Florida Power & Light Company, 6501 S. Ocean Drive, Jensen Beach, FL 34957

FPL

November 30, 2005

Allen Hubbard, P.E.
Industrial Wastewater Section
Florida Department of Environmental Protection
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

RE: FPL – St. Lucie Plant
State IWW Permit # FL0002208
Request for Minor Revision Due to Minor Modification of Facility
Discharge of Dewatering Effluent Resulting From Dry Cask Storage Pad Construction

Dear Mr. Hubbard:

Attached please find the following items to support the request for a minor revision to the Florida Power & Light Company (FPL) St. Lucie Plant State IWW Permit Number FL0002208:

1) Four signed, sealed copies of DEP Form 62-620.910(9) "Application for a Minor Revision to a Wastewater Facility or Activity Permit" including Attachment 1 – Description of Proposed Minor Plant Modification Necessitating Minor Permit Revision with Figures and Appendices.

2) An FPL check (check no. 0938588) payable to the Florida Department of Environmental Protection for the $250 application fee.

If you have any questions or need additional information on this matter, please contact Ron Hix at (561) 691-7641.

Sincerely,

William Jefferson, Jr.
Vice President – St. Lucie Plant

Enclosures
Vppsl038

cc:
USNRC Document Control Desk
FDEP Tallahassee – Donnie McClougherty
FDEP - SE District - Tim Powell
FDEP – SE District – Paul Wierzbicki

C001

APPLICATION FOR A MINOR REVISION TO A WASTEWATER FACILITY OR ACTIVITY PERMIT

1. Instructions

a. In accordance with Rule 62-620.325, F.A.C., this form must be submitted to the appropriate Department district office or approved local program when requests for minor revisions to a permit or minor modifications to a facility are made by a permittee, except for transfer of a permit to a new permittee and addition of a major user of reclaimed water to a Part III reuse system. Application for transfer of a permit to a new permittee shall be made on DEP Form 62-620.910(11). Application for addition of a major user of reclaimed water shall be made on DEP Form 62-610.300(4)(a)1.
b. Each applicable item must be completed in full in order to avoid delay in processing of this form. Where attached sheets or other technical documentation are provided, indicate appropriate cross-references.
c. Three (3) copies of this application with supporting documentation shall be submitted with this form.
d. All information is to be typed or printed in ink. Dates are to be entered in MM/DD/YR format.
e. This application and attachments shall be signed in accordance with Rule 62-620.305, F.A.C. Also, as applicable, this application and all attachments shall be signed and sealed by a professional engineer registered in Florida in accordance with Rule 62-620.310, F.A.C.

2. Facility Information

a. Permit Number: FL0002208 b. Facility Identification Number: FL0002208
c. Project/Facility Name: FPL St. Lucie Steam Electric Power Plant
d. Contact Name: Ron Hix
Number and Street: 700 Universe Boulevard
City/State/Zip Code: Juno Beach, Florida 34997
Telephone (561) 691-7641

3. Type of Revision

☐ **Correct Typographical Errors**[1] - Submit one copy of each page of the permit showing revisions being requested.

☐ **Change Improvement Schedule**[1] - Provide a description of the improvement, a list of the dates to be revised, and a reason for the proposed change in each date.

☐ **Change Expiration Date of Permit**[1] - Provide the current and proposed expiration dates for the permit and the reasons for the proposed change.

☐ **Change Staffing Requirements**[2] - Describe the proposed change and submit justification for the change in accordance with Chapter 62-699, F.A.C.

[1]A processing fee is not required.
[2]A processing fee is required with the application in accordance with Rule 62-4.050, F.A.C.

☐ **Change Monitoring and Reporting Requirements**[2] - Describe the proposed change and submit justification for the change in accordance with Chapter 62-601, F.A.C.

☐ **Modify Approved Pretreatment Program**[1] - Describe the proposed modification and provide the information required by Rule 62-625.540, F.A.C.

☐ **Delete Point Source Outfall**[1] - Identify the outfall and explain why the outfall is being eliminated.

☐ **Modify or Expand Approved Residuals Land Application Sites**[2] - Attach a new or updated Agricultural Use or Dedicated Site Plan as required by Chapter 62-640, F.A.C.

☒ **Minor Modification to the Facility**[2] - Provide a description of the proposed modification. If applicable, attach any reports, plans, and specifications which have been developed to implement this modification.

☐ **Other**[2] - Provide appropriate documentation. Describe.

4. Certifications

a. Applicant or Authorized Representative

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this application and all attachments and that, based on my inquiry of persons immediately responsible for obtaining the information contained in the application, I believe that the information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

(Signature of Applicant or Authorized Representative[3]) — (Date) 11/30/2005

Name (please type) William Jeffereson, Jr. Company Name FPL
Title Vice President, St. Lucie Plant Company Address: 6451 S Ocean Drive
Phone: 772-467-7100 City/State/Zip Code: Jensen Beach, Florida 34957

b. Professional Engineer Registered in Florida

I certify that the engineering features of this project have been ~~(designed)~~ (examined) by me and found to conform to engineering principles applicable to such projects. In my professional judgement, this facility, when properly constructed, operated, and maintained, will comply with all applicable statutes of the State of Florida and rules of the Department.

Name (please type): Carl F. St.Cin
Florida Registration Number: 28556
Company Name: Tetra Tech EC, Inc.
Company Address: 759 S. Federal Highway, Suite 100
City/State/Zip Code: Stuart, Florida 34994
Phone Number: (772) 781-3412

CF St. Cin
11/30/05
28556
(Seal, Signature, Date, and Registration Number)

CARL F. ST. CIN LICENSE NO. 28556 STATE OF FLORIDA PROFESSIONAL ENGINEER

[3]If signed by the authorized representative, attach a letter of authorization in accordance Rule 62-620.305, F.A.C.

Attachment 1

Description of Proposed Minor Plant Modification Necessitating Minor Permit Revision

Description of Dry Cask Storage:

The Florida Power and Light Company (FPL) St. Lucie Nuclear Plant is located on Hutchinson Island, between Jensen Beach and Ft. Pierce, Florida (see Figure 1). Unit 1 has been in service since 1976, with Unit 2 commencing operation in 1983.

FPL is engaging in a project to construct a dry storage facility to store some of its used nuclear fuel. The facility, also known as an Independent Spent Fuel Storage Installation (ISFSI), is licensed and approved by the Nuclear Regulatory Commission. The St. Lucie ISFSI is needed because the current spent fuel pool storage facilities for St. Lucie Unit No. 1 will have reached maximum storage capacity in 2008. In an ISFSI, used fuel is placed into controlled environment, completely sealed, metal containers which are then loaded into 3-foot thick reinforced concrete storage units, known as storage casks. ISFSIs are currently licensed and operated at 25 nuclear plants around the country.

The St. Lucie Plant ISFSI will be comprised of a 450 foot square area located on the southern corner of the plant site (see Figure 2 for location). The construction of the "floor" for the ISFSI, a specially engineered concrete pad, is also strictly regulated by the NRC.

Reason for the Minor Plant Modification:

In order to ensure proper construction of the ISFSI and meet NRC requirements, the soil under the pad must be "improved". The existing soil will be excavated to a depth of approximately 18 feet and improved soil placed back into the excavated area. "Engineered" fill will then be added to achieve an elevation of 3-8 feet above current grade. In order to conduct the required excavation, the site must be dewatered. To conduct the dewatering; approximately 30 wells will be placed to a depth of approximately 40 feet. It is expected that, worst case (the final design has not yet been completed), the maximum initial dewatering flow will be approximately 4,500 gallons per minute (gpm), which, after reaching steady state within about two weeks, will be reduced to approximately 1,500 gpm for the duration of the dewatering (approximately 90-120 days). FPL is exploring the feasibility of various methods, such as using sheet piling on several, or all, of the sides of the dewatering area, to reduce the rate of dewatering. This dewatering effluent will be discharged to the plant's intake canal. The flow in the intake canal is approximately 1,000,000 gpm with both units operating and approximately 500,000 gpm with one unit operating. The effluent from dewatering will combine with the high volume of intake water, be routed through the plant to the plant's discharge canal, and then finally to the Atlantic Ocean.

Figure 3 shows the "worst case" Zone of Influence for the dewatering effort (see Appendix A, GZA Report, for specific information on the modeling used to obtain this information). Due to the close proximity of the intake canal, it is expected that, at steady state, approximately 70% of the dewatering effluent will actually be intake (Atlantic Ocean) water.

In addition, in the groundwater on the north side of the proposed site for the ISFSI, there exists a "mixed plume" of petroleum and chlorinated solvents (see Figure 4). Management of this mixed plume has been addressed in a 1999 Consent Order with the Waste Clean-up Section of the Southeast District DEP. At the present time, the remaining contaminant of concern is vinyl chloride. Recent sampling (June 2005) has indicated that Monitoring Wells 8 and 9 contain less than 1.0 µg/L of vinyl chloride, while Well 7a contained 1.2 µg/L of vinyl chloride and Well 12, 10 µg/L. FPL has evaluated various methods for ensuring that this mixed plume will not be significantly moved by and, therefore, impact the dewatering process. A Pump & Treat (P&T) approach will be employed to maintain the natural gradient of the plume and to intercept migrating VOCs for recovery followed by conventional treatment using air stripping. From 1 to 3 plume control wells will be placed on the north side of the project. These wells will be pumped at a combined rate of approximately 25 to200 gpm. This recovered, treated groundwater effluent will be sent to one of the on-site industrial wastewater treatment ponds and may eventually need to be discharged to the intake canal via existing outfall I-008.

Please note that measures associated with control of the mixed plume will be conducted under an Interim Remedial Action Plan that was submitted to the FDEP Southeast District, Waste Clean-up Section, on November 21, 2005.

Characterization of the Dewatering Effluent:

As estimated in the GZA Report, at least 70% of the total dewatering effluent is seepage drawn from the nearby Intake Canal by steep flow gradients that will be induced. For purposes of this analysis, the amount and constituent concentrations of dewatering effluent pumped to the Intake Canal that is assumed to be from Intake Canal seepage is not included as "new input" to the Intake Canal. Stated another way, this simplifying assumption says that Intake Canal water is drawn from the Canal into the dewatering wells and then returned to the Canal as dewatering pump effluent, without attenuation of the Intake Canal constituent concentrations. This is a conservative assumption that allows for a simplified analysis of impact to the Outfall D-001 Point of Discharge (POD).

In order to characterize the quality of the native groundwater component (approximately 30 percent of the total dewatering effluent, as estimated in the GZA Report) of the dewatering effluent, FPL used a direct push groundwater sampling technique ("Geo-probe") to collect representative samples from the area on which the ISFSI will be located. Samples were collected at depths of 25, 50 and 75 feet. Appendix B contains analytical results from these samples reported on Form 2CS. The values entered on Form 2CS represent the native groundwater component of the dewatering effluent, and are the maximum values from respective samples taken at the 3 depths. Further, the transient flow rate of 4,500 gpm is used as the basis for calculating the estimated concentration impacts at the Outfall D-001 POD.

Characterization of Mixed Plume "Pump and Treat" Effluent:

To characterize the quality of the mixed plume P&T effluent, FPL used the same samples described above, but used the higher of the values from the 25 and 50 foot samples for reporting on Form 2CS. Appendix C contains these results. These constituent concentrations are applied to 100 percent of the groundwater recovered by the plume control wells. For conservatism, it is assumed that the P&T system does not attenuate any constituent concentrations in the recovered groundwater. For additional conservatism, FPL assumes that the intermittent pumping rate of 1,900 gpm currently permitted at outfall I-008 be applied to the P&T effluent for estimating the short-term worst case concentration impacts at Outfall D-001 POD.

Projected Water Quality Impacts at Outfall D-001 POD:

Details of the approach and methodology for obtaining the following conclusions are found in Appendix D. Evaluation of this data indicates that dewatering effluent and P&T effluent, combined with other concurrent discharges to the intake and discharge canal, will at all times meet all applicable water quality standards for Class III marine waters at the plant's POD, located at the end of the discharge canal.

Chemicals to Be Used in the Pump and Treat System:

Due to the high "salt" (i.e., calcium and magnesium hardness , and iron) content of the groundwater on the site and the potential for the growth of iron reducing bacteria, several water treatment chemicals may be used to prevent the air strippers from scaling and fouling.

The chemicals proposed to be used are:

Redux 380 – A blended deposit (scaling) control agent

The P&T equipment vendor has proposed feeding Redux 380 at a rate of 35 mg/l. If the flow rate is 25 gpm, 1.15 gallons per day (gpd) at a rate of 0.048 gallons per hour (gph) is recommended. If the system flow rate is 200 gpm, 9.2 gpd at a rate of 0.38 gph is recommended.

Redux B-15 – a gluteraldehyde-based water treatment microbiocide

Based on the use of the Redux 380, the equipment vendor does not anticipate having to use a biocide and would only do so if needed. However, if required, B-15 would be fed at a rate of 17 to 40 fluid ounces of product per 1,000 gallons of water one (1) out of every seven (7) days, should slime growth appear. Because the half-life of B-15 is measured in hours, and aqueous hydrolysis of the chemical yields a simple dimmer that is non-biocidal and relatively non-toxic to aquatic organisms, no adverse impact is expected at the POD.

This is particularly true as the time frame for the P&T effluent to get from the south basin, to the southeast basin and finally from I-008 to the discharge canal would be days, rather than hours.

Since the discharge of the P&T effluent is scheduled to coincide with the spring, plant refueling outage, FPL proposes that the potential effect of these chemicals in the effluent be evaluated as part of the toxicity testing already required in the most recent St. Lucie Plant State IWW permit.

Appendices E and F respectively contain the product description, MSDSs and toxicological information for these two chemicals.

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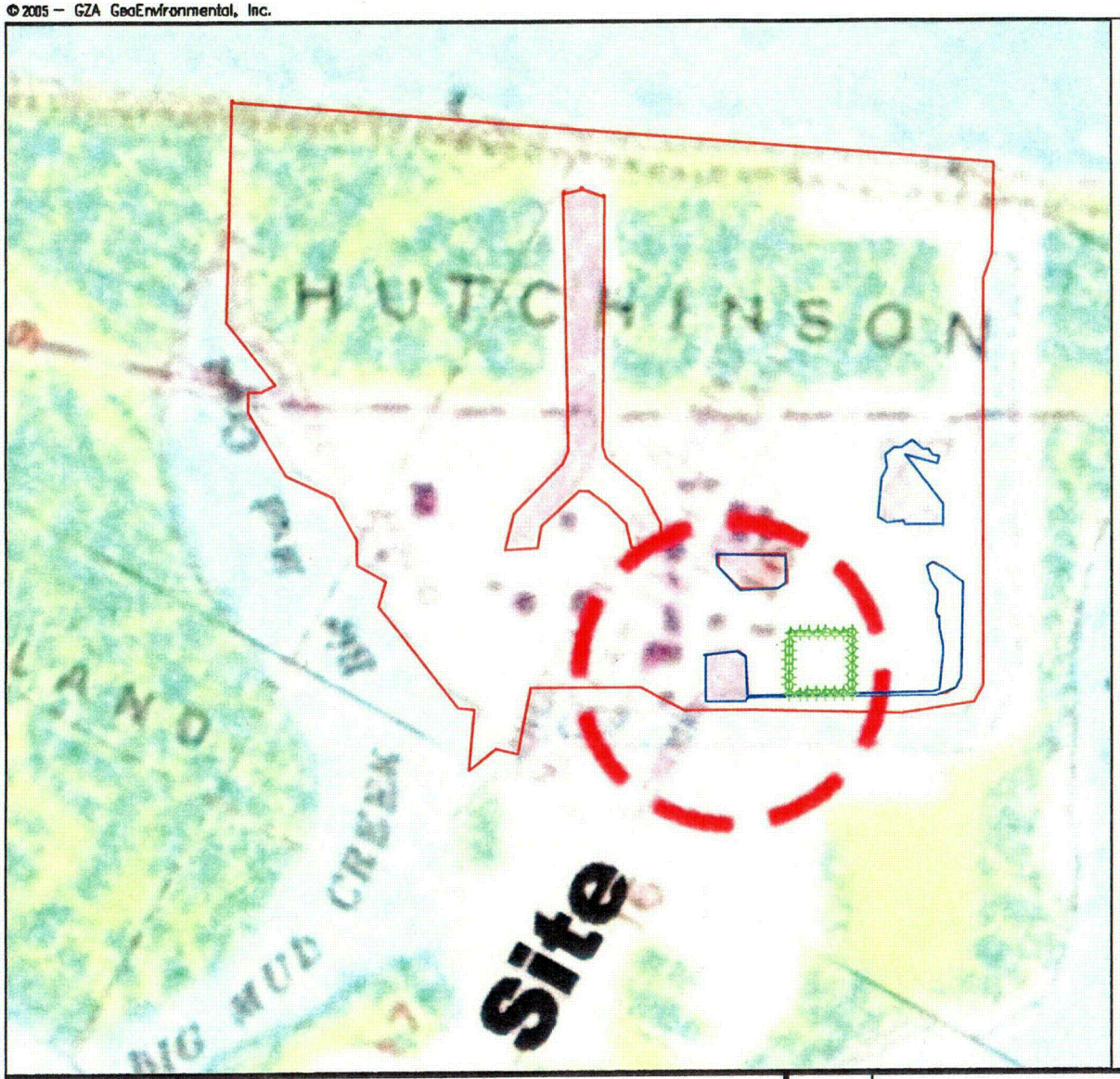

NOTES:

1. BASE MAP DEVELOPED FROM TOPOGRAPHIC MAP PREPARED BY USGS ENTITLED ANKONIA QUADRANGLE MAP.

LEGEND:

- CONSTANT HEAD BOUNDARY
- GENERAL HEAD BOUNDARY
- HORIZONTAL FLOW BOUNDARY
- DEWATERING WELL

FIGURE 1	PROJECT NO. 43301.10	PSL ISFSI "SOUTH 40" HUTCHINSON ISLAND, FLORIDA	
		MODEL BOUNDARY CONDITIONS	

REV. NO.	DESCRIPTION	BY	DATE

SCALE

0 1000FT.

PROJ MGR: DS
DESIGNED BY:
REVISED BY:
DRAWN BY: MJG
APPROVED BY:
DATE: 10-25-05

GZA GeoEnvironmental, Inc.
38619 SCHOOLCRAFT ROAD
LIVONIA, MICHIGAN 48150

C-01

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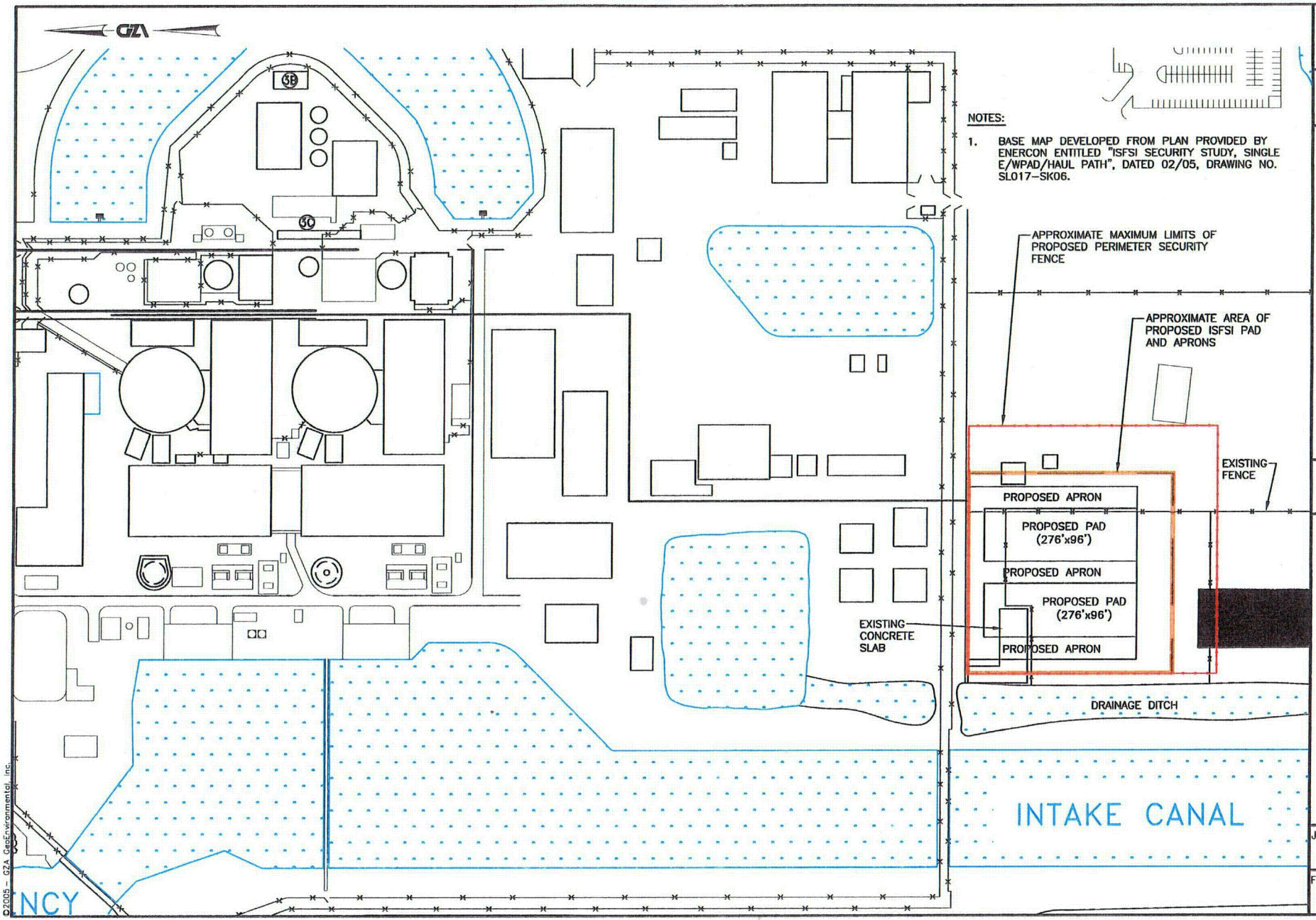

REV. NO.	DESCRIPTION	BY	DATE

PROJ MGR: CJT
DESIGNED BY: DMB
REVIEWED BY: DCS
DRAWN BY: MJS
DATE: 9/9/05

NOT TO SCALE

0

GeoEnvironmental, Inc.
27 Naek Road
Vernon, Connecticut 06066
Phone (860)875-7655 Fax (860)872-2416

PSL ISFSI
"SOUTH 40"
HUTCHINSON ISLAND, FLORIDA

SITE PLAN

JOB NO.
43301.10

FIGURE NO.
2

C-04

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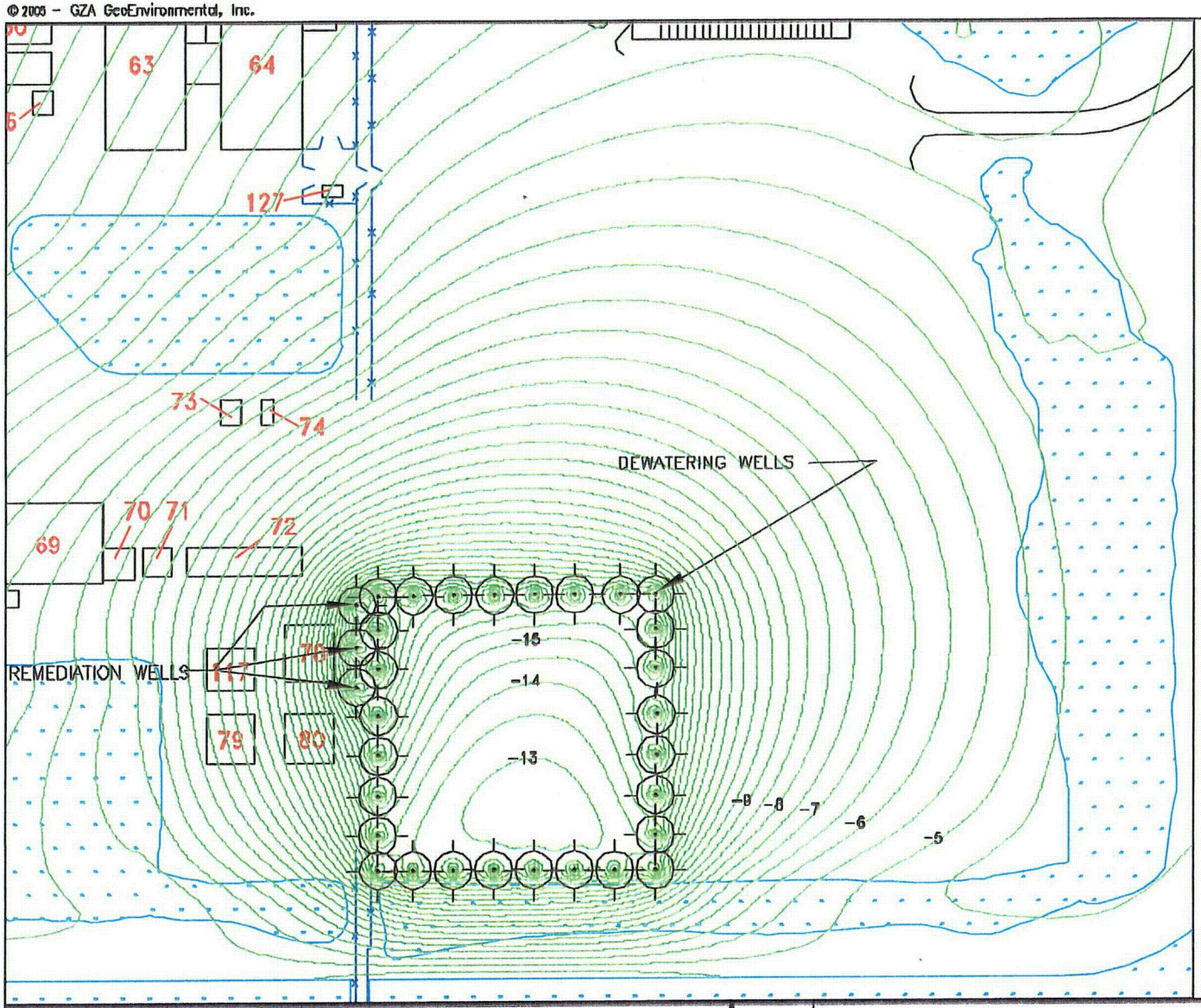

NOTES:

1. BASE MAP DEVELOPED FROM MAP PROVIDED BY PSL, PREPARED BY FLORIDA POWER AND LIGHT, ENTITLED SITE DESCRIPTION MAP, AND DATED 9/9/04. ORIGINAL SCALE WAS NOT RECORDED. DRAWING NO. PSL-SD-MAP.

2. GROUNDWATER CONTOURS ARE BASED ON MODELED RESULTS AND AND MAY NOT REFLECT ACTUAL SUBSURFACE CONDITIONS.

LEGEND:

GROUNDWATER CONTOURS (0.5 FOOT INTERVAL)

FIGURE 3

PROJECT NO. 43301.10

PSL ISFSI
"SOUTH 40"
HUTCHINSON ISLAND, FLORIDA

MODELED GROUNDWATER CONTOURS
NO SHEETING WITH DEWATERING
AND REMEDIATION WELLS

REV. NO.	DESCRIPTION	BY	DATE

SCALE
0 200FT.

PROJ MGR: DS
DESIGNED BY:
REVISED BY:
DRAWN BY: MJG
APPROVED BY:
DATE: 10-25-05

GZA GeoEnvironmental, Inc.
38018 SCHOOLCRAFT ROAD
LIVONIA, MICHIGAN 48150

C-03

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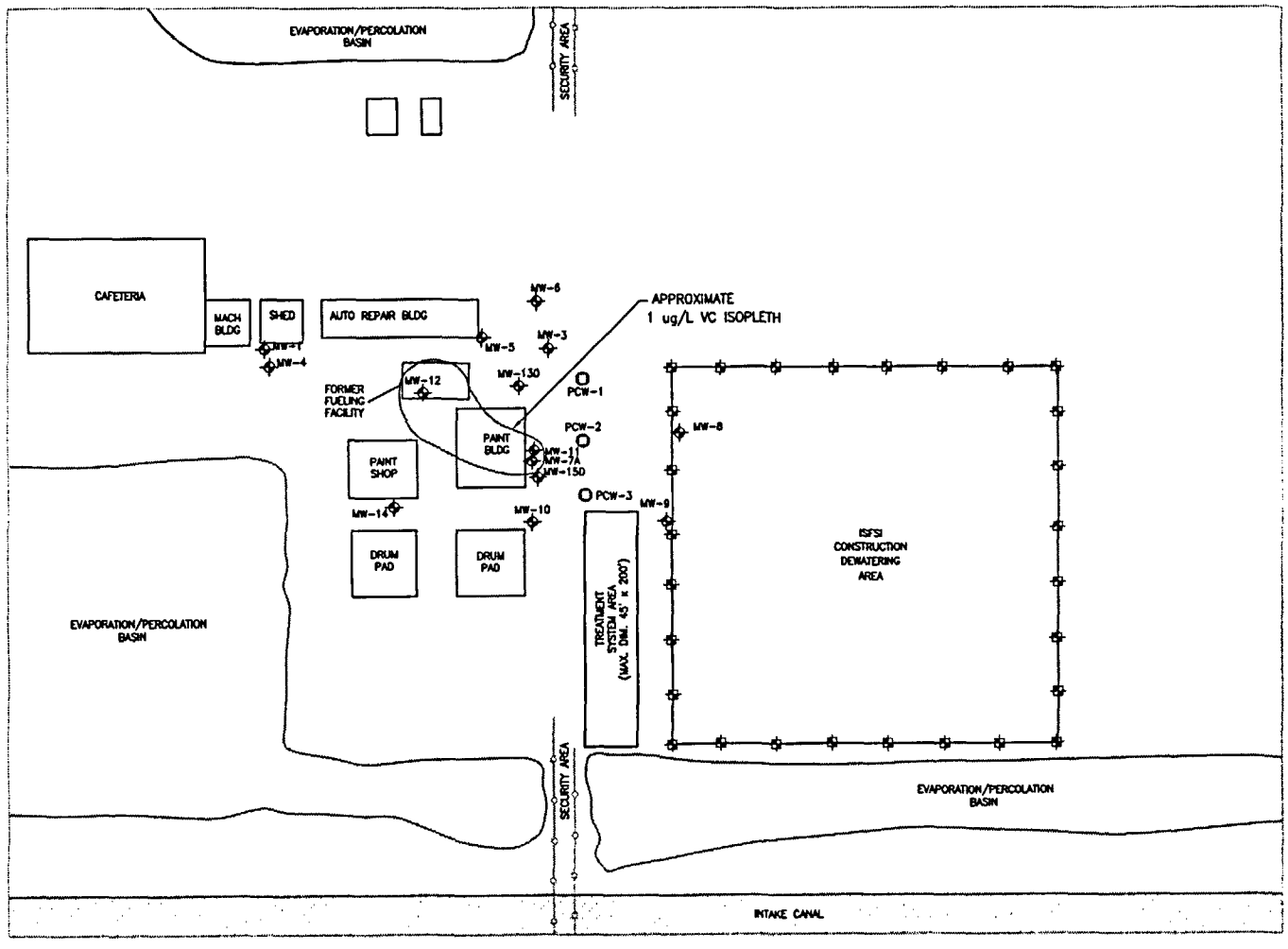


LEGEND

- MONITORING WELL (MW)
- FENCE
- DEWATERING WELL (DW)
- PLUME CONTROL WELL (PCW)

NOTES

1. THIS DRAWING WAS NOT SURVEYED BY PROFESSIONAL LAND SURVEYORS. LOCATIONS OF ITEMS ARE CONSIDERED TO BE APPROXIMATE.
2. LOCATION OF BUILDINGS, LAND FEATURES AND PROPOSED ISFSI CONSTRUCTION DEWATERING AREA REFERENCED TO GZA GeoEnvironmental, Inc. PROJECT 43301.10, FIGURE 9 AS ATTACHED TO THE MODELING REPORT (APPENDIX C OF IRAP). ISFSI CONSTRUCTION DEWATERING AREA LOCATION SHOWN IS BASED ADDITIONALLY ON FPL DIRECTION.
3. PCW-1/2/3 LOCATIONS ARE APPROXIMATE. FINAL LOCATION AND NUMBER OF PC WELLS TO BE DETERMINED BASED ON FINAL DEWATERING CONSTRUCTION DOCUMENTS.

