, W-13 and W-15.

The distribution of chromium in the soil was likely caused by a combination of processes. Overland flow likely transported the chromium in a downslope direction near borings W-2, W-3 and W-16. In addition, variation in chromium concentration with depth at borings W-8, W-11 and W-12 suggest that the chromium may have flowed laterally along an impermeable stratum. With the possible exception of boring W-16, vertical migration of chromium contamination was impeded by the stiff reddish brown silty clay stratum.

what about W-3, W-1A,

To evaluate the degree of soil contamination, extraction tests were performed on Samples W-1, S-1 and W-2, S-2. The analyses were performed in accordance with the EPA TEP procedures following the filtration method. These results were submitted in the December 10, 1979 report. The total chromium extracted from W-2, S-2 exceeded the limits for a non-toxic and non-hazardous waste, according to the proposed classification of hazardous wastes published in the December 18, 1978 Federal Register. We anticipate that the final classification of hazardous waste to be promulgated April 30th will be based on extraction concentrations greater than 100 times the drinking water standards. This change would make both soil samples non-toxic. The total chromium of the samples tested using the hydrofluoric acid soil digestion technique was 212 and 235 ppm on a dry soil basis for samples used in the extraction tests. These concentrations are generally representative of the test results for other contaminated borings.

Ground Water Contamination

In general, the concentration of chromium in the ground water varied with the concentrations found in the soil. A band of high chromium concentration ground water was located south and west of the plating building (Borings W-1, W-3 and W-16). Concentration of chromium in ground water decreased in all directions from this band. The soluble hexavalent chromium contamination will likely follow the direction of ground water flow as presented in previous reports. Based on the observed ground water quality downstream from the contaminated area, it appears that the contamination movement is slow due to the relatively impermeable soils. The presence of contaminated soil at depth at borings W-11 and W-12 supports the phenomenon of non-homogeneous ground water flow at the site. Silty clayey sand seams were encountered in selected borings which may be the primary stratum for contamination transport. Samples were taken intermittently during drilling so the continuity of the silty clayey sand stratum cannot be defined.

We anticipate that most of the chromium contamination, especially the hexavalent form, is present in the soil moisture or ground water. The total chromium contamination in the ground water (i.e. soil moisture) may be estimated by the following equation:

$$\text{Ground water concentration, ppm} = \left(\frac{\text{soil concentration} - 60 \text{ mg/kg}}{\text{(dry solids basis, mg/kg)}} \right) \times \text{constant}$$

The constant ranges from approximately 2 to 10 depending on the ratio of effective porosity to total porosity, water content, dry density and adsorption.

13.5
295

RECOMMENDED REMEDIAL ACTION

What about
diggings?

Ground Water Control

To collect and control the contaminated ground water at this site, we recommend the installation of a ground water extraction system. This system will consist of a drainage trench excavated below the static ground water level to collect ground water in the on-site and off-site contaminated areas. The trench will be excavated to a depth 2 to 3 feet below the depth of observed contamination in late summer, 1979, so that all ground water passing through the contaminated soils may be collected. The trench invert will also be installed a minimum of 5 feet below the static ground water level observed in late summer, 1979.

how deep is this?

The trench will reverse ground water gradients along the southern and western property lines. The reversal of gradients will also collect soluble off-site contamination. The trench will be placed down-gradient from the zone of maximum on-site ground water contamination and as near as possible to the areas of observed off-site ground water contamination. The trench will be located close to the highest contamination to speed collection and treatment of the contaminated ground water as quickly as possible. The recommended location for the trench is shown on the site plan in the Appendix. Details of the trench construction are also illustrated. The trench will discharge to a 500 gallon steel-lined sump where the ground water will be temporarily stored for treatment. A pump will be provided to transport the ground water to a pretreatment system if it exceeds 0.5 ppm total chromium. If the ground water is not contaminated, it may be discharged

↓ they mean WWTP?

