File Copy

ENTERED
Harding Lawson Associates

A Report Prepared for:

Sparton Corporation
2400 East Ganson Street
Jackson, Michigan 49202

HYDROGEOLOGIC CHARACTERIZATION AND REMEDIAL INVESTIGATION SPARTON TECHNOLOGY, INC. 9261 COORS ROAD, NORTHWEST ALBUQUERQUE, NEW MEXICO

HLA Job No. 6310,013.12

by

David L. Bratberg
Hydrogeologist

Frank A. DeLuca
Principal Hydrogeologist

Thomas S. Burger, Manager
Environmental Science Division

Harding Lawson Associates
6300 Westpark Drive, Suite 100
Houston, Texas 77057
Telephone: (713) 789-8050

March 13, 1985

TABLE OF CONTENTS

LIST OF TABLES

I INTRODUCTION

This report presents the work performed by Harding Lawson Associates (HLA) for the SPARTON Technology, Inc. manufacturing facility located at Coors Boulevard, Albuquerque, New Mexico. In this report, we have incorporated data from previous work phases conducted by HLA at the site.

The purpose of this report is to provide SPARTON with additional understanding of the hydrogeologic conditions at the plant site, to categorize the extent and rate of migration of dissolved volatile organics and metals in the ground water, and to determine the concentration of organics and metals in soil near a suspected contamination source.

HLA performed a review of existing data, reports, and files relevant to the above purpose. Field work for this phase of the project included drilling and installation of six monitoring wells and one production well, collecting soil and water samples for organic and metal analyses, water level monitoring, and conducting both a pump test and an infiltration test to evaluate the hydrogeologic framework.

This report includes appendices which describe in detail the operating procedures and methods used during the field work and for data analyses. The main text therefore contains only data and interpretation obtained during this work phase. The reader is referred to these appendices to obtain specific methodology.

II FIELD WORK

A. Drilling, Well Construction and Development

Six monitor wells (MW-12 through MW-17) and one production well (PW-1) were installed during this phase of work. Wells were installed using both rotary wash (mud-rotary) and hollow-stem auger drilling methods. Appendices A and B detail the methodologies used for the drilling program. The locations of all existing and new wells are shown on Figure 1.

B. Well MW-12

Well MW-12 was drilled approximately 50 feet northeast of MW-9. The well site was selected to collect formation samples for the design of the production well, to obtain a water sample representative of the ground water in the vicinity of the planned production well, and to monitor water level response during the pumping test.

A hollow-stem auger drilling rig was used to drill to a depth of 70 feet below grade. Continuous sampling with the 5-foot core barrel was conducted from 50 to 70 feet. Flowing sand conditions and large gravels in the borehole slowed the drilling rate and the remainder of the boring was completed with a mud-rotary drilling rig. Soils were classified from split-spoon samples taken at selected depths in conjunction with a description of the drill cuttings. Figures 2A and 2B are a log of the materials penetrated and the well construction details for MW-12.

The boring encountered fine to medium grain sand from 0 to 39 feet. A dense fine layer was present from 39 to 40 feet which overlaid a 5-foot section of coarse gravel and cobbles. The coarse material appeared to be a terrace-type deposit consisting of sub-rounded, flat granite cobbles 2 inches in diameter.

Drive samples from 50 to 70 feet indicated a well graded sand with small percentages of gravel and silt. The soils increased in moisture content at 60 feet and the auger rig encountered flowing (saturated) sand conditions below 65 feet.

Split-spoon samples obtained by the mud-rotary rig showed that a 4-foot thick layer of dense brown, fine silty sand is present from 74 to 78 feet. A sample obtained from the 75- to 77-foot depth was submitted to HLA's soil laboratory for sieve analysis. Figure 3 is a grain size distribution graph showing the material as a very fine sand with about 25 percent fines.