NOT FOR CONSTRUCTION

ISSUED FOR REGULATORY AGENCY REVIEW

0 50 100 200

Graphic Scale in Feet (Approx)

FLORIDA POWER & LIGHT COMPANY

ST. LUCIE NUCLEAR POWER PLANT

SITE LAYOUT (WITH PLUME)

TETRA TECH EC, INC.

SCALE AS SHOWN	PREPARED HB	CAD FILE NO. NPDES-01.DWG
DATE: 11/22/05	CHECKED CFS APPROVED CFS	FIGURE No. 4

APPENDIX A

GZA Groundwater Modeling Report for the ISFSI Project

GZA
GeoEnvironmental, Inc.

Engineers and Scientists

November 14, 2005
File No. 43301.10

Mr. Ron Miranda
Enercon Services, Inc.
400 Valley Road
Mount Arlington, New Jersey 07856

Re: Groundwater Dewatering Analysis
Proposed ISFSI Construction
St. Lucie Nuclear Power Plant

140 Broadway
Providence
Rhode Island
02903
401-421-4140
Fax: 401-751-8613
www.gza.com

Dear Mr. Miranda:

GZA GeoEnvironmental, Inc. (GZA) completed an evaluation of dewatering requirements for earthwork construction for the proposed Independent Spent Fuel Storage Installation (ISFSI) at the St. Lucie Nuclear Plant. These services were performed for Enercon Services, Inc. in general accordance with our agreement dated October 25, 2005.

PURPOSE

The purpose of our services was twofold: (1) to develop estimates of the dewatering requirements for the proposed ISFSI construction; and (2) to identify ways to manage the volatile organic compound (VOC) groundwater contaminant plume located immediately north of the ISFSI, during construction. The results of our work are to be used in developing construction specifications and as an aid in obtaining necessary permits.

This report is subject to the limitations presented in Appendix A.

BACKGROUND

The ISFSI is proposed to be located to the south of the existing Protected Area, within an area referred to as the "South 40". Figure 1 presents a Site Locus. Figure 2 indicates the approximate project location. While the ISFSI design is on going, current development features are:

- Two pads, oriented as shown on Figure 2;
- The dimensions of each pad are approximately 275 feet (length) by 100 feet (width);
- The pads will be constructed as reinforced concrete mats ranging from about 28 to 36 inches in thickness;
- Approximately 40-foot wide aprons will be located between the pads, as well as abutting their north, east and west sides. The surface construction of the aprons (i.e., concrete or gravel) has not been determined at this time;

- The developed area of the ISFSI Pads and Aprons (including adjacent security and nuisance fences) will be about 202,500 square feet (about 5.0 acres); and;
- Finish grade of the top of the pad will be approximately Elevation 18 Mean Low Water (MLW)[1].

We completed a geotechnical study for the design of the ISFSI. This study included the performance of subsurface explorations (including test borings, cone penetrometer explorations and soil sampling). Details of this study are presented in the draft report entitled "Draft Report - Geotechnical Site Investigation and Evaluation, Proposed ISFSI Pad-"South 40" Site, St. Lucie Nuclear Power Plant, Hutchinson Island, Florida", draft dated September 2005.

This study identified the presence of organic soils that, due to their compressibility, are unsuited for support of the ISFSI pad. Over-excavation of the organic deposits and replacement with a granular structural fill was recommended. This method would involve excavating the soils to depths ranging from about 12 feet to 25 feet below existing grade (average depth of about 16 feet) to remove the upper compressible clay, peat and organic silt soils and replace them, in the dry, with compacted Structural Fill. This will require excavation below the water table.

The excavation will include the following:

1. Install sheet piling for temporary earth support to protect existing structures and limit the lateral extent of the excavation, and as required to provide hydraulic control;
2. Dewater the excavation;
3. Excavate the soil with a large hydraulic excavators, bulldozers and front-end loaders.
4. Approximately 60,000 cubic yards of earth will be excavated or placed below the water table. Assuming 1,000 cubic yards of earthwork per day and a five day work week, on the order of 90 days of dewatering will be required.
5. The total volume of material to be placed is approximately 90,000 cubic yards;

A similar construction approach was utilized for the existing plant construction. Information presented in the updated Final Safety Analysis Report (uFSAR) and substantiated through recent conversations with the dewatering contractor for the original plant construction, indicates that dewatering for the original construction included 90 to 100 wells, installed to depths of about 100 feet. The wells were constructed on 50-foot spacing and maintained the water table at about elevation -40. Total dewatering flows were about 8,000 gallons per minute (GPM). The dewatering contractor also reported that waters in portions of the aquifer had a low pH and were rich in iron.

[1] Per conversations with Florida Power and Light, the plant datum is Mean Low Water, referenced to the ocean. The conversion to MLW from NGVD 1929 is NGVD (ft) minus 1.56 feet.

A release of petroleum and chlorinated solvents was identified between 1985 and 1990 in an area located to the immediate north (up gradient) of the proposed ISFSI. Details of the release are presented elsewhere. The area is currently being remediated by natural attenuation in accordance with a consent order. We understand the contaminant of concern is vinyl chloride (VC). This contamination is shallow being found only in two water-table monitoring wells, with the highest observed concentration of VC being 10 ug/L. There is no evidence of a release of DNAPLs.

SUBSURFACE CONDITIONS

As described in the uFSAR, the St. Lucie area is underlain by the Anastasia geologic formation, locally an approximately 150 feet thick sequence of Pleistocene unconsolidated to partially cemented sands and sandy limestone[2]. Underlying the Anastasia formation is a thin sequence of shell marls and sands known as the Tamiami formation, which is in turn underlain by partially cemented and indurated sands, clays and sandy limestone of the Miocene Hawthorne Formation.

As identified during the geotechnical investigation, the proposed ISFSI pad area is underlain by about 6 to 10 feet of loose to dense sand fill (extending down to about El.4 to El – 0 MLW.), overlying naturally-deposited layers of clay, organic silt and peat (surficial, natural materials deposited in the former mangrove swamps). These deposits are underlain by loose sand with occasional, discontinuous lenses (up to 9 inches thick) of organic silt, extending to depths of about 12 to 25 feet (elevation -2 to -15 MLW). Below this depth, the subsurface profile observed in the explorations performed for this study was generally consistent with the conditions described in the uFSAR.

As presented in the uFSAR, the subsurface materials were separated into three zones: 1) an upper zone of 50 to 60 feet consisting principally of loose to medium dense sand; 2) an intermediate zone extending from 60 to 150 feet depth consisting of similar material as the upper zone, only in a more dense state and containing a greater percentage of fine-grained soil; and 3) a clayey, very dense lower zone.

The elevation of the base of the aquifer is at the top of, or within, the intermediate zone. We have assumed the bottom of the aquifer is at elevation -135 MLW which should result in a conservative assumption of groundwater extraction rates. Note that, the purpose of this study, we have assumed that an over-estimation of extraction rates is conservative.

Figure 3 presents the location of GZA's subsurface explorations. Figures 4 through 6 present conceptual subsurface profile of the ISFSI area.

[2] Reference is Chapter 2.5 of the updated Final Safety Analysis Report.

Groundwater investigations performed to evaluate the environmental release have measured groundwater elevations, flow direction and gradient in the site vicinity. In brief, these studies identified the following:

- The direction of groundwater flow is governed by local geohydrologic boundaries including the intake and discharge channels;
- The direction of groundwater flow in the vicinity of the contaminated ground and the proposed excavation is northeast to southwest;
- The thickness of a fresh water lens in the area of the ISFIS is limited. For the limited purpose of this study, the thickness is of little interest other than to note that construction dewatering will include salt-water flow;
- Existing information on the hydraulic conductivity of the shallow soils indicates that the aquifer in non-homogeneous. Reported values range from less than one (1) foot per day (3.5E-4 cm/sec) to more than six hundred (600) feet per day (2E-1 cm/sec). Based primarily on reports of the dewatering system required to construct Unit Two, our current opinion is that the effective average hydraulic conductivity is about 40 feet per day (1E-2 cm/sec). This results in a transmissivity of on the order of 5,200 feet squared per day (39,000 gallons per day per foot). We note that pump test data was not available ;
- Based on grain size and density we believe the effective porosity of the shallow soils is approximately 0.25.

GROUNDWATER MODEL DEVELOPMENT

The groundwater model was developed to assess the effects of groundwater extraction during construction. Because of the close proximity of boundary conditions as described below, we believe it is inappropriate to say the model is calibrated. Because pump test data was not available, we were unable to test the model against stressed aquifer conditions. Consequently, the model is not verified.

However, because of the close proximity of strong geologic boundaries and the assumptions used to develop the model, it will likely over-estimate dewatering flow rates; and is consequently (for the purposes of this study) conservative. See Appendix B for a list of assumptions we used in developing the model.

We utilized the USGS modular three-dimensional finite difference groundwater flow model MODFLOW. MODPATH, a particle-tracking post-processing package was also used to compute three-dimensional flow paths using output from steady-state groundwater flow simulations by MODFLOW. GMS v. 5.1, a graphical user environment for

performing groundwater simulations, developed by the Environmental Modeling Research Laboratory of Brigham Young University, was used as a pre-processor and post-processor.

The model area and boundary conditions are shown on Figure 7. The total area modeled was approximately 1.3×10^7 square feet (ft^2) or 300 acres. The model domain was divided into discrete 113 columns and 103 rows. The vertical and horizontal grid spacing was varied across the modeled domain such that grid spacing within the area of interest (dewatering area) was relatively small (10 feet by 10 feet) and grew to 100 feet by 100 feet near the model boundaries.

Four layers were incorporated into the model. Layer 1 was created at Elevations 10.0 feet MLW to -5.0 feet MLW, layer 2 was created at elevations -5.0 feet MLW to -10.0 feet MLW, layer 3 was created at elevations -10 feet MLW to -40 feet MLW, and layer 4 was created at elevations -40 feet MLW to -135 feet MLW. Layers 1, 3, and 4 were assumed to consist of sand and were assigned the same hydraulic properties (including a hydraulic conductivity of 40 ft/day and Specific Yield of 0.25). Layer 2 was comprised of silt, clay, and organic material and it was assumed that the hydraulic conductivity of this layer would be less than the others. The hydraulic properties of Layer 2 included a hydraulic conductivity of 4.0 feet/day and Specific Yield of 0.1.

MODEL SIMULATIONS

We used the model to simulate three flow patterns; (1) ambient, (2) dewatering without sheeting, and (3) dewatering with sheeting as a partial groundwater control measure. Simulations two and three included additional groundwater extraction wells for the purpose of management of the groundwater contaminant plume. The results are shown on Figures 8 through 13 and are discussed below.

Simulation 1 - Ambient Flow

Figure 8 depicts the simulated water table under non-pumping conditions. The shape of the water table is in agreement with the existing conditions observed at the site. The predominant direction of flow is from the discharge canal (at elevation 8.3 NGVD) to the intake canal (at elevation -4.8 NGVD).

The apparent groundwater sink shown in the southwest corner of Figure 8 is the result of recharge from the stormwater management pond in that area. This is the superposition of a groundwater mound on a sloping water table. Because of the general shape of the simulated water table, it is our opinion that the simulation demonstrates that the model is an effective tool for its intended purpose.

Simulation 2 - Pumping Without Sheeting

Simulation 2 evaluated the extraction of groundwater, without the use of sheeting for groundwater control purposes. This simulation indicates that at steady-state conditions, the extraction rate of approximately 1500 GPM, from 31 perimeter wells, will produce the draw-downs required for construction. Pumping rates at start-up will be larger; for planning purposes we have estimated that these initial flows could be as large as 4500 GPM.

Figure 9 depicts the simulated groundwater table contours for this condition. A comparison of this figure and figure 8 indicates that the general direction of groundwater flow in the vicinity of the plume is not altered by the construction dewatering (the plume is located up-gradient of the proposed excavation.)

Figure 10 depicts simulated draw-downs (i.e., it represents the amount that the simulated water table is lowered by construction dewatering). The model simulates draw-downs from 10 to 14.5 feet; where required draws vary from less than two feet to as much as 15 feet (averaging eight feet). This indicates that, while these estimated steady-state extraction rates are reasonable, the contractor will need to build flexibility into this system to meet the actual dewatering needs encountered during construction. Not all 31 wells will be installed before pumping commences, and the number, spacing, and depth of wells will be varied based on the observer aquifer response, and project needs.

This model simulation indicates that approximately 1,000 GPM or 70 percent of the flow being extracted will be flows from the intake canal. This indicates that the extracted water will become saline, and that waters from the western side of the excavation may have less iron and be less corrosive than waters extracted from the eastern side.

Three additional extraction wells are located near the northeast corner of the excavation, for the purpose of managing the groundwater contaminant plume (specifically to intercept VOC contamination before it is pumped by the construction dewatering). The exact number and location of interceptor wells will need to be refined; however, the simulation suggests that pumping at the rate of 150 to 200 GPM may be required to intercept the low level of VOCs that would otherwise migrate towards the excavation.

Also, note it is possible that a single well located farther north in conjunction with groundwater recharge could also be used to hydrodynamically limit contaminated water migration. This would, however, require construction and operation of a system within the security area, and runs the risk that recharge could drive portions of that contamination deeper into the aquifer.

Simulation 3 - Pumping With Sheeting

Simulation 3 is similar to Simulation 2, except in this case steel sheet-piling (or other comparable hydraulic barrier) is used to help control groundwater flows. Figures 11 and 12 depict the shape of the water table and the resulting draw-downs generated by simulating the extraction of 700 GPM from 29 extraction locations, situated inside a 60 foot deep no-flow boundary (sheeting).

The construction dewatering extraction nodes along the parameter are as described in the proceeding section. As noted, the actual well depth and spacing will be refined in the field during construction to meet project needs.

This simulation indicates there are at least four advantages to using sheeting:

1. Required extraction rates are reduced by at least half. Because of our assumed aquifer properties (constant to elevation -135), we believe the actual flows would be less than 50 percent of flows extracted without sheeting;
2. Draw-downs and gradients away from the excavation are less than would be observed if sheeting were not used. This retards the movement of contaminants and limits increases in effective soil stresses;
3. It significantly reduces the volume of groundwater that needs to be extracted to control the migration of the VOC contaminated groundwater. We simulated this control by using a single extraction location (outside the sheeting) and an extraction rate of 25 GPM. Using this approach we were concerned that pumping from within the excavation would induce flows of contaminated water beneath the sheeting. Our simulations show that this is not the case. Figure 13 was generated by up-gradient particle tracking from inside and beneath the sheeting. It demonstrates that the shallow ground water will be intercepted by the exterior well and not by the interior extraction wells; and
4. The travel time between the remedial extraction well and the construction dewatering wells is longer. With this approach, should the extraction well temporarily stop operating, it would be days before low levels of VOCs would be induced to the excavation wells.

Our observations relative to the need for building flexibility into the proposed dewatering system, noted in the previous section, apply here as well. And again, this simulation indicates that approximately 500 GPM or 70 percent of the flow being extracted will be flows induced from the intake canal. We believe water quality will vary from well to well, with water quality being extracted from the west side being generally more saline and lower in iron.

RESULTS

The following presents the results of our dewatering evaluations. To understand how we developed these findings and their limitations, please read the report in its entirety.

1. Extraction of groundwater during construction will increase hydraulic gradients in the area of the excavation. This in turn has the potential to alter ongoing attenuation processes, allowing for migration of low levels of VOCs. Modeling indicates that VOC migration (if it occurs) will be along the current pathway, and can be managed with the installation of interceptor wells located outside the construction area (i.e. a pump and treat system);
2. Our simulation of ambient conditions (Simulation 1) suggests the model is a useful tool for estimating groundwater extraction rates. Aquifer heterogeneities and water quality may make withdrawal of groundwater more complex than suggested by the model;
3. The model indicates that without sheeting as a groundwater control (Simulation 2), the steady-state dewatering flow will be about 1,500 GPM and plume treatment flow will be approximately 200 GPM;
4. The model indicates that with sheeting (Simulation 3) the steady state dewatering flow will be less than 700 GPM, and plume treatment flow will be about 25 GPM;
5. For permitting purposes, we recommend:
    a. A pumping duration of 90 days,
    b. A peak discharge flow of 4,500 GPM,
    c. A total discharge volume of 324 million gallons.
6. Provided below are preliminary details for the groundwater treatment extraction wells. Note that actual conditions may vary form those assumed here. Consequently modification may be required as additional field data becomes available or to better accommodate the well driller's equipment and/or methods.
    a. Extraction wells (two to four) without the use of sheeting as a groundwater control method (Simulation 2):
        i. Minimum well diameter: 12 inches
        ii. Minimum well depth: 40 feet
        iii. Minimum screen length: 20 feet
        iv. Minimum percent open area: 10 percent
        v. Maximum entrance velocity: 0.1 feet/second
    b. Extraction well used in conjunction with sheeting for groundwater control (Simulation 3):
        i. Minimum well diameter: 6 inches
        ii. Minimum well depth: 25 feet
        iii. Minimum screen length: 10 feet
        iv. Minimum percent open area: 10 percent
        v. Maximum entrance velocity: 0.1 feet/second

If you have any questions or comments, please do not hesitate to call Michael Powers at (401) 421-4140, ext. 3404 or via E-mail at mpowers@gza.com

Very truly yours,

GZA GEOENVIRONMENTAL, INC.

Matthew J. Gozdor
Sr. Technical Specialist

Daniel Stapleton
Associate Principal

Michael A. Powers
Senior Principal

MAP:lds

Attachments: Figures 1 through 13
Appendix A – Limitations
Appendix B – Assumptions

APPENDIX A

MODEL LIMITATIONS

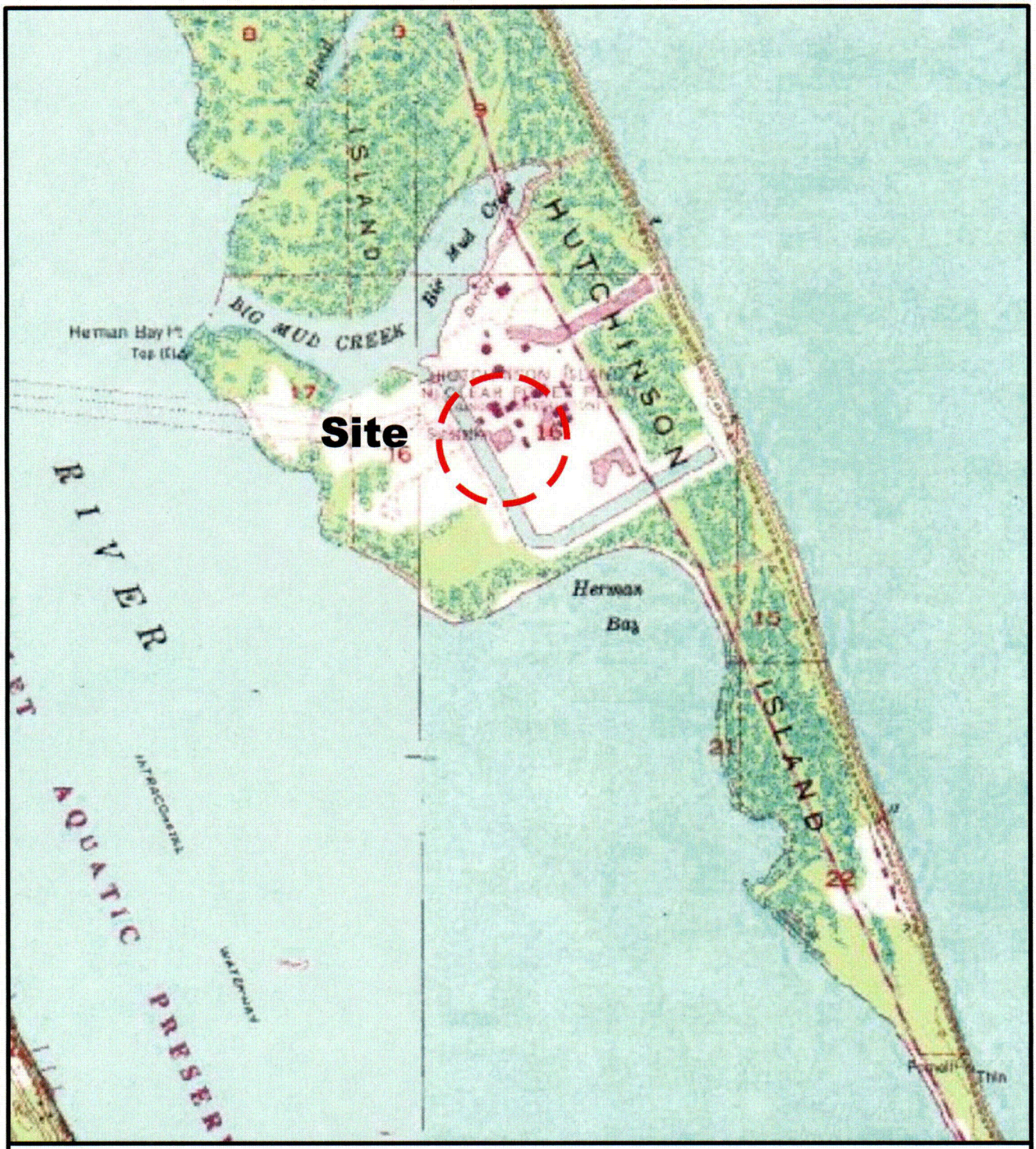
1. The model was developed for use at a specific site. Results should not be used in evaluating other locations.
2. The model was developed for the specific purposes identified in the report. Use of the model, or model results, for other purposes, may lead to inappropriate conclusions.
3. The model is a mathematical representation of an idealized aquifer system. The model uses a finite difference method to compute heads and other mathematical methods to develop groundwater contours. These approximations result in small, generally insignificant, errors that should, however, be kept in mind in reviewing small scale changes in gradients, or curious results.
4. The model was developed using available field data from widely spaced points and discrete intervals, and we made assumptions based on that data. As additional data becomes available, it may be necessary to modify our assumptions.
5. The mathematical model is based on a conceptual model of a complex subsurface environment and by nature is a simplification of the actual conditions. In constructing the model, point specific data was generalized and extrapolated across the project space. In addition, in areas where field data was not available, professional judgment based experience and regional information was used.
6. Model assumptions are provided in Appendix B. Actual conditions are likely more complex than assumed. These variations may cause flow patterns, or volumes, to be other than simulated.
7. As field data becomes available, the model can be modified to better reflect actual conditions. If observed conditions are not consistent with model results, we recommend that GZA be retained to reassess our findings.
8. The model was developed using the level of care customary of other professions providing similar services for similar purposes in 2005. No other warranty, stated or implied, is made.

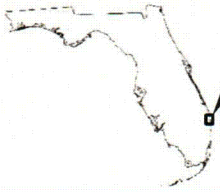
APPENDIX B

MODEL ASSUMPTIONS

The model was developed to assist in permitting and the development of groundwater control specifications required for the ISFSI construction at the Port St. Lucie Nuclear Power Station. The following is a list of the major assumptions we used in developing the model.

- It is conservative to develop a model that tends to overestimate groundwater extraction rates.
- We have assumed that the code for MODFLOW and MODPATH are correct.
- Soil conditions across the model area are similar and are represented by conditions observed in test borings completed for the ISFSI.
- The aquifer is typically 135 feet thick. The finer grained soils observed in the lower 55 feet of the borings have the same hydraulic conductivity (40 feet/day, 1.4 x 10^{-2} cm/sec) as the upper coarser deposits.
- Our assumption of a continuous low hydraulic conductivity layer (representing shallow clay) does not significantly alter our findings.
- The vertical hydraulic conductivity of the soils is one third the horizontal hydraulic conductivity.
- The porosity of aquifer is 0.25.
- The intake, discharge canals, mud creek, and the Atlantic Ocean are in perfect hydraulic communication with the aquifer at the boundary.
- Average reported elevations of water level at the boundaries were used, and are assumed to be constant over time (tidal variations, and variations due to changes in pumping rates at the plant were not considered).
- Stormwater control structures were assumed to recharge the aquifer at rates ranging from .07 $ft^3/day/ft^2$ to .19 $ft^3/day/ft^2$.
- Areal recharge due to precipitation was assumed to be 10 inches per year.
- The differences in flows flowing to fluid properties (fresh vs. saline water) were ignored.
- Due to the proximity of the intake canal (about 125 feet) and the anticipated duration of extraction (90 day) steady state simulations were used.





1"=2000'

0 1000' 2000' 4000'

SOURCE: U.S.G.S. ANKONA QUADRANGLE MAP

NORTH

GZA GeoEnvironmental, Inc.

PSL ISFSI
"SOUTH 40"
HUTCHINSON ISLAND, FLORIDA

LOCUS MAP

43301 AUGUST 2005 1

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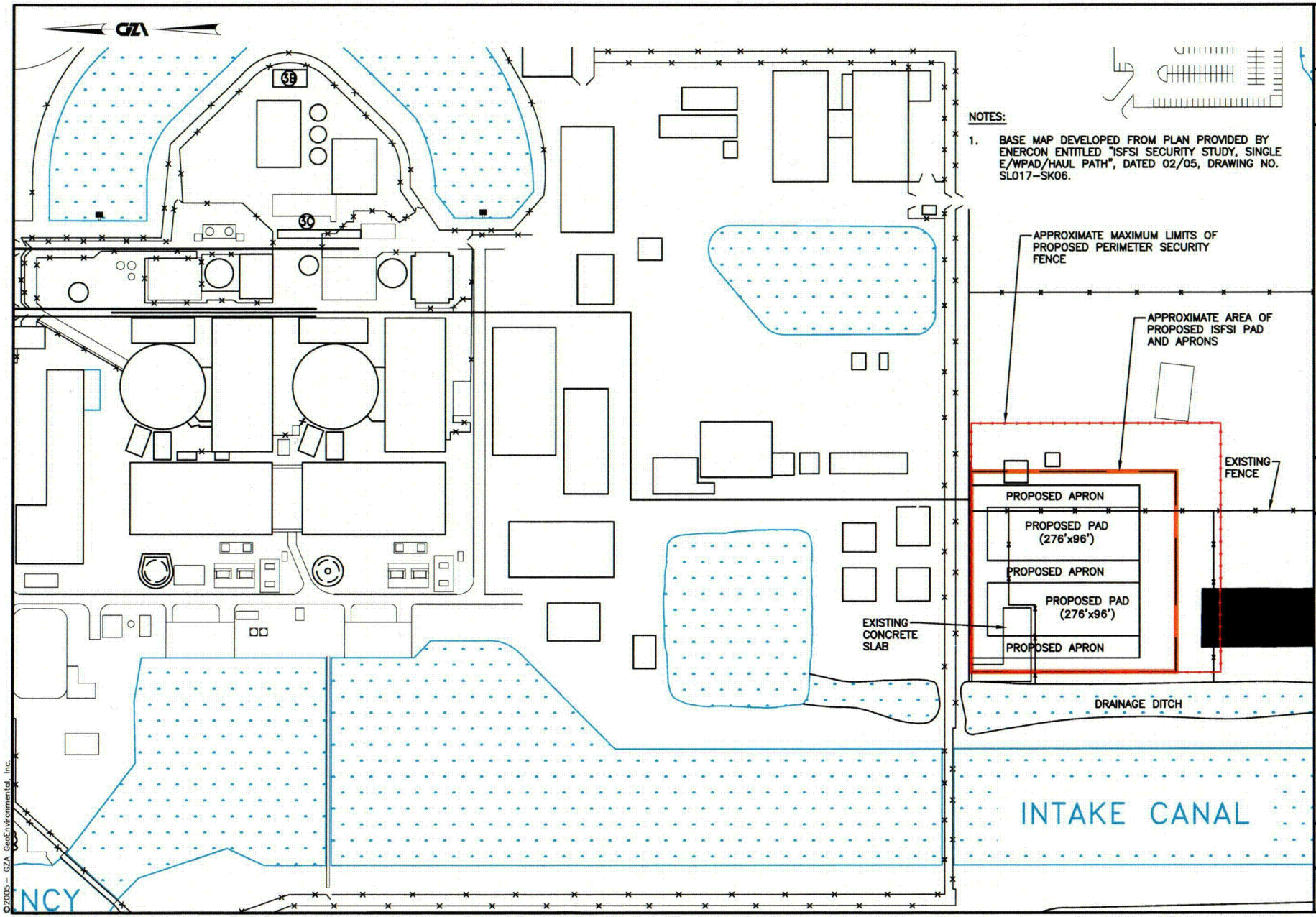

REV. NO.	DESCRIPTION	BY	DATE

PROJ MGR: CJT
DESIGNED BY: DMB
REVIEWED BY: DCS
DRAWN BY: MJS
DATE: 9/9/05

NOT TO SCALE

0

GeoEnvironmental, Inc.
27 Naek Road
Vernon, Connecticut 06066
Phone (860)875-7655 Fax (860)872-2416

PSL ISFSI
"SOUTH 40"
HUTCHINSON ISLAND, FLORIDA

SITE PLAN

JOB NO.
43301.10

FIGURE NO.
2

G:\JOBS\43301.P78\43301-10.DCS\43301.1-CAD\DWG\FIGURE 2 SITE PLAN.DWG Sep 08, 2005-11:42am

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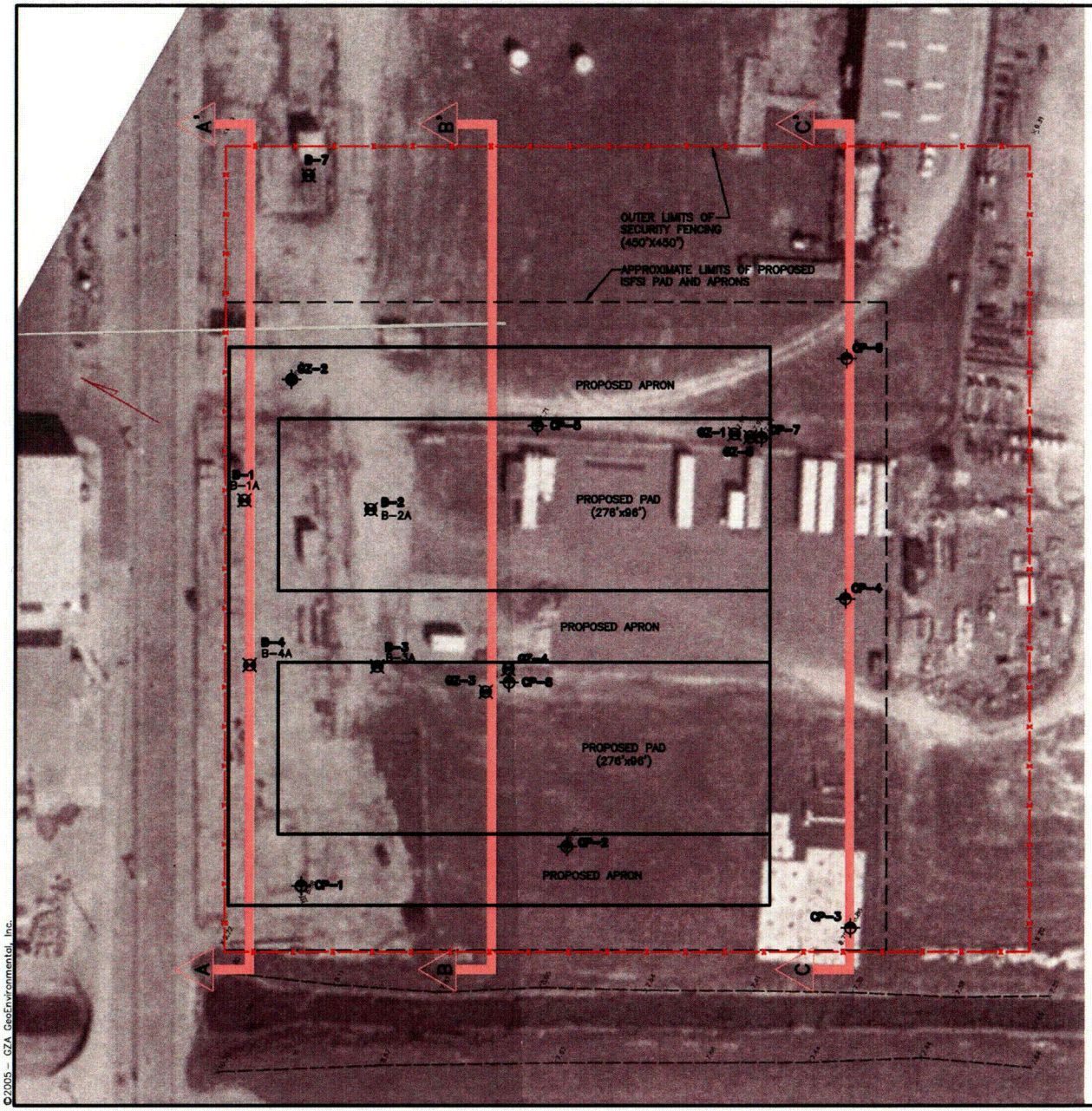
C-2



LEGEND

- B-7 — TEST BORING LOCATION (B-SERIES; PERFORMED PREVIOUSLY BY OTHERS)
- GZ-2 — TEST BORING (GZ-SERIES; THIS STUDY)
- CP-5 — CONE PENETROMETER (THIS STUDY)
- A — SECTION LINE

NOTES:

1. BASE MAP DEVELOPED FROM PLAN PROVIDED BY ENERCON ENTITLED "ISFSI SECURITY STUDY, SINGLE E/WPAD/HAUL PATH", DATED 02/05, DRAWING NO. SL017-SK06 AND SURVEY PLAN W/ AERIAL PHOTO PROVIDED BY GCY, DATED 8/30/05. THE B-SERIES BORINGS WERE PERFORMED BY LAW ENGINEERING AND PRESENTED ON THEIR FIGURE ENTITLED "FIELD EXPLORATION PLAN, STEAM GENERATOR REPLACEMENT", DATED 12/93, FIGURE NO. 3.
2. THE LOCATION OF THE B-SERIES (LAW ENGINEERING) BORINGS WERE APPROXIMATELY DETERMINED BY SCALING THE LOCATIONS FROM PREVIOUS EXPLORATION LOCATION PLANS. THE GZ-SERIES BORINGS AND CONE PENETROMETER EXPLORATIONS WERE LOCATED BY SURVEY BY GCY INC. DURING AUGUST 2005.
3. B-SERIES BORINGS PERFORMED BY LAW ENGINEERING IN OCTOBER 1993. GZ-SERIES BORINGS PERFORMED BY EARTH TECH DRILLING IN MARCH AND JULY 2005 AND OBSERVED AND LOGGED BY GZA PERSONNEL.
4. CONE PENETROMETER EXPLORATIONS PERFORMED BY GREGG DRILLING AND TESTING INC. IN JULY 2005 AND OBSERVED BY GZA PERSONNEL.

