Quality Assurance Project Plan

For Field Sampling of Alternative and Innovative Onsite Wastewater Treatment Systems

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Date: **September 19, 2003**

This publication is supported by URI Cooperative Extension. It is contribution number 4017 of the College of the Environment and Life Sciences, University of Rhode Island with partial support by the Rhode Island Agricultural Experiment Station. Partial funding for this publication was also provided by the U.S. Environmental Protection Agency under the Block Island / Green Hill Pond Watershed national Community Decentralized Wastewater Treatment Demonstration Project and the Section 319 Program of the RI Department of Environmental Management.

Worksheet #1: Title and Approval Page

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For Field Sampling of Alternative and Innovative
Onsite Wastewater Treatment Systems

September, 2003

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2.0 Table of Contents

2.0 Table of Contents (cont.)

List of Figures

List of Tables

Please note that worksheet numbers correspond to US EPA Worksheet numbering.

EPA Worksheet #	EPA Worksheet Name
9c	Field and Quality Control Summary Table
12b	Sampling Locations, Sampling and Analysis Method/SOP Requirements Table
13	Project Sampling SOP Reference Table
16	Sample Handling System
22a	Field Sampling QC Table
26	Project Documentation and Records Table

APPENDICES **Page**

Table 1. Required Information Checklist

EPA Worksheet	Section	Location	Comments
1	1.0	Title Page	In narrative
2	2.0	Table of Contents	In narrative
3	3.0	Distribution List	In narrative
4	3.0	NA	All relevant personnel are included on the Approval page
5a	4.0	Organizational Chart	In narrative
5b	4.0	Communication Pathway	In narrative
6	4.0	Personnel responsibilities and Qualifications	In Narrative
7	4.0	NA	Information on training in narrative.
8a	5.0	NA	Meeting notes retained by Project Manager (L Joubert)
8b	5.0	Problem definition	In narrative
9a	6.0	Project description	In narrative
9b	6.0	Contaminants of concern	In narrative
9c	6.0	Field QC sample table	In Worksheet Section
10	6.0	Project schedule	In narrative
11a	7.0	Quality objectives	In narrative
11b	7.0	Meas. Performance Criteria	In narrative
12a	8.0	Sample design	In narrative
12b	8.0	Sampling locations and methods	In narrative, Worksheet Section, and Schematics of Systems
13	9.0	Sampling SOPs	In Appendix D and E, Worksheet Section, and in narrative
14	9.0	Field equipment calibration	In Appendix D
15	9.0	Field equip. maintenance	In Appendix D
16	10.0	Sample handling, custody	In Worksheet Section
17	11.0	Field analytical SOP	In Appendix D
18	11.0	Instrument calibration	In Appendix D
19	11.0	Field Instrument Calib.	In Appendix D
20	12.0	Lab analytical SOPs	See Appendix A for source
21	12.0	Lab instrument maintenance	See Appendix A for source
22a	13.0	Field sampling QC table	In Worksheet Section
22b	13.0	NA	No field analysis
23a	13.0	NA	No field analysis
23b	13.0	NA	No field analysis
24a	13.0	NA	No field analysis
24b	13.0	NA	No multiple analytes
25	14.0	NA	No non-direct measurements
26	15.0	Project records table	In Worksheet Section
27a	16.0	Assessment and response actions	In narrative
27b	16.0	NA	In narrative
27c	16.0	NA	In narrative
28	17.0	QA management reports	In narrative
29a	19.0	Verification requirements	In narrative
29b	19.0	NA	In narrative
29c	19.0	NA	In narrative
30	20.0	Data usability assessment	In narrative

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4.0 Project Organization, Personnel Responsibilities and Qualifications

The following University of Rhode Island On-site Wastewater Training Center staff will conduct all field sampling activities.

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George Loomis is a senior level research and extension soil scientist at the University of Rhode Island Onsite Wastewater Training Center. He is responsible for coordinating and overseeing all sampling activities in the field, sample transfer to lab, and is the Field Sampling QA Officer. He has twenty years of field experience, including seventeen years directly involved with siting, design, installation, operation and maintenance, sampling, and performance evaluation of alternative and innovative treatment systems.

David Dow is a senior level research associate at the University of Rhode Island Onsite Wastewater Training Center. He has ten years of experience with alternative and innovative treatment systems. This includes five years direct experience with siting, design, installation, operation and maintenance, sampling, and performance evaluation of alternative and innovative wastewater treatment systems. Mr. Dow is a RIDEM Class I Licensed Septic System Designer and a Class IV Licensed Soil Evaluator. Mr. Dow has coordinating and oversight responsibilities for all field sampling activities in the event that George Loomis can not perform that function.

Justin Jobin is a Research Assistant at the URI Cooperative Extension Onsite Wastewater Training Center, the Wastewater Management Specialist for Jamestown, RI, and the co-owner of J.D. Septic Services. Mr. Jobin has three years of extensive experience, starting his formal hands-on training as a URI Coastal Fellow with the OWT Center when he was an undergraduate. Justin holds a B.S. degree in Environmental Science and Management from the URI Department of Natural Resources Science. In his capacity at Jamestown, Mr. Jobin runs the wastewater management office, reviews inspections, manages the town septic tracking data base, and provides technical advise and educational information to residents. His private company specializes in operation and maintenance of conventional and alternative treatment systems.

All personnel conducting field sampling will be trained prior to performing supervised sampling tasks by David Dow and George Loomis of the URI Onsite Wastewater Training Center. This training will consist of field sampling techniques and procedures as outlined in this document. A list of all individuals that have successfully completed the training will be kept on file by the Field Sampling Team Leader.

All laboratory analyses will be conducted at the University of Rhode Island Watershed Watch (URIWW) Lab. **Separate quality assurance plans for standard laboratory procedures have been prepared by the Watershed Watch Lab and accepted by EPA. Those plans are entitled *Kickemuit Reservoir Quality Assurance Project Plan* dated April 26, 2000 and for (nitrate nitrogen and fecal coliform analyses only) the *QAPP For Private Well Tap Water Testing* (BIGHP Project) dated August 26, 2001 (see Appendix A for availability and contact information to receive a copy of these particular documents).**

All lab procedures will to be conducted under the direction of:

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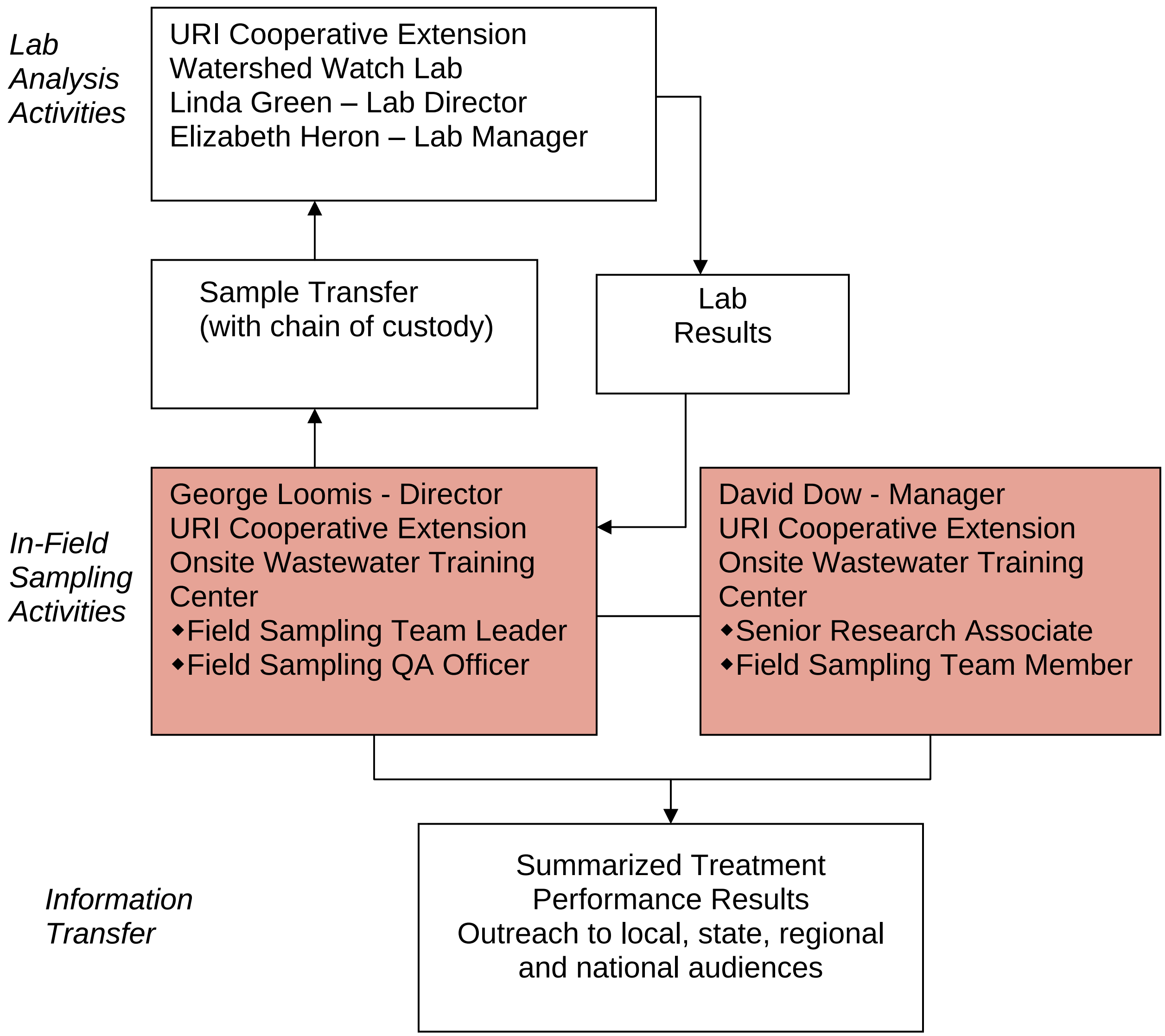
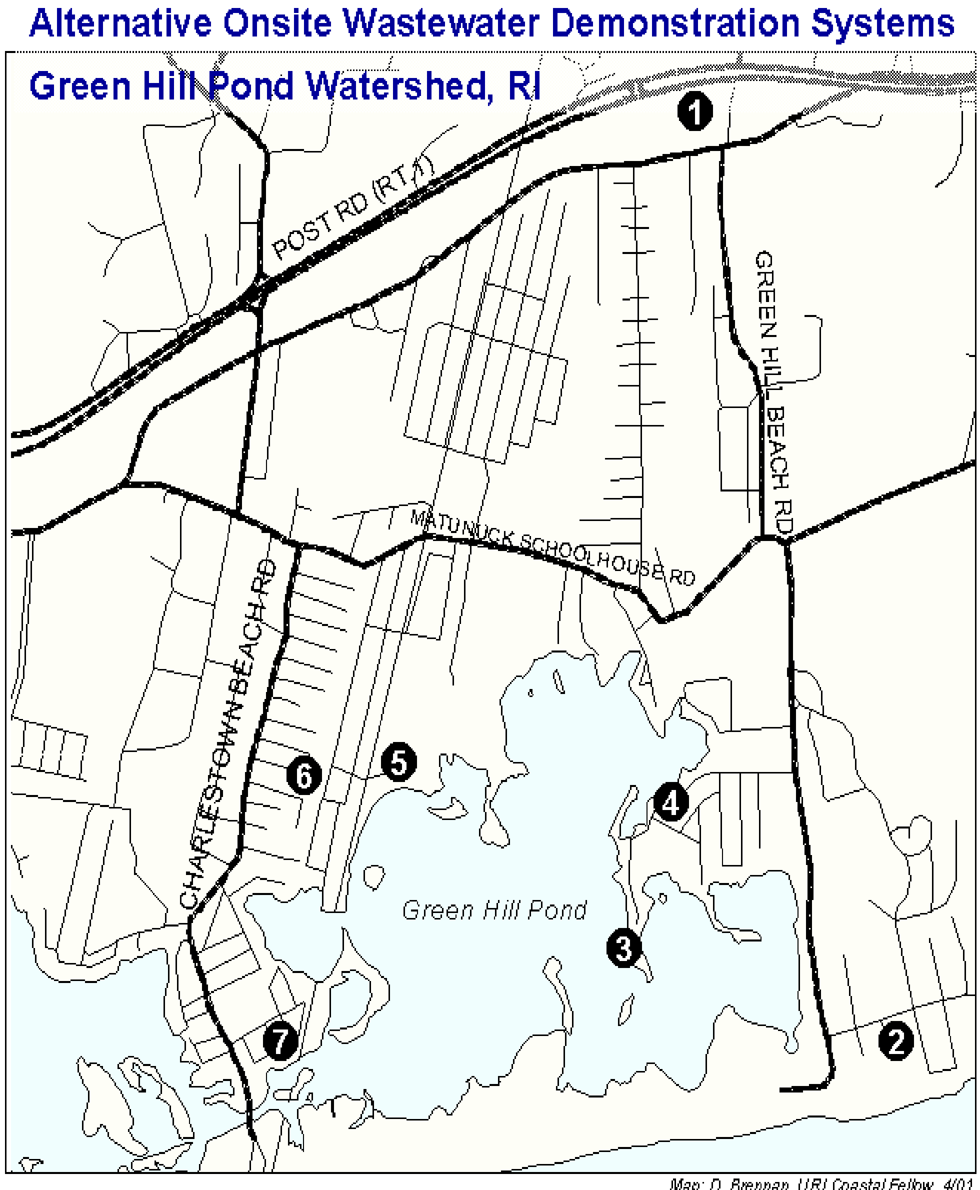


Figure 1. Organization chart for field sampling alternative and innovative onsite wastewater treatment systems . systems. sysystems. systems.



1. Single pass sand filter, Old Shannock Rd., South Kingstown.
2. Recirculating textile filter with bottomless sand filter, Surfside Ave., South Kingstown.
3. FAST system with UV light disinfection, Twin Peninsula Rd., South Kingstown.
4. Peat filter with UV disinfection, Kingfisher Rd., South Kingstown.
5. Recirculating textile filter, Ram Island Rd., South Kingstown.
6. Drip irrigation system, Thomas St., Charlestown.
7. Recirculating textile filter, Third St., Charlestown.

UNIVERSITY OF RHODE ISLAND

Figure 2. Existing Alternative and Innovative System Locations in Green Hill Pond Watershed.

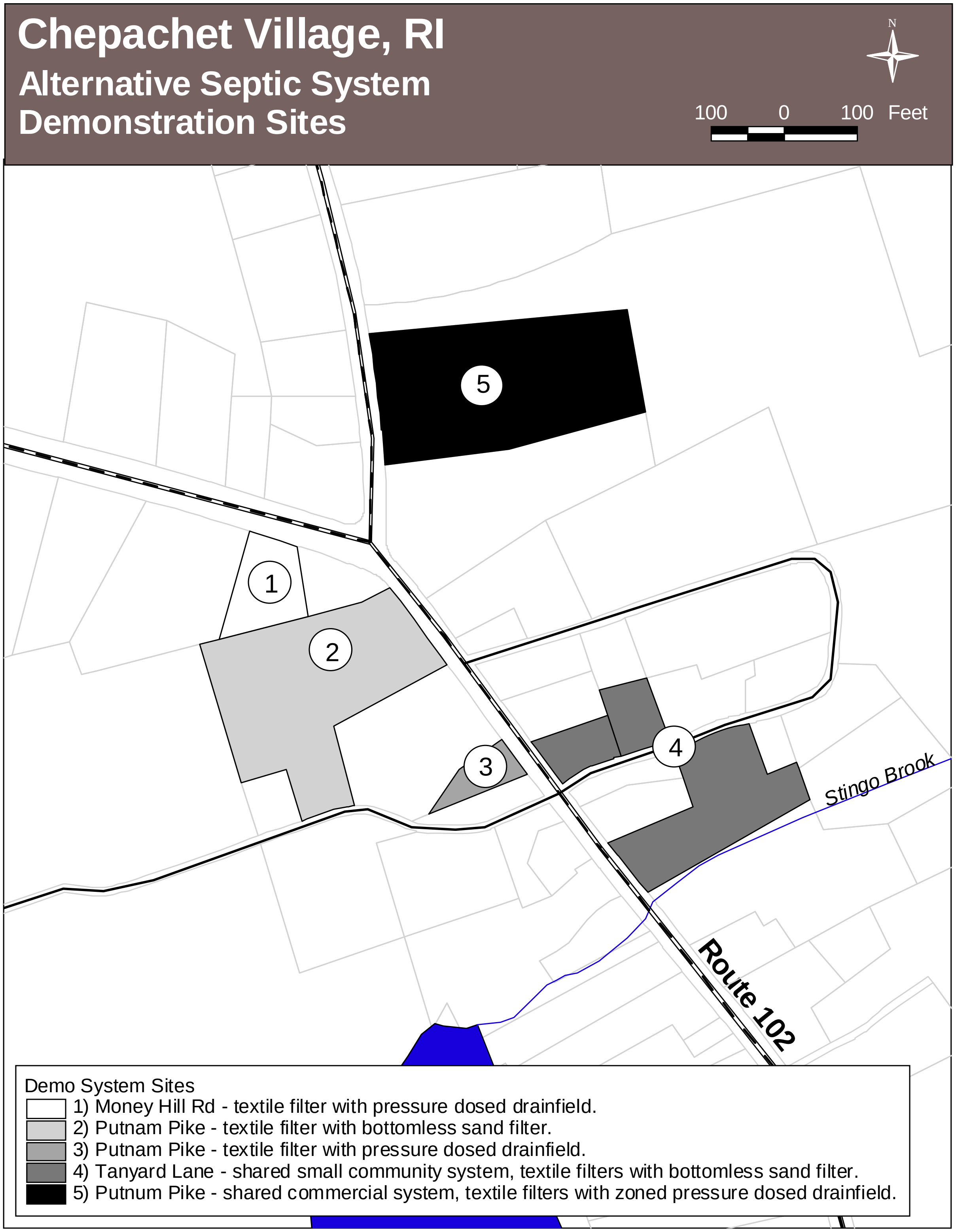


Figure 3. Alternative Septic System Demonstration Site Locations in Chepachet Village, Glocester, RI.

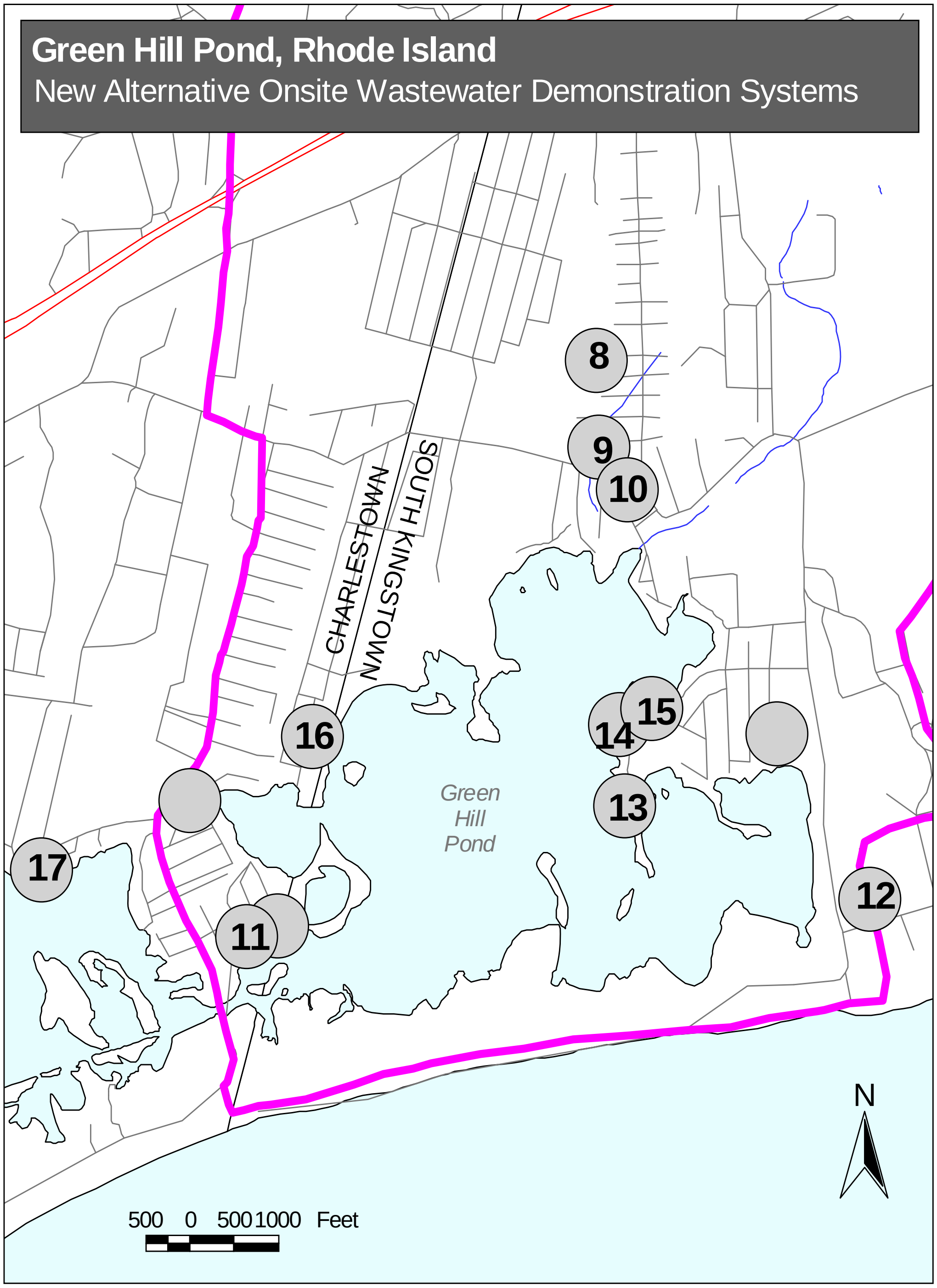


Figure 4: New Alternative and Innovative System Locations in the Green Hill Pond Watershed (GHN system code).

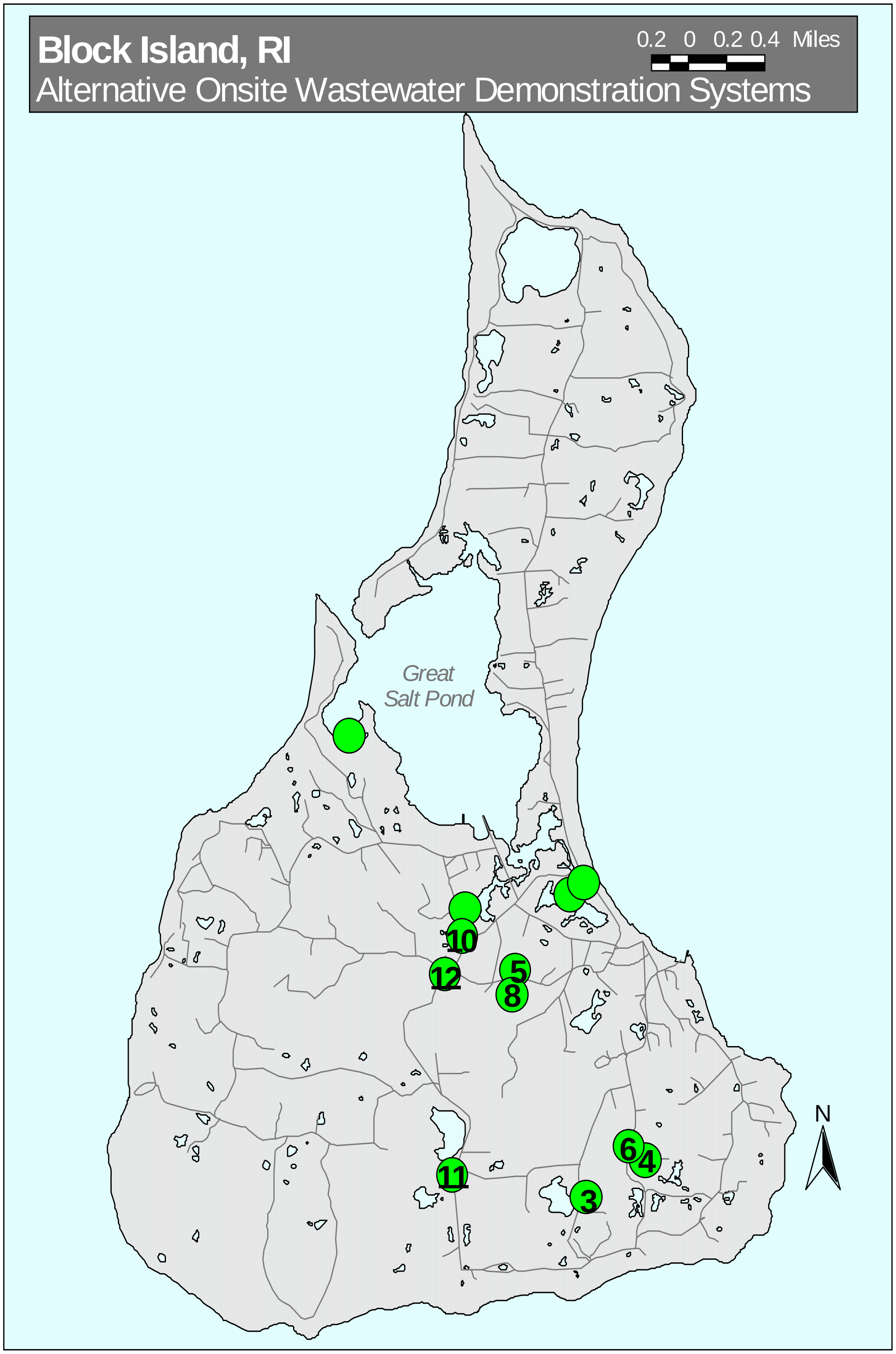


Figure 5. Alternative and Innovative System Locations on Block Island (BI), Rhode Island.

