



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
Four Penn Center
1600 John F Kennedy Blvd
Philadelphia, Pennsylvania 19103-2852

UNDERGROUND INJECTION CONTROL AREA PERMIT NUMBER
VAS5B170028617
AUTHORIZATION TO OPERATE CLASS V INJECTION WELLS

In compliance with provisions of the Safe Drinking Water Act, as amended, 42 U.S.C. §§ 300f *et seq.* (SDWA) and the SDWA implementing regulations promulgated by the U. S. Environmental Protection Agency at Parts 144 -147 of Title 40 of the Code of Federal Regulations, this Permit authorizes

Hampton Roads Sanitation District
1434 Air Rail Avenue
Virginia Beach, Virginia 23455

to construct ten (10) Class V aquifer recharge injection wells (hereinafter, "Injection Wells", "HRSD SWIFT Injection Wells", "JR SWIFT injection wells", or "Facility") and to operate the Injection Wells for the purpose of injecting wastewater treated at the Hampton Roads Sanitation District (HRSD) James River wastewater treatment plant as part of the Potomac Aquifer System (PAS) managed aquifer recharge program known as the Sustainable Water Initiative for Tomorrow (SWIFT) in accordance with the provisions of this Permit. The Injection Wells must be located at or around the James River Treatment Plant, 111 City Farm Road in Newport News, Virginia. The centroid coordinates for the Injection Wells are: Latitude 37° 05' 14" and Longitude -76° 31' 54.1".

All references to Title 40 of the Code of Federal Regulations (C.F.R.) are to all regulations that are in effect on the date that this Permit becomes effective.

This Permit shall become effective 35 days after date of signature.

This Permit and its authorization to inject shall remain in effect until midnight 10 years after the effective date.

Catherine A. Libertz, Director
Water Division

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PART I. EFFECT OF PERMIT

A. Effect of a Permit

Hampton Roads Sanitation District (the “Permittee”) is authorized to engage in underground injection at the Injection Wells in accordance with the conditions of this Permit number VAS5B170028617 (“Permit”). The Permittee must not allow the underground injection activity, otherwise authorized by this Permit, to cause or contribute to the movement of fluid containing any contaminant into any underground source(s) of drinking water (“USDW”), if the presence of that contaminant may cause a violation of any primary drinking water regulation under 40 C.F.R. Part 141 or if it may otherwise adversely affect the health of persons. Any underground injection activity not expressly authorized in this Permit or otherwise authorized by permit or rule is prohibited. Issuance of this Permit does not convey property rights or mineral rights of any sort or any exclusive privilege; nor does it authorize any injury to persons or property, any invasion of other private rights, or any infringement of State or local law or regulations. Compliance with the terms of this Permit does not constitute a defense to any action brought under Part C or D of the SDWA, 42 U.S.C. §§ 300h-300i-4, or any other common or statutory law for any breach of any other applicable legal duty.

B. Permit Actions

This Permit can be modified, revoked and reissued, or terminated for cause unilaterally or upon request as specified in 40 C.F.R. §§ 144.12, 144.39 and 144.40. Also, the Permit is subject to minor modifications as specified in 40 C.F.R. § 144.41. The filing of a request for a permit modification, revocation and reissuance, or termination, or the notification of planned changes, or anticipated noncompliance on the part of the Permittee, shall not stay the applicability or enforceability of any permit condition.

C. Severability

The provisions of this Permit are severable from one another, and if any provision of this Permit is held invalid, the applicability of such provision to other circumstances, and the remainder of this Permit shall not be affected thereby.

D. General Requirements

1. Duty to Comply. The Permittee must comply with all provisions of this Permit and all applicable UIC regulations, including 40 C.F.R. Parts 124 and 144-147. Any permit non-compliance constitutes a violation of the SDWA and is grounds for enforcement action, permit termination, revocation and reissuance or modification, or for denial of a permit renewal application. Permittee need not comply with the provisions of this Permit to the extent and for the duration such noncompliance is permitted by an EPA-issued emergency permit pursuant to 40 C.F.R. §144.34.
2. Reapplication. If the Permittee wishes to continue an activity regulated by this Permit after the expiration date of the Permit, the Permittee must submit a

complete application for a new permit at least 180 days before this Permit expires.

3. Reopening Permit for Modification EPA recognizes that new or additional scientific information or data specific to the James River facility operations may further inform the determination of adequately protecting the underground source of drinking water from contaminants of emerging concern. As such, the Director of the EPA Region III Water Division (“Director”) may reopen the Permit to modify the selection of and thresholds for the parameters listed in Attachments 1 through 3 or to revoke and reissue the Permit.
4. Need to Halt or Reduce Activity not a Defense. It shall not be a defense for the Permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this Permit.
5. Duty to Mitigate. The Permittee must take all reasonable steps to minimize or correct any adverse impact on the environment resulting from noncompliance with this Permit.
6. Proper Operation and Maintenance. The Permittee must, at all times, properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the Permittee to achieve compliance with the conditions of this Permit. Proper operation and maintenance includes: effective performance, adequate funding, adequate operator staffing and training, adequate security to prevent unauthorized access and operation of the Injection Wells, and adequate laboratory and process controls, including appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems only when necessary to achieve compliance with the conditions of this Permit.
7. Duty to Provide Information. The Permittee must furnish to the Director, within a time specified by the Director, any information which the Director may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this Permit, or to determine compliance with this Permit. The Permittee must also furnish to the Director, upon request, copies of records required to be kept by this Permit. If the Permittee becomes aware of any incomplete or incorrect information in the permit application or subsequent reports, the Permittee must promptly, but no later than 24 hours after becoming aware, submit information identifying and addressing these deficiencies to the Director. Notification must be made pursuant to paragraph III.D.3 of this Permit. For purposes of this Permit, unless otherwise specified herein, all reports, notices/notifications and information that are required to be submitted “in writing,” or in “written” format, must contain the certification and signature required under paragraph I.D.11 below, and may be submitted via email in portable document format (*i.e.*, as a “pdf” document), in accordance with the instructions set forth in paragraph III.A of this Permit.

8. Inspection and Entry. The Permittee must allow the Director, or an authorized representative, upon the presentation of credentials and other documents as may be required by the law to:
 - a. Enter upon the Permittee's premises where the Facility or activity is located or conducted, or where records must be kept under the conditions of this Permit;
 - b. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this Permit;
 - c. Inspect, at reasonable times, the Facility, equipment (including monitoring and control equipment), practices, or operations regulated or required under this Permit; and
 - d. Sample or monitor at reasonable times any substances or parameters at any location for the purposes of assuring permit compliance or as otherwise authorized by the SDWA.
9. Penalties. Any person who violates a requirement of this Permit is subject to administrative or civil penalties, fines and other enforcement actions under the SDWA. Any person who willfully violates conditions of this Permit is subject to criminal prosecution.
10. Transfer of Permits. This Permit is not transferable to any person except after written notice is sent to EPA, approval is received from the Director, and the requirements of 40 C.F.R. § 144.38 are satisfied. The Director may require modification or revocation of the Permit to change the name of the Permittee and incorporate such other requirements as may be necessary under the SDWA or its implementing regulations. The transferee is not authorized to inject under this Permit unless and until the Director notifies the transferee that the transferee is so authorized through issuance of a revised permit identifying the transferee as the Permittee.
11. Signatory Requirements.
 - a. The Permittee must sign all reports required by this Permit and other information requested by the Director as follows:
 - (1) for a corporation, by a responsible corporate officer of at least the level of vice-president;
 - (2) for a partnership or sole proprietorship, by a general partner or the proprietor, respectively; or
 - (3) for a Municipality, State, Federal, or other public agency by either a principal executive officer or a ranking elected official.
 - b. A duly authorized representative of the person designated in paragraph a.

above may also sign only if:

- (1) the authorization is made in writing by a person described in paragraph I.D.11.a. above;
 - (2) the authorization specifies either an individual or a position having responsibility for the overall operation of the regulated Facility or activity, such as the position of plant manager, operator of a well or a well field, superintendent, or a position of equivalent responsibility. A duly authorized representative may thus be either a named individual or any individual occupying a named position; and
 - (3) the written authorization is submitted to the Director.
- c. If an authorization under paragraph b. of this section is no longer accurate because a different individual or position has responsibility for the overall operation of the Facility, a new authorization satisfying the requirements of paragraph b. of this section must be submitted to the Director prior to or together with any reports, information or applications to be signed by an authorized representative.
- d. Any person signing a document under paragraph a. or b. of this section must make the following certification:

"I certify under the penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person(s) who manage the system, or those persons directly responsible for gathering the information, the information submitted is to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

12. Confidentiality of Information.

- a. In accordance with 40 C.F.R. Part 2 (Public Information), and 40 C.F.R. § 144.5, any information submitted to the Director pursuant to this Permit may be claimed as confidential by the submitter. Any such claim must be asserted at the time of submission by stamping the words "confidential business information" on each page containing such information. If no claim is made at the time of submission, EPA may make the information available to the public without further notice. If a claim is asserted, the information must be treated in accordance with the procedures in 40 C.F.R. Part 2.