REV. NO.	DESCRIPTION	BY	DATE

PROJ MGR: CJT
DESIGNED BY: DMB
REVIEWED BY: DCS
DRAWN BY: MJS
DATE: 9/9/05

1"=60'
0 30' 60' 120'

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EXPLORATION LOCATION PLAN

JOB NO. 43301.10

FIGURE NO. 3

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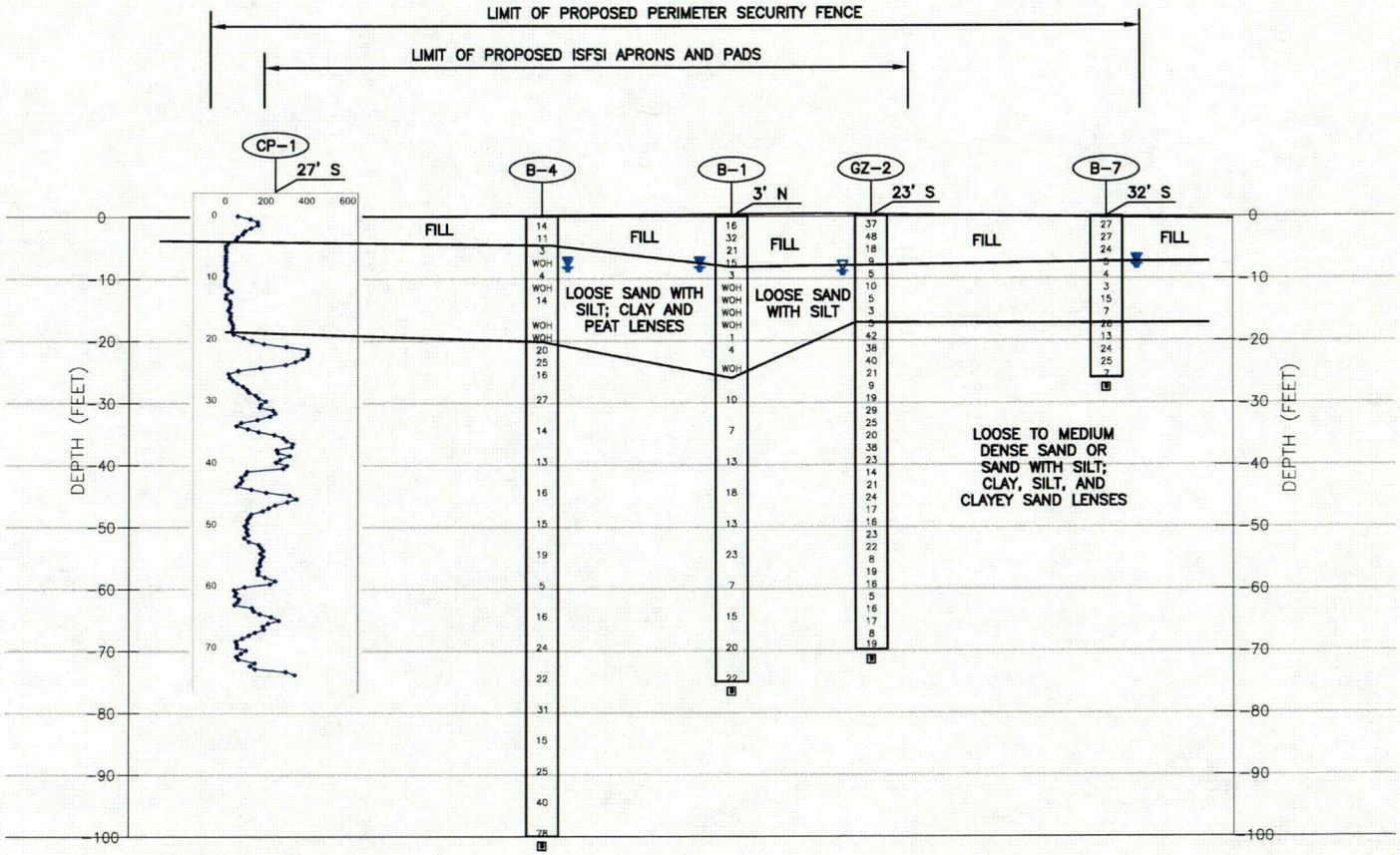
G:\JOBS\43301.P78\43301-10.DCS\43301.1-CAD\DWG\FIGURE 3 EXPLORATION LOCATION PLAN.DWG Sep 08, 2005-11:30am

C-06



LEGEND

B-5 — BORING DESIGNATION

10' N — OFFSET DISTANCE AND DIRECTION FROM SECTION LINE

OBSERVED GROUNDWATER DEPTH (1993 BORINGS)

25 — STANDARD PENETRATION TEST N-VALUE (BLOWS PER FOOT) WOH = WEIGHT OF HAMMER

OBSERVED GROUNDWATER DEPTH (2005 BORINGS)

B — BOTTOM OF EXPLORATION

CP-1 — CONE PENETROMETER LOCATION ID

DEPTH BELOW GROUND SURFACE

Qt (tsf)

NOTES:

1. REFER TO TEXT FOR MORE DETAILED STRATA DESCRIPTIONS.
2. THE STRATIFICATION LINES ARE BASED UPON INTERPOLATIONS BETWEEN WIDELY SPACED TEST BORING EXPLORATIONS AND THUS REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES. ACTUAL TRANSITIONS MAY VARY FROM THOSE SHOWN.
3. WATER LEVEL READINGS WERE MADE IN THE BOREHOLES DURING DRILLING. THIS DATA HAS BEEN REVIEWED AND INTERPRETATIONS MADE IN THE TEXT OF THIS REPORT. FLUCTUATIONS IN GROUNDWATER LEVEL OCCUR DUE TO VARIATIONS IN TIDE, RAINFALL AND OTHER FACTORS.
4. APPROXIMATE GROUND SURFACE ELEVATION IS 10 MEAN LOW WATER.

REV. NO.	DESCRIPTION	BY	DATE

PROJ MGR: CJT
DESIGNED BY: DMB
REVIEWED BY: DCS
DRAWN BY: MJS
DATE: 9/9/05

HORIZ. 1"=60'
VERT. 1"=20'

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Vernon, Connecticut 06066
Phone (860)875-7655 Fax (860)872-2416

PSL ISFSI
"SOUTH-40"
HUTCHINSON ISLAND, FLORIDA

CONCEPTUAL PROFILE A-A'

JOB NO. 43301.10

FIGURE NO. 4

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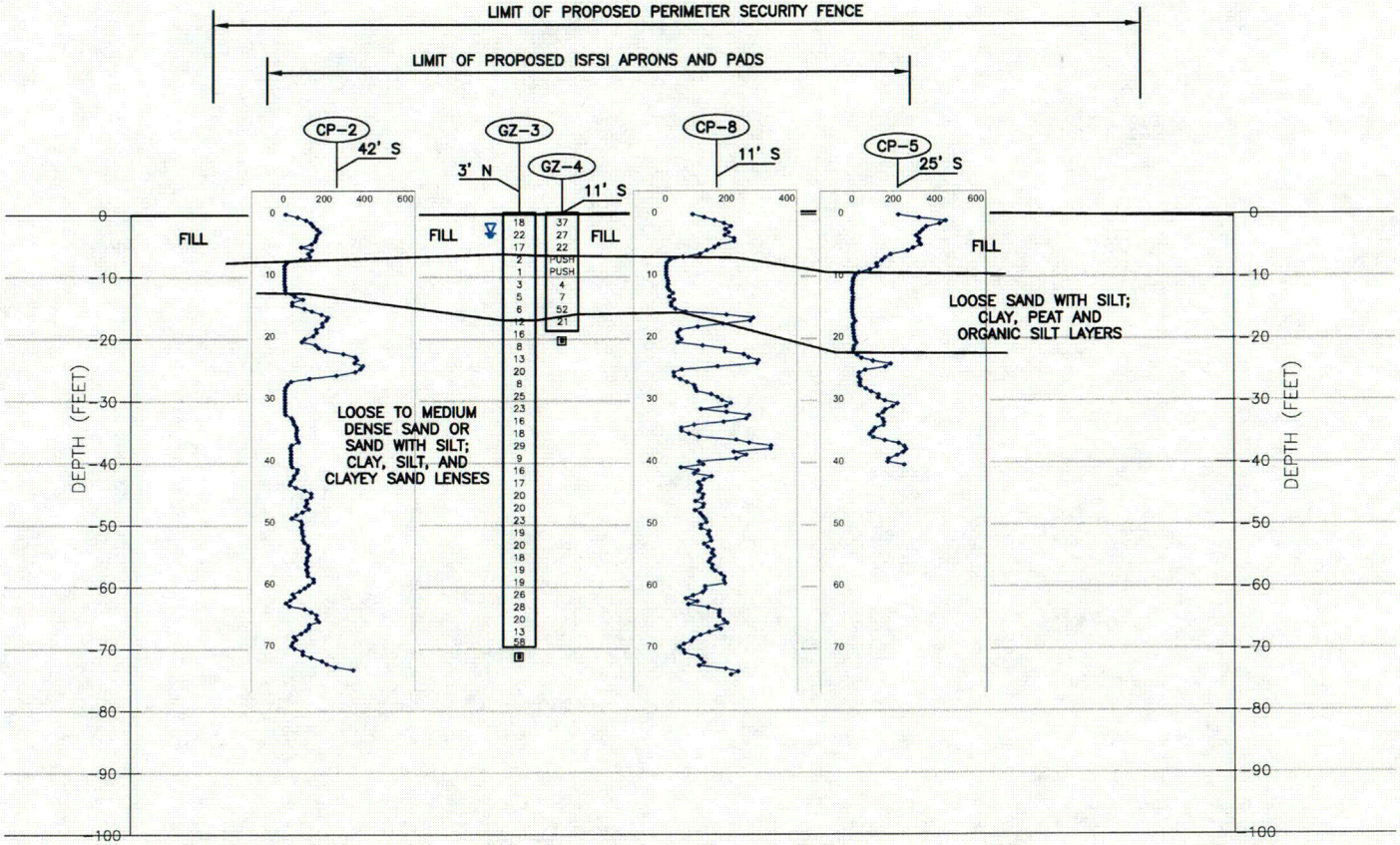
C-01



LEGEND

B-5 — BORING DESIGNATION

10' N — OFFSET DISTANCE AND DIRECTION FROM SECTION LINE

OBSERVED GROUNDWATER DEPTH (1993 BORINGS)

25 25 40 — STANDARD PENETRATION TEST N-VALUE (BLOWS PER FOOT) WOH = WEIGHT OF HAMMER

OBSERVED GROUNDWATER DEPTH (2005 BORINGS)

B — BOTTOM OF EXPLORATION

CP-2 — CONE PENETROMETER LOCATION ID

DEPTH BELOW GROUND SURFACE

0 200 400 600 — Qt (tsf)

NOTES:

1. REFER TO TEXT FOR MORE DETAILED STRATA DESCRIPTIONS.
2. THE STRATIFICATION LINES ARE BASED UPON INTERPOLATIONS BETWEEN WIDELY SPACED TEST BORING EXPLORATIONS AND THUS REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES. ACTUAL TRANSITIONS MAY VARY FROM THOSE SHOWN.
3. WATER LEVEL READINGS WERE MADE IN THE BOREHOLES DURING DRILLING. THIS DATA HAS BEEN REVIEWED AND INTERPRETATIONS MADE IN THE TEXT OF THIS REPORT. FLUCTUATIONS IN GROUNDWATER LEVEL OCCUR DUE TO VARIATIONS IN TIDE, RAINFALL AND OTHER FACTORS.
4. APPROXIMATE GROUND SRUFACE ELEVATION IS 10 MEAN LOW WATER.

REV. NO.	DESCRIPTION	BY	DATE

PROJ MGR: CJT
DESIGNED BY: DMB
REVIEWED BY: DCS
DRAWN BY: MJS
DATE: 9/9/05

HORIZ. 1"=60' (0, 30', 60', 120')
VERT. 1"=20' (0, 10', 20', 40')

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CONCEPTUAL PROFILE B-B'

JOB NO. 43301.10

FIGURE NO. 5

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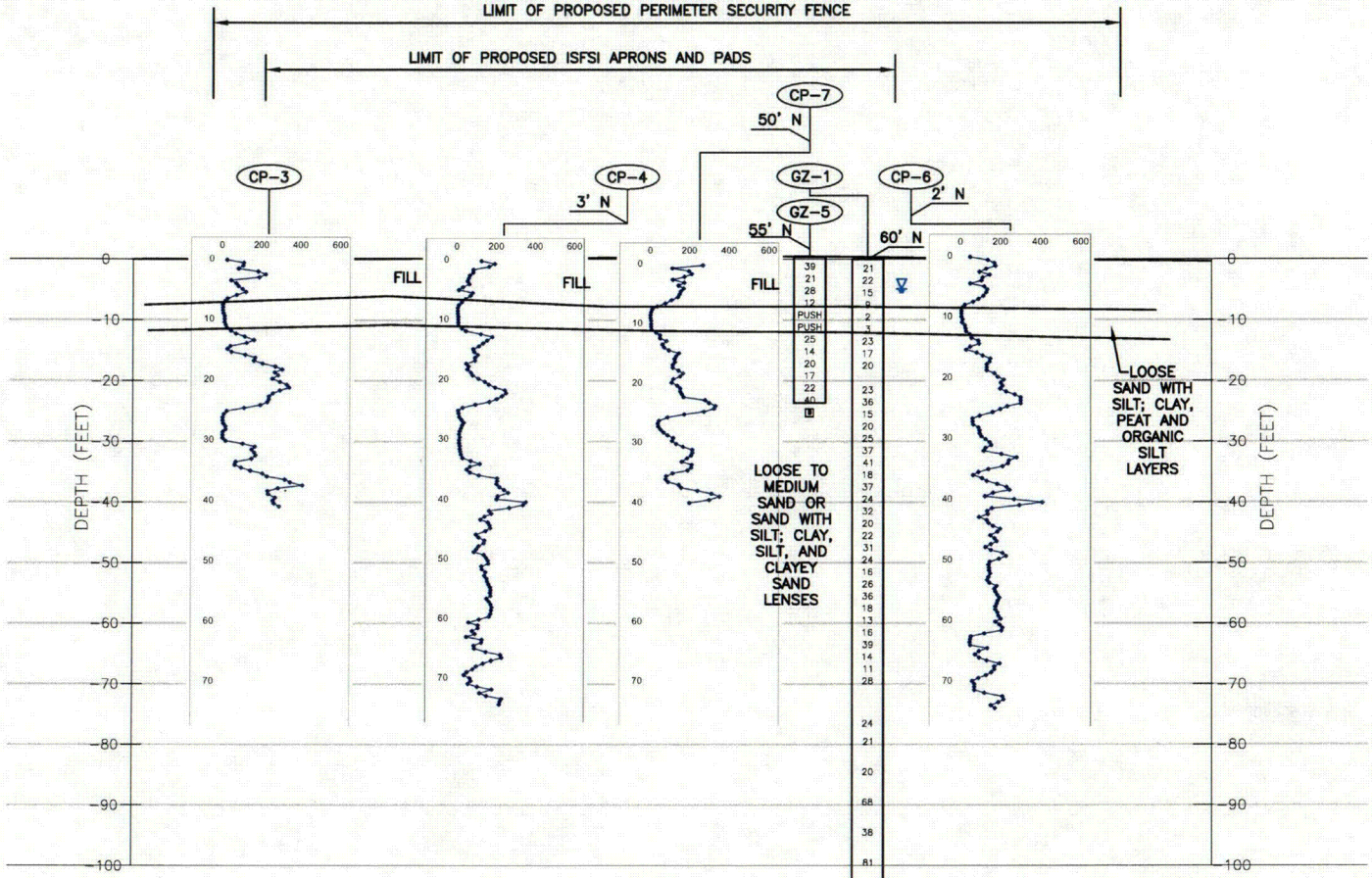

LEGEND

B-5 — BORING DESIGNATION

10' N — OFFSET DISTANCE AND DIRECTION FROM SECTION LINE

25 25 40 — STANDARD PENETRATION TEST N-VALUE (BLOWS PER FOOT) WOH = WEIGHT OF HAMMER

B — BOTTOM OF EXPLORATION

OBSERVED GROUNDWATER DEPTH (1993 BORINGS)

OBSERVED GROUNDWATER DEPTH (2005 BORINGS)

CP-3 — CONE PENETROMETER LOCATION ID

Qt (tsf)

DEPTH BELOW GROUND SURFACE

NOTES:

1. REFER TO TEXT FOR MORE DETAILED STRATA DESCRIPTIONS.
2. THE STRATIFICATION LINES ARE BASED UPON INTERPOLATIONS BETWEEN WIDELY SPACED TEST BORING EXPLORATIONS AND THUS REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES. ACTUAL TRANSITIONS MAY VARY FROM THOSE SHOWN.
3. WATER LEVEL READINGS WERE MADE IN THE BOREHOLES DURING DRILLING. THIS DATA HAS BEEN REVIEWED AND INTERPRETATIONS MADE IN THE TEXT OF THIS REPORT. FLUCTUATIONS IN GROUNDWATER LEVEL OCCUR DUE TO VARIATIONS IN TIDE, RAINFALL AND OTHER FACTORS.
4. APPROXIMATE GROUND SURFACE ELEVATION IS 10 MEAN LOW WATER.

REV. NO.	DESCRIPTION	BY	DATE

PROJ MGR: CJT
DESIGNED BY: DMB
REVIEWED BY: DCS

DRAWN BY: MJS
DATE: 9/9/05

HORIZ. 1"=60'
VERT. 1"=20'

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Vernon, Connecticut 06066
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HUTCHINSON ISLAND, FLORIDA

CONCEPTUAL PROFILE C-C'

JOB NO. 43301.10

FIGURE NO. 6

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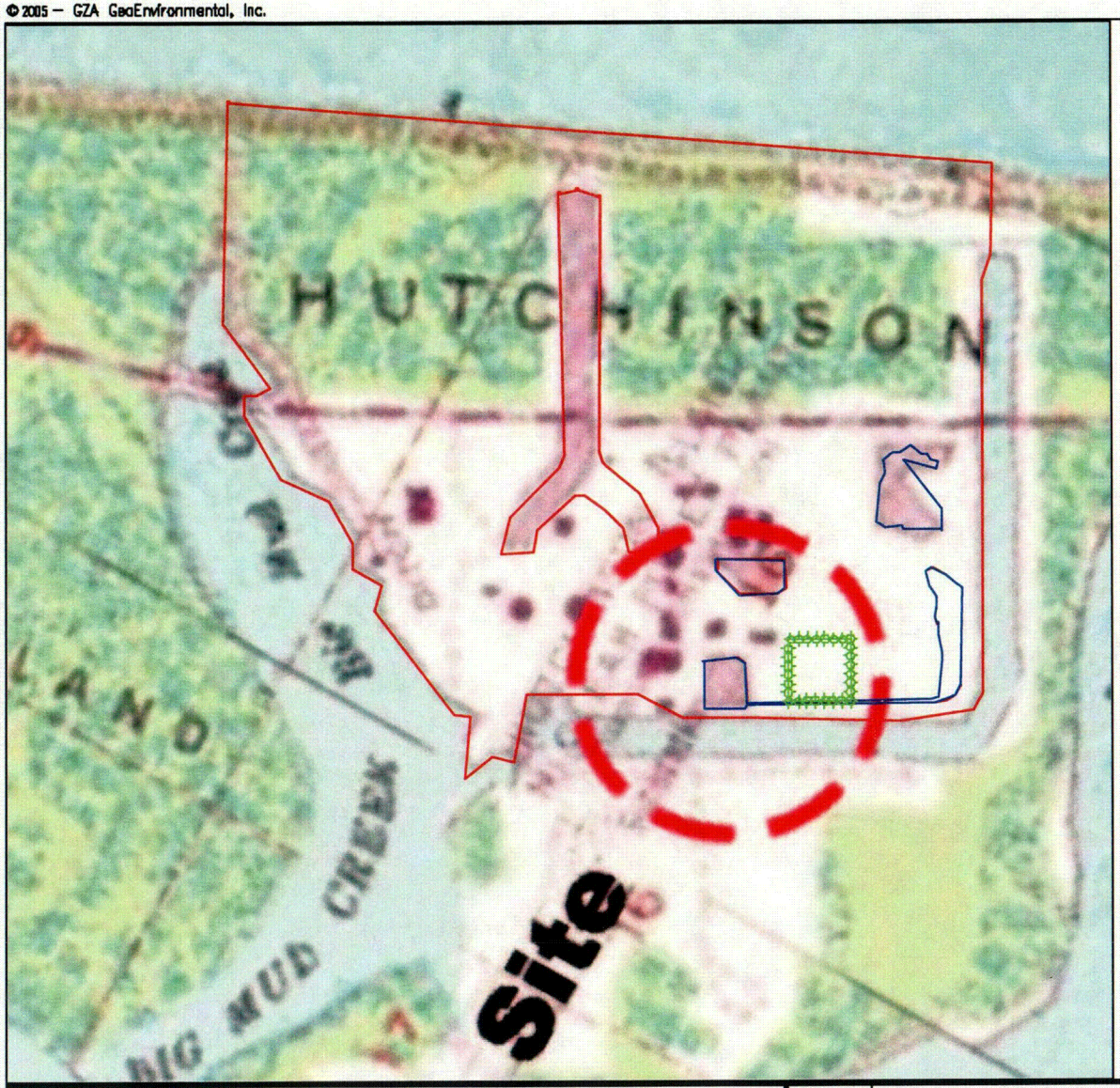

NOTES:

1. BASE MAP DEVELOPED FROM TOPOGRAPHIC MAP PREPARED BY USGS ENTITLED ANKONIA QUADRANGLE MAP.

LEGEND:

- CONSTANT HEAD BOUNDARY
- GENERAL HEAD BOUNDARY
- HORIZONTAL FLOW BOUNDARY
- DEWATERING WELL

FIGURE 7

PROJECT NO. 43301.10

PSL ISFSI
"SOUTH 40"
HUTCHINSON ISLAND, FLORIDA

MODEL BOUNDARY CONDITIONS

REV. NO.	DESCRIPTION	BY	DATE

SCALE
0 1000FT.

PROJ MGR: DS
DESIGNED BY:
REVISED BY:
DRAWN BY: MJG
APPROVED BY:
DATE: 10-25-05

GZA GeoEnvironmental, Inc.
38019 SCHOOLCRAFT ROAD
LIVONIA, MICHIGAN 48150

C-10

X:\MODEFILE\PortStLucie\reports\FIGURE_1.dwg, Layout1, 11/3/2005 11:34:30 AM, mjg, Acrobat PDFWriter, 1:1

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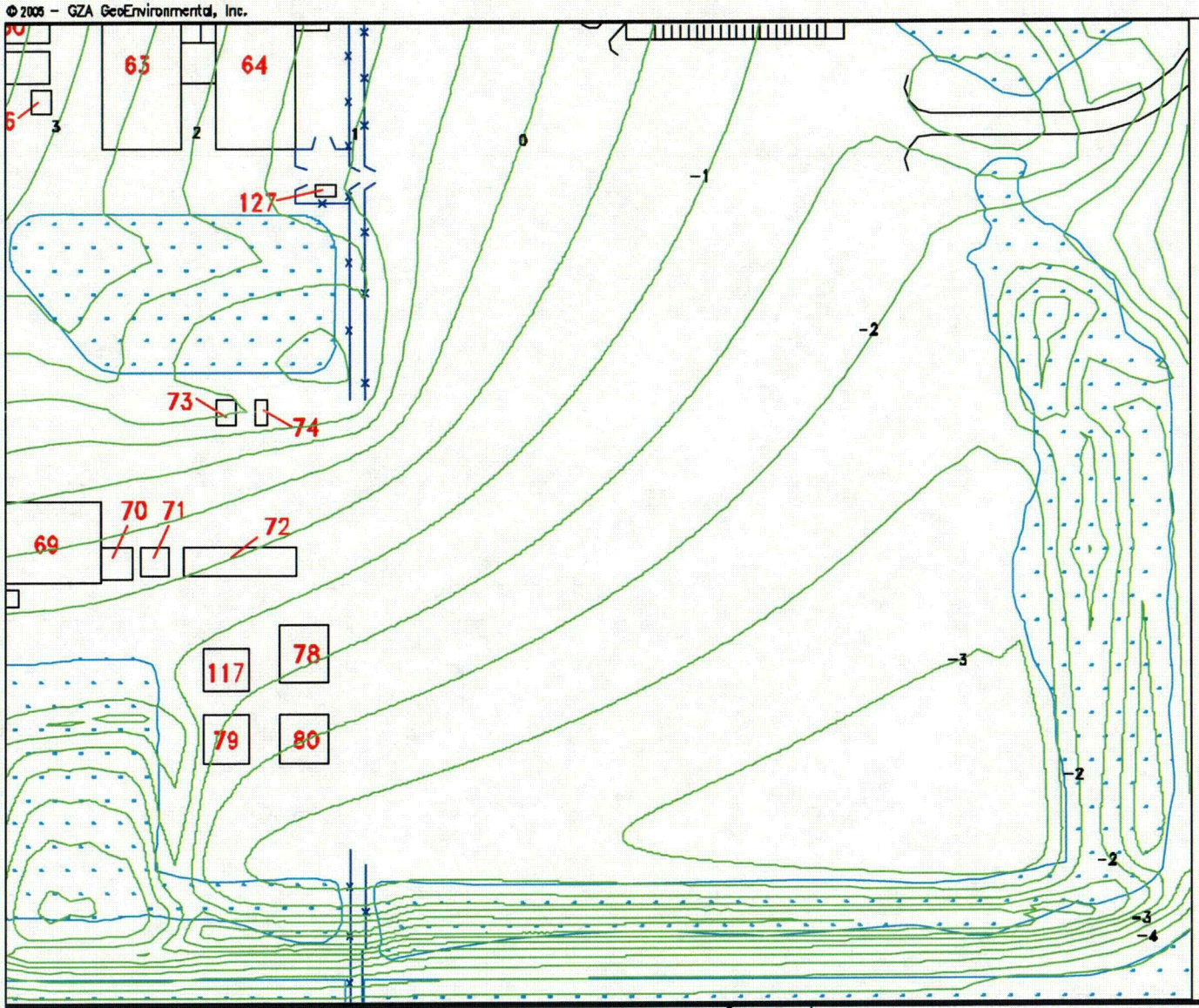

NOTES:

1. BASE MAP DEVELOPED FROM MAP PROVIDED BY PSL, PREPARED BY FLORIDA POWER AND LIGHT, ENTITLED SITE DESCRIPTION MAP, AND DATED 9/9/04. ORIGINAL SCALE WAS NOT RECORDED. DRAWING NO. PSL-SD-MAP.

2. GROUNDWATER CONTOURS ARE BASED ON MODELED RESULTS AND AND MAY NOT REFLECT ACTUAL SUBSURFACE CONDITIONS.

LEGEND:

GROUNDWATER CONTOURS (0.5 FOOT INTERVAL)

FIGURE 8

PROJECT NO. 43301.10

PSL ISFSI
"SOUTH 40"
HUTCHINSON ISLAND, FLORIDA

AMBIENT MODELED
GROUNDWATER CONTOURS

REV. NO.	DESCRIPTION	BY	DATE

SCALE
0 200FT.