*they mean No!
50 in ?*

to the sanitary sewer. We estimate that the average daily discharge to this system will range from 50 to 200 gallons per day. These estimates are based on the permeability and soil profile that are expected along the trench alignment. We anticipate that the initial flows will be greater until the ground water system has an opportunity to stabilize with respect to the trench installation. The daily flow will fluctuate according to seasonal ground water recharge.

not enough data

The proposed trench will be excavated mostly in clay and some fill soils. Based on the concentration of chromium in the preliminary TEP tests, the soil materials will be classified non-toxic and hazardous and may be disposed in a sanitary landfill with DNR approval or the soil materials may be stockpiled on site in the ground and surface water collection area. The trench excavation will generate approximately 300 yards of soil material.

The trench construction is depicted on the attached design drawing. Specifically, the trench will be excavated to the lines and grades shown with a V-notch base and backfilled with permeable materials to act as a French drain. To maintain optimum drainage in the trench, we recommend that impermeable sheeting such as polyethylene or polyvinyl chloride be placed at the base of the trench. The first ^{*not consistent w/ drawings*} 2 to 3 feet of backfill in the trench should consist of a clean gravel with sizes ranging from 3/4 inch to 1-1/2 inch. This material should be encapsulated in a filter fabric such as Mirafi 140S or equivalent. The PVC perforated drain pipe will be installed at the base of this material at a 0.007 slope to direct the collected water to the sump. Four-inch PVC riser pipes are proposed at junctions along the drain alignment for sampling. The riser pipes will be connected to the drain pipe with a 4-inch junction where a 1 foot deep capped pipe is provided

below the drain pipe invert. Samples may be obtained from the capped pipe (sump) to locate the primary source of contamination. The soil materials backfilled above the gravel should consist of clean medium to coarse sands up to within 1 to 2 feet of the ground surface where a clay cap should be placed over the trench. The sand backfill should also be encapsulated with the filter fabric.

All materials which are placed in the trench should be moderately compacted to approximately 90 percent of the maximum dry density determined from the standard Proctor Method of Test ASTM D 698.

Water collected in the trench will flow to the sump located in a manhole near the surface water impoundment area. This sump should consist of a metal container having a minimum 500-gallon volume below the drain invert. An electric sump pump with a 50 gpm capacity will be set to discharge ground water to the sanitary sewer. This pump should be metered separately to monitor total flow.

Our analysis indicates that the proposed trench design should collect most of the contaminated ground water within a two year period, reducing chromium concentration to 0.5 ppm total chromium in the observation wells. If ground water flow rates are slower than anticipated, time extensions may be required. For this case, lower daily flow rates will be observed.

Surface Water Control

*does this mean
dilution?*

A surface water sample collected at the site on August 1979 contained 1500 ppm total chromium. We recommend that surface water be collected on-site until the water quality is demonstrated to be below 0.5 ppm total chromium.

To collect the surface water, we recommend the placement of a berm on the south and west sides of the trench alignment shown in the attached drawing. This berm should be constructed of clay materials excavated from the surface water impoundment area located near the ground water sump. Water collected by the berm will be directed to the surface water impoundment area where it will be temporarily detained, analyzed and discharged to the sanitary sewer, if necessary. If the total chromium concentration is greater than 0.5 ppm, the surface water will be discharged to the sanitary sewer. If it is lower than 0.5 mg/l, it will be discharged to the storm sewer.

The impoundment area shall be excavated to elevation +90.5 at the southwest corner as referenced to the floor slab of the existing plating building. The bottom of the impoundment area should slope upward at approximately 1 percent to the northeast. A 3 to 6-inch layer of coarse sand and gravel is recommended on the base and sides of the impoundment area. A sump extending below the invert level shall be provided in the southwest corner where a submersible pump can be placed to remove surface water to the sanitary sewer or storm drain, depending on the quality.

calculations

The surface water collection system will be operated seasonally. During the winter months, the pump system should be removed to prevent freezing and reduce maintenance costs. The surface water impoundment area has been sized to impound 100 percent of the runoff resulting from a 2 to 2.5 inch thunderstorm. When the surface water runoff has consistent acceptable quality for discharge (0.5 ppm), we suggest that a portion of the berm be removed to direct runoff to the storm drain directly west of the surface water impoundment area. Details of the surface water collection system are shown on the attached drawing.