5.0 Planning / Project Definition

Background

Several communities in Rhode Island are developing wastewater management programs that are premised on risk based approaches to protect water quality at the watershed level. Under this approach treatment zones and onsite wastewater system treatment standards are being established to help assure long-term water quality improvements and sustainability. The Rhode Island Department of Environmental Management (RIDEM) has approved several alternative and innovative onsite wastewater treatment technologies for use. These technologies are available for use in critical resource areas and in proposed treatment zones. As more new technologies emerge, treatment performance information is needed to help determine their potential use in community risk based management programs and demonstration projects. Standardized field sampling quality assurance / control procedures are needed to assure that proper protocol is in place to assure that equitable evaluation of these technologies occurs.

Block Island and Green Hill Pond Project

The alternative and innovative system monitoring project is one component of the overall wastewater demonstration project of the Block Island and Green Hill Pond Watershed USEPA National Community Decentralized Wastewater Treatment Demonstration (BIGHP) Project. Fact sheets, project summaries and a detailed description of the overall project can be found on the following website: www.uri.edu/ce/wq/bighp.html.

The objective of the alternative and innovative portion of the overall BIGHP project is to collect, monitor and analyze wastewater samples from alternative and innovative wastewater treatment systems installed as demonstration systems for those communities. Treatment performance of various components of several technologies will be evaluated and reported.

Chepachet Village Wastewater Project

Five alternative and innovative systems were installed in the historic mill village of Chepachet in the Town of Glocester, Rhode Island during the fall 2001. The systems were installed to remediate failed septic systems that were adversely impacting water quality in the Chepachet River.

The **overall goal** of this quality assurance project plan is to assure that field sampling methods facilitate collection of high quality data from the alternative and innovative systems on both these projects.

6.0 Project Description and Schedule

During the time period from December 1998 to June 1999 seven alternative and innovative systems were installed in the Green Hill Pond Watershed under the auspices of the National Onsite Wastewater Demonstration Project - Phase II (program administration at the National Small Flows Clearinghouse at West Virginia University). In this QAPP, these systems are referred to as “existing Green Hill Pond Watershed systems”. Additional performance monitoring of these systems was conducted under a Section 319 project funded through RIDEM (this Section 319 project expires September 30, 2003). Present monitoring of these seven “existing systems” is under the auspices the Block Island and Green Hill Pond Watershed National Community Decentralized Wastewater Treatment Demonstration Project (USEPA).

An additional 25 systems were installed under the auspices of this project (12 systems on Block Island and 13 “new systems” in the Green Hill Pond Watershed communities of South Kingstown and Charlestown, RI). The end date for this Block Island and Green Hill Pond Watershed National Community Decentralized Wastewater Treatment Demonstration Project (USEPA) is June 30, 2005.

During the Fall 2001 five alternative and innovative systems were installed in Chepachet Village (Town of Glocester), Rhode Island under the auspices of a Sec. 319 grant administered by RIDEM. The sampling for this project is complete. The field sampling protocol for these systems followed the procedures outlined in this QAPP. The end date of this project is May 16, 2004.

7.0 Project Quality Objectives and Measurement Performance Criteria

High quality data is the goal of all URI Onsite Wastewater Training Center projects. Specific lab data quality objectives include detection limits, precision, accuracy, representativeness, comparability, and completeness and are listed in the plan entitled *Kickemuit Reservoir Quality Assurance Project Plan* dated April 26, 2000 and the *QAPP for the Private Well Tap Water Testing, a component of the Block Island and Green Hill Pond Watershed National Community Decentralized Wastewater Demonstration Project* dated August 26, 2001 (see Appendix A for details about how to obtain a copy of these plans).

Representativeness

The homes where alternative and innovative demonstration systems were installed were selected (by a several member committee) in part because of their potential to represent typical homes in that watershed. Wastewater flow generated within a home can have a potential impact on system performance and sample representativeness. Volume of wastewater flow to all the systems being sampled will be determined at the time of each sample event. This will be done by recording pump run times and pump events from programmable logic timers, and water meters if applicable. Wastewater flow data will also be evaluated and compared during treatment performance analysis and review.

Before sampling commenced, all systems were allowed to equilibrate for a minimum of two to three months. During this period any necessary system adjustments were made to try to optimize treatment in accordance to average daily flows being produced at that particular home. If a proprietary system was being investigated, that particular company was consulted to help fine-tune the system according to their specifications. All new systems added to the Block Island and Green Hill Pond Watershed National Community Decentralized Wastewater Treatment Demonstration Project will follow these same start-up procedures.

To help obtain representative system treatment performance associated with seasonal or climatic conditions, sample events will occur during the cold (November through March) and warm season periods.

8.0 & 9.0 Sampling Process Design, Procedures, and Requirements

In the grant projects we are involved with the alternative and innovative treatment demonstration systems are not randomly located within a watershed, but rather occur in targeted pollution hot spots or in areas with a history of septic system failures. The alternative and innovative systems selected for monitoring all met Rhode Island Department of Environmental Management and Rhode Island Coastal Resource Management Council regulations for remedial repairs to failed septic systems. Systems were designed and installed by licensed individuals and inspected in the field by Rhode Island DEM Inspector(s). Members of the University of Rhode Island On-site Wastewater Training Center staff performed design assistance and construction oversight for these systems.

In general, all the technologies being monitored have a primary treatment component (either a septic tank or septic compartment within a tank), an advanced treatment component (consisting of some type of packed-bed filter, aeration tank, or treatment zone), and a drainfield option of varying type and size.

The "existing systems" installed in the Green Hill Pond Watershed under a previous demonstration project grant consist of the following treatment trains:

System Number: **(please see Figures 6 – 12 in Appendix G.)**

GH – 1 4 x 8 foot Orenco Systems, Inc. Recirculating Advantex (RX-30) Textile Filter (in a blended effluent mode) followed by a 5 x 15 foot raised bottomless sand filter (serving as a drainfield). See Figure 2 location 2.

GH – 2 4 x 8 foot Orenco Systems, Inc. Recirculating Advantex (RX –30) Textile Filter (in a recirculating mode) followed by three pressure dosed 30 foot long shallow narrow drainfield lines. See Figure 2 location 7.

GH - 3. Drip Irrigation System with 1,350 linear feet of drip tubing and a separate sand lined trench drainfield. The system is designed to work either as a drip irrigation system or sand lined trench. Currently the system is operating in a drip irrigation mode. All wastewater going to final dispersal is discharged through alternating flushable disk filters (no other additional treatment occurs). See Figure 2 location 6.

GH- 4. 15 x 15 foot single pass sand filter followed by three pressure dosed 40 foot long shallow narrow drainfield lines. See Figure 2 location 1.

GH - 5. 4 x 8 foot Orenco Systems, Inc. Recirculating Advantex (RX- 30) Textile Filter (in a recirculating mode) followed by 80 feet of pressure dosed shallow narrow drainfield. See Figure 2 location 5.

GH - 6. Three Bord-na-Mona Peat Filter modules, followed by an ultraviolet (UV) light disinfection unit, and four pressure dosed 25 foot long shallow narrow drainfield lines. See Figure 2 location 4.

GH - 7. Biomicrobics, Inc. FAST (fixed activated sludge) System, followed by an ultraviolet light (UV) disinfection unit and four pressure dosed 25 foot long shallow narrow drainfield lines. See Figure 2 location 3.

Systems installed on the Chepachet project consist of the following treatment trains:

System (please see Figures 13 – 17 in Appendix G.)
<u>Number:</u>

CH -1. 4 x 8 foot Orenco Systems, Inc. Recirculating Advantex (AX-20) Textile Filter followed by 164 feet of pressure dosed shallow narrow drainfield. See Figure 3 location 1.

CH - 2. 4 x 8 foot Orenco Systems, Inc. Recirculating Advantex (AX-20) Textile Filter followed by a 7 x 25 foot raised bottomless sand filter (serving as a drainfield). See Figure 3 location 2.

CH - 3. Septic tank gravity flowing to a recirculation tank containing a time dosed pump that pressure doses a 4 x 8 foot Orenco Systems, Inc. Recirculating Advantex (AX- 20) Textile Filter. Final wastewater is dosed to 180 feet of pressure dosed shallow narrow drainfield. See Figure 3 location 3.

CH - 4. Consists of three buildings attached to a shared small community system (total of 900 gallons per day design flow). Each building unit has its own primary treatment tank gravity flowing to a 2000 gallon recirculation tank. Wastewater is time dosed to two 4 x 8 foot Orenco Systems, Inc. Recirculating Advantex (AX- 20) Textile Filters (in a recirculating mode). Final treated effluent is dosed to a 7 X 48 foot raised bottomless sand filter serving as the final treatment and effluent dispersal zone. See Figure 3 location 4.

CH - 5. This system consist of a 2,700 gallon per day commercial system servicing a restaurant, small doctor's office, one duplex apartment, and a five small business strip mall. The doctor's office and strip mall each have 1,000 gallon septic tanks and the duplex has a 1,250 gallon septic tank. All three of these septic tanks gravity flow to a 2,500 gallon recirculation tank.

Wastewater flow in the restaurant is separated into black water (toilet wastes) and gray water (kitchen wastewater). Black water generated in the restaurant flows by gravity into a 2,500 gallon two compartment septic tank and then into the aforementioned 2,500 gallon recirculation tank. Gray water from the restaurant kitchen flows by gravity into a three compartment 2,000 gallon grease trap, then into the aforementioned 2,500 gallon black water septic tank and 2,500 gallon recirculation tank.

Wastewater is time dosed to four 4 x 8 foot Orenco Systems, Inc. Recirculating Advantex (AX-20) Textile Filters. Treated final effluent is pressured dosed to eight 98 foot long shallow narrow drainfield lines (fed from the middle and set in four zones – consisting of two lines each). See Figure 3 location 5.

New Green Hill Pond Watershed systems installed under the auspices of the USEPA National Community Decentralized Wastewater Treatment Demonstration (BIGHP) Project:

System <u>Number:</u> **(please see Figures 18 – 27 in Appendix G.)**

GHN 8 A 4 x 8 foot Orenco Systems, Inc. Recirculating Advantex (AX-20) Textile Filter followed by a tipping D-Box and three approximately 28 foot long 12 inch wide plastic (Infiltrator) chambers. See Figure 4 location 8.

GHN 9 Processing tank time dosing wastewater to a recirculating Waterloo (foam) Biofilter. Fifty percent of Biofilter effluent is recirculated back to processing tank and fifty percent is pressure dosed to a raised bottomless sand filter. See Figure 4 location 9

GHN 10 A 4 x 8 foot Orenco Systems, Inc. Recirculating Advantex (AX-20) Textile Filter followed by a pressure dosed shallow narrow drainfield. See Figure 4 location 10.

GHN 11 A 4 x 8 foot Orenco Systems, Inc. Recirculating Advantex (AX-20) Textile Filter followed by a pressure dosed shallow narrow drainfield. See Figure 4 location 11.

GHN 12 A 4 x 8 foot Orenco Systems, Inc. Recirculating Advantex (AX-20) Textile Filter followed by one pressure dosed Bord-na-Mona Peat Filter module (serving as a drainfield) resting on a 1 foot layer of washed stone. See Figure 4 location 12.

GHN 13 This Septitech System consists of a primary anoxic tank (also serving as a septic tank) gravity flowing to a aerobic tank containing four pumps. The first pump recirculates wastewater within the aerobic tank to the top of media pillows, the second pump recirculates sludge return pump, the third pump recirculates decanted wastewater to the mid point of the primary tank for denitrification, and the last pump discharges treated wastewater to the shallow narrow drainfield. See Figure 4 location 13.

GHN 14 This Septitech System consists of a primary anoxic tank (also serving as a septic tank) gravity flowing to a aerobic tank containing four pumps. The first pump recirculates wastewater within the aerobic tank to the top of media pillows, the second pump recirculates sludge return pump, the third pump recirculates decanted wastewater to the mid point of the primary tank for denitrification, and the last pump discharges treated wastewater to the bottomless sand filter.See Figure 4 location 14

GHN 15 Septic tank with a screen pump vault containing a pump which time doses wastewater to three Bord-na-Mona Peat Filter modules. Peat filter effluent flows by gravity through a Nitrex Upflow Filter and into a drainfield discharge basin containing a pump that pressure doses a bottomless sand filter. See Figure 4 location 15.

GHN 16 Septic tank with a screen pump vault containing a pump which time doses wastewater to three Bord-na-Mona Peat Filter modules. Peat filter effluent flows by gravity through a Nitrex Upflow Filter and into a drainfield discharge basin containing a pump that pressure doses a shallow narrow drainfield. See Figure 4 location 16.

GHN 17 A 4 x 8 foot Orenco Systems, Inc. Recirculating Advantex (AX-20) Textile Filter followed by a bottomless sand filter**.** See Figure 4 location 17.

Systems installed on Block Island, RI under the auspices of the USEPA National Community Decentralized Wastewater Treatment Demonstration (BIGHP) Project:

System **(please see Figures 28 – 35 in Appendix G.)**
Number:

BI 3 Consists of two homes each having its own primary treatment tank gravity flowing to a 2000 gallon recirculation tank. Wastewater is time dosed to two 4 x 8 foot Orenco Systems, Inc. Recirculating Advantex (AX- 20) Textile Filters (in a recirculating mode). Final treated effluent is dosed to a shallow narrow drainfield. See Figure 5 location 3.

BI 4 Septic tank effluent gravity flowing into a recirculation tank containing a time dosed pump that pressure doses a 4 x 8 foot Orenco Systems, Inc. Recirculating Advantex (AX- 20) Textile Filter. Final wastewater is dosed to a shallow narrow drainfield. See Figure 5 location 4.

BI 5 A 4 x 8 foot Orenco Systems, Inc. Recirculating Advantex (AX-20) Textile Filter followed by a pressure dosed shallow narrow drainfield**.** See Figure 5 location 5.

BI 6 A 4 x 8 foot Orenco Systems, Inc. Recirculating Advantex (AX-20) Textile Filter followed by a pressure dosed shallow narrow drainfield. See Figure 5 location 6

BI 8 A 4 x 8 foot Orenco Systems, Inc. Recirculating Advantex (AX-20) Textile Filter followed by one pressure dosed Bord-na-Mona Peat Filter module (serving as a drainfield) resting on a 1 foot layer of washed stone. See Figure 5 location 8.

BI 10 A 4 x 8 foot Orenco Systems, Inc. Recirculating Advantex (AX-20) Textile Filter followed by a pressure dosed shallow narrow drainfield. See Figure 5 location 10.

BI 11 A 4 x 8 foot Orenco Systems, Inc. Recirculating Advantex (AX-20) Textile Filter followed by a shallow narrow drainfield that is fed by a dosing siphon located in a 24 inch diameter siphon basin. See Figure 5 location 11.

BI 12 Septic tank effluent gravity flowing into a recirculation tank containing a time dosed pump that pressure doses a 4 x 8 foot Orenco Systems, Inc. Recirculating Advantex (AX- 20) Textile Filter. Final wastewater is dosed to a shallow narrow drainfield. See Figure 5 location 12.

Due to homeowner confidentiality reasons, actual street addresses are not used in this QAPP or in other printed materials about these demonstration systems. The maps and descriptive information about the New Green Hill Pond Watershed and Block Island systems installed under the auspices of the USEPA National Community Decentralized Wastewater Treatment Demonstration (BIGHP) Project, have no mention of street location per our agreement with the participating homeowners. Because of the wide distribution of this QAPP, and to honor our agreements with participating homeowners, we will *not* include detailed site locations. This information will be kept on file by the BIGHP URI Project Manager and Field Sampling Team Leader, and will be made available upon request to EPA officials with a need to know. The locations of sites shown in Figures 2 – 5 are representative and accurate to determine general location in the watersheds and there proximity to water bodies and water quality.

Sample Event Frequency

Table 2 lists the sample event frequency for each project covered under this QAPP.

“Existing” Green Hill Pond Watershed Systems

We sampled seven existing systems on a monthly basis from September 1999 through December 2001. Thereafter, up to 7 existing systems will be sampled three times per year for two years. Two of these sample events will occur in a cold weather time period.

Block Island Systems

Twelve systems were installed on Block Island during the late 2001 and early 2002 construction seasons. These system installations were conducted under the auspices of the USEPA National Community Decentralized Wastewater Treatment Demonstration Project. Up to 8 systems will be sampled four times per year for three years. Two of these sample events will occur during a cold weather time period.

"New" Green Hill Pond Systems

Thirteen additional systems were constructed on the USEPA National Community Decentralized Wastewater Treatment Demonstration Project during the 2003 construction season. Up to ten of these new systems will be sampled 4 times per year for three years, and two of the events will be during cold weather periods.

Chepachet Village, Glocester, RI Systems

These five systems were sampled four times in 2002, including two events during the cold weather months. Field sampling protocol followed the procedures outlined in this QAPP. This sampling is completed. No additional sampling is planned at this time for these systems. However, if funding is made available, continued sampling may resume, following the guidelines established in this QAPP.

Sample Station Locations, Sample Types

Whenever possible, grab samples will be gathered from exposed pipe ends accessed via 18 to 30 inch diameter watertight polyvinyl chloride (PVC) manholes with gasketed bolt-down lids. Wherever feasible, technologies will be sampled at the outlet of the primary treatment component (septic tank or septic compartment effluent). This sample location will provide a beginning wastewater strength sample. Samples taken after advanced treatment components (consisting of some type of packed-bed filter, aerated tank, or treatment zone) will provide a sample to evaluate advanced treatment component performance. See individual schematics for sample location points and Tables 3 and 4 for a summary of system component sampling locations / points.

Depending upon the type of system being investigated, a mixed or blended wastewater sample consisting of treatment component wastewater combined with fresh incoming wastewater from the septic tank /compartment may also be collected. Septic tank effluent being dosed to the surface of a buried single pass sand filter and a bottomless sand filter will be sampled at the sweep elbow end of the dosing lateral. To facilitate collecting a sample from this point, a simple commonly available threaded and serrated PVC adapter and clear vinyl hose will be attached to the lateral clean out valve. Any accumulated solids that may be in the lateral will first be flushed out and then in-stream samples will be taken. The sample hose assembly will be cleaned between sampling events following standard laboratory protocol and stored in a clean plastic bag(s).

Table 2. Sampling Event Frequency. *

Project Location	# of systems (sets of samples)	# events per year	# of years	Starting year	Monitoring season Cold #1	Cold #2	Warm #1	Warm #2
Glocester, Rhode Island	5	4	1	2002	February	March	May	July
Block Island, Rhode Island **	Up to 8*	4	3	2002	March	November	May	September
Green Hill Pond Watershed (existing systems)	Up to 7*	3	2	2002	February	November	July	NA
Green Hill Pond Watershed (new systems)	Up to 10*	4	3	2003	December	March	May	July

* Weather, climatic conditions, and seasonal occupancy of homes may influence the frequency and actual monitoring months.

** Factors such as the remote location of this island, the influence of weather upon travel to/from the island, the limited ferry schedules, the seasonal occupancy nature of these homes, can influence the number of systems sampled annually, the sample events per year, and the actual sampling months.

Where pressure lateral ends or outlet pipe ends are not readily available, aliquots of septic tank effluent will be collected through a hose placed in the pump vault assembly. This hose will be connected to a hand-operated vacuum pump, which transfers the liquid to grab sample bottles. The hose and pump assembly will be cleaned between sample events following standard laboratory practices and stored in clean plastic bags.

Zero tension pan lysimeters, if so installed during construction, will be used to collect filter effluent at the base of a bottomless sand filter. These lysimeters collect bottomless sand filter percolate that intercepts the pan lysimeter at the filter base. This process involves no vacuum equipment. Earlier versions of lysimeters utilized on the existing Green Hill Pond systems, were constructed of 30 mil flexible PVC sheeting (2.25 ft^2 (0.209 m^2) in surface area), with a polyethylene bulkhead fitting through which sand filter percolate collects and flows by gravity through a rigid sampling tube. A latter version of pan lysimeters were used on bottomless sand filters installed on the new Green Hill Pond Watershed systems. These more recent lysimeters consist of a 10 X 1 X 0.5 foot (LXWXD; 10 ft^2 in surface area) PVC pipe cut longitudinally, installed at the bottomless sand filter base and sloped to a screened 1 inch outlet pipe. Samples are collected at the end of this outlet pipe.

Samples will be collected mid-week during the 0800 to 1200 hours time period. For passively operated systems (hydraulic displacement of wastewater by gravity flow) typical wastewater flow corresponds to active wastewater generation in the home during the hours of 0600 – 1000 and 1600 – 2100 (depending upon occupant lifestyle). Where system programmable timers are used to dose selected treatment technologies, wastewater transfer volume and dose frequency to treatment units is evenly and uniformly spaced over nearly a twenty-four hour clock. In the case of the systems on this project all systems except the existing BIGHP system number 3 are time dosed with programmable timers.

Grab samples may also be taken during field sampling and used for dissolved oxygen and temperature determinations. Care will be taken to minimize or eliminate introducing additional air into these samples. During all sampling activities, care will be taken not to touch the sampling containers to the pipe ends because this may dislodge any accumulated solids and contaminate the sample.

Sample Containment and Transport

All sample bottles, prepared by laboratory personnel, will be washed in soapy tap water with phosphate-free detergent and triple-rinsed with tap water. In addition, glass bottles are acid washed in 10 percent H_2SO_4, then soaked in deionized water for 24 hours prior to final rinse. Clean sterile plastic drinking cups will be fixed into long-handled PVC sample cup holders to collect wastewater samples that get directly transferred into the prepared sample bottles.

Samples will be collected and stored in 500 ml Nalgene HDPE (high density polyethylene) bottles for five day biochemical oxygen demand (BOD-5) and total suspended solids (TSS) analyses. Samples being analyzed for nutrients and chlorides will be collected and stored in 125 ml brown glass bottles. Fecal coliform bacteria samples will be collected and stored in sterilized 125 – 250 ml Nalgene HDPE bottles. Samples for alkalinity and pH will be collected and stored in 125 ml

Nalgene HDPE bottles. Sample preservation techniques will follow standard procedures and methods (APHA, 1995).

All samples will be placed on ice in clean polyethylene coolers while in the field and during transport to the lab. No samples will be exposed to direct sunlight for more than a 10-minute interval during sample collection and transport. Samples will be transported from the field to the laboratory within 4 hours of collection by the field sampling team senior staff / principal investigators. Sample bottles will be taken from the coolers and transferred to laboratory refrigerators where they will be stored at 4^0 C. Sample preservation and holding time will follow methods and procedures as outlined in standards methods (APHA, 1995) and in the separate lab QAPP referenced earlier.

Table 3. Common system component sampling locations.

System Component	Sample Location
Septic (primary) tank with gravity discharge pipe	Septic tank outlet pipe end
Septic tank without gravity discharge pipe (where access to next step is not available)	Screened pump vault (using a hand vacuum pump) where access is limited or by dip sample
Septic tank with pump discharge	At distal end of pressure manifold in packed bed filter
Single pass sand filter	Underdrain pipe ends in filter pump vault
Foam, Peat or Textile packed bed filters	Filter outlet pipe at drainfield pump basin
Peat filter before woodchip upflow filter	Inlet to woodchip upflow filter
Textile filter (blended effluent mode)	Distribution manifold on bottomless sand filter
Bottomless sand filter	Zero tension pan lysimeter sample tube end
Fixed activated sludge system	FAS system outlet pipe end at drainfield pump basin
Ultraviolet light disinfection unit	UV light unit outlet pipe end
Wood chip upflow filter	Pump basin following unit

Please see Table 4 for additional information on sample point locations noted on the individual system diagrams in Appendix G.

Table 4a. System components sampled and analyses performed for existing Green Hill Pond Watershed systems.