- b. EPA will deny any claims of confidentiality for the following information:
- (1) The name and address of any permit applicant or Permittee.
 - (2) Information which deals with the existence, absence, or level of contaminants in drinking water.
13. State Laws. Nothing in this Permit shall be construed to preclude the institution of any legal action or relieve the Permittee from any responsibilities, liabilities, or penalties established pursuant to any applicable State law or regulation.
14. Calculation of Days. All references to number of days in this Permit shall mean calendar days.
15. Definitions:
- Advanced Wastewater Treatment – A tertiary wastewater treatment process, after conventional primary and secondary treatment, that includes sediment removal, ozone oxidation, biologically active filtration, granular activated carbon adsorption, ultra-violet light disinfection and pH adjustment, which results in highly treated wastewater.
- Critical Control Points – Multiple points throughout each of the components of the Advanced Wastewater Treatment Process which are monitored and controlled to assure that each component is functioning properly.
- JR SWIFT Recharge Water – Potomac Aquifer System (PAS) recharge water which has undergone advanced wastewater treatment at the James River Wastewater Treatment Plant to meet Safe Drinking Water Act (SDWA) Maximum Contaminant Levels (MCLs), among other requirements, as determined after treatment and prior to injection.
- SDWA MCLs (PMCLs) – EPA national drinking water standards that establish the maximum permissible level for contaminants in water which is delivered to any user of a public water system for human consumption, and that reflect the level that protects human health and accounts for best available technology and detection methods. They are commonly known as primary maximum contaminant levels (PMCLs).
- SDWA Maximum Residual Disinfectant Levels (MRDLs) – The highest level of a disinfectant allowed in drinking water.
- Monitoring Wells (MWs) – Groundwater monitoring wells strategically located near JR SWIFT injection wells to determine groundwater level increases in response to aquifer recharge and to document ambient

groundwater quality prior to the effects of recharge and the water quality impacts to the PAS subsequent to recharge.

Potomac Aquifer System (PAS) – A series of interbedded coastal plain sediments composed of a combination of unconsolidated permeable sands and gravel and less permeable clay layers. The permeable sand and gravel layers are hydraulically continuous on a regional scale exhibiting characteristics of differentiated hydraulic units referred to as the Potomac Aquifer System. The PAS is a USDW.

Permit Limits – PMCLs and other limits specified in Attachment 1.

Part II. CONSTRUCTION, OPERATION, AND FINANCIAL RESPONSIBILITY

The Permittee is not authorized to inject into any JR SWIFT Injection Well until it has demonstrated to the Director that each of the following Construction Requirements have been satisfied:

A. Construction Requirements

1. Confining Zones. The Area of Review (AOR) for this Permit is the one-quarter mile fixed width from the outermost JR SWIFT Injection Well boundary. See Attachment A of the permit application page 2 and 3. Notwithstanding any other provision of this Permit, the Permittee must inject through the Injection Wells only into the Potomac Aquifer System (PAS). The PAS occurs at an interval of approximately 400 to 1300 feet below ground surface in the project area. The PAS is separated from the shallow surficial and other aquifers by multiple low permeability confining zones, that are free of known open faults or fractures within the Area of Review.
2. Casing and Cementing. Each JR SWIFT Injection Well and each Monitoring Well must be constructed based upon the specific conditions at each well site during construction. The Permittee must maintain the following conditions in the Injection Wells and Monitoring Wells at all times:
 - a. Casing, bentonite grout, and silica sand filter pack as appropriate to minimize the movement of fluids into or between underground sources of drinking water;
 - b. The casing, bentonite grout, and silica sand filter packs used must be maintained to assure integrity throughout Injection Well operation;
 - c. Surface casing that has been installed from the surface, through the upper confining formations to the top of the PAS at approximately 400 feet below land surface and grouted back to the surface; and

- d. Multiple screened depths and lengths, filter packs and grout at intervals determined from data obtained during each well construction, to ensure recharge fluid injection into the intended portion of the PAS.
3. Logs and Tests. After installation of the surface casing and placement of bentonite grout from the upper silica sand filter pack to the surface to secure the surface casing, the Permittee must perform a bond log and casing pressure test to document the mechanical integrity of the surface casing. The Permittee must submit to the Director, for all Injection Wells, bentonite grout records, a narrative report that interprets the well log(s) and test results which specifically relate to the effectiveness of the grouting operation, and a detailed description of the rationale used to make these interpretations. The narrative report must be prepared by a knowledgeable log analyst and submitted to the Director. The Director may prescribe additional logs or waive logging requirements in the future should field conditions so warrant.
4. Mechanical Integrity. The Permittee is prohibited from conducting injection operations into a JR SWIFT Injection Well until it receives notice from the Director that the casing pressure test has demonstrated mechanical integrity of the surface casing in accordance with paragraph II.A.3. and III.D.2. of this Permit. The Permittee is prohibited from injecting into any Injection Well that lacks or loses mechanical integrity.
5. Corrective Action. There are no wells within the Area of Review which penetrate the confining zone(s) and therefore no corrective action is necessary.
6. Cumulative Effects. Baseline groundwater chemistry must be established prior to JR SWIFT Recharge Water influence. The cumulative effects of operation of the Injection Wells will be monitored by Monitoring Wells and reported as described in paragraphs II.B.7, III.C.10, and III.D.8.
7. Completion Reports. Prior to the commencement of injection operations, the Permittee must prepare a written Completion Report that summarizes the activities and the results of the testing required in paragraphs A.1 through 6 of Part II of this Permit and submit the Completion Report to the Director for review and approval. Commencement of injection operations must not begin until the Director has approved the Completion Report.

B. Operating Requirements

1. Injection Formation. The Permittee must inject only into the Potomac Aquifer System (PAS) in the subsurface interval between approximately 400 to 1200 feet below land surface elevation, through well screened intervals across these depths.
2. Injection Fluid.
 - a. Injection into or recharge of the Potomac Aquifer System (PAS) is prohibited

unless the JR SWIFT Recharge Water meets Permit Limits, including

1. Safe Drinking Water Act (SDWA) specified Primary Maximum Contaminant Levels (PMCLs) as detailed in 40 C.F.R. Part 141, as specified in Attachment 1; and
2. Other applicable limits as specified in Attachment 1.

Compliance with Permit Limits shall be determined according to paragraph III.C.3.

- b. The Permittee must not inject any hazardous waste as defined in 40 C.F.R. Part 261 or any fluid other than JR SWIFT Recharge Water or fluid approved in writing in advance by EPA to condition the aquifer material or to flush the Injection Wells.
3. Injection Volume Limitation. Injection into or recharge of the Potomac Aquifer System (PAS) utilizing the ten (10) permitted JR SWIFT Injection Wells must not exceed sixteen (16) million gallons per day (MGD).
4. Injection Pressure Limitation. The maximum allowable injection pressure (MAIP) as measured at the well head of each JR SWIFT Injection Well must not exceed thirty (30) pounds per square inch (psi). 30 psi is the maximum well head pressure necessary to overcome increasing formation fluid pressures in the PAS as it is recharged, and down hole pressure losses resulting from friction in the injection casing and screens.
5. Injection Well Restrictions. The Permittee must inject fluids into the Injection Wells solely through well screens located in the target recharge zones. The Permittee is prohibited from injecting between the outermost casing protecting the USDW and the well bore and prohibited also from injecting into any unspecified USDW.
6. Critical Control Points. The Permittee must establish, maintain and monitor multiple Critical Control Points (CCPs) throughout the Advanced Wastewater Treatment Process (AWTP). CCPs provide a multiple barrier approach for the control and prevention of contaminants in the wastewater treated prior to injection. CCPs verify that treatment goals are being met throughout the AWTP.
7. Groundwater Monitoring Wells. The Permittee must construct, as specified in paragraph II.A.2 of this Permit, and monitor eight (8) Monitoring Wells (MW). The MWs must monitor changes in groundwater levels and monitor existing groundwater quality and migrating recharge water chemistry. The Monitoring Wells must be situated in two Monitoring Well Clusters as specified in the table directly below; four (4) in each cluster. Three (3) MWs in each cluster must be screened in the Upper Zone of the Potomac Aquifer (UPA) and one (1) MW screened in the Middle Zone of the Potomac Aquifer (MPA). The Potomac Aquifer System is the target recharge aquifer.

Placement of the MW screens must match JR SWIFT injection well screen zones. Each Monitoring Well Cluster will be located approximately 500 feet from the nearest JR SWIFT Injection Well to monitor the cumulative effects of the injection wells. The MWs are described as follows:

Monitoring Well Cluster 1	Monitoring Well Cluster 2
MW 1 Upper Zone Potomac Aquifer (UPA) A	MW 1 Upper Zone Potomac Aquifer (UPA) A
MW 2 Upper Zone Potomac Aquifer (UPA) B	MW 2 Upper Zone Potomac Aquifer (UPA) B
MW 3 Upper Zone Potomac Aquifer (UPA) C	MW 3 Upper Zone Potomac Aquifer (UPA) C
MW 4 Middle Zone Potomac Aquifer (MPA) A	MW 4 Middle Zone Potomac Aquifer (MPA) A

- C. Plugging and Abandonment. The Permittee must plug and abandon the Injection Wells in accordance with 40 C.F.R §§ 144.51(o) and 146.10 and paragraph III.D.9 and as specified in the EPA-approved Plugging and Abandonment Plan (EPA Form 7520-19) (Attachment 4), which is incorporated herein, and any EPA-approved modifications and/or revisions thereto.
- D. Financial Responsibility
1. The Permittee must maintain continuous compliance with the requirement to maintain financial responsibility and resources to close, plug and abandon the JR SWIFT Injection Wells and Monitoring Wells in accordance with 40 C.F.R. § 144.52(a)(7) in the amount of at least \$1,223,521.
 2. The Injection Wells may not be constructed, reworked or operated if the financial responsibility for that well has not been established. Further, the Permittee must provide documentation to the Director that financial responsibility has been established for each Injection Well prior to construction, rework or operation. Hampton Roads Sanitation District has provided a Financial Statement demonstrating evidence of the financial resources necessary to plug and abandon the JR SWIFT Injection Wells and Monitoring Wells.
 - a. If the circumstances regarding the acceptability of the Financial Statement submitted to EPA to demonstrate financial responsibility should change, the Permittee must provide advance notification to the Director, and the Director may seek an alternative financial demonstration from the Permittee.
 - b. The financial statement demonstration must be submitted to the Director on an annual basis for evaluation and approval. The Permittee must continue to demonstrate and maintain financial responsibility and resources to close, plug, and abandon the underground injection operation in the manner required herein until:
 1. The Injection Wells have been plugged and abandoned in accordance with an approved plugging and abandonment plan pursuant to this Permit and 40 C.F.R. §§ 144.51(o) and 146.10, and submitted a plugging and abandonment report pursuant to § 144.51(p); or

2. The Injection Wells have been converted in compliance with the requirements of 40 C.F.R. § 144.51(n); or
 3. The transferor of a permit has received notice from the Director that the owner or operator receiving transfer of the Permit, the new Permittee, has demonstrated financial responsibility for the Injection Well.
3. Insolvency of Financial Institution. If applicable, in the event of the bankruptcy of the trustee or issuing institution of the financial mechanism, or a suspension or revocation of the authority of the trustee institution to act as a trustee or the institution issuing the financial mechanism to issue such an instrument, the Permittee must immediately notify the Director in writing and submit an alternative demonstration of financial responsibility acceptable to the Director within sixty days (60) after such an event.