The materials from 80 to 135 feet are a well-graded sand with little or no fines. Figure 3 also includes the grain size analyses conducted by Rodgers & Company of samples taken from 60 to 70 and from 80 to 135 feet for the design of the well screen. The sand has a median grain size of greater than 0.6 millimeters, which is about three times larger than the median grain size of the silty sand layer of 74 to 78 feet. The silty sand layer had over 25 percent silt and clay size particles while the sand had no appreciable quantity of fine materials.

A layer of fine-grained material was encountered at a depth of 138 feet. A split-spoon sample collected from 139 to 140 foot interval contained 4 inches of silty clay above a dense brown silt having a small percentage of clay.

A 4-inch-diameter PVC threaded and flush-jointed well was constructed in the borehole with 69 feet of well screen. The screen with a slot size of 0.020 inches was installed at a depth of 64 to 133 feet. Centralizers were placed around the screen to keep the well in the center of the boring. Solid 4-inch-diameter casing extended from the top of the screen to ground surface. Specially-graded sand (Grade No. 10 x 20; see Appendix A) was placed in the annular space to 60 feet. A 2-foot bentonite pellet layer was placed above the sand and the remainder of the annular space was pressure grouted with a neat grout and bentonite mixture. The well was finished below grade with a drive over box and locking cap. The elevation of the top of casing was surveyed into mean sea level datum. The information is listed at the end of this chapter in Section J.

The well was developed for two hours with an air compressor. The flow rate at the end of development was estimated at 30 to 40 gallons per minute (gpm). Following development, a 1/2 horsepower submersible pump was lowered 100 feet below top of casing and the well was pumped for 60 minutes at 5 gpm. The flow rate was then reduced to 1 gpm and samples were obtained for organic and metal analyses using the sampling protocol in Appendix C. All water from development and sampling was discharged to the municipal sanitary sewer. The volatile organic samples were placed in 40 milliliter teflon-sealed vials with no head space and a two liter sample was taken for metal analyses. All samples were immediately iced and delivered to Rocky Mountain Analytical Laboratory (RMA), Arvada, Colorado by overnight delivery. Section III C. discusses the results of the analytical work.

C. Well MW-13

This monitoring well is located next to the south property line, about 200 feet west of MW-8 (Figure 1). The purpose of this boring was to determine the stratigraphy of the subsurface between wells MW-8 and MW-9 and for use as an observation well and a sampling location during later portions of this field work. An 8-inch diameter boring was drilled using mud-rotary techniques. The geologic log and well construction details are shown in Figures 4A and 4B.

The upper 66 feet of the boring consisted of sands and gravels, with two layers of fine-grained material from 30 to 44 feet and from 54 to 56 feet. A dense, silty clay layer with a small quantity of fine sand was noted from 66 to 71. A split-spoon sample was pushed into this material, but no recovery of the soil was obtained. Beneath this layer, a fine sandy silt layer was present from 70 to 80 feet.

Sand was noted from 80 to 86 feet, which changed to silty sand from 86 to 90 feet. A sandy silt was penetrated from 90 to 105 feet and a coarse gravelly sand was present from 105 to 135 feet. This gravelly sand material had similar drilling and textural properties as was noted during the drilling from 80 to 138 feet in MW-12.

A fine-grained layer was present in the bottom of MW-13, and a split-spoon sample of the material was taken at 140 feet. The soil was a fine sandy silt with a trace of clay. The sample was very dense.

A 2-inch diameter threaded and flush-jointed PVC well was constructed in the boring with 79.5 feet of 0.020-inch slot screen placed from 60 to 139.5 feet. The annular space around the well screen was packed with 10 x 20 sand up to 58 feet. Two feet of bentonite pellets were placed above the sand pack and the remainder of the annular space was filled with a neat grout and bentonite slurry. The well construction was completed by cementing a 6-inch diameter steel protector pipe with a locking cap around the PVC well.

The well was developed with air for two hours. The average withdrawal rate of water was 6 gpm. All water was discharged to the municipal sanitary sewer.