PROJ MGR: DS
DESIGNED BY:
REVISED BY:
DRAWN BY: MJG
APPROVED BY:
DATE: 10-25-05

GZA GeoEnvironmental, Inc.
38018 SCHOOLCRAFT ROAD
LIVONIA, MICHIGAN 48150

C-11

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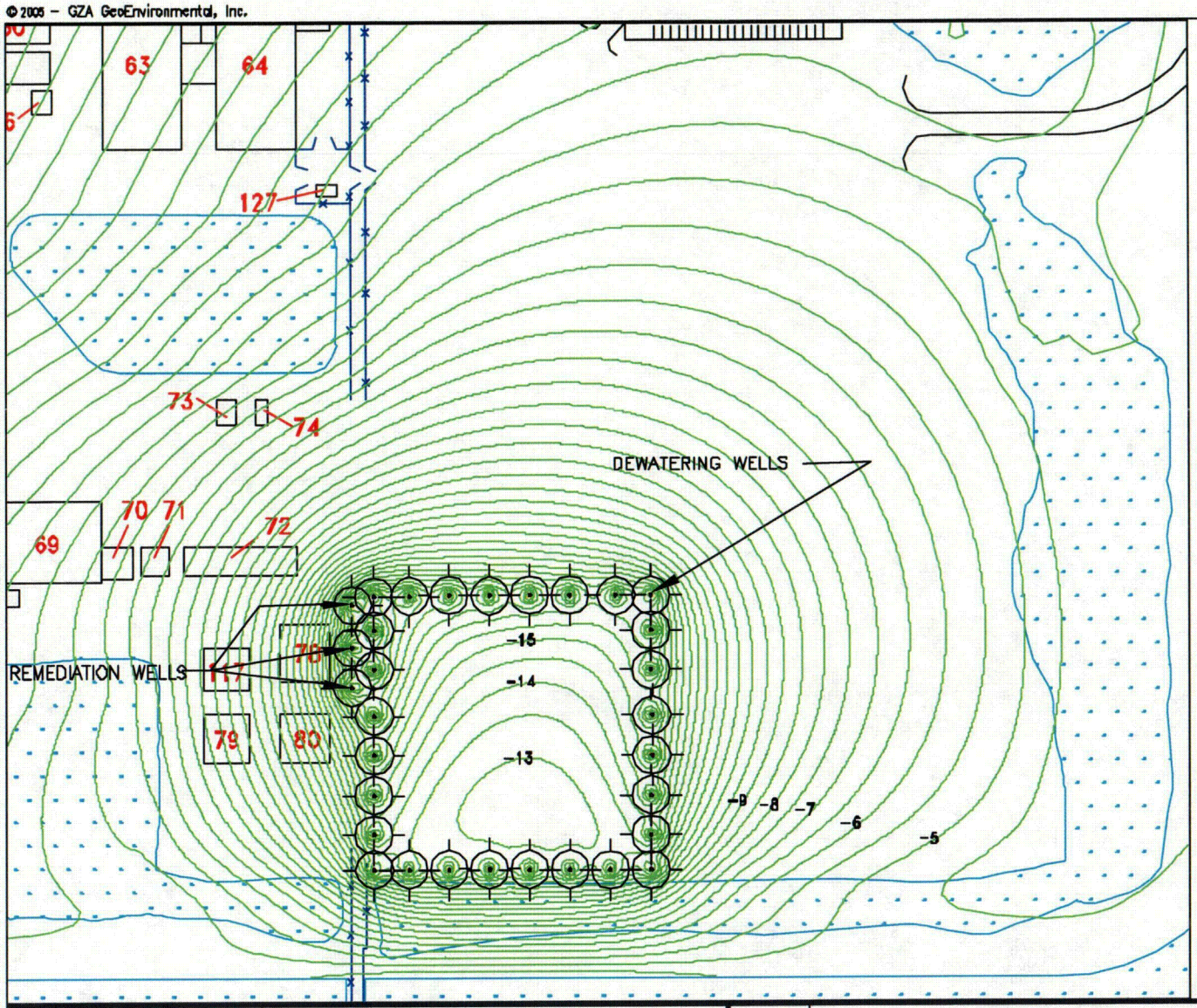

NOTES:

1. BASE MAP DEVELOPED FROM MAP PROVIDED BY PSL, PREPARED BY FLORIDA POWER AND LIGHT, ENTITLED SITE DESCRIPTION MAP, AND DATED 9/9/04. ORIGINAL SCALE WAS NOT RECORDED. DRAWING NO. PSL-SD-MAP.

2. GROUNDWATER CONTOURS ARE BASED ON MODELED RESULTS AND AND MAY NOT REFLECT ACTUAL SUBSURFACE CONDITIONS.

LEGEND:

GROUNDWATER CONTOURS (0.5 FOOT INTERVAL)

REV. NO.	DESCRIPTION	BY	DATE

PSL ISFSI
"SOUTH 40"
HUTCHINSON ISLAND, FLORIDA

MODELED GROUNDWATER CONTOURS
NO SHEETING WITH DEWATERING
AND REMEDIATION WELLS

FIGURE 9

PROJECT NO. 43301.10

SCALE
0 200FT.

PROJ MGR: DS
DESIGNED BY:
REVISED BY:
DRAWN BY: MJG
APPROVED BY:
DATE: 10-25-05

GZA GeoEnvironmental, Inc.
38019 SCHOOLCRAFT ROAD
LIVONIA, MICHIGAN 48150

C-12

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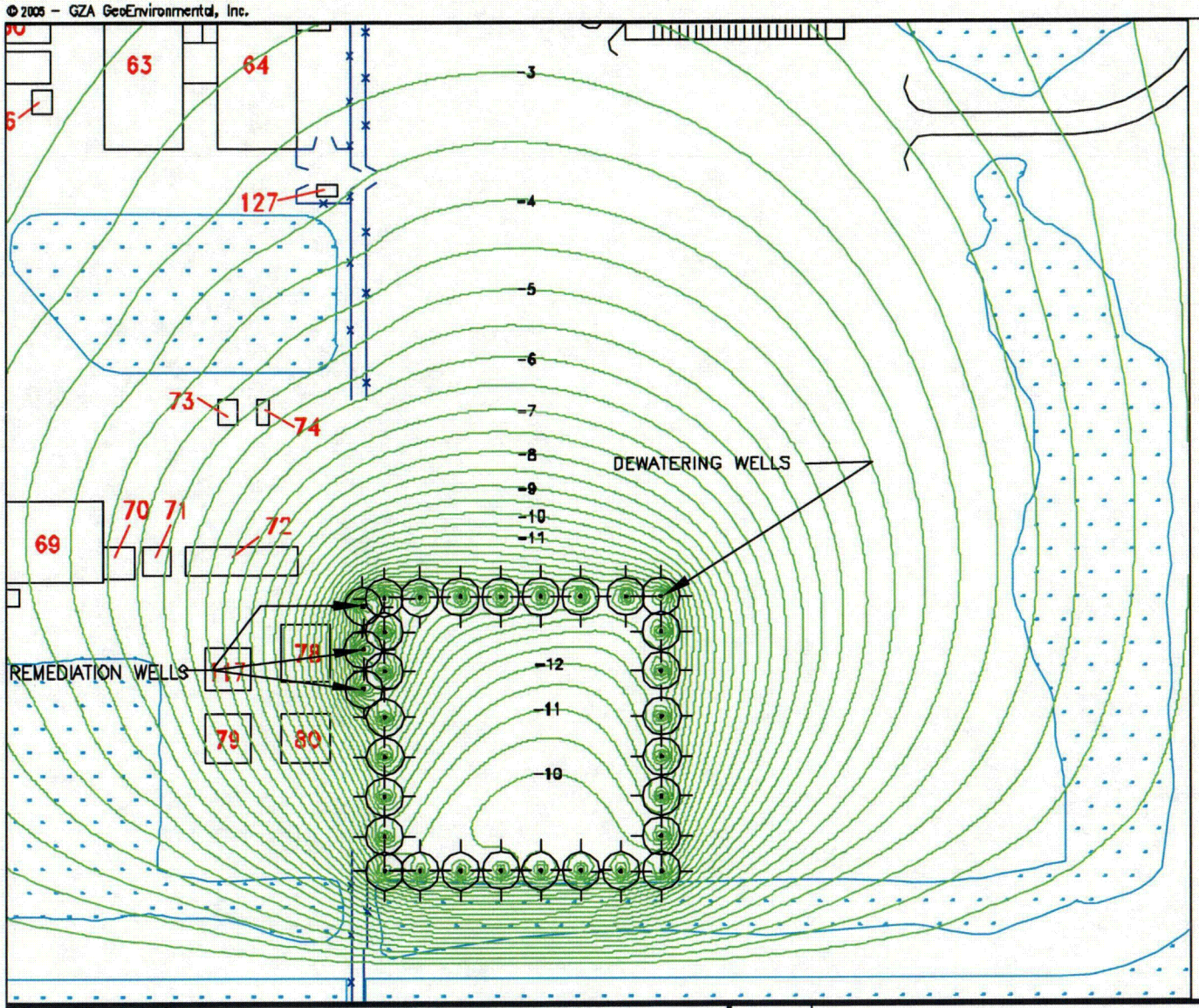

NOTES:

1. BASE MAP DEVELOPED FROM MAP PROVIDED BY PSL, PREPARED BY FLORIDA POWER AND LIGHT, ENTITLED SITE DESCRIPTION MAP, AND DATED 9/9/04. ORIGINAL SCALE WAS NOT RECORDED. DRAWING NO. PSL-SD-MAP.

2. GROUNDWATER CONTOURS ARE BASED ON MODELED RESULTS AND AND MAY NOT REFLECT ACTUAL SUBSURFACE CONDITIONS.

LEGEND:

GROUNDWATER CONTOURS (0.5 FOOT INTERVAL)

FIGURE 10

PROJECT NO. 43301.10

PSL ISFSI
"SOUTH 40"
HUTCHINSON ISLAND, FLORIDA

MODELED DRAWDOWN
NO SHEETING
WITH DEWATERING AND REMEDIATION WELLS

REV. NO.	DESCRIPTION	BY	DATE

SCALE
0 200FT.

PROJ MGR: DS
DESIGNED BY:
REVISED BY:
DRAWN BY: MJG
APPROVED BY:
DATE: 10-25-05

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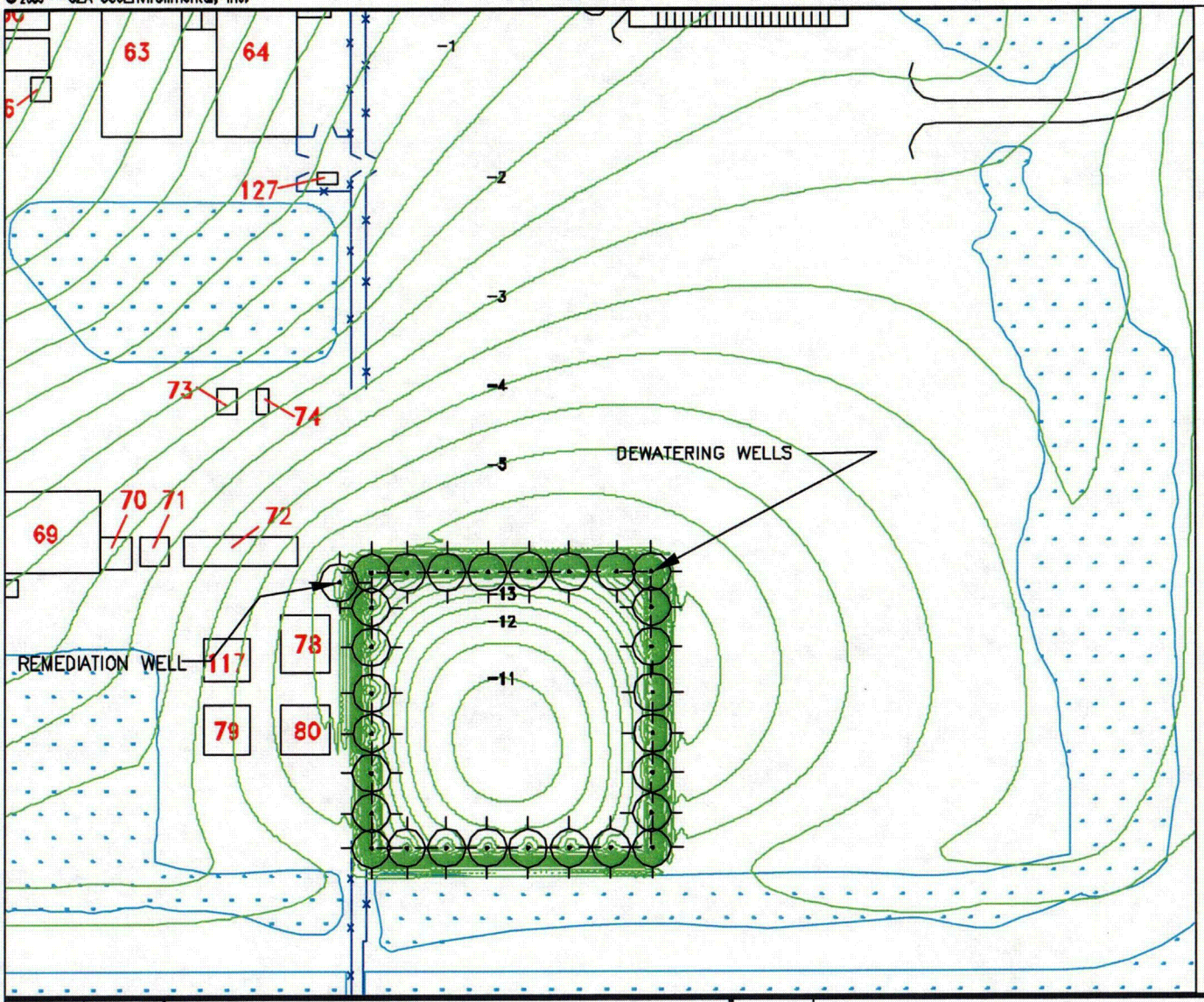

NOTES:

1. BASE MAP DEVELOPED FROM MAP PROVIDED BY PSL, PREPARED BY FLORIDA POWER AND LIGHT, ENTITLED SITE DESCRIPTION MAP, AND DATED 9/9/04. ORIGINAL SCALE WAS NOT RECORDED. DRAWING NO. PSL-SD-MAP.

2. GROUNDWATER CONTOURS ARE BASED ON MODLED RESULTS AND AND MAY NOT REFLECT ACTUAL SUBSURFACE CONDITIONS.

LEGEND:

GROUNDWATER CONTOURS (0.5 FOOT INTERVAL)

FIGURE 11

PROJECT NO. 43301.10

PSL ISFSI
"SOUTH 40"
HUTCHINSON ISLAND, FLORIDA

MODELED GROUNDWATER CONTOURS
WITH SHEETING
WITH REMEDIATION WELL

REV. NO.	DESCRIPTION	BY	DATE

SCALE
0 200FT.

PROJ MGR: DS
DESIGNED BY:
REVISED BY:
DRAWN BY: MJG
APPROVED BY:
DATE: 10-25-05

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LIVONIA, MICHIGAN 48150

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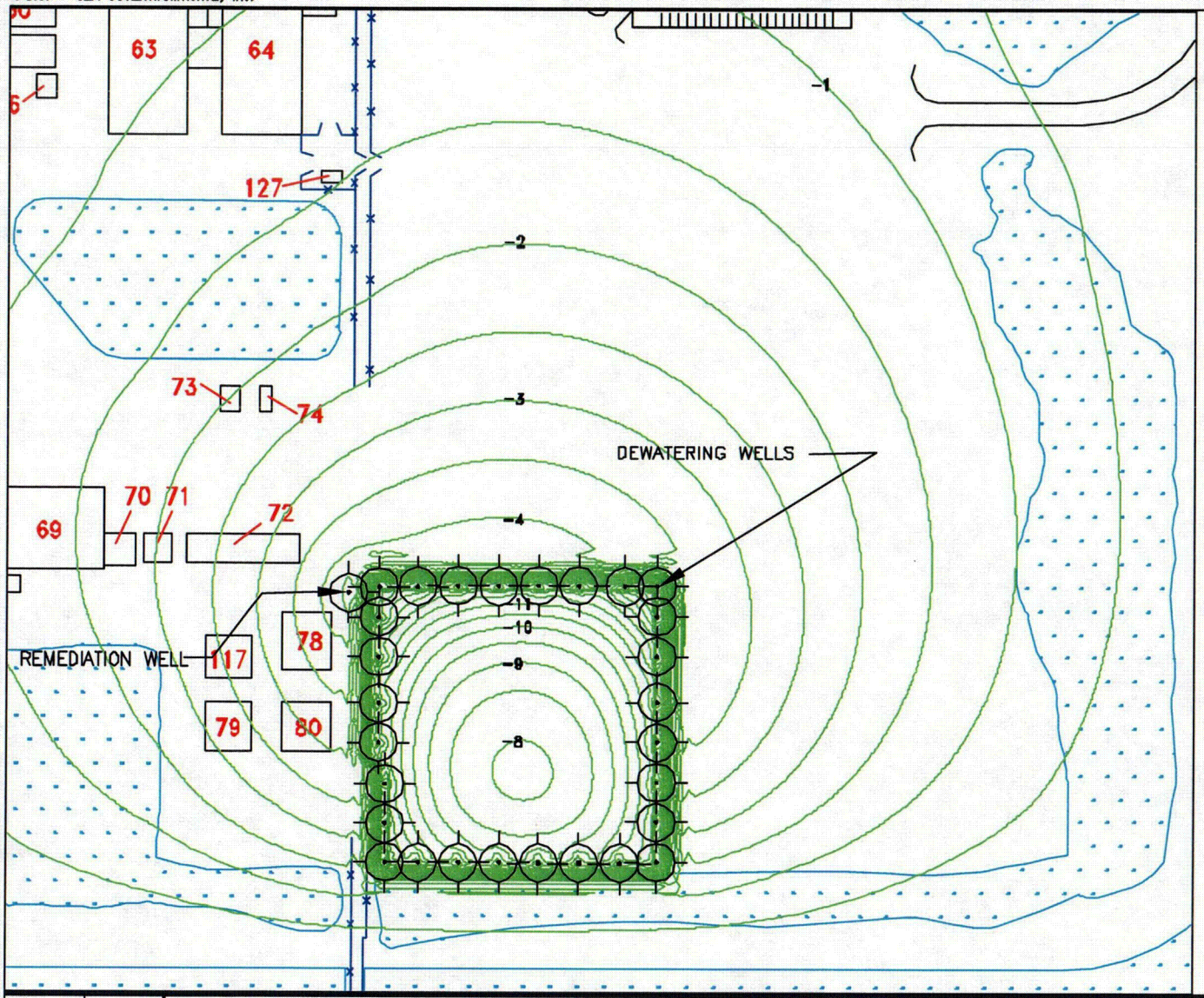

NOTES:

1. BASE MAP DEVELOPED FROM MAP PROVIDED BY PSL, PREPARED BY FLORIDA POWER AND LIGHT, ENTITLED SITE DESCRIPTION MAP, AND DATED 9/9/04. ORIGINAL SCALE WAS NOT RECORDED. DRAWING NO. PSL-SD-MAP.

2. GROUNDWATER CONTOURS ARE BASED ON MODELED RESULTS AND AND MAY NOT REFLECT ACTUAL SUBSURFACE CONDITIONS.

LEGEND:

GROUNDWATER CONTOURS (0.5 FOOT INTERVAL)

FIGURE 12

PROJECT NO. 43301.10

PSL ISFSI
"SOUTH 40"
HUTCHINSON ISLAND, FLORIDA

MODELED GROUNDWATER DRAWDOWN
WITH SHEETING
WITH REMEDIATION WELL

REV. NO.	DESCRIPTION	BY	DATE

SCALE
0 200FT.

PROJ MGR: DS
DESIGNED BY:
REVISED BY:
DRAWN BY: MJG
APPROVED BY:
DATE: 10-25-05

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38018 SCHOOLCRAFT ROAD
LIVONIA MICHIGAN 48150

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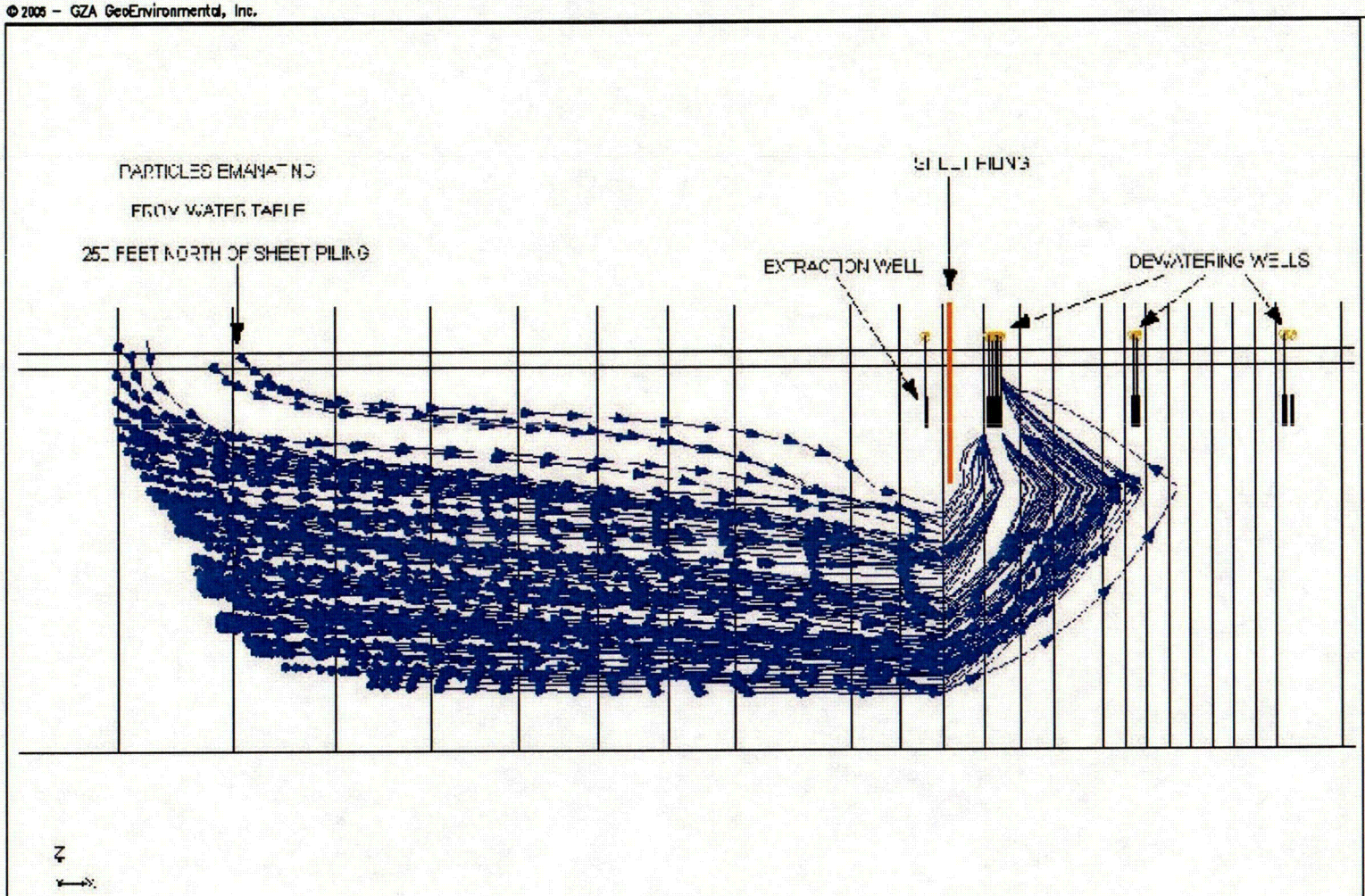

NOTES:

1. FLOW PATHS SHOWN REPRESENT PARTICLE MOVEMENT TRACKED BACKWARD 180 DAYS FROM INSIDE THE DEWATERING CELL.

FIGURE 13

PROJECT NO. 43301.10

PSL ISFSI
"SOUTH 40"
HUTCHINSON ISLAND, FLORIDA

MODELED GROUNDWATER FLOW PATH
UNDER SHEETING-WITH REMEDIATION WELL
CROSS SECTION PERPENDICULAR TO BLDG 78

REV. NO.	DESCRIPTION	BY	DATE

SCALE
0 NOT TO SCALE

PROJ MGR: DS
DESIGNED BY:
REVISED BY: MJG
DRAWN BY: MJG
APPROVED BY:
DATE: 11-14-05

GZA GeoEnvironmental, Inc.
38018 SCHOOLCRAFT ROAD
LIVONIA, MICHIGAN 48150

C-16

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APPENDIX B

Dewatering Effluent Characteristics (Form 2CS)

Facility ID. Number: FL0002208 Outfall No. Temp Dewatering

PLEASE PRINT OR TYPE ONLY: You may report some or all of this information on separate sheets instead of completing these pages. Use the same format. SEE INSTRUCTIONS.

VII. INTAKE AND EFFLUENT CHARACTERISTICS

PART A - You must provide the results of at least one analysis for every pollutant in this table. Complete one table for each outfall. See instructions for additional details.

1. Pollutant	2. Effluent							3.. Units		4. Intake (optional)		
	a. Max. Daily Value		b. Max. 30-day Value		c. Annual Avg. Value		d. No. of Analyses	a. Concentration	b. Mass	a. Long Term Avg. Value		b. No. of Analyses
	(1) Conc.	(2) Mass	(1) Conc.	(2) Mass	(1) Conc.	(2) Mass				(1) Conc.	(2) Mass	
a Carbonaceous Biochemical Oxygen Demand (CBOD)	31						3	mg/L				
b. Chemical Oxygen Demand (COD)	1800						3	mg/L				
c. Total Organic Carbon (TOC)	20						3	mg/l				
d. Total Suspended Solids (TSS)	1300						3	mg/L				
e. Total Nitrogen (as N)	3.3						3	mg/L				
f. Total Phosphorus (as P)	3						3	mg/L				
g. Ammonia (as N)	3.6						3	mg/L				
h. Flow - actual or projected	Value 2.4		Value		Value			MGD		Value		
i. Flow - design	Value 2.4		Value		Value			MGD		Value		
j. Specific Conductivity	Value 51000		Value		Value		3	umhos/cm		Value		
k. Temperature (winter)	Value26		Value		Value			°C		Value		
l. Temperature (summer)	Value		Value		Value			°C		Value		
m. . pH	Min. 6.83	Max 7.14	Min.	Max.			3	STANDARD UNITS				

PART B - Mark "X" in column 2a for each pollutant you know or have reason to believe is present. Mark "X" in column 2b for each pollutant you believe to be absent. If you mark column 2a for any pollutant which is limited either directly, or indirectly but expressly, in an effluent limitations guideline, you must provide the results of at least one analysis for that pollutant. For other pollutants for which you mark column 2a, you must provide quantitative data or an explanation of their presence in your discharge. Complete one table for each outfall. See the instructions for additonal details and requirements.

1. Pollutant and CAS No. (if available)	2. Mark "X"		3. Effluent							4. Units		5. Intake (optional)		
	a. be-lieved present	b. be lieved absent	a. Maximum Daily Value		b. Max. 30-day Value (if available)		c. Long Term Avg. Value (if available)		d. No. of Analyses	a. Conc.	b. Mass	a. Long Term Avg. Value		b. No. of Analyses
			(1) Conc...	(2) Mass	(1) Conc.	(2) Mass	(1) Conc.	(2) Mass				(1) Conc.	(2) Mass	
a. Bromide (24949-67-9)	☒	☐	0.011U						3	mg/L				
b. Chlorine, Total Residual	☐	☒												
c. Color	☒	☐	500						3	PCU				
d. Fecal Coliform	☐	☒												
e. Fluoride (16984-48-8)	☒	☐	1.3						3	mg/L				
f. Nitrate-Nitrite (as N)	☒	☐	0.029						3	mg/L				

: Item VII-B Contd. Facility ID. Number FL0002208 Outfall No. Temp Dewatering

1. Pollutant and CAS No. (if available)	2. Mark "X"		3. Effluent							4. Units		5. Intake (optional)		
	a. believed present	b. believed absent	a. Maximum Daily Value		b. Max. 30-day Value (if available)		c. Long Term Avg. Value (if available)		d. No. of Analyses	a. Conc.	b. Mass	a. Long Term Avg. Value		b. No. of Analyses
			(1) Conc.	(2) Mass	(1) Conc.	(2) Mass	(1) Conc.	(2) Mass				(1) Conc.	(2) Mass	
g. Nitrogen, Total Organic (as N)	☒	☐	1.6						3	mg/L				
h. Oil and grease	☒	☐	2						3	mg/L				
i. Phosphorus, Total (as P) (7723-14-0)	☒	☐	3						3	mg/L				
j. Radioactivity														
(1) Alpha, Total	☒	☐	68 +/- 9						3	pCi/L				
(2) Beta, Total	☒	☐	402 +/- 27						3	pCi/L				
(3) Radium, Total	☐	☒												
(4) Radium 226, Total	☐	☒												
k. Sulfate (as SO_4) (14808-79-8)	☒	☐	900						3	mg/l				
l. Sulfide (as S)	☒	☐	29						3	mg/L				
m. Sulfite (as SO_3) (14265-45-3)	☒	☐	28						3	mg/L				
n. Surfactants	☒	☐	0.14						3	mg/L LAS				
o. Aluminum, Total (7429-90-5)	☒	☐	12						3	mg/L				
p. Barium, Total (7440-39-3)	☒	☐	0.11						3	mg/L				
q. Boron, Total (7440-42-8)	☒	☐	4.7						3	mg/L				
r. Cobalt, Total (7440-48-4)	☒	☐	0.012						3	mg/L				
s. Iron, Total (7439-89-6)	☒	☐	45						3	mg/L				
t. Maagnesium, Total (7439-95-4)	☒	☐	1300						3	mg/L				
u. Molybdenum, Total (7439-98-7)	☒	☐	0.049						3	mg/L				
v. Manganese, Total (7439-96-5)	☒	☐	0.51						3	mg/L				
w. Tin, Total (7440-31-5)	☒	☐	0.032U						3	mg/L				
x. Titanium, Total (7440-32-6)	☒	☐	0.2						3	mg/L				

Facility ID. Number: FL0002208 Outfall No. Temp Dewatering

PART C - If you are a primary industry and this outfall contains process wastewater, refer to Table 2c-2 in the instructions to determine which of the GC/MS fractions you must test for. Mark "X" in column 2a for all GC/MS fractions that apply to your industry and for ALL toxic metals, cyanides, and total phenols. If you are not required to mark column 2a (secondary industries, non-process wastewater outfalls, and non-required GC/MS fractions), mark "X" in column 2b for each pollutant you know or have reason to believe is present. Mark "X" in column 2c for each pollutant you believe is absent. If you mark column 2a for any pollutant, you must provide the results of at least one analysis for that pollutant. If you mark column 2b for any pollutant, you must provide the results of at least one anlysis for that pollutnat if you know or have reason to believe it will be discharged in concentrations of 10 ppb or greater. If you mark column 2b for acrolein, acrylonitrile, 2,4,dinitrophenol, or 2-methyl-4,6 dinitrophenol, you must provide the results of at least one analysis for each of these pollutants which you know or have reason to believe that you discharge in concentrations of 100 ppb or greater. Otherwise, for pollutants for which you mark column2b, you must either submit at least one analysis or briefly describe the reasons the pollutant is expected to be discharged. Note that there are 7 pages to this part; please review each carefully. Complete one table (all 7 pages) for each outfall. See instructions for additional details and requirements.