During the winter, snow should not be stockpiled up-slope from the berm so that drainage is maintained.

may want to go to san. sewer to reduce all Cr+6 to Cr+3

Soil Treatment

Contaminated soils were observed in the garden area on the Konrath property. We recommend that the near surface soils be replaced to a depth of 3 feet with a fertile garden topsoil. The approximate boundary of this excavation replacement is shown on the attached drawing. The soil material excavated in this area should be disposed in a sanitary landfill or stockpiled in the ground water and surface water collection area. Approximately 360 cubic yards of material will require removal and replacement. Prior to placement of the new material, we recommend that soil chemistry tests be performed to verify that the topsoil chemistry is good.

MONITORING PROGRAM

In conjunction with daily testing and analysis of surface and ground water, we recommend that samples also be analyzed from riser pipes R-1 and R-2 quarterly. We also recommend that wells W-1A, W-2, W-3, W-5 and W-16 be sampled and analyzed quarterly. Each of the water samples should be analyzed for total chromium and hexavalent chromium.

The weekly discharge from the sump pump and the monitoring results should be recorded and submitted to the DNR quarterly.

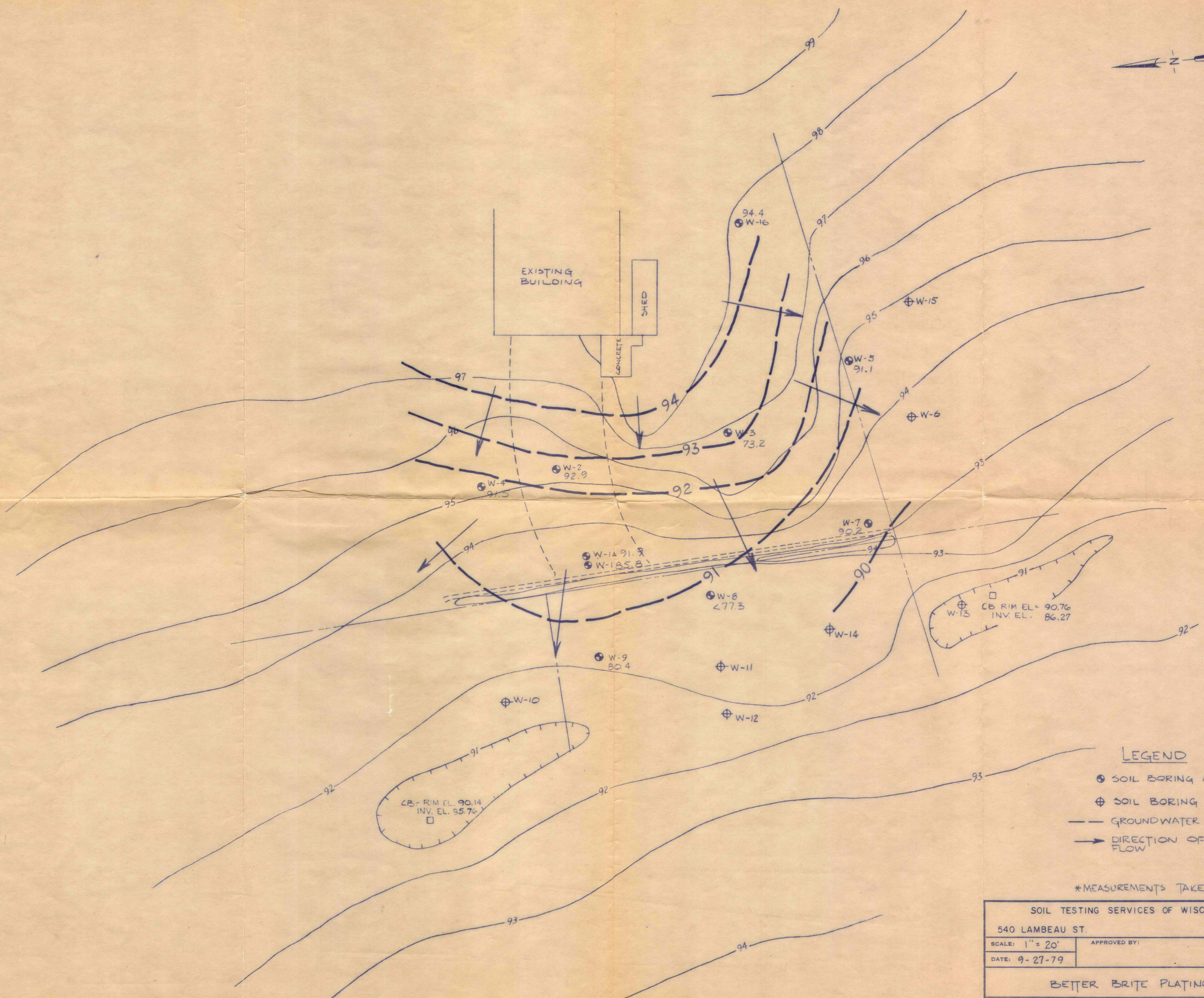
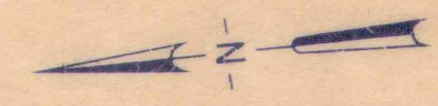
GENERAL QUALIFICATIONS