System	Sample Point	Component Sampled	Field Analyses Performed (D.O. and Temp.)	Lab Analyses Performed *
GH1 GRE	SP1	PCTE	X	
	SP2	PCTE		X
	SP3	RFE	X	X
	SP4	BSFE	X	X
GH2 TWE	SP1a	STE	X	
	SP1b	RTE	X	
	SP2	STE		X
	SP3	RFE		X
GH3 MAT	SP1	STE	X	
	SP2	STE		X
GH4 HAZ	SP1	STE	X	
	SP2	STE		X
	SP3	SFE	X	X
GH5 MAZ	SP1A	STE	X	
	SP1B	RTE	X	
	SP2	STE		X
	SP3	RFE	X	X
GH6 SIS	SP1	STE	X	
	SP2	STE		X
	SP3	PFE	X	X
	SP4	UVE		Bacteria only
GH7 TAR	SP1	FE	X	X
	SP2	UVE	X	Bacteria only

*Lab analyses include BOD-5, TSS, pH, alkalinity, TN, TP, NO3N, NH4N, fecal coliform
Please consult system diagrams in Appendix G.

Table 4b. System components sampled and analyses performed for Chepachet Village systems.

System	Sample Point	Component Sampled	Field Analyses Performed (D.O. and Temp.)	Lab Analyses Performed *
CH 1 HAT	SP1	PCTE	X	
	SP2	PCTE		X
	SP3	AXE	X	X
CH 2 BRA	SP1	PCTE	X	
	SP2	PCTE		X
	SP3	AXE		X
CH 3 CHR	SP1a	STE	X	
	SP1b	RTE	X	
	SP2	STE		X
	SP3	RTE		X
	SP4	AXE	X	X
CH 4 ETH	SP1	STE	X	
	SP2	STE		X
	SP3	RTE		X
	SP4	AXE	X	X
CH 5 LAV	SP1a	STE	X	
	SP1b	RTE	X	
	SP2	STE		X
	SP3	RTE	X	X
	SP4	AXE	X	X

*Lab analyses include BOD-5, TSS, pH, alkalinity, TN, TP, NO3N, NH4N, fecal coliform

Please consult system diagrams in Appendix G.

Table 4c. System components sampled and analyses performed for *NEW* Green Hill Pond Watershed systems.

System	Sample Point	Component Sampled	Field Analyses Performed (D.O. and Temp.)	Lab Analyses Performed *
GHN 8 TNY	SP1	PCTE	X	
	SP2	PCTE		X
	SP3	AXE	X	X
GHN 9 GRA	SP1a	PCTE	X	
	SP1b	WBF	X	
	SP2	PCTE		X
	SP3	WBF		X
	SP4	BSFE	X	X
GHN 10 CAL	SP1	PCTE	X	
	SP2	PCTE		X
	SP3	AXE		X
GHN 11 GRU	SP1	PCTE	X	
	SP2	PCTE		X
	SP3	AXE		X
GHN 12 HIG	SP1	PCTE	X	
	SP2	PCTE		X
	SP3	AXE		X
GHN 13 LAF	SP1a	PAT	X	
	SP1b	SEPE	X	
	SP2	SEPE		X
GHN 14 AND	SP1a	PAT	X	
	SP1b	SEPE	X	
	SP2	SEPE		X

*Lab analyses include BOD-5, TSS, pH, alkalinity, TN, TP, NO3N, NH4N, fecal coliform

Please consult system diagrams in Appendix G.

Table 4c (con't.). System components sampled and analyses performed for *NEW* Green Hill Pond Watershed systems.

System	Sample Point	Component Sampled	Field Analyses Performed (D.O. and Temp.)	Lab Analyses Performed*
GHN 15 LAM	SP1	STE	X	
	SP2	STE		X
	SP3	PFE	X	X
	SP4	NXE	X	X
	SP5	BSFE	X	X
GHN 16 HAR	SP1	STE	X	
	SP2	STE		X
	SP3	PFE	X	X
	SP4	NXE	X	X
GHN 17 BAN	SP1	PCTE	X	
	SP2	PCTE		X
	SP3	AXE	X	X

*Lab analyses include BOD-5, TSS, pH, alkalinity, TN, TP, NO3N, NH4N, fecal coliform
Please consult system diagrams in Appendix G.

Table 4d. System components sampled and analyses performed for Block Island systems.

System	Sample Point	Component Sampled	Field Analyses Performed (D.O. and Temp.)	Lab Analyses Performed*
BI 3 REA	SP1a	STE	X	
	SP1b	STE	X	
	SP1c	RTE	X	
	SP2	STE		X
	SP3	STE		X
	SP4	RTE	X	X
	SP5	AXE	X	X
BI 4 ONE	SP1a	STE	X	
	SP1b	RTE	X	
	SP2	STE		X
	SP3	RTE		X
	SP4	AXE	X	X
BI 5 FEI	SP1	PCTE	X	
	SP2	PCTE		X
	SP3	AXE	X	X
BI 6 RYN	SP1	PCTE	X	
	SP2	PCTE		X
	SP3	AXE	X	X
BI 8 BRN	SP1	PCTE	X	
	SP2	PCTE		X
	SP3	AXE	X	X
	SP4	PFE	X	X

*Lab analyses include BOD-5, TSS, pH, alkalinity, TN, TP, NO3N, NH4N, fecal coliform

Please consult system diagrams in Appendix G.

Table 4d (con't.). System components sampled and analyses performed for Block Island systems.

System	Sample Point	Component Sampled	Field Analyses Performed (D.O. and Temp.)	Lab Analyses Performed*
BI 10 ORT	SP1	PCTE	X	
	SP2	PCTE		X
	SP3	AXE	X	X
BI 11 DER	SP1	PCTE	X	
	SP2	PCTE		X
	SP3	AXE	X	X
BI 12 FLA	SP1a	STE	X	
	SP1b	RTE	X	
	SP2	STE		X
	SP3	RTE		X
	SP4	AXE	X	X

*Lab analyses include BOD-5, TSS, pH, alkalinity, TN, TP, NO3N, NH4N, fecal coliform
Please consult system diagrams in Appendix G.

Sample Identification and Labeling

All sample labels will be developed on a PC and printed on labels. Each bottle will have a label stating the type of analysis to be performed and sample identification information. Sample identification will follow the format in the example listed below.

GH-5 MAZ
Date
STE

Where: GH = target watershed or community location = Green Hill Pond (existing system)
BI = Block Island
CH = Chepachet
GHN = New Green Hill Pond Watershed system

5 = the system number (preestablished)
MAZ = homeowner name code
Date = month/day/year that sample was collected (sample event date)
STE = sample location – septic tank effluent
SFE = sample location – sand filter effluent
PFE = sample location – peat filter effluent
NXE = sample location – Nitrex (wood chip) upflow filter
FE = sample location – fixed activated sludge system effluent
RFE = sample location – Reactex textile filter effluent (coupon type textile media)
AXE = sample location – Advantex sheet type textile filter effluent
WBE = sample location – Waterloo (foam) Biofilter effluent
BSFE = sample location – bottomless sand filter effluent
RTE = sample location – recirculation tank effluent
SEPE = sample location – Septitech unit effluent (final effluent from aerobic tank)
PAT = sample location – primary anoxic tank (on Septitech system)
PCTE = sample location – processing tank effluent
UVE = sample location – ultraviolet light disinfection unit effluent

Prior to heading into the field, sample bottles will be prepackaged and organized in plastic bags according to system location, sample point location and component in the system treatment train. Sample bottle identification is checked by two separate individuals in the field to make certain that the correct bottles are being used for that particular site, sampling location, or component within the system treatment train.

Health, Safety and Protective Measures

All field sampling will be conducted and supervised by a team of experienced senior level investigators consisting of not fewer than two people. Any new field assistants will first be trained under the direction of a senior investigator before participating in sampling. Field personnel will not, under any circumstances, enter confined spaces. Use of long-handle PVC sample cup holders eliminates or greatly minimizes the occurrence of field crew body parts breaking the plane of the manhole /access risers while sampling. Electrical components used on demonstration systems are "touch safe" circuits and typically pose little threat to field personnel. All sampling personnel will use disposable latex, flexible PVC and/or heavy duty rubber gloves and eye protection while sampling. All field sampling personnel will adhere to standard hygiene practices when returning from the field. Upon leaving a sample site, all manhole access covers will be bolted down in place and double-checked by field staff to make certain they are secure. Component electrical switches in the system control panel boxes will be placed back into the operating position and double-checked before closing, latching and fastening the panel box door.

10.0 Sample Handling, Tracking, and Chain of Custody Requirements

Principal field sampling team members, will collect samples and handle the movement of all samples from the field to the University of Rhode Island Watershed Watch Lab. All samples will be hand delivered to the lab under the supervision of the Field Sampling Team Leader. A chain-of-custody form will be completed for each set of samples and will be provided to the lab along with the samples. A chain-of-custody form will be maintained in the project file. An example of this form is included in Appendix B.

11.0 Field Analytical Method Requirements

During each sample event, all field observations and readings on all electrical impulse (event) counters and time lapse meters installed for any system component / pump will be recorded in field sampling team members waterproof field books and on separate note cards located in the electrical control panel boxes. In addition, water meter readings (if so equipped) will be recorded for the pressure lines serving the drainfields on these systems. These water meter readings enable a very accurate calculation of average wastewater generation from the homes since the last sample date. Flows are calculated in the field with a hand-held calculator and noted in gallons per day (gpd). These readings are watched for abnormalities that can indicate a possible system malfunction. Appendix C contains an example of a field data sheet.

The dissolved oxygen concentration (D.O.; reported in mg/l) of the various tanks and component effluents will be measured in the field using a YSI, Inc. Model 550 Dissolved Oxygen Meter. Effluent temperature measurements will also be taken in the field using the temperature probe on the YSI D.O. Meter. Appendix D contains a field operating guide and standard operating procedures for maintaining, operating, and calibrating the D.O. meter.

12.0 Fixed Laboratory Analytical Method Requirements

Fixed laboratory analyses are *not* covered under this field sampling QAPP. Wastewater laboratory analyses will be performed in accordance with the requirements detailed in a previously-EPA accepted QAPP entitled *Kickemuit Reservoir Quality Assurance Project Plan* dated April 26, 2000. Nitrate nitrogen and fecal coliform analyses only will follow the *QAPP For Private Well Tap Water Testing* (BIGHP Project) dated August 26, 2001 referenced earlier (see Appendix A for availability and contact information to receive a copy of these particular QAPP documents). SOPs that supplement the Kickemuit QAPP are available from Linda Green, Wastewater Watch Director. Please see the distribution list for contact information.

13.0 Quality Control Requirements

Quality control (QC) requirements are the system of technical activities that measure the performance of a process. For the purposes of this study, quality control requirements will be utilized within the various aspects of field and fixed laboratory activities/analysis following the procedures outlined in Worksheet 22a, in the *Kickemuit Reservoir Quality Assurance Project Plan* dated April 26, 2000 (see Appendix A). Field precision will not be determined for this project and field duplicates will not be collected due to the following reasons: the remote nature of Block Island systems, the overall difficulty in obtaining adequate sample volumes, the large number of sample locations sampled per event, sampling day time constraints, and field sample holding times. A set of bottle blanks will be included for each sample event to help determine any contamination introduced from sample containers. A set of field trip bottle blanks will be included for each sample event, which will help determine any introduced sampling error. Sample transport cooler temperature will be determined for each sample event. Some of the of the installed technologies have replicate systems, which should provide some limited quality control.

14.0 External Data Acquisition Requirements

There will be no data acquired from external sources.

15.0 Documentation, Records, and Data Management

The Onsite Wastewater Training Center Project Managers will be in charge of field sampling, collecting and recording field data, analyzing system performance data, preparation of reports and transmission of this performance information to funding agencies and interested parties. Sample collection is documented in SOP-1 and 2, as outlined in Appendix D and E, respectively. Field data information, as indicated in Appendix C, will be collected at the time of sampling. This information will be recorded manually by the Field Sampling Team Leader, on pages in a waterproof field notebook, and in pencil. Corrections to this recorded field data will be accomplished by a single line drawn through errors and initialed. Appendix B illustrates the information that will be documented when field samples are transferred from the field and into the lab. Project documentation is illustrated in Worksheet 26.

Dissolved oxygen, temperature, and flow volume data documented in original field notebooks will be converted to Microsoft Excel data files and stored as electronic copies on computer hard drive, as well as on CD. A hard copy version of this data will also be kept on file by the Field Sampling Team Leader.

16.0 Assessment and Response Actions

Field sampling procedures and data collected in the field will be periodically assessed by the Field Sampling Team Leader to ensure that procedures and data are usable for the purposes of this study. It is not anticipated that assessments will be needed often, but rather at certain times. For example, field sampling procedures will be reviewed whenever a new technology is sampled, if system operating parameters are changed, or whenever an obvious sampling problem arises in the field that may compromise collection of useful data. The decision to modify a sampling procedure will be made by the Project Managers and Field QA Officer. A primary cause of an assessment will be a deviation from the field sampling SOP 1 and 2 (Appendix D and E), or from the Field SOPs Assessment Checklist in Appendix F. Corrective actions to an assessment will be done by verbal communication from the Field Sampling Team Leader.

17.0 Quality Assessment Management Reports

No quality management reports are expected to be generated from these field sampling efforts.

18.0 Verification and Validation Requirements

The Project Managers and the Field QA Officer will review all field sampling data collected during this study to determine if the data meets QAPP objectives. Decisions to qualify or reject data will be made by the Project Managers and Field QA Officer.

19.0 Verification and Validation Procedures

All field data collected will be reviewed by the URI OWT Center Project Managers for indications of possible treatment system malfunction. Key field data that the Project Managers will watch for that may indicate possible treatment system malfunction may include – dissolved oxygen concentrations and/or excessive number of pump cycles. Clarity or odor of a sample, the wastewater level in a tank of treatment unit, and the presence of ponded effluent are visual indicators of possible abnormal conditions. The field sampling team will watch for these conditions, make field notes when found, and investigate the potential cause and make note of that, and perform corrective actions if needed. Field notes will be kept on file by Field Sampling Team Leader.

Dissolved oxygen in primary treatment tanks or in processing tanks should be less than 0.3 mg/l, while secondary treatment steps (packed bed filters) should generally be above 2.5 mg/l, indicating favorable D.O. levels for nitrification of wastewater. Dissolved oxygen in recirculation tanks should be below 0.3 mg/l to promote biological denitrification.

The effluent from a single pass or recirculating sand filter, and textile filter should have the clarity of tap water and have no septic odor. Peat filter effluent will typically have an initial strong tea color and musty (but not septic) odor; the color gradually becoming lighter with time. Extended aeration and aerobic treatment unit effluent typically looks cloudy and has a slight septic odor. These factors vary depending upon the treatment technology and the amount of hydraulic flow through the system. Excessive pump cycles (as determined from review of the data from electrical panel controls in a system) will typically indicate a period of excess flow, which may translate into poor treatment performance.

It is typical in colder months to see a reduction in temperature in a system treatment train from the proximal end (inlet end of technology) to the distal end (final effluent). The temperature depends on home wastewater generation, technology, aspect of system (south vs north side of property), shading from trees or buildings, and ground cover / protection over system. The field sampling team will watch temperature readings for abnormal dips or spikes (in summer) that could indicate a potential problem.

Collected field data will be entered into Microsoft Excel files. The Project Managers will review the field log sheets, proofread the data entry for errors and correct as needed. Outliers and inconsistencies will be flagged for further review with the QA Officer. The decision to discard field data will be made by the Onsite Wastewater Training Center Project Managers and the Field QA Officer. Field sampling problems will be discussed in any final report(s).

Sample log in reports (COC forms) will be reviewed internally upon their completion and verified against packed sample coolers once delivered to laboratory. These forms will be kept in a site file.

No formal QA/QC management reports will be generated for the field sampling verification aspects of this QAPP. The URI Watershed Watch Laboratory Director and Manager will review QC results related to *fixed laboratory activities* as well as qualify lab data under the provisions of the separate *Kickemuit Reservoir Watershed QAPP* and the *QAPP for Private Well Tap Water Testing* (BIGHP Project). The URI Watershed Watch Lab participates in EPA WP studies 1 –2 times per year and uses the remaining QA samples for ongoing quality control in the laboratory.

20.0 Data Usability / Reconciliation with Project Quality Objectives

The routine effluent temperature, dissolved oxygen, and gallons per day data are reviewed in the field at the time of sampling to make sure the system is functioning. If data does not meet the expected measurement performance criteria, then the data may be discarded and the system sampled again or the data may be used with a stipulation written about its accuracy in reports. The expected cause of error will be evaluated and corrective measures taken. Limitations in the field data will be documented in the final report.

21.0 References Cited

American Public Health Association, American Water Works Association, and Water Pollution Control Federation. 1995. Standard Methods for the Examination of Water and Wastewater. 19th ed. APHA. Washington, DC.

EPA WORKSHEETS SECTION

EPA-NE QAPP Worksheet #9c - Rev. 10/99
Summarize by matrix the number of field and QC samples that will be collected for each analytical parameter and concentration level. (Refer to *QAPP Manual* Section 6.1 for guidance.)

Title:
Revision Number:
Revision Date:
Page: of

Field and Quality Control Sample Summary Table

Medium/ Matrix	Analytical Parameter	Conc. Level	Analytical Method/ SOP Reference[1]	No. of Sampling Locations[2]	No. of Field Duplicate Pairs	Organic		Inorganic		No. of Trip Blanks	No. of Bottle Blanks	No. of Equip. Blanks	No. of PE Samples	Total No. of Samples to Lab for Each Parameter
						No. of MS	No. of MSD	No. of Duplicates	No. of MS					
Wastewater	TN / TP	ppb to ppm	URI WW SOP – 1B	See Tables 2 and 12b										CH = 13 GH = 13 BI = 21 GHN = 22
Wastewater	Fecal coliform	# / 100 ml	URI WW SOP – 4B	Same as above										CH = 13 GH = 15 BI = 21 GHN = 22
Wastewater	NO3 NH4 – N	ppb to ppm	URI WW SOP – 2 URI WW SOP - 3	Same as above										CH = 13 GH = 13 BI = 21 GHN = 22
Wastewater	BOD TSS	mg / l	URI WW SOP – 6 URI WW SOP - 9	Same as above										CH = 13 GH = 13 BI = 21 GHN = 22
Wastewater	Alkalinity	ppm	URI WW SOP – 7A	Same as above										CH = 13 GH = 13 BI = 21 GHN = 22
Wastewater	PH	Standard units	URI WW SOP – 7A	Same as above										CH = 13 GH = 13 BI = 21 GHN = 22
Wastewater	Disolved oxygen Temperature	ppm Degrees C	URI OWT SOP – 1	Same as above										CH = 13 GH = 13 BI = 22 GHN = 22

[1]Complete the Field Analytical Method/SOP Reference Table (EPA-NE QAPP Worksheet #17), and the Fixed Laboratory Method/SOP Reference Table (EPA-NE QAPP Worksheet #20) and specify the appropriate letter/number reference in the above table.
[2]If samples will be collected at different depths at the same location, count each discrete sampling depth as a separate sampling location/station.

EPA-NE QAPP Worksheet #12b - Rev. 10/99
List all site locations that will be sampled and include sample location ID number, if applicable. Specify medium/matrix and, if applicable depth at which samples will be taken. Complete all required information, using additional worksheets if necessary. (Refer to *QAPP Manual* Section 8.1 for guidance.)

Title:
Revision Number:
Revision Date:
Page: of

Sampling Locations, Sampling and Analysis Method/SOP Requirements Table

Sampling Location[1,2]	Location ID Number	Medium/ Matrix	Depth (Units)	Analytical Parameter	Conc. Level	No. of Samples (Identify field duplicates and replicates)	Sampling SOP[3]	Analytical Method/SOP[3]	Sample Volume	Containers (Number, size and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/ analysis)
Glocester, R.I. Green Hill Pond (existing) Green Hill Pond (new) Block Island	CH 1- 5 GH 1-7 GHN 8 - 17 BI 3-6, 8, 10-12	Wastewater	N/A	Nitrate N	ppb - ppm	13 13 22 21	URI OWT SOP - 2	URI WW SOP – 2 (All Watershed Watch SOPs are available from Linda Green, WW Lab Director)	100 ml	Brown glass	Refrigerate /on ice At 4 degrees C	28 days with acidification; 4 days without
Same	Same	Same	N/A	Fecal coliform	Counts/100ml	Same as above, plus 2 more for GH existing	URI OWT SOP - 2	URI WW SOP – 4B	250 ml	Sterile plastic	Same as above	6 hours
Same	Same	Same	N/A	BOD-5	ppm	Same as nitrate	URI OWT SOP - 2	URI WW SOP – 6	500 ml	Plastic	Same as above	24 hours
Same	Same	Same	N/A	TSS	ppm	Same as nitrate	URI OWT SOP - 2	URI WW SOP - 9	250 ml	Plastic	Same as above	7 days
Same	Same	Same	N/A	pH	Std. Units	Same as nitrate	URI OWT SOP - 2	URI WW SOP - 7A	125 ml	Plastic	Same as above	24 hours
Same	Same	Same	N/A	Tot. P	ppm	Same as nitrate	URI OWT SOP - 2	URI WW SOP – 1B	125 ml	Brown glass	Same as above	28 days with acidification; 4 days without
Same	Same	Same	N/A	Tot. N	ppm	Same as nitrate	URI OWT SOP – 2	URI WW SOP – 1B	125 ml	Brown glass	Same as above	28 days with acidification; 4 days without

EPA-NE QAPP Worksheet #12b - Rev. 10/99
List all site locations that will be sampled and include sample location ID number, if applicable. Specify medium/matrix and, if applicable depth at which samples will be taken. Complete all required information, using additional worksheets if necessary. (Refer to *QAPP Manual* Section 8.1 for guidance.)

Title:
Revision Number:
Revision Date:
Page: of

Sampling Locations, Sampling and Analysis Method/SOP Requirements Table

Sampling Location[1,2]	Location ID Number	Medium/ Matrix	Depth (Units)	Analytical Parameter	Conc. Level	No. of Samples (Identify field duplicates and replicates)	Sampling SOP[3]	Analytical Method/SOP[3]	Sample Volume	Containers (Number, size and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/ analysis)
Same	Same	Same	N/A	Ammon. N	ppm	Same as nitrate	URI OWT SOP - 2	URI WW SOP - 3	125 ml	Brown glass	Same as above	28 days with acidification; 4 days without
Same	Same	Same	N/A	Dissolved Oxygen	ppm	CH = 12 GH = 15 GHN = 21 BI = 22	URI OWT SOP – 1	URI OWT SOP – 1	N/A	N/A	N/A	N/A
Same	Same	Same	N/A	Temperature	Degrees C	Same as for dissolved oxygen	URI OWT SOP – 1	URI OWT SOP – 1	N/A	N/A	N/A	N/A
Same	Same	Same	N/A	Alkalinity	ppm	Same as nitrate	URI OWT SOP – 2	URI WW SOP – 7	125 ml	Plastic	Same as nitrate	24 hours

[1]Indicate critical field sampling locations with "1".
[2]Indicate background sampling locations with "2".
[3]Complete the Project Sampling SOP Reference Table (EPA-NE QAPP Worksheet #13), Field Analytical Method/SOP Reference Table (EPA-NE QAPP Worksheet #17), and Fixed Laboratory Method/SOP Reference Table (EPA-NE QAPP Worksheet #20) and specify the appropriate letter/number reference in the above table.

EPA-NE QAPP Worksheet #13 - Rev. 10/99
List all SOPs associated with sample collection. Include copies of all written SOPs as attachments to the QAPP. Sequentially number sampling SOP references in the Reference Number column. Use additional pages if necessary. The Reference Number can be used throughout the QAPP to refer to a specific SOP. (Refer to *QAPP Manual* Sections 9.1-9.3 for guidance.)

Title:
Revision Number:
Revision Date:
Page: of

Project Sampling SOP Reference Table

Reference Number	Title, Revision Date and/or Number	Originating Organization	Equipment Identification	Modified for Project Work Y or N	Comments
URI OWT SOP – 1	Handheld Dissolved Oxygen and Temperature Meter Operations Procedures	YSI Incorporated	YSI Model 550 Dissolved Oxygen Meter	N	
URI OWT SOP - 2	Onsite Wastewater System Field Sampling Procedures	URI Onsite Wastewater Training Center	Not Applicable	N	

EPA-NE QAPP Worksheet #16 - Rev. 10/99
Use this worksheet to identify components of the project-specific sample handling system. Record personnel and their organizational affiliations, who are primarily responsible for ensuring proper handling, custody, and storage of field samples from the time of collection to laboratory delivery, to final sample disposal. Indicate the number of days original field samples and their extracts/digestates will be archived prior to disposal. (Refer to *QAPP Manual* Section 10.2 for guidance.)