PART III. MONITORING AND RECORDKEEPING

A. General

The Permittee shall sign and certify copies of all reports and notifications required by this Permit in accordance with the requirements of Paragraph I.D.11. of this Permit and shall submit such information to the Director in portable document format (i.e., as a “.pdf” file), via e-mail, at the following addresses:

R3_UIC_Mailbox@epa.gov
 Source Water & UIC Section (3WD22)
 Drinking Water & Source Water Protection Branch
 U.S. Environmental Protection Agency
 Region III
 Four Penn Center
 1600 John F. Kennedy Boulevard
 Philadelphia, Pennsylvania 19103

B. Record Retention

1. The Permittee must retain records of all monitoring and other information required by this Permit, including the following (if applicable), for a period of at least five years from the date of the sample, measurement, report or application, unless such records are required to be retained for a longer period of time under paragraph III.B.2 below. This period may be extended by the Director at any time. If the period is extended, the Permittee must comply with the new period.
 - a. All data required to complete the permit application form for this Permit and any supplemental information submitted under 40 C.F.R. § 144.31;

- b. Calibrations and maintenance records of all wastewater treatment equipment or any other devices integral to this operation; and
 - c. Copies of all reports required by this Permit.
- 2. The Permittee must retain records concerning the nature and composition of all injected fluids, as listed in paragraphs III.C.3 and III.C.5-7 of this Permit, until at least three years after the plugging and abandonment procedures are complete. The Permittee must continue to retain these records after the three-year retention period unless he or she delivers the records to the Director or obtains written approval from the Director to discard the records.
- 3. Pursuant to 40 C.F.R. § 144.51(j)(3) records of monitoring information must include:
 - a. The date, sampling location, and the time of sampling or measurements;
 - b. The name(s) of the individual(s) who performed the sampling or measurements;
 - c. A precise description of both sampling methodology and the handling (custody) of samples;
 - d. The date(s) analyses were performed;
 - e. The name(s) of the individual(s) who performed the analyses;
 - f. The analytical techniques or methods used; and
 - g. The results of such analyses including supporting documentation.

C. Monitoring Requirements

- 1. Samples and measurements taken for the purpose of monitoring must be representative of the monitored activity. The Permittee must obtain representative sample(s) of the fluid to be analyzed and conduct analysis(es) of the sample(s) in accordance with the approved methods, test procedures, and certified laboratories provided in 40 C.F.R. § 136.3, 40 C.F.R. § 141.28(a), EPA's SW-846 Compendium, or methods and test procedures otherwise approved by the Director. The Permittee must identify in its monitoring records the types of tests and methods used to generate the monitoring data.
- 2. The Permittee must continuously monitor and record the flow rate, cumulative volume, and injection pressure in each JR SWIFT Injection Well beginning on the date each Injection Well commences operation and concluding when each Injection Well is plugged and abandoned.

3. The Permittee must monitor and record the water quality/chemistry of JR SWIFT Recharge Water for compliance with the requirements of Attachment 1.
 - a. PMCL compliance is determined by either a running annual average (RAA), or as a single instance limit as detailed in Attachment 1. MRDL compliance is determined by a RAA as detailed in Attachment 1.
 - b. The Permittee is in violation of limits on constituents regulated on a RAA basis when the RAA exceeds the numerical PMCL or MRDL. Once a PMCL or MRDL violation has occurred, HRSD may collect follow-up samples no more frequently than once per day. Each time a sample is measured, the single monthly or quarterly value and RAA must be recalculated. If the RAA is below the PMCL or MRDL, the facility is no longer in violation and may resume recharge.
 - i. For constituent groups with a minimum sampling frequency period of "Monthly", the RAA must consist of an average of twelve (12) equally weighted "single monthly values", with each single monthly value representing the average of all data points collected during the corresponding calendar month. If, during the first year of injection operations, the "single monthly value" at the end of any month is high enough that when averaged with the prior "single monthly value(s)," and the remaining yet unsampled "single monthly value(s)" (assumed to be zero) for that first year, it would be impossible to meet the PMCL, the PMCL has been exceeded.
 - ii. For constituent groups with a minimum sampling frequency period of "Quarterly", the RAA must consist of an average of four (4) equally weighted "single quarterly values", with each single quarterly value representing the average of all data points collected during the corresponding quarter. If, during the first year of injection operations, the "single quarterly value" at the end of any quarter is high enough that when averaged with the prior "single quarterly value(s)," and the remaining yet unsampled "single quarterly value(s)" (assumed to be zero) for that first year, it would be impossible to meet the PMCL, the PMCL has been exceeded.
 - iii. For constituent groups with a minimum sampling frequency period of "Daily", the RAA must consist of an average of three hundred sixty-five (365) equally weighted single daily grab sample values. If, during the first year of injection operations, the single daily grab sample value at the end of any one day is high enough that when averaged with the prior single daily grab sample value(s), and the remaining yet unsampled single daily grab sample value(s) (assumed to be zero) for that first year, it would be impossible to meet the MRDL, the MRDL has been exceeded.

- c. Compliance for constituent groups regulated on a single instance basis is to be determined based on individual sample results. If any single sample exceeds the numerical PMCL, the facility is in violation and must stop recharging. Once a PMCL exceedance has occurred, HRSD may collect follow-up samples no more frequently than once per day. Each time a follow-up sample is collected, the results of the initial sample that triggered the exceedance and all follow-up samples must be averaged. If this average is below the PMCL, the facility is no longer in violation and may resume recharge.
 - d. The RAA must be calculated as an average of single values that correspond to the minimum sampling frequency period defined in Attachment 1. When the average of multiple samples is calculated to evaluate compliance, any values less than the quantitation limit must be calculated as zero for the purposes of averaging.
- 4. If any JR SWIFT Recharge Water sampling results exceed Permit Limits, subject to paragraphs III.C.3.b and c, the Permittee must notify EPA orally within 24 hours [telephone number: (215) 814-2816] and within fourteen (14) days must submit to EPA in writing the potential cause for the exceedance and an appropriate plan for mitigation. The reporting requirements in this paragraph are required in addition to and not in lieu of the reporting requirements set forth in paragraph III.D.3.
- 5. The Permittee must monitor and record the water quality/chemistry of JR SWIFT Recharge Water at the recharge water pump station compliance point prior to injection for the parameters listed and at the frequency specified in Attachment 2.
- 6. The Permittee must monitor and record the water quality/chemistry of the treated wastewater at the Critical Control Points throughout the Advanced Wastewater Treatment Process.
- 7. The Permittee must monitor and record the water quality/chemistry of the USDWs as specified in Attachment 3 of this permit.
- 8. If the RAA of water quality/chemistry sampling result(s) exceed the threshold values set forth in Attachment 2, the Permittee must notify EPA in writing within 7 days of the exceedance. Within 30 days after notifying EPA, the Permittee must conduct an investigation on the cause of the exceedance and report to EPA in writing the findings of such investigation. If the investigation has not been completed by the time of such report, the Permittee must provide written progress reports on the investigation every 30 days thereafter until the investigation is completed. The RAA calculation of water quality/chemistry sampling result(s) for constituents set forth in Attachment 2 is subject to the following calculation(s), as applicable:
 - i. For constituent groups with a minimum sampling frequency

- period of "Quarterly", the RAA must consist of an average of four (4) equally weighted "single quarterly values", with each single quarterly value representing the average of all data points collected during the corresponding quarter. If, during the first year of injection operations, the "single quarterly value" at the end of any quarter is high enough that when averaged with the prior "single quarterly value(s)," and the remaining yet unsampled "single quarterly value(s)" (assumed to be zero) for that first year, it would be impossible to meet the threshold value, the threshold value has been exceeded.
- ii. For constituent groups with a minimum sampling frequency period of "Monthly", the RAA must consist of an average of twelve (12) equally weighted "single monthly values", with each single monthly value representing the average of all data points collected during the corresponding calendar month. If, during the first year of injection operations, the "single monthly value" at the end of any month is high enough that when averaged with the prior "single monthly value(s)," and the remaining yet unsampled "single monthly value(s)" (assumed to be zero) for that first year, it would be impossible to meet the threshold value, the threshold value has been exceeded.
 - iii. For constituent groups with a minimum sampling frequency period of "Weekly", the RAA must consist of an average of fifty-two (52) equally weighted "single weekly values", with each single weekly value representing the average of all data points collected during the corresponding week. If, during the first year of injection operations, the "single weekly value" at the end of any week is high enough that when averaged with the prior "single weekly value(s)," and the remaining yet unsampled "single weekly value(s)" (assumed to be zero) for that first year, it would be impossible to meet the threshold value, the threshold value has been exceeded.
9. If any water quality/chemistry sampling result(s) for Attachment 3, necessitate(s) a change in operations, the Permittee must notify EPA in writing on a quarterly basis, identifying the potential cause for the water quality sampling result(s) that prompted the change in operation and providing an appropriate plan for mitigation.
 10. The Permittee must compile the monitoring data for paragraphs III.C.2, 3, 5, 7 requirements monthly, submit the information to EPA quarterly, and use the monitoring data to complete the Annual Report referenced in paragraph III.D.8 of this Permit. This quarterly report must include any changes to CCPs, including location, monitoring parameters, and threshold values. For parameters subject to continuous monitoring, the monthly averages and the monthly maximum values should be reported quarterly.