The analysis and recommendations submitted in this report are based on the data obtained from 16 soil borings and well installations. Variations may occur between soil borings, the nature and extent of which cannot be determined without further testing. If variations are noted during construction, our firm should be informed. It may be necessary to make additional on-site observations and tests during construction to make a re-evaluation of the recommendations of this report.

This report has been submitted based on the data collected to date. No warranty is either expressed or implied in the report relating to the performance and efficiency of contamination removal.

If any changes in the concepts, locations or grades are made during construction, these changes should be transmitted to the Engineer to determine the effect the changes may have on the overall design.

During construction, we recommend that all necessary precautions be taken in dealing with chromium contaminated soils, water and vapor. Any activities should be in compliance with OSHA standards.



LEGEND

- SOIL BORING AND WELL
- ⊕ SOIL BORING
- GROUNDWATER TABLE CONTOURS
- DIRECTION OF GROUNDWATER FLOW

*MEASUREMENTS TAKEN 9-27-79

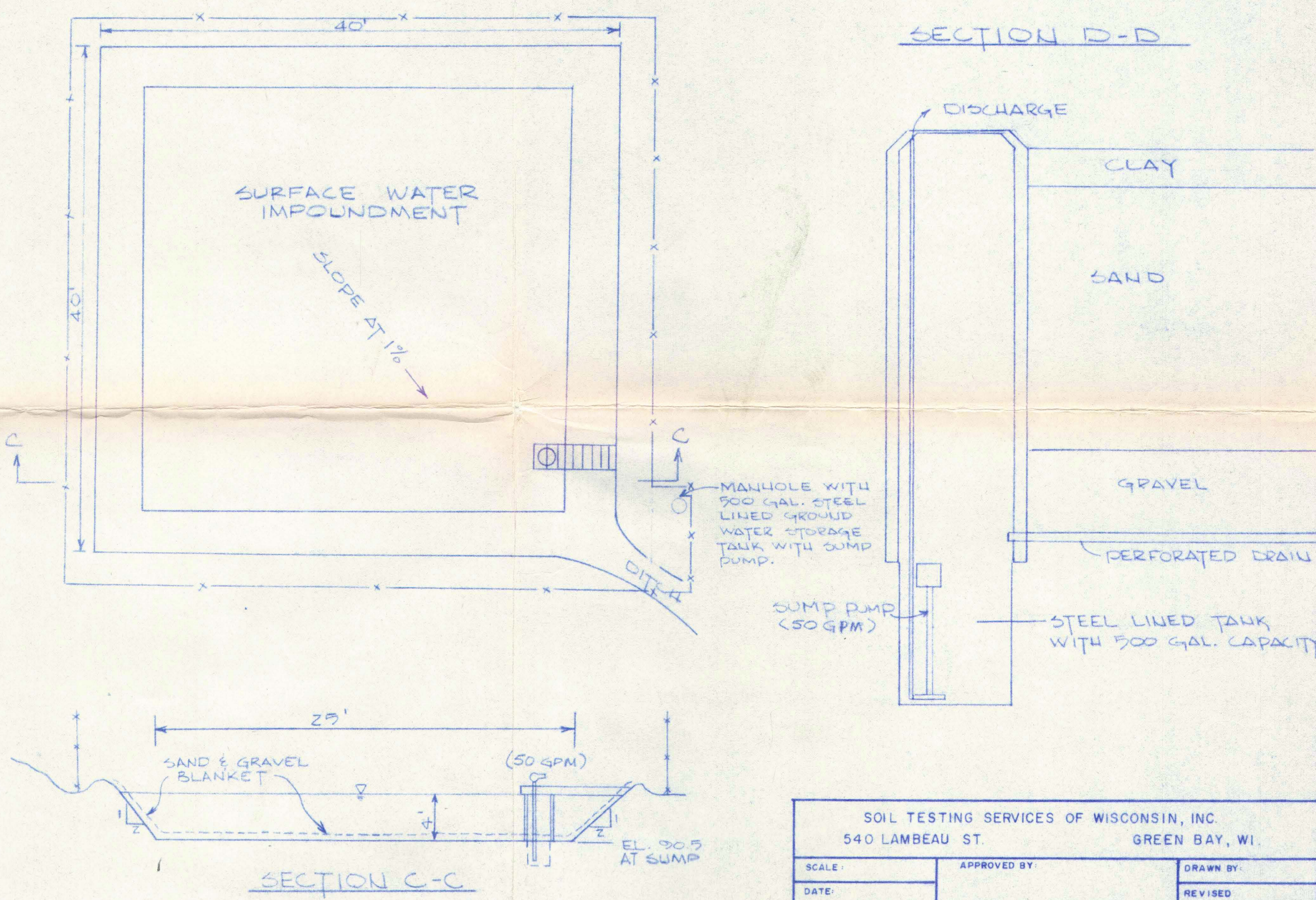
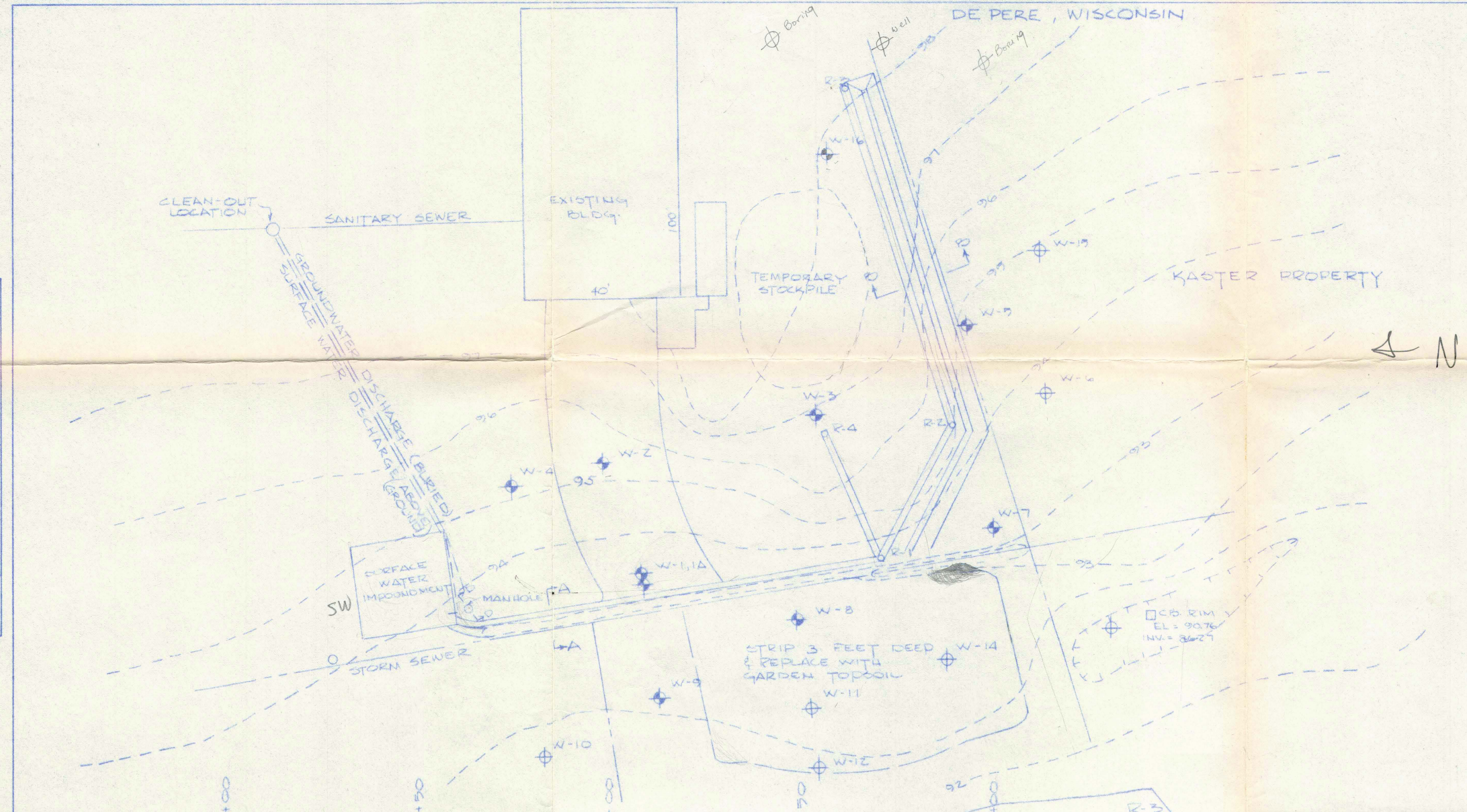
SOIL TESTING SERVICES OF WISCONSIN, INC.		
540 LAMBEAU ST.		GREEN BAY, WI.
SCALE: 1" = 20'	APPROVED BY:	DRAWN BY JPJ
DATE: 9-27-79		REVISED
BETTER BRITE PLATING Co.		
PERCHED GROUNDWATER CONTOUR MAP		DRAWING NUMBER 9879-2

