DATA REVIEW AND WORK PLAN TO CONDUCT FURTHER GROUNDWATER CHARACTERIZATION AT THE MARKETPLACE/NIELSEN PROPERTIES THE MARTIN GROUP

AUGUST 9, 1989

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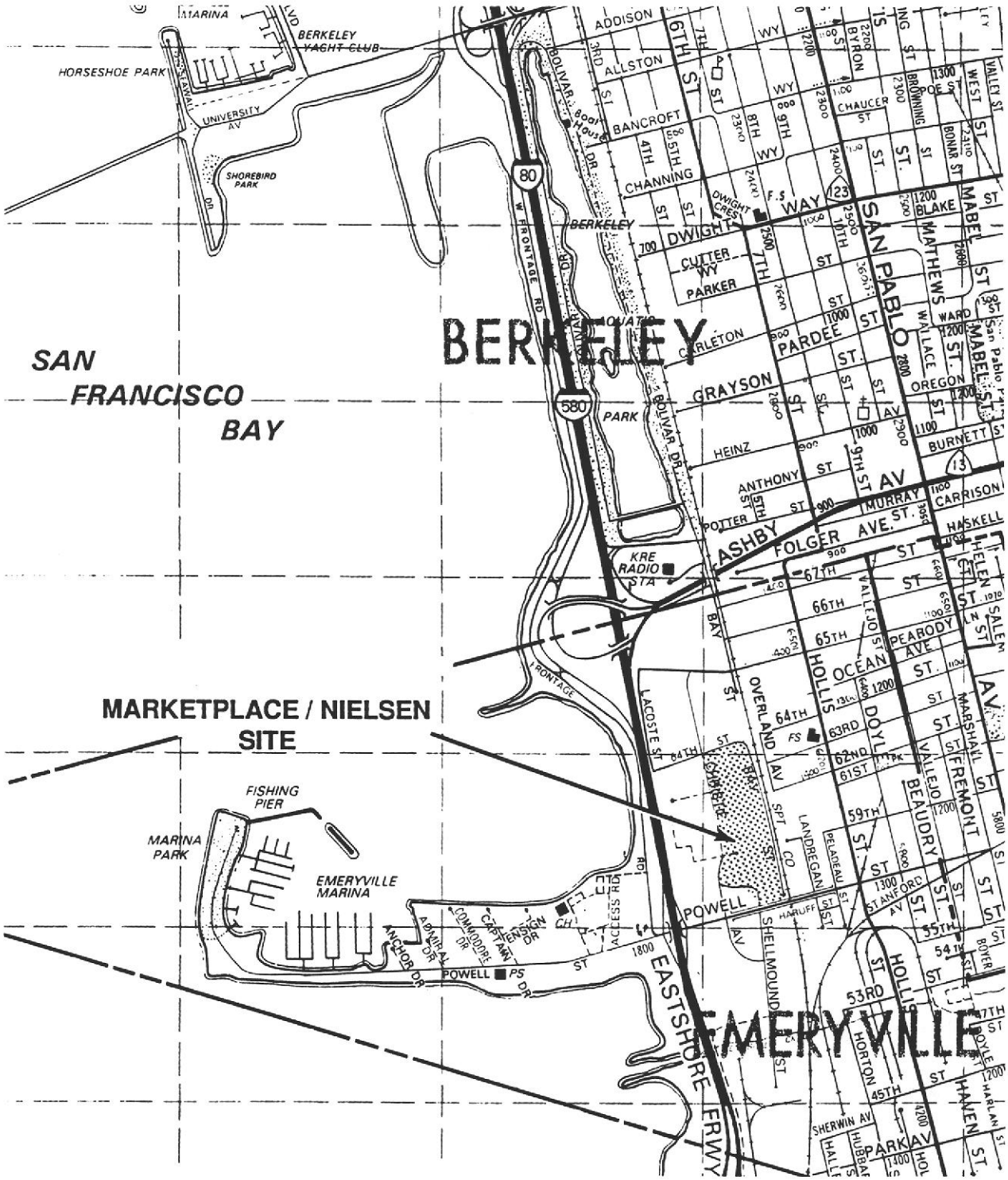
INTRODUCTION

This technical proposal has been prepared on behalf of the Martin Group at the request of the Alameda County Department of Environmental Health (DEH) for the characterization and evaluation of chemicals in groundwater at the Marketplace/Nielsen site (Figure 1). Soil and groundwater characterization investigations have been conducted at the site since 1981. The DEH requested further characterization of the extent of chemicals in groundwater in April 1989. To accomplish this goal, construction and sampling of three additional monitor wells is recommended. A review of existing hydrogeological data, a review of the extent of chemicals in on-site groundwater, and rationale for the selected well locations and analysis of groundwater samples are presented herein. This work plan also presents a scope of work for the additional groundwater investigation, including the recommended locations for these wells, a description of associated tasks and a schedule for performing the tasks.

FIGURE 1
SITE LOCATION MAP



BACKGROUND

SITE HISTORY

The northeast corner of the Marketplace was occupied by the Paraffine Company in 1884. This company was involved in research and development of bituminous and petroleum-based products and may have also been involved in the refining of asphalt and kerosene. In 1902, the Paraffine Company began to manufacture roofing materials and refine asphalt for use in paints. The asphalt refinery was located in what is now the northeastern corner of the Marketplace property and southern portion of the Nielsen property. Asphalt was refined by removing the light hydrocarbon fractions from crude asphalt. The light fractions were used to fuel a powerhouse located on-site.

In 1920, the Paraffine Company changed its name to PABCO. In 1929, PABCO began manufacturing paints. By 1930, most of what is now the Marketplace property was covered with buildings. Early development of the former Nielsen Freight Lines site occurred contemporaneously with development of the Marketplace site. Between 1935 and 1937, the portion of the Nielsen site north of 63rd Street was filled. The Nielsen site was part of the manufacturing operation at the Marketplace site, making roofing products and paint; at that time there were four large above ground storage tanks, a building, and a storage yard (Earth Metrics, 1988) on the Nielsen property. The two existing Marketplace buildings were used for storage and paint manufacturing. Paint mediums included linseed and oil and synthetic toluene. Paint pigments included titanium oxide, lead, zinc oxide, zinc chromate, magnesium silicate, and barium sulfate. In 1957, PABCO was purchased by Fibreboard Corporation. In 1964, Fibreboard began to divest its industries and by 1974, and all structures except those currently existing were demolished. In 1975, the site was graded and construction of the existing Marketplace parcel lot was completed.

The Nielsen site was developed as a trucking facility in the 1960's. Several diesel, gasoline, and waste oil underground tanks were installed in the 1960's and solvents and degreasers were stored on the ground surface. Storage at the Nielsen site included:

- A 10,000-gallon gasoline storage tank and fueling manifold,
- A 10,000-gallon diesel tank and fueling manifold,
- A 500-gallon waste oil tank,
- A 500-gallon lube oil tank, and
- An antifreeze and motor oil drum storage area.

PREVIOUS GROUNDWATER INVESTIGATIONS

Marketplace Property

An environmental assessment of the Marketplace property was performed in 1982 (WCC, 1982). This investigation included drilling soil borings at 15 locations and installation of four groundwater monitoring wells. The results of this investigation indicated the presence of tar in soils adjacent to the north end of the Marketplace building and east of the northern part of the building. The thickness of the asphaltic substance was determined as a result of additional soil borings by Earth Metrics (Earth Metrics, 1988).

Nielsen Property

An environmental assessment of the Nielsen property was performed in 1987 (WCC, 1987) in conjunction with closure activities for on-site underground tanks, piping, and manifolds. During excavation activities, all soils containing greater than 100 ppm of fuel was removed and aerated on site in accordance with Bay Area Air Quality Management District guidelines. A total of eight groundwater monitoring wells were installed during these activities to determine the potential impact of these tanks and chemical use areas on groundwater. The wells were installed either upgradient or downgradient of chemical use areas (See Table 1 and Figure 3 in WCC, 1987).

← NO -

REGULATORY CRITERIA

The California Regional Water Quality Control Board (RWQCB), San Francisco Bay Region has adopted a formal definition of "sources of drinking water" as resolved in California State Water Resources Control Board policy No. 88-63. In this policy, "sources of drinking water" are defined in Water Quality Control Plans as those water bodies with beneficial uses designated as suitable, or potentially suitable, for municipal or domestic water supply. The policy states that all surface and groundwaters of the State are considered to be suitable, or potentially suitable for municipal or domestic water supply with the exception of water where either:

- The total dissolved solids (TDS) exceeds 3,000 mg/L or electrical conductivity exceeds 5,000 uS/cm and the water is not reasonably expected by Regional Boards to supply a public water system, or,

- There is contamination, either by natural processes or by human activity (unrelated to a specific pollution incident), that cannot reasonably be treated for domestic use using either Best Management Practices or best economically achievable treatment practices, or,

what is policy on other waters i.e. degradation of waters not drinking

- The water source does not provide sufficient water to supply a single well capable of producing an average, sustained yield or 200 gallons per day.

Therefore, it is necessary to determine if any of these criteria are met at sites with chemicals in groundwater.