11. The Permittee must perform all environmental measurements required by the Permit, including, but not limited to chemical analyses in accordance with EPA guidance on quality assurance.

D. Reporting and Notification Requirements

1. Report on Permit Review. Within thirty (30) days of the effective date of this Permit, the Permittee must ensure the person designated pursuant to paragraph I.D.11 of this Permit reports to the Director in writing that he or she has read and is personally familiar with all terms and conditions of this Permit.
2. Authorized Injection. The Permittee is not authorized to inject into the JR SWIFT Injection Wells until construction is complete and the following conditions have been satisfied:
 - a. The Permittee has submitted notice of completion of construction (EPA Form 7520-18) to the Director; and
 - b. The Director has inspected or otherwise reviewed the JR SWIFT Injection Wells and finds they are in compliance with the conditions of this Permit; or the Permittee has not received notice from the Director of his or her intent to inspect or otherwise review the JR SWIFT Injection Wells within 13 days of the date of the notice in paragraph III.D.2.a of this Permit, in which case, prior inspection or review is waived and the Permittee may commence injection.
3. Twenty-four Hour Reporting.
 - a. The Permittee must report to the Director any noncompliance, event or action which may endanger, or has endangered, health or the environment, including, without limitation, wastewater treatment disruptions, spills, possible contamination of a USDW, or other activity deemed extraordinary to normal operating conditions. The Permittee must provide such report orally to phone number (215) 814-2816 within 24 hours from the time the Permittee becomes aware of the circumstances. The Permittee must include the following information in the oral report:
 - (1) Any monitoring or other information which indicates that any contaminant may cause an endangerment, or has endangered, an underground source of drinking water.
 - (2) Any noncompliance with a permit condition, malfunction of the injection system which may cause or contribute, or has caused or contributed, to fluid migration into or between underground sources of drinking water, or any other failure.

- b. In addition to the oral report required in III.D.3.a herein, the Permittee must provide a written submission to EPA at the address in paragraph III.A. of this Permit herein within five (5) days of the time the Permittee becomes aware of the circumstances described above in paragraph III.D.3.a. The written submission must contain a description of the noncompliance and its cause; the period of noncompliance, including exact dates and times, and – if the noncompliance has not been corrected – the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent recurrence of the noncompliance.
- 4. Anticipated Noncompliance. The Permittee must give a thirty (30) day advance notice to the Director of any planned changes in the permitted Facility or activity which may result in noncompliance with permit requirements.
- 5. Other Noncompliance. The Permittee must report all other instances of noncompliance for which noncompliance was not anticipated to the Director in writing within five (5) days of the time the Permittee becomes aware of the circumstances. The report must contain the information listed in paragraph III.D.3 of this Permit.
- 6. Planned Changes. The Permittee must provide immediate written notice to the Director regarding any planned physical alterations or additions to the permitted Facility. The Permittee may not implement such planned physical alterations or additions to the permitted Facility unless and until it obtains written approval from EPA. The Permittee must provide written notice to the Director of any changes to the Critical Control Points.
- 7. Conversion. The Permittee must submit to EPA for review and approval thirty (30) days prior to the conversion of JR SWIFT Injection Wells to an operating status other than an injection well. Permittee must not commence conversion of the well for any purpose until it receives written approval from EPA.
- 8. Annual Report. The Permittee must submit a written Annual Report (EPA Form 7520-11) to the Director summarizing the results of all monitoring required in this Permit. This report must include monthly monitoring records for Attachments 1, 2, and 3, including any major modifications to the water treatment process, changes to CCPs, and any major changes in characteristics or sources of injected fluids. The Permittee must submit the Annual Report to the Director no later than January 31st of each year, summarizing the activity of the calendar year ending the previous December 31st.
- 9. Plugging and Abandonment Reports and Notifications.
 - a. The Permittee must notify the Director in writing and in accordance with paragraph III.A at least forty-five (45) days before plugging and abandonment of any JR SWIFT Injection Well as described in paragraph II.C of this Permit. The Director may allow a shorter notice

period upon written request.

- b. Prior to abandoning any JR SWIFT Injection Well, the Permittee must prepare, maintain, and comply with a plan for plugging and abandonment (hereinafter, "Plugging and Abandonment Plan") that: (i) meets the requirements of 40 C.F.R. §§ 144.51(o) and 146.10; (ii) is submitted to and approved by the Director; and (iii) contains the following information: (A) The composition and quantity and material to be used in plugging; (B) The location and extent (by depth) of the plugs; (C) Any proposed test or measurement to be made; (D) The amount, size, and location (by depth) of casing to be left in the well; (E) The method and location where casing is to be parted; (F) The estimated cost of plugging the well; and (G) Any other relevant information needed to review and ensure that the Plugging and Abandonment Plan meets all SDWA permit requirements. The EPA approved Plugging and Abandonment Plan is included as Attachment 4 hereto, and is incorporated herein.
- c. The Permittee must submit any revisions to the EPA approved Plugging and Abandonment Plan to the Director on EPA Form 7520-19 (EPA Plugging and Abandonment Form) no less than forty-five (45) days prior to commencing plugging and abandonment. The Permittee must not commence plugging and abandonment until it receives written approval of the revisions to the Plan from the Director.
- d. To the extent that any unforeseen circumstances occur during plugging and abandonment of an Injection Well that cause the Permittee to believe the Plugging and Abandonment Plan should be modified, the Permittee must obtain written approval from EPA of any changes to the Plugging and Abandonment Plan prior to plugging an Injection Well.
- e. Within sixty (60) days after plugging any JR SWIFT Injection Well, the Permittee must submit a Plugging and Abandonment Report to the Director which must consist of either:
 - (i) A statement that the JR SWIFT Injection Well was plugged in accordance with the EPA approved Plugging and Abandonment Plan; or
 - (ii) Where actual plugging differed from the Plugging and Abandonment Plan previously submitted, the Permittee must provide to the Director an updated version of EPA Form 7520-19 specifying the different procedures used.
- f. The Permittee must ensure that the Plugging and Abandonment Report is accurate and certified as complete by the person who performed the plugging operation.

10. Compliance Schedules. The Permittee must submit reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of this Permit no later than 30 days following each schedule date.
11. Cessation of Injection Activity. Two years after the Permittee has ceased injection into any JR SWIFT Injection Well, the Permittee must plug and abandon the Injection Well in accordance with the EPA approved Plugging and Abandonment Plan unless the Permittee:
 - a. Provides written notice to the Director describing actions and/or procedures necessary to ensure that the Injection Well will not endanger any USDW during the period of temporary abandonment. These actions and procedures must include compliance with the requirements of this Permit applicable to active injection wells unless waived, in writing, by the Director;
 - b. Receives approval from the Director that the actions and/or procedures described in the notice are satisfactory; and
 - c. Implements such EPA approved actions and/or procedures.

Attachment 1

JR SWIFT Recharge Water Limitations and Monitoring Requirements

<u>Parameter</u>	<u>JR SWIFT Recharge Water Monitoring Frequency</u>	<u>Compliance Determination</u>
EPA Drinking Water Primary Maximum Contaminant Level (PMCLs)	See Appendix A	Meet all PMCLs
<i>Cryptosporidium</i> , <i>Giardia lamblia</i> , <i>Legionella</i> , Male specific and somatic coliphage	Quarterly	Monitoring Only
Chloramines, Chlorine	Continuous – confirmed daily with grab sample	Meet MRDLs ¹ of 4 mg/L. Compliance with the MRDL is determined by a Running Annual Average (RAA) of the daily grab samples. If the average is greater than the MRDL, the MRDL has been exceeded.
Total Nitrogen (TN)	5x/week	5mg/L Monthly Average; 8 mg/L Max Daily
Turbidity Individual Filter Effluent (IFE)	Record the results of individual filter monitoring every 15 minutes. If there is a failure in the continuous turbidity monitoring equipment, the system must conduct grab sampling every four hours in lieu of continuous monitoring, but for no more than five working days following the failure of the equipment.	< 0.15 NTU 95% of the time within one calendar month and never > 0.3 NTU in two consecutive 15-minute measurements
Turbidity Combined Filter Effluent (CFE)	Record the results of combined filter monitoring every 15 minutes	≤ 0.15 NTU 95% of the time within one calendar month in 15-minute measurements
Total Organic Carbon (TOC)	3x/week	4 mg/L Monthly Average, 5 mg/L Maximum Instantaneous Total
Total Coliform ²	5x/week	< 2 CFU/100 mL 95% of collected samples within one calendar month, applied as the 95 th percentile ²
E. Coli	5x/week	Non-Detect

Total Dissolved Solids (TDS)	Monthly	No Limit; Monitoring Only
Antimony, arsenic, barium, beryllium, cadmium, free cyanide, total chromium, fluoride, mercury, selenium, thallium	Monthly	Compliance with the PMCL is determined by a Running Annual Average (RAA). If the average is greater than the PMCL, the PMCL has been exceeded
Asbestos	Quarterly	Compliance with the PMCL is determined by a Running Annual Average (RAA). If the average is greater than the PMCL, the PMCL has been exceeded
Nitrate, Nitrite	5x/week	Compliance for these constituent groups is to be determined based on individual sample results. If any single sample is greater than the PMCL, the PMCL has been exceeded.
Lead, Copper	Monthly	Monitoring Only
Organic chemicals (See Appendix A)	Monthly	Compliance with the PMCL is determined by a Running Annual Average (RAA). If the average is greater than the PMCL, the PMCL has been exceeded
Acrylamide, Epichlorohydrin	Monthly	<p>HRSD must certify, in writing, to EPA (using third-party or manufacturer's certification) that when acrylamide and epichlorohydrin are used to treat water, the combination (or product) of dose and monomer level does not exceed the levels specified, as follows:</p> <p>Acrylamide = 0.05% dosed at 1 mg/L (or equivalent) Epichlorohydrin = 0.01% dosed at 20 mg/L (or equivalent)</p>
Disinfection byproducts TTHM, HAA5, Bromate, Chlorite	Monthly	Compliance with the PMCL is determined by a Running Annual Average (RAA). If the average is greater than the PMCL, the PMCL has been exceeded

Radionuclides (See Appendix A)	Monthly	Compliance for these constituent groups is to be determined based on individual sample results. If any single sample is greater than the PMCL, the PMCL has been exceeded.
PFOA, PFOS, PFBA, PFHpA, PFHxS, PFNA, Gen-X, PFBS. ^{3,4}	Quarterly	Monitoring Only

1 Maximum Residual Disinfectant Level (MRDL) - The highest level of a disinfectant allowed in drinking water. There is convincing evidence that addition of a disinfectant is necessary for control of microbial contaminants.

