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NSB KINGS BAY
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LETTER REGARDING NSB KINGS BAY GA REQUESTING PERMISSION TO DISCHARGE A
GROUNDWATER STREAM TO THE CITY OF ST MARYS WASTEWATER TREATMENT
SYSTEM
1/28/1994
NSB KINGS BAY

31547.000
13.01.00.0069

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Ser N56/0469

JAN 28 1994

Mr. Mike Mahaney
City Manager
City of St. Marys
418 Osborne Street
St. Marys, Georgia 31558

Dear Mr. Mahaney:

This follows up our October 15, 1993 letter requesting permission to discharge a treated groundwater stream to the St. Marys wastewater treatment system. This would occur as part of our study of groundwater contamination originating from the old County landfill, currently located on Naval Submarine Base, Kings Bay's property.

We received your fax of Mayes, Sudderth & Etheredge's (MSE) comments on November 1, 1993 and transmitted them to our consultant, ABB Environmental Services, Inc. (ABB-ES), for their review. ABB-ES's comments, dated December 28, 1993, are forwarded as enclosure (1). We are also forwarding a copy of this response to MSE.

We appreciate your involvement and cooperation on this important project and hope ABB-ES's comments adequately answer MSE's questions and concerns. However, if additional information is needed, please contact Mr. John Garner at 673-8845. We are prepared to meet with you and your consultant to address any remaining concerns.

Sincerely,

M. J. PATTERSON
Lieutenant Commander, CEC, USN
Assistant Public Works Officer
By direction of the
Commanding Officer

Encl:

(1) ABB-ES letter of December 28, 1993

Copy to:

Mayes, Sudderth & Etheredge
GADNR (EPD), Hazardous Waste Branch

Blind Copy to:

SOUTHNAVFACENGCOM (Code 1868) (w/o encl)
ABB-ES (Frank Cater) (w/o encl)

N56/PF/JG!



28 December 1993

Commanding Officer
Naval Submarine Base
Kings Bay, GA 31547

ATTN: Public Works Department
LCDR Mike Patterson

SUBJECT: Discharge to the City of St. Marys' Point Peter Plant
Naval Submarine Base, Kings Bay, Georgia
Contract Task Order #041
Contract N62467-89-D-0317

Dear Mr. Patterson:

ABB Environmental Services, Inc. (ABB-ES) has reviewed the comments provided by Mayes, Sudderth & Etheredge (MSE) on the plan to discharge treated groundwater to the City of St. Marys' Point Peter Plant sewage treatment facility and provides the following responses. The comments were discussed with MSE at a meeting with Mr. Tom Holbrook (Manager of Environmental Planning) and Mr. Tom Bailey, both with MSE, on 5 November 1993. The meeting minutes are included as Attachment 1.

Comment 1: Hydraulic Loading

The Point Peter Plant is permitted to discharge an average flow of 0.8 million gallons per day (MGD). Review of flow data provided by the City for the period of July 1992 to June 1993 shows that the average flow was exceeded in July 1992 (0.916 MGD) and was 0.786 MGD in February 1993. If the proposed discharge of 0.086 MGD is superimposed on the February 1993 flow, the combined discharge of 0.872 MGD would exceed the permitted limit.

It is our understanding that waste water can be pumped to either the Point Peter Plant or the Weed Street Plant. If the combined permitted capacities of these plants is adequate to treat and dispose of an additional 0.086 MGD during the peak monthly flow conditions, then there would be adequate hydraulic capacity. We recommend that you compare your total hydraulic capacity to the peak monthly flow with the addition of 0.086 MGD and assess your ability

ABB Environmental Services Inc.

ENC. (1)

to manage the hydraulic balance between the two treatment plants. It may also be advantageous to control the discharge from the remediation system to arrive at the plant(s) during off-peak periods of the day.

Resolution: During peak loads at the Point Peter Plant, the facility operator from the Point Peter Plant is capable of diverting flow to the City's Weed Street Plant, which is currently not operating near capacity. Therefore, the Navy will rely on the Point Peter Plant facility operator to manage the flow at the treatment facility and alert the Navy of diverting discharge to the Weed Street Plant.

Comment 2: Remediation Effluent Quality. We recommend that the Navy provide the following quality controls to limit excessive discharge.

Comment 2a: Perform complete priority pollutant analyses on groundwater samples. The documentation presented for the proposed pilot plant states that complete chemical characterizations were not performed. It is possible that there are additional, unidentified contaminants that would not be adequately removed by stripping. Additionally, conventional wastewater characterizations, parameters (such as BOD, COD, nitrogen, phosphorus, alkalinity, suspended solids and pH) should be assessed.

Response: The analytical programs associated with the various investigative tasks conducted at the site have not specifically called for priority pollutant list analytes. However, Appendix IX, Target Compound List (TCL) and Target Analyte List (TAL) analyses have been conducted on groundwater samples from the site. The following two paragraphs provide information regarding the analytical data available for the site. Tables 1 through 9, referenced in the following discussion, are Attachment 2.

Groundwater samples collected during six bimonthly sampling events from February 1992 to January 1993 from nine groundwater monitoring wells, each 13 feet deep, were analyzed for Appendix IX constituents (Table 1, Attachment 2). Tables 2 and 3 summarize results for these analyses. During August, October, and November 1992, and March of 1993, a Phase I Interim Investigation and Interim Corrective Measure Screening Investigation were conducted. Groundwater samples were analyzed for a select list of VOCs in an on-site laboratory, with 10 percent duplicated for analysis in an off-site, contract laboratory. Results of these analyses are summarized in Tables 4 and 5. As indicated in Table 5, two samples were collected for analysis of semivolatile organic compounds.

During July 1993 and October 1993, groundwater samples were collected from monitoring well KBA-11-10 and recovery well KBA-RW-01, respectively, for analysis of parameters associated with evaluating the need for metals and carbonate removal prior to air stripping. The analytical results are summarized in Table 6. Phosphorus has not been analyzed to date, but will be included in the analyses associated with samples collected from the monitoring wells in January 1994. Field measurements of pH were collected during the six bimonthly sampling events, during development of the newly installed monitoring wells, and during development and sampling of the recovery wells. Values of pH have ranged from 4 to 6 standard units. Groundwater samples will be collected from the recovery wells and monitoring wells for analysis of conventional wastewater parameters, including phosphorus, to evaluate the maximum loading to the treatment facilities.

During November 1993, groundwater samples were collected from four recovery wells (KBA-RW-01 through KBA-RW-04) for analysis of TCL and TAL parameters (Table 7, Attachment 2). The results of these analyses are summarized in Tables 8 and 9. The recovery wells are screened from 20 to 70 feet below ground surface (bgs).

During January 1994, groundwater samples will be collected from the newly installed monitoring wells. Analyses for the samples will include TCL and TAL analytes, with a subset of samples submitted for Appendix IX analyses (Tables 1 and 7, Attachment 2). The data for these samples will be received and reviewed prior to the start of the Phase I Pilot Scale Test. In the event non-strippable chemicals are detected in the groundwater samples at concentrations above MCLs, the Navy will investigate the use of pretreatment technologies to remove non-strippable contaminants.

Comment 2b: Periodically sample and analyze groundwater from monitoring wells. The quality of leachate from a landfill is expected to change with time. The documentation presented does not state that multiple rounds of groundwater quality assessment were performed. Therefore, there is no basis to conclude that the characterization is representative of existing conditions or predictive of future conditions.

Response: Additional groundwater characterization is part of the ongoing RFI. The Interim Measure (IM) is being implemented before full characterization is completed to quickly minimize the migration of the contaminated groundwater. The air stripper design is based on groundwater samples collected to date, which would represent expected conditions of the influent. The stripper design is also based on air to water ratios to treat various chemicals. A safety

factor on air to water ratios is inherent in the design to account for variability of the influent. As additional groundwater samples are collected and analyzed, the analytical results will be compared to existing influent characteristics to determine if a change in air to water ratios is necessary to remove higher concentrations of chemicals. As mentioned in the response to Comment 2a, if non-strippable contaminants are found at concentrations above MCLs, the Navy will investigate the use of pretreatment technologies to remove non-strippable contaminants.

Comment 2c: Implement operating controls. During the 8 month operating period, the only proposed control is a weekly effluent sample with a one-week laboratory turn-around time. It is possible for an exceedance not to be discovered for two weeks. We recommend that some combination of on-site effluent retention and enhanced analytical frequency be implemented to allow confirmation of effluent quality prior to discharge.

Additionally, some type of rapid operational monitoring is recommended. This might consist of monitoring selected indicator parameters such as pH, specific conductivity and/or total organic carbon (TOC).

Response: During discussions between the Navy and MSE held on 5 November 1993, MSE expressed that daily monitoring of an indicator parameter (for example, TOC) would preclude the use of effluent retention. Modeling could also show that only gradual variations in groundwater chemistry or contaminant concentrations are anticipated from pumping the aquifer.

The model used to show the movement of a "slug" of contamination within or around the capture zone of the groundwater extraction wells was the two-dimensional semi-analytical General Particle Tracking Module (GPTRAC) from the USEPA's Well Head Protection Area (WHPA) delineation code. Using this model, slugs of contamination or chemical variations of the groundwater can be represented as particles transported by advective movement through the aquifer. GPTRAC models the movement of particle(s) of constituents through the proposed recovery wells' capture zones using analytical velocity computation techniques. Distance traveled therefore is time-dependent.

Several plots of the five-well recovery system and its effective capture zone are provided as Figures 1 through 5. These plots show the movement of "slugs" of constituents from seven arbitrarily selected locations within the plume. Particle #1 in each figure represents a particle within the zone unaffected by the groundwater

extraction system, or the baseline particle movement. The projected particle pathway for each model duration (7 days, 30 days, 90 days, 1 year, and 5 years) is shown to begin at the indicated circles. The pathways which appear as dots in the shorter durations are lines indicating travel distances.