Title:
Revision Number:
Revision Date:
Page: of

Field Sample Handling System

SAMPLE COLLECTION, PACKAGING AND SHIPMENT
Field Sample Collection: George Loomis and David Dow URI Onsite Wastewater Training Center
Field Sample Packing: As above
Coordination of Shipment: As above
Type of Shipment (Courier): Samples hand delivered
SAMPLE RECEIPT AND ANALYSIS
Responsible Organization: URI Watershed Watch Laboratory
Sample Receipt: Elizabeth Herron, Laboratory Manager / Linda Green, Laboratory Director
Sample Custody and Storage: Elizabeth Herron / Linda Green
Sample Preparation: Elizabeth Herron / Linda Green
Sample Determinative Analysis: Elizabeth Herron / Linda Green

EPA-NE QAPP Worksheet #16 - Rev. 10/99
Use this worksheet to identify components of the project-specific sample handling system. Record personnel and their organizational affiliations, who are primarily responsible for ensuring proper handling, custody, and storage of field samples from the time of collection to laboratory delivery, to final sample disposal. Indicate the number of days original field samples and their extracts/digestates will be archived prior to disposal. (Refer to *QAPP Manual* Section 10.2 for guidance.)

Title:
Revision Number:
Revision Date:
Page: of

Field Sample Handling System

SAMPLE COLLECTION, PACKAGING AND SHIPMENT
SAMPLE ARCHIVAL
Field Sample Storage (No. of days from sample collection): 3 months for nutrients; 1 week for all others
Sample Extract/Digestate Storage (No. of days from extraction/digestion): 30 days
SAMPLE DISPOSAL
Responsible Organization: URI Watershed Watch Laboratory
Responsible Personnel: Elizabeth Herron / Linda Green

EPA-NE QAPP Worksheet #22a - Rev. 10/99
Complete a separate worksheet for each sampling technique, medium/matrix, analytical parameter and concentration level. If an analytical parameter[1] has multiple analytes, then complete EPA-NE QAPP Worksheet #22b. Worksheet #22b lists the overall field and analytical precision and accuracy/bias expected for each analyte when using the specified sampling and analytical technique. If method/SOP QC acceptance limits[2] exceed the measurement performance criteria[3], then data may not meet user needs. (Refer to *QAPP Manual* Sections 13.0 and 13.1, and Table 4 for guidance.)

Title: GHP-BI Tap Water
Revision Number:1
Revision Date: 7/16/01
Page: 1 of 1

Field Sampling QC Table

Field Sampling SOP*	URI OWT SOP-2
Medium/Matrix	Wastewater
Analytical Parameter[1]	For All Fixed Lab Analyses (see Table 4a-d)
Concentration Level	Low to high
Analytical Method/SOP Reference	See Kickemuit Reservoir and Private Well Tap Water Testing QAPPs and URIWW SOPs
Sampler's Name	URI OWT Staff
Field Sampling Organization	URI OWT Staff
No. of Sample Locations	CH=5, BI<=8, GH<=7, GHN <= 10

Field QC:	**Frequency/Number**	**Method/SOP QC Acceptance Limits[2]**	**Corrective Action (CA)**	**Person(s) Responsible for CA**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria[3]**
Equipment Blanks/ Rinsate Blanks	N/A					
Bottle Blanks	1 (Does not apply to pH)	No target compounds >QL	Qualify data	L Green, E Herron	Accuracy/bias/ contamination	No target compounds >QL
Trip Blanks	1 (Does not apply to pH)	Same as above	Same as above	Same	Same as above	Same as above
Cooler Temperature Blanks	1 per cooler	4 deg. C +/_2 deg C.	Qualify data	L Green, E Herron	Accuracy/bias/ preservation	4 deg C +/- 2 deg C
Field Duplicate Pairs	N/A					

EPA-NE QAPP Worksheet #22a - Rev. 10/99
Complete a separate worksheet for each sampling technique, medium/matrix, analytical parameter and concentration level. If an analytical parameter[1] has multiple analytes, then complete EPA-NE QAPP Worksheet #22b. Worksheet #22b lists the overall field and analytical precision and accuracy/bias expected for each analyte when using the specified sampling and analytical technique. If method/SOP QC acceptance limits[2] exceed the measurement performance criteria[3], then data may not meet user needs. (Refer to *QAPP Manual* Sections 13.0 and 13.1, and Table 4 for guidance.)

Title: GHP-BI Tap Water
Revision Number:1
Revision Date: 7/16/01
Page: 1 of 1

Field Sampling QC Table

Field Sampling SOP*	URI OWT SOP-2
Medium/Matrix	Wastewater
Analytical Parameter[1]	For All Fixed Lab Analyses (see Table 4a-d)
Concentration Level	Low to high
Analytical Method/SOP Reference	See Kickemuit Reservoir and Private Well Tap Water Testing QAPPs and URIWW SOPs
Sampler's Name	URI OWT Staff
Field Sampling Organization	URI OWT Staff
No. of Sample Locations	CH=5, BI<=8, GH<=7, GHN <= 10

Field QC:	**Frequency/Number**	**Method/SOP QC Acceptance Limits[2]**	**Corrective Action (CA)**	**Person(s) Responsible for CA**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria[3]**
(Duplicate Subsamples)						
Collocated Samples	N/A					
Field Splits	N/A					
PES sent to Laboratory	N/A					

***Specify appropriate reference number/letter from the Project Sampling SOP Reference Table (EPA-NE QAPP Worksheet #13), Field Analytical Method/SOP Reference Table (EPA-NE QAPP Worksheet #17), and Fixed Laboratory Method/SOP Reference Table (EPA-NE QAPP Worksheet #20).**

EPA-NE QAPP Worksheet #26 - Rev. 10/99
Identify the documents and records that will be generated for all aspects of the project. (Refer to *QAPP Manual* Section 15.1 for guidance.)

Title: Alternative Onsite Wastewater Systems
Revision Number: 1
Revision Date: August 2003
Page: of

Project Documentation and Records Table

Sample Collection Records	Field Analysis Records	Fixed Laboratory Records	Project Data Assessment Records	Other ____________
Field log books / notes	Sample log in / tracking sheet	Sample receipt and tracking logs	Field sampling checklists	
Field data collection notes		Results of EPA WP QC tests	EPA WP QC sample results	
Sample bottle label list form		Preparation and analysis forms	Data validation reports	
		Sample prep and run logs		
		Tabulated data summary forms		
		Raw data for field samples, standards, QC checks and samples		
		Reported results for field samples, standards, QC checks and samples		

APPENDIX A. Availability and contact information to receive a copy of:

Kickemuit Reservoir Quality Assurance Project Plan **dated April 26, 2000. And / or**

QAPP for Private Well Tap Water Testing, a component of the Block Island and Green Hill Pond Watershed National Community Decentralized Wastewater Treatment Demonstration Project

Contact person:

Stephen DiMattei
Environmental Protection Agency, Region 1
Office of Environmental Measurement & Evaluation
11 Technology Drive
N. Chelmsford, MA 01863
Phone: 617-918-8369 Fax: 617-918-8397

Appendix B. Example Septic System Sample Login in Sheet

DATE:________________

Check in each sample bottle to be sure that it has been received.
*** indicates that there should be a filled bottle brought in from the field.**
**** indicates a bottle that is filled in the laboratory (ie. filtered from field samples).**
If there is nothing in the box, there should NOT be bottle.

Comm	Site	Sample Location	Log - in Tech. Initials	Sample Date	Fecal sterile plastic	TSS/BOD Large plastic	pH Plastic	Nutrients Brown Glass Unfiltered	Nutrients Brown Glass Filtered	Filtering Tech. Intials
GH	1 Gre	STE –S			*	*	*	*	**	
GH	1 Gre	RFE			*	*	*	*	**	
GH	1 Gre	SFE			*	*	*	*	**	
GH	2 Twe	STE –S			*	*	*	*	**	
GH	2 Twe	RFE			*	*	*	*	**	
GH	3 Mat	STE –R			*	*	*	*	**	
GH	4 Haz	STE –S			*	*	*	*	**	
GH	4 Haz	SFE			*	*	*	*	**	
GH	5 Maz	STE –S			*	*	*	*	**	
GH	5 Maz	RFE			*	*	*	*	**	
GH	6 Sis	STE –S			*	*	*	*	**	
GH	6 Sis	PFE			*	*	*	*	**	
GH	6 Sis	UVE			*					
GH	7 Tar	FE			*	*	*	*	**	
GH	7 Tar	UVE			*					

Delivered by: ____________________   Date/time: ____________________

Appendix C
Example Field Data Sheet for Alternative and Innovative System Sampling

Date: **Weather:** **Personnel:**

System	Sample location *	Temp ^{o}C	Dissolved Oxygen mg/l	Event reading Septic tank	Event reading Drainfield	Lapsed time Septic tank (hrs)	Lapsed time Drainfield (hrs)	Flow meter reading (gals)
GH 4 H	STE							
	RSFE							
	SFE							
	RTE							
	PFE							
	FE							
	BSFE							
	WBE							

* Where STE = septic tank effluent; RSFE = recirculating sand filter effluent; SFE = sand filter effluent; RTE = Reactex filter effluent; PFE = peat filter effluent; FE = FAST effluent; BSFE = bottomless sand filter effluent; WBE = Waterloo Biofilter effluent. The mention of proprietary devices here does not form an endorsement by the authors, they are mentioned only as an example of systems typically encountered in the field in Rhode Island.

Appendix D

Standard Operating Procedures for Maintaining, Operating, and Calibrating

YSI Model 550 Dissolved Oxygen and Temperature Meter

URI OWT – SOP – 1

Inspection

1. Visually check for air bubbles under the probe membrane. If bubbles are visible, replace the probe tip.
2. Check that batteries are fresh and have sufficient power. Replace if necessary.
3. Check overall condition of meter, probe and cable for damage that would require servicing or replacement.

Calibration

1. Ensure that the sponge inside the calibration chamber is moist. Insert the probe into the calibration chamber.
2. Turn the instrument on by pressing the ON/OFF button on the front of the instrument. Wait for the dissolved oxygen and temperature readings to stabilize (usually 15 minutes is required after turning the instrument on).
3. Choose to calibrate the instrument in mg/l BEFORE entering the calibration mode. Press the Mode key to switch between mg/l and percent saturation to be displayed as the meter reading units. The meter will display mg/l on the right side on the screen.
4. To enter the calibration menu, use two fingers to press the release both the UP ARROW and DOWN ARROW keys at the same time.
5. Make sure that the DO reading (large display) is stable, then press the ENTER button. The do meter should now display CAL in the lower left of the display screen, the calibration value should be displayed in the lower right of the display and the current DO reading (before calibration) should be on the main display.
6. Make sure that the DO reading (large display) is stable, then press the ENTER button. The LCD screen will prompt you to enter the appropriate salinity of the water you are about to analyze. You can enter a number from 0 to 40 parts per thousand (PPT) of salinity. Use the arrow keys to increase or decrease the salinity settling When the correct salinity appears o the LCD (zero for fresh water), press the ENTER key. The instrument will then turn to normal operation.

Once the calibration is complete, the only keys that will remain operational are the MODE key, the LIGHT key and the ON?OFF key. If needed, the LIGHT key will activate the back-light of the meter display.

Appendix E
Onsite Wastewater System Field Sampling Procedures
URI OWT – SOP – 2

Safety Controls:

To protect personnel from accidental exposure while field sampling, gloves and eyewear will be worn while collecting and transporting samples. Waste materials will be disposed of in proper receptacle.

Materials / Location:

Room 001H URI Coastal Institute in Kingston

YSI Model 550 D.O. meter
3/16 inch hexagonal wrenches for accessing bolt down manhole covers
Philips and slotted screw drivers
Latex and rubber protective gloves
Protective glasses and first aid kit
PVC long handle sample cup holders
9 fl. ounce Sterile plastic cups
Hand calculator
Hand sanitizing lotion
Extra bottles, batteries, D.O. meter probe membranes
Hand siphon pump, polyethylene hoses

Room 001C URI Coastal Institute in Kingston

Waterproof field notebooks

URI Watershed Watch Lab, Room 002 Coastal Institute in Kingston

Sample bottles – prepared and prepackaged in plastic bags according to system and sample point location within the system.
2 Coolers appropriately labeled as containing wastewater samples.

Basement North end of URI Woodward Hall

Ice machine. Fill coolers half way with ice.

Methods:

Prior to sampling day:

1. Set up field sample book.
2. Check sample bottle order to verify all bottles are accounted for.
3. Load sample bottles into large tote bags.

Sampling day:

1. Fill coolers half way with ice.
2. Turn dissolved oxygen meter on at least 20 minutes before calibrating so it can warm up.
3. At first site calibrate D.O. meter using procedure in Appendix D
4. Remove appropriate sample bottles, separating bottles by sample point locations in system.
5. Have separate person verify that sample bottle labels match the sample point location in system, before collecting any samples.
6. Open the electrical panel box. Determine event counter and lapse time meter readings and record them in the field note book and on the card located on the door of the panel box.
7. Open the manholes or access covers to the appropriate sample point locations in the system. Be careful to place the hex head bolts in a location where they will not be lost.
8. Visually observe level in tank or component; note any odd odors. Record if abnormal.
9. Place a clean sterile sample cup into the PVC holder avoiding touching the inner surfaces of the cup.
10. **For pipe end sample points.** Collect effluent flowing out of the pipe end into a sample cup; avoid touching the lip of the cup to any surface that could cause dislodgement of organic material and contamination of the sample.
11. **For sample points at the distal ends of pressure manifolds (i.e. textile and sand filter <u>influent</u>.** Open the threaded end caps or ball valves at the distal end of the dosing manifold. Manually start pump by engaging toggle switch in control panel box. Allow wastewater to flow out of manifold ends to remove any accumulated solids and collect in-stream effluent sample directly into sample bottles.
12. **For sump areas where pipe end or pressure manifold samples are not feasible.** Insert clean polyethylene siphon tubing into sample zone area, and siphon sample into sample bottles.
13. Transfer sample in the cup to the appropriate labeled sample bottle. Avoid touching sample cup to lip of sample bottle.
14. Cap sample bottle tightly, invert bottle and watch for leaks in cap. Retighten cap or replace with a new clean cap if necessary.
15. Put sample bottles back into plastic bags and place in cooler.
16. Place D.O. probe into tank and submerge to about mid depth. Move the probe cable up and down over a distance of about three inches from the mid depth point to allow flow of liquid around the probe sensor. Determine D.O. and temperature in degrees Celsius and record in waterproof field notebook.

17. Remove D.O. probe, replace manhole / access riser lid, and secure lid to manhole / riser with hex head bolts.
18. At the system control electrical panel box, place all pump operating control switches in the automatic position, verify that current information has been entered on the panel box data and it has been placed back in door sleeve. Close and secure panel box with latch and safety screws.
19. Verify that all access risers lids are closed and secured. Verify that all field sampling equipment has been removed from the site.
20. Discard used sampling cups and disposable latex gloves into plastic garbage bag; place this bag in appropriate container for final disposal.

Appendix F

Field SOPs Assessment Check List

For URI OWT SOP – 1

Standard Operating Procedures for Maintaining, Operating, and Calibrating

YSI Model 550 Dissolved Oxygen and Temperature Meter

Inspection – To be done one or two days before sampling

1. Visually check for air bubbles under the D.O. probe membrane. If bubbles are visible, replace the probe tip.
2. Check that batteries are fresh and have sufficient power. Replace if necessary.
3. Check that spare batteries are present in field sampling supply box.
4. Check overall condition of meter, probe and cable for damage that would require servicing or replacement.
5. Check that the sponge inside the calibration chamber is moist

Calibration – To be done on the sampling day

1. Verify that the instrument has been turned on about 15 minutes prior to its intended use.
2. Calibrate the instrument following the procedure in SOP – 1.
3. Assure that the D.O. probe is moved / agitated gently while in the sample to assure movement of liquid over the probe membrane.
4. Allow sufficient time for probe to be in contact with wastewater sample.
5. To the maximum extent possible, conduct readings in the shade to minimize the potential influence of direct sunlight on readings.
6. Check that probe is at the approximate middle depth and of a tank when taking readings.
7. Verify that tanks or treatment zones have not become D.O. stratified by moving the probe up and down slowly and noting changes in readings.
8. Check that meter reading has stabilized before recording temperature and D.O. readings.
9. Check that probe is thoroughly rinsed after final use and that instrument is allowed to dry before storing.
10. Check that sponge in instrument calibration chamber is moist before storage
11. Check condition of probe membrane and tip assembly, as well as overall condition of meter.
12. Verify that power to meter is turned off after use.

Appendix F (continued)

Field SOPs Assessment Check List

For URI OWT SOP – 2
Onsite Wastewater System Field Sampling Procedures

Safety Controls:

1. Prior to the sample date, check that all proper safety gear is readily available in the field sampling supply box.
2. Check that protective gloves and eyewear are worn while collecting and transporting samples.
3. Verify that waste materials are disposed of in proper receptacle.
4. Verify that field sampling personnel are using proper personal hygiene to minimize potential exposure to harmful agents in wastewater.
5. Check that field sampling personnel are keeping their heads up and out of manholes / access risers.
6. Check and recheck that all manhole / riser lids are secures before leaving the site.

Check that the following field sampling equipment is packed and ready to travel:

YSI Model 550 D.O. meter
3/16 inch hexagonal wrenches for accessing bolt down manhole covers
Philips and slotted screw drivers
Cordless drill with hexagonal bit and Robertson bit
Latex and rubber protective gloves
Protective glasses and first aid kit
PVC long handle sample cup holders
9 fl. ounce Sterile plastic cups
Hand calculator
Hand sanitizing lotion
Extra bottles, batteries, D.O. meter probe membranes
Hand siphon pump, polyethylene hoses
5 gallon carboy of tap water

Prior to sampling day:

1. Verify that the waterproof field notebooks have been pre-labeled prior to sample day.
2. Check that lab personnel have prepared the proper sample bottle order – and prepackaged in plastic bags according to system and sample point location within the system.
3. Check that the appropriate number of sample storage coolers are available.
4. Load sample bottles into large tote bags.

Sampling day:

1. Check that cooler are filled half way with ice.
2. Verify that dissolved oxygen meter has been turned on (warmed up) at least 20 minutes before calibrating.
3. Verify that D.O. meter was calibrated.
4. Check that the appropriate sample bottles have been placed at the correct sample point locations in system.
5. Have separate person verify that sample bottle labels match the sample point location in system, before collecting any samples.
6. Check that event counter and lapse time meter readings from the electrical control panel box has been recorded in the field note book and on the card located on the door of the panel box.
7. Check that the correct manholes or access covers to the appropriate sample point locations in the system have been opened. Check for sample point labeling on manhole covers. Check that the hex head bolts are placed in a location where they will not be lost.
8. Visually check level in tank or component; note any odd odors. Record if abnormal.
9. Check that a clean sterile sample cup is used for each sample point location
10. Check that fingers do not touch the inner surfaces of the sample cup.
11. For pipe end sample points. Check that the lip of the sample cup does not contact any surface that could cause dislodgement of organic material and contamination of the sample.
12. For sample points at the distal ends of pressure manifolds (i.e. textile and sand filter influent. Check that wastewater has been allowed to flow out of the threaded end caps / ball valves at the distal end of the dosing manifold to remove any accumulated solids prior to collecting in-stream effluent sample directly into sample bottles.
13. Check that the sample in the cup get transferred to the appropriate labeled sample bottle.
14. Check that sample cup does not touch lip of sample bottle.
15. Check that sample botles do not leak by, inverting the capped bottle and watching for leaks in cap. Retighten cap or replace with a new clean cap if necessary.
16. Check that sample bottles are placed back into the appropriately labeled plastic bags and place in cooler.
17. Check that ice is packed around bottles in the cooler.
18. Check that D.O. probe is placed at the mid depth level in the tank. Check that the probe is moved up and down over a distance of about three inches from the mid depth point to allow flow of liquid around the probe sensor.
19. Check that manhole / access riser lid are replaced, and that the hex head bolts secure the lid to manhole / riser.

20. At the system control electrical panel box, check that all pump operating control switches are placed in the automatic position, verify that current information has been entered on the panel box data and it has been placed back in door sleeve. Check that the panel box is closed and secured with latch and safety screws.
21. Recheck that all access risers lids are closed and secured. Verify that all field sampling equipment has been removed from the site.

APPENDIX G. Schematics of Alternative and Innovative Demonstration Systems

Figures 6 – 12.	Schematics of Treatment Trains and Sampling Point Locations for Existing Green Hill Pond Project Innovative Wastewater Treatment Systems
Figures 13 – 17.	Schematics of Treatment Trains and Sampling Point Locations for the Chepachet Village Project Innovative Wastewater Treatment Systems
Figures 18 - 27	Schematics of Treatment Trains and Sampling Point Locations for *New* Green Hill Pond Innovative Wastewater Treatment Systems (USEPA National Community Decentralized Wastewater Demonstration (BIGHP) Project)
Figures 28 - 35	Schematics of Treatment Trains and Sampling Point Locations for Block Island Innovative Wastewater Treatment Systems (USEPA National Community Decentralized Wastewater Treatment Demonstration (BIGHP) Project)

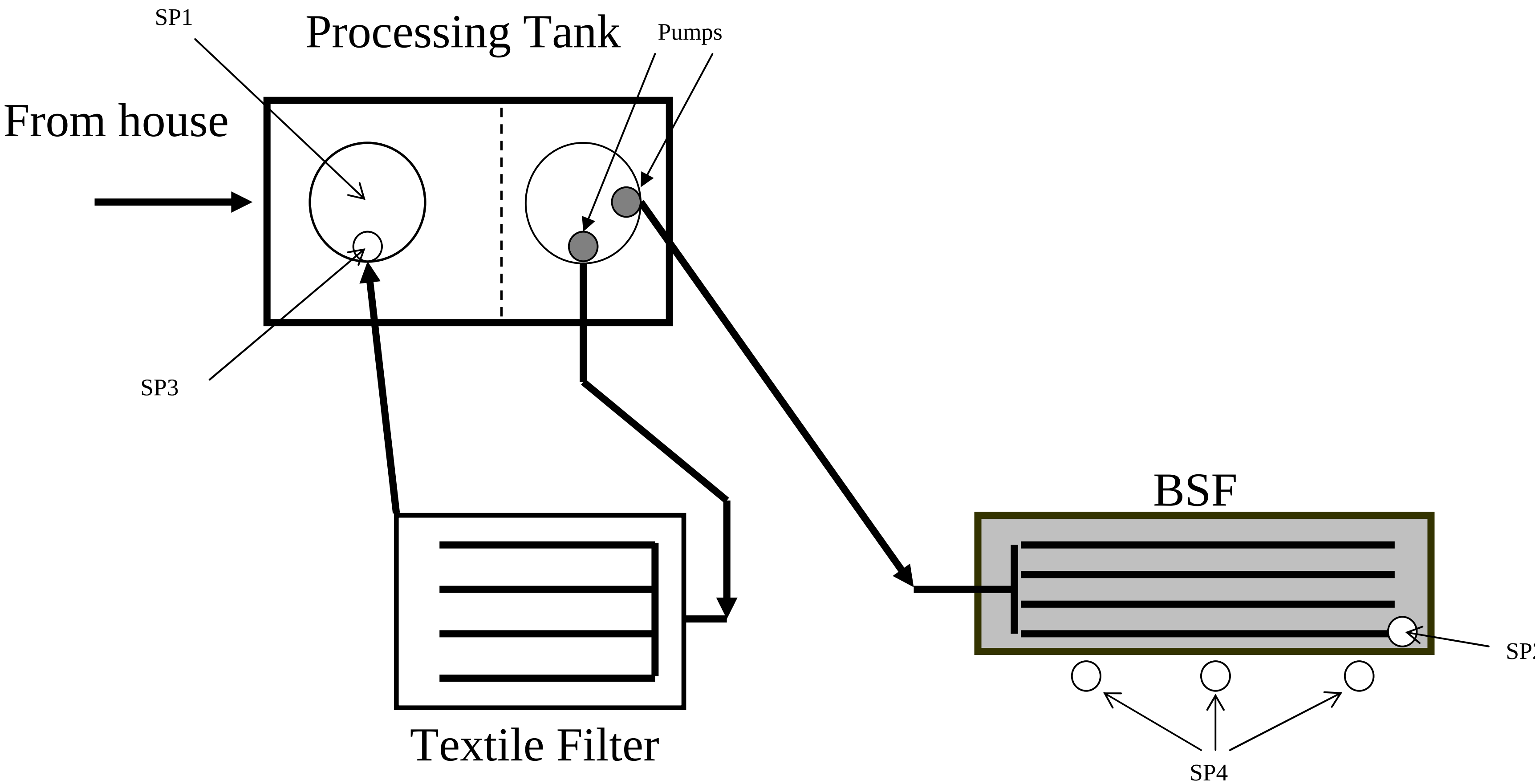


Figure 6. Textile Filter Treatment Train: Existing Green Hill Pond System GH 1 (GRE)

