APPENDIX B:
RESOLUTION 68-16 ANALYSIS
(ANTI-DEGREDATION ANALYSIS)

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RESOLUTION 68-16 ANALYSIS

Prepared by:

Marc R. Crum, CEG
Senior Geologist
John H. Kramer, Ph.D., CHG, CEG
Principal Hydrogeologist
Condor Earth Technologies, Inc.
21663 Brian Lane
PO Box 3905
Sonora, CA 95370

Bob Godwin, P.E.
Senior Project Manager
Lee & Ro, Inc.
8880 Cal Center Drive, Suite 170
Sacramento, CA 95826

Stoel Rives LLP
500 Capitol Mall, Suite 1600
Sacramento, CA 95814

RESOLUTION 68-16 Analysis

The City of Ione (City) will be filing a Report of Waste Discharge (ROWD) with the Regional Water Quality Control Board, Central Valley Region (RWQCB) for the discharge of tertiary treated wastewater to onsite, unlined percolation ponds. The City prepared this analysis to evaluate the proposed discharge in light of State Water Resources Control Board (SWRCB) Resolution No. 68-16, Statement of Policy with Respect to Maintaining High Quality of Waters in California (Resolution). The Resolution directs that "existing high quality [water] will be maintained until it has been demonstrated to the State that any change will be consistent with maximum benefit to the people of the State, will not unreasonably affect present and anticipated beneficial use of such water and will not result in water quality less than that prescribed in [State] policies" (emphasis added). The Resolution directs that any activities that result in discharges to "existing high quality waters" are required to use "the best practicable treatment or control [(BPTC)] of the discharge necessary to assure that (a) a pollution or nuisance will not occur and (b) the highest water quality consistent with maximum benefit to the people of the State will be maintained." The Resolution also notes that meeting "waste discharge requirements . . . will result in the [(BPTC)] of the discharge necessary to assure [(a) and (b) above]."

The analysis herein demonstrates that the City's proposed discharge of tertiary treated wastewater to percolation ponds complies with Resolution 68-16.

Wastewater Treatment Facility Description and Treatment Process

The City of Ione currently operates two wastewater treatment and disposal facilities, the City of Ione Wastewater Treatment Plant (WWTP) and the Castle Oaks Water Reclamation Plant (COWRP).

City's Secondary WWTP

The City of Ione WWTP, otherwise known as the City's Secondary WWTP, is located directly south of Sutter Creek at the corner of Marlette Street and Old Stockton Road. The original facility was constructed in 1958 and was modified and expanded multiple times in succeeding years.

This facility treats wastewater generated by the City and primarily of residential origin but includes filter backwash water from the Ione Water Treatment Plant operated by Amador Water Agency (AWA). The hydraulic, treatment, and disposal capacity of the existing facility is approximately 0.55 million gallons a day (MGD). The actual disposal capacity of the percolation ponds is higher than the treatment capacity and is approximately 0.78 MGD, but the excess capacity is reserved for Amador Regional Sanitation Authority (ARSA).

Wastewater enters the City's Secondary WWTP from three collection sewers which combine at the headworks where flow is diverted into one (or both) of two open concrete channels. In the channel, a portion of the sand and gravel in the wastewater is removed via gravel traps. Downstream of the channel are communitors, which grind and shred any solids. The untreated wastewater is then pumped by up to three pumps to ponds for further treatment and disposal.

There are a total of seven ponds. Four of the ponds (Ponds 1 through 4) are aerated wastewater treatment ponds and the remaining three (Ponds 5 through 7) are percolation ponds. The untreated wastewater from the headworks arrives at Pond 1 where two surface aerators supply the required oxygen to produce an aerobic zone. Gradually, the wastewater moves to Pond 2, where oxygen is also supplied by one surface aerator. The aerators in Ponds 3 and 4 help to maintain a minimum dissolved oxygen concentration. By Pond 4, the wastewater has completed its cycle and is considered secondary treated wastewater that is in compliance with regulations for effluent evaporation and percolation.

The three remaining ponds (Ponds 5 through 7) are percolation ponds, which use a combination of evaporation and percolation to provide final treatment and disposal of the secondary treated wastewater. Pond 5 receives secondary treated wastewater. Pond 6 is typically only utilized for ARSA wastewater during the wet months of the year when the Castle Oaks Golf Course does not require irrigation. The final pond, Pond 7 is intended to accommodate excess wastewater from Ponds 5 and 6. Since the secondary WWTP is currently at or near capacity, Pond 6 and sometimes Pond 7 may contain treated secondary wastewater throughout the year and not just during the wet months.

Castle Oaks Water Reclamation Plant

The COWRP is located on Five Mile Drive, north of Sutter Creek. Tertiary water from the plant is delivered to the Castle Oaks Golf Course for landscape irrigation and use in a series of decorative ponds. COWRP provides all the water for the golf course during the dry season and does not operate continuously. Water is treated to Title 22 standards before it is used for irrigation of the Castle Oaks Golf Course.

Tertiary treatment is provided to meet Department of Health Services standards, and is accomplished by chemical enhanced sand filters and disinfection with liquid sodium hypochlorite. Treatment facilities to provide Title 22 tertiary treatment include:

- Headworks
- Tertiary Sand Filters (four filter cells with two filters per cell)
- Chlorine Mix Tank and Contact Basin (for a detention time of 120 minutes at a design flow of 1.2 MGD)
- Effluent Pump Station
- Chemical Feed Systems

Proposed Water Reclamation Facility

Section 2.3 of the EIR provides an overview of the City's Existing System. Section 2.4 contains a detailed description of the Project, Part II of which involves disposal. Disposal of treated wastewater is addressed in more detail in Section 2.4.4.

The new treatment facilities will consist of a single facility with an average dry weather flow (ADWF) design capacity of 0.8 MGD, expandable to 1.6 MGD. The new facilities will provide

for tertiary treatment of all wastewater flows, and include influent pumping, preliminary treatment (screening and grit removal), activated sludge biological treatment with nutrient (nitrogen) removal, Title 22 tertiary filtration and treatment, Title 22 ultraviolet (UV) disinfection of effluent, a recycled water pumping station, and a distribution pipeline to the COWRP. Auxiliary facilities include a control building, odor control, sludge digestion, and biosolids dewatering facilities. The proposed facilities contemplate closure of Ponds 1 through 4, lining or partially filling Ponds 5 and 6 within 200 feet of Sutter Creek, and construction of percolation Pond 8 to accommodate disposal of tertiary treated water.

The proposed treatment facility will meet BPTC by use of activated sludge, biological nutrient removal, chemical enhanced filtration, and disinfection for the treatment of City wastewater. A discussion of each technology is presented below.

Activated Sludge: Wastewater contains carbon based waste material which in nature is treated by bacteria that reduces (digests) and consumes the waste. Waste in large enough concentration can result in depletion of oxygen and result in anaerobic conditions in either surface waters or shallow groundwater.