1. Pollutant and CAS No. (if available)	2. Mark "X"			3. Effuent							4. Units		5. Intake (optional)		
	a. testing required	b. believed present	c. believed absent	a. Maximum Daily Value		b. Max. 30-day Value (if available)		c. Long Term Avg. Value (if available)		d. No. of Analyses	a. Conc.	b. Mass	a. Long Term Avg. Value		b. No. of Analyses
				(1) Conc.	(2) Mass	(1) Conc.	(2) Mass	(1) Conc.	(2) Mass				(1) Conc.	(2) Mass	
METALS, CYANIDE, AND TOTAL PHENOLS															
1M. Antimony, Total (7440-36-0)	☒	☐	☐	0.0036U						3	mg/L				
2M. Arsenic, Total (7723-14-0)	☒	☐	☐	0.042						3	mg/L				
3M. Beryllium, Total (7440-41-7)	☒	☐	☐	0.0037U						3	mg/L				
4M. Cadmium, Total (7440-43-9)	☒	☐	☐	0.00077						3	mg/L				
5M. Chromium, Total (7440-47-3)	☒	☐	☐	0.19						3	mg/L				
6M. Copper, Total (7440-50-8)	☒	☐	☐	0.045						3	mg/L				
7M. Lead, Total (7439-92-1)	☒	☐	☐	0.012						3	mg/L				
8M. Mercury, Total (7439-97-6)	☒	☐	☐	0.000072U						3	mg/L				
9M. Nickel, Total (7440-02-0)	☒	☐	☐	0.041						3	mg/L				
10M. Selenium, Total (7782-49-2)	☒	☐	☐	0.03U						3	mg/L				
11M. Silver, Total (7440-22-4)	☒	☐	☐	0.0095U						3	mg/L				
12M. Thallium, Total (7440-28-0)	☒	☐	☐	0.033U						3	mg/L				
13M. Zinc, Total (7440-66-6)	☒	☐	☐	0.094						3	mg/L				
14M. Cyanide, Total (57-12-5)	☒	☐	☐	0.005U						3	mg/L				
15M. Phenols, Total	☒	☐	☐	0.035U						3	mg/L				
DIOXIN															
2,3,7,8-Tetra-chlorodibenzo-P-Dioxin (1764-01-6)	☐	☒	☐												
GC/MS FRACTION-VOLATILE COMPOUNDS															
1V. Acrolein (107-02-8)	☒	☐	☐	3.8U						3	ug/L				
2V. Acrylonitrile (107-13-1)	☒	☐	☐	1.2U						3	ug/L				

Facility ID. Number: FL0002208 Outfall No. Temp Dewatering

1. Pollutant and CAS No. (if available)	2. Mark "X"			3. Effluent							4. Units		5. Intake (optional)		
	a. testing required	b. believed present	c. believed absent	a. Maximum Daily Value		b. Max. 30-day Value (if available)		c. Long Term Avg. Value (if available)		d. No. of Analyses	a. Conc.	b. Mass	a. Long Term Avg. Value		b. No. of Analyses
				(1) Conc.	(2) Mass	(1) Conc.	(2) Mass	(1) Conc.	(2) Mass				(1) Conc.	(2) Mass	
GC/MS FRACTION - VOLATILE COMPOUNDS (continued)															
3V. Benzene (71-43-2)	☒	☐	☐	0.27U						3	ug/L				
4V. Bis (Chloromethyl) Ether (542-88-1)	☒	☐	☐	0.86U						3	ug/L				
5V. Bromoform (75-25-2)	☒	☐	☐	0.58U						3	ug/L				
6V. Carbon Tetrachloride (56-23-5)	☒	☐	☐	0.42U						3	ug/L				
7V Chlorobenzene (108-90-7)	☒	☐	☐	0.63U						3	ug/L				
8V. Chlorodi-bromomethane (124-8-1)	☒	☐	☐	0.34U						3	ug/L				
9V. Chloroethane (74-00-3)	☒	☐	☐	0.8U						3	ug/L				
10V. 2-Chloro-ethylvinyl Ether (110-75-8)	☒	☐	☐	0.98U						3	ug/L				
11V. Chloroform (67-86-3)	☒	☐	☐	0.9U						3	ug/L				
12V. Dichloro-bromomethane (75-24-4)	☒	☐	☐	0.35U						3	ug/L				
13V. Dichloro-difluoromethane (75-71-8)	☒	☐	☐	0.4U						3	ug/L				
14V. 1,1-Dichloroethane (75-34-3)	☒	☐	☐	0.52U						3	ug/L				
15V. 1,2-Dichloroethane (107-06-2)	☒	☐	☐	0.57U						3	ug/L				
16V. 1,1-Dichloroethylene (75-35-4)	☒	☐	☐	0.45U						3	ug/L				
17V. 1,2,-Dichloropropane (78-87-5)	☒	☐	☐	0.52U						3	ug/L				
18V. 1,3-Dichloropropylene (542-75-6)	☒	☐	☐	0.14U						3	ug/L				
19V. Ethylbenzene (100-41-4)	☒	☐	☐	0.44U						3	ug/L				
20V. Methyl Bromide (74-83-9)	☒	☐	☐	0.66U						3	ug/L				
21V. Methyl Chloride (74-87-3)	☒	☐	☐	0.64U						3	ug/L				
22V. Methylene Chloride (74-98-2)	☒	☐	☐	4U						3	ug/L				
23V. 1,1,2,2-Tetra-chloroethane (79-34-5)	☒	☐	☐	0.14U						3	ug/L				
24V. Tetrachloroethylene (127-18-4)	☒	☐	☐	0.34U						3	ug/L				

Facility ID. Number: FL0002208 Outfall No. Temp Dewatering

1. Pollutant and CAS No. (if available)	2. Mark "X"			3. Effluent							4. Units		5. Intake (optional)		
	a. testing required	b. believed present	c. believed absent	a. Maximum Daily Value		b. Max. 30-day Value (if available)		c. Long Term Avg. Value (if available)		d. No. of Analyses	a. Conc.	b. Mass	a. Long Term Avg. Value		b. No. of Analyses
				(1) Conc.	(2) Mass	(1) Conc.	(2) Mass	(1) Conc.	(2) Mass				(1) Conc.	(2) Mass	
GC/MS FRACTION - VOLATILE COMPOUNDS (continued)															
25V. Toluene (108-88-3)	☒	☐	☐	0.51U						3	ug/L				
26V. 1,2-Trans-Dichloroethylene (156-60-5)	☒	☐	☐	0.44U						3	ug/L				
27V. 1,1,2-Trichloroethane (71-55-6)	☒	☐	☐	0.47U						3	ug/L				
28V. 1,1,2-Trichloroethane (79-00-5)	☒	☐	☐	0.47U						3	ug/L				
29V. Trichloroethylene (79-01-6)	☒	☐	☐	0.28U						3	ug/L				
30V. Trichloro-fluoromethane (75-69-4)	☒	☐	☐	0.98U						3	ug/L				
31V. Vinyl Chloride (75-01-4)	☒	☐	☐	0.5U						3	ug/L				
GC/MS FRACTION - ACID COMPOUNDS															
1A. 2-Chlorophenol (95-57-8)	☒	☐	☐	0.24U						3	ug/L				
2A. 2,4-Dichlorophenol (120-83-2)	☒	☐	☐	0.66U						3	ug/L				
3A. 2,4-Dimethylphenol (105-67-9)	☒	☐	☐	1.2U						3	ug/L				
4A. 4,6-Dinitro-O-Cresol (534-53-1)	☒	☐	☐	1.2U						3	ug/L				
5A. 2,4-Dinitrophenol (51-28-5)	☒	☐	☐	1.5U						3	ug/L				
6A. 2-Nitrophenol (88-75-5)	☒	☐	☐	1.4U						3	ug/L				
7A. 4-Nitrophenol (100-02-7)	☒	☐	☐	1.5U						3	ug/L				
8A P-Chloro-M-Cresol (59-50-7)	☒	☐	☐	0.33U						3	ug/L				
9A Pentachlorophenol (87-86-5)	☒	☐	☐	0.97U						3	ug/L				
10A Phenol (108-95-2)	☒	☐	☐	0.85U						3	ug/L				
11A 2,4,5-Trichloro-phenol (88-06-2)	☒	☐	☐	0.35U						3	ug/L				
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS															
1B. Acenaphthene (63-32-9)	☒	☐	☐	1.1U						3	ug/L				
2B. Acenaphtylene (208-96-8)	☒	☐	☐	0.59U						3	ug/L				
3B. Anthracene (120-12-7)	☒	☐	☐	1.2U						3	ug/L				
4B. Benzidine (92-87-5)	☒	☐	☐	12U						3	ug/L				

Facility ID. Number: FL0002208 Outfall No. Temp Dewatering

1. Pollutant and CAS No. (if available)	2. Mark "X"			3. Effuent							4. Units		5. Intake (optional)		
	a. testing required	b. believed present	c. believed absent	a. Maximum Daily Value		b. Max. 30-day Value (if available)		c. Long Term Avg. Value (if available)		d. No. of Analyses	a. Conc.	b. Mass	a. Long Term Avg. Value		b. No. of Analyses
				(1) Conc.	(2) Mass	(1) Conc.	(2) Mass	(1) Conc.	(2) Mass				(1) Conc.	(2) Mass	
5B. Benzo *(a)* Anthracene (56-55-3)	☒	☐	☐	1.2U						3	ug/L				
6B. Benzo *(a)* Pyrene (50-32-8)	☒	☐	☐	1.4U						3	ug/L				
7B. 3,4-Benzo-fluoranthene (205-99-2)	☒	☐	☐	1.2U						3	ug/L				
8B. Benzo *(ghi)* Perylene (191-24-2)	☒	☐	☐	1.3U						3	ug/L				
9B. Benzo *(k)* Fluoranthene (207-08-9)	☒	☐	☐	1.7U						3	ug/L				
10B. Bis *(2-Chloroethoxy)* Methane (111-91-1)	☒	☐	☐	0.92U						3	ug/L				
11B. Bis *(2-chloroethyl)* Ether (111-44-4)	☒	☐	☐	0.86U						3	ug/L				
12B. Bis *(2-Chloroisopropyl)* Ether (102-60-1)	☒	☐	☐	1.3U						3	ug/L				
13B. Bis *(2-Ethylhexyl)* Phthalate (117-81-7)	☒	☐	☐	3.6U						3	ug/L				
14B. 4-Bromophenyl Phenyl Ether (101-55-3)	☒	☐	☐	1.1U						3	ug/L				
15B Butyl Benzyl Phthalate (84-68-7)	☒	☐	☐	1.4U						3	ug/L				
16B. 2-Chloronaphthalene (91-58-7)	☒	☐	☐	0.83U						3	ug/L				
17B. 4-Chlorophenyl Phenyl Ether (7005-72-3)	☒	☐	☐	0.78U						3	ug/L				
18B. Chrysene (218-01-9)	☒	☐	☐	1.2U						3	ug/L				
19B. Dibenzo *(a,h)* Anthracene (53-70-3)	☒	☐	☐	1.4U						3	ug/L				
20B. 1,2-Dichlorobenzene (95-50-1)	☒	☐	☐	0.76U						3	ug/L				
21B. 1,3-Dichlorobenzene (541-73-1)	☒	☐	☐	0.6U						3	ug/L				
22B. 1,4-Dichlorobenzene (106-46-7)	☒	☐	☐	0.71U						3	ug/L				
23B. 3,3'-Dichlorobenzidine (92-94-1)	☒	☐	☐	1.6U						3	ug/L				
24B. Diethyl Phthalate (84-66-2)	☒	☐	☐	1.1U						3	ug/L				
25B. Dimethyl Phthalate (131-11-3)	☒	☐	☐	1U						3	ug/L				
26B. Di-N-Butyl Phthalate (84-74-2)	☒	☐	☐	1.5U						3	ug/L				
27B. 2,4-Dinitrotoluene (121-14-2)	☒	☐	☐	1.3U						3	ug/L				
28B. 2,6-Dinitrotoluene (606-20-2)	☒	☐	☐	1U						3	ug/L				

Facility ID. Number: FL0002208 Outfall No. Temp Dewatering

1. Pollutant and CAS No. (if available)	2. Mark "X"			3. Effluent							4. Units		5. Intake (optional)		
	a. testing required	b. believed present	c. believed absent	a. Maximum Daily Value		b. Max. 30-day Value (if available)		c. Long Term Avg. Value (if available)		d. No. of Analyses	a. Conc.	b. Mass	a. Long Term Avg. Value		b. No. of Analyses
				(1) Conc.	(2) Mass	(1) Conc.	(2) Mass	(1) Conc.	(2) Mass				(1) Conc.	(2) Mass	
29B. Di-N-Octyl Phthalate (117-84-0)	☒	☐	☐	1.7U						3	ug/L				
30B. 1,2-Diphenylhydrazine *(as Azobenzene)* (122-66-7)	☒	☐	☐	3.6U						3	ug/L				
31B. Fluoranthene (206-44-0)	☒	☐	☐	1.5U						3	ug/L				
32B. Fluorene (86-73-7)	☒	☐	☐	0.99U						3	ug/L				
33B. Hexachlorobenzene (118-74-1)	☒	☐	☐	0.78U						3	ug/L				
34B. Hexachlorobutadiene (87-68-3)	☒	☐	☐	0.82U						3	ug/L				
35B. Hexachlorocyclopentadiene (77-47-4)	☒	☐	☐	1U						3	ug/L				
36B. Hexachloroethane (67-72-1)	☒	☐	☐	0.67U						3	ug/L				
37B. Indeno *(1,2,3-cd)* Pyrene (193-39-5)	☒	☐	☐	1.3U						3	ug/L				
38B. Isophorone (78-59-1)	☒	☐	☐	0.81U						3	ug/L				
39B. Naphthalene (91-20-3)	☒	☐	☐	0.72U						3	ug/L				
40B. Nitrobenzene (98-95-9)	☒	☐	☐	0.83U						3	ug/L				
41B N-Nitrosodimethylamine (62-75-9)	☒	☐	☐	1.5U						3	ug/L				
42B. N-Nitrosodi-N-Propylamine (621-64-7)	☒	☐	☐	0.92U						3	ug/L				
43B. N-Nitro-sodiphenylamine (86-30-6)	☒	☐	☐	1.2U						3	ug/L				
44B Phenanthrene (85-01-8)	☒	☐	☐	1.2U						3	ug/L				
45B. Pyrene (129-00-0)	☒	☐	☐	1.3U						3	ug/L				
46B. 1,2,4-Trichlorobenzene (120-82-1)	☒	☐	☐	0.78U						3	ug/L				
GC/MS FRACTION - PESTICIDES															
1P. Aldrin (309-00-2)	☐	☐	☒												
2P. -BHC (319-84-6)	☐	☐	☒												
3P -BHC (319-85-7)	☐	☐	☒												
4P. -BHC (58-89-9)	☐	☐	☒												
5P. -BHC (319-86-8)	☐	☐	☒												

Facility ID. Number: FL0002208 Outfall No. Temp Dewatering

1. Pollutant and CAS No. (if available)	2. Mark "X"			3. Effluent							4. Units		5. Intake (optional)		
	a. testing required	b. believed present	c. believed absent	a. Maximum Daily Value		b. Max. 30-day Value (if available)		c. Long Term Avg. Value (if available)		d. No. of Analyses	a. Conc.	b. Mass	a. Long Term Avg. Value		b. No. of Analyses
				(1) Conc.	(2) Mass	(1) Conc.	(2) Mass	(1) Conc.	(2) Mass				(1) Conc.	(2) Mass	
6P. Chlordane (57-74-9)	☐	☐	☒												
7P. 4,4'-DDT (50-29-3)	☐	☐	☒												
8P. 4,4'-DDE (72-55-9)	☐	☐	☒												
9P. 4,4'-DDD (72-54-8)	☐	☐	☒												
10P. Dieldrin (60-57-1)	☐	☐	☒												
11P. -Endosulfan (115-29-7)	☐	☐	☒												
12P. -Endosulfan (115-29-7)	☐	☐	☒												
13P. Endosulfan Sulfate (1031-07-8)	☐	☐	☒												
14P. Endrin (72-20-8)	☐	☐	☒												
15P. Endrin Aldehyde (7421-92-4)	☐	☐	☒												
16P. Heptachlor (76-44-8)	☐	☐	☒												
17P. Heptachlor Epoxide (1024-57-3)	☐	☐	☒												
18P. PCB-1242 (53469-21-9)	☐	☐	☒												
19P. PCB-1254 (11097-69-1)	☐	☐	☒												
20P. PCB-1221 (11104-28-2)	☐	☐	☒												
21P. PCB-1232 (11141-16-5)	☐	☐	☒												
22P. PCB-1248 (12672-29-6)	☐	☐	☒												
23P. PCB-1260 (11096-82-5)	☐	☐	☒												
24P. PCB-1016 (12674-11-2)	☐	☐	☒												
25P. Toxaphene (8001-35-2)	☐	☐	☒												

APPENDIX C

Plume Control Effluent Characteristics (Form 2CS)

Facility ID. Number: FL0002208 Outfall No. I-008

PLEASE PRINT OR TYPE ONLY: You may report some or all of this information on separate sheets instead of completing these pages. Use the same format. SEE INSTRUCTIONS.

VII. INTAKE AND EFFLUENT CHARACTERISTICS

PART A - You must provide the results of at least one analysis for every pollutant in this table. Complete one table for each outfall. See instructions for additional details.

1. Pollutant	2. Effluent							3.. Units		4. Intake (optional)		
	a. Max. Daily Value		b. Max. 30-day Value		c. Annual Avg. Value		d. No. of Analyses	a. Concentration	b. Mass	a. Long Term Avg. Value		b. No. of Analyses
	(1) Conc.	(2) Mass	(1) Conc.	(2) Mass	(1) Conc.	(2) Mass				(1) Conc.	(2) Mass	
a Carbonaceous Biochemical Oxygen Demand (CBOD)	31						2	mg/L				
b. Chemical Oxygen Demand (COD)	1800						2	mg/L				
c. Total Organic Carbon (TOC)	20						2	mg/l				
d. Total Suspended Solids (TSS)	1300						2	mg/L				
e. Total Nitrogen (as N)	3.3						2	mg/L				
f. Total Phosphorus (as P)	3						2	mg/L				
g. Ammonia (as N)	3.6						2	mg/L				
h. Flow - actual or projected	Value 2.736		Value		Value			MGD		Value		
i. Flow - design	Value 2.736		Value		Value			MGD		Value		
j. Specific Conductivity	Value 50000		Value		Value		2	umhos/cm		Value		
k. Temperature (winter)	Value26		Value		Value			°C		Value		
l. Temperature (summer)	Value		Value		Value			°C		Value		
m. . pH	Min. 6.89	Mx 7.14	Min.	Max.			2	STANDARD UNITS				

PART B - Mark "X" in column 2a for each pollutant you know or have reason to believe is present. Mark "X" in column 2b for each pollutant you believe to be absent. If you mark column 2a for any pollutant which is limited either directly, or indirectly but expressly, in an effluent limitations guideline, you must provide the results of at least one analysis for that pollutant. For other pollutants for which you mark column 2a, you must provide quantitative data or an explanation of their presence in your discharge. Complete one table for each outfall. See the instructions for additonal details and requirements.

1. Pollutant and CAS No. (if available)	2. Mark "X"		3. Effluent							4. Units		5. Intake (optional)		
	a. be-lieved present	b. be lieved absent	a. Maximum Daily Value		b. Max. 30-day Value (if available)		c. Long Term Avg. Value (if available)		d. No. of Analyses	a. Conc.	b. Mass	a. Long Term Avg. Value		b. No. of Analyses
			(1) Conc...	(2) Mass	(1) Conc.	(2) Mass	(1) Conc.	(2) Mass				(1) Conc.	(2) Mass	
a. Bromide (24949-67-9)	☒	☐	0.011U						2	mg/L				
b. Chlorine, Total Residual	☐	☒												
c. Color	☒	☐	450						2	PCU				
d. Fecal Coliform	☐	☒												
e. Fluoride (16984-48-8)	☒	☐	1.3						2	mg/L				
f. Nitrate-Nitrite (as N)	☒	☐	0.024						2	mg/L				

: Item VII-B Contd. Facility ID. Number FL0002208 Outfall No. I-008

1. Pollutant and CAS No. (if available)	2. Mark "X"		3. Effuent							4. Units		5. Intake (optional)		
	a .believed present	b. believed absent	a. Maximum Daily Value		b. Max. 30-day Value (if available)		c. Long Term Avg. Value (if available)		d. No. of Analyses	a. Conc.	b. Mass	a. Long Term Avg. Value		b. No. of Analyses
			(1) Conc.	(2) Mass	(1) Conc.	(2) Mass	(1) Conc.	(2) Mass				(1) Conc.	(2) Mass	
g. Nitrogen, Total Organic (as N)	☒	☐	1.6						2	mg/L				
h. Oil and grease	☒	☐	2						2	mg/L				
i. Phosphorus, Total (as P) (7723-14-0)	☒	☐	3						2	mg/L				
j. Radioactivity														
(1) Alpha, Total	☒	☐	54 +/- 7						2	pCi/L				
(2) Beta, Total	☒	☐	402 +/- 27						2	pCi/L				
(3) Radium, Total	☐	☒												
(4) Radium 226, Total	☐	☒												
k. Sulfate (as SO_4) (14808-79-8)	☒	☐	900						2	mg/l				
l. Sulfide (as S)	☒	☐	29						2	mg/L				
m. Sulfite (as SO_3) (14265-45-3)	☒	☐	28						2	mg/L				
n. Surfactants	☒	☐	0.08						2	mg/L LAS				
o. Aluminum, Total (7429-90-5)	☒	☐	11						2	mg/L				
p. Barium, Total (7440-39-3)	☒	☐	0.1						2	mg/L				
q. Boron, Total (7440-42-8)	☒	☐	4.7						2	mg/L				
r. Cobalt, Total (7440-48-4)	☒	☐	0.008						2	mg/L				
s. Iron, Total (7439-89-6)	☒	☐	35						2	mg/L				
t. Maagnesium, Total (7439-95-4)	☒	☐	1200						2	mg/L				
u. Molybdenum, Total (7439-98-7)	☒	☐	0.025						2	mg/L				
v. Manganese, Total (7439-96-5)	☒	☐	0.36						2	mg/L				
w. Tin, Total (7440-31-5)	☒	☐	0.032U						2	mg/L				
x. Titanium, Total (7440-32-6)	☒	☐	0.11						2	mg/L				

Facility ID. Number: FL0002208 Outfall No. I-008

PART C - If you are a primary industry and this outfall contains process wastewater, refer to Table 2c-2 in the instructions to determine which of the GC/MS fractions you must test for. Mark "X" in column 2a for all GC/MS fractions that apply to your industry and for ALL toxic metals, cyanides, and total phenols. If you are not required to mark column 2a (secondary industries, non-process wastewater outfalls, and non-required GC/MS fractions), mark "X" in column 2b for each pollutant you know or have reason to believe is present. Mark "X" in column 2c for each pollutant you believe is absent. If you mark column 2a for any pollutant, you must provide the results of at least one analysis for that pollutant. If you mark column 2b for any pollutant, you must provide the results of at least one anlysis for that pollutnat if you know or have reason to believe it will be discharged in concentrations of 10 ppb or greater. If you mark column 2b for acrolein, acrylonitrile, 2,4,dinitrophenol, or 2-methyl-4,6 dinitrophenol, you must provide the results of at least one analysis for each of these pollutants which you know or have reason to believe that you discharge in concentrations of 100 ppb or greater. Otherwise, for pollutants for which you mark column2b, you must either submit at least one analysis or briefly describe the reasons the pollutant is expected to be discharged. Note that there are 7 pages to this part; please review each carefully. Complete one table (all 7 pages) for each outfall. See instructions for additional details and requirements.

1. Pollutant and CAS No. (if available)	2. Mark "X"			3. Effluent							4. Units		5. Intake (optional)		
	a. testing required	b. believed present	c. believed absent	a. Maximum Daily Value		b. Max. 30-day Value (if available)		c. Long Term Avg. Value (if available)		d. No. of Analyses	a. Conc.	b. Mass	a. Long Term Avg. Value		b. No. of Analyses
				(1) Conc.	(2) Mass	(1) Conc.	(2) Mass	(1) Conc.	(2) Mass				(1) Conc.	(2) Mass	
METALS, CYANIDE, AND TOTAL PHENOLS															
1M. Antimony, Total (7440-36-0)	☒	☐	☐	0.0036						2	mg/L				
2M. Arsenic, Total (7723-14-0)	☒	☐	☐	0.042						2	mg/L				
3M. Beryllium, Total (7440-41-7)	☒	☐	☐	0.0037U						2	mg/L				
4M. Cadmium, Total (7440-43-9)	☒	☐	☐	0.00077						2	mg/L				
5M. Chromium, Total (7440-47-3)	☒	☐	☐	0.12						2	mg/L				
6M. Copper, Total (7440-50-8)	☒	☐	☐	0.026						2	mg/L				
7M. Lead, Total (7439-92-1)	☒	☐	☐	0.012						2	mg/L				
8M. Mercury, Total (7439-97-6)	☒	☐	☐	0.000072U						2	mg/L				
9M. Nickel, Total (7440-02-0)	☒	☐	☐	0.034						2	mg/L				
10M. Selenium, Total (7782-49-2)	☒	☐	☐	0.03U						2	mg/L				
11M. Silver, Total (7440-22-4)	☒	☐	☐	0.0095U						2	mg/L				
12M. Thallium, Total (7440-28-0)	☒	☐	☐	0.033U						2	mg/L				
13M. Zinc, Total (7440-66-6)	☒	☐	☐	0.078						2	mg/L				
14M. Cyanide, Total (57-12-5)	☒	☐	☐	0.005U						2	mg/L				
15M. Phenols, Total	☒	☐	☐	0.035U						2	mg/L				
DIOXIN															
2,3,7,8-Tetra-chlorodibenzo-P-Dioxin (1764-01-6)	☐	☒	☐												
GC/MS FRACTION - VOLATILE COMPOUNDS															
1V. Acrolein (107-02-8)	☒	☐	☐	3.8U						2	ug/L				
2V. Acrylonitrile (107-13-1)	☒	☐	☐	1.2U						2	ug/L				

Facility ID. Number: FL0002208 Outfall No. I-008

1. Pollutant and CAS No. (if available)	2. Mark "X"			3. Effluent							4. Units		5. Intake (optional)		
	a. testing required	b. believed present	c. believed absent	a. Maximum Daily Value		b. Max. 30-day Value (if available)		c. Long Term Avg. Value (if available)		d. No. of Analyses	a. Conc.	b. Mass	a. Long Term Avg. Value		b. No. of Analyses
				(1) Conc.	(2) Mass	(1) Conc.	(2) Mass	(1) Conc.	(2) Mass				(1) Conc.	(2) Mass	
GC/MS FRACTION - VOLATILE COMPOUNDS (continued)															
3V. Benzene (71-43-2)	☒	☐	☐	0.27U						2	ug/L				
4V. Bis (Chloromethyl) Ether (542-88-1)	☒	☐	☐	0.86U						2	ug/L				
5V. Bromoform (75-25-2)	☒	☐	☐	0.58U						2	ug/L				
6V. Carbon Tetrachloride (56-23-5)	☒	☐	☐	0.42U						2	ug/L				
7V Chlorobenzene (108-90-7)	☒	☐	☐	0.63U						2	ug/L				
8V. Chlorodi-bromomethane (124-8-1)	☒	☐	☐	0.34U						2	ug/L				
9V. Chloroethane (74-00-3)	☒	☐	☐	0.8U						2	ug/L				
10V. 2-Chloro-ethylvinyl Ether (110-75-8)	☒	☐	☐	0.98U						2	ug/L				
11V. Chloroform (67-86-3)	☒	☐	☐	0.9U						2	ug/L				
12V. Dichloro-bromomethane (75-24-4)	☒	☐	☐	0.35U						2	ug/L				
13V. Dichloro-difluoromethane (75-71-8)	☒	☐	☐	0.4U						2	ug/L				
14V. 1,1-Dichloroethane (75-34-3)	☒	☐	☐	0.52U						2	ug/L				
15V. 1,2-Dichloroethane (107-06-2)	☒	☐	☐	0.57U						2	ug/L				
16V. 1,1-Dichloroethylene (75-35-4)	☒	☐	☐	0.45U						2	ug/L				
17V. 1,2,-Dichloropropane (78-87-5)	☒	☐	☐	0.52U						2	ug/L				
18V. 1,3-Dichloropropylene (542-75-6)	☒	☐	☐	0.14U						2	ug/L				
19V. Ethylbenzene (100-41-4)	☒	☐	☐	0.44U						2	ug/L				
20V. Methyl Bromide (74-83-9)	☒	☐	☐	0.66U						2	ug/L				
21V. Methyl Chloride (74-87-3)	☒	☐	☐	0.64U						2	ug/L				
22V. Methylene Chloride (74-98-2)	☒	☐	☐	4U						2	ug/L				
23V. 1,1,2,2-Tetra-chloroethane (79-34-5)	☒	☐	☐	0.14U						2	ug/L				
24V. Tetrachloroethylene (127-18-4)	☒	☐	☐	0.34U						2	ug/L				

Facility ID. Number: FL0002208 Outfall No. I-008

1. Pollutant and CAS No. (if available)	2. Mark "X"			3. Effluent							4. Units		5. Intake (optional)		
	a. testing required	b. believed present	c. believed absent	a. Maximum Daily Value		b. Max. 30-day Value (if available)		c. Long Term Avg. Value (if available)		d. No. of Analyses	a. Conc.	b. Mass	a. Long Term Avg. Value		b. No. of Analyses
				(1) Conc.	(2) Mass	(1) Conc.	(2) Mass	(1) Conc.	(2) Mass				(1) Conc.	(2) Mass	
GC/MS FRACTION - VOLATILE COMPOUNDS (continued)															
25V. Toluene (108-88-3)	☒	☐	☐	0.51U						2	ug/L				
26V. 1,2-Trans-Dichloroethylene (156-60-5)	☒	☐	☐	0.44U						2	ug/L				
27V. 1,1,2-Trichloroethane (71-55-6)	☒	☐	☐	0.47U						2	ug/L				
28V. 1,1,2-Trichloroethane (79-00-5)	☒	☐	☐	0.47U						2	ug/L				
29V. Trichloroethylene (79-01-6)	☒	☐	☐	0.28U						2	ug/L				
30V. Trichloro-fluoromethane (75-69-4)	☒	☐	☐	0.98U						2	ug/L				
31V. Vinyl Chloride (75-01-4)	☒	☐	☐	0.5U						2	ug/L				
GC/MS FRACTION - ACID COMPOUNDS															
1A. 2-Chlorophenol (95-57-8)	☒	☐	☐	0.24U						2	ug/L				
2A. 2,4-Dichlorophenol (120-83-2)	☒	☐	☐	0.66U						2	ug/L				
3A. 2,4-Dimethylphenol (105-67-9)	☒	☐	☐	1.2U						2	ug/L				
4A. 4,6-Dinitro-O-Cresol (534-53-1)	☒	☐	☐	1.2U						2	ug/L				
5A. 2,4-Dinitrophenol (51-28-5)	☒	☐	☐	1.5U						2	ug/L				
6A. 2-Nitrophenol (88-75-5)	☒	☐	☐	1.4U						2	ug/L				
7A. 4-Nitrophenol (100-02-7)	☒	☐	☐	1.5U						2	ug/L				
8A P-Chloro-M-Cresol (59-50-7)	☒	☐	☐	0.33U						2	ug/L				
9A Pentachlorophenol (87-86-5)	☒	☐	☐	0.97U						2	ug/L				
10A Phenol (108-95-2)	☒	☐	☐	0.85U						2	ug/L				
11A 2,4,5-Trichloro-phenol (88-06-2)	☒	☐	☐	0.35U						2	ug/L				
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS															
1B. Acenaphthene (63-32-9)	☒	☐	☐	1.1U						2	ug/L				
2B. Acenaphtylene (208-96-8)	☒	☐	☐	0.59U						2	ug/L				
3B. Anthracene (120-12-7)	☒	☐	☐	1.2U						2	ug/L				
4B. Benzidine (92-87-5)	☒	☐	☐	12U						2	ug/L				

Facility ID. Number: FL0002208 Outfall No. I-008

1. Pollutant and CAS No. (if available)	2. Mark "X"			3. Effluent							4. Units		5. Intake (optional)		
	a. testing required	b. believed present	c. believed absent	a. Maximum Daily Value		b. Max. 30-day Value (if available)		c. Long Term Avg. Value (if available)		d. No. of Analyses	a. Conc.	b. Mass	a. Long Term Avg. Value		b. No. of Analyses
				(1) Conc.	(2) Mass	(1) Conc.	(2) Mass	(1) Conc.	(2) Mass				(1) Conc.	(2) Mass	
5B. Benzo *(a)* Anthracene (56-55-3)	☒	☐	☐	1.2U						2	ug/L				
6B. Benzo *(a)* Pyrene (50-32-8)	☒	☐	☐	1.4U						2	ug/L				
7B. 3,4-Benzo-fluoranthene (205-99-2)	☒	☐	☐	1.2U						2	ug/L				
8B. Benzo *(ghi)* Perylene (191-24-2)	☒	☐	☐	1.3U						2	ug/L				
9B. Benzo *(k)* Fluoranthene (207-08-9)	☒	☐	☐	1.7U						2	ug/L				
10B. Bis *(2-Chloroethoxy)* Methane (111-91-1)	☒	☐	☐	0.92U						2	ug/L				
11B. Bis *(2-chloroethyl)* Ether (111-44-4)	☒	☐	☐	0.86U						2	ug/L				
12B. Bis *(2-Chloroisopropyl)* Ether (102-60-1)	☒	☐	☐	1.3U						2	ug/L				
13B. Bis *(2-Ethylhexyl)* Phthalate (117-81-7)	☒	☐	☐	3.6U						2	ug/L				
14B. 4-Bromophenyl Phenyl Ether (101-55-3)	☒	☐	☐	1.1U						2	ug/L				
15B Butyl Benzyl Phthalate (84-68-7)	☒	☐	☐	1.4U						2	ug/L				
16B. 2-Chloronaphthalene (91-58-7)	☒	☐	☐	0.83U						2	ug/L				
17B. 4-Chlorophenyl Phenyl Ether (7005-72-3)	☒	☐	☐	0.78U						2	ug/L				
18B. Chrysene (218-01-9)	☒	☐	☐	1.2U						2	ug/L				
19B. Dibenzo *(a,h)* Anthracene (53-70-3)	☒	☐	☐	1.4U						2	ug/L				
20B. 1,2-Dichlorobenzene (95-50-1)	☒	☐	☐	0.76U						2	ug/L				
21B. 1,3-Dichlorobenzene (541-73-1)	☒	☐	☐	0.6U						2	ug/L				
22B. 1,4-Dichlorobenzene (106-46-7)	☒	☐	☐	0.71U						2	ug/L				
23B. 3,3'-Dichlorobenzidine (92-94-1)	☒	☐	☐	1.6U						2	ug/L				
24B. Diethyl Phthalate (84-66-2)	☒	☐	☐	1.1U						2	ug/L				
25B. Dimethyl Phthalate (131-11-3)	☒	☐	☐	1U						2	ug/L				
26B. Di-N-Butyl Phthalate (84-74-2)	☒	☐	☐	1.5U						2	ug/L				
27B. 2,4-Dinitrotoluene (121-14-2)	☒	☐	☐	1.3U						2	ug/L				
28B. 2,6-Dinitrotoluene (606-20-2)	☒	☐	☐	1U						2	ug/L				