REGIONAL HYDROGEOLOGY

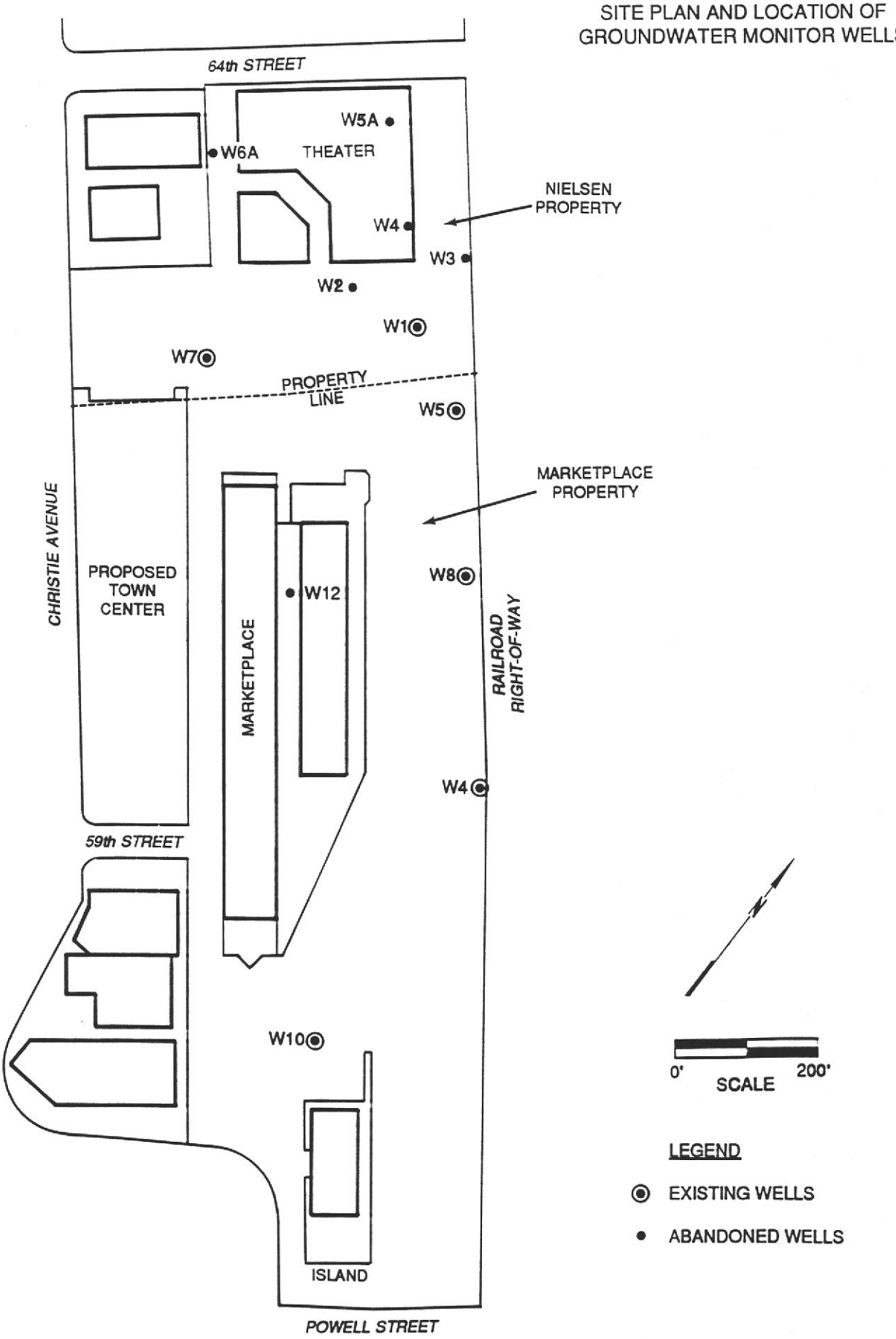
The Marketplace and Nielsen properties (Figures 1 and 2) lie to the west of the Hayward Fault on the Berkeley Alluvial Plain of the East Bay Plain Area. Uplift of bedrock on the eastern side of the fault occurred approximately 1 million years ago and resulted in the formation of the East Bay Hills to the east. The soils beneath the Emeryville area were deposited by streams as alluvium eroded from the hills and as tidal flat and tidal channel deposits of San Francisco Bay (Alameda Flood Control and Water Conservation District [ACFC and WCD], 1988). These native soils are referred to as the "Older Alluvium" and the "Bay Mud".

The Older Alluvium is a laterally continuous deposit comprised of layers of poorly consolidated clay, silt, sand, and gravel that directly overlie bedrock. The top of the Older Alluvium is approximately 20 to 25 feet below grade in the Emeryville area and is approximately 200 to 300 feet thick in the Emeryville area (ACFC and WCD, 1988). Groundwater within the Older Alluvium is semi-confined or unconfined depending on the presence or absence of the overlying Bay Mud. Based on the variable composition and thickness of individual deposits within the Older Alluvium, hydraulic conductivities and yields of wells are highly variable and range from tens of gallons per minute (gpm) to over a thousand gpm (ACFC and WCD, 1988). This deposit is the major groundwater reservoir in the East Bay Plain Area (ACFC and WCD, 1988). Groundwater within this deposit flows towards San Francisco Bay to the west (Earth Metrics, Inc., 1987).

Where present, the Bay Mud overlies the Older Alluvium. This unit is laterally continuous throughout the western portion of the Berkeley Alluvial Plain and ranges in thickness from less than 1 foot in inland areas to as much as 50 feet under the San Francisco Bay. In the Emeryville area, the Bay Mud occurs at approximately 5 to 10 feet below grade and is approximately 5 feet thick (ACFC and WCD, 1988). The Bay Mud is relatively impermeable and serves as a hydraulic barrier separating the Older Alluvium from overlying artificial "fill" material (described below). Groundwater within the Bay Mud flows relatively slowly and this unit does not freely yield water to wells.

Artificial fill material overlies the native Bay Mud and Older Alluvium deposits over approximately one-third of the land area of Emeryville. The fill was imported and deposited in order to extend the shoreline of Emeryville (Earth Metrics, 1987). The thickness of the fill material ranges from approximately 1 to 15 feet. The composition of the fill material is highly variable. Clays, silts, sands, and gravels occur in

FIGURE 2
SITE PLAN AND LOCATION OF
GROUNDWATER MONITOR WELLS



varying thicknesses throughout the fill material. In addition, boring logs indicate the presence of construction debris (e.g., concrete blocks, wood, glass, plastic, tar paper, and metal) within the fill material.

The water table occurs within the artificial fill and is encountered at depths of 5 to 10 feet. The depth to the water table within the fill at certain locations in this area may vary in response to San Francisco Bay tides. At certain locations, there may be perched water zones within the fill due to the presence of impermeable layers of limited aerial extent. Groundwater in this material is unconfined and flows to the west. Topographic control results in southwesterly groundwater flow in some portions of Emeryville.

SITE GEOLOGY

The Marketplace and Nielsen properties are underlain by artificial fill. The thickness of the fill ranges from approximately 1 to 5 feet under the Marketplace property and from 5 to 15 feet under the Nielsen property. The fill consists of clays, silts, sands, and gravels as well as construction and industrial debris. A number of borings were discontinued due to the presence of debris. (See Section entitled "Well Construction and Development").

Underlying the fill is the Bay Mud which separates the fill material from the underlying older alluvium. The Bay Mud is laterally continuous beneath the Marketplace property but was not encountered at depth beneath the Nielsen Property. This is likely due to the fact that a tidal slough crossed the Nielsen Property. The lower boundary of the Bay Mud is located approximately 10 feet below grade at the Marketplace Property. The Older Alluvium was encountered at approximately 6 to 10 feet below grade at the Marketplace property and approximately 12 feet below grade at the Nielsen property.

SITE HYDROGEOLOGY

Groundwater within the fill material overlying the Bay Mud is unconfined. Recent water level elevations in monitor wells at both properties is lacking, however. Table 1 contains approximate water level elevations and/or depths to groundwater beneath the site. The most recent water level data for the Marketplace property was obtained on January 18, 1982 (WCC, 1982). Data for one well on the property was taken on May 6, 1987 (WCC, 1987). These data indicate that the groundwater flow direction within the fill material beneath the Marketplace property is towards the southwest. The most recent water level data for the Nielsen property was obtained on May 6, 1987. These data indicate that the groundwater flow direction within the fill material beneath the Nielsen property is towards the west (WCC, 1987). This westerly groundwater flow direction is consistent with the regional groundwater flow direction.

Schedule 40 PVC pipe. The well screens have 0.02-inch slots and extend from 2 to 4 feet below grade to the bottom of the well.

The top of the screens were above the water table and below zones of known soil contamination. Lonestar No. 3 sand was used as a filter pack. The filter pack extends from the bottom of the boring to approximately 1 foot above the screened section. A bentonite seal was place above the filter pack to within 0.5 to 1 foot of the surface. The remaining annular space was grouted to just above the ground surface. All monitor wells are capped with a PVC slip cap. The groundwater monitor wells were developed by surging and pumping between April 9, 1987 and April 17, 1987.

EXTENT OF PRIOR GROUNDWATER SAMPLING AND ANALYSIS

Chemical analyses performed on all wells at the Marketplace/Nielsen site are summarized in Table 2. This table indicates the dates each well was sampled, the report the data was first presented, analytical method, and analytical laboratory.

Because these were separate properties with different use histories, a variety of chemical analyses were performed. Groundwater from all four wells at the Marketplace site has been sampled at least one time for priority pollutant metals. However, groundwater from only two wells, W-4 and W-12, has been analyzed for organic constituents. The groundwater in Well W-12 was analyzed for volatile organic compounds according to EPA Method 624 in 1982 (WCC, 1982), and groundwater in Wells W-4 and W-12 was analyzed for total semi-volatile organic compounds according to EPA Method 9020 in 1988 (Earth Metrics, 1988).