The modeling shows that because of the relatively low seepage velocity within the aquifer, current groundwater quality will be representative of groundwater quality for the duration of the initial operations of the IM. Plume characteristics are expected to change slowly; however, the changes during the initial operations of the IM will be gradual enough for weekly monitoring to be sufficient to detect and respond to the changes. Vinyl chloride will be the greatest indicator of change in plume characteristics since it is a degradation product for most of the chlorinated organics present in the aquifer.

Comment 3: Establish a written agreement with the U.S. Navy. The Navy proposes to discharge 0.086 MGD (60 gallons per minute (gpm)) of remediation effluent of drinking water quality for a pilot period of 45 to 60 days and for an operating period of 8 months. If the contaminant source is not isolated or removed, we suspect that the treatment will continue for decades rather than months. The Navy should make its intentions clear - Is the 8 month operating period an interim measure while a permanent disposal method is being implemented? Does the Navy intend to eliminate the source (install a slurry wall or equivalent) and treat only that contaminated groundwater that has already escaped the landfill?

An operating and monitoring plan, acceptable to the City, should be established to prevent discharges in excess of drinking water standards (or some other standard acceptable to the City). The Navy should commit to withholding discharges that do not meet the effluent limits.

Response: ABB-ES recommends that a written agreement on influent quantity/quality and IM duration be established between the Navy and the City for discharge to the POTW.

The Navy intends for the IM to hydraulically control groundwater and control migration of the plume of contamination. The ongoing RFI will be used to evaluate the need for further corrective action at the site. The proposed duration for the IM, in two phases, is:

Phase 1 (Pilot)	Six weeks of pilot scale testing at maximum design flow rate of 60 gpm
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Phase 1 (Operation)	Up to 8 months of continued operation at 60 gpm maximum
Phase 2 (Long-term)	Up to 5 years at potentially higher flow rates - not expected to exceed 200 gpm

During the initial Pilot phase of operations, the groundwater extraction system and treatment system will be operated and monitored on a twenty-four (24) hour basis.

An operations and maintenance (O&M) plan/manual would be submitted to the City upon selection of operation parameters estimated during the pilot Phase 1 air stripper operation. The O&M Plan would provide details on the flow rates for operation of the air stripper and a contingency plan (for example, shut-off recovery well pumps) to address non-conformances to the discharge standards.

Comment 4: Cost Recovery - US EPA Regulations (40 CFR 35.925-11) require that municipalities that received design or construction grants for publicly owned treatment works (POTW) establish a program to cover the cost of operating and maintaining the system. The cost recovery must address both flow and mass loadings and prohibits volume discounts. We assume that your existing rate structure incorporates this requirement and would apply to the proposed discharge.

Response: Because cost recovery would involve allocation of Navy funds and it is not a technical issue, ABB-ES would like to defer a response to this comment to the Navy.

Comment 5: Regulatory Agency Approval. The Navy has presented the argument that the City would not be subject to RCRA or CERCLA liability for accepting the effluent. We recommend that you solicit concurrence from Georgia EPD. Also, we have contacted Ms. Mary Barcala of the Georgia EPD Municipal Wastewater Program regarding discharge permit requirements. Ms. Barcala is investigating additional monitoring compliance requirements that might be imposed on the City.

Response: This question may have arisen from the text of the 15 October 1993 letter from SUBASE to Mr. Mahaney. In this letter, SUBASE states that the groundwater, if it is determined to "contain" a hazardous waste, could be accepted by the POTW through the Domestic Sewage Treatment Exclusion if the constituents do not pass through, interfere with, or are otherwise incompatible with the POTW. This letter does not unequivocally state that the City would not be subject to RCRA liability, nor does it address CERCLA liability. Additionally, because SUBASE is not a CERCLA site, no CERCLA

liability would be associated with the discharge. RCRA liability could be an issue if the groundwater is determined to contain hazardous waste and the discharge is not determined to "no longer contain" a hazardous waste. The City will be clearly informed if the waste is determined to be hazardous, and if RCRA liability is an issue.

Additional: The treatability modeling performed for the Point Peter Plant has some minor inconsistencies such as use of 1.0 MGD as the design flow, cis-1,2-dichloroethane was not modeled, and calibration data are referred to but not presented. (Did they perform calibration analyses at the Point Peter Plant?). If the Navy meets the proposed discharge limits (MCLs), these concerns may not be significant.

Response: Treatability modeling and calculations have been performed at 0.8 MGD, the model printout evidently rounds this number to 1.0.

The original letter to Mike Mahaney, dated 15 October 1993, listed cis-1,2-dichloroethene as a constituent in the discharge criteria. We assume the comment above is referring to this chemical. The treatability of cis-1,2-dichloroethene was inferred by modeling trans-1,2-dichloroethene, which is more difficult to remove from wastewater compared to cis-1,2-dichloroethene. Cis-1,2-dichloroethene was not included in the list of contaminants for the model.

The calibration data is in the form of the EPA publication of the model. We would be happy to provide Mr. Mahaney with this information if needed. The model was calibrated against empirical data from over 50 POTWs across the U.S. and Canada, which is in the model's database. The Point Peter Plant is not one of the POTWs in the calibration database. However, the model was run with the specific parameters (i.e., influent, etc.) of the Point Peter Plant.

Comment 1: Air quality sampling points shown appear to be along streets and property lines, rather than at structures. This may be appropriate to evaluate exposure from water use; however, we would expect that gases released from the soil would accumulate in basements and crawl spaces, and under floor slabs. It does not appear that this was assessed.

Response: Low lying areas, such as the bottom of ditches and interior of meter boxes, were targeted to be sampled to determine the presence of vapors outcropping from the soil. Most of the homes in the neighborhood are built on slabs (and without basements), which also act as a barrier to entry of soil vapors.

Comment 2: Water from private wells is reported to have been sampled and analyzed. Analytical results were not available in the data that we reviewed.

Response: Analytical data from private wells is available in the RFI Interim Report, located in the Information Repository.

Comment 3a: Exposure Duration. The assessment duration for adults was 30 years, while periods of 3 and 6 years were assessed for children. Is it reasonable to assume that adults living in a house for 30 years will be accompanied by their children for only 3 to 6 years? Is it customary to assess risks over a lifetime exposure (70 years) or for short duration?

Response: The USEPA risk assessment methodology does not evaluate the risks to adults living in their home with their children. Rather, it evaluates the risks to a person living in the same home from birth to age 30. The 30-year exposure is made up of a combination of a 6-year child exposure plus a 24-year adult exposure. A 30-year rather than a lifetime exposure period was selected by the USEPA because approximately 90 percent of the families in the United States live in a single home for 30 years without moving.

In addition, because of the transient nature of the military personnel living in the neighborhood, USEPA allowed for risks to be calculated for 3-year adult and child exposures, provided that the standard 6- and 30-year exposures were also calculated.

Comment 3b: The lifetime carcinogenic (cancer) risks per 1,000,000 children exposed for 3 and 6 years are reportedly 88 and 180, respectively. A note on the slides states that "the USEPA suggest an acceptable risk range of 1 to 100 in a million people." The 6 years exposure risk of 180 clearly exceeds the range of 1 to 100. We do not have figures available for lifetime exposure.

Response: The lifetime excess cancer risks of 88 and 180 per 1,000,000 children exposed do exceed the USEPA acceptable range of 1 to 100 in a million people. However, these were the risks to the hypothetical family studied in the risk assessment who were exposed to the hypothetical groundwater plume, not actual risks to a family living in the subdivision. Many of the assumptions used to study this family were excessively conservative compared to the actual conditions at the site. These assumptions, many of which were required by the USEPA Region IV, include:

- 1) The composition of the groundwater plume was assumed to be uniform throughout. The highest detected concentration of

each contaminant was used as characteristic of the entire plume, including in the neighborhood. This conservative assumption is inconsistent with actual data. For example, the maximum vinyl chloride concentration detected in the plume was 310 micrograms per liter ($\mu\text{g}/\text{l}$). The highest concentration of vinyl chloride detected in the neighborhood was 5.2 $\mu\text{g}/\text{l}$. The risk evaluation was performed as if 310 $\mu\text{g}/\text{l}$ of vinyl chloride was present in the private irrigation wells in the neighborhood. Since over 95 percent of the cancer risks calculated were due to vinyl chloride exposure at a concentration 59 times greater than actually present anywhere in the subdivision, the actual risks to the children in the neighborhood are believed to be far lower than those presented.

- 2) The vinyl chloride was assumed to be absorbed through the skin, resulting in 50 percent of the total cancer risk calculated. Realistically, vinyl chloride will vaporize when exposed to air before any absorption can take place. Additionally, dermal absorption of vinyl chloride has never been documented in humans, yet USEPA risk assessment methodology requires that this exposure route be evaluated.
- 3) The concentration of constituents in the groundwater were assumed to remain constant for 30 years. Realistically, the constituent's concentration will decrease naturally through natural biodegradation, soil adsorption potential, and groundwater movement and dilution in addition to other factors.

Because these assumptions are based on a worst case scenario, a decrease in any one of the assumed values, which is clearly the most likely case, would result in a risk within the acceptable range. A further discussion of the process used to verify the conservative nature of these assumptions may be found in the response to comment 3d.

Per USEPA methodology, lifetime exposure cancer risks are never calculated in baseline risk assessments, only 3-, 6-, and 30-year exposure periods. The rationale for selection of these exposure periods by USEPA is discussed in the response to comment 3a.

Comment 3c: The reported total non-carcinogenic hazard index (HI) for children was reported to be 5.3 for both 3- and 6-year exposures. A note on the bottom of the slide states that "USEPA suggest if HI is greater than 1.0, further analysis is required." Again, we do not know what the effects of lifetime exposure would be.