2 If TC is not less than 2 CFU/100 mL in 95% of the collected samples (calculated by the 95th percentile) in one calendar month, HRSD must conduct an additional investigation (e.g., evaluating sample collection and training protocols, possible sample line contamination, etc.). A TC exceedance is not considered a PMCL exceedance unless E. coli is present. The results of the investigation must be included in the next quarterly report.

3 Perfluorooctanoic acid (PFOA), perfluorooctane sulfonic acid (PFOS), hexafluoropropylene oxide (HFPO) dimer acid and its ammonium salt (Gen-X chemicals), perfluorobutane sulfonic acid and its potassium salt (PFBS), perfluorobutanoic acid (PFBA), perfluoroheptanoic acid (PFHpA), perfluorohexanesulfonic acid (PFHxS) and perfluorononanoic acid (PFNA).

4 If the Running Annual Average concentration of PFOA or PFOS exceeds the 4 ng/L threshold in two consecutive quarters, HRSD must make operational adjustments to the granular activated carbon contactors to increase removal efficiency and achieve the < 4 ng/L threshold. If the operational adjustments cannot be made within one day of notification that PFOA or PFOS is > 4 ng/L, HRSD will cease recharge until the adjustment is complete. HRSD will resample within one week following the completion of the adjustment to verify that the PFOA and PFOS are both < 4 ng/L.

Appendix A

EPA Drinking Water Primary Maximum Contaminant Level (PMCLs)

Disinfection Byproducts		
Contaminant	JR SWIFT Recharge Water Monitoring Frequency	PMCL (mg/L)*
Bromate	Monthly	0.010
Chlorite	Monthly	1.0
Haloacetic acids (HAA5)	Monthly	0.060
Total Trihalomethanes (TTHMs)	Monthly	0.080

Inorganic Chemicals		
Contaminant	JR SWIFT Recharge Water Monitoring Frequency	PMCL (mg/L)*
Antimony	Monthly	0.006
Arsenic	Monthly	0.010 as of 01/23/06
Asbestos (fiber > 10 micrometers)	Quarterly	7 MFL**
Barium	Monthly	2
Beryllium	Monthly	0.004
Cadmium	Monthly	0.005 -
Chromium (total)	Monthly	0.1
Cyanide (as free cyanide)	Monthly	0.2
Fluoride	Monthly	4.0
Mercury (inorganic)	Monthly	0.002
Nitrate (measured as Nitrogen)	5x/week	10
Nitrite (measured as Nitrogen)	5x/week	1
Selenium	Monthly	0.05
Thallium	Monthly	0.002

Organic Chemicals		
Contaminant	JR SWIFT Recharge Water Monitoring Frequency	PMCL (mg/L)*
Alachlor	Monthly	0.002
Atrazine	Monthly	0.003
Benzene	Monthly	0.005
Benzo(a)pyrene (PAHs)	Monthly	0.0002
Carbofuran	Monthly	0.04
Carbon tetrachloride	Monthly	0.005
Chlordane	Monthly	0.002
Chlorobenzene	Monthly	0.1

Organic Chemicals		
Contaminant	JR SWIFT Recharge Water Monitoring Frequency	PMCL (mg/L)*
2,4-D	Monthly	0.07
Dalapon	Monthly	0.2
1,2-Dibromo-3-chloropropane (DBCP)	Monthly	0.0002
o-Dichlorobenzene	Monthly	0.6
p-Dichlorobenzene	Monthly	0.075
1,2-Dichloroethane	Monthly	0.005
1,1-Dichloroethylene	Monthly	0.007
cis-1,2-Dichloroethylene	Monthly	0.07
trans-1,2-Dichloroethylene	Monthly	0.1
Dichloromethane	Monthly	0.005
1,2-Dichloropropane	Monthly	0.005
Di(2-ethylhexyl) adipate	Monthly	0.4
Di(2-ethylhexyl) phthalate	Monthly	0.006
Dinoseb	Monthly	0.007
Dioxin (2,3,7,8-TCDD)	Monthly	0.00000003
Diquat	Monthly	0.02

Organic Chemicals		
Contaminant	JR SWIFT Recharge Water Monitoring Frequency	PMCL (mg/L)*
Endothall	Monthly	0.1
Endrin	Monthly	0.002
Ethylbenzene	Monthly	0.7
Ethylene dibromide	Monthly	0.00005
Glyphosate	Monthly	0.7
Heptachlor	Monthly	0.0004
Heptachlor epoxide	Monthly	0.0002
Hexachlorobenzene	Monthly	0.001
Hexachlorocyclopentadiene	Monthly	0.05
Lindane	Monthly	0.0002
Methoxychlor	Monthly	0.04
Oxamyl (Vydate)	Monthly	0.2
Polychlorinated biphenyls (PCBs)	Monthly	0.0005
Pentachlorophenol	Monthly	0.001
Picloram	Monthly	0.5

Organic Chemicals		
Contaminant	JR SWIFT Recharge Water Monitoring Frequency	PMCL (mg/L)*
Simazine	Monthly	0.004
Styrene	Monthly	0.1
Tetrachloroethylene	Monthly	0.005
Toluene	Monthly	1
Toxaphene	Monthly	0.003
2,4,5-TP (Silvex)	Monthly	0.05
1,2,4-Trichlorobenzene	Monthly	0.07
1,1,1-Trichloroethane	Monthly	0.2
1,1,2-Trichloroethane	Monthly	0.005
Trichloroethylene	Monthly	0.005
Vinyl chloride	Monthly	0.002
Xylenes (total)	Monthly	10

Radionuclides		
Contaminant	JR SWIFT Recharge Water Monitoring Frequency	PMCL (mg/L)*
Alpha particles	Monthly	15 picocuries per Liter (pCi/L)
Beta particles and photon emitters	Monthly	4 millirems per year
Radium 226 and Radium 228 (combined)	Monthly	5 pCi/L
Uranium	Monthly	30 ug/L as of 12/08/03

* Units are in milligrams per liter (mg/L) unless otherwise noted. Milligrams per liter are equivalent to parts per million (PPM).

** Million Fibers per Liter (MFL)

Attachment 2

Attachment 2.1: Non-Regulatory Parameters

Constituent	Threshold Value	SWIFT Water Monitoring Frequency
1,4-Dioxane	1 µg/L	Quarterly
17-β-Estradiol	0.9 ng/L ¹	Quarterly
N,N-diethyl-meta-toluamide (DEET)	200 µg/L	Quarterly
Ethinyl Estradiol	280 ng/L ¹	Quarterly
N-Nitroso-dimethylamine (NDMA)	10 ng/L	Weekly
Perchlorate	6 µg/L	Quarterly
Tris(2-carboxyethyl)phosphine (TCEP)	5 µg/L	Quarterly
Cotinine	1 µg/L	Quarterly
Primidone	10 µg/L	Quarterly
Phenytoin	2 µg/L	Quarterly
Meprobamate	200 µg/L	Quarterly
Atenolol	4 µg/L	Quarterly
Carbamazepine	10 µg/L	Quarterly
Estrone	320 ng/L	Quarterly
Sucralose	150 mg/L	Quarterly

Triclosan	2,100 µg/L	Quarterly
Dissolved Oxygen	None	Monthly
pH	None	Continuous
Specific Conductivity	None	Monthly
Oxidation-reduction potential (ORP)	None	Monthly
Total Sodium	None	Monthly
Total Aluminum	None	Monthly
Total Iron	None	Continuous
Total Manganese	None	Monthly
Alkalinity	None	Monthly
Silica	None	Monthly
Total Hardness	None	Monthly
Total Magnesium	None	Monthly
Total Potassium	None	Monthly

Attachment 2.2 Relevant Virginia Groundwater Protection Standards (9VAC25-280-40)

Constituent	Threshold Value	SWIFT Water Monitoring Frequency
Aldrin/Dieldrin	0.003 µg/l	Monthly
DDT	0.001 µg/l	Monthly
Kepone	None	Monthly
Mirex	None	Monthly
Phenols	0.001 mg/l	Monthly
Strontium-90	8 pCi/l	Monthly
Tritium	20,000 pCi/l	Monthly

Attachment 3

Monitoring Wells 1 through 8 Frequency and Analyte

Baseline (B)*, Quarterly (Q) and Annually (A) monitored analytes are identified in the table below.

*Baseline Groundwater Chemistry Must Be Established Prior to JR SWIFT Recharge Water Influence.