More complete data has been collected from the wells at the Nielsen site. These wells were all sampled when installed for priority pollutant metals and volatile organic compounds according to EPA Method 624. At the same time, groundwater from specific wells was analyzed for general minerals (wastewater), oil and grease according to EPA Method 418.1, total petroleum hydrocarbons according to EPA Method 8015, semivolatile organic compounds according to EPA Method 625, halogenated volatile organic compounds according to EPA Method 601, or ethylene glycol by GC/FID. Additionally, groundwater from all Nielsen wells was analyzed for pH and specific conductivity during development (WCC, 1987).

CHEMICAL DISTRIBUTION IN GROUNDWATER

All analytical data for groundwater samples collected at the Marketplace/Nielsen site are presented in Tables 3 through 7. Semi-volatile organic compounds, volatile organic compounds, hydrocarbons, and metals detected in groundwater at all wells at the Marketplace/Nielsen site are shown in Figures 3 through 8. The highest specific conductivity readings for groundwater are shown in Figure 9.

TABLE 2

SUMMARY OF ANALYSES PERFORMED ON GROUNDWATER SAMPLES FROM MARKETPLACE AND NIELSEN PROPERTIES

Well No.	Date	Report (g)	Lab Name	Metals	General Minerals	Semi-volatile Organics EPA 625	Total Semi-volatile Organics EPA 9020	Volatile Organics EPA 624	Halogenated Volatile Organics EPA 601	Ethylene Glycol GC/FID	Oil & Grease EPA 418.1	TPH EPA 8015
Marketplace												
W-4 (a)	1/20/81	WCC 1982	B&C (d)	X								
	12/1/87	EM 1988	FF (e)	X			X					
W-5 (a,b)	1/20/81	WCC 1982	B&C	X								
W-10 (a)	1/20/81	WCC 1982	B&C	X								
	4/17/87	WCC 1987	B&C					X	X			
W-12 (c)	1/20/81	WCC 1982	B&C	X				X				
	1/27/82	WCC 1982	B&C					X				
	12/1/87	EM 1988	FF	X			X					
Nielsen Property												
W-1 (a)	4/14/87	WCC 1987	B&C	X	F (f)			X	X	X	X	X
		EM 1988	No Lab Data									
W-2 (c)	4/14/87	WCC 1987	B&C	X	F			X	X		X	X
		EM 1988	No Lab Data									X
W-3 (c)	4/14/87	WCC 1987	B&C	X	X , F	X		X	X			
W-4 (c)	4/14/87	WCC 1987	B&C	X	F			X	X		X	X
	12/1/87	EM 1988	Anametrix			X		X				
W-5A (c)	4/16/87	WCC 1987	B&C	X	F			X				X
W-6A (c)	4/16/87	WCC 1987	B&C	X	F			X				X
		EM 1988	No Lab Data									X
W-7 (a)	4/16/87	WCC 1987	B&C	X	X , F	X		X				
W-8 (a)	4/17/87	WCC 1987	B&C	X	F	X		X	X			

(a) Existing well.
(b) Groundwater samples cannot be presently collected from this well as it is filled with asphaltic material.
(c) Well no longer exists.
(d) Brown and Caldwell Analytical Laboratory.
(e) Fireman's Fund Analytical Laboratory.
(f) "F" indicates that partial field tests were performed including pH and/or specific conductance.
(g) Refer to References for complete report name.

Reports/dates/labs2

FIGURE 3
SEMIVOLATILE ORGANIC COMPOUNDS (SOCs) IN GROUNDWATER (ppb)