Facility ID. Number: FL0002208 Outfall No. I-008

1. Pollutant and CAS No. (if available)	2. Mark "X"			3. Effluent							4. Units		5. Intake (optional)		
	a. testing required	b. believed present	c. believed absent	a. Maximum Daily Value		b. Max. 30-day Value (if available)		c. Long Term Avg. Value (if available)		d. No. of Analyses	a. Conc.	b. Mass	a. Long Term Avg. Value		b. No. of Analyses
				(1) Conc.	(2) Mass	(1) Conc.	(2) Mass	(1) Conc.	(2) Mass				(1) Conc.	(2) Mass	
29B. Di-N-Octyl Phthalate (117-84-0)	☒	☐	☐	1.7U						2	ug/L				
30B. 1,2-Diphenylhydrazine *(as Azobenzene)* (122-66-7)	☒	☐	☐	3.6U						2	ug/L				
31B. Fluoranthene (206-44-0)	☒	☐	☐	1.5U						2	ug/L				
32B. Fluorene (86-73-7)	☒	☐	☐	0.99U						2	ug/L				
33B. Hexachlorobenzene (118-74-1)	☒	☐	☐	0.78U						2	ug/L				
34B. Hexachlorobutadiene (87-68-3)	☒	☐	☐	0.82U						2	ug/L				
35B. Hexachlorocyclopentadiene (77-47-4)	☒	☐	☐	1U						2	ug/L				
36B. Hexachloroethane (67-72-1)	☒	☐	☐	0.67U						2	ug/L				
37B. Indeno *(1,2,3-cd)* Pyrene (193-39-5)	☒	☐	☐	1.3U						2	ug/L				
38B. Isophorone (78-59-1)	☒	☐	☐	0.81U						2	ug/L				
39B. Naphthalene (91-20-3)	☒	☐	☐	0.72U						2	ug/L				
40B. Nitrobenzene (98-95-9)	☒	☐	☐	0.83U						2	ug/L				
41B N-Nitrosodimethylamine (62-75-9)	☒	☐	☐	1.5U						2	ug/L				
42B. N-Nitrosodi-N-Propylamine (621-64-7)	☒	☐	☐	0.92U						2	ug/L				
43B. N-Nitro-sodiphenylamine (86-30-6)	☒	☐	☐	1.2U						2	ug/L				
44B Phenanthrene (85-01-8)	☒	☐	☐	1.2U						2	ug/L				
45B. Pyrene (129-00-0)	☒	☐	☐	1.3U						2	ug/L				
46B. 1,2,4-Trichlorobenzene (120-82-1)	☒	☐	☐	0.78U						2	ug/L				
GC/MS FRACTION - PESTICIDES															
1P. Aldrin (309-00-2)	☐	☐	☒												
2P. -BHC (319-84-6)	☐	☐	☒												
3P -BHC (319-85-7)	☐	☐	☒												
4P. -BHC (58-89-9)	☐	☐	☒												
5P. -BHC (319-86-8)	☐	☐	☒												

Facility ID. Number: FL0002208 Outfall No. I-008

1. Pollutant and CAS No. (if available)	2. Mark "X"			3. Effuent							4. Units		5. Intake (optional)		
	a. testing required	b. believed present	c. believed absent	a. Maximum Daily Value		b. Max. 30-day Value (if available)		c. Long Term Avg. Value (if available)		d. No. of Analyses	a. Conc.	b. Mass	a. Long Term Avg. Value		b. No. of Analyses
				(1) Conc.	(2) Mass	(1) Conc.	(2) Mass	(1) Conc.	(2) Mass				(1) Conc.	(2) Mass	
6P. Chlordane (57-74-9)	☐	☐	☒												
7P. 4,4'-DDT (50-29-3)	☐	☐	☒												
8P. 4,4'-DDE (72-55-9)	☐	☐	☒												
9P. 4,4'-DDD (72-54-8)	☐	☐	☒												
10P. Dieldrin (60-57-1)	☐	☐	☒												
11P. -Endosulfan (115-29-7)	☐	☐	☒												
12P. -Endosulfan (115-29-7)	☐	☐	☒												
13P. Endosulfan Sulfate (1031-07-8)	☐	☐	☒												
14P. Endrin (72-20-8)	☐	☐	☒												
15P. Endrin Aldehyde (7421-92-4)	☐	☐	☒												
16P. Heptachlor (76-44-8)	☐	☐	☒												
17P. Heptachlor Epoxide (1024-57-3)	☐	☐	☒												
18P. PCB-1242 (53469-21-9)	☐	☐	☒												
19P. PCB-1254 (11097-69-1)	☐	☐	☒												
20P. PCB-1221 (11104-28-2)	☐	☐	☒												
21P. PCB-1232 (11141-16-5)	☐	☐	☒												
22P. PCB-1248 (12672-29-6)	☐	☐	☒												
23P. PCB-1260 (11096-82-5)	☐	☐	☒												
24P. PCB-1016 (12674-11-2)	☐	☐	☒												
25P. Toxaphene (8001-35-2)	☐	☐	☒												

APPENDIX D

Calculation of Dewatering Effluent Impacts to Outfall D-001 POD

Tetra Tech EC, Inc. MICROSOFT EXCEL CALCULATION SHEET					
Subject:	**Water Quality Impacts at the Canal POD - Flow / Volume Calculations**				
Client:	**Florida Power & Light (FPL)**				
Project:	**St. Lucie Nuclear Plant**				
Project Description:	**NPDES Permit Modification for excavation dewatering associated with the Independent Spent Fuel Storage Installation (ISFSI) Area**				
	Prepared By:	C. St.Cin	DATE :	11/22/05	**Appendix: B**
	Checked By:	H. Barone	DATE :	11/29/05	**Calculation No.: 1**
	Approved By:	C. St.Cin	DATE :	11/29/05	

Purpose of Calculation

This calculation estimates the water quality at the Point of Discharge (POD) (Outfall D-001) resulting from temporary additional discharges into the Intake Canal. Its purpose is to demonstrate reasonable assurance that Water Quality Criteria (Chapter 62-302.530, F.A.C.) will be met at the POD. Reference: NPDES Permit No. FL0002208.

Background

At the St. Lucie Nuclear Plant (Plant), FPL is planning construction of the ISFSI area on a 5-acre parcel that is adjacent to and geohydrologically downgradient of the Mixed Plume (plume) area. Extensive dewatering over a 3 to 6 month period will be performed for construction of the new project. A groundwater (gw) Pump & Treat (P&T) system will be installed to provide hydraulic control of the plume. GZA GeoEnvironmental, Inc. (GZA) is performing groundwater modeling to support the design of the construction excavation dewatering system, and specification of the hydraulic plume control (PC) requirements. The P&T system is described in an Interim Remedial Action Plan (IRAP) submitted to the Florida Department of Environmental Protection, Southeast District, on November 21, 2005.

There are two construction dewatering design cases that describe the range of dewatering flow rates. These cases are based on the inclusion and exclusion, respectively, of the use of sheet pile to assist with hydraulic control of the excavation and the plume. The higher of these two estimates for flow rates reflects steady-state operation of the construction dewatering pumps, without the installation of extensive sheet pile, at approximately 1,500 gpm, with a corresponding discharge from the P&T system of approximately 200 gpm to the Evaporation / Percolation (EP) Basins. The maximum initial/startup flow rate for the dewatering system is 4,500 gpm to the Intake Canal. The intermittent pumping rate from the EP Basins to the Intake Canal at Outfall I-008 is 1,900 gpm. These two flow rates are used in this calculation of "worse case" impacts to criteria constituent concentrations at the NPDES POD.

Approach

This calculation uses a 2-part mass balance approach to estimate the incremental changes to the water quality at the Intake Canal, and hence at the Discharge Canal POD D-001. Two streams are added to the Intake Canal, and the mass contribution from each stream is added to the mass contribution from the Atlantic Ocean, which is used by the FPL Plant at large flow rates for once-through condenser cooling water. The first part of the calculation estimates the flow component of each new stream and of the Intake Canal. The second part of the calculation uses laboratory data to characterize the quality and mass contribution of the 2 new streams to the intake canal. A sample calculation is provided to show how the temporary concentrations are estimated for the Discharge Canal POD.

Narrative Assumptions:

1. Flow contributions to and from the dewatering well pumps and the PC well pumps are a combination of local native gw, Intake Canal water as gw, and the EP Basin system water as gw. Per GZA modeling report, dewatering withdrawal of gw from the nearby Intake Canal is estimated to be at least 70% of the total dewatering withdrawal. For purposes of this analysis, the amount and constituent concentrations of dewatering effluent pumped to the Intake Canal that is assumed to be from Intake Canal seepage is not included as "new input" to the Intake Canal. Stated another way, this simplifying assumption says that Intake Canal water is drawn from the Canal into the dewatering wells and then returned to the Canal as dewatering pump effluent, without attenuation of the Intake Canal constituent concentrations. This is a conservative assumption that allows for a simplified analysis of potential impact to the Discharge Canal.

2. The concentrations of the compounds of interest ascribed to the dewatering system effluent and the plume control system effluent are taken from those detected during the 3-level geoprobe sampling of the ISFSI area. This sampling was performed on November 1, 2005 at the approximate center of the planned construction dewatering area, at depths of 25 ft, 50 ft and 75 ft bls.

The highest detected concentration from the three intervals is used to characterize native gw quality for purposes of assessing the potential construction dewatering impacts. The highest detected concentration from the top two intervals is used to characterize native gw quality for purposes of assessing the potential PC impacts. This use of maximum concentrations from the recent sampling event is a conservative approach.

3. Since the general quality of the local native gw down to 75 ft bls is lower than that of the EP Basins surface water, native gw quality data is used for chatacterizing the portion of construction dewatering effluent that is coming from native gw and the EP Basins seepage. Further, the highest (not the average) of the gw concentrations detected during the November 1, 2005 sampling event from the depths of 25 ft, 50 ft and 75 ft bls is used for the calculation of the dewatering effluent quality. This is a conservative approach.

4. The EP Basins water quality is assumed to approach that of native gw in the upper 50 ft as a result of continuous discharge from the plume control system. At 200 gpm input from the PC P&T system, the EP Basins water quality will approach the quality of the P&T system effluent within 2 to 3 months from dewatering start. Therefore, the gw contribution from the EP Basins to the construction dewatering wells and to the plume control wells is assumed to be predominantly from pumped native local gw. This is a conservative assumption that allows for a simplified analysis of impact to the Discharge Canal.

As a conservative basis for this analysis, it is assumed also that the P&T system will not treat or attenuate constituents in the native gw, even though volatile organic constituents are actually removed by the air stripper. Although the P&T effluent to the EP Basins is expected to be a maximum of 200 gpm, the EP Basins discharge via Outfall I-008 intermittently to the Intake Canal at a pumping rate of 1,900 gpm. For conservatism, this calculation uses this 1,900 gpm as an "instantaneous" input to the Intake Canal, and hence the Outfall D-001 POD.

Calculation continued on Page 2 of 2

Tetra Tech EC, Inc.
MICROSOFT EXCEL CALCULATION SHEET

Subject:	**Water Quality Impacts at the Canal POD - Flow / Volume Calculations**
Client:	**Florida Power & Light (FPL)**
Project:	**St. Lucie Nuclear Plant**
Project Description:	**NPDES Permit Modification for excavation dewatering associated with the Independent Spent Fuel Storage Installation (ISFSI) Area**

Prepared By:	C. St.Cin	DATE :	11/22/05	**Appendix: B**
Checked By:	H. Barone	DATE :	11/29/05	**Calculation No.: 1**
Approved By:	C. St.Cin	DATE :	11/29/05	

System Flow Assumptions:			
Intake Canal			
Cooling water flow from Ocean	1,362	mgd	FPL NPDES Permit, average annual flow with 2 Units operating (using 2003 data)
Cooling water flow from Ocean	472,917	gpm	Net annual average cooling water flow required based on 1 Generating Unit operation
EP Basins			
Plume Control System Influent	200	gpm	Based on the maximum average pumping rate for the PC wells. (GZA Report)
Discharge to Intake Canal	1,900	gpm	Instantaneous pumping of EP Basin water to Intake Canal at Outfall I-008. (FPL NPDES)
Dewatering System			
Discharge Flow Transient	4,500	gpm	Based on initial dewatering pumping rates to Intake Canal for the "no sheet pile" case. (GZA)
Discharge Flow Steady-state	1,500	gpm	Based on steady-state dewatering pumping rates to the intake canal for the "no sheet pile" case. (GZA)

Flow Network Assumptions:			
Fraction of Intake Canal water in dewatering pump discharge (GZA)	70%	Fraction of Intake Canal water in plume control system discharge	0%
Fraction of native groundwater in dewatering pump discharge	30%	Fraction of native gw in plume control system discharge	100%
	100%		100%

Contributing Intake Canal Flows:			
From Ocean to Intake Canal	472,917	gpm	99.317%
From Dewatering Effluent as native gw	1,350	gpm	0.284%
From PC wells via EP Basins	1,900	gpm	0.399%
Total	476,167	gpm	100.000%

EP Basin Capacities (million gal)				**Operating Capacity (gal/unit time)**		
	Total Volume	Avail Cap Factor	Capacity	Per Month	Per day	Per Minute
Southeast & South Basins	11.2		5.6			
East Basin	4.6	50%	2.3			
West Basin	11.1		5.55			
Total	26.9		13.45	14,000,000	466,667	324
Plume Control P&T system effluent	200 gpm			8,640,000	gal / month	
Plug Flow (Displacement) Factor	50%			4,320,000	adjusted gal / month	
EP Basin Turnover Rate				3.2	Months / turnover	

Sample Calculation for Max Concentrations at the Point of Discharge

1. Determine Constituent Mass (M) and Flows (F) from Dewatering Effluent plus Plume Control Effluent, and add to the background constituent mass and flow as measured at the POD.
2. Determine Combined Concentration (Ccomb) at POD based on combined mass and flow.

Given for Arsenic:	Cgw	42	µg/L		Max of values detected in gw at 25', 50' & 75' bls
	Cpod	2.30	µg/L		From POD analysis reported in FPL NPDES permit application
Dewatering Effluent flow rate	Fdw	1,350	gpm		Based on native gw flow at 30% of total flow developed, during transient state
Plume Control flow rate	Fpc	1,900	gpm		Based on native gw flow at 100% of average flow developed
Discharge Canal flow rate	Fpod	472,917	gpm		From POD average flow reported in FPL NPDES permit application
Dewatering mass contribution	Mdw	0.21463	grams/min	Where:	Mdw = (Cgw*Fdw*3.785 L/gal)/1000000
Plume Control mass contribution	Mpc	0.30208	grams/min		Mpc = (Cgw*Fpc*3.785 L/gal)/1000000
Background seawater mass contribution	Mpod	0.28734	grams/min		Mpod = (Cpod*Fpod*3.785 L/gal)/1000000
Combined Concentration at POD	Ccomb =	6.39	µg/L	Where:	Ccomb=(Mdw+Mpc+Mpod)*(1000000*3.785 L/gal)/(Fdw+Fpc+Fpod)
Class III WQ Marine Criterion	Ccrit =	50	µg/L		Comparison concludes Criterion is not exceeded.

References:

FPL NPDES - FPL St. Lucie Plant NPDES Permit No. FL0002208, Application Dated June 15, 2004
IRAP - Tetra Tech EC, Inc. Interim Remedial Action Plan (IRAP), November 18, 2005
GZA - GZA GeoEnvironmental, Inc. Groundwater Modeling Report, Nov. 14, 2005

Conversion Factors:		
1 day =	1440	minutes
1 day =	24	hours
1 month =	30	days, nominal
1 gal =	3.785412	liters

Tetra Tech EC, Inc.
MICROSOFT EXCEL CALCULATION SHEET

Subject: Water Quality Impacts at the Canal POD - Concentration / Mass Calculations
Client: Florida Power & Light (FPL)
Project: St. Lucie Nuclear Plant
Project Description: NPDES Permit Modification for excavation dewatering associated with the Independent Spent Fuel Storage Installation (ISFSI) Area

Prepared By:	C. St.Cin	DATE:	11/22/05	Appendix:	B
Checked By:	H. Barone	DATE:	11/29/05	Calculation No.:	2
Approved By:	C. St.Cin	DATE:	11/29/05		

CAS No.	Analyte	Units	Native Groundwater Concentration at Boring Depth: Total 25 ft bls	Total 50 ft bls	Total 75 ft bls	Dissolved 25 ft bls	Dissolved 50 ft bls	Dissolved 75 ft bls	Max "Total" Values 25' & 50'	Max "Total" Values 25', 50' & 75'	Class III Marine WQ Criteria Conc µg/L	Intake Canal Contribution from Dewatering (as Native GW) at Temporary Influent Point: Conc µg/L	Flow gpm	Mass grams/min	Intake Canal Contribution from Plume Control (as Native GW) at Influent Point I-008: Conc µg/L	Flow gpm	Mass grams/min	Background Discharge Canal Concentrations: Conc µg/L	Flow gpm	Mass grams/min	Calculated D-001 POD Concentrations from ISFSI Temporary Dewatering: Conc µg/L	Flow gpm	Mass grams/min
71-55-6	1,1,1-Trichloroethane	ug/L	0.46	0.46	0.46				0.46	0.46	*No Criteria	0.46	1350	0.00235074	0.46	1900	0.00330845	1	472,917	1.7901844	1.00	476,167	1.7958436
79-34-5	1,1,2,2-Tetrachloroethane	ug/L	0.14	0.14	0.14				0.14	0.14	10.8	0.14	1350	0.00071544	0.14	1900	0.00100692	0.2	472,917	0.3580369	0.20	476,167	0.3597592
79-00-5	1,1,2-Trichloroethane	ug/L	0.47	0.47	0.47				0.47	0.47	*No Criteria	0.47	1350	0.00240184	0.47	1900	0.00338037	1	472,917	1.7901844	1.00	476,167	1.7959666
75-34-3	1,1-Dichloroethane	ug/L	0.52	0.52	0.52				0.52	0.52	*No Criteria	0.52	1350	0.00265736	0.52	1900	0.00373999	1	472,917	1.7901844	1.00	476,167	1.7965818
75-35-4	1,1-Dichloroethylene	ug/L	0.45	0.45	0.45				0.45	0.45	3.2	0.45	1350	0.00229964	0.45	1900	0.00323653	1	472,917	1.7901844	1.00	476,167	1.7957206
120-82-1	1,2,4-Trichlorobenzene	ug/L	0.78	0.78	0.78				0.78	0.78	*No Criteria	0.78	1350	0.00398604	0.78	1900	0.00560998	10	472,917	17.901844	9.94	476,167	17.91144
95-50-1	1,2-Dichlorobenzene	ug/L	0.76	0.76	0.76				0.76	0.76	*No Criteria	0.76	1350	0.00388383	0.76	1900	0.00546613	10	472,917	17.901844	9.94	476,167	17.911194
107-06-2	1,2-Dichloroethane	ug/L	0.57	0.57	0.57				0.57	0.57	*No Criteria	0.57	1350	0.00291287	0.57	1900	0.0040996	1	472,917	1.7901844	1.00	476,167	1.7971969
78-87-5	1,2-Dichloropropane	ug/L	0.52	0.52	0.52				0.52	0.52	*No Criteria	0.52	1350	0.00265736	0.52	1900	0.00373999	1	472,917	1.7901844	1.00	476,167	1.7965818
122-66-7	1,2-Diphenylhydrazine	ug/L	3.6	3.6	3.6				3.6	3.6	*No Criteria	3.6	1350	0.0183971	3.6	1900	0.02589222	10	472,917	17.901844	9.96	476,167	17.946134
156-60-5	1,2-trans-Dichloroethylene	ug/L	0.44	0.44	0.44				0.44	0.44	*No Criteria	0.44	1350	0.00224853	0.44	1900	0.0031646	1	472,917	1.7901844	1.00	476,167	1.7955976
541-73-1	1,3-Dichlorobenzene	ug/L	0.6	0.6	0.6				0.6	0.6	*No Criteria	0.6	1350	0.00306618	0.6	1900	0.00431537	10	472,917	17.901844	9.94	476,167	17.909226
106-46-7	1,4-Dichlorobenzene	ug/L	0.71	0.71	0.71				0.71	0.71	*No Criteria	0.71	1350	0.00362832	0.71	1900	0.00510652	10	472,917	17.901844	9.94	476,167	17.910579
88-06-2	2,4,6-Trichlorophenol	ug/L	0.35	0.35	0.35				0.35	0.35	6.5	0.35	1350	0.00178861	0.35	1900	0.0025173	4	472,917	7.1607377	3.98	476,167	7.1650436
120-83-2	2,4-Dichlorophenol	ug/L	0.66	0.66	0.66				0.66	0.66	790	0.66	1350	0.0033728	0.66	1900	0.00474691	0.53	472,917	0.9487977	0.53	476,167	0.9569175
105-67-9	2,4-Dimethylphenol	ug/L	1.2	1.2	1.2				1.2	1.2	*No Criteria	1.2	1350	0.00613237	1.2	1900	0.00863074	10	472,917	17.901844	9.94	476,167	17.916607
51-28-5	2,4-Dinitrophenol	ug/L	1.5	1.5	1.5				1.5	1.5	14260	1.5	1350	0.00766546	1.5	1900	0.01078842	16	472,917	28.642951	15.90	476,167	28.661405
121-14-2	2,4-Dinitrotoluene	ug/L	1.3	1.3	1.3				1.3	1.3	9.1	1.3	1350	0.0066434	1.3	1900	0.00934997	0.45	472,917	0.9055853	0.45	476,167	0.8215764
606-20-2	2,6-Dinitrotoluene	ug/L	1	1	1				1	1	*No Criteria	1	1350	0.00511031	1	1900	0.00719228	0.39	472,917	0.6981719	0.39	476,167	0.7104745
110-75-8	2-Chloroethyl vinyl ether	ug/L	0.98	0.98	0.98				0.98	0.98	*No Criteria	0.98	1350	0.0050061	0.98	1900	0.00704844	10	472,917	17.901844	9.94	476,167	17.913901
91-58-7	2-Chloronaphthalene	ug/L	0.83	0.83	0.83				0.83	0.83	*No Criteria	0.83	1350	0.00424155	0.83	1900	0.00596959	10	472,917	17.901844	9.94	476,167	17.912055
95-57-8	2-Chlorophenol	ug/L	0.24	0.24	0.24				0.24	0.24	400	0.24	1350	0.00122647	0.24	1900	0.00172615	10	472,917	17.901844	9.94	476,167	17.904797
88-75-5	2-Nitrophenol	ug/L	1.4	1.4	1.4				1.4	1.4	*No Criteria	1.4	1350	0.00715443	1.4	1900	0.0100692	10	472,917	17.901844	9.94	476,167	17.919068
91-94-1	3,3'-Dichlorobenzidine	ug/L	1.6	1.6	1.6				1.6	1.6	*No Criteria	1.6	1350	0.00817649	1.6	1900	0.01150765	10	472,917	17.901844	9.94	476,167	17.921528
534-52-1	4,6-Dinitro-o-cresol	ug/L	1.2	1.2	1.2				1.2	1.2	*No Criteria	1.2	1350	0.00613237	1.2	1900	0.00863074	50	472,917	89.509221	49.67	476,167	89.523984
101-55-3	4-Bromophenyl phenyl ether	ug/L	1.1	1.1	1.1				1.1	1.1	*No Criteria	1.1	1350	0.00562134	1.1	1900	0.00791151	10	472,917	17.901844	9.94	476,167	17.915377
7005-72-3	4-Chlorophenyl phenyl ether	ug/L	0.78	0.78	0.78				0.78	0.78	*No Criteria	0.78	1350	0.00398604	0.78	1900	0.00560998	10	472,917	17.901844	9.94	476,167	17.91144
100-02-7	4-Nitrophenol	ug/L	1.5	1.5	1.5				1.5	1.5	*No Criteria	1.5	1350	0.00766546	1.5	1900	0.01078842	50	472,917	89.509221	49.67	476,167	89.527675
83-32-9	Acenaphthene	ug/L	1.1	1.1	1.1				1.1	1.1	2700	1.1	1350	0.00562134	1.1	1900	0.00791151	1.1	472,917	1.9692029	1.10	476,167	1.9827357
208-96-8	Acenaphthylene	ug/L	0.59	0.59	0.59				0.59	0.59	*No Criteria	0.59	1350	0.00301508	0.59	1900	0.00424345	1.1	472,917	1.9692029	1.10	476,167	1.9764614
107-02-8	Acrolein	ug/L	3.8	3.8	3.8				3.8	3.8	*No Criteria	3.8	1350	0.01941916	3.8	1900	0.02733067	50	472,917	89.509221	49.68	476,167	89.555971
107-13-1	Acrylonitrile	ug/L	1.2	1.2	1.2				1.2	1.2	*No Criteria	1.2	1350	0.00613237	1.2	1900	0.00863074	1	472,917	1.7901844	1.00	476,167	1.8049475
120-12-7	Anthracene	ug/L	1.2	1.2	1.2				1.2	1.2	110000	1.2	1350	0.00613237	1.2	1900	0.00863074	1.1	472,917	1.9692029	1.10	476,167	1.983966
71-43-2	Benzene	ug/L	0.27	0.27	0.27				0.27	0.27	71.28	0.27	1350	0.00137978	0.27	1900	0.00194192	1	472,917	1.7901844	1.00	476,167	1.7935061
92-87-5	Benzidine	ug/L	12	12	12				12	12	*No Criteria	12	1350	0.06132367	12	1900	0.08630739	80	472,917	143.21475	79.54	476,167	143.36239
56-55-3	Benzo(a)anthracene	ug/L	1.2	1.2	1.2				1.2	1.2	*No Criteria	1.2	1350	0.00613237	1.2	1900	0.00863074	0.2	472,917	0.3580369	0.21	476,167	0.3728
50-32-8	Benzo(a)pyrene	ug/L	1.4	1.4	1.4				1.4	1.4	*No Criteria	1.4	1350	0.00715443	1.4	1900	0.0100692	0.2	472,917	0.3580369	0.21	476,167	0.3752605
191-24-2	Benzo(g,h,i)perylene	ug/L	1.3	1.3	1.3				1.3	1.3	*No Criteria	1.3	1350	0.0066434	1.3	1900	0.00934997	1.1	472,917	1.9692029	1.10	476,167	1.9851962
207-08-9	Benzo(k)fluoranthene	ug/L	1.7	1.7	1.7				1.7	1.7	*No Criteria	1.7	1350	0.00868752	1.7	1900	0.01222688	0.2	472,917	0.3580369	0.21	476,167	0.3789513
111-91-1	Bis(2-chloroethoxy)methane	ug/L	0.92	0.92	0.92				0.92	0.92	*No Criteria	0.92	1350	0.00470148	0.92	1900	0.0066189	10	472,917	17.901844	9.94	476,167	17.913163
111-44-4	Bis(2-chloroethyl)ether	ug/L	0.86	0.86	0.86				0.86	0.86	*No Criteria	0.86	1350	0.00439486	0.86	1900	0.00618536	4	472,917	7.1607377	3.98	476,167	7.1713179
39638-32-9	Bis(2-chloroisopropyl) ether	ug/L	1.3	1.3	1.3				1.3	1.3	*No Criteria	1.3	1350	0.0066434	1.3	1900	0.00934997	10	472,917	17.901844	9.94	476,167	17.917838
117-81-7	Bis(2-ethylhexyl) phthalate	ug/L	3.6	3.6	3.6				3.6	3.6	*No Criteria	3.6	1350	0.0183971	3.6	1900	0.02589222	4	472,917	7.1607377	4.00	476,167	7.205027
75-25-2	Bromoform	ug/L	0.58	0.58	0.58				0.58	0.58	360	0.58	1350	0.00298398	0.58	1900	0.00417152	1.7	472,917	3.0433135	1.69	476,167	3.050449
85-68-7	Butyl benzyl phthalate	ug/L	1.4	1.4	1.4				1.4	1.4	*No Criteria	1.4	1350	0.00715443	1.4	1900	0.0100692	10	472,917	17.901844	9.94	476,167	17.919068
56-23-5	Carbon tetrachloride	ug/L	0.42	0.42	0.42				0.42	0.42	4.42	0.42	1350	0.00214633	0.42	1900	0.00302076	1	472,917	1.7901844	1.00	476,167	1.7953515
108-90-7	Chlorobenzene	ug/L	0.63	0.63	0.63				0.63	0.63	*No Criteria	0.63	1350	0.00321949	0.63	1900	0.00453114	1	472,917	1.7901844	1.00	476,167	1.7979351
124-48-1	Chlorodibromomethane	ug/L	0.34	0.34	0.34				0.34	0.34	34	0.34	1350	0.0017375	0.34	1900	0.00244538	0.4	472,917	0.7160738	0.40	476,167	0.7202567
75-00-3	Chloroethane	ug/L	0.8	0.8	0.8				0.8	0.8	*No Criteria	0.8	1350	0.00408824	0.8	1900	0.00575383	1	472,917	1.7901844	1.00	476,167	1.8000265
67-66-3	Chloroform	ug/L	0.9	0.9	0.9				0.9	0.9	470.8	0.9	1350	0.00459928	0.9	1900	0.00647305	1	472,917	1.7901844	1.00	476,167	1.8012568
218-01-9	Chrysene	ug/L	1.2	1.2	1.2				1.2	1.2	*No Criteria	1.2	1350	0.00613237	1.2	1900	0.00863074	1.1	472,917	1.9692029	1.10	476,167	1.983966
53-70-3	Dibenz(a,h)anthracene	ug/L	1.4	1.4	1.4				1.4	1.4	*No Criteria	1.4	1350	0.00715443	1.4	1900	0.0100692	0.2	472,917	0.3580369	0.21	476,167	0.3752605
75-27-4	Dichlorobromomethane	ug/L	0.35	0.35	0.35				0.35	0.35	22	0.35	1350	0.00178861	0.35	1900	0.0025173	0.6	472,917	1.0741107	0.60	476,167	1.0784166
75-71-8	Dichlorodifluoromethane	ug/L	0.4	0.4	0.4				0.4	0.4	*No Criteria	0.4	1350	0.00204412	0.4	1900	0.00287691	1	472,917	1.7901844	1.00	476,167	1.7951055
84-66-2	Diethyl phthalate	ug/L	1.1	1.1	1.1				1.1	1.1	*No Criteria	1.1	1350	0.00562134	1.1	1900	0.00791151	10	472,917	17.901844	9.94	476,167	17.915377
131-11-3	Dimethyl phthalate	ug/L	1	1	1				1	1	*No Criteria	1	1350	0.00511031	1	1900	0.00719228	10	472,917	17.901844	9.94	476,167	17.914147
84-74-2	Di-n-butyl phthalate	ug/L	1.5	1.5	1.5				1.5	1.5	*No Criteria	1.5	1350	0.00766546	1.5	1900	0.01078842	10	472,917	17.901844	9.94	476,167	17.920298
117-84-0	Di-n-octyl phthalate	ug/L	1.7	1.7	1.7				1.7	1.7	*No Criteria	1.7	1350	0.00868752	1.7	1900	0.01222688	10	472,917	17.901844	9.94	476,167	17.922759
100-41-4	Ethylbenzene	ug/L	0.44	0.44	0.44				0.44	0.44	*No Criteria	0.44	1350	0.00224853	0.44	1900	0.0031646	1	472,917	1.7901844	1.00	476,167	1.7955976
206-44-0	Fluoranthene	ug/L	1.5	1.5	1.5				1.5	1.5	370	1.5	1350	0.00766546	1.5	1900	0.01078842	1.1	472,917	1.9692029	1.10	476,167	1.9876568
86-73-7	Fluorene	ug/L	0.99	0.99	0.99				0.99	0.99	14000	0.99	1350	0.0050592	0.99	1900	0.00712036	1.1	472,917	1.9692029	1.10	476,167	1.9813824
118-74-1	Hexachlorobenzene	ug/L	0.78	0.78	0.78				0.78	0.78	*No Criteria	0.78	1350	0.00398604	0.78	1900	0.00560998	1	472,917	1.7901844	1.00	476,167	1.7997804
87-68-3	Hexachlorobutadiene	ug/L	0.82	0.82	0.82				0.82	0.82	49.7	0.82	1350	0.00419045	0.82	1900	0.00589767	10	472,917	17.901844	9.94	476,167	17.911932
77-47-4	Hexachlorocyclopentadiene	ug/L	1	1	1				1	1	*No Criteria	1	1350	0.00511031	1	1900	0.00719228	10	472,917	17.901844	9.94	476,167	17.914147
67-72-1	Hexachloroethane	ug/L	0.67	0.67	0.67				0.67	0.67	*No Criteria	0.67	1350	0.00342391	0.67	1900	0.00481883	2	472,917	3.5803689	1.99	476,167	3.5886116
193-39-5	Indeno(1,2,3-cd)pyrene	ug/L	1.3	1.3	1.3				1.3	1.3	*No Criteria	1.3	1350	0.0066434	1.3	1900	0.00934997	0.2	472,917	0.3580369	0.21	476,167	0.3740303
78-59-1	Isophorone	ug/L	0.81	0.81	0.81				0.81	0.81	*No Criteria	0.81	1350	0.00413935	0.81	1900	0.00582575	10	472,917	17.901844	9.94	476,167	17.911809
74-83-9	Methyl bromide	ug/L	0.66	0.66	0.66				0.66	0.66	*No Criteria	0.66	1350	0.0033728	0.66	1900	0.00474691	2	472,917	3.5803689	1.99	476,167	3.5884886
74-87-3	Methyl chloride	ug/L	0.64	0.64	0.64				0.64	0.64	470.8	0.64	1350	0.0032706	0.64	1900	0.00460006	1	472,917	1.7901844	1.00	476,167	1.7990581
75-09-2	Methylene Chloride	ug/L	4	4	4				4	4	1580	4	1350	0.02044122	4	1900	0.02876913	5	472,917	8.9509221	4.97	476,167	9.0001325
91-20-3	Naphthalene	ug/L	0.72	0.72	0.72				0.72	0.72	*No Criteria	0.72	1350	0.00367942	0.72	1900	0.00517844	1.1	472,917	1.9692029	1.10	476,167	1.9780607
98-95-3	Nitrobenzene	ug/L	0.83	0.83	0.83				0.83	0.83	*No Criteria	0.83	1350	0.00424155	0.83	1900	0.00596959	4	472,917	7.1607377	3.98	476,167	7.1709488
62-75-9	N-Nitrosodimethylamine	ug/L	1.5	1.5	1.5				1.5	1.5	*No Criteria	1.5	1350	0.00766546	1.5	1900	0.01078842	2	472,917	3.5803689	2.00	476,167	3.5988227
621-64-7	N-Nitrosodi-n-propylamine	ug/L	0.92	0.92	0.92				0.92	0.92	*No Criteria	0.92	1350	0.00470148	0.92	1900	0.0066189	4	472,917	7.1607377	3.98	476,167	7.1720561
86-30-6	N-Nitrosodiphenylamine	ug/L	1.2	1.2	1.2				1.2	1.2	*No Criteria	1.2	1350	0.00613237	1.2	1900	0.00863074	4	472,917	7.1607377	3.98	476,167	7.1755008
59-50-7	p-Chloro-m-cresol	ug/L	0.33	0.33	0.33				0.33	0.33	*No Criteria	0.33	1350	0.0016864	0.33	1900	0.00237345	10	472,917	17.901844	9.93	476,167	17.905904
87-86-5	Pentachlorophenol	ug/L	0.97	0.97	0.97				0.97	0.97	7.9	0.97	1350	0.004957	0.97	1900	0.00697651	2	472,917	3.222332	1.79	476,167	3.2342655
85-01-8	Phenanthrene	ug/L	1.2	1.2	1.2				1.2	1.2	*No Criteria	1.2	1350	0.00613237	1.2	1900	0.00863074	1.1	472,917	1.9692029	1.10	476,167	1.983966
108-95-2	Phenol	ug/L	0.85	0.85	0.85				0.85	0.85	300	0.85	1350	0.00434376	0.85	1900	0.00611344	1	472,917	1.7901844	1.00	476,167	1.8006416
129-00-0	Pyrene	ug/L	1.3	1.3	1.3				1.3	1.3	11	1.3	1350	0.0066434	1.3	1900	0.00934997	1.1	472,917	1.9692029	1.10	476,167	1.9851962
127-18-4	Tetrachloroethylene	ug/L	0.34	0.34	0.34				0.34	0.34	8.85	0.34	1350	0.0017375	0.34	1900	0.00244538	1	472,917	1.7901844	1.00	476,167	1.7943673
108-88-3	Toluene	ug/L	0.51	0.51	0.51				0.51	0.51	*No Criteria	0.51	1350	0.00260626	0.51	1900	0.00366806	1	472,917	1.7901844	1.00	476,167	1.7964587
79-01-6	Trichloroethylene	ug/L	0.28	0.28	0.28				0.28	0.28	*No Criteria	0.28	1350	0.00143089	0.28	1900	0.00201384	1	472,917	1.7901844	1.00	476,167	1.7936291
75-69-4	Trichlorofluoromethane	ug/L	0.98	0.98	0.98				0.98	0.98	*No Criteria	0.98	1350	0.0050081	0.98	1900	0.00704844	1	472,917	1.7901844	1.00	476,167	1.802241
75-01-4	Vinyl chloride	ug/L	0.5	0.5	0.5				0.5	0.5	*No Criteria	0.5	1350	0.00255515	0.5	1900	0.00359614	1	472,917	1.7901844	1.00	476,167	1.7963357