Currently treatment at the WWTP is accomplished utilizing mechanically aerated treatment ponds. Ponds produce relatively good effluent quality but this quality can be impacted by seasonal conditions including algae growth, changes in pH, temperature, and solar radiation. To meet BPTC, the City proposes use of an activated sludge system to reduce biological oxygen demand (BOD). This technology will provide an effluent with the lowest BOD concentrations and eliminate many of the operation variables seen in the current treatment system. Further, this technology is well understood and has been demonstrated to be successful throughout the United States.

Nutrient Removal: The City's proposed treatment system will provide nutrient removal in the form of nitrogen compound reduction. Nitrogen can be present in wastewater in various forms including ammonia, organic nitrogen, nitrite, and nitrate. The goal of the City is to reduce total nitrogen to the lowest obtainable value by conversion of aqueous nitrogen to nitrogen gas. To meet BPTC the proposed treatment systems will nitrify and denitrify aqueous nitrogen.

Filtration: The City proposes to meet BPTC by filtration of all secondary effluent prior to discharge. Filtration will be accomplished utilizing technology approved by the California Department of Public Health for Title 22 filtration. Filtration will be enhanced utilizing chemical polymer to create ionized floc to remove small particulates suspended in the effluent. Filtration will reduce effluent concentrations of suspended material including bacteria, and precipitated chemicals like iron and manganese. Currently the City has no filtration system.

Disinfection: To meet BPTC, the City proposes to utilize California Department of Public Health -approved ultraviolet (UV) light disinfection technology to destroy biological pathogens in the effluent. Ultraviolet light is superior for disinfection when compared to sodium hypochlorite or chlorine gas and meets BPTC because UV does not create chlorinated hydrocarbon compounds (trihalomethanes), increase dissolved solids concentrations, require chemicals for dechlorination, and is not a material risk management issue. Currently the City has no disinfection system.

Regional Hydrogeology

Section 3.1.1 of the EIR contains information related to the watershed, groundwater aquifers, hydrography, groundwater levels and movement, as well as existing water quality information in the vicinity of the proposed discharge. Information related to the proposed disposal methods can be found on pages 3.1-38 through 3.1-43; 3.1-45 through 3.1-49 of the EIR.

Wastewater Disposal Alternatives

The proposed Project consists of the development and use of onsite, unlined percolation ponds, designed to accommodate all of the City's treated wastewater. Alternative (or additional) water disposal options were evaluated as part of the overall process, but none of the other disposal options were deemed feasible. A full discussion of disposal alternatives can be found in Section 5 of the EIR.

Water Quality Objectives

Potential groundwater beneficial uses in the vicinity of the Project are outlined in the Water Quality Control Plan for the Sacramento and San Joaquin River Basins (Basin Plan). Such beneficial uses for groundwater include municipal (MUN), agricultural (AGR), industrial (IND), and industrial process supply (PRO) uses. The Basin Plan identifies water quality objectives (WQOs) for groundwaters, which include bacteria (total coliform) limits. Limits for chemical constituents are based on maximum contaminant levels (MCLs) and other Water Quality Goals for dissolved chemical constituents published by the State of California and the Central Valley Regional Water Quality Control Board.[1] The Basin Plan also contains narrative limits for taste and odor, and toxicity. Numerical WQOs employed in this analysis are listed in Table R-1 by constituent. Table R-2 shows the various water quality goals used to define the WQOs for this site.

Receiving Groundwater Quality

The characterization of background groundwater quality herein is derived from reports of laboratory analyses of groundwater samples collected from 2003 to 2008 at upgradient wells MW1 and MW1A. All data were previously reported to the Regional Water Quality Control Board. The data from MW-1 were statistically evaluated using EPA software (ProUCL, V4.00.02). Within the data set of 26 samples from MW-1, normally distributed populations (95 percent confidence) were present for total Kjeldahl nitrogen (TKN), calcium, total boron, total sodium, chloride, total dissolved solids, and total manganese. Total nitrate as nitrogen, total iron and sulfate data were not normally distributed, which indicates that these constituents are influenced by non-random processes. Time-series plots of the constituent data did not display obvious long-term trends. Therefore, the data set is a reliable indicator of the background groundwater quality for most constituents upgradient of the proposed discharge. The MW-1A data set had only six samples and was not evaluated statistically.

[1] Central Valley Regional Water Quality Control Board, *A Compilation of Water Quality Goals*, July 2008.

The average values for each constituent were calculated separately for MW1 and MW1A. In calculating these averages, non-detects were valued at half the reporting level, a common convention for estimating averages in samples with non-detect values. Data from MW-1A indicated higher upgradient concentrations of salts (sodium, chloride, etc) than upgradient well MW-1. This is most likely attributable to the fact that well MW-1A draws water from both the alluvial deposits and the underlying Ione formation, whereas MW-1 draws only from alluvial deposits (see well logs, attached). Higher background salinity in Ione formation wells is documented in Section 3.1.1 of the EIR. Local beneficial uses for groundwater include wells into the Ione formation; therefore, the samples for MW1 and MW1A were combined and the constituent averages were calculated. The resulting three sets of data (MW1, MW1A, and MW1 plus MW1A) are used below to characterize background groundwater quality. The tabulated averages are listed in Table R-1 and the source data are listed in Table R-3.

From Table R-1, average total iron in MW1 and MW1A and average total manganese in MW1A exceeded the California Secondary MCLs for iron and manganese (Table R-2). The Primary and Secondary MCL values are based on dissolved concentrations in groundwater, not total values. Total analyses include undissolved constituents attached to solid particles. These constituents have been described as artifacts of the sampling process that do not truly represent the constituents that are mobile in a normal groundwater flow regime.[2] Rapid well-entry flow velocities resulting from monitor well sampling protocols such as bailing or rapid pumping entrain solids in the sample. A number of filtered samples, which measure only the mobile constituents in groundwater, were collected and tested in 2007 and 2008. The result of these tests for manganese and iron are listed separately in Table R-1 and demonstrate that dissolved concentrations of iron and manganese are orders of magnitude less than total constituent concentrations. This effect is true for effluent chemistry, discussed below, as well as groundwater.

Average water quality results from monitoring well MW-1 samples collected from 2003 to 2008 indicate that groundwater has exceeded WQOs for coliform bacteria in 3 of 26 samples. No other background groundwater constituents upgradient from the proposed tertiary treatment facility exceed WQOs.

Wastewater Quality

Data from monthly grab water samples from the existing plant effluent for the period 2003 to October 2009 were averaged for each constituent and are listed in Table R-1. The source data are provided in Table R-4. Anticipated average constituent concentrations of effluent from the proposed facility were derived from existing effluent data, modified for the effects of the proposed additional treatment systems: activated sludge removal, nitrogen removal, filtration and disinfection.