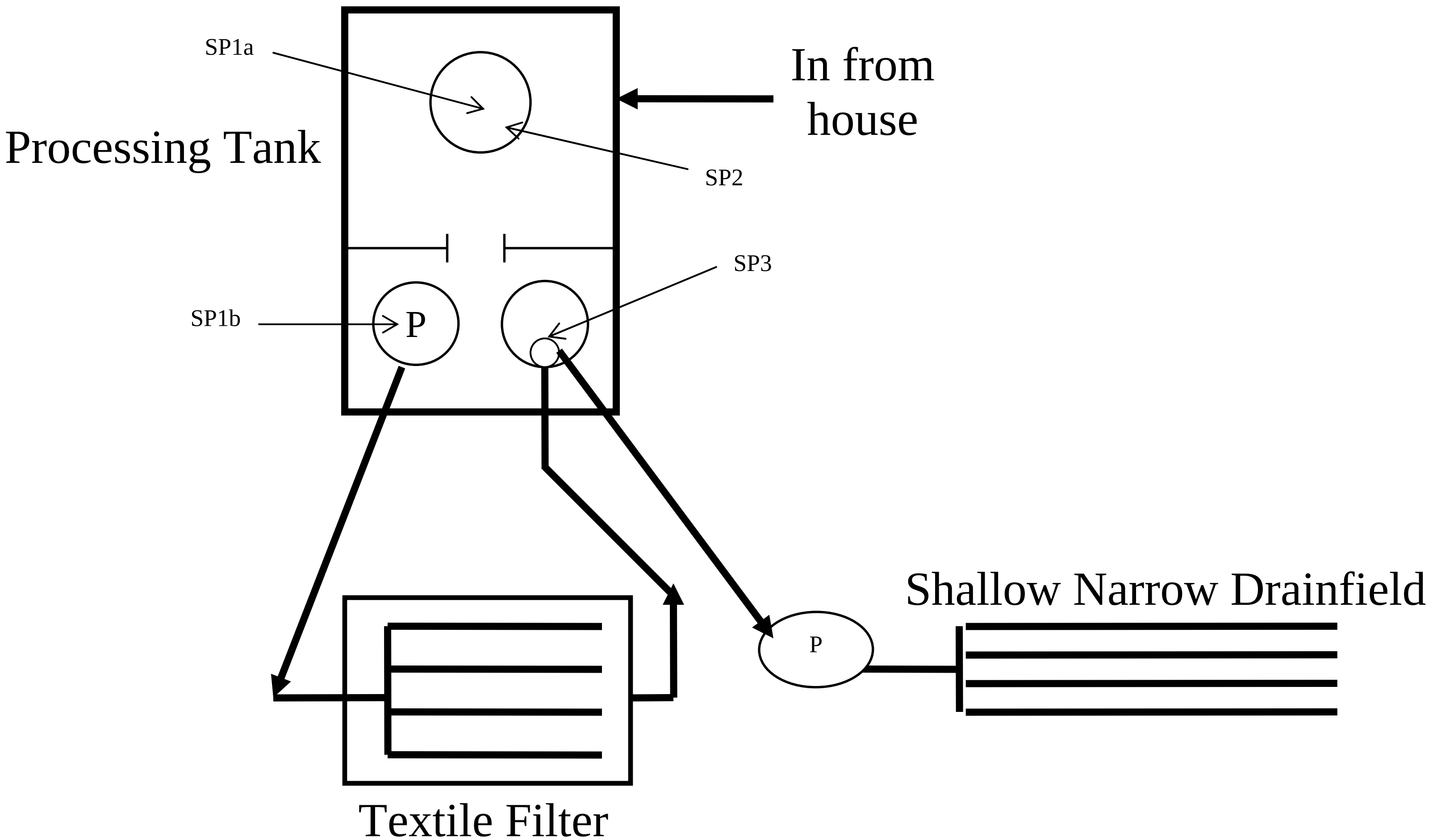


Figure 7. Textile Filter Treatment Train: Existing Green Hill Pond System GH 2 (TWE)

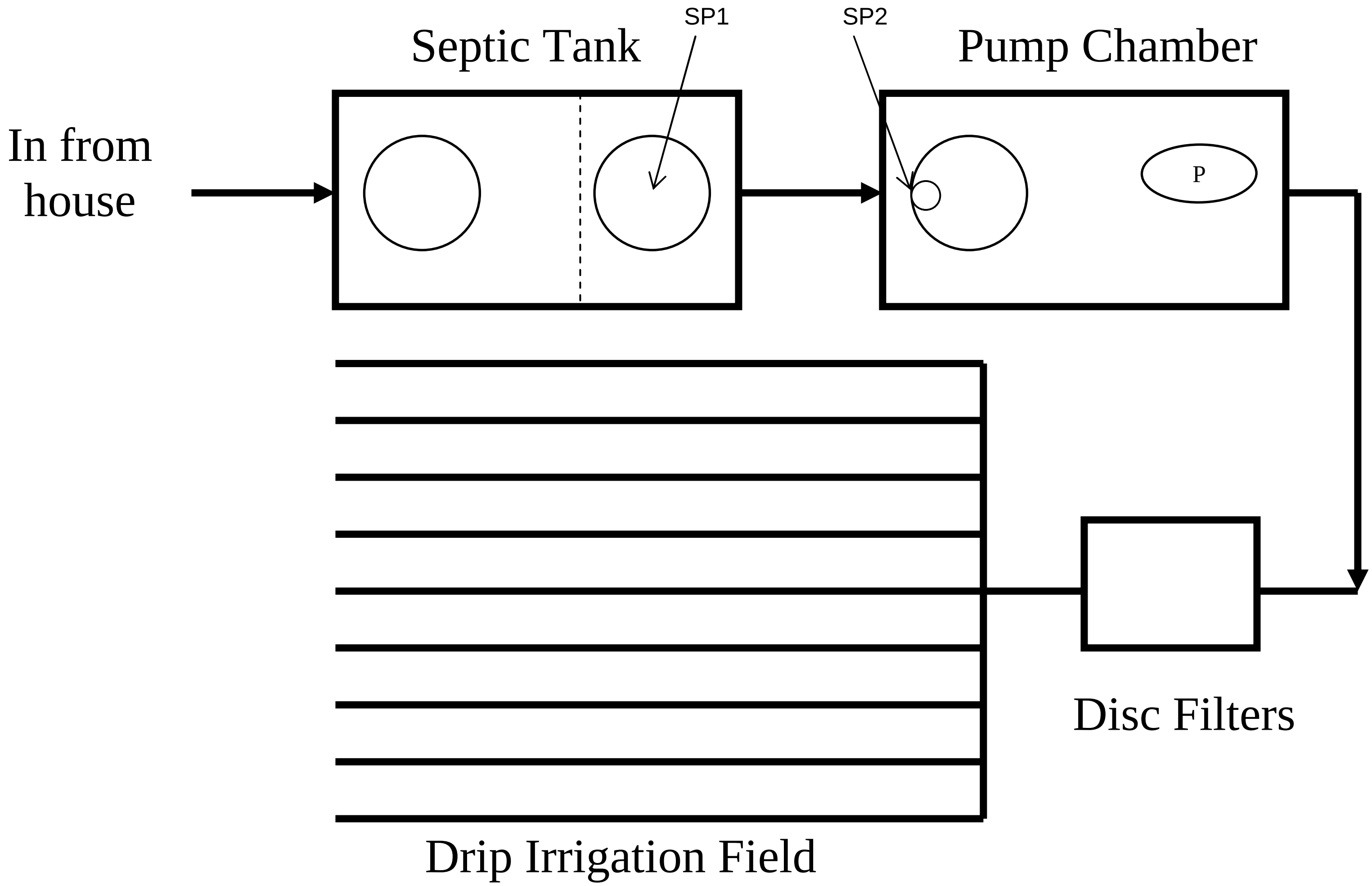


Figure 8. Drip Irrigation System Treatment Train: Existing Green Hill Pond System 3 (MAT)

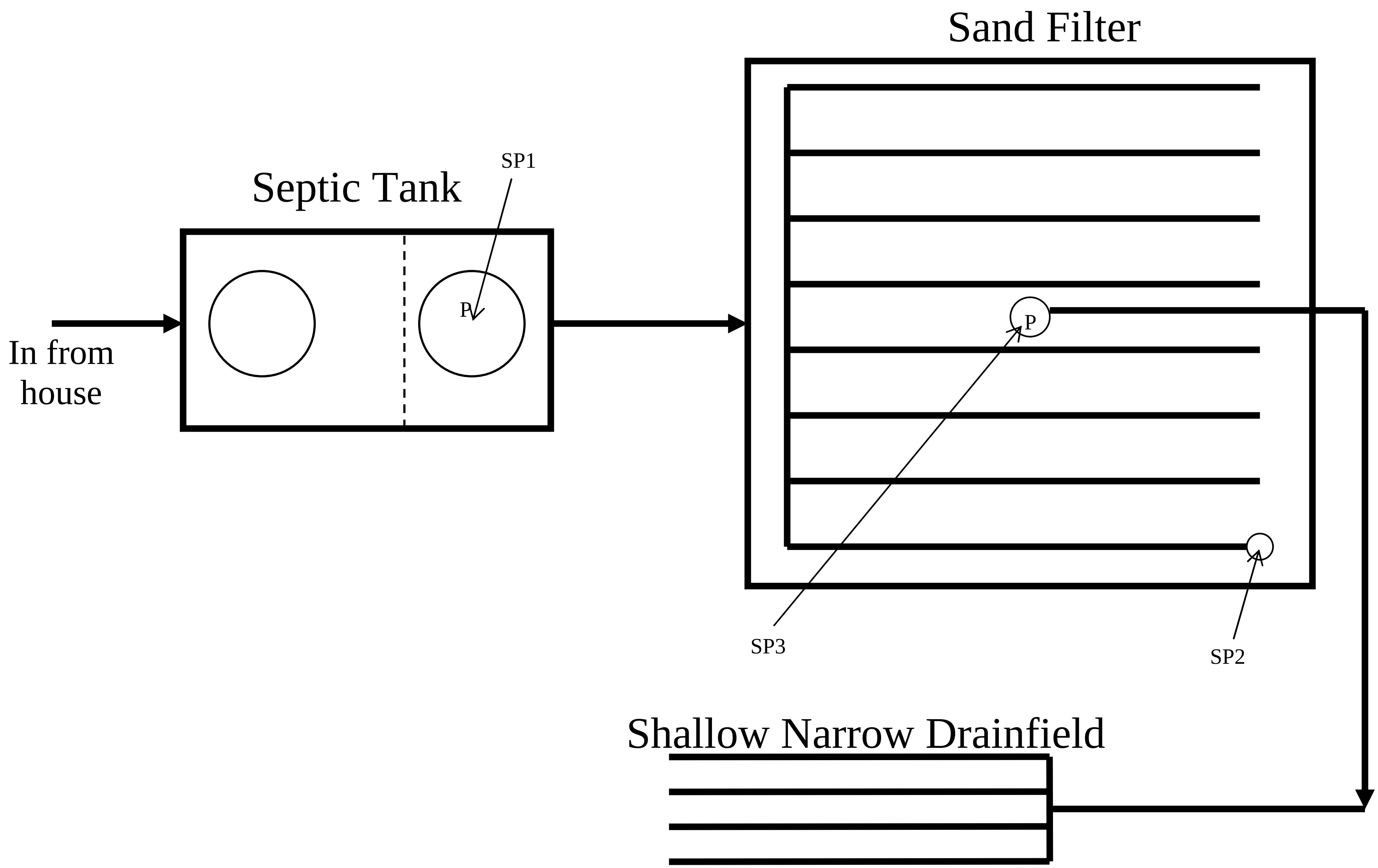


Figure 9. Single Pass Sand Filter Treatment Train: Existing Green Hill Pond System GH 4 (HAZ)

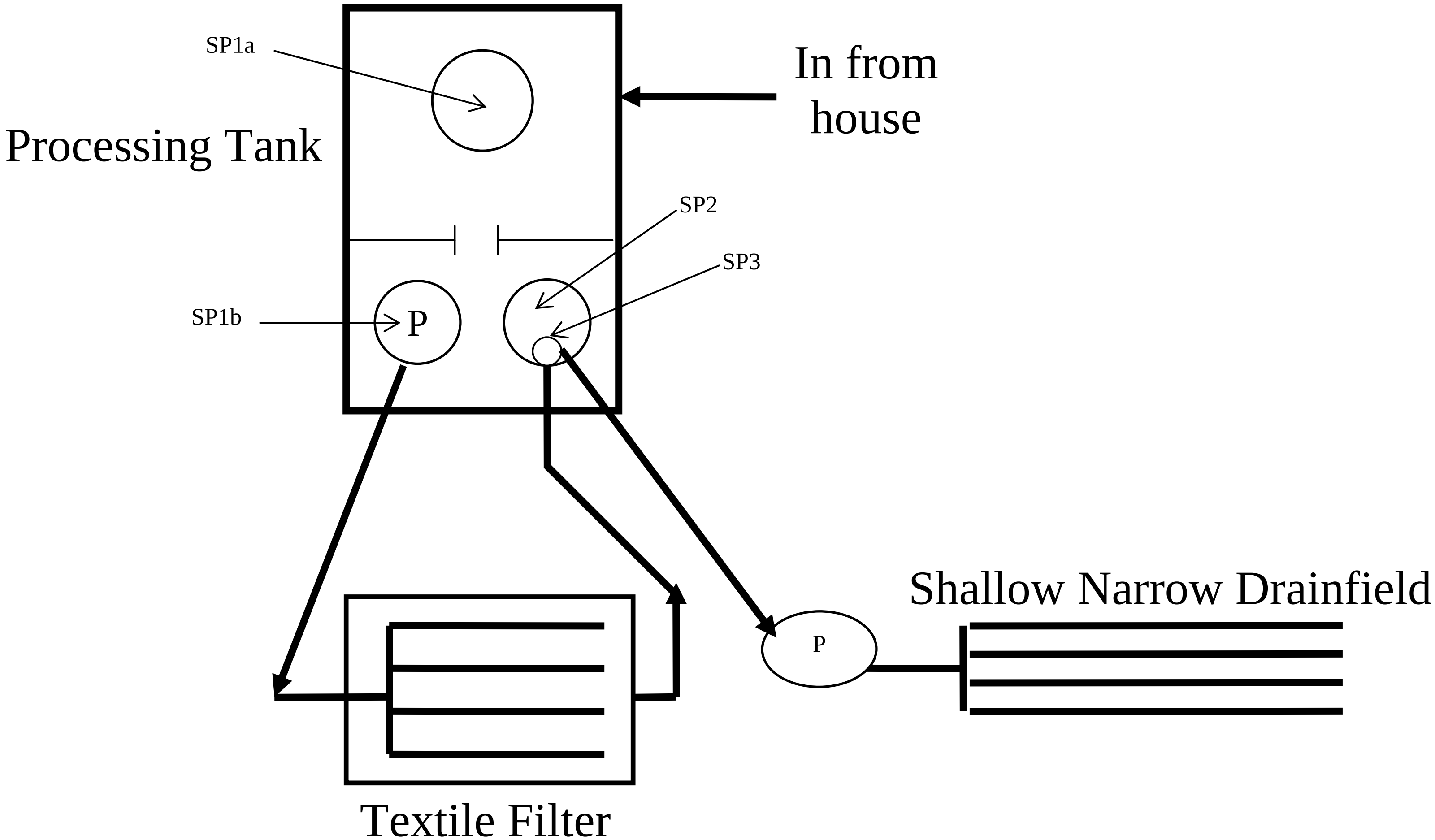


Figure 10. Textile Filter Treatment Train: Existing Green Hill Pond System GH 5 (MAZ)

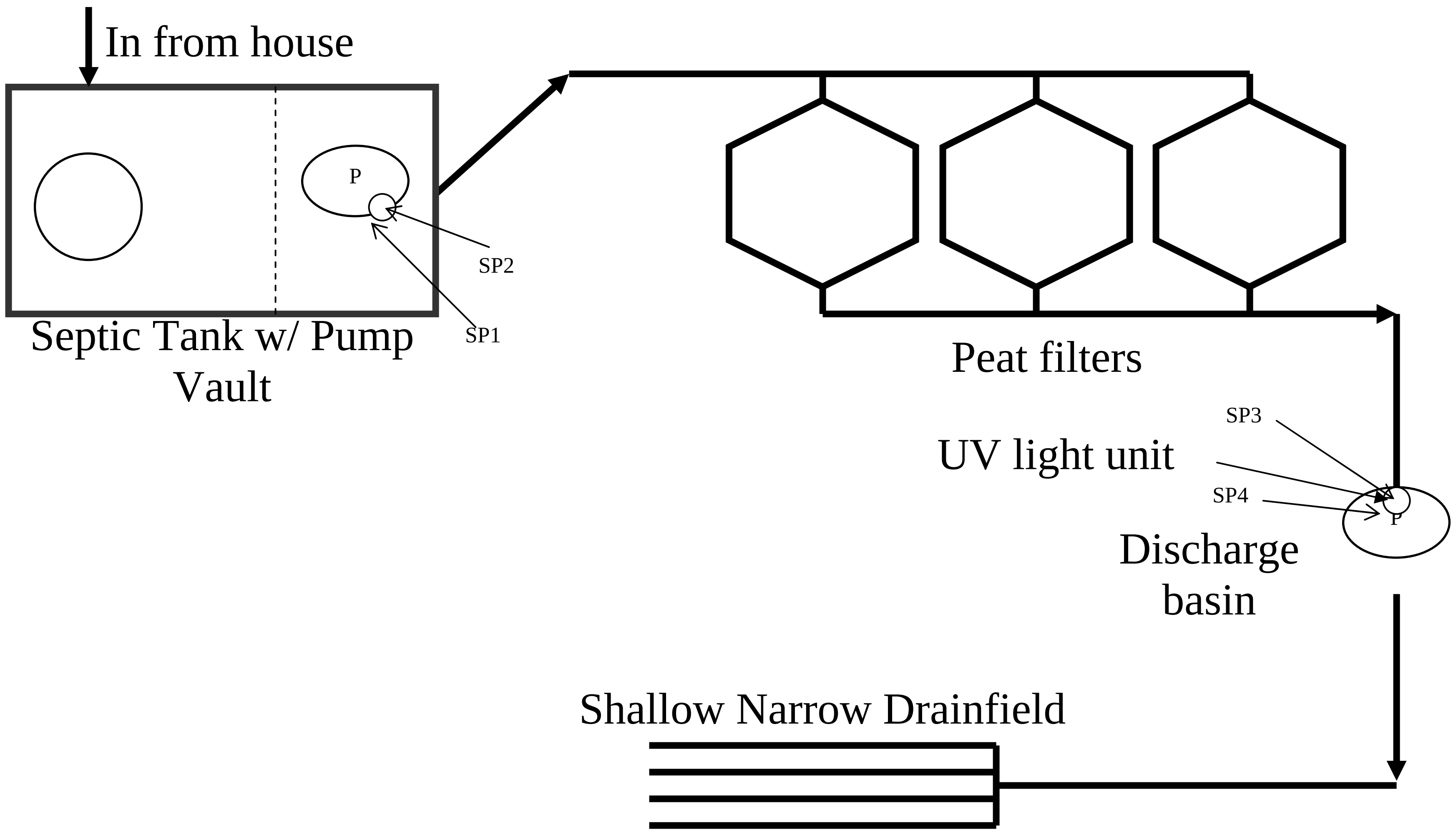


Figure 11. Puraflow Peat Filter Treatment Train: Existing Green Hill Pond System GH 6 (SIS)

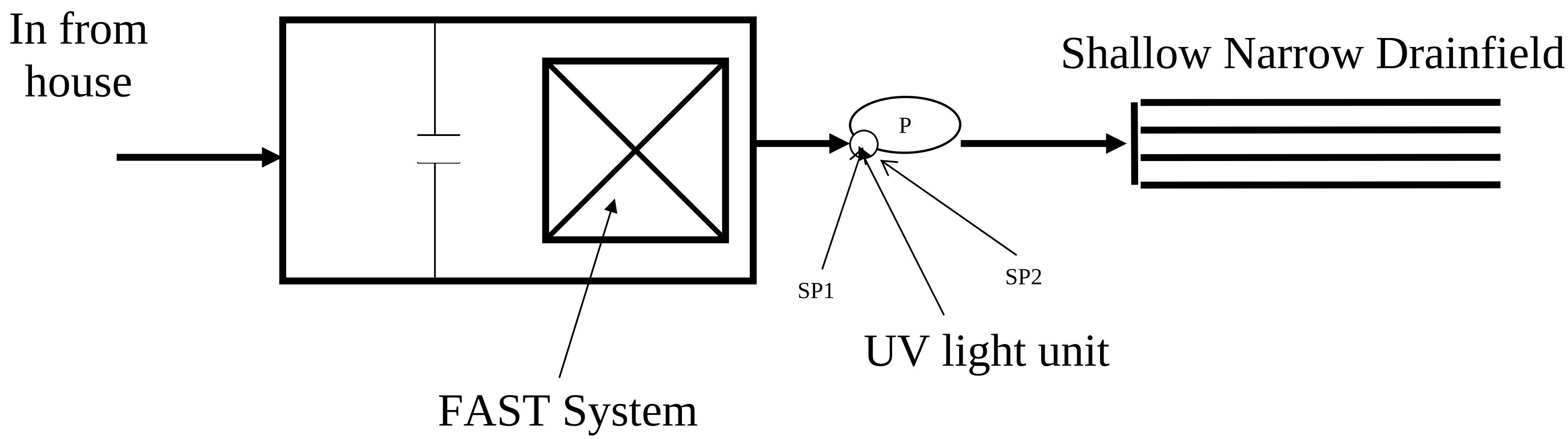


Figure 12. FAST System Treatment Train: Existing Green Hill Pond System GH 7 (TAR)

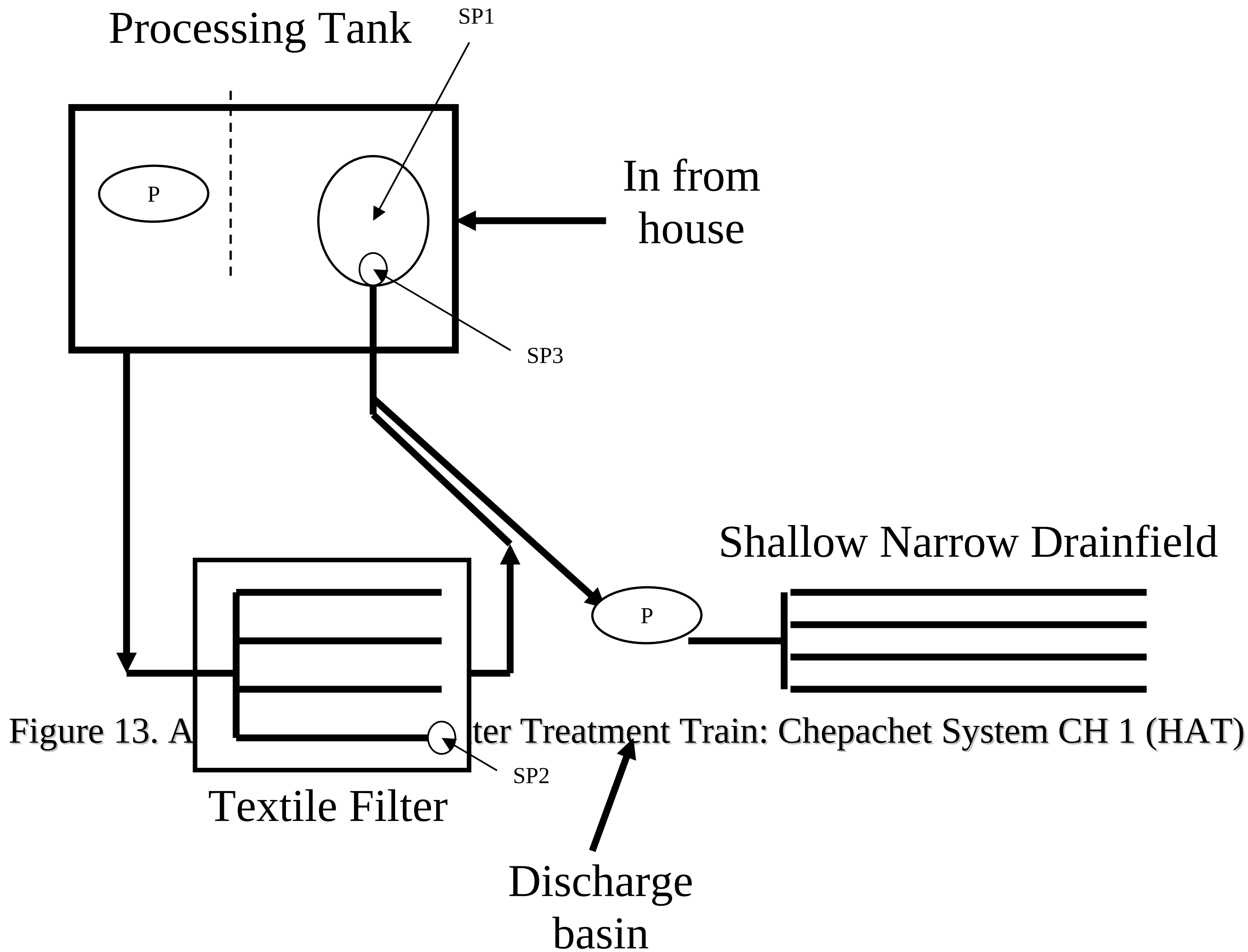


Figure 13. A ter Treatment Train: Chepachet System CH 1 (HAT)