Tetra Tech EC, Inc.
MICROSOFT EXCEL CALCULATION SHEET

Subject: Water Quality Impacts at the Canal POD - Concentration / Mass Calculations
Client: Florida Power & Light (FPL)
Project: St. Lucie Nuclear Plant
Project Description: NPDES Permit Modification for excavation dewatering associated with the Independent Spent Fuel Storage Installation (ISFSI) Area

Prepared By:	C. St.Cin	DATE:	11/22/05	Appendix:	B
Checked By:	H. Barone	DATE:	11/29/05	Calculation No.:	2
Approved By:	C. St.Cin	DATE:	11/29/05		

			Native Groundwater Concentration at Boring Depth								Class III Marine WQ Criteria	Intake Canal Contribution from Dewatering (as Native GW) at Temporary Influent Point			Intake Canal Contribution from Plume Control (as Native GW) at Influent Point I-008			Background Discharge Canal Concentrations			Calculated D-001 POD Concentrations from ISFSI Temporary Dewatering		
			Total			Dissolved			Max "Total" Values														
CAS No.	Analyte	Units	25 ft bls	50 ft bls	75 ft bls	25 ft bls	50 ft bls	75 ft bls	25' & 50'	25', 50' & 75'	Conc µg/L	Conc µg/L	Flow gpm	Mass grams/min	Conc µg/L	Flow gpm	Mass grams/min	Conc µg/L	Flow gpm	Mass grams/min	Conc µg/L	Flow gpm	Mass grams/min
7429-90-5	Aluminum (see Note 3)	mg/L	3.5	11	12	0.07	0.35	0.35	11	12	1500	12000	1350	61.3236744	11000	1900	79.1151108	10	472.917	17.901844	87.85	476.167	158.34063
7664-41-7	Ammonia	mg/L	3.6	1.1	1.1				3.6	3.6	*No Criteria	3600	1350	18.3971023	3600	1900	25.8922181	500	472.917	895.09221	521.16	476.167	939.38153
7440-36-0	Antimony (see Note 5)	mg/L	0.0036	0.018	0.018				0.0036	0.0036	4300	3.6	1350	0.0183971	3.6	1900	0.02589222	250	472.917	447.54611	248.32	476.167	447.5904
7440-38-2	Arsenic	mg/L	0.0074	0.042	0.024	0.0048	0.024	0.024	0.042	0.042	50	42	1350	0.21463286	42	1900	0.30207588	2.3	472.917	4.1174242	2.57	476.167	4.6341329
7440-39-3	Barium	mg/L	0.025	0.1	0.11	0.021	0.049	0.055	0.1	0.11	*No Criteria	110	1350	0.56213368	100	1900	0.71922828	(see Note 4)					
7440-41-7	Beryllium (see Note 6)	mg/L	0.00074	0.0037	0.0037				0.0037	0.0037	0.13	3.7	1350	0.01890813	3.7	1900	0.02661145	430	472.917	769.7793	427.09	476.167	769.82482
7440-42-8	Boron	mg/L	2.3	4.7	4.6	2.2	4.6	4.4	4.7	4.7	*No Criteria	4700	1350	24.0184391	4700	1900	33.8037292	4900	472.917	8771.9037	4,898.63	476.167	8829.7259
24959-67-9	Bromide	mg/L	0.011	0.011	0.011				0.011	0.011	*No Criteria	11	1350	0.05621337	11	1900	0.07911511	65000	472.917	116361.99	64,556.43	476.167	116362.12
7440-43-9	Cadmium (see Note 5)	mg/L	0.00077	0.0036	0.0036				0.00077	0.00077	9.3	0.77	1350	0.00393494	0.77	1900	0.00553806	0.17	472.917	0.3043314	0.17	476.167	0.3138043
STL00260	Carbonaceous Biochemical Oxygen D	mg/L	31	2	2				31	31	*No Criteria	31000	1350	158.419492	31000	1900	222.960767	80000	472.917	143214.75	79,665.56	476.167	143596.13
STL00070	Chemical Oxygen Demand	mg/L	180	1800	700				1800	1800	*No Criteria	1800000	1350	9198.55116	1800000	1900	12946.109	1700000	472.917	3043313.5	1,700,682.53	476.167	3065458.2
7440-47-3	Chromium	mg/L	0.042	0.12	0.19				0.12	0.19	50	190	1350	0.97095818	120	1900	0.86307394	1.7	472.917	3.0433135	2.71	476.167	4.8773456
7440-48-4	Cobalt	mg/L	0.0022	0.008	0.012	0.0018	0.008	0.008	0.008	0.012	*No Criteria	12	1350	0.06132367	8	1900	0.05753826	(see Note 4)					
STL00153	Color (see Note 8)	PCU	250	450	500						*No Criteria							5					
7440-50-8	Copper	mg/L	0.0077	0.026	0.045				0.026	0.045	3.7	45	1350	0.22996378	26	1900	0.18699935	2	472.917	3.5803689	2.21	476.167	3.997332
57-12-5	Cyanide, Total (see Note 6)	mg/L	0.005	0.005	0.005				0.005	0.005	1	5	1350	0.02555153	5	1900	0.03596141	5	472.917	8.9509221	5.00	476.167	9.0124351
16984-48-8	Fluoride	mg/L	1.3	0.48	0.48				1.3	1.3	5000	1300	1350	6.64339806	1300	1900	9.34996764	1000	472.917	1790.1844	1,002.05	476.167	1806.1778
STL00181	HEM (Oil and Grease)	mg/L	2	0.73	0.73				2	2	5000	2000	1350	10.2206124	2000	1900	14.3845656	1700	472.917	3043.3135	1,702.05	476.167	3067.9187
7439-89-6	Iron	mg/L	9.6	35	45	0.11	0.11	2.9	35	45	300	45000	1350	229.963779	35000	1900	251.729898	10	472.917	17.901844	277.17	476.167	499.59552
7439-92-1	Lead	mg/L	0.0037	0.012	0.01				0.012	0.012	8.5	12	1350	0.06132367	12	1900	0.08630739	7.2	472.917	12.889328	7.23	476.167	13.036959
7439-95-4	Magnesium	mg/L	450	1200	1300	440	1200	1200	1200	1300	*No Criteria	1300000	1350	6643.39806	1200000	1900	8630.73936	1400	472.917	2506.2582	9,864.37	476.167	17780.396
7439-96-5	Manganese	mg/L	0.097	0.36	0.51	0.061	0.095	0.22	0.36	0.51	*No Criteria	510	1350	2.60625616	360	1900	2.58922181	21	472.917	37.593873	23.74	476.167	42.789351
7439-97-6	Mercury (see Note 6)	mg/L	0.000072	0.000072	0.000072				0.000072	0.000072	0.025	0.072	1350	0.00036794	0.072	1900	0.00051784	0.03	472.917	0.0537055	0.03	476.167	0.0545913
STL00077	Methylene Blue Active Substances	mg/L	0.046	0.08	0.14				0.08	0.14	*No Criteria	140	1350	0.71544287	80	1900	0.57538282	200	472.917	358.03689	199.35	476.167	359.32771
7439-98-7	Molybdenum	mg/L	0.01	0.025	0.049	0.0057	0.02	0.02	0.025	0.049	*No Criteria	49	1350	0.250405	25	1900	0.17980707	11	472.917	19.692029	11.14	476.167	20.122241
7440-02-0	Nickel	mg/L	0.011	0.034	0.041				0.034	0.041	8.3	41	1350	0.20952255	34	1900	0.24453762	0.63	472.917	1.1278162	0.88	476.167	1.5818764
STL00217	Nitrate Nitrite Nitrogen	mg/L	0.011	0.024	0.029				0.024	0.029	*No Criteria	29	1350	0.14819888	24	1900	0.17261479	50	472.917	89.509221	49.84	476.167	89.830035
STL00111	Nitrogen, Organic	mg/L	0.04	1.6	1.2				1.6	1.6	*No Criteria	1600	1350	8.17648992	1600	1900	11.5076525	613	472.917	1097.3831	619.74	476.167	1117.0672
STL00155	Nitrogen, Total	mg/L	3.3	2.7	2.3				3.3	3.3	*No Criteria	3300	1350	16.8640105	3300	1900	23.7345332	700	472.917	1253.1291	717.73	476.167	1293.7276
STL00204	pH (see Note 8)	SU	7.14	6.89	6.83						*No Criteria							7.93					
64743-03-9	Phenols, Total (see Note 6)	mg/L	0.035	0.035	0.035				0.035	0.035	1	35	1350	0.17886072	35	1900	0.2517299	10	472.917	17.901844	10.17	476.167	18.332435
7723-14-0	Phosphorus, Total (see Note 10)	mg/L	0.7	3	2.6				3	3	0.1	3000	1350	15.3309186	3000	1900	21.5768484	20	472.917	35.803689	40.34	476.167	72.711456
7782-49-2	Selenium	mg/L	0.0059	0.03	0.03				0.03	0.03	71	30	1350	0.15330919	30	1900	0.21576848	47	472.917	84.138668	46.88	476.167	84.507746
7440-22-4	Silver	mg/L	0.0019	0.0095	0.0095				0.0095	0.0095	2.3	9.5	1350	0.04854791	9.5	1900	0.06832669	0.52	472.917	0.9308959	0.58	476.167	1.0477705
STL00244	Specific Conductance (see Note 7)	umhos/cm	20000	50000	51000				50000	51000	*No Criteria	51000	1350	260.625616	50000	1900	359.61414	54000	472.917	96669.959	53,975.53	476.167	97290.199
14808-79-8	Sulfate	mg/L	900	3.1	3.1				900	900	*No Criteria	900000	1350	4599.27558	900000	1900	6473.05452	2700000	472.917	4833497.9	2,687,714.39	476.167	4844570.3
18496-25-8	Sulfide	mg/L	29	1.8	1				29	29	*No Criteria	29000	1350	148.19888	29000	1900	208.576201	(see Note 2)					
14265-45-3	Sulfite	mg/L	28	5	5				28	28	*No Criteria	28000	1350	143.088574	28000	1900	201.383918	(see Note 2)					
7440-28-0	Thallium (see Note 9)	mg/L	0.0066	0.033	0.033				0.033	0.033	6.3	33	1350	0.1686401	33	1900	0.23734533	200	472.917	358.03689	198.86	476.167	358.44287
7440-31-5	Tin (see Note 4)	mg/L	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	*No Criteria	32	1350	0.1635298	32	1900	0.23015305	(see Note 4)					
7440-32-6	Titanium	mg/L	0.032	0.11	0.2				0.11	0.2	*No Criteria	200	1350	1.02206124	110	1900	0.79115111	(see Note 4)					
7440-44-0	Total Organic Carbon	mg/L	7.5	20	14				20	20	*No Criteria	20000	1350	102.206124	20000	1900	143.845656	1300	472.917	2327.2398	1,427.63	476.167	2573.2915
STL00161	Total Suspended Solids	mg/L	290	1300	610				1300	1300	*No Criteria	1300000	1350	6643.39806	1300000	1900	9349.96764	9000	472.917	16111.66	17,811.53	476.167	32105.026
7440-66-6	Zinc	mg/L	0.045	0.078	0.094				0.078	0.094	86	94	1350	0.48036878	78	1900	0.56099806	2.8	472.917	5.0125164	3.34	476.167	6.0538832
	Gross Alpha (see Notes 10 & 11)	pCi/L	12.0 +/- 1.4	54 +/- 7	68 +/- 9				54	68	15	68	1350	0.34750082	54	1900	0.38838327	77.3	472.917	138.38126	77.18	476.167	139.11714
	Gross Alpha (see Notes 10 & 12)	pCi/L	26 +/- 38	93 +/- 66	99 +/- 74				93	99	15	99	1350	0.50592031	93	1900	0.6688823	77.3 **	472.917	138.38	77.43	476.167	139.55606
	Gross Beta (see Note 10)	pCi/L	169 +/- 8	402 +/- 27	400 +/-27				402	402	15	402	1350	2.05434309	402	1900	2.89129769	372.0	472.917	665.94861	372.20	476.167	670.89425

*No Criteria - No Class III Marine Water Quality Criterion for this constituent or parameter.
** Background concentration not available for EPA Method 00-02, therefore background concentration using EPA Method 900 was used.
Note: For concentrations reported below the Method Detection Limits (MDL), the reported concentrations was used for this analysis.
Note 2: Sulfide and Sulfite convert rapidly to Sulfate in sea water, and were not sampled in the FPL Cooling Water Intake or Discharge Canals during the recent NPDES Permit renewal because they were believed absent.
Note 3: Aluminum concentration in D-001 POD is taken from http://www.innvista.com/science/earth/water.htm
Note 4: Cobalt, Barium, Tin and Titanium were not sampled in the FPL Cooling Water Intake or Discharge Canals during the recent NPDES Permit renewal because they were believed absent.
Note 5: Actual Antimony and Cadmium concentrations detected are less than the respective MDL, and are used for the analysis.
Note 6: Groundwater and surface water samples for Beryllium, Cyanide, Mercury, and Phenols are reported below their respective MDLs. The MDL was used in the analysis.
Note 7: Specific Conductance is reported and analyzed in units of micro mohs/cm
Note 8: Color and pH sample values are shown, however they are not amenable to this method of analysis.
Note 9: Groundwater samples for Thallium are reported as below their respective MDL, which was used in the analysis for conservatism. Criteria exceedence is due to background, and not the ISFSI project effluents.
Note 10: Criteria exceedence is due to background concentrations.
Note 11: Gross Alpha analyzed using EPA Method 900.0, as required by the State and is reported and analyzed in units of Picocuries per Liter.
Note 12: Gross Alpha analyzed using EPA Method 00-02 and is reported and analyzed in units of Picocuries per Liter.

APPENDIX E

Redux 380 Scale Control Product Information

Redux™ Technology

Redux-380 Deposit Control Agent

PRODUCT APPLICATION:

Redux-380 is a concentrated blend of sequestering agents and polymers specifically designed to prevent the precipitation and deposition of calcium and other hardness salts and limited metal oxide concentrations in groundwater recovery and treatment systems. By maintaining clean treatment system surfaces, use of the product helps to increase mass transfer rates, improve circulation and, perhaps most importantly, reduce instances of highly destructive underdeposit corrosion. When used on a continuous basis, or as part of a coordinated clean-up program, Redux-380 can also help to remove existing deposits from the system.

Redux-380 is easy to use in that the product is environmentally safe, does not promote microbiological contamination, is active over a broad pH range and is compatible with all other water treatment compounds. The product is also chlorine-stable and does not contribute to foaming problems.

PRODUCT DESCRIPTION:

Appearance:	Clear, pale yellow liquid
Specific Gravity:	1.0 - 1.1 @ 25 degrees C
Density:	8.91 pounds per gallon
pH:	Less than 5.0
Freeze Point:	Less than 32 degrees F

PRODUCT DOSAGE:

As product feed rates are highly dependent upon makeup water characteristics and system operating conditions, your sales representative should be consulted for specific dosage recommendations. Typically, however, Redux-380 is dosed to the system at a rate of 25 - 200 ppm (as product). The recommended feed method is continuously feed into the treatment system influent line.

PRODUCT SAFETY:

As with any industrial chemical, Redux-380 should be handled with appropriate care. Therefore, please have all supervisory personnel and operating employees review the Material Safety Data Sheet (MSDS) to obtain recommended application, storage and disposal procedures before using the product in your facility.

PRODUCT PACKAGING:

Redux-380 is available in 55 and 30 gallon drums, 15 gallon containers, 6 gallon pails and bulk containers of various sizes.

550 Vermont Rte.30, P.O. Box 331, Newfane, Vermont 05345
Phone: 802-365-7200 Fax: 802-365-4652 remedeproducts.com

Redux™ Technology

Material Safety Data Sheet

Product Name: Redux 380
MSDS #: 22

Effective date: 12/15/2004

SECTION 1 -- CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

IDENTIFICATION

Product Name	Redux 380
Chemical Name	Aqueous Blended Deposit Control Agent
Chemical Family	
Formula	
Synonym	

COMPANY IDENTIFICATION

Redux Technology
550 VT Rte. 30, P.O. Box 331
Newfane, VT 05345
Phone: 802-365-7200
Fax: 802-365-4652
Email: info@reduxtech.com

EMERGENCY TELEPHONE NUMBER

24 hours a day: CHEMTREC 1-800-424-9300.
Number for non-emergency questions concerning MSDS: (802) 365-7200

SECTION 2 -- COMPOSITION / INFORMATION ON INGREDIENTS

Component	CAS #	Amount (%W/W)
Water	7732-18-5	~60.%
Polymaleic Acid	26099-09-2	~16.0%
Residual Monomers		< 0.01%
2 phosphono-1,2,4-butanetricarboxylic acid	37971-36-1	~24.0%

SECTION 3 -- HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW	**Eye and skin irritant. Material may cause burns on exposed tissues. Eye contact may cause corneal injury, which may result in permanent impairment of vision, or even blindness. Prolonged or repeated skin may cause irritation or even a burn.**

POTENTIAL HEALTH EFFECTS	
INGESTION.....	Corrosive and causes severe and permanent damages to mouth throat and stomach. May be fatal if swallowed.
INHALATION.....	Damages airways and lungs, depending upon amount and duration of exposure. Effects can vary from irritation to bronchitis or pneumonia.
EYE CONTACT.....	Severely corrosive to the eyes, and may cause permanent damage, including blindness.
SKIN CONTACT.....	Corrosive; causes severe skin burns. Harmful contact may not cause immediate pain.

SECTION 4 -- FIRST AID MEASURES

INGESTION	If swallowed, DO NOT induce vomiting. Immediately drink a large quantity of water. If available, give large quantities of milk. Never give anything by mouth to an unconscious person. **Get medical attention immediately.** If vomiting occurs spontaneously, keep airway clear.
INHALATION	Get person out of contaminated area to fresh air. If breathing has stopped, resuscitate and administer oxygen if readily available. **Get medical attention immediately.**
EYE CONTACT	Immediately flush eye with plenty of cool, running water. Remove contact lenses if applicable and continue flushing for at least 15 minutes, holding eyelids apart to ensure thorough rinsing of the entire eye. **Get medical attention immediately.**
SKIN CONTACT	Immediately flush skin with plenty of cool running water for at least 15 minutes. Wash with soap and water. If irritation develops or persists, get medical attention. Remove contaminated clothing and shoes; wash before reuse.
NOTE TO PHYSICIAN	Information pertaining to ingestion toxicology, therapy, symptomatology and treatment can be found in Clinical Toxicology of Commercial Products, authored by Gosselin, Smith and Hodge and published by Williams & Wilkins, Baltimore, Maryland.

SECTION 5 -- FIRE FIGHTING MEASURES

FLASH POINT / METHOD	None / N.A.	FLAMMABLE LIMITS	Not flammable or combustible
EXTINGUISHING MEDIA	Use extinguishing media appropriate for surrounding fire.		
SPECIAL FIRE FIGHTING PROCEDURES	Pressure demand self-contained respiratory protection and protective clothing should be worn by fire fighters.		
FIRE AND EXPLOSION HAZARDS	Not a fire or explosion hazard		

SECTION 6 -- ACCIDENTAL RELEASE MEASURES

RESPONSE TO SPILLS	Absorb with inert material such as vermiculite, shovel into closeable container for disposal. Thoroughly flush residual with water.

SECTION 7 -- HANDLING AND STORAGE

HANDLING PRECAUTIONS	Wear proper safety equipment. Mix only with water. Follow appropriate tank entry procedures (ANSI Z117) and OSHA Confined Space Regulations.
STORAGE PRECAUTIONS	Store in a cool, dry and well-ventilated place. Keep from freezing. Keep container tightly closed when not in use.

SECTION 8 -- EXPOSURE CONTROLS / PERSONAL PROTECTION

HYGIENIC PRACTICES	Observe label precautions; use personal protective equipment. Avoid breathing mists or vapors of this product.
ENGINEERING CONTROLS	**Facilities using this product must be equipped with an eyewash station.** Local Exhaust: None

PERSONAL PROTECTIVE EQUIPMENT

X	**RESPIRATOR**	NIOSH/MSHA approved respirator where mists or sprays may be generated.
X	**GOGGLES / FACE SHIELD**	Chemical splash goggles required; also use face shield if exposure is severe
X	**APRON**	Required; PVC, Neoprene or Vinyl acceptable
X	**GLOVES**	Required; use PVC, Neoprene or Nitrile with long gauntlet or protective cuff
X	**BOOTS**	Rubber

SECTION 9 -- PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE	Clear pale yellow liquid	BOILING POINT	> 212° F
ODOR	Slight Odor	FREEZING POINT	< 32° F
pH	Approx. 2.5	VAPOR PRESSURE	Similar to water
SPECIFIC GRAVITY	1.1	VAPOR DENSITY	Similar to water
SOLUBILITY IN WATER	Complete	EVAPORATION RATE	Similar to water

SECTION 10 -- STABILITY AND REACTIVITY

CHEMICAL STABILITY		**STABLE**	X		**UNSTABLE**	
CONDITIONS TO AVOID	Do not mix with anything but water.					
INCOMPATIBILITY	Do not mix with quaternay amines, acids, sulfides and strong oxidizers.					
HAZARDOUS PRODUCTS OF DECOMPOSITION	Carbon dioxide and carbon monoxide.					
POLYMERIZATION		**WILL NOT OCCUR**	X		**MAY OCCUR**	
CONDITIONS TO AVOID	Not applicable					

SECTION 11 -- TOXICOLOGICAL INFORMATION

Oral: Rat LD50 = >6,500 mg/kg
Eye Irritation: Corrosive
Skin irritation Mild Irritant

CARCINOGENICITY

	THIS PRODUCT CONTAINS A KNOWN OR SUSPECTED CARCINOGEN
X	**THIS PRODUCT DOES NOT CONTAIN ANY KNOWN OR ANTICIPATED CARCINOGENS ACCORDING TO THE CRITERIA OF THE NTP ANNUAL REPORT ON CARCINOGENS AND OSHA 29 CFR 1910, Z**

OTHER EFFECTS

ACUTE	May be corrosive to all body tissues which it comes in contact.
CHRONIC	The chronic local effect may consist of multiple areas of superficial destruction of the skin or of primary irritant dermatitis. Similarly, inhalation of dust, spray, or mist may result in varying degrees of irritation or damage to the respiratory tract tissues and an increased susceptibility to respiratory illness.

SECTION 12 -- ECOLOGICAL INFORMATION

BIODEGRADABILITY		**CONSIDERED BIODEGRADABLE**	X		**NOT BIODEGRADABLE**	
BOD / COD VALUE	Not established					
ECOTOXICITY	Ceriodaphnia: 48 hr LD50 = 2900 mg/l NOAEL = 2000 mg/l Fathead Minnow: 96 hr LD50 = 5700 mg/l NOAEL = 2000 mg/l					

SECTION 13 -- DISPOSAL CONSIDERATIONS

WASTE DISPOSAL METHOD	Product that cannot be used according to the label must be disposed of as a hazardous waste at an approved hazardous waste management facility. Empty containers may be triple rinsed, then offered for recycling or reconditioning; or puncture and dispose of in a sanitary landfill.								
RCRA CLASSIFICATION	Hazardous, corrosive D002								
RECYCLE CONTAINER		**YES**	X		**CODE**	2 - HDPE		**NO**	

SECTION 14 -- TRANSPORT INFORMATION

DOT CLASSIFICATION		**HAZARDOUS**	X		**NOT HAZARDOUS**	
DESCRIPTION	Corrosive					

SECTION 15 -- REGULATORY INFORMATION

REGULATORY STATUS

	EPA REGISTERED (UNDER FIFRA)	
	FDA REGULATED	
	KOSHER	
	SARA TITLE III MATERIAL	
	USDA AUTHORIZED	
	NSF APPROVAL	

SECTION 16 -- OTHER INFORMATION

NFPA CLASSIFICATION

2	**BLUE**	HEALTH HAZARD
0	**RED**	FLAMMABILITY
1	**YELLOW**	REACTIVITY
C	**WHITE**	SPECIAL HAZARD

Redux™ Technology

Summary of Bioassay Toxicity Testing

Redux 380

Redux Technology contracts with independent laboratories to perform standard bioassay toxicity testing. Testing for Redux 380 was completed in April 2004. Testing protocols were taken from EPA standards defined in recent editions of *Short-Term Methods for Estimating Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms* (EPA 600/4-90/027F). Testing was completed on vertebrate (fat head minnow) and invertebrate (ceriodaphnia) species, for a test duration of 96 hours and 48 hours respectively. This testing involved an initial rangefinder test to determine appropriate concentration for detailed testing, with subsequent determination of LD50 and NOAEL (No Observed Adverse Effect Level).

Summary of test results for Redux 380 are given below. All concentration values are given as parts per million, as product:

Product	LD50	NOAEL
Redux 380		
ceriodaphnia	2,900 ppm	2,000 ppm
fathead minnow	5,700 ppm	2,000 ppm

Test reports, methodology and raw data are available upon request.