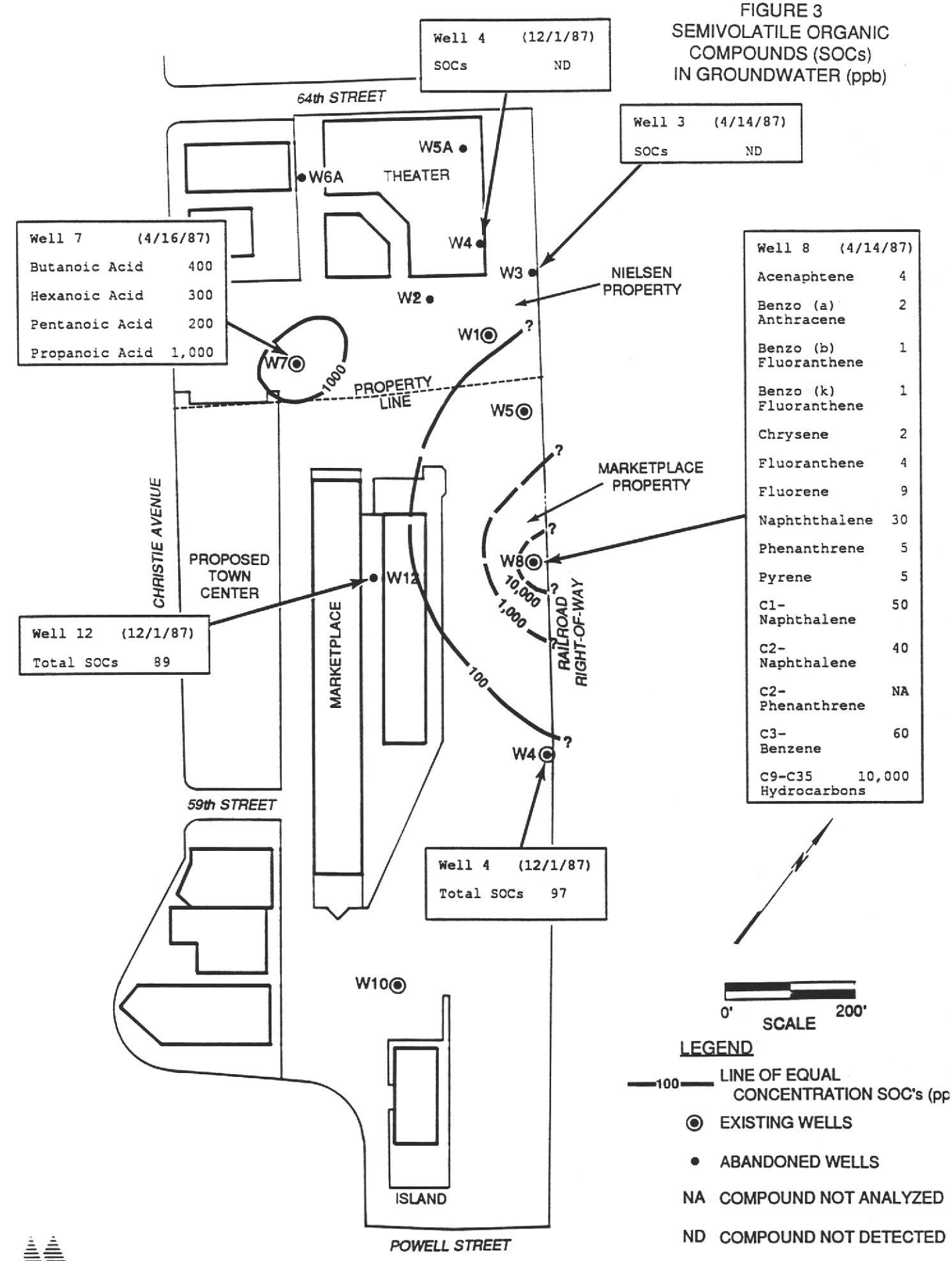


FIGURE 4
ARSENIC IN
GROUNDWATER

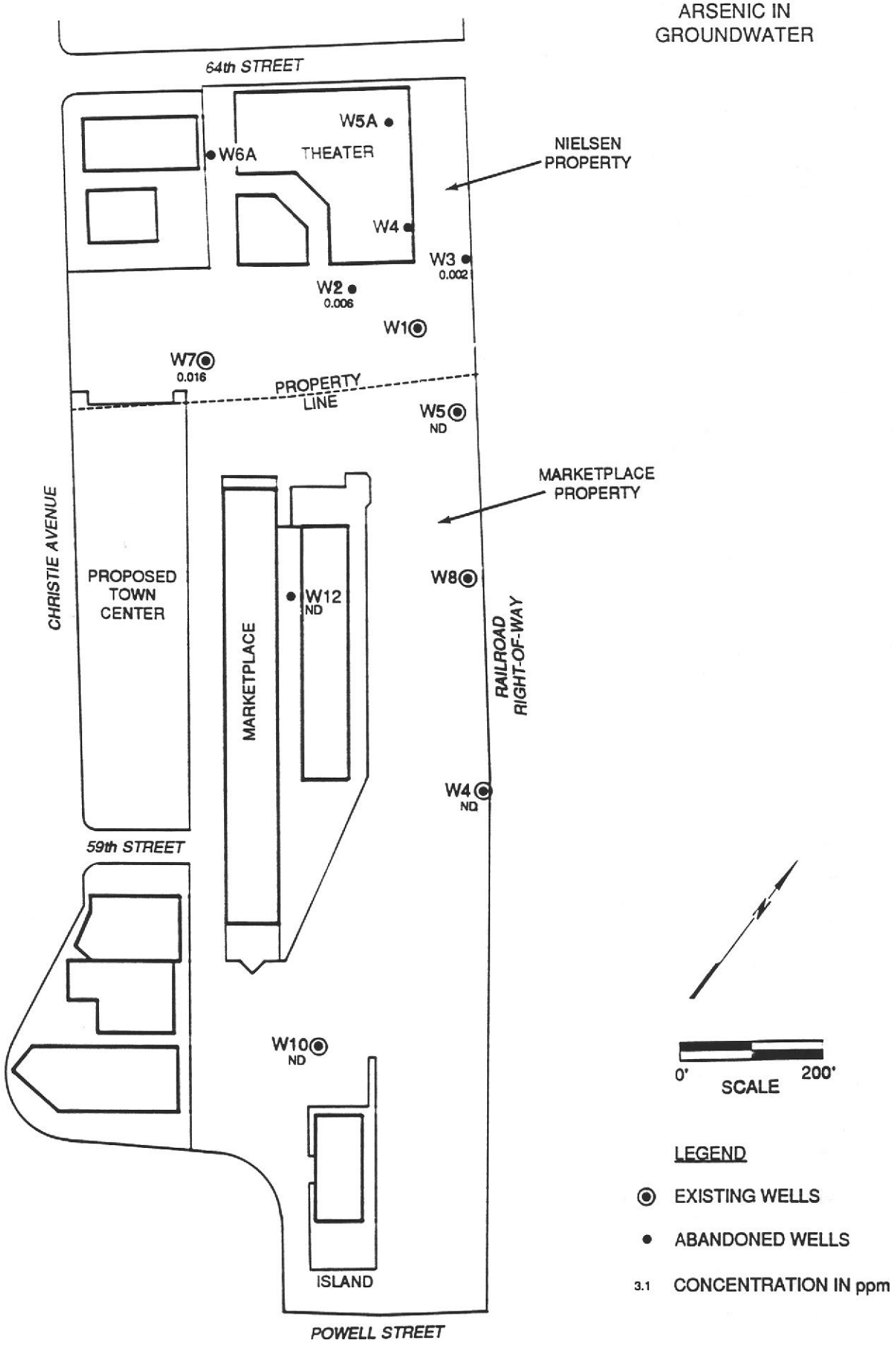


FIGURE 5
CHROMIUM IN
GROUNDWATER

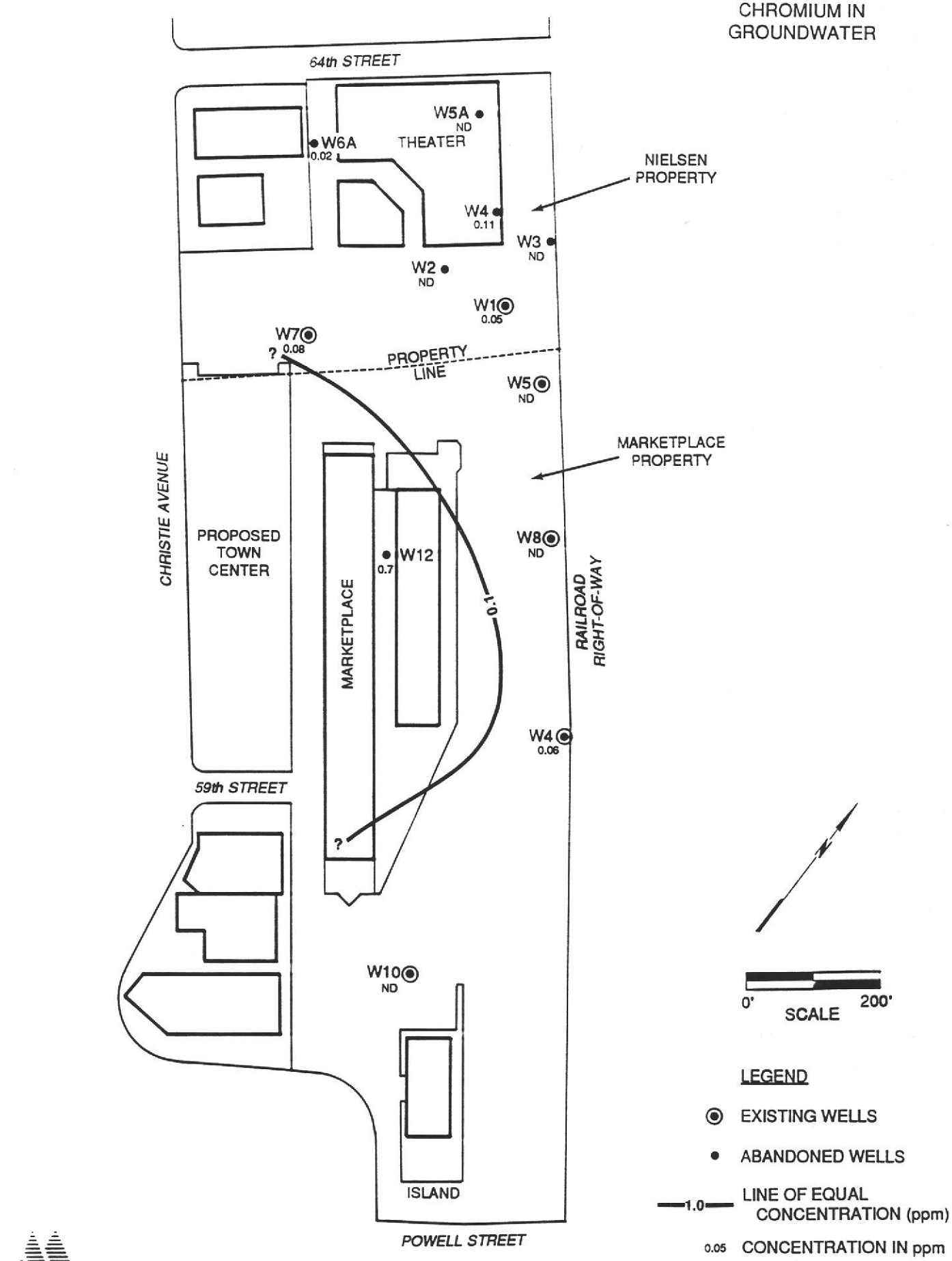


FIGURE 6
COPPER IN
GROUNDWATER