Response: An HI of 5.3 indicates that further analysis is suggested, not that a toxic effect is going to occur. This analysis indicated that the HI was due to exposure to cis-1,2-dichloroethene (DCE) and toluene. Again, following USEPA guidance, the highest concentration of DCE (3,600 µg/l) and toluene (580 µg/l) were used. The highest concentration of DCE actually detected in the neighborhood was 13 µg/l, 275 times less than the concentration used in the calculation, and less than the federal maximum contaminant level (MCL) of 70 µg/l, used as a drinking water standard. The toluene concentration used also is less than its MCL of 1,000 µg/l. Therefore, the HI of 5.3 was determined to not indicate realistic potential for toxic effects.

The HI is not considered cumulative over a lifetime and is calculated on a daily basis. The lifetime HI is the same as the adult HI of 0.3.

Comment 3d: The argument is presented that exceeding the USEPA acceptable risk level is not a concern since the assessment assumptions were conservative. It is our experience that conservative assumptions are normally used to simplify an assessment using "worst case" conditions. If the worst case is acceptable, anything less severe is assumed to be acceptable. Where worst case conditions are not acceptable, refined analysis is required. It appears that either a refined analysis is appropriate or the community must be willing to accept the assessed level of risk.

We asked Ms. Madeleine Kellam, the project remediation officer for Georgia EPD, if USEPA or Georgia EPD would review the risk assessment. Ms. Kellam stated that EPD did not have a risk assessment program and that EPA would not be involved since it is not a CERCLA (Superfund) site. Apparently there will be no review by the regulators. We recommend that you discuss the risk assessment with the County Health Officer.

Response: A complete Baseline Risk Assessment was not conducted because this is not a CERCLA site. A screening risk evaluation was performed to evaluate potential health risks to the residents of Crooked River Plantation Subdivision.

The methodology selected for the screening risk evaluation at the Crooked River Plantation Subdivision was to perform a "worst" case analysis and then to provide the results of this analysis to the public at a public meeting. During the public meeting, the audience was invited to compare their actual use of the groundwater to that of the hypothetical family studies in the screening risk evaluation. This methodology made the audience an integral part of the risk assessment decision-making process.

Although the risks presented to the public were higher than would be reported for the refined analysis, the weaknesses of the assumptions in the "worst case" were openly discussed, as were the impacts of these weaknesses on the risks presented. For example, in the public meeting, where the results of the screening risk evaluation were presented to the public, the vinyl chloride concentrations used in the supplemental risk evaluation were compared with the actual results from the private irrigations wells. It was also emphasized that if the actual concentration of vinyl chloride in the groundwater under the Crooked River Plantation Subdivision was lower than that used in the supplemental risk evaluation, then the actual risks due to exposure to vinyl chloride in the neighborhood were also lower.

The members of the audience independently agreed to this same conclusion. The audience was also informed that a future refined analysis would be performed when the necessary environmental data were available, and the results of this analysis would be provided to them when completed. The future refined analysis will be based on the RCRA Health and Environmental Assessment.

The results of the screening risk evaluation were also reviewed by the USEPA Region IV and Dr. Randy Manning of the Georgia EPD. Comments were received from Georgia EPD, which we understand incorporated comments from EPA, and a final version of the screening risk evaluation was released in August of 1993. While both the USEPA and Georgia EPD have reviewed or commented on the risk evaluation including the methods used, ABB-ES concurs that the results and conclusions should be communicated to the County Health Officer.

Comment 4: A 4-inch and a 10-inch well are shown on the drawings. There is no mention in the data that we receive of their purpose, if they are in use, screening depth, or water quality data from these wells. This is a potentially significant omission.

Response: These wells are private wells, to which the Navy does not have access. The Navy has determined that these wells are not in use for drinking water or any other purpose. They were originally installed to provide water to Porcupine Lake during dry periods but have not been used, based on available information.

Comment 5: We understand that the Floridan Aquifer is the second aquifer underlying the site and is a source of potable water for much of South Georgia and Florida. The groundwater monitoring data that we

reviewed did not include data from the Floridan Aquifer. The impact to your water supply does not appear to have been assessed.

Response: Current knowledge of the vertical extent of contamination is that it extends approximately 60 feet bgs downgradient and west of the landfill and approximately 85 feet bgs beneath the landfill. These conclusions are based on the absence of detectable concentrations of VOCs in the groundwater samples from deeper intervals at locations where shallower samples contained VOC contaminants. Collection and analysis of groundwater samples from the newly installed RFI monitoring wells will be used to confirm and refine the present conceptual model of groundwater contamination.

The surficial aquifer is underlain by a confining unit, the Hawthorn formation. The Hawthorn formation was encountered at approximately 80 feet bgs during drilling of the RFI monitoring wells. The surficial aquifer is separated from the potable supply aquifer by the Hawthorn formation. The Hawthorn formation is reportedly 380 to 530 feet thick in the 1989 "U.S. Geological Survey Professional Paper 1403-D." This publication discusses the hydrogeology of the Floridan aquifer system in southeast Georgia.

The stratigraphy and groundwater analytical data do not indicate that the potable aquifer is likely to be affected by contaminants in groundwater at the site. This can be evaluated further using data obtained from the newly installed monitoring wells, after they are sampled. The depths of the monitoring wells range from 20 to 96 feet bgs. Each monitoring well has a 10-foot screened interval. An array of 25 monitoring wells was designed to provide data within and below the plume.

If you have any further questions concerning the response to comments, please contact me at 615-531-1922.

Respectfully,

ABB ENVIRONMENTAL SERVICES, INC.



Frank B. Cater, P.E.

mlv (8503.007)032/93

pc: John Garner
David Driggers
Ed Lohr
CTO 094 Files

Attachment 1

**Meeting Minutes
5 November 1993**

Meeting Minutes
City of St. Marys' POTW

Date: 5 November 1993

Location: Mayes, Sudderth, and Etheredge offices
Atlanta, Georgia

Attendees: Tom Holbrook - MSE
Tom Bailey - MSE
Valerie Rule - MSE
Jan Sointion - MSE

The minutes are not intended to be an exact transcript of the meeting, but are presented to summarized pertinent conversations and resulting actions.

The topic of discussion was the Point Peter POTW discharge request letter written to Mike Mahaney in October 1993 and the resulting comments from MSE regarding this request. Each item in their letter was discussed and is summarized below.

1. During peak loads, hydraulic loading to the POTW can easily be shared with the City's Weed Street Plant, which does not operate near capacity.

2a) MSE wants to evaluate full analytical on groundwater at the depth of the recovery well capture zone before approving use of the facility. ABB-ES discussed the past testing performed and pumping test analytical and how indications were that the concentrations appeared to be less than anticipated. Their concern is complete characterization of the capture zone. ABB-ES discussed the RFI monitoring well testing planned. ABB-ES suggested that they ask if they would accept results from any analytical that we propose to do beforehand. This would prevent the possibility that they do not accept proposed analyses as nonrepresentative.

ABB-ES discussed the engineering parameters analyzed to date. MSE requested that parameters from additional locations be collected.

2b) Periodic groundwater sampling - ABB-ES explained that groundwater characterization is part of the ongoing RFI. Additionally, the purpose of the IM is not groundwater cleanup; therefore, the quality of the groundwater over time (other than as it enters the treatment system) is not an issue to be resolved at this moment.

2c) Operating Controls - MSE would accept daily monitoring of an indicator parameter in lieu of effluent retention. Their desire is to detect new plume characteristics before they enter the system. They requested that the indicator parameter chosen be sensitive enough to indicate contaminants in the range of 100s of $\mu\text{g}/\text{l}$. ABB-ES will look into the sensitivity of TOC, BOD, COD, etc. as possibilities. This monitoring should be combined with a contingency plan of how exceedances of monitoring parameters will be addressed.

If daily monitoring of an indicator parameter is performed, other operational monitoring of pH, TOC, etc. will not be critical.

- 3) ABB-ES explained a schedule of:
 - Phase 1 - six weeks
 - Phase 1 continuance - 8 months
 - Phase 2 - up to 5 years
 - Corrective Action - may or may not include groundwater extraction

MSE explained that approval for 5 years at potentially higher flows is difficult since the system would take 11 percent of their capacity and additional requirements by city growth, etc. would take precedence. ABB-ES explained that if they approved only 1 year, at least ABB-ES would have the time to apply for an NPDES permit or evaluate other options if needed.

- 4) Cost recovery was not discussed between ABB-ES and MSE.
- 5) ABB-ES explained that they did not state that the city would not be subject to RCRA or CERCLA liability. With treatment to MCLs before discharge to the POTW, this is not an issue anyway.

MSE has spoken with Mary Barcala of GA EPD Municipal Wastewater Program who states that the only permitting requirement is that the Navy apply for an Operating Permit (Consent Order) through the Industrial Wastewater Program. Per Ms. Barcala, no change to the POTW's permit is required.

Additional:

Treatability modeling was performed at 0.8 MGD; the model printout, but not the model calculation, evidently rounds this number to 1.0. Cis-1,2-DCE was modeled using a more conservative constituent to get removal efficiencies since this constituent was not included in the model's list of contaminants. The model was calibrated against empirical data from the POTWs used to generate the model's database, not the Point Peter Plant.

- 1) ABB-ES will determine how these points were chosen.
- 2) Analytical from private wells is in the RFI Interim Report.
- 3) Risk Assessment was discussed in detail. Comments from Marland Delaney are attached. Basically, MSE is satisfied that if EPA guidelines were followed and GA DNR has approved the Screening Risk assessment and conclusions. Randy Manning, Ph.D., Environmental Toxicology Coordinator for GA EPD (phone number: 404/656-4713), has approved the Risk Assessment.
- 4) ABB-ES explained that these wells are private wells that they do not have access to. Their concern is that these could present a conduit to the Floridian Aquifer.
- 5) This does not appear to be a big issue with MSE. ABB-ES explained that constituents were not detected below 85 feet, and the marl was defined as a confining layer of more than 200 feet, sufficient to protect the lower aquifer.