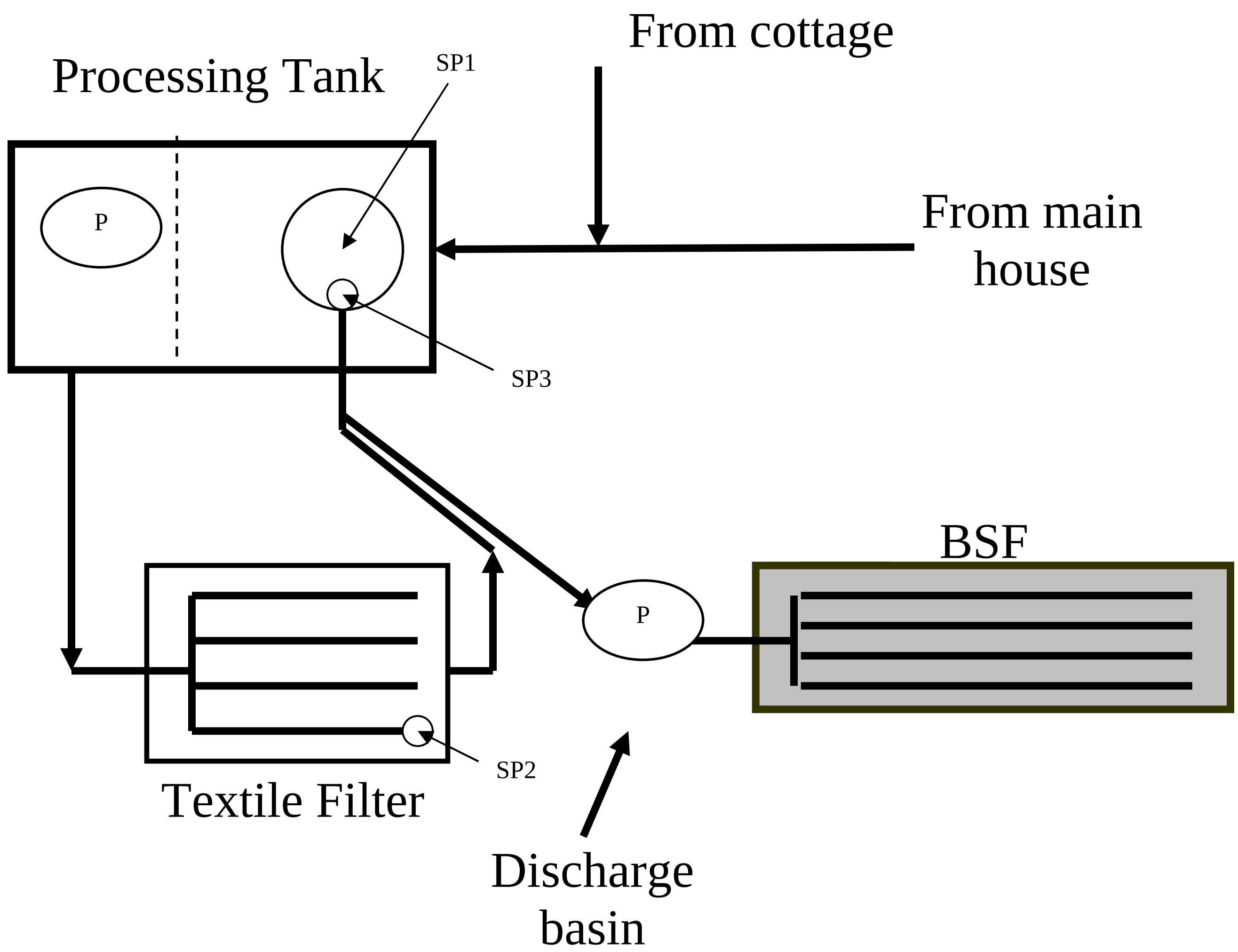


Figure 14. Advantex Textile Filter Treatment Train: Chepachet System CH 2 (BRA)

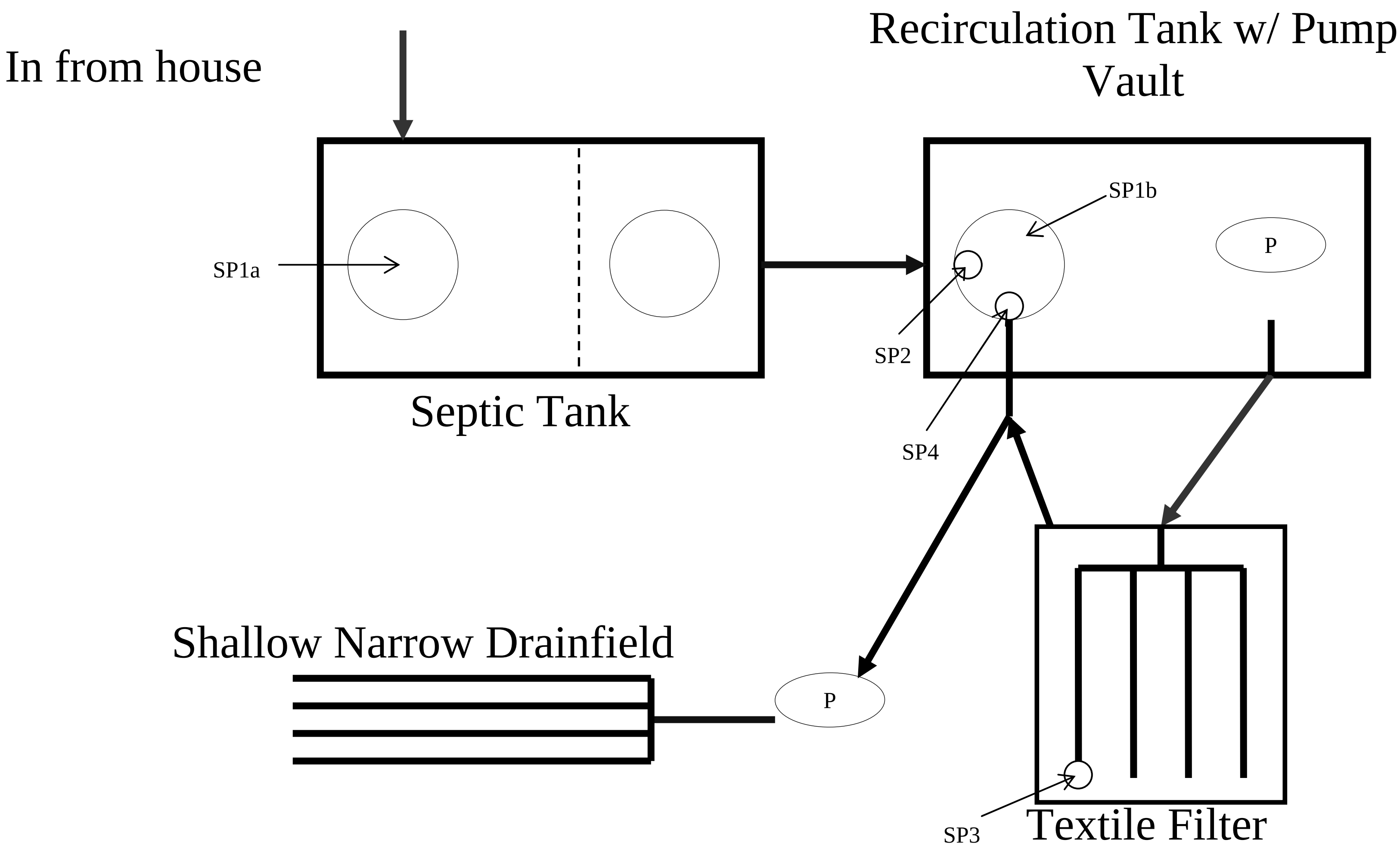


Figure 15. Advantex Textile filter Treatment Train: Chepachet System CH 3 (CHR)

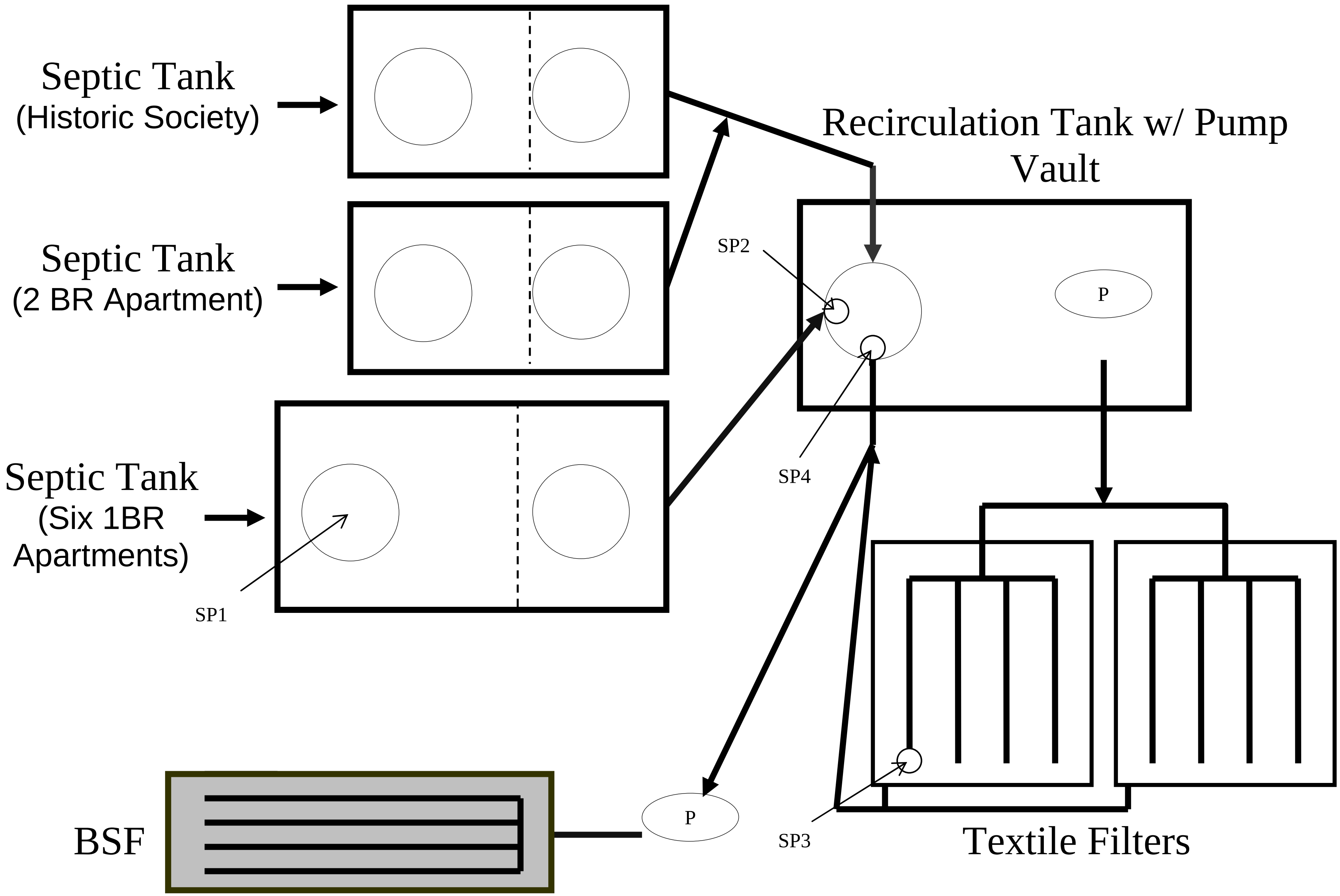


Figure 16. Advantex Textile Filter Treatment Train: Chepachet System CH 4 (ETH)

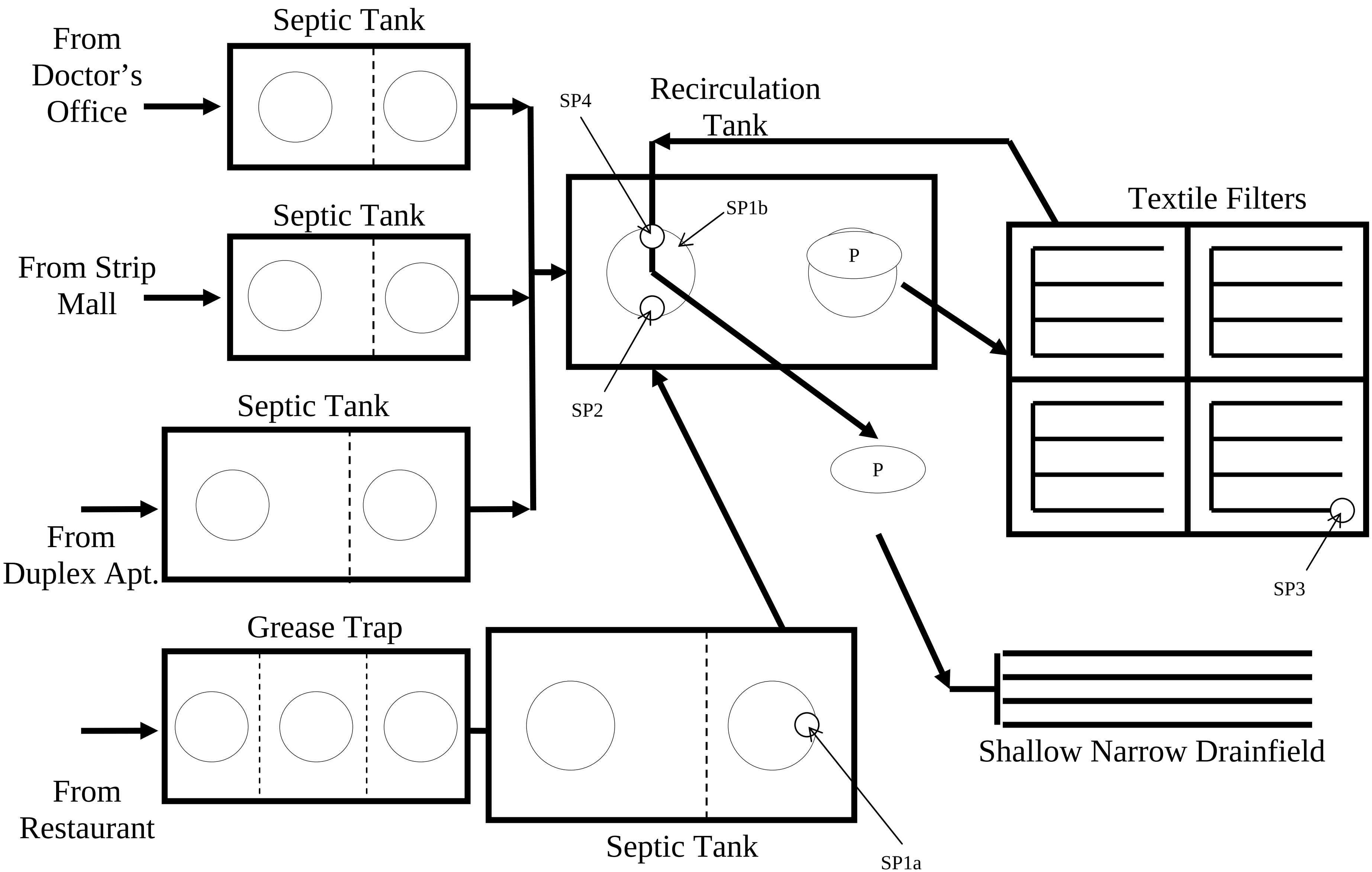


Figure 17. Advantex Textile Filter Treatment Train: Chepachet System CH 5 (LAV)

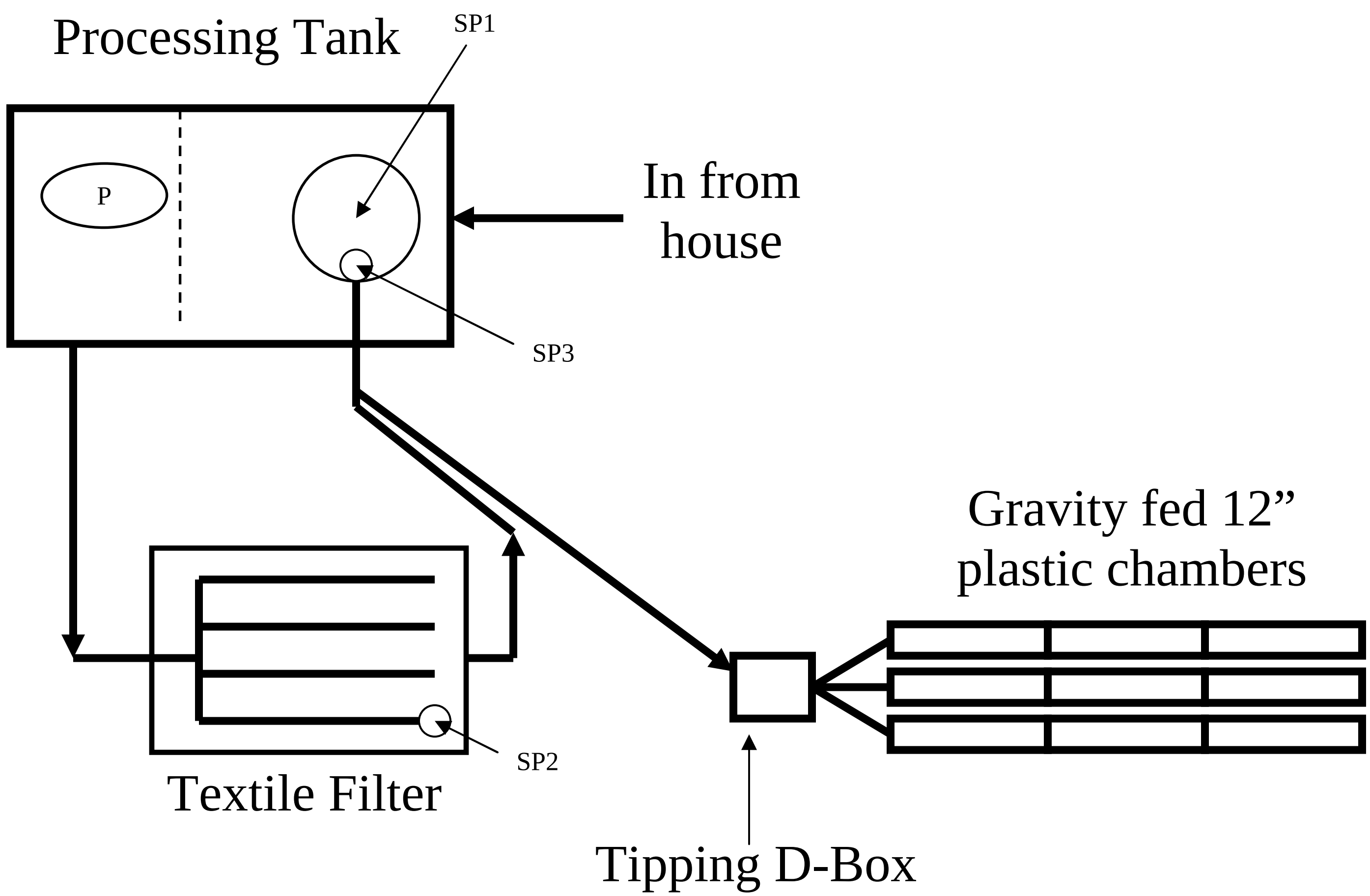


Figure 18. Advantex Textile Filter Treatment Train: New Green Hill Pond System GHN 8 (TNY)

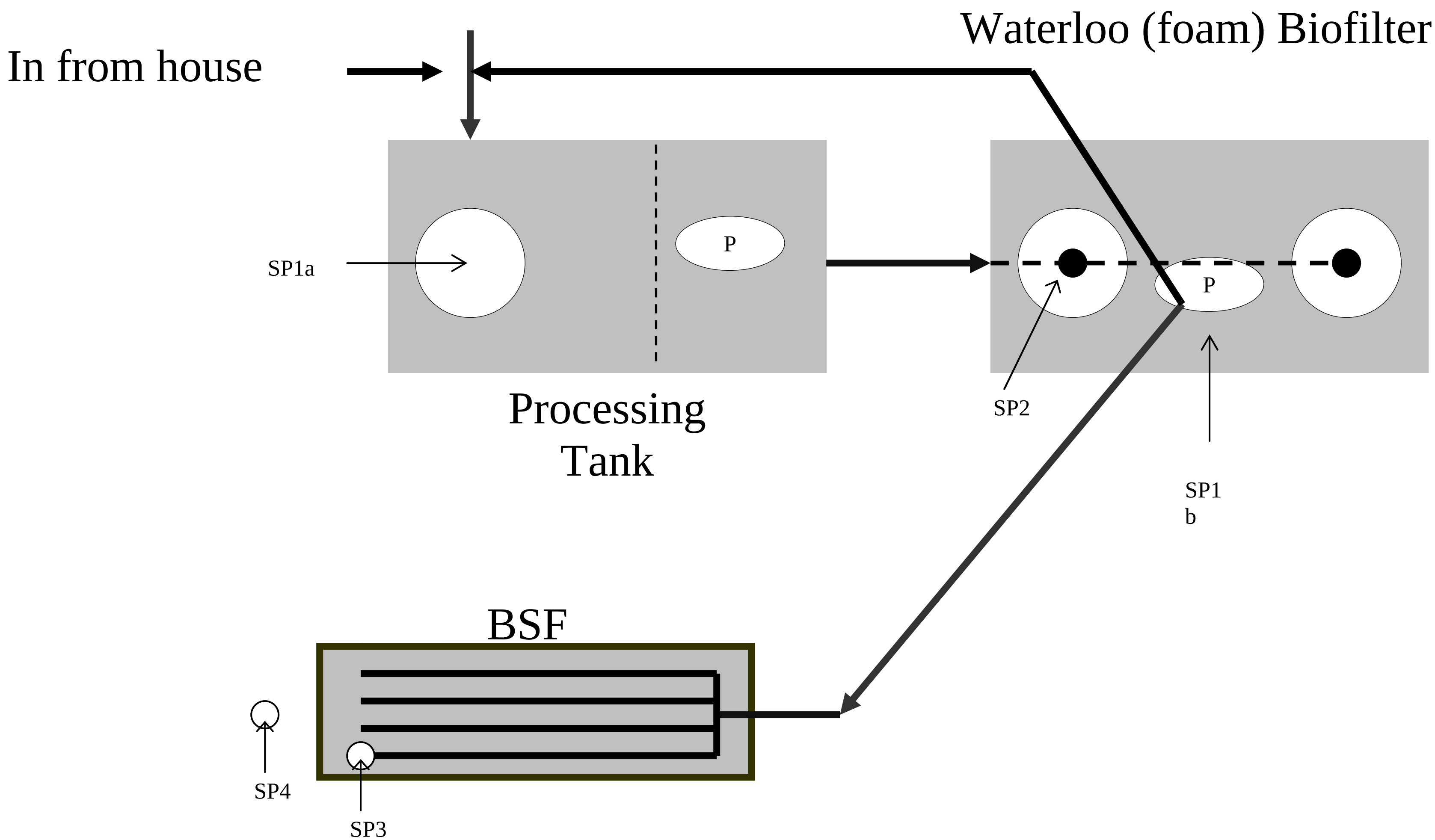


Figure 19. Waterloo Biofilter Treatment Train: New Green Hill Pond System GHN 9 (GRA)