The City's proposed new treatment plant is anticipated to have treatment effectiveness for bacteria, biochemical oxygen demand, suspended solids, and total nitrogen that meet typical standards for modern tertiary facilities. (i.e., TCO<2.2 mpn/100ml, BOD<20 mg/L, TSS<20

[2] Zemo, Dawn A., 2009, *Suggested Methods to Mitigate Bias from Nondissolved Petroleum in Ground Water Samples Collected from the Smear Zone*. Ground Water Monitoring and Remediation, v29, no.3/Summer 2009/ pages 77-83

mg/L, TN<5 mg/L). The additional filtering treatment described above in the section titled "Proposed Water Reclamation Facility" will act to reduce from current levels the iron and manganese in the future effluent. As described above, only dissolved iron and manganese constituents pose a potential threat to groundwater. There is no effluent data on dissolved manganese or dissolved iron; however, based on the reduction observed from side-by-side testing of total and dissolved values reported for groundwater, it is anticipated that the concentration of dissolved iron in effluent will be approximately 2 percent of current total iron values, and the concentration of dissolved manganese in effluent will be approximately 17 percent of current total manganese values.

Anticipated water quality of the proposed effluent is listed in Table R-1. None of the anticipated constituent concentrations exceed WQOs.

Degradation Analysis

Comparisons of anticipated effluent constituent concentrations with those of background groundwater indicate minor potential to degrade groundwater, but no threat to cause groundwater to exceed WQOs. Shaded cells in Table R-1 indicate anticipated effluent constituents that exceed background groundwater. These include electrical conductivity, total dissolved solids, total boron, chloride, dissolved manganese, total potassium, and total sodium.

Conservatively ignoring dilution from mixing and other attenuation in groundwater, the worst degradation possible is the difference between anticipated effluent and background groundwater. For all constituents highlighted in Table R-1, this difference is a fraction of the difference between existing groundwater quality and WQOs. For example, anticipated total dissolved solids in effluent will be 222 mg/L while the average background groundwater is 210 mg/L. The difference, 12 mg/L, is the maximum anticipated degradation. The WQO for TDS is 450 mg/L and the difference between the WQO and current quality groundwater is 240 mg/L. Thus the maximum anticipated groundwater degradation is 5 percent (12/240 = 0.05) of the range to the WQO. In a similar manner, the percentages of the maximum anticipated allowable degradation were calculated for each effluent constituent with potential to degrade groundwater.

Electrical conductivity = 5%
Total dissolved solids = 5%
Boron = 25%
Chloride = 20%
Dissolved manganese = 21%
Potassium and sodium do not have WQOs.

The degradation indicated by these calculations is consistent with Resolution 68-16 because it does not threaten to cause groundwater downgradient of the proposed facility to be of lesser quality than set in guidelines. Effective treatment of sanitary wastes is consistent with the maximum benefit to the people of the State and BPTC described above will be employed to minimize potential degradation of existing high quality water.

Conclusions

The analysis summarized herein indicates that the proposed discharge would not create a condition of pollution or nuisance, and would maintain the highest water quality consistent with maximum benefit to the people of the State. Tertiary treated wastewater with ultra-filtration disinfection is BPTC, thus ensuring the highest water quality of wastewater disposed to the percolation ponds. Although disposal to the percolation ponds could cause minor degradation of groundwater quality for some constituents described above, this degradation will not exceed WQOs. Moreover, since the proposed treatment is BPTC, and compliance with waste discharge requirements constitutes BPTC under the express language of Resolution 68-16, the City's proposed discharge is consistent with Resolution 68-16.

Based on the analysis set forth herein, any groundwater degradation from baseline quality is *de minimus*, and no constituents would be discharged at rates that exceed WQOs (or MCLs). Further, the proposed tertiary treated wastewater discharge is utilizing BPTC, is in the best interest of, and is consistent with, the maximum benefit to the citizens of the State of California, and will not unreasonably affect present and anticipated future beneficial uses of the groundwater.

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Table R-1 Water Quality Objectives, Receiving Water Quality and Anticipated Effluent Water Quality

				2007-2009 MW-1A		2003-2009		
			Receiving Groundwater			Effluent		
Constituent	**Units**	**Water Quality Objective[1]**	**MW-1 Average[2]**	**MW-1A Average[2]**	**MW-1 + MW-1A Average[2]**	**Anticipated Effluent Monthly Average**	**Exist. WWTP Effluent Avg.**	**Notes on basis for Anticipated Effluent values**
Fecal Coliform	MPN/100 mL	2.2	-	-	-	<2.2	-	Ttile 22
Total Coliform	MPN/100 mL	2.2	-	-	-	<2.2	-	Title 22
Biological Oxygen Demand (BOD_5)	mg/L	20	-	-	-	<10	30	Title 22
Total Suspended Solids	mg/L	20	-	-	-	<10	-	Title 22
pH		6.4-8.4	6.8	6.7	6.8	6.4-8.4	8.1	Title 22
Electrical Conductivity	µmhos/cm	900	279	418	344	371	371	Existing effluent
Solids, Total Dissolved	mg/L	450	191	277	210	222	222	Existing effluent
Ammonia as N (NH3-N)	mg/L	1.5	-	-	-	<1	10.8	Typical for modern plant
Nitrate as N (NO2-N)	mg/L	10	0.5	1.1	0.7	<5	2.3	Typical for modern plant
Nitrite as N (NO3-N)	mg/L	1.0	-	-	-	<1	1.6	Typical for modern plant
TKN		-	0.5	1.1	0.7	?	14.5	Not estimated
Total Nitrogen (TN)		10	1	2	1	<7	18.4	TN=TKN+(NO3-N)+(NO2-N)
Aluminum, total	mg/L	0.2	-	-	-	0.08	0.08	Existing effluent
Arsenic	mg/L	0.010	0.002	0.005	0.003	0.002	0.002	Existing effluent
Barium	mg/L	1	-	-	-	0.08	0.08	Existing effluent
Boron	mg/L	0.70	0.05	0.08	0.06	0.22	0.22	Existing effluent
Calcium	mg/L	-	32	45	34	10.8	10.8	Existing effluent
Chloride	mg/L	106	8.0	24.3	11.7	30.6	30.6	Existing effluent
Copper	mg/L	0.2	-	-	-	0.014	0.014	Existing effluent
Iron	mg/L	-	0.49	1.44	0.70	-	0.33	Total iron reduced by filtration
Iron, dissolved	mg/L	0.300	0.015	0.017	0.016	0.008	-	2% of total Fe in existing effluent
Magnesium	mg/L	-	14	16	15	3.4	3.4	Existing effluent
Manganese	mg/L	0.050	0.022	0.074	0.032	-	0.09	Total Mn reduced by filtration
Manganese, dissolved	mg/L	0.050	0.005	0.006	0.005	0.015	-	17% of total Mn in existing effluent
Potassium	mg/L	-	1.4	1.1	1.1	9.5	9.5	Existing effluent
Sodium	mg/L	-	9.4	21.8	12.0	36	36	Existing effluent
Sulfate	mg/L	250	25.3	21.2	24.6	22	22	Existing effluent

anticipated effluent exceeds background groundwater (MW-1 and MW-1A combined)

Notes

1 See Table R-2

2 Averages include values of 1/2 the detection limit for non-detects, data in Table R-3
Bacterial testing not averaged for groundwater due to infrequent sporadic detections.