Attachment 2

Tables 1 through 9

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Attachment 2 - Tables

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Table 1 Appendix IX, Groundwater Monitoring List

Volatile Organic Compounds (58 total)
SW-846 Method 8240

Chloromethane	Tetrachloroethene
Bromomethane	1,1,2,2-Tetrachloroethane
Vinyl Chloride	Toluene
Chloroethane	Chlorobenzene
Methylene Chloride	Ethylbenzene
Acetone	Styrene
Carbon Disulfide	Xylene (total)
Trichlorofluoromethane	1,3-Dichlorobenzene
1,1-Dichloroethene	1,4-Dichlorobenzene
1,1-Dichloroethane	1,2-Dichlorobenzene
1,2-Dichloroethene (total)	Acrolein
Chloroform	Iodomethane
1,2-Dichloroethane	Acrylonitrile
2-Butanone	Dibromomethane
1,1,1-Trichloroethane	Ethyl Methacrylate
Carbon Tetrachloride	1,2,3-Trichloropropane
Vinyl Acetate	trans-1,4-Dichloro-2-Butene
Bromodichloromethane	Acetonitrile
1,2-Dichloropropane	3-Chloropropene
cis-1,3-Dichloropropene	Propionitrile
Trichloroethene	Methacrylonitrile
Dibromochloromethane	1,4-Dioxane
1,1,2-Trichloroethane	Methyl Methacrylate
Benzene	1,2-Dibromoethane
trans-1,3-Dichloropropene	1,1,1,2-Tetrachloroethane
2-Chloroethylvinylether	1,2-Dibromo-3-Chloropropane
Bromoform	Pentachloroethane
2-Hexanone	Isobutyl alcohol
4-Methyl-2-Pentanone	Chloroprene

Semivolatile Organic Compounds (acid fraction)
SW-846 Method 8270 (18 total)

Phenol	2,4-Dichlorophenol
2,6-Dichlorophenol	4-Chloro-3-Methylphenol
2-Chlorophenol	2,4,6-Trichlorophenol
2-Methylphenol	2,4,5-Trichlorophenol
2,3,4,6-Tetrachlorophenol	2,4-Dinitrophenol
3-Methylphenol	4-Nitrophenol
4-Methylphenol	4,6-Dinitro-2-Methylphenol
2-Nitrophenol	2,4-Dimethylphenol
Benzoic Acid	Pentachlorophenol

Semivolatile Organic Compounds (base/neutral fraction)
SW-846 Method 8270 (93 total)

N-Nitrosodimethylamine	Di-n-Octyl Phthalate
Aniline	Benzo (b) Fluoranthene
bis (2-Chloroethyl) Ether	Benzo (k) Fluoranthene
1,3-Dichlorobenzene	Benzo (a) Pyrene
1,4-Dichlorobenzene	Indeno (1,2,3-cd) Pyrene
Benzyl Alcohol	Dibenz (a,h) Anthracene
1,2-Dichlorobenzene	Benzo (g,h,i) Perylene
bis (2-Chloroisopropyl) Ether	2-Picoline
N-Nitroso-Di-n-Propylamine	Methyl methanesulfonate
Hexachloroethane	Ethyl methanesulfonate
Nitrobenzene	Acetophenone
Isophorone	N-Nitrosopiperidine
bis (2-Chloroethoxy) Methane	Phenyl-tert-butylamine
1,2,4-Trichlorobenzene	N-Nitroso-di-n-butylamine
Naphthalene	N-Nitrosodiethylamine
4-Chloroaniline	N-Nitrosopyrrolidine
Hexachlorobutadiene	Benzidine
2-Methylnaphthalene	1,2,4,5-Tetrachlorobenzene
Hexachlorocyclopentadiene	Pentachlorobenzene
2-Chloronaphthalene	1-Naphthylamine
2-Nitroaniline	2-Naphthylamine
Dimethylphthalate	Diphenylamine
Acenaphthylene	Phenacetine
2,6-Dinitrotoluene	4-Aminobiphenyl
3-Nitroaniline	Pentachloronitrobenzene
Acenaphthene	Pronamide
Dibenzofuran	p-Dimethylaminoazobenzene
2,4-Dinitrotoluene	3-Methylcholanthrene
Diethylphthalate	7,12-Dimethylbenz (a) Anthracene
4-Chlorophenyl-phenylether	Pyridine
Fluorene	N-Nitrosomethylethylamine
4-Nitroaniline	N-Nitrosomorfoline
N-Nitrosodiphenylamine	o-Toluidine
1,2-Diphenylhydrazine	Hexachloropropene
4-Bromophenyl-phenylether	p-Phenylenediamine
Hexachlorobenzene	Safrole
Aramite	Isosafrole
Phenanthrene	1,4-Napthoquinone
Anthracene	1,3-Dinitrobenzene
Di-n-Butylphthalate	5-Nitro-o-toluidine
Fluoranthene	1,3,5-Trinitrobenzene
Pyrene	4-Nitroquinoline-1-oxide

Semivolatile Organic Compounds (base/neutral fraction) (Continued)
SW-846 Method 8270 (93 total)

Butylbenzylphthalate	Methapyrilene
3,3'-Dichlorobenzidine	3,3'-Dimethylbenzidine
Benzo(a)Anthracene	2-Acetamidofluorene
Chrysene	Hexachlorophene
bis(2-Ethylhexyl)Phthalate	

Chlorinated Dibenzofurans and Dibenzo-p-dioxins
SW-846 Method 8280 (7 total)

Tetrachlorodibenzo-p-dioxins (TCDDs) (total)
2,3,7,8- TCDD (total)
Pentachlorodibenzo-p-dioxins (PeCDDs) (total)
Hexachlorodibenzo-p-dioxins (HeCDDs) (total)
Tetrachlorodibenzofurans (TCDFs) (total)
Pentachlorodibenzofurans (PeCDFs) (total)
Hexachlorodebenzofurans (HeCDFs) (total)

Organochlorine Pesticide and PCB Compounds (30 total)
SW-846 Method 8080

alpha-BHC	4,4'-DDT
beta-BHC	Methoxychlor
delta-BHC	Chlordane
gamma-BHC (Lindane)	Toxaphene
Heptachlor	Aroclor-1016
Aldrin	Aroclor-1221
Heptachlor epoxide	Aroclor-1232
Endosulfan I	Aroclor-1242
Dieldrin	Aroclor-1248
4,4'-DDE	Aroclor-1254
Endrin	Aroclor-1260
Endosulfan II	Kepone
4,4'-DDD	Chlorobenzilate
Endrin aldehyde	Diallate
Endosulfan Sulfate	Isodrin

Organophosphorous Pesticide Compounds (9 total)
SW-846 Method 8140

Triethylphosphorothioate	Disulfoton
Thionazin	Methyl Parathion
Sulfotepp	Ethyl Parathion
Phorate	Famphur
Dimethoate	

Chlorinated Herbicide Compounds (4 total) SW-846 Method 8150			
2,4-D	Silvex	2,4,5-T	Dinoseb
Inorganic Analytes (19 total) SW-846 Methods			
Antimony	Copper	Thallium	
Arsenic	Lead	Vanadium	
Barium	Mercury	Zinc	
Beryllium	Nickel	Tin	
Cadmium	Selenium	Cyanide	
Chromium	Silver	Sulfide	
	Cobalt		

Table 2 Summary of Volatile Organic Compound and Semivolatile Organic Compound Analytical Data for the RFI Groundwater Monitoring Program at Site 11

Monitoring Well I.D.	SVOCs Detected	VOCs Detected	Concentration Range ($\mu\text{g/l}$)	Associated Sample Events
KBA-11-1	None	None		
KBA-11-2	None	vinyl chloride	18 - 160	1,2,3,4,5,6
		1,2-dichloroethene	4.8 - 22	1,2,3,4,5,6
		ethylbenzene	1 J	5
		toluene	1 J - 3 J	2,4,5,6
		xylene (total)	2 J - 4 J	2,3,5,6
		1,4-dichlorobenzene	1 J	5
		chloroethane	3 J - 5 J	3,5
		methylene chloride	3.3	4
		trichloroethene	1 J	2
		tetrachloroethene	1 J	2
		chloroform	4 J	1
KBA-11-3	1,4-dichlorobenzene	chlorobenzene	3 J - 6	1,2,3,4,5,6
		1,4-dichlorobenzene	4 - 28	1,2,4,5,6
		1,3-dichlorobenzene	15	2,3
		bis(2-ethylhexyl) phthalate	31	2
KBA-11-4		None		
KBA-11-5		xylene (total)	2	1
		1,4-dichlorobenzene	1 J - 2 J	1,2,3,4
		bis(2-ethylhexyl) phthalate	4 J	2
KBA-11-6		xylene (total)	2	1
		1,4-dichlorobenzene	1 J - 2 J	1,2,3,4,6
		bis(2-ethylhexyl) phthalate	5 J	2
KBA-11-7	bis(2-ethylhexyl) phthalate	None	94	1

See notes at end of table.

Table 2 (Continued)

Summary of Volatile Organic Compound and Semivolatile
Organic Compound Analytical Data for the RFI Groundwater
Monitoring Program at Site 11

Monitoring Well I.D.	SVOCs Detected	VOCs Detected	Concentration Range ($\mu\text{g/l}$)	Associated Sample Events
KBA-11-8		vinyl chloride	2 J	1
		ethylbenzene	1 J	1
		xylene (total)	5	1
		chloroethane	2 J	2
		diethylphthalate	9 J	1
KBA-11-9		xylene	3 J	1

Notes:

$\mu\text{g/l}$ = micrograms per liter
 J = estimated concentration
 VOC = volatile organic compound
 SVOC = semivolatile organic compound

Source:

ABB-ES, 1993a.