D. Well MW-14

This well, located in the southwestern corner of the SPARTON property (Figure 1), was used as an observation point for water level measurements, water sample collection, and to obtain subsurface information from that portion of the site. An 8-inch boring was drilled using rotary wash techniques. Figures 5A and 5B shows the log of subsurface material and well construction.

A coarse sand and gravel layer was present from 40 to 127 feet separated by a 2-foot layer of fine silty sand from 69 to 71 feet. A dense, silty clay layer was encountered at 127 to 130 feet. Split-spoon samples show that the material from both layers was very dense and nonplastic.

A 2-inch-diameter threaded and flush-jointed PVC monitoring well was constructed with 66 feet of 0.020 slot well screen from 61 to 127 feet. Graded 10 x 20 sand was placed in the annular space from 58 to 130 feet. The remainder at the annular space was sealed with a 2-foot layer of bentonite pellets, followed by neat grout with bentonite. The well was finished by cementing a 6-inch diameter steel protector pipe with a locking cap.

The well was developed with air for a period of two hours with a yield of 5 gpm. All water was discharged to the municipal sanitary sewer.

E. MW-15

An 8-inch boring was drilled by rotary wash technique at the western border of the plant property (Figure 1). Data obtained from this boring, along with the information derived from MW-14, were used to develop a better understanding of the hydrogeology on the western site of the property. Figures 6A and 6B are a log of the sub-surface materials and well construction details.

The top 39 feet of the boring consisted of a fine silty sand with a small percentage of clay. Beneath this material was a coarse gravel layer to 70 feet. A fine-grained layer was encountered from 70 to 77 feet. A soil sample from 70 to 71.5 feet showed a fine silty sand with a small percentage of clay. A 3-foot gravel layer was present from 77 to 80 feet. Beneath the gravel layer the formation alternated from coarse sand and gravel to fine-grained soils in approximately 10-foot layers. A dense clay was encountered at 125 feet. Drilling was continued to 130 feet where a split-spoon sample was to have been taken. However, the formation changed to sand and gravel, and the sample was not obtained. Drilling continued to a total depth of 140 feet.

The clay layer breached from 125 to 130 feet may separate a lower aquifer. To assure that ground-water flow would not occur through the boring, the bottom was filled with sand to 130 feet, and a 2-foot layer of bentonite pellets were placed in the boring opposite the clay layer prior to well construction.

MW-15 was constructed using 2-inch-threaded and flush-jointed PVC with 64.5 feet of 0.020-slot well screen from 60 to 124.5 feet. The sand pack extended from 55 to 128 feet and consisted of 10 x 20 sand. The remainder of the annular space was sealed with a 2-foot layer of bentonite followed by a neat grout with bentonite. A 6-inch steel protector pipe with locking cap was cemented into place.

The well was developed with air for two hours. The average yield of the well was 6 gpm. All water from the development was discharged to the municipal sanitary sewer.

F. MW-16

This boring is located in the fenced area adjacent to the two lined lagoons and is about 5 feet east from MW-1 (Figure 1). The boring was drilled using hollow-stem auger methods. Sampling with a 5-foot internal core barrel was used to a total depth of 73 feet.

The purpose of this boring was to obtain a series of soil samples for analytical analyses of total metals. Soil samples were also screened for organic vapor concentration using a photo-ionization detector (PID) meter manufactured by HNU Corporation (Model 101 with 11.7 eV lamp). The PID was calibrated to benzene vapors and was also used to continuously monitor the ambient atmosphere in the work area for health and safety purposes. Figure 7 is a log of the subsurface material encountered and the well construction details.

The boring penetrated brown, well-graded sand to 30 feet, where a 5-foot dense layer of clay was encountered. Beneath the clay layer coarse sand was present to 70 feet with a stiff clay layer located at 53 to 55 feet. Flowing sand conditions were encountered below 70 feet, causing sand to enter the augers after the core barrel was removed. Data regarding organic vapor concentration and metal concentration are included in Section III D.