Table R-2. Water Quality Objectives used in Ione Treatment Plant Degradation Analysis

Constituent	Units	WQO	CA MCL Limit, pmcl	CA MCL Limit, smcl	FED MCL Limit, pmcl	FED MCL Limit, smcl	CA Toxicity Action Level	Agricultural Water Quality Limits	Fed Taste, Odor, Welfare	Notes
Fecal Coliform	MPN/100 mL	2.2	2.2	2.2	2.2	2.2				Basin Plan
Total Coliform	MPN/100 mL	2.2	2.2	2.2	2.2	2.2				Basin Plan
Biological Oxygen Demand (BOD_5)	mg/L	20								Title 22
pH		6.4-8.4				6.4-8.4				Title 22
Turbidity	NTU	-		5	1/ 0.5 /0.3					Title 22
Electrical Conductivity	µmhos/cm	900		900						Title 22 (Table 64449-A)
Total Dissolved Solids	mg/L	450		500		500		450	250	Agricultural limit
Ammonia as N	mg/L	1.5							1.5	Taste and Odoer
Nitrate as N	mg/L	10	10		10					Drinking Water Std
Nitrite as N	mg/L	1	1.0		1.0					Drinking Water Std
TKN		-								
Total Nitrogen		10								total convertable nitrogen
Aluminum, total	mg/L	0.2	1.0	0.2		.05 -0.2		5		RWQCB Water Quality Goals
Arsenic	mg/L	0.01	0.050/0.010		0.010			0.1		Title 22 (Table 64431-A)
Barium	mg/L	1.0	1.0		2.0					Title 22 (Table 64431-A)
Boron	mg/L	0.70					1.0	0.70/0.75		Agricultural limit
Calcium	mg/L	-								No limit
Chloride	mg/L	106		250		250		106		Agricultural limit
Copper	mg/L	0.2	1.3	1.0	1.3	1.0		0.2	1.0	Agricultural limit
Iron, dissolved	mg/L	0.30		0.3		0.3		5	0.3	Title 22 (Table 64449-A)
Manganese, dissolved	mg/L	0.05		0.05		0.05		0.2	0.05	Title 22 (Table 64449-A)
Potassium	mg/L	-								No limit
Sodium	mg/L	-								No limit
Sulfate	mg/L	250		250	500	250				Title 22 (Table 64449-B)

pmcl= primary maximum contaminant level (health based)
smcl= secondary maximum contaminant level (taste and odor based)