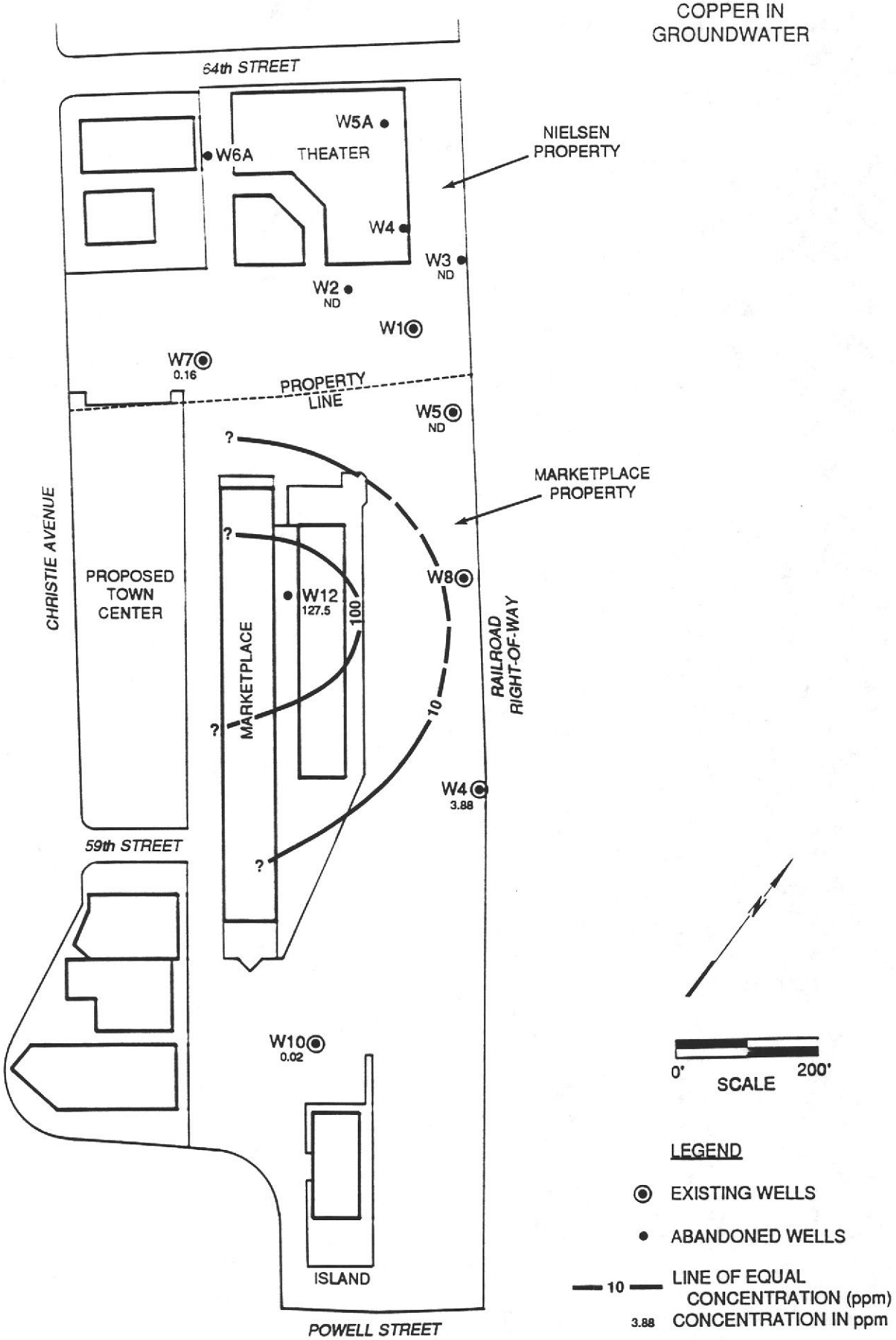


FIGURE 7
LEAD IN
GROUNDWATER

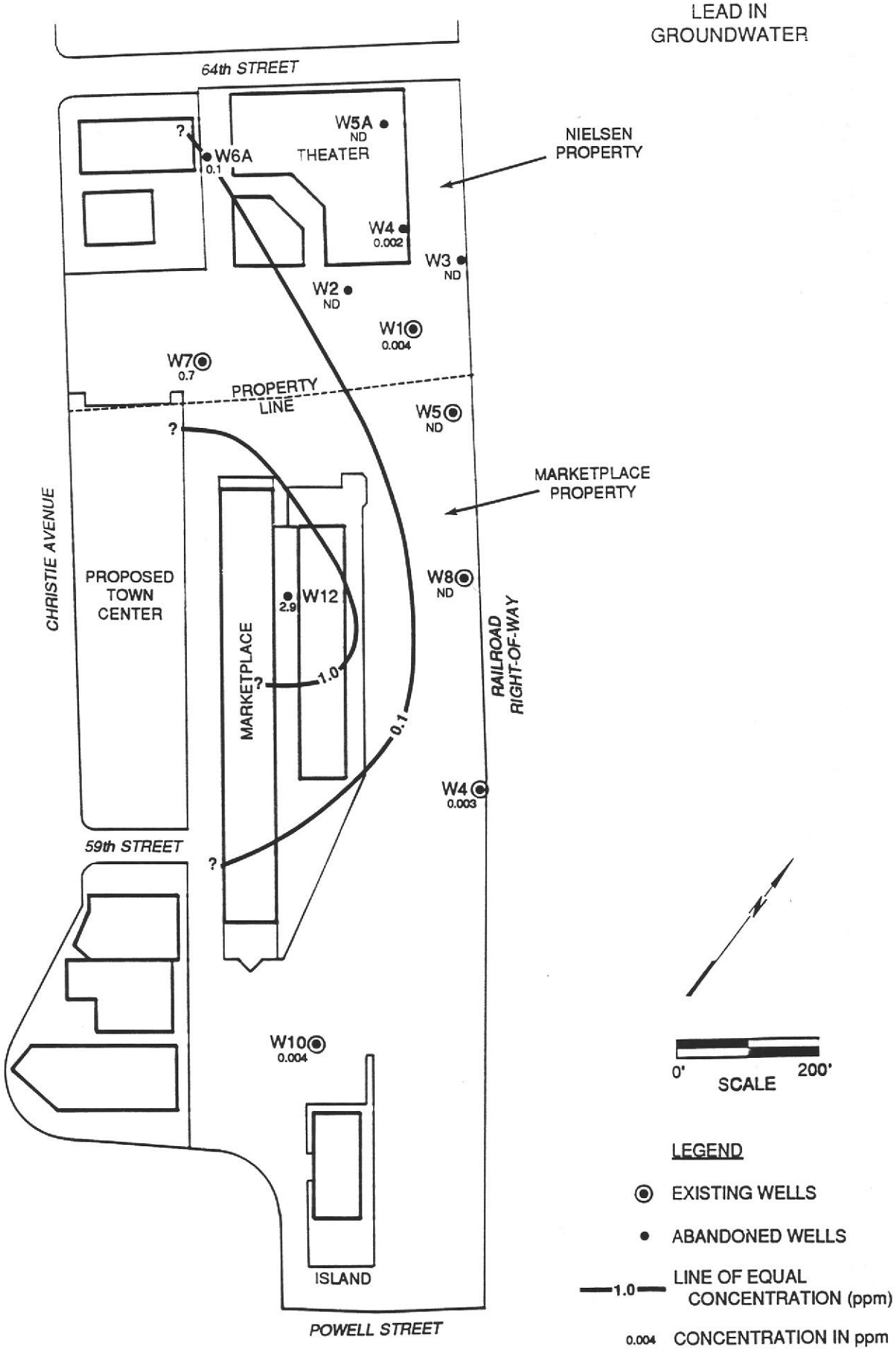


FIGURE 8
ZINC IN
GROUNDWATER

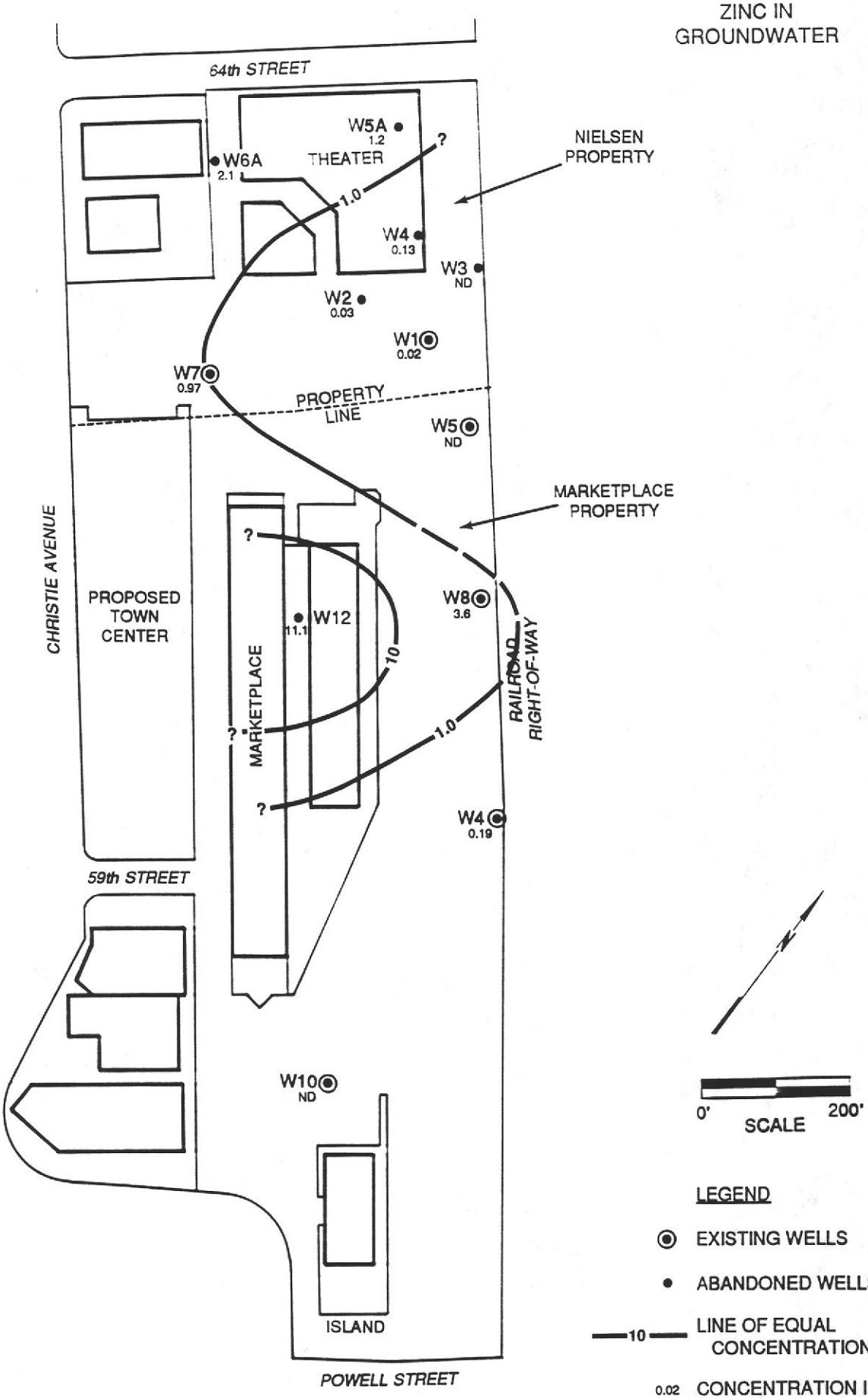
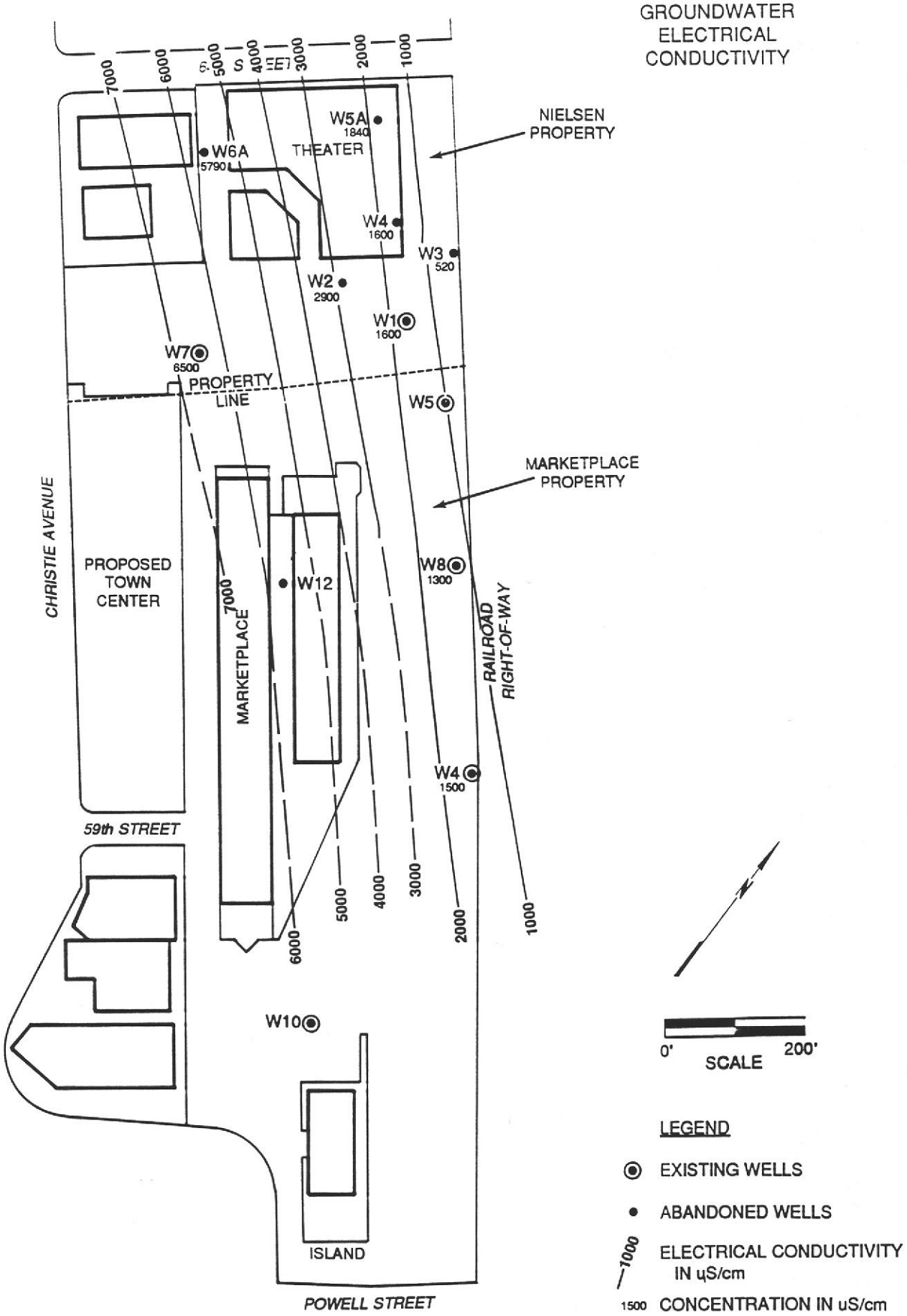