550 Vermont Route 30, P.O. Box 331, Newfane, Vermont 05345
Phone: 802-365-7200 Fax: 802-365-4652 www.reduxtech.com

APPENDIX F

Redux B-15 Microbiocide Product Information

Redux™ Technology

Redux B-15 MICROBIOCIDE

PRODUCT APPLICATION:

B-15 is a concentrated liquid microbiocide that provides broad-spectrum control of bacteria in groundwater recovery and treatment systems. The product is particularly effective in controlling the growth of slime-forming, sulfate-reducing, and iron related bacteria, microorganisms that can initiate a wide variety of operating problems, including reduced mass transfer rates, restricted water flows and highly destructive pitting-type corrosion. Unlike many alternative treatments, B-15 is not an oxidizing agent, so it will not cause deposition of inorganic water constituents, or corrosion of system components. The product also displays some dispersing capabilities, so continued use will enhance system cleanliness.

PRODUCT BENEFITS:

- Will not oxidize inorganic compounds
- Broad-spectrum microbiological activity
- Effective against both algae and bacteria
- Functions independently of pH levels
- Environmentally and hygienically-safe

PRODUCT DESCRIPTION:

Appearance:	Clear, water-white liquid
Specific Gravity:	1.04 - 1.06 @ 25 degrees C
Density:	8.8 pounds per gallon
pH:	Less than 5.0
Freeze Point:	Less than 32 degrees F
EPA Reg. No.:	10352-23/73810

PRODUCT DOSAGE:

As product feed rates are highly dependent upon the degree of microbiological activity and other system operating conditions, your sales representative should be consulted for specific dosage recommendations. Typically, however, B-15 is fed to the system at a rate of 17 - 40 fluid ounces of product per 1,000 gallons of water every seven days, or sooner should growth appear. For best results, heavily fouled systems should be mechanically cleaned before initiating the treatment.

The recommended feed method is by slug addition, but continuous feed is acceptable if necessary. To eliminate handling problems, the feed equipment should preferably be of stainless steel or plastic construction.

PRODUCT SAFETY:

As with any industrial chemical, B-15 should be handled with appropriate care. Therefore, please have employees review the Material Safety Data Sheet (MSDS) to obtain recommended application, storage and disposal procedures before using the product in your facility.

PRODUCT PACKAGING:

B-15 is available in 55 and 30 gallon drums, 15 gallon containers and 6 gallon pails.

550 Vermont Route 30, P.O. Box 331, Newfane, Vermont 05345
Phone: 802-365-7200 Fax: 802-365-4652 www.reduxtech.com

Redux™ Technology

Material Safety Data Sheet

Product Name: B – 15 Microbiocide **Effective date: 1/25/2004**
MSDS #: 20

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

1.1 IDENTIFICATION

Product Name	B - 15
Chemical Name	Aqueous Glutaraldehyde Solution
Chemical Family	Aldehydes
Formula	OHCC3H6CHO
Synonym	Glutaral, glutaric dialdehyde

1.2 COMPANY IDENTIFICATION

Redux Technology
550 VT Rte. 30, P.O. Box 331
Newfane, VT 05345
Phone: 802-365-7200
Fax: 802-365-4652
Email: info@reduxtech.com

1.3 EMERGENCY TELEPHONE NUMBER

24 hours a day: CHEMTREC 1-800-424-9300.
Number for non-emergency questions concerning MSDS: (802) 365-7200

2. COMPOSITION INFORMATION

Component	CAS #	Amount (%W/W)
Water	7732-18-5	<= 85%
Glutaraldehyde	111-30-8	15 %
Methanol	67-56-1	<= 0.15%

3. HAZARDS IDENTIFICATION

3.1 EMERGENCY OVERVIEW

Appearance	Transparent colorless
Physical State	Liquid
Odor	Sharp, Fruity, Medicinal

Hazards of product	DANGER!	CAUSES IRREVERSIBLE EYE DAMAGE. CAUSES SKIN IRRITATION. HARMFUL IF INHALED. HARMFUL IF SWALLOWED. PROLONGED OR FREQUENTLY REPEATED SKIN CONTACT MAY CAUSE ALLERGIC REACTIONS IN SOME INDIVIDUALS. CAUSES ASTHMATIC SIGNS AND SYMPTOMS IN HYPER-REACTIVE INDIVIDUALS. ASPIRATION MAY CAUSE LUNG DAMAGE.

3.2 POTENTIAL HEALTH EFFECTS

Effects of Single Acute Overexposure

Inhalation Vapor is irritating to the respiratory tract, causing stinging sensations in the nose and throat, discharge from the nose, possibly bleeding from the nose, coughing, chest discomfort and tightness, difficulty with breathing, and headache. Heating the solution may result in more severe irritant effects.

Eye Contact Liquid will cause a severe and persistent conjunctivitis, seen as excess redness and marked swelling of the conjunctiva with profuse discharge. Severe corneal injury may develop, which could permanently impair vision if prompt first-aid and medical treatment are not obtained. Vapor will cause stinging sensations in the eye with excess tear production, blinking, and possibly a slight excess redness of the conjunctiva.

Skin Contact Brief contact may cause moderate irritation with itching, local redness and possible slight swelling. Contact with solutions of glutaraldehyde may cause a harmless yellow or brownish discoloration of the skin.

Skin Absorption No evidence of harmful effects from available information.

Swallowing Moderately toxic. May cause moderate to marked irritation and possibly chemical burns of the mouth, throat, esophagus, and stomach. There will be discomfort or pain in the chest and abdomen, nausea, vomiting, diarrhea, dizziness, faintness, drowsiness, thirst, weakness, circulatory shock, collapse and coma. Aspiration into the lungs may occur during ingestion or vomiting, resulting in lung injury.

Chronic, Prolonged or Repeated Overexposure

Effects of Repeated Overexposure Repeated skin contact may cause a cumulative dermatitis.

Other Effects of Overexposure May cause skin sensitization in a small portion of individuals and present as an allergic contact dermatitis. This usually results from contact with the liquid, but occasionally there may be a reaction to glutaraldehyde vapor. May cause asthma, particularly in those with an increased tendency to develop allergic reactions to common environmental allergens (i.e., atopic individuals).

Medical Conditions Aggravated by Exposure

Skin contact may aggravate an existing dermatitis. Inhalation may aggravate asthma and inflammatory or fibrotic pulmonary disease.

3.3 POTENTIAL ENVIRONMENTAL EFFECTS

See Section 12 for Ecological Information.

4. FIRST AID PROCEDURES

4.1 INHALATION

Remove to fresh air. Give artificial respiration if not breathing. If breathing is difficult, oxygen may be given by qualified personnel. Obtain medical attention.

4.2 EYE CONTACT

Immediately flush eyes with water and continue washing for at least 15 minutes. DO NOT remove contact lenses, if worn. Obtain medical attention without delay, preferably from an ophthalmologist.

4.3 SKIN CONTACT

Immediately remove contaminated clothing and shoes. Wash skin with soap and water. Obtain medical attention. Wash clothing before reuse. Discard contaminated leather articles such as shoes and belt.

4.4 SWALLOWING

DO NOT INDUCE VOMITING. Do not give anything to drink. Obtain medical attention without delay.

4.5 NOTES TO PHYSICIAN

The hazards of this material are due mainly to its severely irritant properties on skin and mucosal surfaces.
Moderately toxic by swallowing.

Due to the severely irritating or corrosive nature of the material, swallowing may lead to ulceration and inflammation of the upper alimentary tract with hemorrhage and fluid loss. Also, perforation of the esophagus or stomach may occur, leading to mediastinitis or peritonitis and the resultant complications. Any material aspirated during vomiting may cause lung injury. Therefore, emesis should not be induced mechanically or pharmacologically. If it is considered necessary to evacuate the stomach contents, this should be done by means least likely to cause aspiration (e.g., gastric lavage after endotracheal intubation).

5. FIRE FIGHTING MEASURES

5.1 FLAMMABLE PROPERTIES

Flash Point - Closed Cup: *Tag Closed Cup ASTM D 56* None.
Flash Point - Open Cup: *Tag Open Cup ASTM D 1310* None.
Autoignition Temperature: *Not currently available.*
Flammable Limits In Air:
Lower *Not Determined, Aqueous System*
Upper *Not Determined, Aqueous System*

5.2 EXTINGUISHING MEDIA

Non-flammable (aqueous solution): After water evaporates, remaining material will burn. Use alcohol-type or all-purpose-type foam, applied by manufacturer's recommended techniques for large fires. Use carbon dioxide or dry chemical media for small fires.

5.3 EXTINGUISHING MEDIA TO AVOID

No information currently available.

5.4 SPECIAL FIRE FIGHTING PROCEDURES

No information currently available.

5.5 SPECIAL PROTECTIVE EQUIPMENT FOR FIREFIGHTERS

Use self-contained breathing apparatus and protective clothing.

5.6 UNUSUAL FIRE AND EXPLOSION HAZARDS

None known.

5.7 HAZARDOUS COMBUSTION PRODUCTS

Burning can produce the following products: Carbon monoxide and/or carbon dioxide. Carbon monoxide is highly toxic if inhaled. Carbon dioxide in sufficient concentrations can act as an asphyxiant.

6. ACCIDENTAL RELEASE MEASURES

Steps to be Taken if Material is Released or Spilled:
Very low concentrations (5 ppm or less of glutaraldehyde) can be degraded in a biological wastewater treatment system. Thus, small spills can be flushed with large quantities of water. Large quantities or 'slugs' can be harmful to the treatment system. Thus, large spills should be collected for disposal. It may also be possible to decontaminate spilled material by careful application of aqueous sodium hydroxide or sodium bisulfite. Depending on conditions, considerable heat and fumes can be liberated by the decontamination reaction.

Personal Precautions: Wear suitable protective equipment. See Section 8.2 - Personal Protection.

Environmental Precautions: Toxic to fish; avoid discharge to natural waters.

7. HANDLING AND STORAGE

7.1 HANDLING

General Handling
Do not get in eyes, on skin, on clothing.
Avoid breathing vapor.
Do not swallow.
Wear goggles, protective clothing and gloves.
Wash thoroughly with soap and water after handling.
Remove contaminated clothing and wash before reuse.
FOR INDUSTRY USE ONLY.

Ventilation
General (mechanical) room ventilation is expected to be satisfactory if this material is kept in covered equipment or if the solution is highly diluted. However, if vapors are strong enough to be irritating to the nose (or eyes), the TLV is probably being exceeded and special ventilation and/or respiratory protection may be required.

Other Precautions
This product in its undiluted form must not be used in a spray or aerosol application. If dilutions or mixtures of this product are used in a spray application, full personal protective equipment is strongly recommended to prevent exposure. CAUTION! PLASTIC CONTAINER, IF PRESENT, MAY CAUSE STATIC IGNITION HAZARD. Do not handle or empty container in the presence of flammable vapors.

7.2 STORAGE

Please refer to Remede Products Technical Guidance Document 20-1, GLUTARALDEHYDE. Safe Handling and Storage Guide.

8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

8.1 EXPOSURE LIMITS

Component	Exposure Limits	Skin	Form
Glutaraldehyde	0.05 ppm CEILING ACGIH		activated and unactivated
	0.2 ppm CEILING OSHA-Vacated		
	0.8 mg/m3 CEILING OSHA-Vacated		
	0.1 ppm CEILING UCC		
Methanol	200 ppm TWA8 ACGIH	Yes	
	262 mg/m3 TWA8 ACGIH	Yes	
	250 ppm STEL ACGIH	Yes	
	328 mg/m3 STEL ACGIH	Yes	
Methanol	200 ppm TWA8 OSHA-Vacated	Yes	
	260 mg/m3 TWA8 OSHA-Vacated	Yes	
	250 ppm STEL OSHA-Vacated	Yes	
	325 mg/m3 STEL OSHA-Vacated	Yes	
	200 ppm TWA8 OSHA		
	260 mg/m3 TWA8 OSHA		

In the Exposure Limits Chart above, if there is no specific qualifier (i.e., Aerosol) listed in the Form Column for a particular limit, the listed limit includes all airborne forms of the substance that can be inhaled.

A "Yes" in the Skin Column indicates a potential significant contribution to overall exposure by the cutaneous (skin) route, including mucous membranes and the eyes, either by contact with vapors or by direct skin contact with the substance. A "Blank" in the Skin Column indicates that exposure by the cutaneous (skin) route is not a potential significant contributor to overall exposure.

8.2 PERSONAL PROTECTION

Respiratory Protection: Use self-contained breathing apparatus in high vapor concentrations. If self-contained breathing apparatus is not available, a MSHA/NIOSH approved air purifying respirator equipped with an organic vapor cartridge should be used.

Ventilation:

General (mechanical) room ventilation is expected to be satisfactory if this material is kept in covered equipment or if the solution is highly diluted. However, if vapors are strong enough to be irritating to the nose (or eyes), the TLV is probably being exceeded and special ventilation and/or respiratory protection may be required.

Eye Protection:

Splash proof monogoggles or safety glasses with side shields in conjunction with a face shield.

Protective Gloves:

Nitrile (NBR)
Butyl

Other Protective Equipment:

Chemical apron
Eye Bath, Safety Shower
Rubber boots

8.3 ENGINEERING CONTROLS

Use good housekeeping and acceptable industrial engineering practices.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State: Liquid
Appearance: Transparent colorless
pH: **3.1 - 4.5**
Solubility in Water (by weight): *20 °C* **100 %**
Odor: Sharp, Fruity, Medicinal
Molecular Weight: **100.11 g/mol**
Boiling Point (760 mmHg): **~ 100.5 °C ~ 213 °F** As product.
Freezing Point: **-7 °C 20 °F**
Specific Gravity (H2O = 1): **1.042** *20 °C / 20 °C*
Vapor Pressure at 20°C: **0.2 mmHg** Based on glutaraldehyde
Vapor Density (air = 1): **0.7**
Evaporation Rate (Butyl Acetate = 1): **0.8**
Melting Point: *Not applicable.*

10. STABILITY AND REACTIVITY

10.1 STABILITY/INSTABILITY Stable

Conditions to Avoid: Avoid high temperature and evaporation of water.
Incompatible Materials: Strong alkalies and acids catalyze an aldol-type condensation (exothermic, but not expected to be violent).

10.2 HAZARDOUS POLYMERIZATION Will Not Occur.

Conditions to Avoid : Temperatures above 100°C. Although polymerization may occur, it is not hazardous.

10.3 INHIBITORS/STABILIZERS Not applicable.

11. TOXICOLOGICAL INFORMATION

ACUTE TOXICITY

Percutaneous
Rabbit; male = 16 ; 24 h occluded.
Mortality: 0/5
Major Signs: necrosis with subsequent desquamation at application site
Gross Pathology: lungs discolored

Percutaneous
Rabbit; female = 16 ; 24 h occluded.
Mortality: 1/5
Major Signs: necrosis with subsequent desquamation at application site
Gross Pathology: lungs discolored

SENSITIZATION (ANIMAL AND HUMAN STUDIES)

Guinea Pig Maximization Test: intradermal injection of a 0.1% glutaraldehyde solution and topical administration of a 5% solution. Evidence of delayed contact hypersensitivity in 68% of test animals upon challenge.

SIGNIFICANT DATA WITH POSSIBLE RELEVANCE TO HUMANS

Studies in humans have shown that glutaraldehyde is neither phototoxic nor a photosensitizer. Subchronic drinking water studies in rats, mice and dogs using concentrations up to 1000 ppm showed no evidence for any target organ toxicity. In vitro studies for genetic toxicology using a variety of assays [bacterial mutagenicity, forward gene mutation (HGPRT and TK loci), sister chromatid exchanges, chromosome abberrations UDS, and DNA repair] have given variable results, ranging from negative to weak positive. In vivo genetic toxicology studies have

generally shown no activity (micronucleus, some chromosome aberration tests, dominant lethal, and Drosophila), although one mouse bone marrow study showed increased chromosomal aberrations following intraperitoneal dosing, but this was not seen in the rat after oral dosing. Several developmental toxicity studies have demonstrated that at maternally nontoxic doses, glutaraldehyde does not produce fetotoxic, embryotoxic or teratogenic effects. In a two-generation reproduction study involving continuous exposure of CD rats to glutaraldehyde up to 1000 ppm, in drinking water there were effects on parental body weight and food consumption at 1000 ppm (due to an aversion to the taste), but no adverse effects on repro- ductive performance. In a chronic (2-year) continuous drinking water combined chronic toxicity-oncogenicity study using Fischer 344 rats, there was no evidence for non-oncogenic target organ toxicity. The only possible oncogenicity-related finding was an increase in the incidence of large granular cell does not represent direct chemical carcinogenic activity but, rather, a modifying influence on the expression of this spontaneous and commonly occurring neooplasm in the Fischer 344 rat. Repeated applications of aqueous solutions of glutaraldehyde to the rat skin for 20 dosages over a 28-day period at 50, 100 or 150 mg/kg/day produced mild local inflammatory effects, but no evidence for target organ or tissue systemic toxicity. Under the auspices of the National Toxicology Program a chronic study with glutaraldehyde vapor was conducted in rats (0,250,500 and 750 ppb) and mice (0,62.5,125 and 250 ppb). Animals were exposed for 6 hr/day, 5 days/week for 104 weeks. Under these conditions there were no significant increases in any tumor types, and glutaraldehyde was not carcinogenic.
An extensive clinical survey has been conducted on nursing staff in 59 endoscopy units (340 currently employed workers and 18 former employees); investigational procedures included detailed questionnaire, sensitization to common allergens, blood for IgE measurements, lung function tests, peak flow diaries, and measurement of workplace glutaraldehyde vapor concentrations. About two-thirds of current employees had ocular, nasal, or lower respiratory tract symptoms, but these were more prevalent for non-work conditions. The only effect correlated with glutaraldehyde exposure was nasal irritation. There was a slight, but no statistically or biologically significant, decrease in FEV1 for those with lower respiratory tract symptoms. There were no indications of asthma and no objective evidence for respiratory sensitization.

12. ECOLOGICAL INFORMATION

12.1 ENVIRONMENTAL FATE

Please refer to Remede Products Technical Guidance Document: Summary of Environmental Fate Data on Glutaraldehyde.

12.2 ECOTOXICITY

Please refer to Remede Products Technical Guidance Document: Summary of Fish and Wildlife Toxicological Studies on Glutaraldehyde.

12.3 FURTHER INFORMATION

None.

13. DISPOSAL CONSIDERATIONS

13.1 WASTE DISPOSAL METHOD

Atomize into a very hot incinerator fire or mix with a suitable flammable solvent, and incinerate where permitted under appropriate Federal, State, and local regulations. High water content may dampen flame. Dispose in accordance with all applicable Federal, State, and local environmental regulations. Empty containers should be recycled or disposed of through an approved waste management facility.

13.2 DISPOSAL CONSIDERATIONS

See Section 13.1

Disposal methods identified are for the product as sold. For proper disposal of used material, an assessment must be completed to determine the proper and permissible waste management options permissible under applicable rules, regulations and/or laws governing your location.

14. TRANSPORT INFORMATION

14.1 U.S. D.O.T.

NON-BULK
Proper Shipping Name : NOT REGULATED

BULK
Proper Shipping Name : NOT REGULATED

This information is not intended to convey all specific regulatory or operational requirements/information relating to this product. Additional transportation system information can be obtained through an authorized sales or customer service representative. It is the responsibility of the transporting organization to follow all applicable laws, regulations and rules relating to the transportation of the material.

15. REGULATORY INFORMATION

15.1 FEDERAL/NATIONAL

COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT OF 1980 SECTION 103 (CERCLA)

The following components of this product are specifically listed as hazardous substances in 40 CFR 302.4 (unlisted hazardous substances are not identified) and are present at levels which could require reporting:

None.

SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT OF 1986 TITLE III (EPCRA) SECTIONS 302 AND 304

The following components of this product are listed as extremely hazardous substances in 40 CFR Part 355 and are present at levels which could require reporting and emergency planning:

None.

SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT OF 1986 TITLE III (EPCRA) SECTION 313

The following components of this product are listed as toxic chemicals in 40 CFR 372.65 and are present at levels which could require reporting and customer notification under Section 313 and 40 CFR Part 372:

- This product does not contain toxic chemicals at levels which require reporting under the statute.

SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT OF 1986 TITLE III (EPCRA) SECTIONS 311 AND 312

Delayed (Chronic) Health Hazard : Yes
Fire Hazard : No
Immediate (Acute) Health Hazard : Yes
Reactive Hazard : No
Sudden Release of Pressure Hazard : No

TOXIC SUBSTANCES CONTROL ACT (TSCA)

All components of this product are on the TSCA Inventory or are exempt from TSCA Inventory requirements.

EUROPEAN INVENTORY OF EXISTING COMMERCIAL CHEMICAL SUBSTANCES (EINECS)

The components of this product are on the EINECS inventory or are exempt from EINECS inventory requirements.

CEPA - DOMESTIC SUBSTANCES LIST (DSL)

The components of this product are on the DSL or are exempt from reporting under the New Substances Notification Regulations.

15.2 STATE/LOCAL

PENNSYLVANIA (WORKER AND COMMUNITY RIGHT-TO-KNOW ACT)

This product is subject to the Worker and Community Right-to-Know Act. The following components of this product are at levels which could require identification in the MSDS:

Component	CAS #	Amount
Glutaraldehyde	111-30-8	<= 15.0000%

MASSACHUSETTS (HAZARDOUS SUBSTANCES DISCLOSURE BY EMPLOYERS)

The following components of this product appear on the Massachusetts Substance List and are present at levels which could require identification in the MSDS:

Component	CAS #	Amount
Glutaraldehyde	111-30-8	<= 15.0000%

CALIFORNIA PROPOSITION 65 (SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT OF 1986)

This product contains no listed substances known to the State of California to cause cancer, birth defects or other reproductive harm, at levels which would require a warning under the statute.

CALIFORNIA SCAQMD RULE 443.1 (SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT RULE 443.1, LABELING OF MATERIALS CONTAINING ORGANIC SOLVENTS)

VOC: Not applicable.

This section provides selected regulatory information on this product including its components. This is not intended to include all regulations. It is the responsibility of the user to know and comply with all applicable rules, regulations and laws relating to the product being used.

16. OTHER INFORMATION

16.1 AVAILABLE LITERATURE AND BROCHURES

ADDITIONAL INFORMATION: There may be additional product safety information on this product, which may be obtained by calling your Remede products or your Customer Service Contact.

16.2 SPECIFIC HAZARD RATING SYSTEM

HMIS ratings for this product are: H - 3 F - 1 R - 0

NFPA ratings for this product are: H - 3 F - 1 R - 0

These ratings are part of specific hazard communications program(s) and should be disregarded where individuals are not trained in the use of these hazard rating systems. You should be familiar with the hazard communication applicable to your workplace.

16.3 RECOMMENDED USES AND RESTRICTIONS

This product in its undiluted form must not be used in a spray or aerosol application. If dilutions or mixtures of this product are used in a spray application, full personal protective equipment is strongly recommended to prevent exposure.

FOR INDUSTRY USE ONLY.

16.4 REVISION

Version: 4.
Revision: 03/19/2001
Most recent revision(s) are noted by the bold, double bars in left-hand margin throughout this document.

16.5 LEGEND

A	Asphyxiant
Bacterial/NA	Non Acclimated Bacteria
F	Fire
H	Health
HMIS	Hazardous Materials Information System
N/A	Not available
NFPA	National Fire Protection Association
O	Oxidizer
P	Peroxide Former
R	Reactivity
TS	Trade Secret
VOL/VOL	Volume/Volume
W	Water Reactive
W/W	Weight/Weight

The opinions expressed herein are those of qualified experts. We believe that the information contained herein is current as of the date of this Material Safety Data Sheet. Since the use of this information and the conditions of the use of the product are not under the control of Redux Technology, it is the user's obligation to determine conditions of safe use of the product.

Redux™ Technology

SUMMARY OF ENVIRONMENTAL FATE STUDIES

- Stable to sunlight
- Aqueous hydrolysis yields simple dimer, which is nonbiocidal and relatively non-toxic to aquatic organisms
- Aerobic soil metabolism causes rapid degradation of GA (half-life < 24 hours), mainly to carbon dioxide
- Anaerobic soil metabolism causes rapid degradation of GA (half-life < 24 hours), mainly to 1,5-pentandiol.

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TABLE I

Half-Life of Glutaraldehyde*

Air Washer	Location	Initial Concentration	Half-Life
Fibers plant	South East	80 ppm	4 hrs
Fibers plant	South East	80 ppm	8 hrs
Fibers plant	South East	90 ppm	10 hrs

Cooling Tower	Location	Initial Concentration**	Half-Life
Petrochemical	Mexico	100 ppm	6 hrs
Office complex	West	90 ppm	8 hrs
Petrochemical	East	75 ppm	6 hrs
Office complex	North	81 ppm	8 hrs

* The pH in these systems ranges from 6.8 to 7.8. If the system pH was 8.5 or greater, the half-life would be reduced, with an increasing pH leading to a shorter half-life.

** Refers to active concentration of glutaraldehyde

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SUMMARY OF FISH AND WILDLIFE STUDIES

B-15 Water Treatment Microbiocides have been extensively examined in several fish and wildlife toxicology studies, as shown in the table below. Results from these studies demonstrate the relatively safe nature of glutaraldehyde-based biocides in water treatment.

Species	Actives, %	No-Effect Level, mg/l	48-Hr LC mg/l	96-Hr LC mg/l
Rainbow Trout	25	32.0	56.2	42.1
	50	18.0	32.6	23.7
Blue Gill Sunfish	25	10.0	47.3	37.6
	50	10.0	23.7	22.4
Oyster Larvae	25	-	2.1	-
Green Crabs	25	-	1100.0	465.0
Grass Shrimp	25	-	400.00	41.0
Daphnia (Water Flea)	25	5.0	16.9	-
	50	5.0	11.5	-

Species	Actives, %	8-Day Dietary LC ppm,	Acute Oral LD mg/kg
Bobwhite Quail	25	10,000	-
	50	10,000	-
Mallard Duck	25	10,000	1,631
	50	10,000	933

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Redux™ Technology

Glutaraldehyde-Based B-15 Water Treatment Microbiocides Environmental Fate Studies

Studies were undertaken to determine the environmental fate of glutaraldehyde, the active ingredient in B-15 Water Treatment Microbiocides.

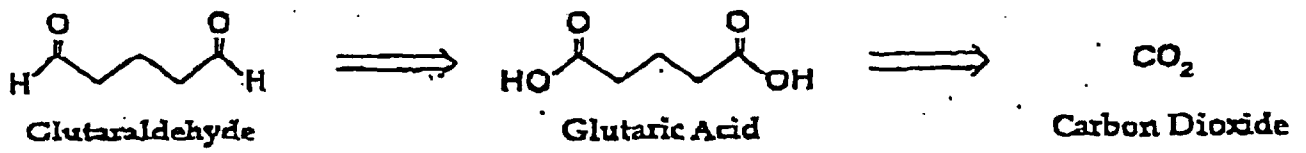
The purpose of these studies was to determine the products formed when glutaraldehyde is allowed to degrade in the presence of river and sediment. Both aerobic and anaerobic conditions were employed in determining the fate of glutaraldehyde.

Glutaraldehyde Metabolizes Completely in Aerobic and Anaerobic Systems

Aerobic System

Glutaraldehyde had a half-life of approximately 12 hours. During this period, the glutaraldehyde was metabolized first to glutaric acid and then to carbon dioxide. (Scheme 1). No traces of either glutaraldehyde or glutaric acid were found after 48 hours.

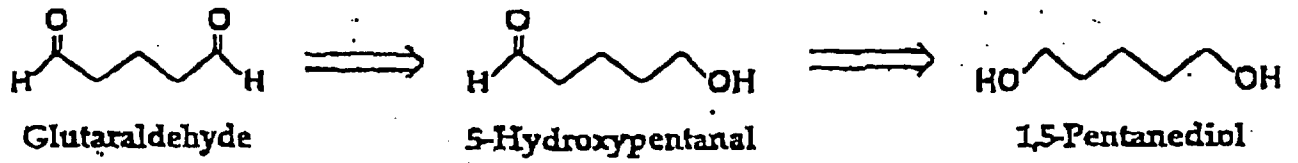
Scheme 1



Anaerobic System

The glutaraldehyde concentration also decreased rapidly in the water and was completely metabolized in three days, with 95 percent degraded in the first 24 hours. The intermediate metabolite in the anaerobic study was 5-hydroxypentanal, which was further metabolized within seven days to 1,5-pentanediol (Scheme 2). This compound has no appreciable biocidal properties.

Scheme 1



Conclusion

Glutaraldehyde is not persistent under aerobic or anaerobic conditions of aquatic soil metabolism.

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STORAGE

Storage Stability

Under proper conditions, aqueous glutaraldehyde solutions may be stored for extended periods of time without adverse effects. The rate of loss of activity will be determined principally by the following conditions of storage:

- Temperature
- pH
- Product contamination

The most important factor affecting the useful storage lifetime of glutaraldehyde solutions is temperature. The material should be stored at or below room temperature whenever possible in order to minimize decomposition. Glutaraldehyde solutions show no change in concentration after one year of storage at 25°C and 37°C. However, storage at elevated temperatures for extended periods will shorten the shelf life.

Freezing will normally have no impact on the activity of glutaraldehyde-based solutions. Even repeated cycles of freezing and thawing will not cause any significant degradation of the material. However, when glutaraldehyde solutions are frozen relatively slowly, as might occur in large containers or at temperatures only slightly below the freezing point, stratification may be observed. The resulting solution will be more concentrated at the bottom of the container than at the top. This effect is more pronounced with solutions containing lower concentrations of glutaraldehyde (15 percent), but does not seem to grow worse with repeated freeze-thaw cycles. When possible, freezing should be prevented. If freezing does occur, drums should be slowly thawed (avoiding localized hot spots) and mixed until homogeneous. Bulk storage tanks should likewise be thawed slowly and then recirculated to counteract stratification.

The pH of glutaraldehyde-based solutions will also have a major impact upon their useful lifetimes. The active material is most stable at a pH around 4.0 and is shipped in this condition. Concentrated solutions tend to become more acidic upon storage, particularly at elevated temperatures. This pH decrease will not have any significant effect on the stability of the solutions. Addition of alkaline materials to concentrated solutions should be avoided, since the lifetime of the material is decreased at an elevated pH.

Contamination of concentrated solutions of glutaraldehyde with substantial quantities of other materials may adversely affect product stability. In particular, ammonia, amines, or products containing these substances should be carefully avoided, since they will react readily with glutaraldehyde. As with all chemicals, storage containers of glutaraldehyde should be tightly closed and protected from other materials when not in use.

In addition, trace levels of iron will adversely impact the storage stability of glutaraldehyde. Therefore, all product transfers should avoid even transient contact with mild steel.

When kept under optimal conditions, glutaraldehyde-based solutions may be stored in sealed containers for over two years. Under more adverse conditions encountered in the field, storage lives of over one year are commonly observed. However, to minimize or prevent polymer buildup, we recommend a storage time of no longer than 6-12 months.

When being emptied, drums should be in a well-ventilated location. Special caution should be taken when removing the downpipe, since the greatest potential for exposure occurs during downpipe removal. Respiratory equipment, eye bath, and safety shower should be located in the area.

Disposal

Drums used to store concentrated solutions of glutaraldehyde may be *(a)* resealed and offered for reconditioning, or *(b)* triple-rinsed (or equivalent) and offered for recycling, reconditioning, or puncture and disposal in a sanitary landfill, or other procedures approved by national or local authorities.

Drum Filling

In drum-filling operations, the primary concern is adequate personnel protection. Operators should be wearing protective gloves; splashproof monogoggles, or both safety glasses with side shields and a wrap-around full-face shield; and protective clothing. A drum lance or pipe that fills from the drum bottom should be used. Filling should be done in a well-ventilated area. Vapors should be drawn away from operating personnel. Respirators, safety showers, and eye baths should be located in the area.

All filling lines and equipment should be constructed of materials listed in the sections on Materials of Construction and Gasket Materials under Storage Design.