Table R-3 City of Ione WWTP - Groundwater Quality

Sample ID	MP Elevation	Date	Depth to Water	Ground-Water Elevation	Volume Purged, gal.	Temp.	Field pH	Field EC	Dissolved Oxygen	Oxydation / Reduction Potential	Field TDS	Turbidity	Total Coliform Bacteria (TCO)		Fecal Coliform Bacteria (FCO)		Nitrate (as N)[1]	Kjeldahl Nitrogen (as N)		Total Dissolved Solids (TDS)	Chloride		Sulfate	Total Sodium	Dissolved Sodium	Total Magnesium	Total Potassium	Total Calcium	Total Arsenic		Total Boron		Dissolved Boron	Total Iron		Dissolved Iron		Total Manganese		Dissolved Manganese		Ammonia	Nitrite (as N)	TOC	E Coli Bacteria	Fecal Strep	MEK	Lab EC
Units:			*ft*	*ft. msl*	*gal*	*deg C*	*std units*	*umhs/c*	*mg/l*	*Mv*	mg/l	*NTUs*	*MPN/100ml*		*MPN/100ml*		*mg/l*	*mg/l*		*mg/l*	*mg/l*		*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*		*mg/l*		*mg/l*	*mg/l*		*mg/l*		*mg/l*		*mg/l*		*mg/l*	*mg/l*	*mg/l*	*MPN/100ml*	*MPN/100ml*	*ug/l*	*umho/cm*
MCL (Secondary MCL where shaded)							6.5-8.5	900				5	2.2		2.2		10			500	250		250						0.050				0.3		0.3		0.05		0.05			1.0					900
MW1	274.17	7/16/02	12.25	261.92			6.90						23	23	-2	1	2.40	3.8	3.8	190	6.3		23	10.0			1.4	33.0					0.160	0.16			-0.030	0.015									
MW1		6/30/03	11.72	262.45			6.80					9.2	-2	1	-2	1	0.55	-1.0	0.5	162	6.6		24	8.7			1.17	28.0			-0.01	0.005		0.810	0.81			0.020	0.02									
MW1		9/30/03	14.98	259.19			6.90					15.0	-2	1	-2	1	0.51	-1.0	0.5	143	6.7		22	8.2			1.24	27.0			-0.10	0.05		1.120	1.12			0.040	0.04									
MW1		12/31/03	10.97	263.20			6.80					1.3	-2	1	-2	1	0.74	-1.0	0.5	170	8.5		19	8.6			1.22	31.0			-0.10	0.05		0.090	0.09			-0.020	0.01									
MW1		3/31/04	10.22	263.95			6.80					0.64	23	23	-2	1	1.70	-1.0	0.5	217	8.4		30	9.2			1.25	33.0			-0.10	0.05		-0.050	0.025			-0.020	0.01									
MW1		6/30/04	12.55	261.62			6.80					3.1	-2	1	-2	1	1.20	-1.0	0.5	187	7.2		28	8.8			1.19	29.0			-0.10	0.05		0.310	0.31			-0.020	0.01									
MW1		10/1/04	14.82	259.35			6.90					-40	-2	1	-2	1	0.82	3.4	3.4	273	9.9		23		14.0		1.66	32.0			0.10	0.1		41.5				0.870									
MW1		10/12/04					6.80					24	-2	1	-2	1	1.20	-1.0	0.5	213	8.3		26	9.2			1.52	32.0			-0.10	0.05		4.72				0.100	0.1									
MW1		1/4/05	10.03	264.14			6.80					5.1	-2	1	-2	1	1.50	-1.0	0.5	196	9.8		24	9.6			1.46	33.0	-0.002	0.001	-0.10	0.05		1.01	1.01			-0.020	0.01									
MW1		4/1/05	8.15	266.02			6.90					3.0	-2	1	-2	1	2.70	-1.0	0.5	210	8.9		32	9.2			1.28	34.0	-0.002	0.001	-0.10	0.05		0.240	0.24			-0.020	0.01									
MW1		6/30/05	9.89	264.28			6.80					1.1	-2	1	-2	1	3.00	-1.0	0.5	191	8.1		30	9.0			1.27	32.0	-0.002	0.001	0.05	0.05		0.080	0.08			-0.020	0.01									
MW1		10/11/05			15	18.4	6.80	310	3.0	172		1.5	-2	1	-2	1	1.30	-1.0	0.5	175	7.0		30	9.9			1.3	33.0	-0.002	0.001	-0.05	0.025		0.130	0.13			-0.020	0.01									
MW1		2/9/06	9.21	264.96	8	17.5	6.90	320	5.7	106		0.54	-2	1	-2	1	2.00	-1.0	0.5	158	9.0		25	10.7			1.4	32.0	-0.0005	0.00025	0.09	0.09		0.055	0.055			-0.020	0.01									
MW1		5/23/06	9.92	264.25	14	16.3	6.80	330	13.4	281		4.6	2	2	-2	1	3.80	-1.0	0.5	215	7.2		25	9.5			1.26	37.0	-0.002	0.001	-0.05	0.025		0.320	0.32			-0.020	0.01									
MW1		8/24/06	11.61	262.56	12	17.8	6.80	340	5.6	284		7.5	-2	1	-2	1	2.20	-1.0	0.5	239	8.0		29	11.0			1.6	37.0	-0.002	0.001	0.05	0.05		0.830	0.83			0.036	0.036									
MW1		12/12/06					6.80					3.6	30	30	-2	1	0.99	-1.0	0.5	165	6.8		21	9.5			1.4	32.0	-0.002	0.001	0.06	0.06		0.310	0.31			0.020	0.02									
MW1		3/13/07			14	17.1	6.90		6.7	214		1.6	-2	1			0.81	-1.0	0.5	185	7.5		23	8.4			1.22	28.0	-0.002	0.001	0.06	0.06		0.130	0.13			-0.020	0.01									
MW1		6/25/07	11.36	262.81	8	17.5	6.90		8.0	284			2	2			0.84	-1.0	0.5	168	6.3		25	8.9			1.2	29.0	-0.002	0.001	0.06	0.064		0.036	0.036			-0.005	0.0025									
MW1		9/27/07	13.72	260.45	8	18.9	6.90	300	7.2	136		3.6	-2	1	-2	1	0.99	-1.0	0.5	156	6.7		22	9.8			1.4	28.0	-0.002	0.001	-0.05	0.025		0.170	0.17	-0.020	0.01	0.007	0.007	-0.005	0.0025	0.005		0.36				263
MW1		12/27/07	10.46	263.71	8	17.8	6.80	370	4.2	127		5.0	-2	1	-2	1	0.84	-1.0	0.5	232	10.0		23	9.8			1.5	30.0	-0.002	0.001	0.05	0.054		1.90	1.9	-0.020	0.01	0.077	0.077	-0.005	0.0025			0.55				282
MW1		7/7/08	11.89	262.28	6.75	17.24	7.04	291	7.9	126			-2	1	-2	1	0.66	-1.0	0.5	170	8.8		28	8.9			1.4	28.0	-0.002	0.001	0.068	0.068		0.620	0.62	-0.020	0.01	0.017	0.017	-0.005	0.0025			0.42				270
MW1		10/10/08	14.22	259.95	5.25	18.56	6.47	261	6.0	59.2			-2	1	-2	1	0.93	-1.0	0.5	186	9.3		23	8.5			1.3	29.0	-0.002	0.001	0.06	0.061		0.325	0.325	-0.020	0.01	0.0097	0.0097	-0.005	0.0025			0.32				279
MW1		12/29/08	11.96	262.21	6.75	18.22	6.70	298	3.4	130			-1.1	0.55			0.93	-0.042	0.021	210		13	23	11		14	1.5	35	-0.0083	0.00415	0.059	0.059		1.60	1.6	0.031	0.031	0.046	0.046	0.0025	0.0025			0.39	-1.1			308
MW1		3/11/09	9.56	264.61	7.5	14.28	6.86	292	5.4	126.3	191		-1.1	0.55			0.86	0.071	0.071	200	8.9		25	9.9		14	1.3	34.0	0.0083	0.0083	0.046	0.046		0.420	0.42	-0.050	0.025	0.013	0.013	-0.010	0.005			0.35	-1.1			273
MW1		6/16/09	10.89	263.28	7.5	17.12	6.75	284	5.3	3.0	185		-2	1	-2	1	0.98	-0.042	0.021	190	8.2		30	10		13	1.4	32	-0.032	0.016	0.057	0.057		0.30	0.3	-0.0093	0.00465	0.0068	0.0068	0.011	0.011			0.50				269
MW1		9/22/09	14.48	259.69	5.25	17.7	6.11	274	5.98	124.3	178	18.4	-2	1	-2	1	1.0	-0.2	0.1	160	6.5				9.0			32.0					0.065			0.022	0.022					0.011	0.011			0.35				286
		AVERAGE				**17.5**	**6.8**	**305.8**	**6.3**	**155.2**	**184.7**	**3.6**		**3.1**		**1.0**	**1.3**		**0.5**	**190.8**	**8.0**		**25**	**9.4**	**11.5**	**14**	**1.4**	**40.0**		**0.0025**		**0.052**	**0.065**		**0.49**		**0.015**		**0.022**		**0.005**			**0.4**	**-1.1**			**278.8**
MW1A		12/27/07	10.63	263.46	22	18.2	6.83		0.5	175		23	-2	1	-2.0	1.0	1.40	-1.0	0.5	301	29		19	25			1.1	47	-0.002	0.001	0.10			1.10		-0.020	0.01	0.070	0.07	0.014	0.014			1.10				408
MW1A		7/7/08	12.33	261.76	14.25	18.67	6.51	488	4.14	192			-2	1	-2.0	1.0	7.70	-1.0	0.5	283	16		24	19			0.86	44	-0.002	0.001	0.08			0.380		-0.020	0.01	0.015	0.015	-0.005	0.0025			0.82				445
MW1A		10/10/08	14.27	259.82	18.0	17.97	6.59	427	3.24	43			-2	1	-2.0	1.0	1.60	-1.0	0.5	297	44		17	26			1.3	48	0.0022	0.0022	0.11			6.31		-0.020	0.01	0.310	0.31	-0.005	0.0025			1.60				451
MW1A		12/29/08	12.41	261.68	14.25	18.70	6.64	445	2.96	168			2.2	2.2			3.20	0.098	0.098	290	28		20	27		17	1.5	51	-0.00083	0.000415	0.11			0.630		-0.072	0.036	0.033	0.033	0.00085	0.00085			0.89				452
MW1A		3/11/09	10.24	263.85	15.25	17.71	6.77	408	2.51	114.5	265		> 1.1	1.1			3.90	0.081	0.081	270	14		23	19		17	1.0	40	0.00910	0.0091	0.0082			0.130		-0.050	0.025	0.015	0.015	-0.010	0.005			0.45	-1.1			384
MW1A		6/16/09	11.28	262.81	15.5	18.33	6.67	350	4.06	-26.7	227		-2	1	-2.0	1.0	3.0	-0.042	0.021	210	9.4		24	15		15	0.97		-0.032	0.016	0.078			0.079		-0.0093	0.00465	0.0038	0.0038	-0.0025	0.00125			0.39				334
MW1A		9/22/09	14.42	259.67	13.5	18.13	6.81	448	2.69	89.8	291	1000	-2	1	-2.0	1.0	3.5	6.3	6.3	290	30				20								0.100			-0.05	0.025			0.016	0.016			1.8				449
		AVERAGE				**18.2**	**6.7**	**427.7**	**2.9**	**107.9**	**261.0**	**511.5**		**1.2**		**1.0**	**3.5**		**1.1**	**277.3**	**24.3**		**21**	**21.8**	**20.0**	**16**	**1.1**	**45.0**		**0.005**	**0.081**		**0.100**	**1.438**		**0.017**		**0.074**		**0.006**			**1.0**	**-1.1**			**417.6**
AVERAGE MW1 and 1A						**17.7**	**6.8**	**346.4**	**5.1**	**139.4**	**222.8**	**52.0**		**2.7**		**1.0**	**1.8**		**0.7**	**209.8**	**11.7**		**24.6**	**12.0**	**14.3**	**15.0**	**1.3**	**33.9**		**0.003**	**0.058**		**0.083**	**0.695**		**0.016**		**0.032**		**0.005**			**0.7**	**-1.1**			**343.5**