Table 3 Summary of Inorganic Analytical Data for the RFI Groundwater Monitoring Program at Site 11

Analyte	MCL (µg/l)	Non-filtered Groundwater			Filtered Groundwater			
		Concentrations (µg/l) Low	High ¹	Frequency Above MCL ^{2,3}	No. Locations Above MCL ²	Concentrations (µg/l) Low	High	Frequency Above MCL ³
Antimony	6	(11.1)	(11.4)	(2/2) 0/0	(2) 0	ND	ND	0/0
Arsenic	50	1.1	(89) 10.3	(1/34) 0/27	(1) 0	0.68	2.5	0/12
Barium	2,000	11.1	(617) 158	(0/54) 0/45	None	4.4	37.9	0/22
Beryllium	4	0.26	(10.2) 4.0	(6/51) 1/42	(6) 1	0.24	0.25	0/2
Cadmium	5	1.3	7.1	(1/8) 1/7	(1) 1	2.8	3.9	0/5
Chromium	100	8.1	(620) 157	(12/45) 4/36	(8) 3	2.6	9.0	0/4
Cobalt	NA	1.6	(16.8) 6.1	NA	None	1.8	2.9	NA
Copper	1,300	3.1	(384) 239	(0/48) 0/42	None	2.6	52.4	0/13
Lead	15	2.9	87.2	(16/53) 8/44	(8) 6	0.98	10.1	0/20
Mercury	2	0.11	4.1	(2/26) 1/18	(2) 1	ND	ND	0/0
Nickel	100	5.7	(107) 89.1	(1/29) 0/20	(1) 0	6.5	11.0	0/4
Selenium	50	0.55	(26.0) 6.4	(0/33) 0/25	None	ND	ND	0/0
Silver	NA	1.5	10.1	NA	None	2.0	2.5	NA
Thallium	2	1.6	1.6	(0/1) 0/1	None	ND	ND	0/0
Vanadium	NA	5.4	(314) 82.5	NA	None	1.4	6.2	NA
Zinc	NA	17.3	555	NA	None	8.4	77.0	NA
Cyanide	200	0.98	26.2	(0/15) 0/12	None	1.1	3.7	0/10
Sulfide	NA	100	(3,400) 2,900	NA	None	100	300	NA
TDS	NA	16	2,110	NA	None	Not Analyzed		
TSS	NA	92	1,090	NA	None	Not Analyzed		

Notes: µg/l = micrograms per liter
MCL = Maximum Contaminant Level

TDS = total dissolved solids
TSS = total suspended solids

Source: ABB-ES, 1993a.

¹ If the high concentration for the six sampling events occurred in sample event 1, it is shown in parentheses, otherwise the high concentration did not occur during sample event 1.

² Numbers in parentheses indicate summary of sample events 1 through 6. Numbers without parentheses indicate summary of sample events 2 through 6.

³ Number of detections above MCL/total number of detections.

Table 4 Summary of On-site Analytical Data for Groundwater Samples Collected during the Phase I Interim Investigation and the Interim Corrective Measure Screening Investigation

Chemical Detected	MCL ($\mu\text{g/l}$)	Number of Detections/Number of Samples ¹	Concentration Range ($\mu\text{g/l}$)	Frequency Above MCL
Volatile Organic Compounds				
Benzene	5	24/102	1.0 - 28	17/24
cis-1,2-Dichloroethene	70	56/125	1.3 - 1,100	10/56
trans-1,2-Dichloroethene	100	9/125	5.0 - 21	0/9
Ethyl benzene	700	24/102	2.7 - 200	0/24
Tetrachloroethene	5	8/125	3.2 - 24	7/8
Toluene	1,000	42/102	4.0 - 430	0/42
Trichloroethene	5	4/125	5.9 - 45	4/4
Xylenes (total)	10,000	31/102	2.1 - 155	0/31
Vinyl chloride	2	113/125	1.1 - 1,400	112/113
Total Volatile Organic Compounds	NA	NA	1.0 - 1537	NA

Notes:

$\mu\text{g/l}$ = micrograms per liter
MCL = Maximum Contaminant Level
NA = Not Applicable

¹ The total number of samples includes those samples that contained at least one or more volatile organic compounds.

Sources:

ABB-ES, 1992.
ABB-ES, 1993c.

Table 5 Summary of Off-site Analytical Data for Groundwater Samples Collected during the Phase I Interim Investigation and the Interim Corrective Measure Screening Investigation

Chemical Detected	MCL (µg/l)	Number of Detections/Number of Samples ¹	Concentration Range (µg/l)	Frequency Above MCL
Volatile Organic Compounds				
Acetone	NA	11/49	6 - 800	NA
Benzene	5	7/49	1.7 - 5	2/7
Bromomethane	NA	1/49	1.5	NA
2-Butanone (methyl ethyl ketone)	NA	6/49	24 - 580	NA
Chlorobenzene	100	2/49	2.3 - 10	0/2
Chloroform	NA	1/49	3	NA
Carbon Disulfide	NA	6/49	1 - 250	NA
1,2-Dichlorobenzene	600	1/49	6.4	0/1
1,4-Dichlorobenzene	75	4/49	1.8 - 12	0/4
Dichlorodifluoromethane	NA	1/49	5.3	NA
1,1-Dichloroethane	NA	8/49	2 - 100	NA
1,1-Dichloroethene	7	1/49	3.9	0/1
1,2-Dichloroethane	5	1/49	9	1/1
cis-1,2-Dichloroethene	70	13/49	1 - 3,600	3/13
trans-1,2-Dichloroethene	100	2/49	1 - 23	0/2
1,2-Dichloropropane	5	2/49	1 - 6	1/2
Ethylbenzene	700	10/49	2 - 41	0/10
2-Hexanone (methyl butyl ketone)	NA	4/49	16 - 70	NA
Methylene chloride	5	3/49	3 - 41	2/3
4-Methyl-2-pentanone	NA	7/49	12 - 110	NA
Tetrachloroethene	5	1/49	3	0/1
Toluene	1,000	9/49	2 - 840	0/9
Trichloroethene	5	6/49	3 - 45	2/6
Xylenes (total)	10,000	9/49	1 - 120	0/9
Vinyl chloride	2	7/49	1.4 - 310	6/7
Semivolatile organic compounds				
2,4-Dimethylphenol	NA	1/2	280	NA
2-Methylphenol	NA	1/2	7	NA
4-Methylphenol	NA	1/2	120	NA

See notes at end of table.

Table 5 (Continued)

Summary of Off-site Analytical Data for Groundwater Samples Collected during the Phase I Interim Investigation and the Interim Corrective Measure Screening Investigation

Chemical Detected	MCL ($\mu\text{g/l}$)	Number of Detections/Number of Samples ¹	Concentration Range ($\mu\text{g/l}$)	Frequency Above MCL
Diethylphthalate	NA	2/2	2 - 50	NA
Naphthalene	NA	1/2	20	NA

Notes:

$\mu\text{g/l}$ = micrograms per liter
MCL = Maximum Contaminant Level
NA = Not Applicable

¹ The total number of samples includes those samples that contained at least one or more volatile organic compounds.

Sources:

ABB-ES, 1992.
ABB-ES, 1993c.

Table 6 Summary of Analytical Data for Samples Collected for Pretreatment Evaluation

Analyte	KBA-11-10 Unfiltered 7-1-93 (µg/l)	KBA-11-10 Filtered 7-1-93 (µg/l)	KBA-RW-01 10-26-93 (µg/l)	KBA-RW-01 Duplicate 10-26-93 (µg/l)
Aluminum	32,800	272		
Antimony	20.2 U	20.2 U		
Arsenic	9.2 J	2.9 J		
Barium	87.1 J	53.3 J		
Beryllium	0.61 J	0.41 J		
Cadmium	2.6 U	2.6 U	<5	<5
Calcium	71,800	68,200		
Chromium	24.2	2.5 U	<10	<10
Cobalt	4.8 U	4.8 U		
Copper	8.7 J	2.6 J		
Iron	55,600	47,500	1,610	1,620
Lead	3.9	1.4 J	<3	<3
Magnesium	17,400	17,500		
Manganese	434	405	31	31
Mercury	0.41	0.08 J		
Nickel	11.7 J	9.2 U		
Potassium	16,200	12,700		
Selenium	3.4 J	1.6 U		
Silver	2.4 U	2.9 J		
Sodium	10,600	10,800		
Thallium	1.6 J	1.3 U		
Vanadium	19.0 J	2.0 U		
Zinc	133	20.9		

See notes at end of table.

Table 6 (Continued)

Summary of Analytical Data for Samples Collected for Pretreatment Evaluation

Parameter	KBA-11-10	KBA-11-10	KBA-RW-01 10-26-93 (mg/l)	KBA-RW-01 Duplicate 10-26-93 (mg/l)
	Unfiltered 7-1-93 (mg/l)	Filtered 7-1-93 (µg/l)		
Alkalinity (as CaCO ₃)	296			
Hardness, Total (as CaCO ₃)	251		38	39
Total Dissolved Solids	319		178	172
Total Suspended Solids	510		2.7	9.8
Volatile Suspended Solids	174			
Total Volatile Solids	619			
Total Solids	830			
Chloride	1.9		65	65
Sulfate	26			
Sulfide	1.1			
Ammonia (as N)	18.0			
Nitrate and Nitrite (as N)	<0.02			
Kjeldahl Nitrogen (as N)	18.9			
BOD (5 day)	14.3			
BOD (20 day)	33			
COD	200			
Grease and Oil Li-Li	18.0			
TOC - Liquid	54.6		22.5	19.6

Notes:

BOD = biochemical oxygen demand
 CaCO₃ = calcium carbonate
 COD = chemical oxygen demand
 J = estimated concentration
 µg/l = micrograms per liter
 mg/l = milligrams per liter
 N = nitrogen
 TOC = total organic carbon
 U = not detected

The list uses a different measurement increment starting with alkalinity.