FIGURE 9
GROUNDWATER
ELECTRICAL
CONDUCTIVITY



To determine which original report contains the data in these tables, the well number and sampling date on each table is keyed to the same well number and sampling date on Table 2.

Semivolatile Organic Compounds in Groundwater

The concentrations of semivolatile organic compounds in groundwater are summarized in Table 3 and illustrated by Figure 3. Groundwater from Nielsen Well W-8, which is actually located on the Marketplace property, contained polyaromatic hydrocarbon (PAH) compounds including the following priority pollutants: acenaphthene at 4 ppb, benzo (a) anthracene at 2 ppb, benzo (b) fluoranthene at 1 ppb, benzo (k) fluoranthene at 1 ppb, chrysene at 2 ppb, naphthalene at 30 ppb, phenanthrene at 5 ppb, and pyrene at 5 ppb. Other compounds detected include fluorene at 9 ppb, C10-H12 at 30 ppb, C1-Naphthalene at 50 ppb, and C2-Naphthalene at 40 ppb. Additionally, fuel weight hydrocarbons including C3-Benzene at 60 ppb and C8-C35 hydrocarbons at 10,000 ppb were detected. This well is on the upgradient side of the Marketplace property.

Groundwater from Marketplace Wells W-4 and W-12 contained 97 and 89 ppb, respectively, of semivolatile organic compounds. Although these wells were not sampled for specific semivolatile compounds, their proximity to Well W-8 indicates that PAH compounds and/or fuel weight hydrocarbons may be present. Presence of these compounds in wells W-4, W-8, and W-12 is also supported by the fact that two deposits of asphalt-like material have been identified on the property, the larger of which is located on the northeast corner of the Marketplace site and the southeast corner of the Nielsen site (Aqua Terra Technologies, July 11 1988 report).

Semi-volatile organic compounds were not detected in Wells W-2, W-3, and W-4 on the Nielsen property. However, organic acids, including 400 ppb butanoic acid, 300 ppb hexanoic acid, 200 ppb pentanoic acid, and 1,000 ppb propanoic acid were detected in Well W-7.

The presence of semivolatile organic chemicals in upgradient wells at the Marketplace site suggests that PAH and/or fuel weight hydrocarbons may be present in soils and groundwater to the east of the site as well. The western extent of these chemicals in groundwater is not known at this time.

Volatile Organic Compounds in Groundwater

The concentrations of volatile organic compounds in groundwater are summarized in Table 4. Volatile organic compounds were not detected in Nielsen Wells W-3, W-5A, W-6A, W-7, and W-8. These wells were situated both upgradient and downgradient of former underground gasoline and diesel storage tanks and manifolds. Ethylene glycol was detected in Well W-1, situated at the antifreeze and motor oil drum storage area. Toluene and

TABLE 3

SEMIVOLATILE ORGANICS IN GROUNDWATER SAMPLES FROM MARKETPLACE AND NIELSEN PROPERTIES (ppb)

Well No.	Date	Analytical Method	Total Semivolatile Organic Compounds	Other 625 Compounds	Acenaphthene	Benzo (a) Anthracene	Benzo (b) Fluoranthene	Benzo (k) Fluoranthene	Chrysene	Fluorene	Fluor-anthene
Marketplace											
W-4	12/1/87	9020	97								
W-12	12/1/87	9020	89								
Nielsen											
W-3	4/14/87	625	NA	ND	<2	<2	<2	<2	<2	<2	<2
W-4	12/1/87	625	NA	ND	<2	<2	<2	<2	<2	<2	<2
W-7	4/16/87	625	NA	ND	<2	<2	<2	<2	<2	<2	<2
W-8	4/17/87	625	NA	ND	4	2	1	1	2	9	4

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TABLE 3
(continued)

SEMIVOLATILE ORGANICS IN GROUNDWATER SAMPLES FROM MARKETPLACE AND NIELSEN PROPERTIES (ppb)

Naphth-alene	Phenan-threne	Pyrene	C1-Naphthalene	C2-Naphthalene	C2-Phenanthrene	C3-Benzene	C9-C35 Hydrocarbons	Butanoic Acid	Hexanoic Acid	Pentanoic Acid	Propanoic Acid
<2	<2	<2	<2	<2	<2	<2	<2	NA	NA	NA	NA
<2	<2	<2	NA	NA	NA	NA	NA	NA	NA	NA	NA
<2	<2	<2	<2	<2	<2	<2	<2	400	300	200	1000
30	5	5	50	40	NA	60	10000	<1	<1	<1	<1

TABLE 4

VOLATILE ORGANICS IN GROUNDWATER SAMPLES FROM MARKETPLACE AND NIELSEN PROPERTIES (ppb)

Well No.	Date	Analytical Method	All Other 624 & 601 Compounds	Benzene	Ethyl Benzene	Toluene	Methylene Chloride	Freon 113	Tetrahydro-furan	Methyl Ethyl Ketone	Ethylene Glycol
Marketplace											
W-12	1/27/82	624	NA	1	2	3	2	NA	340	230	NA
Nielsen											
W-1	4/14/87	624/601	ND	<1	<1	<1	NA	ND	NA	NA	1000
W-2	4/14/87	624/601	ND	<20	<20	80	<20	40	NA	NA	NA
W-3	4/14/87	624/601	ND	<1	<1	<1	<1	ND	NA	NA	NA
W-4	4/14/87	624/601	ND	<1	<1	<1	NA	ND	NA	NA	NA
	12/1/87	624	NA	NA	<2	<2	23	NA	NA	NA	NA
W-5A	4/16/87	624	NA	<10	<10	<10	<50	NA	NA	NA	NA
W-6A	4/16/87	624	NA	<10	<10	<10	<50	NA	NA	NA	NA
W-7	4/16/87	624	NA	<20	<20	<20	<100	NA	NA	NA	NA
W-8	4/17/87	624/601	ND	<100	<100	<100	NA	ND	NA	NA	NA

Freon 113 were detected in Well W-2 at 80 and 40 ppb, respectively, approximately 50 feet downgradient of a diesel tank. Methylene chloride was detected in Well W-4. Benzene, toluene, ethyl benzene, methylene chloride, methyl ethyl ketone, and tetrahydrofuran were detected in Marketplace Well W-12 at 1, 1, 2, 2, 230, and 340 ppb, respectively. Well W-12 was situated downgradient of the former Marketplace underground tank area, which contained crude asphalt and solvents used in paint manufacturing. None of the other Marketplace wells were sampled for volatile organic compounds.

Petroleum Hydrocarbons in Groundwater

The results of groundwater analysis for petroleum hydrocarbons in wells at the Nielsen property are summarized on Table 5. Wells sampled for all petroleum hydrocarbons, diesel, and oil and grease did not exhibit detectable concentrations of these compounds.

Metals in Groundwater

The concentrations of metals in groundwater are summarized in Table 6. Figures 4 through 8 illustrate the distribution of arsenic, chromium, copper, lead, and zinc, respectively. In general, elevated concentrations of these metals were present in Well W-12. Based on the available data, it is not possible to determine whether the source of some of the detected metals to groundwater is on-site or off-site.

Electrical Conductivity of Groundwater

The electrical conductivity of groundwater measured during well development and sampling is presented in Table 7 and illustrated on Figure 9. There is a distinct electrical conductivity gradient across the site from west to east of approximately 6,000 uS/cm (micromhos per centimeter) to 500 uS/cm. Higher conductivity on the west in the direction of groundwater flow may indicate that groundwater beneath the site may not have beneficial uses as defined by the State Water Resources Control Board (Resolution 88-63).