Parameter	Monitoring Cluster 1 and 2. Upper Zone A	Monitoring Cluster 1 and 2. Upper Zone B	Monitoring Cluster 1 and 2. Upper Zone C	Monitoring Cluster 1 and 2. Middle Zone A
Regulatory Parameters				
Total Nitrogen	B, Q	B, Q	B, Q	B, Q
Turbidity	B, Q	B, A	B, A	B, A
TOC	B, Q	B, Q	B, Q	B, Q
TDS	B, Q	B, Q	B, Q	B, Q
Microorganisms				
Male-specific and somatic coliphages	B, Q	B, A	B, A	B, A
Cryptosporidium	B, Q	B, A	B, A	B, A
Giardia lamblia	B, Q	B, A	B, A	B, A
Legionella	B, Q	B, A	B, A	B, A
Total Coliform	B, Q	B, A	B, A	B, A
E. coli	B, Q	B, A	B, A	B, A
Disinfection Byproducts				
Bromate	B, Q	B, A	B, A	B, A
Chlorite	B, Q	B, A	B, A	B, A
Haloacetic acids (HAA5)	B, Q	B, Q	B, Q	B, Q
Total trihalomethanes	B, Q	B, Q	B, Q	B, Q
Inorganic Chemicals				

Parameter	Monitoring Cluster 1 and 2. Upper Zone A	Monitoring Cluster 1 and 2. Upper Zone B	Monitoring Cluster 1 and 2. Upper Zone C	Monitoring Cluster 1 and 2. Middle Zone A
Antimony, Total	B, Q	B, A	B, A	B, A
Arsenic, Total	B, Q	B, Q	B, Q	B, Q
Asbestos	B, Q	B, A	B, A	B, A
Barium, Total	B, Q	B, A	B, A	B, A
Beryllium, Total	B, Q	B, A	B, A	B, A
Cadmium, Total	B, Q	B, A	B, A	B, A
Chromium VI	B, Q	B, A	B, A	B, A
Chromium, Total	B, Q	B, A	B, A	B, A
Copper, Total	B, Q	B, A	B, A	B, A
Cyanide, Total	B, Q	B, A	B, A	B, A
Fluoride	B, Q	B, Q	B, Q	B, Q
Lead, Total	B, Q	B, A	B, A	B, A
Mercury, Total	B, Q	B, A	B, A	B, A
Nitrate -N	B, Q	B, Q	B, Q	B, Q
Nitrite-N	B, Q	B, Q	B, Q	B, Q
Selenium, Total	B, Q	B, A	B, A	B, A
Thallium, Total	B, Q	B, A	B, A	B, A
Organic Chemicals				
Acrylamide	B, Q	B, A	B, A	B, A
Alachlor	B, Q	B, A	B, A	B, A
Atrazine	B, Q	B, A	B, A	B, A
Benzene	B, Q	B, A	B, A	B, A
Benzo(a)pyrene (PAHs)	B, Q	B, A	B, A	B, A
Carbofuran	B, Q	B, A	B, A	B, A
Carbon Tetrachloride	B, Q	B, A	B, A	B, A
Chlordane	B, Q	B, A	B, A	B, A

Chlorobenzene	B, Q	B, A	B, A	B, A
2,4-D	B, Q	B, A	B, A	B, A
Dalapon	B, Q	B, A	B, A	B, A
1,2-dibromo-3-chloropropane (DBCP)	B, Q	B, A	B, A	B, A
1,2-Dichlorobenzene (o- dichlorobenzene)	B, Q	B, A	B, A	B, A
1,4-Dichlorobenzene (p- dichlorobenzene)	B, Q	B, A	B, A	B, A
1,2-Dichloroethane	B, Q	B, A	B, A	B, A

Parameter	Monitoring Cluster 1 and 2. Upper Zone A	Monitoring Cluster 1 and 2. Upper Zone B	Monitoring Cluster 1 and 2. Upper Zone C	Monitoring Cluster 1 and 2. Middle Zone A
1,1-Dichloroethylene	B, Q	B, A	B, A	B, A
cis-1,2-Dichloroethylene	B, Q	B, A	B, A	B, A
trans-1,2-Dichloroethylene	B, Q	B, A	B, A	B, A
Dichloromethane (Methylene chloride)	B, Q	B, A	B, A	B, A
1,2-Dichloropropane	B, Q	B, A	B, A	B, A
Di(2-ethylhexyl) adipate	B, Q	B, A	B, A	B, A
Di(2-ethylhexyl) phthalate	B, Q	B, A	B, A	B, A
Dinoseb	B, Q	B, A	B, A	B, A
Dioxin (2,3,7,8-TCDD)	B, Q	B, A	B, A	B, A
Diquat	B, Q	B, A	B, A	B, A
Endothall	B, Q	B, A	B, A	B, A
Endrin	B, Q	B, A	B, A	B, A
Epichlorohydrin	B, Q	B, A	B, A	B, A
Ethylbenzene	B, Q	B, A	B, A	B, A
Ethylene dibromide (EDB)	B, Q	B, A	B, A	B, A
Glyphosate	B, Q	B, A	B, A	B, A
Heptachlor	B, Q	B, A	B, A	B, A
Heptachlor Epoxide	B, Q	B, A	B, A	B, A
Hexachlorobenzene	B, Q	B, A	B, A	B, A
Hexachlorocyclopentadiene	B, Q	B, A	B, A	B, A
Lindane (Gamma-BHC)	B, Q	B, A	B, A	B, A
Methoxychlor	B, Q	B, A	B, A	B, A
Oxamyl (Vydate)	B, Q	B, A	B, A	B, A
Polychlorinated biphenyls	B, Q	B, A	B, A	B, A
Arochlor (AR)1016	B, Q	B, A	B, A	B, A
AR1221	B, Q	B, A	B, A	B, A

AR1232	B, Q	B, A	B, A	B, A
AR1242	B, Q	B, A	B, A	B, A
AR1248	B, Q	B, A	B, A	B, A
AR1254	B, Q	B, A	B, A	B, A
AR1260	B, Q	B, A	B, A	B, A
Pentachlorophenol	B, Q	B, A	B, A	B, A
Picloram	B, Q	B, A	B, A	B, A

Parameter	Monitoring Cluster 1 and 2. Upper Zone A	Monitoring Cluster 1 and 2. Upper Zone B	Monitoring Cluster 1 and 2. Upper Zone C	Monitoring Cluster 1 and 2. Middle Zone A
Simazine	B, Q	B, A	B, A	B, A
Styrene	B, Q	B, A	B, A	B, A
Tetrachloroethylene	B, Q	B, A	B, A	B, A
Toluene	B, Q	B, A	B, A	B, A
Toxaphene	B, Q	B, A	B, A	B, A
2,4,5-TP (Silvex)	B, Q	B, A	B, A	B, A
1,2,4-Trichlorobenzene	B, Q	B, A	B, A	B, A
1,1,1-Trichloroethane	B, Q	B, A	B, A	B, A
1,1,2-Trichloroethane	B, Q	B, A	B, A	B, A
Trichloroethylene	B, Q	B, A	B, A	B, A
Vinyl Chloride	B, Q	B, A	B, A	B, A
Xylene, Total	B, Q	B, A	B, A	B, A
Radionuclides				
Alpha particles	B, Q	B, A	B, A	B, A
Beta particles and photon emitters	B, Q	B, A	B, A	B, A
Radium 226	B, Q	B, A	B, A	B, A
Radium 228	B, Q	B, A	B, A	B, A
Uranium	B, Q	B, A	B, A	B, A
Regulatory Parameters: Virginia Groundwater Standards				
Aldrin/Dieldrin	B, Q	B, A	B, A	B, A
DDT	B, Q	B, A	B, A	B, A
Kepone	B, Q	B, A	B, A	B, A
Mirex	B, Q	B, A	B, A	B, A
Phenols	B, Q	B, A	B, A	B, A
Strontium-90	B, Q	B, A	B, A	B, A
Tritium	B, Q	B, A	B, A	B, A

Non-regulatory Performance Indicators				
1,4-dioxane	B, Q	B, Q	B, Q	B, Q
17- β -estradiol	B, Q	B, Q	B, Q	B, Q
DEET	B, Q	B, Q	B, Q	B, Q
Ethinyl estradiol	B, Q	B, Q	B, Q	B, Q
NDMA	B, Q	B, Q	B, Q	B, Q

Parameter	Monitoring Cluster 1 and 2. Upper Zone A	Monitoring Cluster 1 and 2. Upper Zone B	Monitoring Cluster 1 and 2. Upper Zone C	Monitoring Cluster 1 and 2. Middle Zone A
Perchlorate	B, Q	B, Q	B, Q	B, Q
PFOA + PFOS	B, Q	B, Q	B, Q	B, Q
PFBA	B, Q	B, Q	B, Q	B, Q
PFHpA	B, Q	B, Q	B, Q	B, Q
PFHxS	B, Q	B, Q	B, Q	B, Q
PFNA	B, Q	B, Q	B, Q	B, Q
Gen-X	B, Q	B, Q	B, Q	B, Q
PFBS	B, Q	B, Q	B, Q	B, Q
tris(2-carboxyethyl)phosphine (TCEP)	B, Q	B, Q	B, Q	B, Q
Cotinine	B, Q	B, Q	B, Q	B, Q
Primidone	B, Q	B, Q	B, Q	B, Q
Phenytoin	B, Q	B, Q	B, Q	B, Q
Meprobamate	B, Q	B, Q	B, Q	B, Q
Atenolol	B, Q	B, Q	B, Q	B, Q
Carbamazepine	B, Q	B, Q	B, Q	B, Q
Estrone	B, Q	B, Q	B, Q	B, Q
Sucralose	B, Q	B, Q	B, Q	B, Q
Triclosan	B, Q	B, Q	B, Q	B, Q
Non-regulatory Parameters: Aquifer Characteristics and/or Compatibility**				
Dissolved Oxygen	B, Q	B, A	B, A	B, A
Temperature	B, Q	B, A	B, A	B, A
pH	B, Q	B, A	B, A	B, A
Specific conductivity	B, Q	B, A	B, A	B, A
ORP	B, Q	B, A	B, A	B, A
Aluminum, dissolved	B, A	B, A	B, A	B, A
Aluminum, total	B, A	B, A	B, A	B, A
Arsenic, dissolved	B, A	B, A	B, A	B, A

Iron, dissolved	B, A	B, A	B, A	B, A
Iron, Total	B, Q	B, Q	B, Q	B, Q
Manganese, dissolved	B, A	B, A	B, A	B, A
Manganese, total	B, Q	B, Q	B, Q	B, Q
Magnesium, total	B, A	B, A	B, A	B, A
Potassium, total	B, A	B, A	B, A	B, A
Sodium, total	B, A	B, A	B, A	B, A

** Dissolved metals analysis will be completed as needed based on the observed relationship between the dissolved and total metal fractions.