Table 7 Target Compound List and Target Analyte List

Parameter: Volatile Organic Compounds
 Method: Contract Laboratory Program Statement of Work for Organic Analysis,
 Multi-media, Multi-concentration.

Chloromethane	cis-1,3-Dichloropropene
Bromomethane	Trichloroethene
Vinyl Chloride	Dibromochloromethane
Chloroethane	1,1,2-Trichloroethane
Methylene Chloride	trans-1,3-Dichloropropene
Acetone	Bromoform
Carbon Disulfide	2-Hexanone
1,1-Dichloroethene	4-Methyl-2-Pentanone
1,1-Dichloroethane	Tetrachloroethene
1,2-Dichloroethene (total)	1,1,2,2-Tetrachloroethane
Chloroform	Toluene
1,2-Dichloroethane	Benzene
2-Butanone	Chlorobenzene
1,1,1-Trichloroethane	Ethylbenzene
Carbon Tetrachloride	Styrene
Bromodichloromethane	Xylene (total)
1,2-Dichloropropane	

Parameter: Semivolatile Organic Compounds
 Method: Contract Laboratory Program Statement of Work for Organic Analysis,
 Multi-media, Multi-concentration.

Phenol	Acenaphthene
bis(2-Chloroethyl) ether	2,4-Dinitrophenol
2-Chlorophenol	4-Nitrophenol
1,3-Dichlorobenzene	Dibenzofuran
1,4-Dichlorobenzene	2,4-Dinitrotoluene
1,2-Dichlorobenzene	Diethylphthalate
2-Methylphenol	4-Chlorophenyl-phenylether
2,2'-oxybis(1-Chloropropane)	Fluorene
4-Methylphenol	4-Nitroaniline
N-Nitroso-di-n-propylamine	4,6-Dinitro-2-methylphenol
Hexachloroethane	N-Nitrosodiphenylamine
Nitrobenzene	4-Bromophenyl-phenylether
Isophorone	Hexachlorobenzene
2-Nitrophenol	Pentachlorophenol
2,4-Dimethylphenol	Phenanthrene
bis(2-Chloroethoxy) methane	Anthracene
2,4-Dichlorophenol	Carbazole
1,2,4-Trichlorobenzene	Di-n-butylphthalate
Naphthalene	Fluoranthene

See note at end of table.

Table 7 (continued) Target Compound List and Target Analyte List

Parameter: Semivolatile Organic Compounds (Continued)

4-Chloroaniline	Pyrene
Hexachlorobutadiene	Butylbenzylphthalate
4-Chloro-3-methylphenol	3,3'-Dichlorobenzidine
2-Methylnaphthalene	Benzo(a)anthracene
Hexachlorocyclopentadiene	Chrysene

Parameter: Semivolatile Organic Compounds - continued

Method: Contract Laboratory Program Statement of Work for Organic Analysis, Multi-media, Multi-concentration.

2,4,6-Trichlorophenol	bis(2-Ethylhexyl)phthalate
2,4,5-Trichlorophenol	Di-n-octyl phthalate
2-Chloronaphthalene	Benzo(b)fluoranthene
2-Nitroaniline	Benzo(k)fluoranthene
Dimethylphthalate	Benzo(a)pyrene
Acenaphthylene	Indeno(1,2,3-cd)pyrene
2,5-Dinitrotoluene	Dibenz(a,h)anthracene
3-Nitroaniline	Benzo(g,h,i)perylene

Parameter: Organochlorine Pesticide and PCB Compounds

Method: Contract Laboratory Program Statement of Work for Organic Analysis, Multi-media, Multi-concentration.

alpha-BHC	Endosulfan sulfate
beta-BHC	4,4'-DDT
delta-BHC	Methoxychlor
gamma-BHC (Lindane)	gamma-Chlordane
Heptachlor	alpha-Chlordane
Aldrin	Toxaphene
Heptachlor epoxide	Aroclor-1016
Endosulfan I	Aroclor-1221
Dieldrin	Aroclor-1232
4,4'-DDE	Aroclor-1242
Endrin	Aroclor-1248
Endosulfan II	Aroclor-1254
4,4'-DDD	Aroclor-1260
Endrin aldehyde	

Parameter: Inorganic Analytes

Method: Contract Laboratory Program Statement of Work for Inorganic Analysis

Aluminum	Cobalt	Potassium
Antimony	Copper	Selenium
Arsenic	Iron	Silver
Barium	Lead	Sodium
Beryllium	Magnesium	Thallium

See note at end of table.

Table 7 (continued) Target Compound List and Target Analyte List

Parameter: Inorganic Analytes (Continued)

Cadmium	Manganese	Vanadium
Chromium	Mercury	Zinc
Calcium	Nickel	Cyanide

Note:

PCBs = polychlorinated biphenyls

Table 8 Summary of Organic Analysis of Groundwater Samples Collected from Interim Measure Recovery Wells - November 1993

Chemical Detected	MCL ($\mu\text{g/l}$)	Number of Detections/Number of Samples ¹	Concentration Range ($\mu\text{g/l}$)	Frequency Above MCL
Volatile Organic Compounds				
Acetone	NA	4/4	10 - 190	NA
Benzene	5	4/4	1 - 4	0/4
2-Butanone (methyl ethyl ketone)	NA	1/4	190	NA
Chlorobenzene	100	2/4	2	0/2
1,1-Dichloroethane	NA	3/4	2 - 31	NA
1,1-Dichloroethene	7	1/4	2	0/1
1,2-Dichloroethene (total)	70	4/4	9 - 1,200	2/4
Ethylbenzene	700	4/4	3 - 65	0/4
2-Hexanone (methyl butyl ketone)	NA	1/4	40	NA
Methylene chloride	5	4/4	2 - 18	2/4
4-Methyl-2-pentanone	NA	2/4	250 - 1,400	NA
Tetrachloroethene	5	1/4	4	0/1
Toluene	1,000	4/4	6 - 95	0/4
Trichloroethene	5	2/4	2 - 44	1/2
Xylenes (total)	10,000	4/4	2 - 61	0/4
Vinyl chloride	2	3/4	2 - 44	3/3
Semivolatile organic compounds				
Phenol	NA	3/4	2 - 28	NA
2,4-Dimethylphenol	NA	1/4	26	NA
2-Methylphenol	NA	1/4	16	NA
4-Methylphenol	NA	3/4	15 - 340	NA
Diethylphthalate	NA	4/4	4 - 11	NA
Naphthalene	NA	2/4	2 - 15	NA

Notes:

$\mu\text{g/l}$ = micrograms per liter
MCL = Maximum Contaminant Level
NA = Not Applicable

¹ The total number of samples includes those samples that contained at least one or more volatile organic compounds.

Table 9 Summary of Inorganic Analysis of Groundwater Samples Collected from Interim Measure Recovery Wells - November 1993

Analyte Detected	MCL (µg/l)	Number of Detections/Number of Samples ¹	Concentration Range (µg/l)	Frequency Above MCL
Aluminum	NA	4/4	478 - 10,600	NA
Arsenic	50	4/4	1.2 - 5.5	0/4
Barium	2,000	4/4	32.4 - 94.9	0/4
Beryllium	4	1/4	0.80	0/1
Calcium	NA	4/4	5,680 - 13,500	NA
Chromium	100	4/4	3.4 - 17.4	0/4
Copper	1,300	1/4	4.5	0/1
Iron	NA	4/4	1,110 - 6,780	NA
Lead	15	2/4	0.46 - 5.4	0/2
Magnesium	NA	4/4	2,740 - 6,260	NA
Manganese	NA	4/4	35.4 - 92.1	NA
Nickel	100	3/4	9.5 - 10.7	0/3
Potassium	NA	4/4	3,700 - 24,400	NA
Sodium	NA	4/4	36,900 - 47,000	NA
Vanadium	NA	4/4	2.7 - 14.4	NA
Zinc	NA	4/4	13.5 - 823	NA
Cyanide	200	3/4	1.9 - 2.1	0/3
Sulfide	NA	4/4	1.8 - 22.7	NA

Notes:

µg/l = micrograms per liter
MCL = Maximum Contaminant Level
NA = Not Applicable

¹ The total number of samples includes those samples that contained at least one or more inorganic analytes.