CONCLUSIONS TO DATE

Based on available data, the following conclusions can be drawn regarding groundwater flow and chemical migration beneath the Marketplace/Nielsen site:

Groundwater Flow

- Based on limited data, groundwater appears to flow beneath the Marketplace/Nielsen site in a predominantly westerly direction;
- Groundwater occurs under unconfined conditions within fill material and at less than five feet beneath the ground surface.

TABLE 5

PETROLEUM HYDROCARBONS IN GROUNDWATER SAMPLES FROM THE NIELSEN PROPERTY (ppm)

Well No.	Date	Analytical Method	TPH (Diesel)	TPH (Oil and Grease)	TPH (Other)	Ethylene Glycol
W-1	4/14/87	418.1/8015	NA	<5	NA	1
W-2	4/14/87	418.1/8015	<1	<5	NA	NA
	Unknown	8015	< 1	NA	NA	NA
W-4	4/14/87	418.1/8015	NA	<5	NA	NA
W-5A	4/16/87	8015	NA	NA	<1	NA
W-6A	4/16/87	8015	NA	NA	<1	NA
	Unknown	8015	< 1	NA	NA	NA

TABLE 6

METALS IN GROUNDWATER SAMPLES FROM THE MARKETPLACE NIELSEN PROPERTIES (ppm)

Well No.	Date	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead
Marketplace										
W-4	1/20/81	NA	<0.0005	NA	NA	<0.01	<0.01	<0.01	<0.01	0.003
	12/1/87	<0.5	<0.2	0.5	<0.01	<0.005	0.06	0.06	3.88	<0.05
W-5	1/20/81	NA	<0.0005	NA	NA	<0.01	<0.01	<0.01	<0.01	<0.001
W-10	1/20/81	NA	<0.0005	NA	NA	<0.01	<0.01	<0.01	0.02	0.004
W-12	1/20/81	NA	<0.0005	NA	NA	<0.01	<0.01	<0.01	<0.01	<0.001
	12/1/87	<0.5	<0.2	26.8	<0.01	<0.058	0.7	0.12	127.5	2.9
Nielsen										
W-1	4/14/87	NA	NA	NA	NA	NA	0.05	NA	NA	0.004
W-2	4/14/87	<0.1	0.006	NA	<0.1	<0.1	<0.02	<0.050	<0.02	<0.001
W-3	4/14/87	<0.1	0.002	NA	<0.1	<0.1	<0.02	<0.050	<0.02	<0.001
W-4	4/14/87	NA	NA	NA	NA	NA	0.11	NA	NA	0.002
W-5A	4/16/87	NA	NA	NA	NA	NA	<0.02	NA	NA	<0.1
W-6A	4/16/87	NA	NA	NA	NA	NA	0.02	NA	NA	0.1
W-7	4/16/87	<0.1	0.016	NA	<0.1	<0.1	0.08	<0.05	0.16	0.7
W-8	4/17/87	NA	NA	NA	NA	NA	<0.02	NA	NA	<0.1

TABLE 6
(continued)

METALS IN GROUNDWATER SAMPLES FROM THE MARKETPLACE
NIELSEN PROPERTIES (ppm)

Manganese	Mercury	Molybdenum	Nickel	Selenium	Silver	Tin	Thallium	Vanadium	Zinc
NA	NA	NA	<0.01	NA	NA	NA	NA	NA	0.02
9.05	<0.05	0.15	<0.05	<0.2	<0.2	<0.1	<0.5	<0.05	0.19
NA	NA	NA	<0.01	NA	NA	NA	NA	NA	<0.01
NA	NA	NA	<0.01	NA	NA	NA	NA	NA	<0.01
NA	NA	NA	<0.01	NA	NA	NA	NA	NA	0.01
6.83	<0.05	0.15	0.53	<0.2	<0.2	<0.1	<0.5	0.38	11.1
NA	NA	NA	< 0.05	NA	NA	NA	NA	NA	0.02
NA	0.0003	NA	< 0.05	<0.001	<0.01	NA	0.1	NA	0.03
NA	0.0002	NA	< 0.05	<0.001	<0.01	NA	<0.1	NA	<0.01
NA	NA	NA	0.15	NA	NA	NA	NA	NA	0.13
NA	NA	NA	< 0.05	NA	NA	NA	NA	NA	1.2
NA	NA	NA	< 0.05	NA	NA	NA	NA	NA	2.1
NA	0.0017	NA	0.2	<0.001	<0.01	NA	0.1	NA	0.97
NA	NA	NA	< 0.05	NA	NA	NA	NA	NA	3.6

TABLE 7

GENERAL MINERALS ANALYSIS OF GROUNDWATER SAMPLES FROM THE NIELSEN PROPERTY (mg/L)

Well No.	Date	TDS	Turbidity (NTU)	pH	Specific Conductance (umhos/cm)	Chloride	Carbonate Alk as CaCO3	Bicarbonate Alk as CaCO3	Hydroxide Alk as CaCO3	Total Alkalinity as CaCO3
W-1	4/14/87	NA	NA	6.9*	1600*	NA	NA	NA	NA	NA
W-2	4/14/87	NA	NA	NA	2900*	NA	NA	NA	NA	NA
W-3	4/14/87	NA	NA	6.7*	400*	NA	NA	NA	NA	NA
	4/14/87	370	130	6.7	520	18	<1	210	<1	210
W-4	4/14/87	NA	NA	6.5*	1500*	NA	NA	NA	NA	NA
W-5A	4/9/87	NA	NA	NA	1600*	NA	NA	NA	NA	NA
	4/16/87	NA	NA	7	1840	NA	NA	NA	NA	NA
W-6A	4/13/87	NA	NA	6.6*	4200*	NA	NA	NA	NA	NA
	4/16/87	NA	NA	7.2	5790	NA	NA	NA	NA	NA
W-7	4/16/87	NA	NA	NA	4800*	NA	NA	NA	NA	NA
	4/16/87	3070	300	6.5	6500	1290	<1	1740	<1	1740
W-8	4/17/87	NA	NA	6.7*	1100*	NA	NA	NA	NA	NA
	4/17/87	NA	NA	6.4	1300	NA	NA	NA	NA	NA

* Field Test Results From Woodward-Clyde, August 1987, Report

TABLE 7
(continued)

GENERAL MINERALS ANALYSIS OF GROUNDWATER SAMPLES FROM THE NIELSEN PROPERTY (mg/L)

Manganese	Nitrate (as N)	Nitrite (as N)	Ammonia Nitrogen	Total Kjeldahl Nitrogen	Total Phosphorus (as P)	Potassium	Silica as SiO2	Sodium	Sulfate	Calcium	Fluoride
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
15	1	<0.01	0.66	0.66	0.71	1.7	50	53	57	18	0.33
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
68	<0.10	<0.01	51	63	4.7	56	72	800	37	210	1.3
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Additional groundwater flow data are required to determine:

- The actual groundwater flow direction across the Marketplace/Nielsen site,
- The sustained yield of groundwater wells beneath the site.

Chemical Distribution in Groundwater

- Fuel type hydrocarbons and PAH compounds were detected in one upgradient well on the Marketplace property,
- VOCs are present in low concentrations in groundwater beneath the site in the fill downgradient of the Marketplace building,
- Metals are detected in groundwater beneath the site at several locations,
- Electrical conductivity across the western part of the site is greater than 5,000 uS/cm (above drinking water criteria).

Additional water quality data are required to further define:

- The upgradient and downgradient extent of fuel hydrocarbons, PAH compounds, and metals,
- The level of total dissolved solids (TDS), electrical conductivity, and salinity of groundwater beneath the site,
- The extent of chemicals in groundwater beneath the asphaltic material at Well W-5.

REFERENCES

Woodward-Clyde Consultants (WCC), 1982, Assessment of Subsurface Contaminants, Marketplace Property, Emeryville, California, May 1982.

Woodward-Clyde Consultants, 1987a, Environmental Assessment Former Nielsen Freight Line Site and Adjacent Parcel, Emeryville, California. August 12,1987.

Woodward-Clyde Consultants 1987b, Recommendations for Underground Storage Tank Closure at Former Nielsen Freight Lines Trucking Facility. August 26, 1987.

Earth Metrics, 1988, Draft Work Plan for Soils Contamination Characterization of Marketplace Site in Emeryville, California. Revised January 28, 1988.

Aqua Terra Technologies, Inc., 1988, Classification of an Asphalt-Like Waste Material Found on the Marketplace and Nielsen site in Emeryville, California. July 11, 1988.

Alameda County Flood Control and Water Conservation District, 1988, Geohydrology and Groundwater Quality Overview, East Bay Plain Area, Alameda County, California, June 1988.

SCOPE OF WORK

Based on conclusions presented in the previous section, construction and sampling of three additional monitor wells is recommended to provide further definition of flow patterns and of the lateral and vertical extent of chemical migration beneath the site. Figure 10 shows proposed locations for the monitor wells.

The rationale for site selection is presented below followed by brief descriptions of various tasks associated with the drilling and sampling effort. These tasks include:

Task 1.0 Review status of surrounding area investigations;

Task 2.0 Groundwater investigation. Install and sample three new wells and sample all existing wells;

Task 3.0 Data interpretation and preparation of a summary report.

TASK 1.0 REVIEW STATUS OF SURROUNDING AREA INVESTIGATIONS

The potential also exists for chemicals to have originated at other facilities and to be moving onto the site or for there to be similar historical contamination at other sites in the area. Because contamination resulting from individual properties may cross property boundaries, it is recommended that the status of surrounding area investigations be reviewed.