Table R-4 City of Ione Existing Plant Effluent Wate r Quality

Parameter	Units	1/6/03	2/3/03	3/3/03	4/2/03	5/5/03	6/1/03	7/2/03	8/2/03	9/3/03	9/24/03	10/1/03	11/3/03	12/1/03	Jan-04	Feb-04	Mar-04	Apr-04	May-04	Jun-04	Jul-04	Aug-04	Sep-04	Oct-04	Nov-04	Dec-04	Jan-05	Feb-05	Mar-05	Apr-05	May-05	Jun-05	Jul-05	Aug-05	Sep-05	Oct-05	Nov-05	Dec-05	Jan-06	Feb-06	Mar-06	Apr-06	May-06	Jun-06
Fecal Coliform	MPN/100 mL																																											
Biological Oxygen Demand (BOD_5)	mg/L	23	35	26	29	67	90	42	49	126		21	39	39	34	25	17	34	28	67	63	29	40	43	40	22	15	10	2	5	33	46	30	23	21	16	17	26	36		11	25	23	30.5
Total Suspended Solids	mg/L																																											
Color																																												
Oil and Grease																																												
pH																																												
Settleable Solids																																												
Turbidity	NTU																																											
Odor (units)																																												
Electrical Conductivity	µmhos/cm	386	418	424	413	389	335	302	321	331	334	346	331	379	389	425	415	372	437	304	303	293	320	316	413	447	448	423	452	401	396	471	346	315	295	282	285	303	338	429	436	362	407	357
Solids, Total Dissolved	mg/L	184	187	204	244	220	242	259	224	237	178	232	234	195	223	222	231	284	255	208	214	209	207	194	224	192	217	218	231	213	296	241	248	201	223	199	210	253	180	217	214	222	204	216
Temperature	(°C)																																											
Dissolved Oxygen	mg/L																																											
Ammonia as N	mg/L																																											
Nitrate as N	mg/L	0.05	0.05	0.05	0.38	0.071	0.05	0.05	0.05	0.05	0.05	0.05	0.08	0.05	0.07	0.05	0.05	0.38	0.05	0.1	0.05	0.05	0.055	0.11	0.09	0.14	0.33	0.87	1.1	0.67	1.8	4.2	1.3	2.6	4.1	2.8	7.5	10.2	2.3	1.2	1.2	1.9	2.1	5.5
Nitrite as N	mg/L																																											
Nitrate plus Nitrite as N	mg/L	0.05	0.05	0.05	0.38	0.071	0.05	0.05	0.05	0.05	0.05	0.05	0.08	0.05	0.07	0.05	0.05	0.38	0.05	0.1	0.05	0.05	0.055	0.107	0.09	0.14	0.325	0.868	1.11	0.67	1.83	4.21	1.3	2.56	4.1	2.78	7.52	10.18	2.3	1.2	1.2	1.9	2.1	5.5
TKN	mg/L														23	23	21	22	26	17	17	13	17	18	20	25	20	19	19	17	18	12	7	5	5	5	5	8	15	19	18	11	12	6
Total Nitrogen	mg/L																																											
Aluminum, total	mg/L																																			0.043								
Arsenic, dissolved	mg/L																																			0.004								
Barium	mg/L										0.1														0.1											0.1								
Boron	mg/L										0.23														0.19											0.23								
Calcium	mg/L										9.3														12											11								
Chloride	mg/L						33	31	30	27	31	30	26	31	31	30	30	31	32	29	27	28	26	25	33	29	27	25	30	26	34	34	33	34	31	31	33	30	25	24	26	22	21	29
Copper, dissolved	mg/L																																			0.03								
Iron	mg/L										0.23														0.7											0.3								
Magnesium	mg/L										2.64														3.6											2.3								
Manganese	mg/L										0.08														0.13											0.08								
Potassium	mg/L										8.84														10											9.2								
Sodium	mg/L						43	39	37	37		35	32	36	33	36	36	38	41	38	34	35	33	31	36	36	31	30	34	29	36	41	36	40	37	38	36	36	28	32	33	28	30	36
Sulfate	mg/L										18														22											29								
Zinc	mg/L	0.02	0.049	0.03	0.04	0.02																														0.02								