Attachment 3

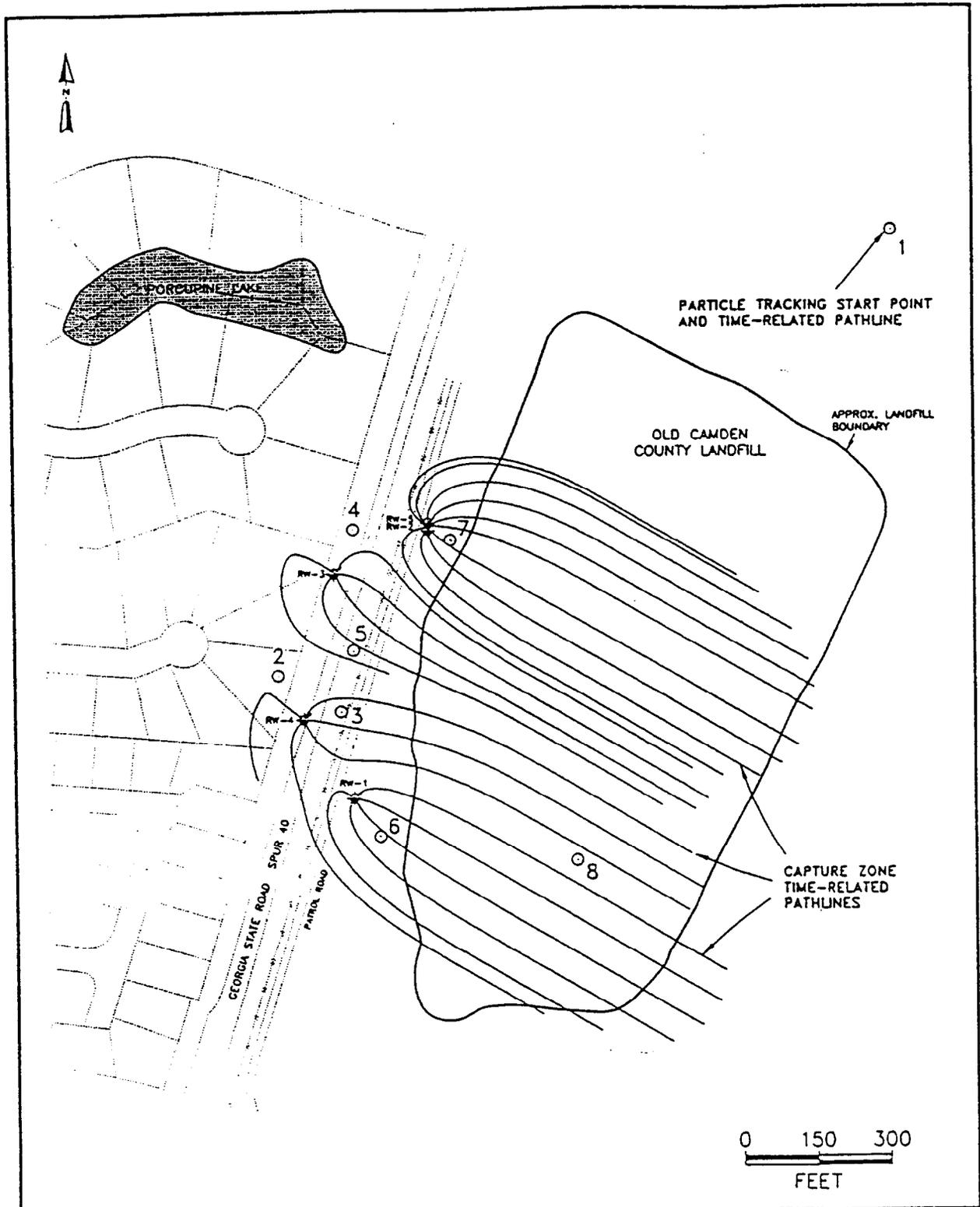
Figures 1 - 5

Capture Zone Plots

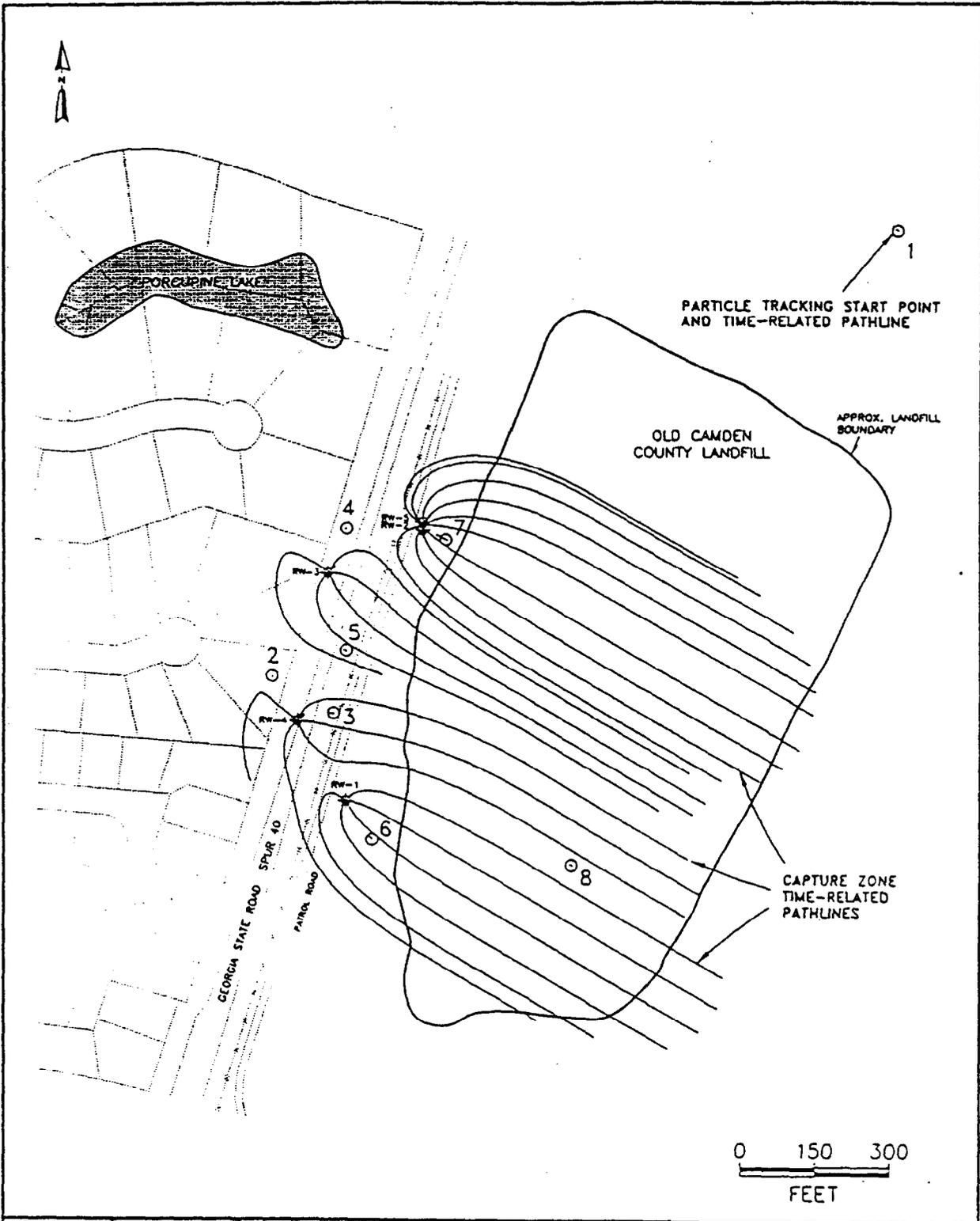
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Attachment 3 - Figures

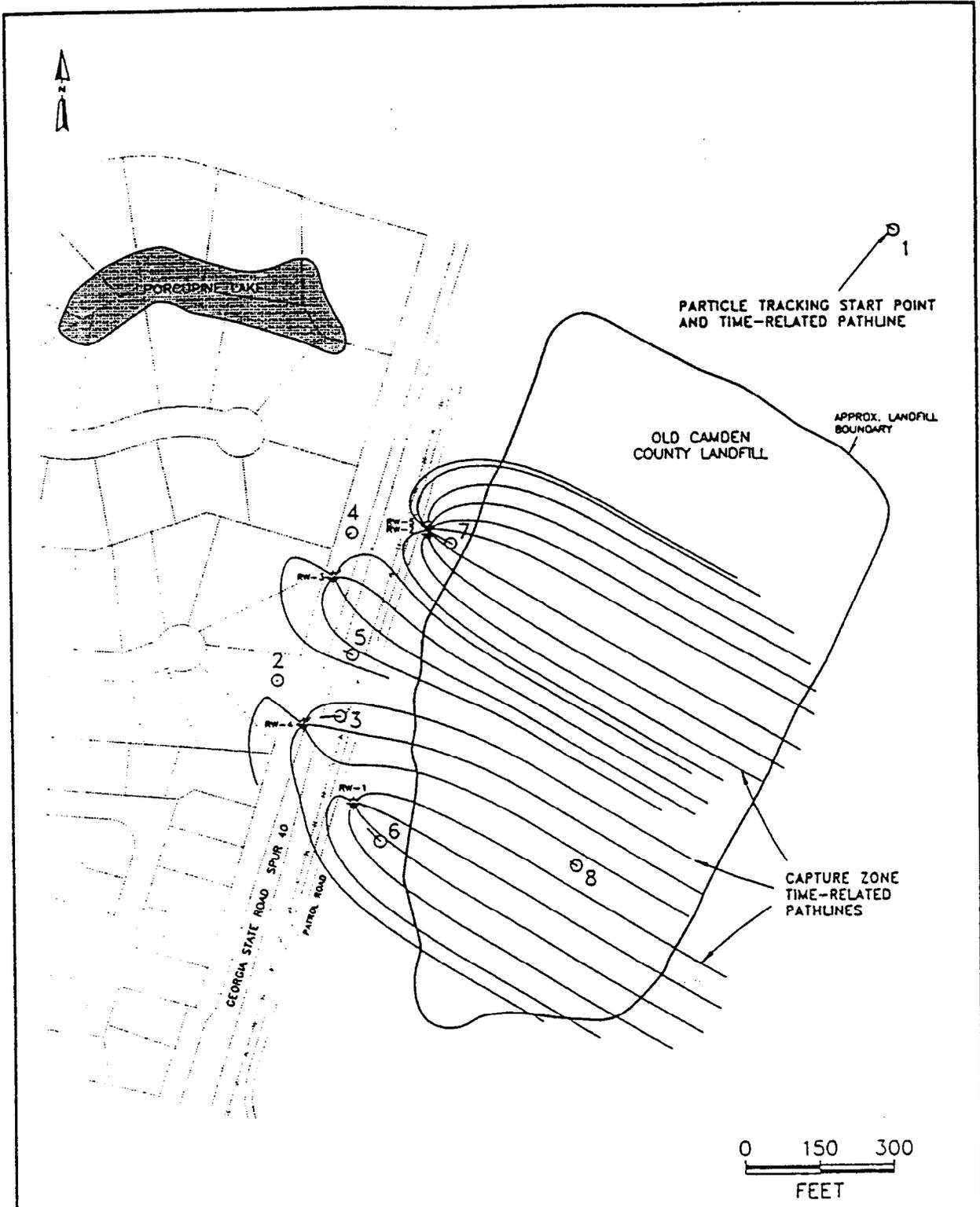
<u>TABLE</u>	<u>DESCRIPTION</u>	<u>PAGE NO.</u>
Figure 1	Particle Tracking Model 7-Day Simulation	Page 1
Figure 2	Particle Tracking Model 30-Day Simulation	Page 2
Figure 3	Particle Tracking Model 90-Day Simulation	Page 3
Figure 4	Particle Tracking Model 1-Year Simulation	Page 4
Figure 5	Particle Tracking Model 5-Year Simulation	Page 5