SURFACE AND GROUNDWATER CONTROL SYSTEM

BETTER BRITE, INC.

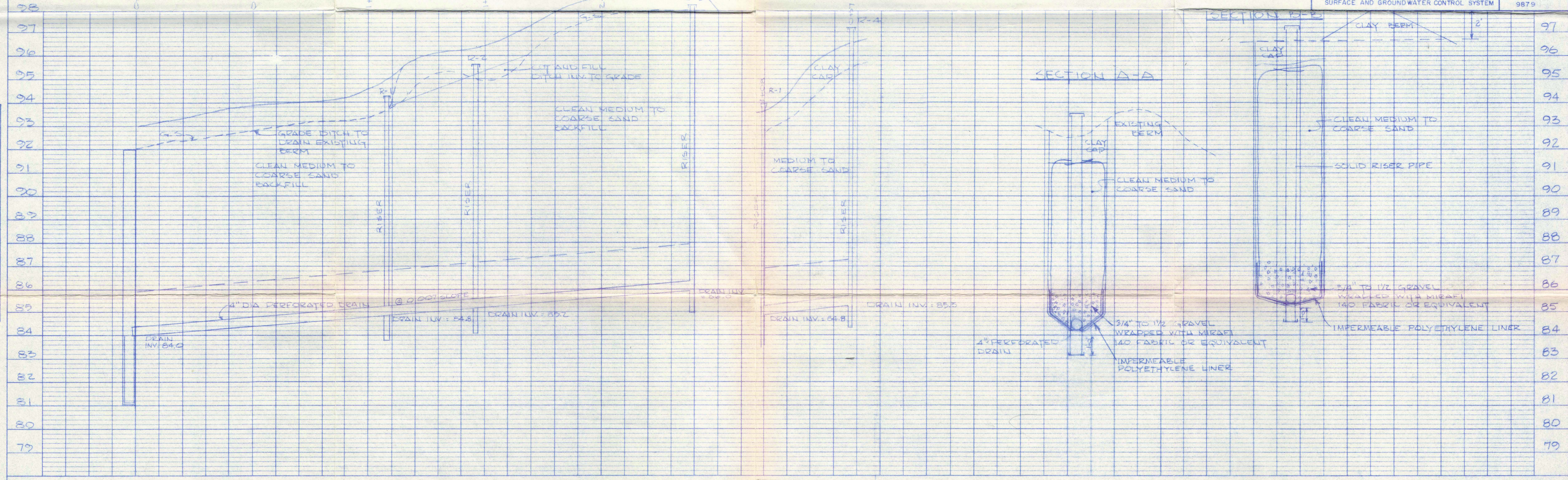
DE PERE, WISCONSIN

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SCALE:	APPROVED BY:	DRAWN BY:
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SURFACE AND GROUNDWATER CONTROL SYSTEM		DRAWING NUMBER 9879