Table R-4 City of Ione Existing Plant Effluent Wate r C

Parameter	Units	Jul-06	Aug-06	Sep-06	Sep-06	Jan-07	Feb-07	Mar-07	Apr-07	May-07	Jun-07	Jul-07	Aug-07	Sep-07	Oct-07	Nov-07	Dec-07	Jan-08	Feb-08	Mar-08	Apr-08	May-08	Jun-08	Jul-08	Aug-08	Sep-08	Oct-08	Nov-08	Dec-08	Jan-09	Feb-09	Mar-09	Apr-09	May-09	Jun-09	Jul-09	Aug-09	Sep-09	Oct-09	Statistics Count	Mean	Median	Min	Max	Std Dev	C.V.
Fecal Coliform	MPN/100 mL																																											
Biological Oxygen Demand (BOD_5)	mg/L	14	16	16	32	17	9	12	17	22	45	16	20	13	24	29	28	21	22	26	14	116	32	16	20	23	27	28	34	24	22	12	6.8	48	62	19	15	16	26	**79**	**30**	**25**	**2**	**126**	**21**	**71%**
Total Suspended Solids	mg/L																																											
Color																																												
Oil and Grease																																												
pH																														7.8	7.8	7.4	7.4	8.2	7.4	9.7	8.6	8.6	8.4	**10**	**8.1**	**8.0**	**7.4**	**9.7**	**0.7**	**9%**
Settleable Solids																																												
Turbidity	NTU																																											
Odor (units)																																												
Electrical Conductivity	µmhos/cm	314	288	283	275	451	479	439	475	452	363	315	284	293	358	318	409	410	395	430	475	452	363	315	284	293	358	318	409	454	461	423	518	453	342	307	310	316	318	**81**	**371**	**363**	**275**	**518**	**63**	**17%**
Solids, Total Dissolved	mg/L	265	198	205	178	208	216	215	241	249	284	207	201	180	187	235	215	201	214	251	241	249	284	207	201	180	187	235	215	214	182	200	241	266	220	289	253	231	266	**81**	**222**	**217**	**178**	**296**	**28**	**13%**
Temperature	(°C)																																											
Dissolved Oxygen	mg/L																																											
Ammonia as N	mg/L					22	22	19	19	13	1.9	0.6	0.5	2.8	7.4	6.1	15																									**12**	**11**	**10**	**1**	**22**	**9**	**79%**
Nitrate as N	mg/L	3.4	2.5	4.9	5.5	1.3	3.6	1.5	1.9	4.7	10.5	3.4	1.0	1.6	5.1	7.4	3.1	1.1	1.3	1.5	2.3	3.3	3.6	3.6	5.4	6.2	5.6	9.9	4.6	1.2	0.5	0.2	0.3	2.4	3.2	0.26	1.70	4.10	4.90	**81**	**2**	**1**	**0.05**	**11**	**3**	**112%**
Nitrite as N	mg/L					0.1	0.1	0.2	0.6	5.7	3.8	2.4	0.6	0.6	1.7	1.2	0.2	0.1	0.2	0.2	0.6	5	1	1.5	2.3	1.1	1	4.2	3.8											**24**	**2**	**1**	**0.10**	**6**	**2**	**106%**
Nitrate plus Nitrite as N	mg/L	3.4	2.5	4.9	5.5	1.4	3.7	1.7	2.5	10.4	14.3	5.8	1.6	2.2	6.8	8.6	3.3	1.2	1.5	1.7	2.9	8.3	4.6	5.1	7.7	7.3	6.6	14.1	8.4	1.2	0.5	0.2	0.3	2.4	3.2	0.26	1.70	4.10	4.90	**81**	**3**	**2**	**0.05**	**14**	**3**	**121%**
TKN	mg/L	4	6	5	8																									26	29	22	27	22	5.6	6.20	5.70	5.00	5.60	**44**	**15**	**17**	**4**	**29**	**8**	**53%**
Total Nitrogen	mg/L																																											
Aluminum, total	mg/L															0.086													0.123											**3**	**0.08**	**0.09**	**0.04**	**0.12**	**0.04**	**48%**
Arsenic, dissolved	mg/L				0.002											0.0024													0.001											**4**	**0.002**	**0.002**	**0.001**	**0.004**	**0.001**	**53%**
Barium	mg/L				0.05											0.05													0.05											**6**	**0.08**	**0.08**	**0.05**	**0.10**	**0.03**	**37%**
Boron	mg/L				0.21											0.25													0.19											**6**	**0.22**	**0.22**	**0.19**	**0.25**	**0.02**	**11%**
Calcium	mg/L				9.6											12													11											**6**	**11**	**11**	**9**	**12**	**1**	**11%**
Chloride	mg/L	30	27	27	25	26	28	28	28	28	31	32	31	33	32	30	29	25	25	31	38	38	36	44	50	42	34	34	30	29	38	25	29	32	36	35	36	34	34	**76**	**31**	**30**	**21**	**50**	**5**	**16%**
Copper, dissolved	mg/L															0.0051													0.007											**3**	**0.01**	**0.01**	**0.01**	**0.03**	**0.01**	**99%**
Iron	mg/L				0.28											0.2													0.264											**6**	**0.33**	**0.27**	**0.20**	**0.70**	**0.19**	**56%**
Magnesium	mg/L				5.4											2.7													3.8											**6**	**3.4**	**3.2**	**2.3**	**5.4**	**1.1**	**33%**
Manganese	mg/L				0.084											0.098													0.063											**6**	**0.09**	**0.08**	**0.06**	**0.13**	**0.02**	**26%**
Potassium	mg/L				8.5											9.3													11											**6**	**9.5**	**9.3**	**8.5**	**11.0**	**0.9**	**10%**
Sodium	mg/L	36	33	33	33	31	31	29	36	34	39	36	38	37	39	39	37	30	29	35	39	43	42	45	49	42	40	35	38	36	33	29	33	36	48	41	46	48	40	**75**	**36**	**36**	**28**	**49**	**5**	**13%**
Sulfate	mg/L				21											23													20											**6**	**22**	**22**	**18**	**29**	**4**	**17%**
Zinc	mg/L															0.026													0.038											**8**	**0.030**	**0.028**	**0.020**	**0.049**	**0.011**	**36%**

BORING NUMBER: MW1
DATE DRILLED: 6/19/02
LOGGED BY: JP

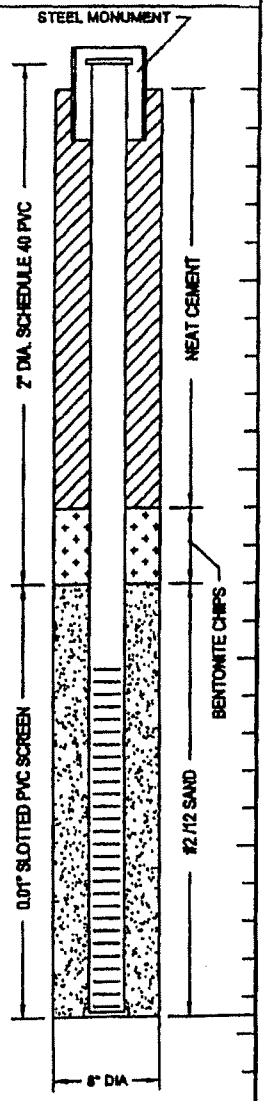
DRILL RIG/METHOD:
CME-75 / 8 INCH
HOLLOW STEM AUGERS

DEPTH (feet)	SAMPLER	SAMPLE NUMBER	BLOWS/FT.	DRY UNIT WT. (PCF)	MOISTURE CONTENT (%)	PID	USCS	GRAPHIC LOG	SOIL DESCRIPTION AND REMARKS
0							ML		Brown, moist, clayey silt, trace fine sand
5		MW1-1I	8						
10		MW1-2I	8						brown, very moist, sandy clayey silt soft
15		MW1-3I	7				SM		Red brown, wet, loose, silty fine sand
20		MW1-4I	58				GW		Brown, dense, wet, coarse sand to 1" gravel sandy gravel increasing gravel size with depth below 18'
25									
30									
35									
40									

Notes:

1. This log depicts conditions only at the boring location, see Plate No. 2, and only on the date of field exploration.
2. For an explanation of the symbols used in the boring log, see Plate No. 15.