OWN: NLW	PROJECT NO.: 08503	TITLE: PARTICLE TRACKING MODEL 7 DAY SIMULATION	
CHKD: KDS	FIGURE NO.: 1		
DATE: 12/09/93			



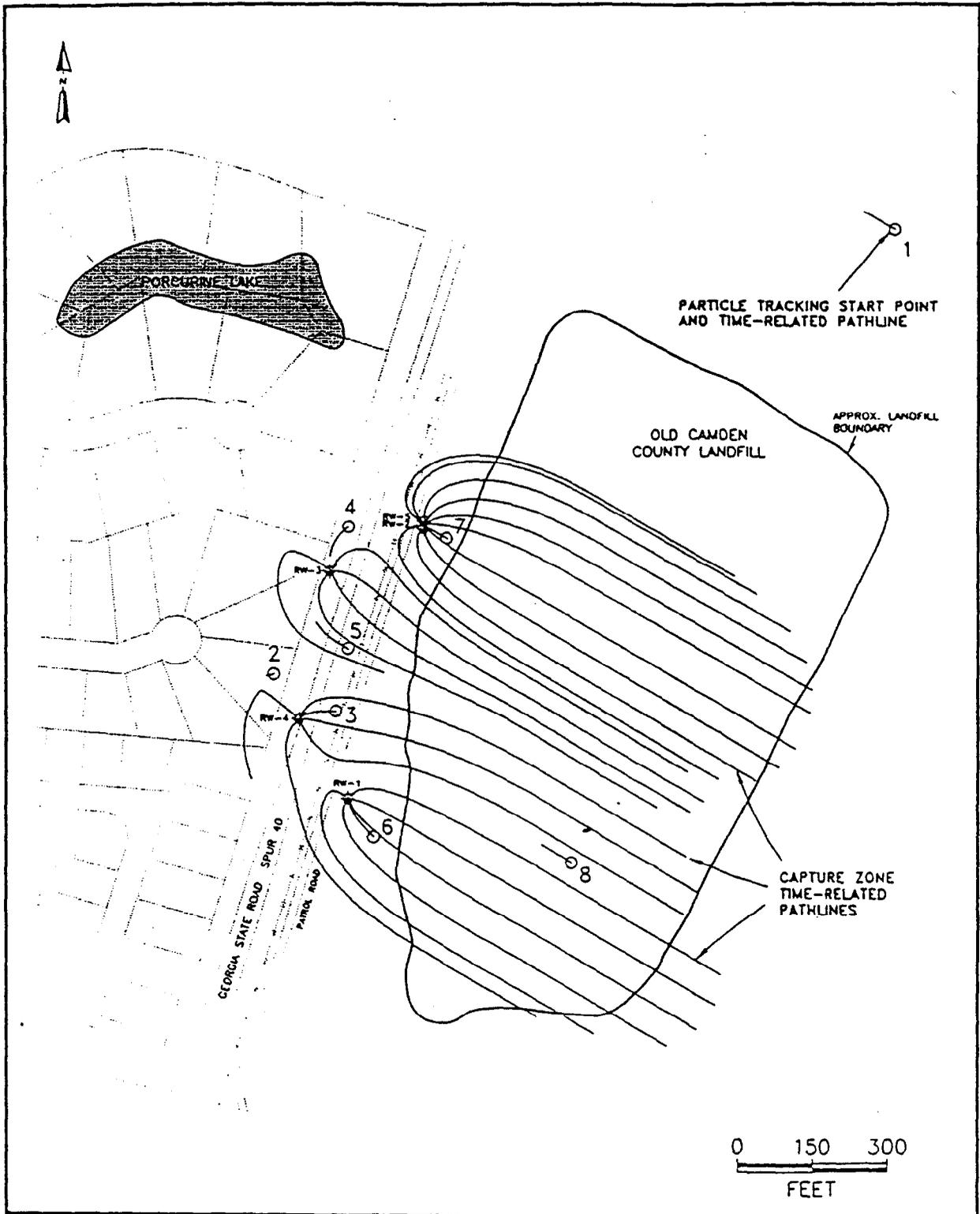
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CHKD: KDS	FIGURE NO.: 2		
DATE: 12/09/93			



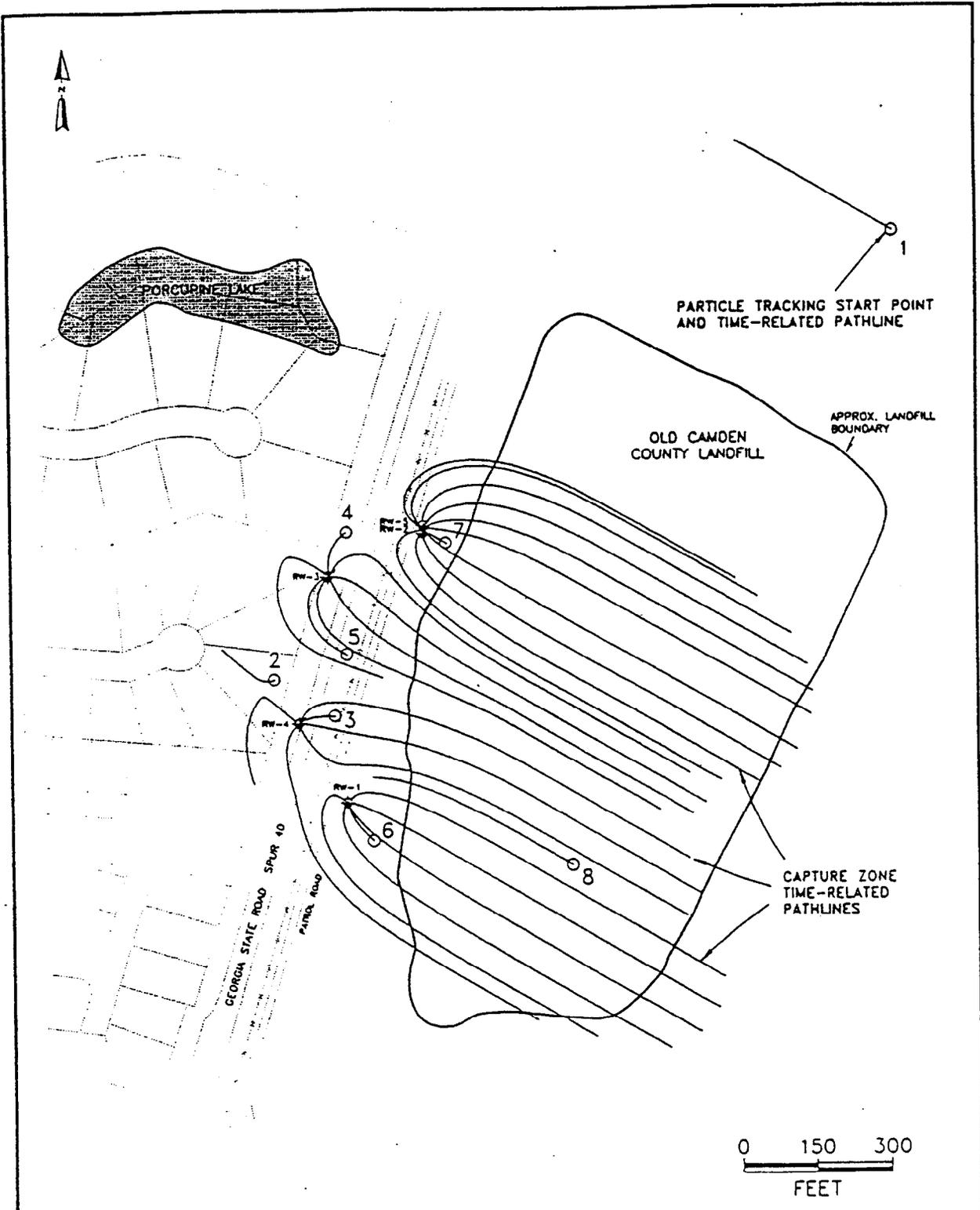
OWN: NLW	PROJECT NO.: 08503
CHKD: KDS	FIGURE NO.: 3
DATE: 12/09/93	

TITLE:
PARTICLE TRACKING MODEL
90 DAY SIMULATION





OWN: NLW	PROJECT NO.: 08503	TITLE: PARTICLE TRACKING MODEL 1 YEAR SIMULATION	 NAVAL SUBMARINE BASE KINGS BAY, GEORGIA
CHKD: KDS	FIGURE NO.: 4		
DATE: 12/09/93			



OWN:	PROJECT NO.:	TITLE:
NLW	08503	PARTICLE TRACKING MODEL 5 YEAR SIMULATION
CHKD:	FIGURE NO.:	
KDS	5	
DATE:		
12/09/93		

NAVAL SUBMARINE BASE
KINGS BAY, GEORGIA