A monitoring well was installed in the boring using 2-inch-diameter threaded and flush-jointed PVC casing and screen. Five feet of 0.020-inch slot well screen was installed from 68 to 73 feet. The annular space surrounding the well screen was allowed to collapse from 58 to 73 feet. Thick bentonite slurry was placed from 14 to 58 feet, and a neat cement grout was set from 0 to 14 feet. The well was finished with a 6-inch steel protector pipe with a locking cap.

The well was developed by bailing sand and water from the well for approximately two hours. The well yield was less than 0.5 gpm. All water was placed into the lined lagoons.

G. MW-17

Boring MW-17 is located approximately 55 feet north of the eastern lined lagoon (Figure 1). This boring was originally located adjacent to MW-3, but was moved when New Mexico Environmental Improvement Division (NMEID) personnel expressed reservations about conducting an infiltration test adjacent to the lined lagoons. The purpose of this well was to monitor water level fluctuation during the infiltration test. The boring was drilled similarly to MW-16, using a hollow-stem auger with a 5-foot internal core barrel. Figure 8 shows the well construction and subsurface materials encountered during drilling.

The top 40 feet of the boring encountered well-graded sand with a few thin fine-grained layers. Fine-grained clayey sand was noted from 40 to 45 feet, with clayey sandy silt from 45 to 50 feet, and coarse sand was penetrated from 50 to 55 feet. A dense clay layer was present from 55 to 60 feet. Coarse sand and gravelly sand was found to 72 feet where flowing sand conditions were encountered.

A 2-inch-diameter threaded and flush-jointed monitoring well was installed with a 5-foot well screen (0.020-slot) from 67 to 72 feet. The borehole was allowed to collapse from 63 to 72 feet. The annular space was filled with a thick bentonite slurry from 20 to 63 feet, with neat grout from 0 to 20 feet. A steel protector pipe was then cemented over the PVC well casing.

The well was developed by bailing for approximately two hours. The yield during development was less then 0.5 gpm. Water was discharged to the lined ponds.

H. PW-1

A production well was drilled approximately 8 feet east of MW-9 (Figure 1). The immediate purpose of this well was to conduct a pump test to evaluate the hydrogeologic properties of the aquifer beneath the site. The well was drilled with a 16-inch drill bit and with 47 feet of stabilizers, using rotary wash techniques. The well depth and screen design were based upon the samples obtained from MW-12. Figures 9A and 9B shows the materials encountered during drilling and the well construction.

The materials encountered during the drilling were similar in texture and stratigraphy as was noted in MW-12. A fine-grained layer was present in the boring from about 70 to 80 feet which corresponds to the upper silty sand layer present from 74 to 78 feet in MW-12. A second fine-grained layer was encountered at about 135 feet. The drill cuttings continued to increase in silt and clay content to the bottom of the boring at 145 feet. Original plans were to drill to 140 feet, but the boring was extended an additional 5 feet to allow an ample sump for any cuttings which may not have been removed from the boring. This allowed the driller to use a much thinner drilling fluid which aided in well development.

A 10-inch diameter threaded and flush-jointed PVC well casing and screen was installed in the boring to a total depth of 138 feet. Two intervals are screened: from 60 to 70 feet to collect ground water from above the upper silty sand layer; and from 80 to 138 feet to allow the well to be open opposite the coarse sand and gravel below the upper fine-grained layer. The well screen has slot openings of 0.045 inches, based on the grain size analyses from MW-12.

Three sets of centralizers were used to allow the uniform placement of 66 - 100 pounds bags of 8 x 16 gravel around the well screen from the bottom of the boring to 55 feet. Bentonite pellets were placed from 53 to 55 feet and a neat grout with bentonite was pumped into the annular space from 53 feet to grade. The well was completed by cementing a 14-inch steel protector pipe with locking cap over the PVC well casing.