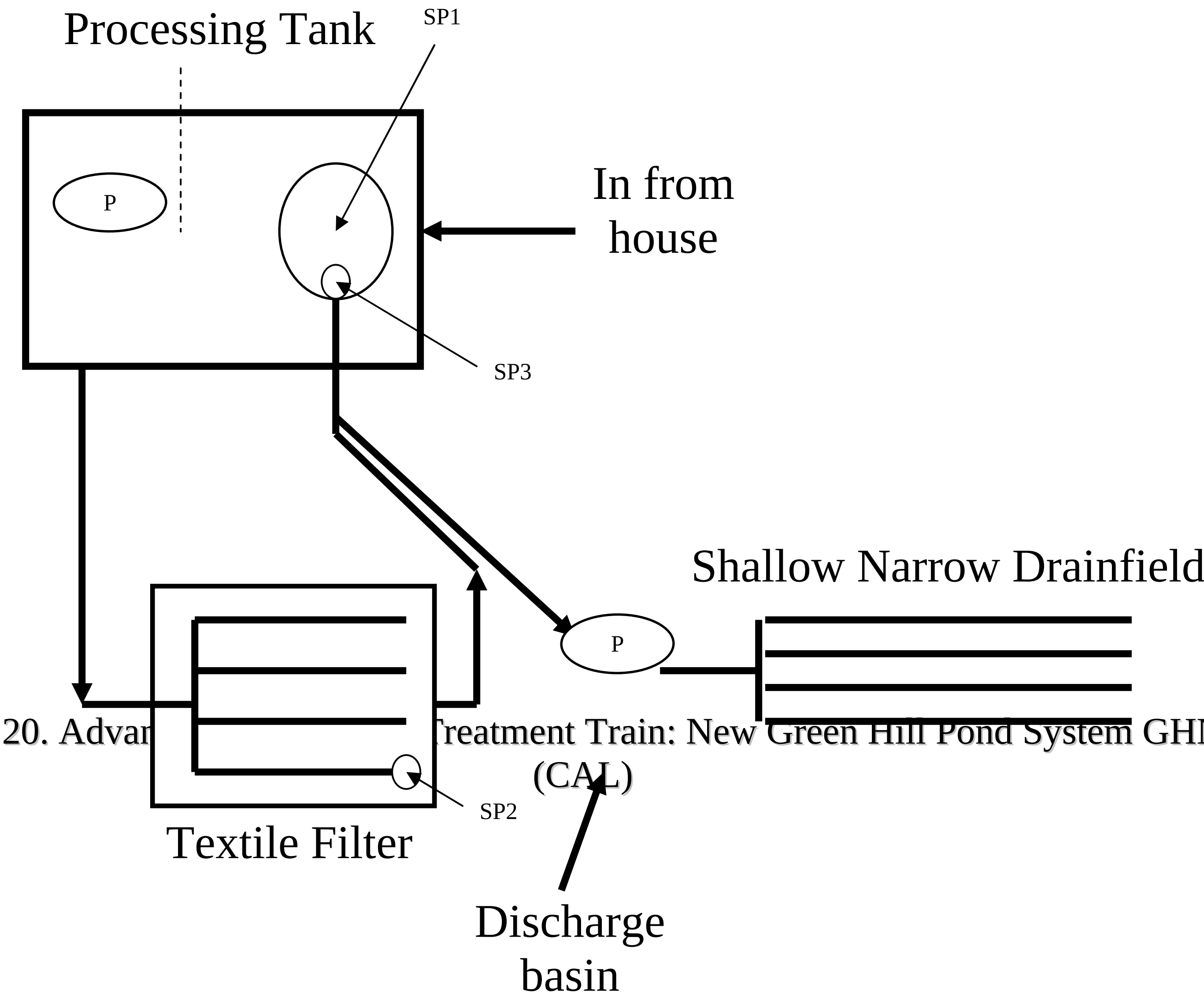


Figure 20. Advan… Treatment Train: New Green Hill Pond System GHN 10 (CAL)

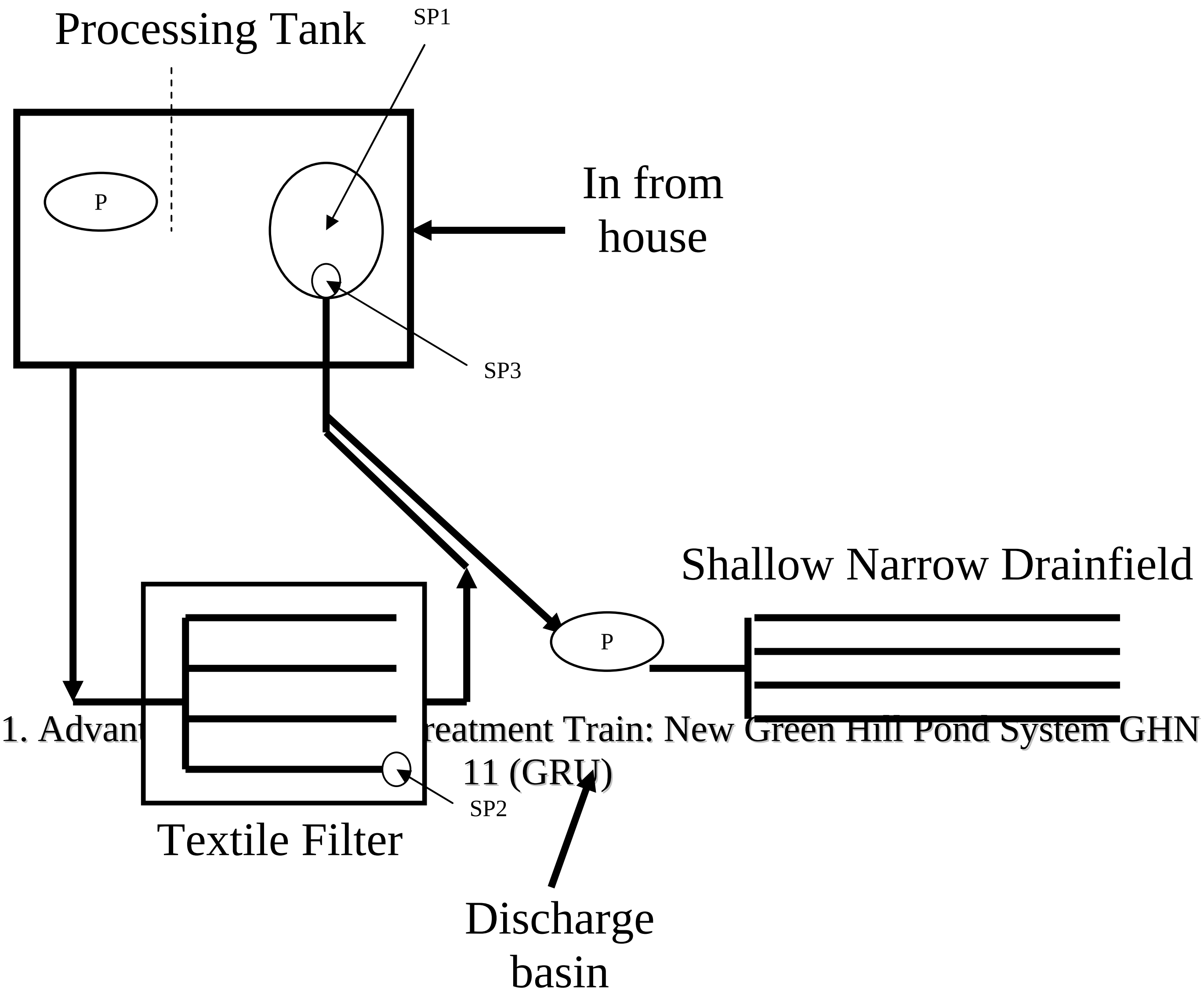


Figure 21. Advant [illegible] reatment Train: New Green Hill Pond System GHN 11 (GRU)

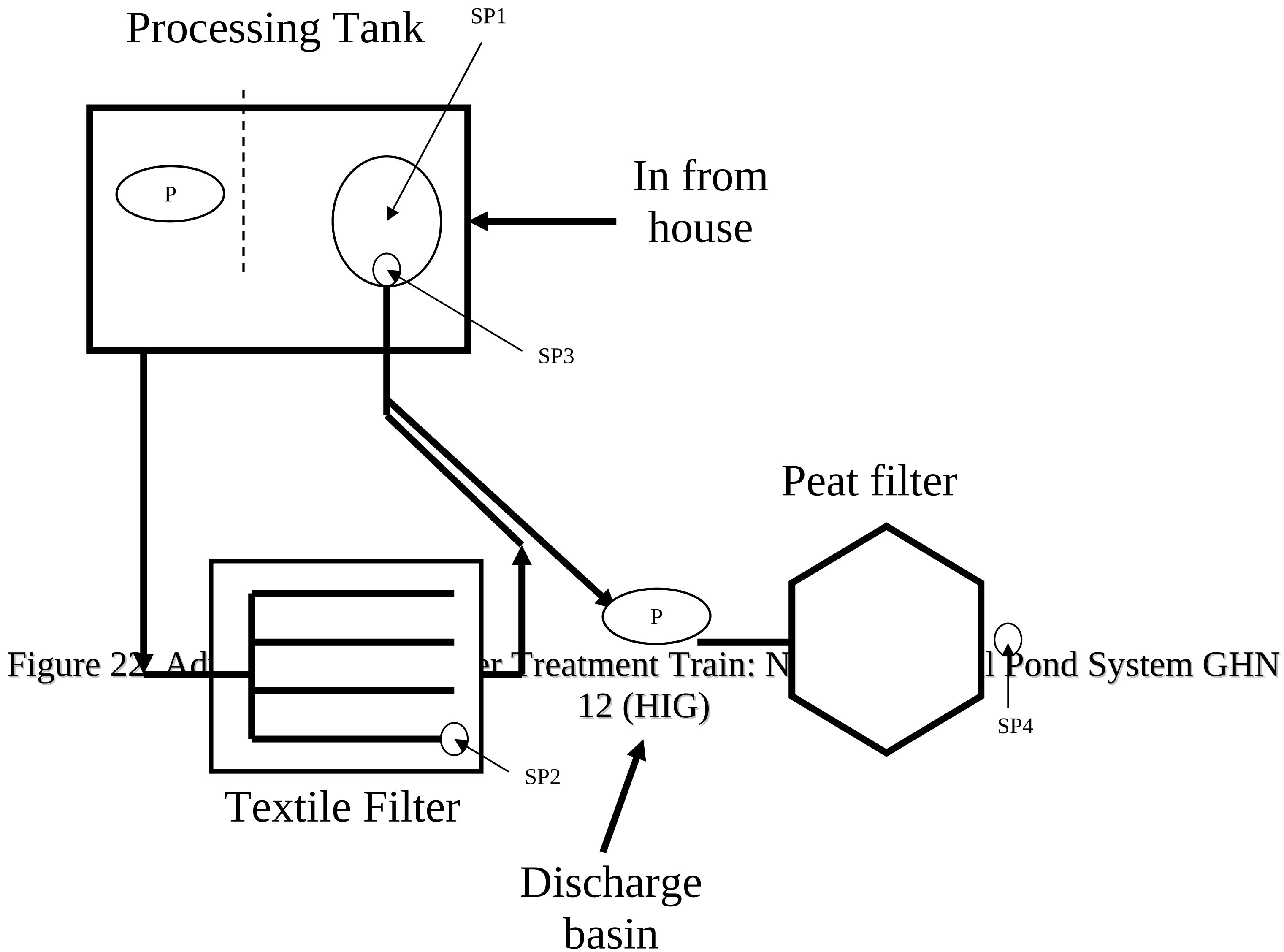


Figure 22. Ad… er Treatment Train: N… l Pond System GHN 12 (HIG)

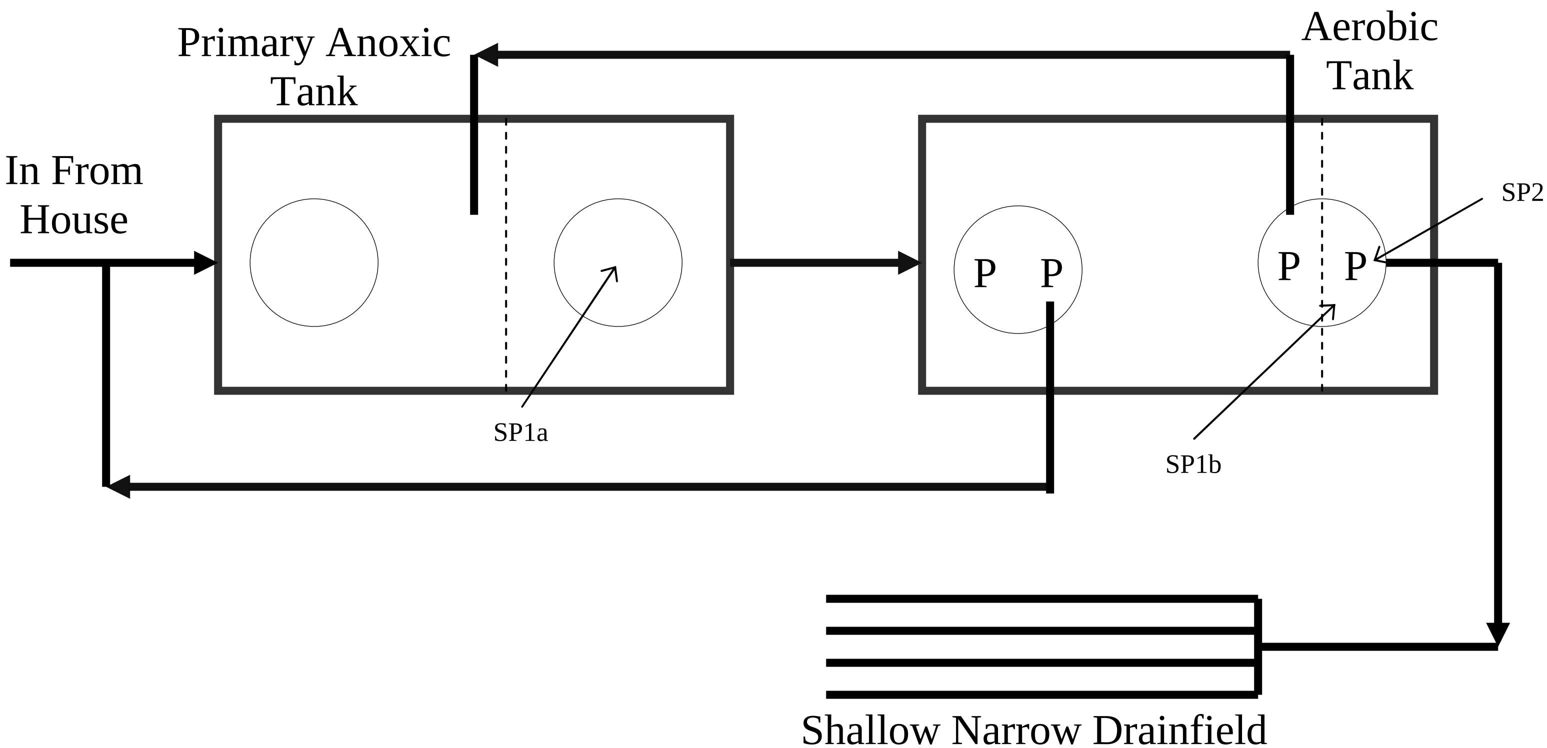


Figure 23. Septitech Treatment Train: New Green Hill Pond System GHN 13 (LAF)

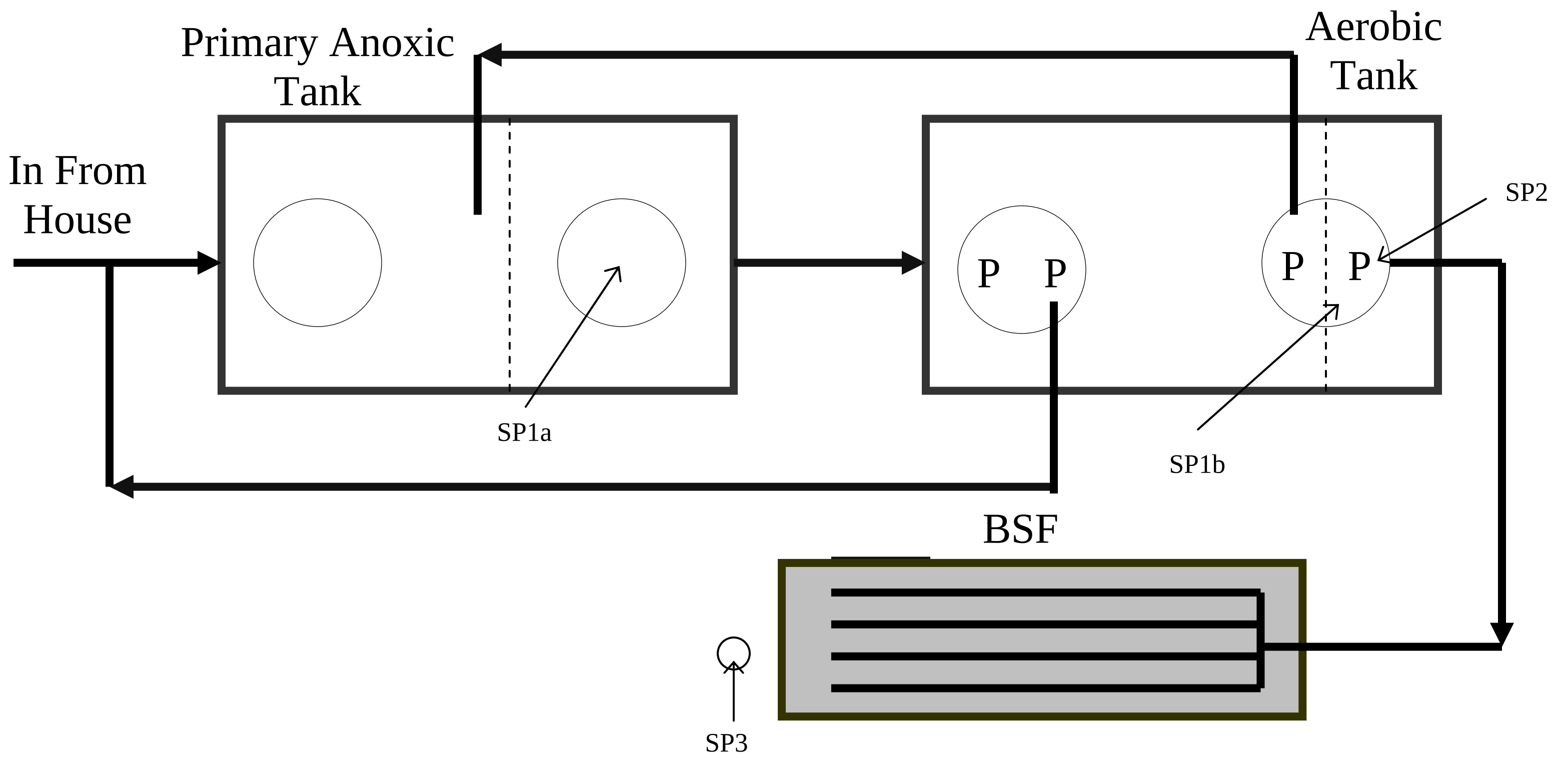


Figure 24. Septitech Treatment Train: New Green Hill Pond System GHN 14 (AND)

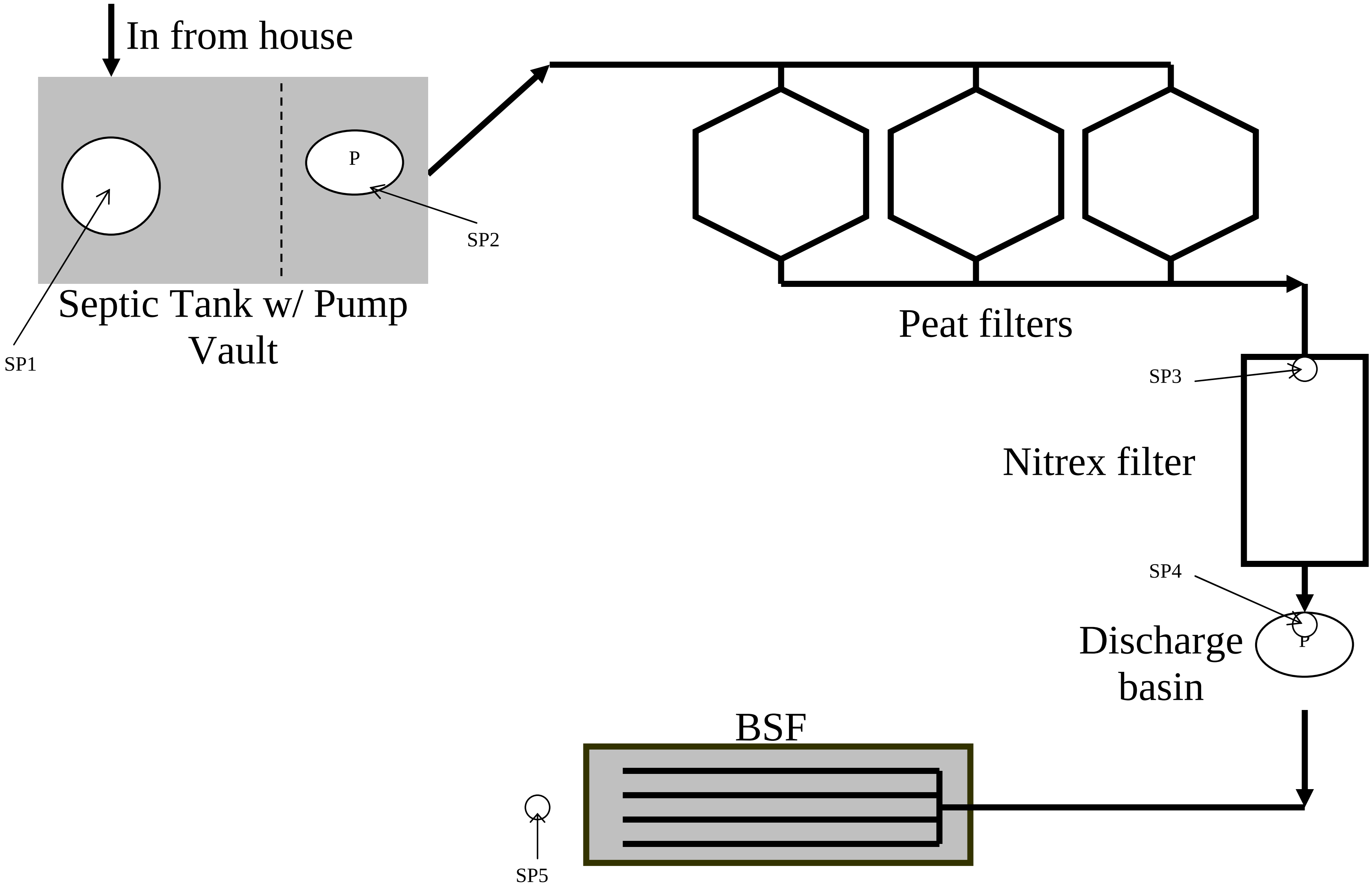


Figure 25. Puraflow Peat Filter and Nitrex Upflow Filter Treatment Train:
New Green Hill Pond System GHN 15 (LAM)

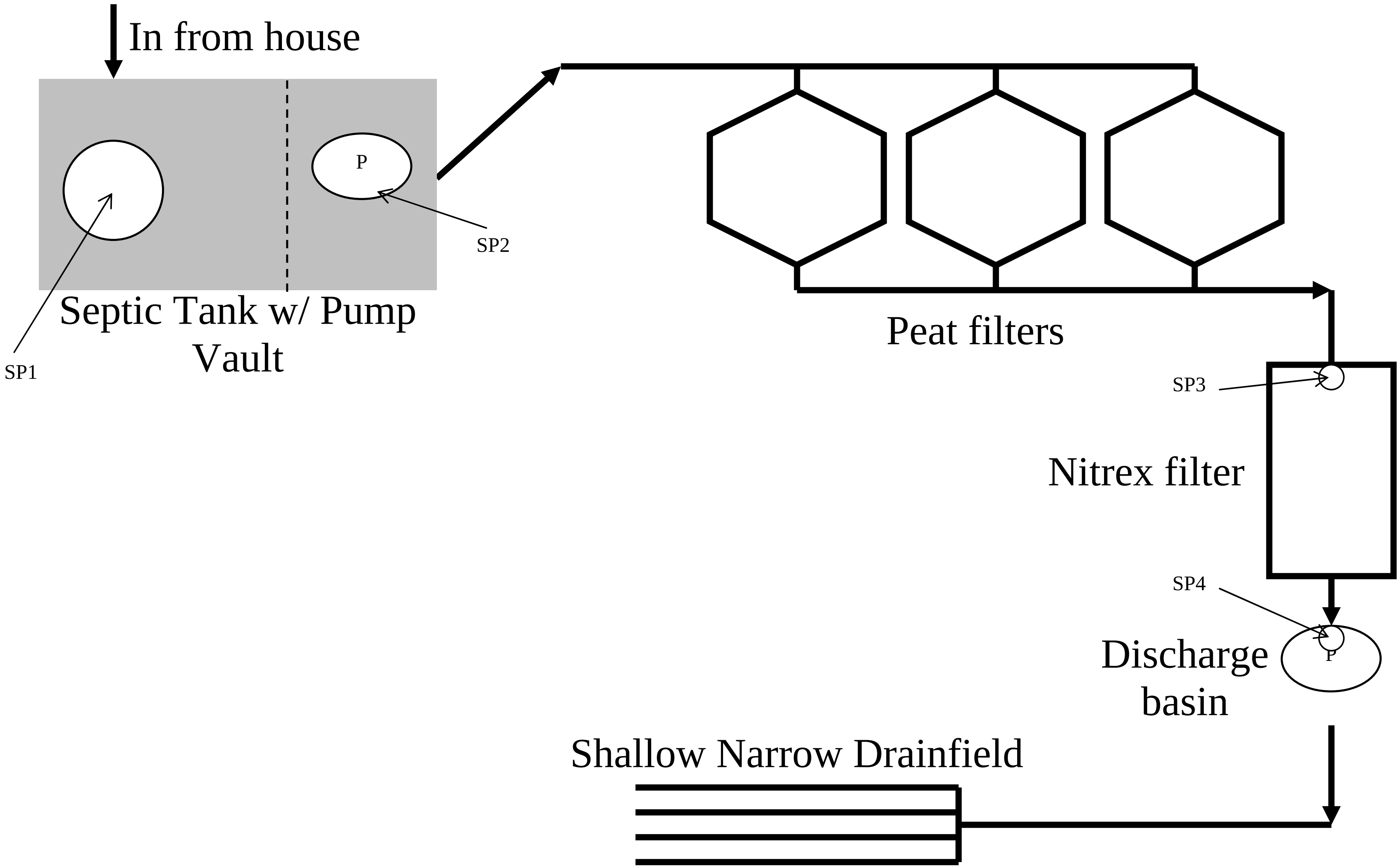


Figure 26. Puraflow Peat Filter and Nitrex Upflow Filter Treatment Train: New Green Hill Pond System GHN 16 (HAR)