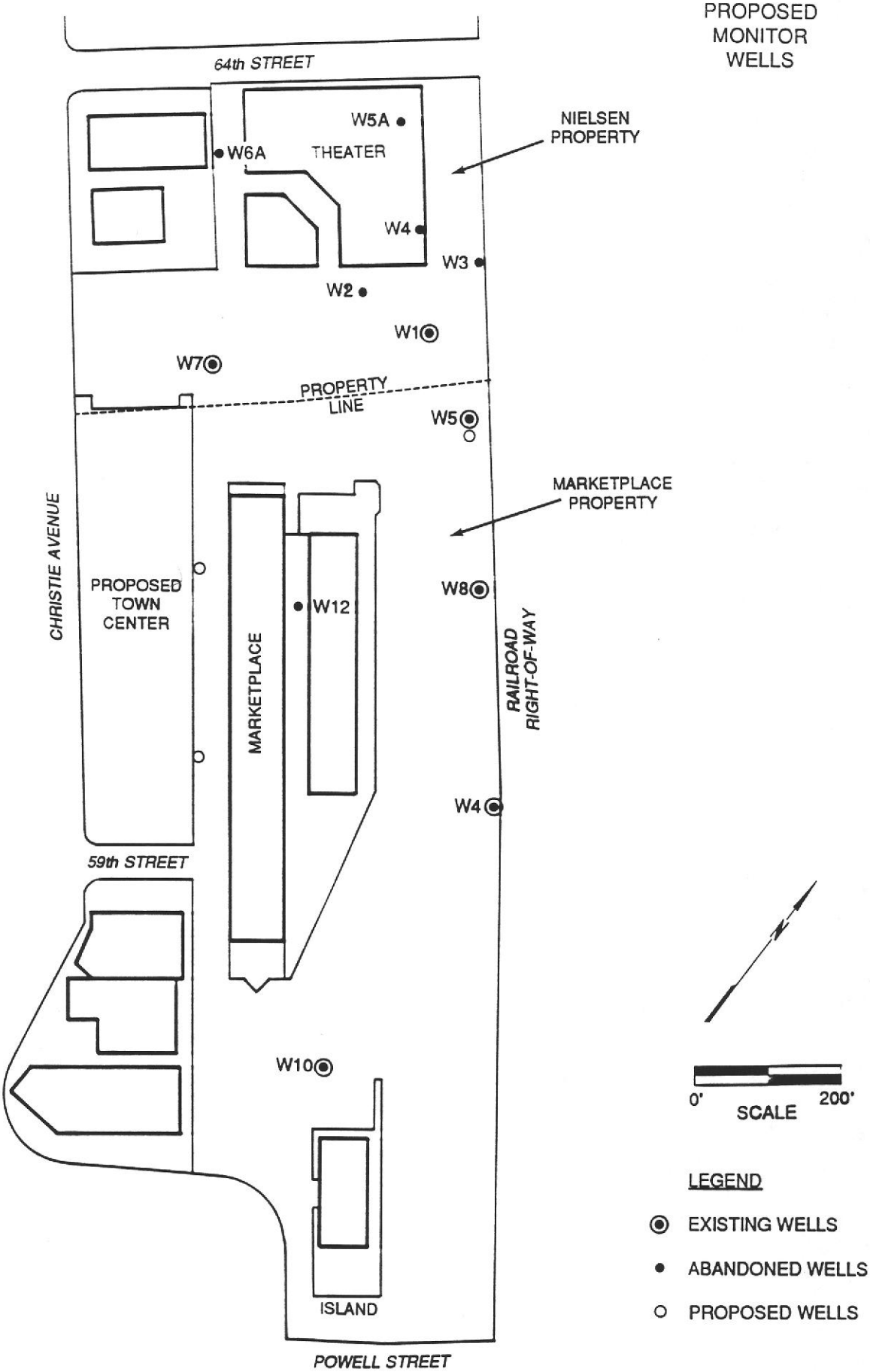
TASK 2.0 GROUNDWATER INVESTIGATION

The following describes the elements involved in the construction of three monitor wells, including: 1) pre-drilling activities; 2) construction and development of the wells; 3) sampling and analysis of the groundwater; and 4) monitor well sounding and preparation of as-builts.

Rationale for Site Selection

Locations and completion zones for the three proposed monitor wells were selected to provide data for further definition of: 1) flow directions within the shallow groundwater, and 2) the distribution of chemicals in groundwater beneath the site. Specifically, two wells will provide water level data to further define flow patterns in the fill within the western portion of the site, and water quality data to further define the extent of chemical migration across the site. One well will be completed beneath the asphaltic material near Well W-5. This well will be completed beneath the asphaltic material that has filled Well W-5 in order to provide water quality data from this location.

FIGURE 10
PROPOSED
MONITOR
WELLS



Subtask 2.1 Pre-Drilling Activities

Activities required prior to start-up of drilling include preparation of a Health and Safety Plan, preparation of a drilling subcontract, conducting a utility clearance at each well location, and obtaining necessary drilling permits. A Health and Safety Plan will be written to include drilling and sampling activities at the site and will be submitted to the ACHD coincident with start-up of drilling activities. A drilling contractor will be scheduled and a subcontract will be prepared for construction and development of the proposed wells. An underground utility clearance which includes review of utility plans, magnetometer search, and hand augering will be conducted at each drilling location.

Subtask 2.2 Well Construction and Development

The borehole for each of the three proposed monitor wells will be eight inches in diameter and will be drilled using hollow-stem auger drilling equipment. The hollow stem augers and sampling tools will be steam cleaned before drilling begins and after each boring is completed. The boreholes for the two downgradient wells will be drilled to a depth of approximately 15 feet. The borehole for the well adjacent to Well W-5 will be drilled to a depth of approximately 25 feet. To prevent cross-contamination between aquifer zones, a conductor casing will be used during the drilling of well W-15. The conductor casing will be placed a fine-grained layer immediately above the zone in which the well is to be screened and extend to the surface. The casing will be centered in the borehole and cemented in place by pumping a bentonite powder and cement mixture through a tremie hose into the annular space between the borehole and the conductor casing. Drilling will continue through the conductor casing after the cement has cured.

4" well if necessary if needed

Soil samples will be collected continuously during drilling. The soil samples will be used for lithologic description. The samples will be collected by driving an 18-inch long California Modified Split-Spoon Sampler ahead of the auger bit with a 140-pound drop hammer. The soil samples will be described using the United States Department of Agriculture and the Unified Soil Classification Systems.

Each monitor well will be constructed of two-inch I.D. 0.010-inch machine slotted, flush joint PVC well screen and two-inch diameter blank PVC casing. The filter pack will consist of washed 12/20 mesh silica sand and will extend approximately two feet above the perforation. This slot size and sand pack was selected after review of previous on-site boring logs which indicate predominately fine grained sediments. Existing wells were constructed with 0.020-inch machine slotted PVC well screen and No. 3 sand. A narrower screen pack was selected because the water in existing wells was turbid. This turbidity is likely due to fine grained sediments passing through the larger screen and sand pack and will be prevented with the chosen screen and sand pack. A one-foot thick washed 30-mesh silica sand bridge will be placed directly on top of the filter pack. A sanitary pack. A sanitary seal consisting of neat cement with five percent added bentonite will be pumped into the annular space and will extend from the

top of the sand bridge to the ground surface. Each well will be provided with a watertight locking cap and a vault box with a traffic-rated lid.

The newly constructed monitor wells will be developed with a centrifugal pump or by bailer until 10 casing volumes of water has been removed. All soil and fluids generated during drilling and well development will be collected in containers (consisting of soil bins and drums) located at the site. Soil samples will be collected from the soil bin for analysis using EPA Method 8240. The soil will be disposed of at a Class III landfill along with other soils stockpiled at the site. The disposal of the well development water will be based on the analytical results of water samples collected from the newly constructed monitor wells.

Subtask 2.3 Groundwater Sampling and Analysis

All existing and newly constructed wells will be sampled. The newly constructed wells will be sampled approximately 24 hours after development. The samples will be transported along with appropriate QA/QC samples to McLaren Analytical Laboratories (MAL) for analysis for priority pollutant metals, for semi-volatile organic compounds according to EPA Method 625, and for pH, electrical conductivity, total dissolved solids (TDS), and chloride.

Subtask 2.4 Monitor Well Sounding and Preparation of As-Builts

Lithologic log and well construction as-builts will be prepared for each of the three new wells. All of the wells, including existing and newly constructed wells, will be surveyed for top of casing elevation to a common benchmark. Water level measurements will be made to provide groundwater surface elevation data at both new and old wells.

TASK 3.0 DATA INTERPRETATION AND PREPARATION OF SUMMARY REPORT

A draft summary letter report summarizing the results of the investigation will be submitted to the Martin Group. A final summary letter will then be prepared incorporating the comments of the Martin Group. The final report will be available for submittal to the ACHD one week after the return of the draft letter from the Martin Group.

Subtask 3.1 Data Interpretation

Evaluation of these results will focus on definition of the lateral and vertical extent of chemical migration beneath the Marketplace site. Specifically, the lithologic, hydrologic and water quality data will be used to:

- Assess surrounding area investigations and how they may relate to the Marketplace site;

- Further evaluate whether the groundwater beneath the site has beneficial uses as drinking water;

- Determine the extent of chemicals in groundwater adjacent to Well W-5; and

- Update the existing chemical distribution maps for the site.

Subtask 3.2 Preparation of a Draft Report

A draft report will be prepared and submitted to the Martin Group on August 25. This letter will summarize investigation activities and present investigation results and conclusions.

Subtask 3.3 Preparation of a Final Report

The final report will be available for submittal to the ACHD one week after the return of the draft letter from the Martin Group.