Well development was conducted with the drill rig's air compressor. The initial withdrawal rate was 60 gpm, but after about 90 minutes, the rate was 100 gpm. Development continued for a total of 4 hours 15 minutes until the well produced water with little to no sediment or turbidity. All water was discharged to the municipal sanitary sewer.

I. Infiltration Gallery

An 8-foot-long by 0.88 foot by 4-foot-deep infiltration gallery was installed with a backhoe 4 feet south of MW-17 (Figure 1). The open area of the bottom of the gallery was 7 $feet^2$. The gallery consisted of a wooden box with an open bottom filled with 3 feet of 1.5-inch gravel to ensure integrity and stop erosion during the test. As mentioned earlier, the intended location of the gallery was originally adjacent to MW-16, but was relocated because of concerns expressed by NMEID.

The purpose of the gallery was to conduct a pilot scale infiltration test to determine the capability of the subsurface to receive infiltration. A test of this scale (as opposed to a small test with an infiltrometer) was used to give a much more accurate depiction of the infiltration characteristics of the subsurface.

J. Well Data Summary

Table 1 lists the top of casing elevation and screened interval below grade for the seven wells. The elevation data were obtained from Denny-Gross & Associates, Inc., registered surveyors from Alburquerque, New Mexico. The top of casing data listed are actually the elevation of the top of a flat 3/8-inch-thick bar laid across the top of the steel protector pipe. All water level measurements were obtained using the top of the bar as the reference point.

TABLE 1

WELL COMPLETION SUMMARY

SPARTON TECHNOLOGY, INC.

ALBUQUERQUE, NEW MEXICO

Well	Top of Casing Feet MSL	Screened Interval Feet Below Grade
MW-12	5041.81	64-133
MW-13	5043.35	60-139.5
MW-14	5041.94	61-127
MW-15	5047.51	60-124.5
MW-16	5047.53	68-73
MW-17	5049.30	67-72
PW-1	5043.89	60-70; 80-138

III HYDROGEOLOGIC FRAMEWORK

A. Geologic Conditions

Based upon the results of previous field investigation and the data obtained from these borings, a conceptual three-dimensional hydrogeologic framework has been developed for the SPARTON site. In general, the plant is located on unconsolidated sand and gravel deposits with occasional fine-grained layers of silt and clay located at specific depths. The stratigraphy of these deposits is characteristic of valley-fill alluvium and colluvium of the unconsolidated aquifer in the Rio Grande Valley. The flat, subrounded gravels are indicative of a meandering stream, which deposited sand and gravel in the main channel, and fine-grained sediments on a relatively broad flood plain. Some of these fine-grained layers appear to be found almost continuously beneath the site; the impact of these layers are discussed in this section.

The subsurface conditions can be most easily understood by constructing cross-sections using the geologic information gathered during this and the previous phases of site work. These crosssections are necessarily interpretive, and are therefore subject to change based upon future data acquisition and analysis.

Figure 10 is cross-section A-A' (shown in Figure 1) which shows the interpreted geologic conditions beneath the center of the plant site in a northeast-southwest direction. The boring information from MW-1, 2, 3, 4, 9, 10, 11, 12, 16, 17 and PW-1 is projected onto this cross-section.

The unsaturated zone consists mainly of sand, silty sand, and sandy gravel, with an occasional silt and clay lenses. No data are available to suggest that any of these fine-grained layers are continuous in the unsaturated zone.

Two fine-grained layers are suspected to be present almost continuously beneath the site in this cross-section. A layer, alternately described as silty sand or clayey silt, is present between elevation 4965 to 4975 feet in boring MW-9, 10, 11, 12 and PW-1. MW-16 and 17 were not drilled to this depth. MW-2, 3, and 4 were not logged as having encountered this material, however split-spoon samples were not obtained during drilling of these wells.