Parameter	Monitoring Cluster 1 and 2. Upper Zone A	Monitoring Cluster 1 and 2. Upper Zone B	Monitoring Cluster 1 and 2. Upper Zone C	Monitoring Cluster 1 and 2. Middle Zone A
Calcium, total	B, A	B, A	B, A	B, A
Sulfate	B, A	B, A	B, A	B, A
Chloride	B, A	B, A	B, A	B, A
Bromide	B, A	B, A	B, A	B, A
Alkalinity	B, A	B, A	B, A	B, A
Total Kjeldahl Nitrogen	B, Q	B, Q	B, Q	B, Q
Ammonia as N	B, Q	B, Q	B, Q	B, Q
Total Phosphorus	B, A	B, A	B, A	B, A
Orthophosphate as P	B, A	B, A	B, A	B, A
Silica as SiO ₂	B, A	B, A	B, A	B, A
Hardness, Total	B, A	B, A	B, A	B, A

PLUGGING AND ABANDONMENT PLAN

[illegible]

Plugging and Abandonment Procedures

Type of cement and method of abandonment is described below for both a typical SWIFT MAR well and typical monitoring well.

MAR Wells (Figure E.1)

Item #1 Includes all work associated with mobilization, demobilization of the drilling rig and supporting equipment for the work.

Item #2 Remove pump and column from 250 to 350 feet below grade (fbg).

Item #3 Conduct a caliper log of the 18-inch, 20-inch and 30-inch diameter casings and screen from the base of the sump (1,175 fbg) to land surface.

Item #4 Place ASTM C150 Type I/II neat cement grout, via tremie pipe:

- 18-inch diameter from the base of the stainless-steel sump (1,175') to 370 fbg = 805 LF.
 - 805 LF = 1,425 ft³ of cement grout
- 20-inch diameter stainless steel casing from 310' to 370' fbg = 60 LF
 - 60 LF = 135 ft³ of cement grout
- 30-inch diameter stainless steel casing from ground surface to 310' fbg = 310 LF
 - 310 LF = 1,525 ft³ of cement grout
- Total estimated volume of cement grout = 3,085 ft³.

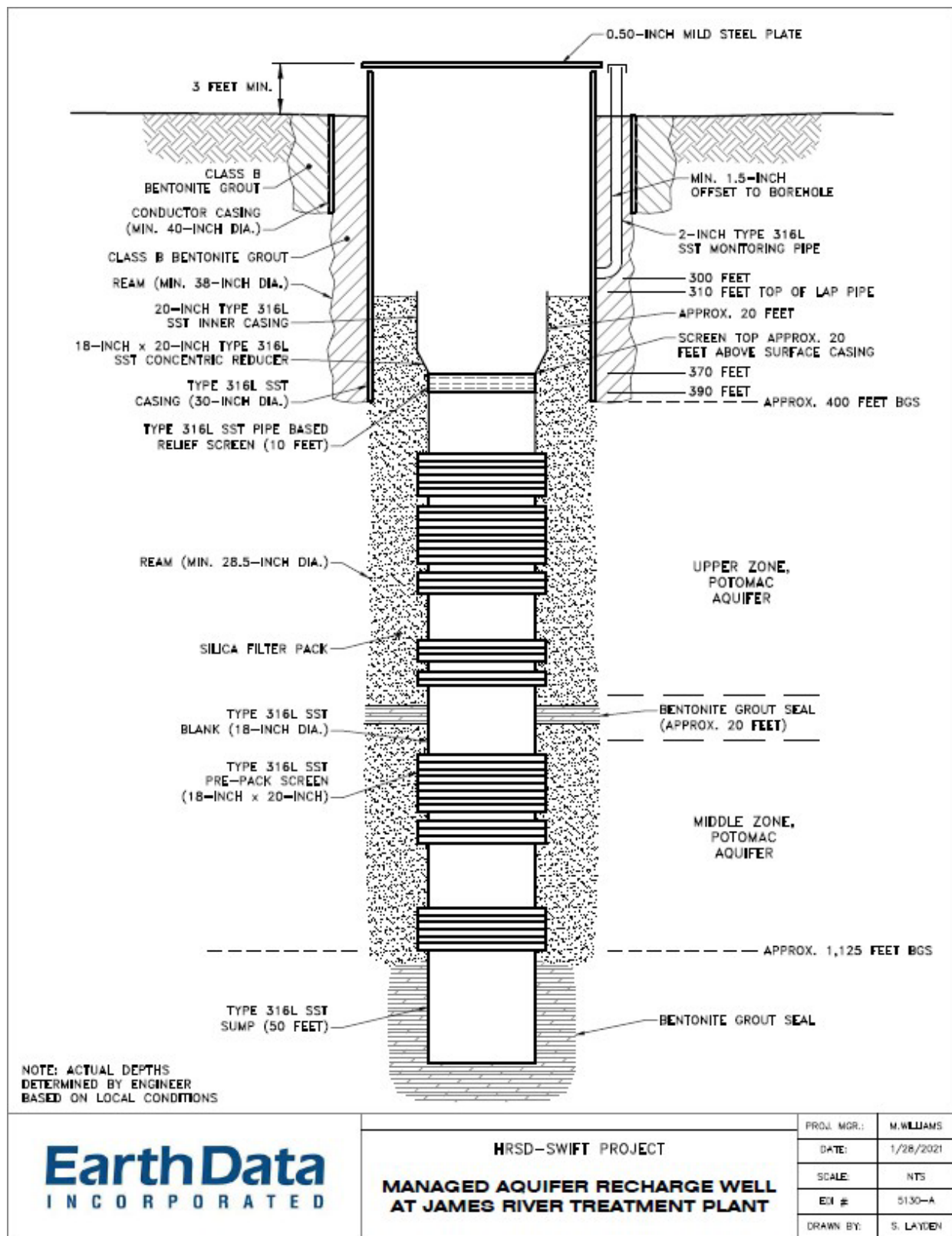


Figure E.1: Proposed Managed Aquifer Recharge Well at JR SWIFT. Elevations and materials of construction may change according to site specific conditions.

Monitoring Wells (Figures E.2, E.3, E.4)

- Six, upper zone of Potomac Aquifer System (UPA) = two at 450', two at 640' and two at 795' to base of sump
- Two, middle zone of Potomac Aquifer System (MPA) = 1,125 to base of sump

Item #1 Includes all work associated with mobilization, demobilization of the drilling rig and supporting equipment for the work.

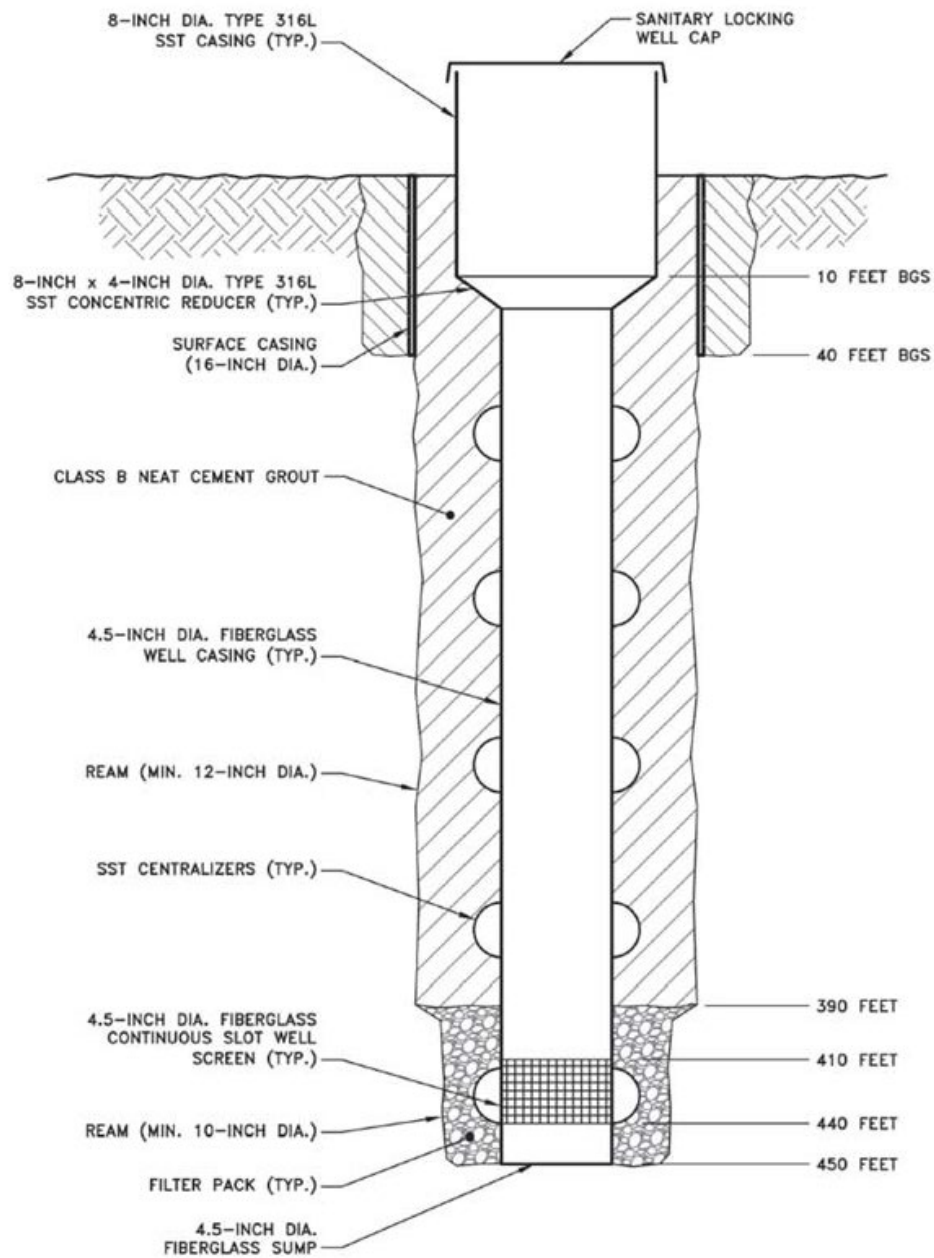
Item #2 Remove pump and column from 250 to 350 feet below grade (fbg).