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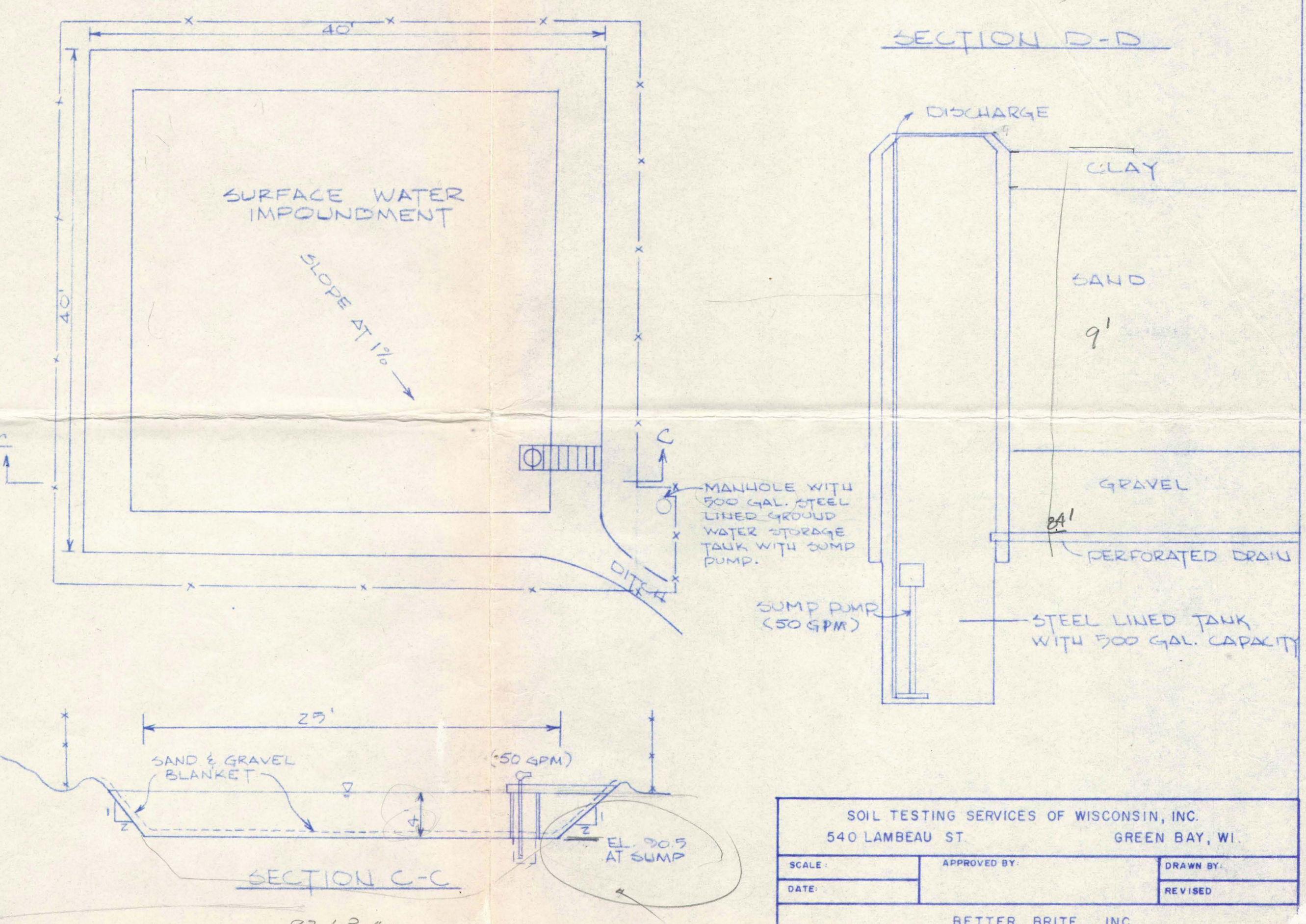
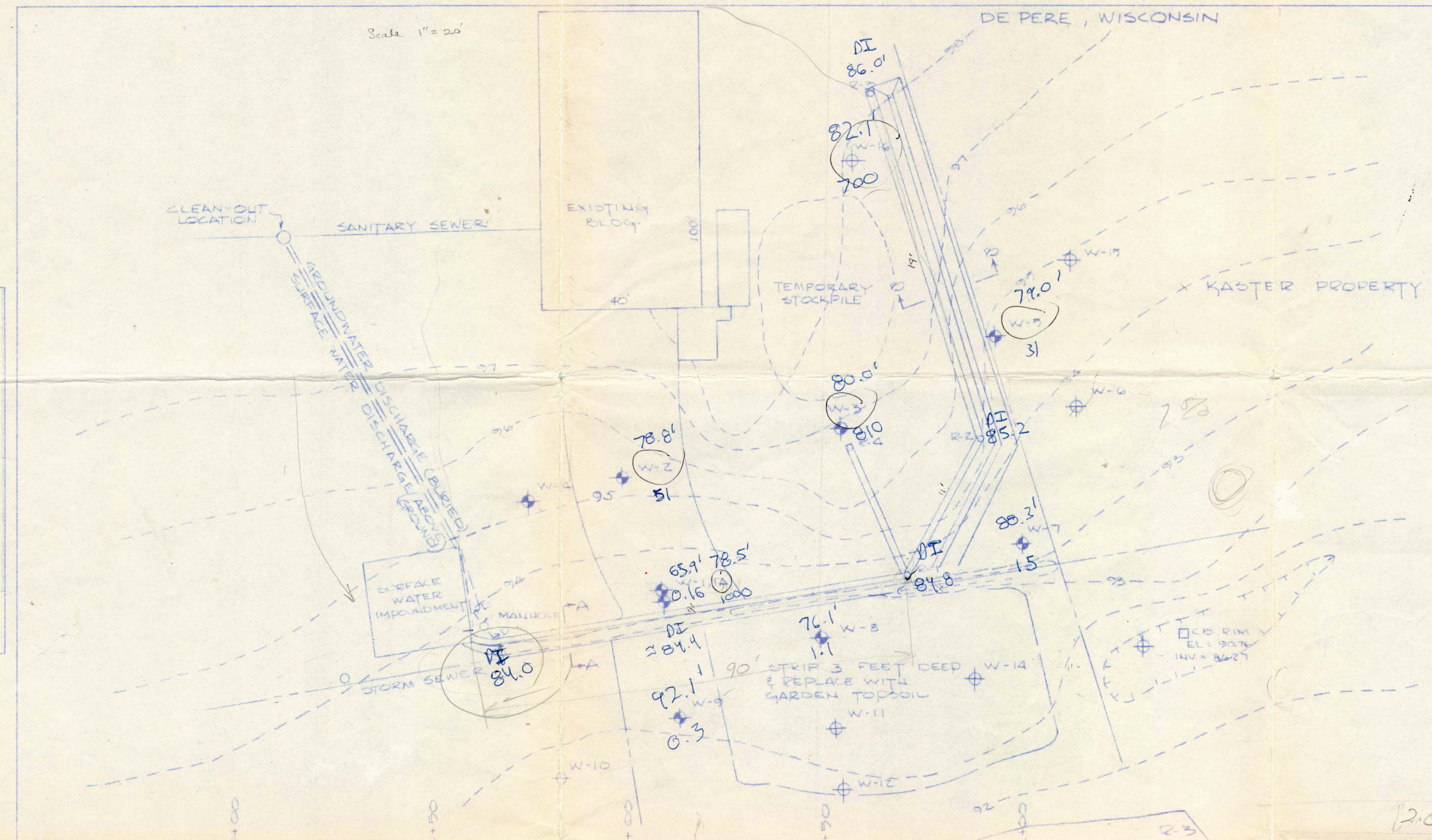


SURFACE AND GROUNDWATER CONTROL SYSTEM BETTER BRITE, INC.

DE PERE, WISCONSIN

Scale 1" = 20'

PLAN
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BY: [Signature]
DATE: [Date]



SOIL TESTING SERVICES OF WISCONSIN, INC. 540 LAMBEAU ST. GREEN BAY, WI.		
SCALE:	APPROVED BY:	DRAWN BY:
DATE:		REVISED:
BETTER BRITE, INC. DE PERE, WISCONSIN		DRAWING NUMBER 9879
SURFACE AND GROUND WATER CONTROL SYSTEM		

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