The second fine-grained layer is present at about elevation 4900 feet and consists of dense fine sands, silts and clays. The thickness and areal extent of this layer is presently unknown, but the log of MW-10 showed a 1-foot thick clay layer at that depth. Wells MW-9, 16, and 17 are screened above the upper fine-grained layer, while MW-1, 2, 3, 4, 12 and PW-1 are screened above and below that layer. MW-10 and 11 are screened at or below the lower fine-grained layer.

Figure 11 shows the interpretive cross-section B-B' along the southern property boundary of the plant (Figure 1) and contains data projected from MW-8, 9, 12, 13, 14 and PW-1. This view shows that both of the fine-grained units are probably continuous at this location and gives added indications that these units may be continuous beneath the plant site. Wells MW-8 and 9 are screened above the upper fine-grained layer, while the remainder of the wells are screened above and below.

Boring MW-13 encountered additional fine-grained layers both above and below the water table. The 20-foot thickness of this material below the water table could reduce the transmissivity of the aquifer between the two fine-grained layers which appear to be continuous beneath the site.

Figure 12 shows geologic cross-section C-C' which includes data projected from MW-5, 14, 15, and P-1 (Figure 1). The upper fine-grained layer is present in all boring logs except for P-1 from which split-spoon samples were not collected. Boring MW-15 apparently drilled through the lower fine-grained layer from 4915 to 4920 feet.

That layer consisted of a dense clay which abruptly changed to gravelly sand at 4915 feet. The boring was sealed with a bentonite plug in this interval to assure that no possible migration pathway remained into the sediments beneath the lower fine-grain layer.

The log of MW-15 is similar to MW-13 in that the aquifer between the fine-grained layers contains units of clays and silty sands which may reduce the transmissivity in this area.

In summary, the subsurface at the SPARTON site can be divided into a series of sand and gravel units separated by fine-grained layers. The upper unit extends from the land surface to approximately 70 feet below grade where the upper fine-grained layer was found to be present in all of the borings during this phase of drilling and was noticed in most of the logs from previous field investigations which did not have as vigorous a sampling plan. Ground water is present above this upper fine-grained layer, causing a 5- to 10- foot thickness of saturated sands and gravels above that layer.

A second sand and gravel unit is generally found at elevation 4910 to 4970 feet. This layer generally consists of coarse sand and gravel beneath the water table, although MW-13 and 15 intersected a series of silts and clays between the two fine-grained layers. A second fine-grained layer appears to be present beneath the site at elevation 4910 to 4900 feet, which may act to separate the lower aquifer from deeper sand and gravel units.

B. Ground-Water Conditions

Ground water was encountered in all of the borings at about 60 to 70 feet below grade. Wells were screened at different intervals throughout the phases of field work at this site, so all water level data must be carefully interpreted in order to develop the most representative concept of the ground-water flow regime of the site.

The upper fine-grained layer appears to divide the sediments into two aquifers: a relatively thin unconfined aquifer at about elevation 4970 to 4980 feet; and a lower aquifer that is present from 4910 to 4970 feet. The integrity of the upper fine-grained layer is not totally known, but based upon this last phase of field work, it appears to be sufficiently continous beneath the site to cause a head difference between the aquifers. Also, chemistry data and results of the aquifer test suggest that the upper unit acts as a semi-confining unit, restricting vertical ground-water flow. These last two topics are discussed in more detail in subsequent sections.

Figure 13 is a cross-section of the ground-water conditions at the SPARTON site. The section was taken through A-A' which is shown on Figure 1. The contour map was constructed using the head data in all wells. The mid-point of the screen was used as the reference elevation corresponding to head measurements for the wells in which large thicknesses of the aquifer were monitored. The contours on the crosssection show an apparent downward vertical gradient with up to 4.0 feet of head difference present between adjacent wells MW-16 and MW-11. The downward vertical gradient present on-site complicates the determination of the horizontal flow gradients since the monitoring wells were completed at different elevations and in both aquifers. We interpolated and extrapolated water-level measurements taken for this study, adjusting the levels to what the piezometric elevation is anticipated to be in the upper and lower aquifers, allowing for the vertical gradient.