Item #3 Conduct a caliper log of the 4.5-inch diameter inner casing and well screen.

- MPA well x 1,125 fbg.
- UPA well x 450, 640 and 795 fbg.

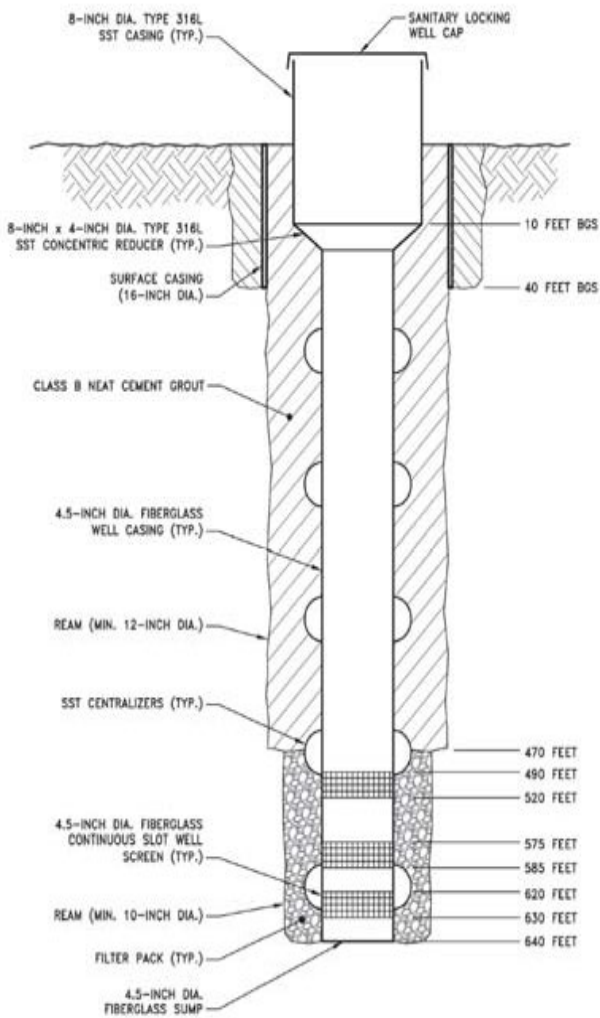
Item #4 Place ASTM C150 Type I/II neat cement grout via tremie:

- MPA wells: 4.5" casing from base of sump (1,125 fbg) to ground surface = 1,125 LF
- 1,125 LF = 200 ft^3 of cement grout per well x 2 wells = 400 ft^3 of cement grout
- UPA wells: 4.5" casing from base of sump (450, 640 and 795 fbg) to ground surface = 1,885 LF
- 1,885 LF = 833 ft^3 of cement grout per cluster x 2 clusters = $1,666 \text{ ft}^3$ of cement grout

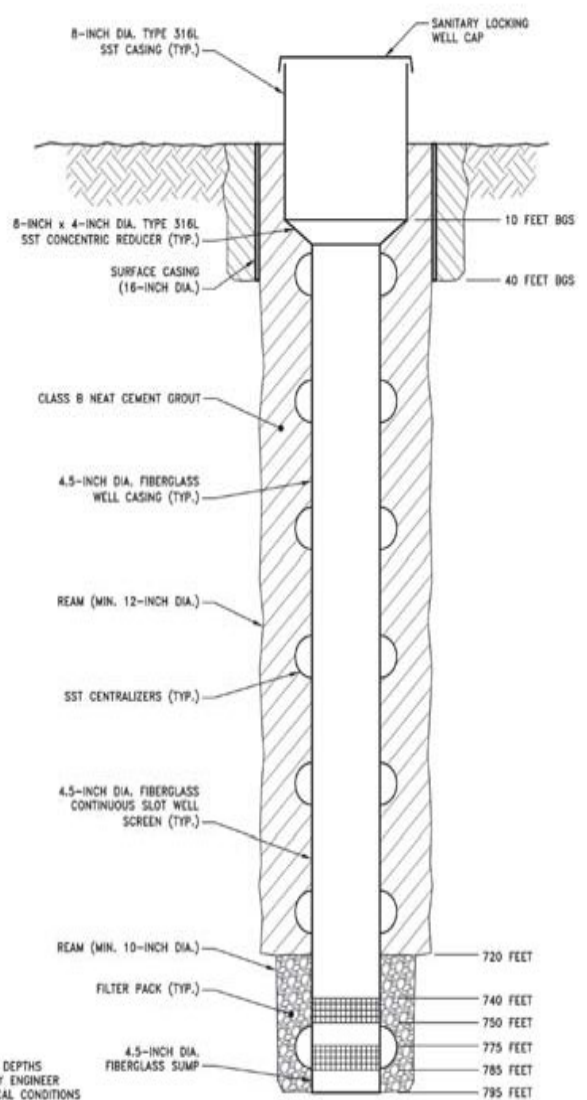


NOTE: ACTUAL DEPTHS
DETERMINED BY ENGINEER
BASED ON LOCAL CONDITIONS

Figure E.2: Typical Shallowest Well Construction Diagram for James River SWIFT monitoring well clusters (JR_MC1 and JR_MC2). Elevations and materials of construction change according to site specific conditions.



NOTE: ACTUAL DEPTHS
DETERMINED BY ENGINEER
BASED ON LOCAL CONDITIONS



NOTE: ACTUAL DEPTHS
DETERMINED BY ENGINEER
BASED ON LOCAL CONDITIONS

Figure E.3: Typical deeper Upper Zone Nest Well Construction Diagram for James River SWIFT monitoring well clusters (JR_MC1 and JR_MC2). Elevations may change according to site specific conditions.

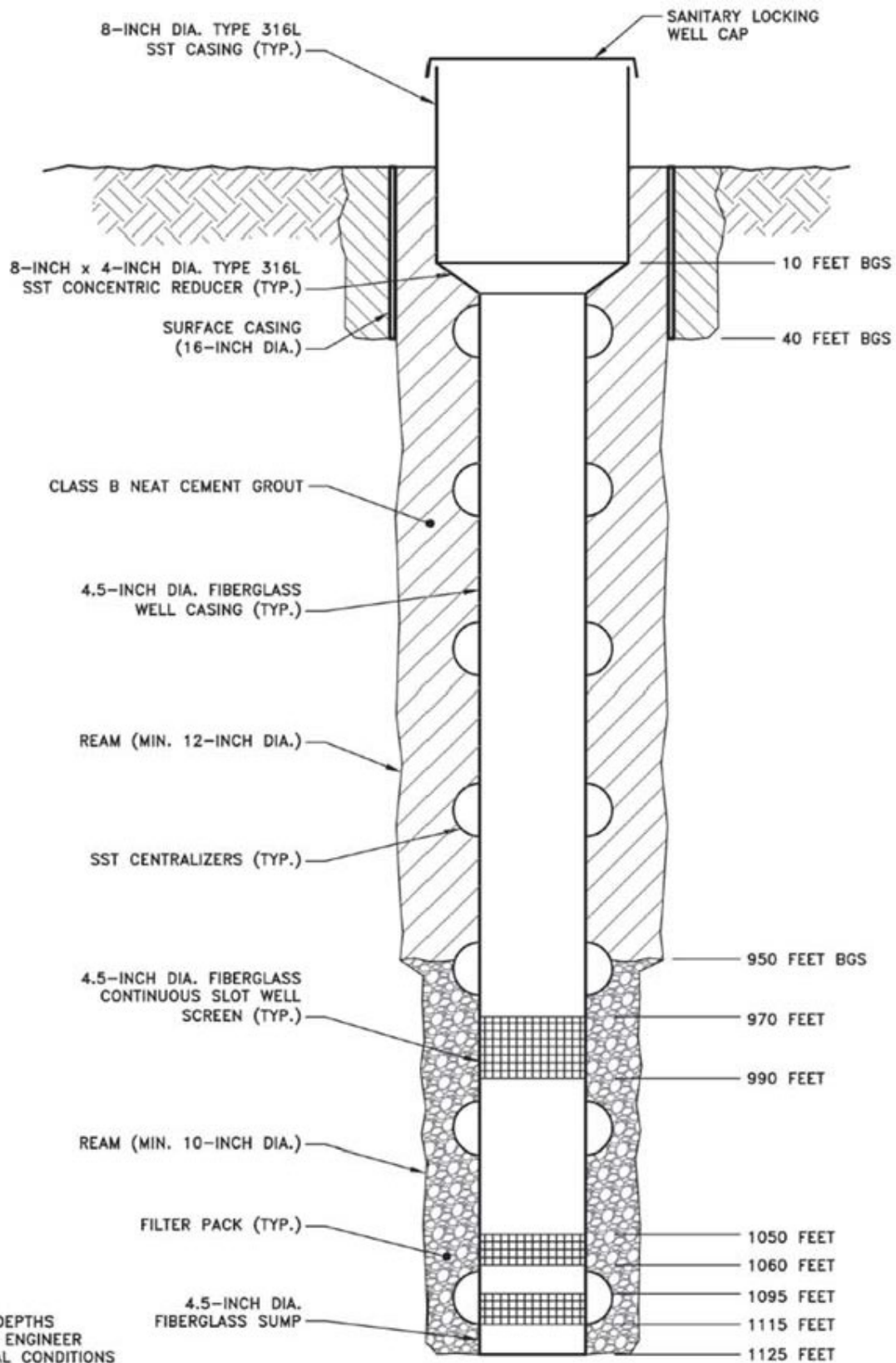


Figure E.4 Typical Middle Zone Well Construction Diagram for James River SWIFT monitoring well clusters (JR_MC1 and JR_MC2). Elevations may change according to site specific conditions