WELL DIAGRAM



WALLACE • KUHL & ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING
GEOLOGIC & ENVIRONMENTAL SERVICES

SOIL BORING LOG AND WELL CONSTRUCTION DETAIL
IONE WASTE WATER TREATMENT PLANT
Ione, California

WKA NO: 4857.01
DATE: 1/03
PLATE NO: 11

Project: Ione WWTP
Project Location: Ione, California
WKA Number: 4857.05

LOG OF MONITORING WELL 1A

Sheet 1 of 2

Date(s) Drilled	8/7/07	Logged By	BMC	Checked By	PJJ
Drilling Method	Hollow Stem Auger	Drilling Contractor	V&W Drilling, Inc.	Total Depth of Drill Hole	41.5 feet
Drill Rig Type	BK-81	Diameter of Hole, inches	8"	Approx. Surface Elevation, ft MSL	274.1
Groundwater Level and Date Measured		Seal or Backfill	Neat Cement Grout Neat Cement Grout and Bentonite Chips		
Sampling Method(s)	Modified California Sampler	Drive Weights and Comments	140 lb Hammer falling 30 inches		

Elevation feet	Depth, feet	Sample Type	Number of Blows	Graphic Log	GEOLOGIC AND ENGINEERING DESCRIPTION	Unified Soil Classification	PID (ppm)	Well Construction	WELL DETAILS AND REMARKS
	0				Native Soil: grass covered				Hand Auger to 5 feet below ground surface bgs)
					Sandy SILT (ML), dark brown, dry, firm, fine to medium grained sand, trace mica.	ML			
	2								Neat Cement Grout
									2-inch, blank Schedule 40 PVC
270	4								Bentonite Chips
			5						
	6		6						
			9						
									First encountered groundwater at approximately 7 feet bgs
	8				Alluvium (Qal): Clayey SILT with Sand (ML), reddish brown to gray, wet, soft, fine grained sand, low to non-plastic, trace black organic material.	ML			
265									
	10		3				NA		
			3						
			5						
	12								#2/12 Sand
					Sandy SILT with trace Gravel (ML), reddish brown, wet, soft, fine grained gravel, fine to coarse sand.	ML			
260	14								2-inch, 0.010-inch slotted Schedule 40 PVC
			3						
	16		4						
			4						
	18				Silty SAND (SM), reddish brown, wet, poorly cemented, fine to medium grained sand.	SM			
255									
	20								

ENVIRO WELL+SOIL LOG 4857.05 IONE WWTP.GPJ WKA.GDT 9/12/07 3:19 PM

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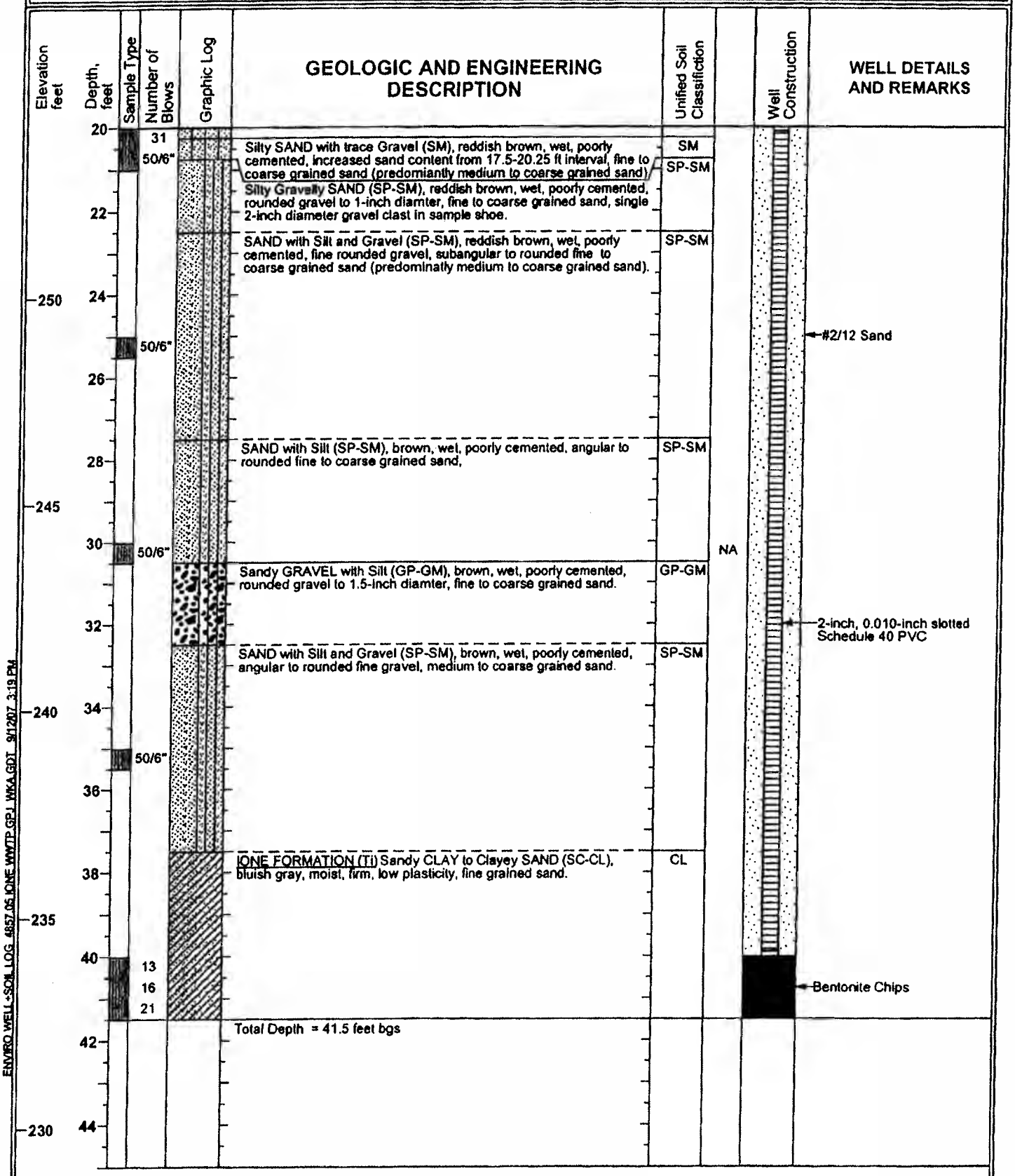
LOG OF MONITORING WELL 1A

Sheet 2 of 2



ENVIRO WELL-SOIL LOG 4857.05 IONE WWTP.GPJ WKA.GDT 9/12/07 3:19 PM

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FIGURE A