Figure 14 is a contour map of the water-table elevations of the upper aquifer. The direction of flow is towards the southwest. An anomoly on this map is the apparent low gradient from MW-6 to MW-8. The gradient beneath the plant site of 0.006 is roughly four times as steep as the gradient along the eastern property boundary. The reason for this difference is presently unknown.

Figure 15 shows the piezometric head data for the lower aquifer on the SPARTON site. As mentioned earlier, construction of this map required the interpretation of the water levels taken throughout the plant site. The horizontal gradient in the lower aquifer is about 0.005 toward the west. The gradient of the lower aquifer's piezometric head is less than the gradient of the overlying water table aquifer. The difference in gradients may be due to leakage or changes in the thickness of the upper aquifer.

C. Ground Water Chemistry

This section includes the analyses of water samples taken during this phase of field work. Water samples have been taken from all monitoring wells and PW-1. All analytical work for this phase has been conducted by Rocky Mountain Analytical Laboratory (RMA), Arvada, Colorado. Water samples collected during this phase of work were obtained according to the Ground-Water Sampling and Analytical Protocol attached as Appendix C. All water obtained during well purging was discharged to the sanitary sewer, which was arranged and authorized through SPARTON personnel.

Water samples were taken in MW-12 in order to obtain preliminary chemical data of the anticipated water quality for discharge into the sanitary sewer. PW-1 was sampled four times during the pumping test to determine if any chemical trends could be identified. Water samples were taken before and after the infiltration test from MW-16 and MW-17 to determine the effects of the vadose zone flushing on ground water chemical constituents. The remainder of the new monitoring wells were sampled to augment and update our information about the areal chemical character of the ground water.

Previous ground-water sampling at the SPARTON site has shown the presence of high concentrations of volatile organic chemicals (VOC) in wells MW-1, 3, and 9 with some VOC constituents found in all of the monitoring well samples. The concentrations of VOCs are greatest from the samples from the wells that are screened above the upper fine-grained layer, as evidenced by the chemical results from MW-9, which is about 500 feet from the suspected contamination source. Wells MW-10 and 11, which are screened at or below the lower fine-grained layer, have shown much lower concentrations. These two wells were not sealed below the water table to prevent downward leakage from the water table to the screened area, so the results from these two wells may not be indicative of ground-water quality at that depth.

Previous sampling of MW-1 through 11 showed high concentrations of boron, chromium, manganese, and nickel. Wells with the highest concentrations were in MW-1, 3, and 9, although manganese was the only one of these metals analyzed in MW-9.

Table 2 lists all of the chemical analyses compiled from the new wells installed during this phase of work. Results of the subs quent sampling in November 1984 are in Appendix C. The concentrations of metals and VOCs were greatest in MW-16, which obtained ground water from above the upper fine-grained layer in the area immediately adjacent to the suspected contamination source. High concentrations of VOCs and metals were also found in MW-14, and 15, on the west side of the plant site. The lowest levels of contaminants were found in the samples from MW-12 and PW-1. Samples for metals analysis were not filtered in the field rior to acidification during this phase of work. Therefore the chemical results re resent total metals instead of dissolved metals.

A comparison of the trichloroethylene, Total Organic Carbon, and Specific Conductance re ults from this work phase and subsequent sampling during November 1984 is shown in Table 3. Trichloroethylene was selected because it is a volatile organic constituent which as been detected in all wells. The highest concentration of trichloroethylene is found in MW-3, with 59,000 ug/l of the organic constituent. The lowest trichloroethylene concentrations are found in MW-5, 6, 8, 10, 12, and PW-1. Trichloroethylene was not detected in MW-11. TOC concentration is highest in MW-3. The highest specific conductance value was found in MW-16, with MW-1, 3, and 9 also exhibiting elevated results. The lowest values were found in MW-2, 5, 7, 8, 10, 11, and 17. A comparison of results in MW-9, 12,