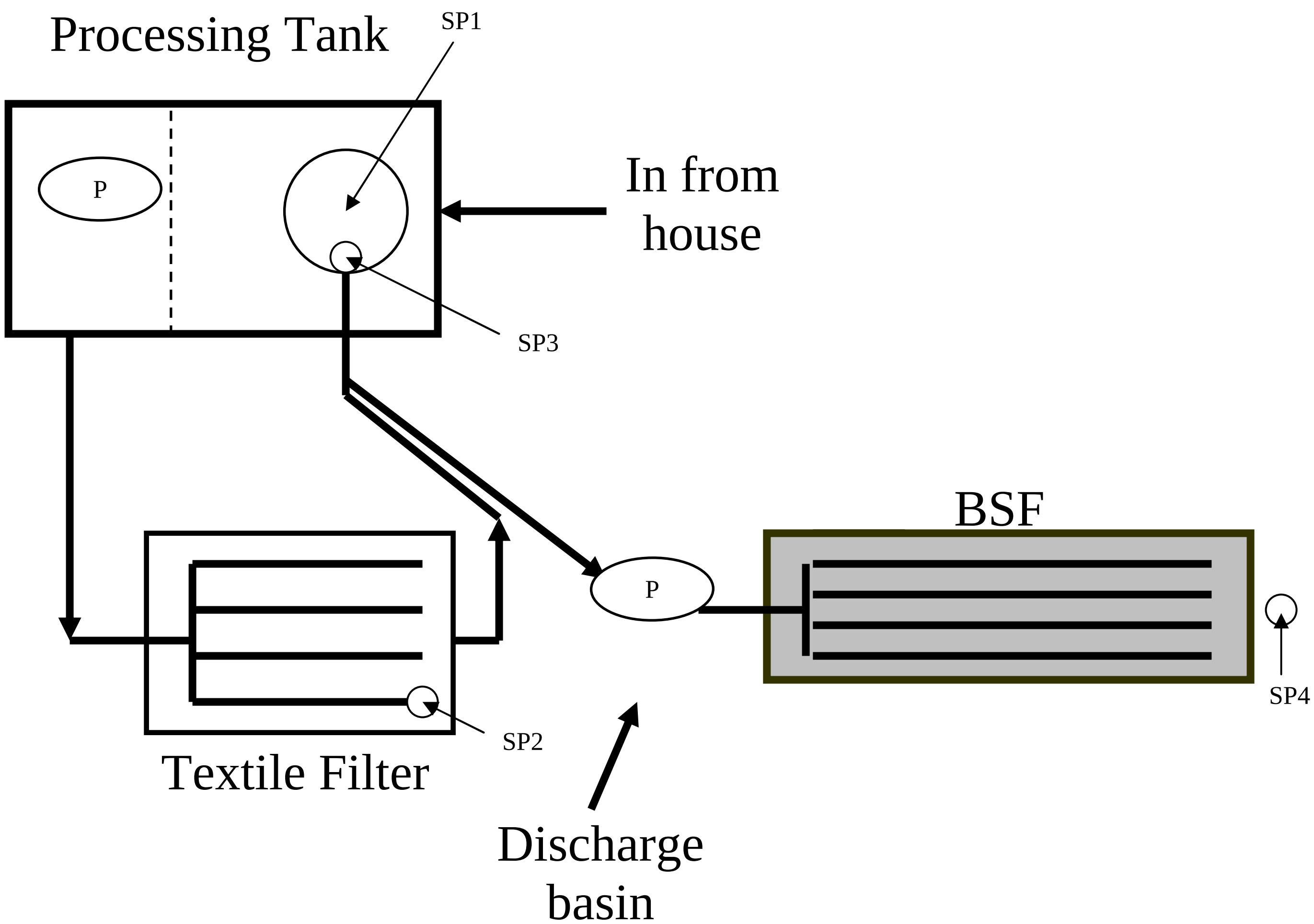


Figure 27. Advantex Textile Filter Treatment Train: New Green Hill Pond System GHN 17 (BAN)

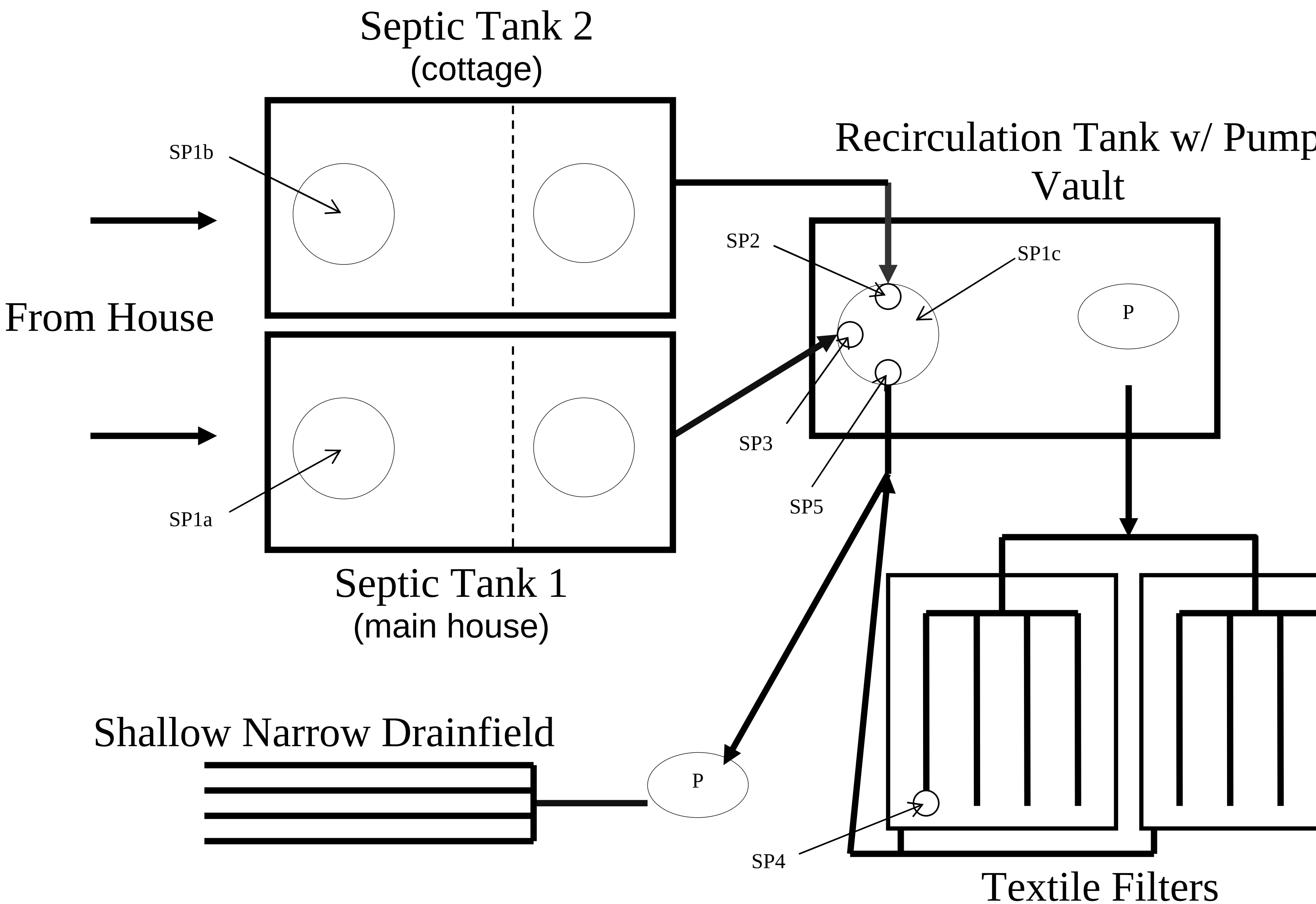


Figure 28. Advantex Textile Filter Treatment Train for Block Island System BI 3 (REA)

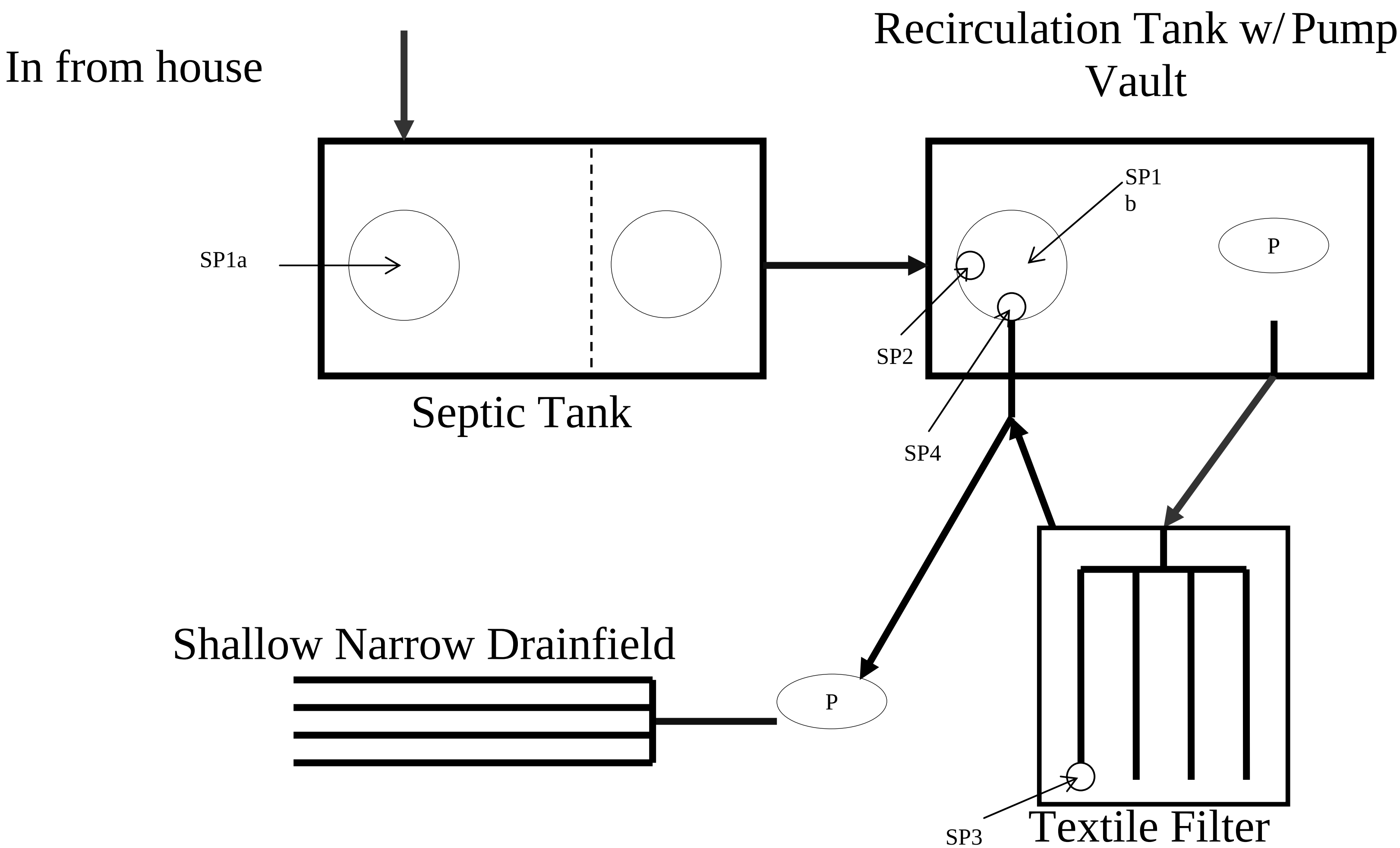


Figure 29. Advantex Textile Filter Treatment Train for Block Island System BI 4 (ONE)

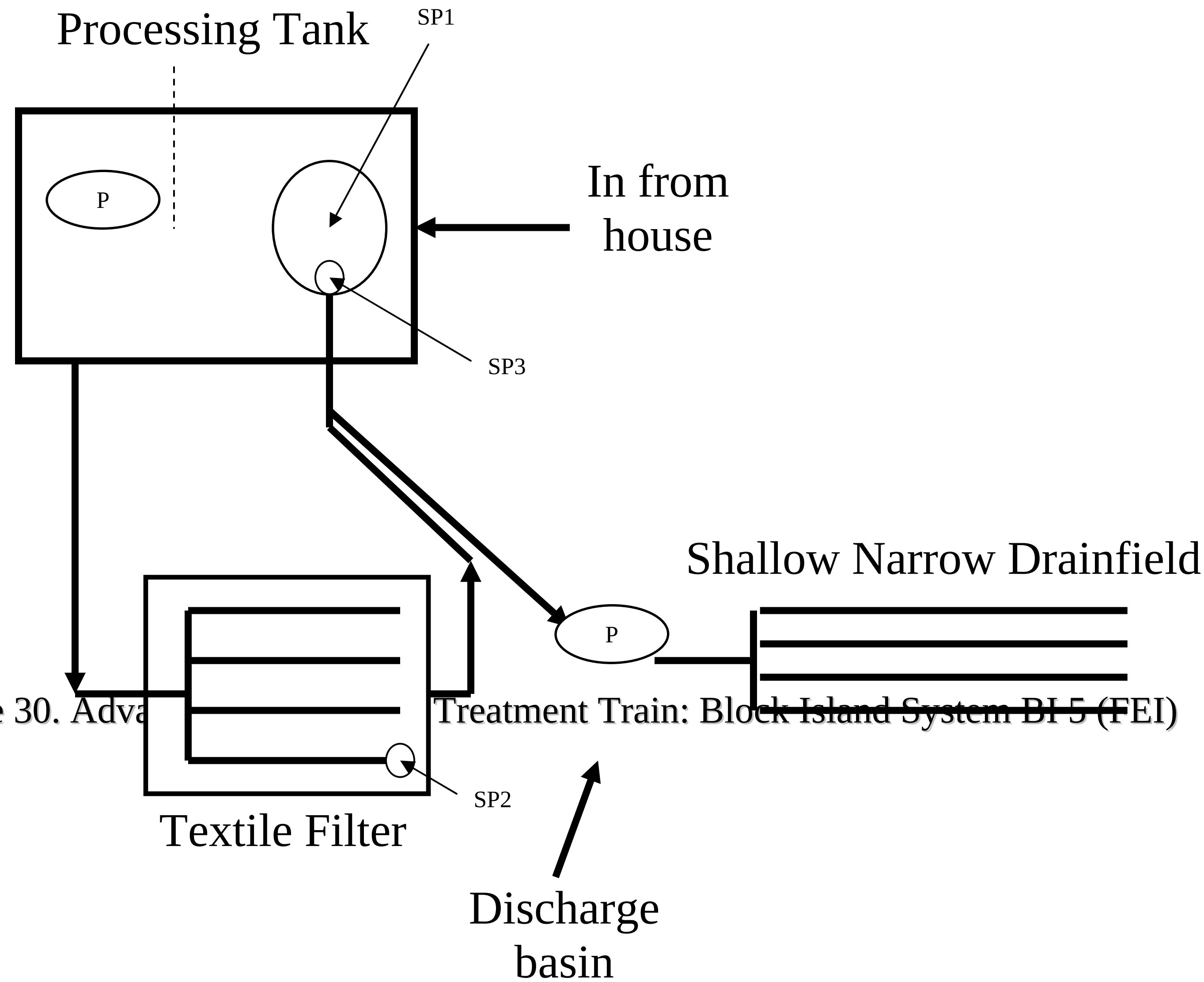


Figure 30. Adva Treatment Train: Block Island System BI 5 (FEI)

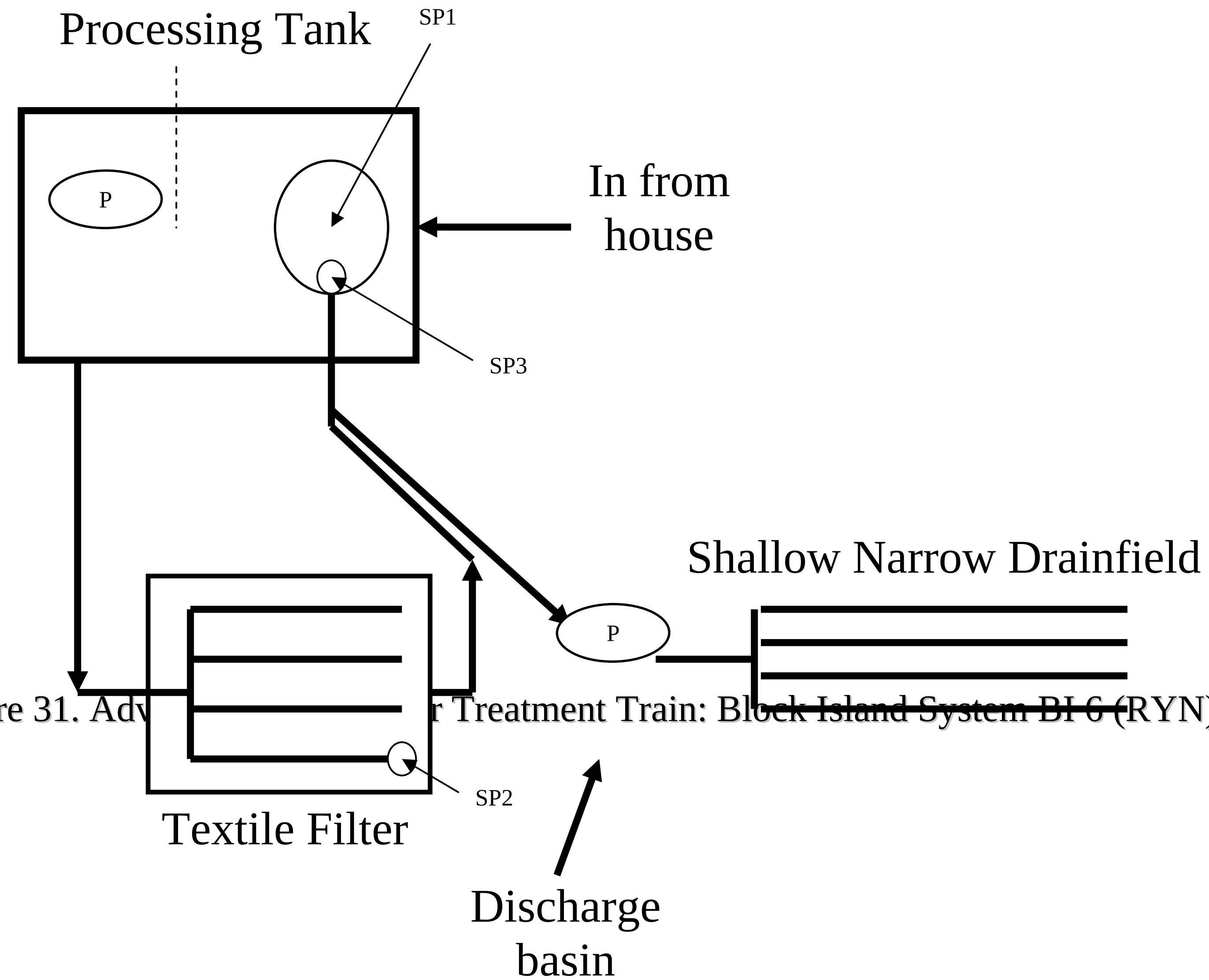


Figure 31. Adv r Treatment Train: Block Island System BI 6 (RYN)

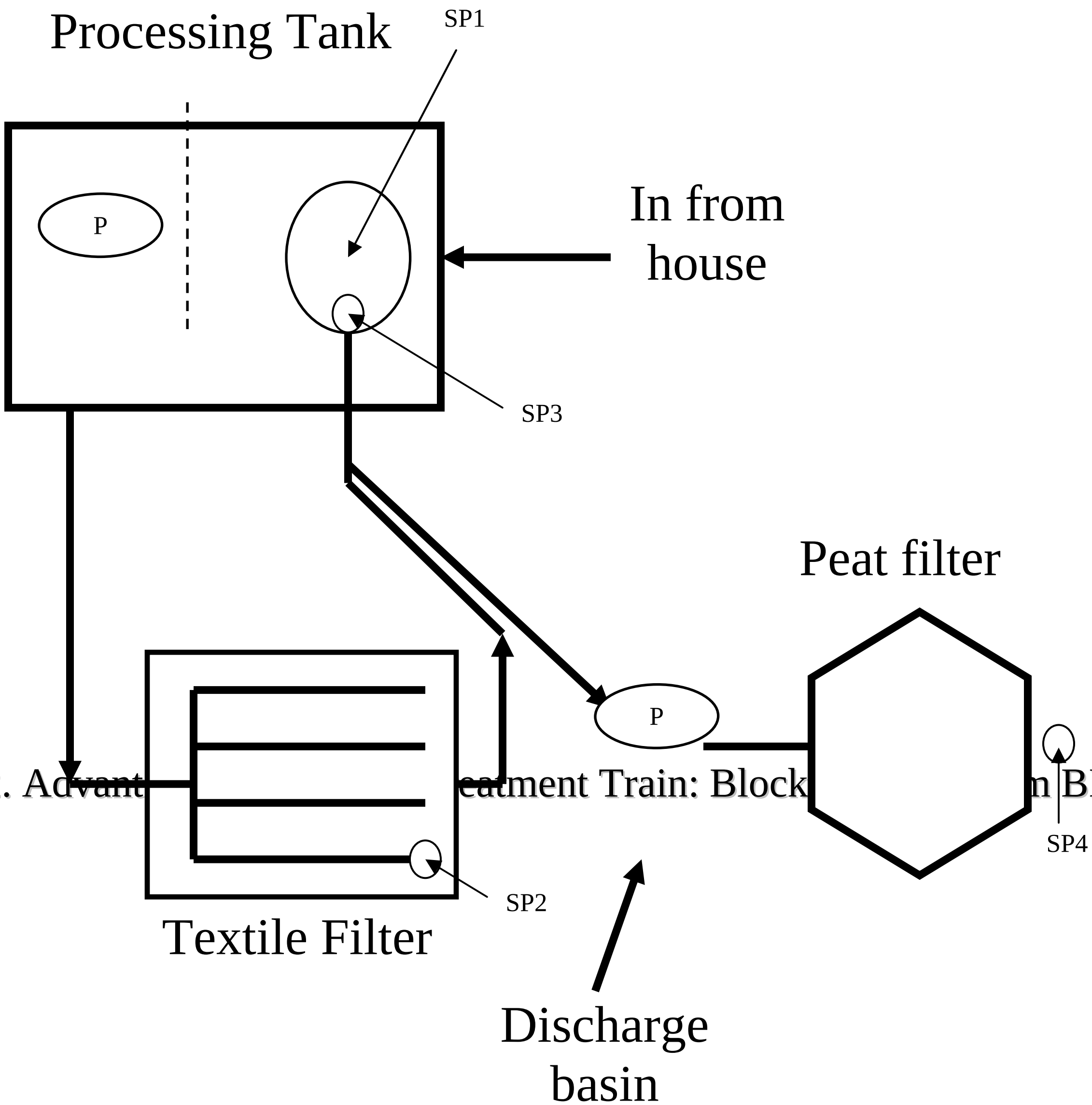


Figure 32. Advant … eatment Train: Block … n BI 8 (BRN)

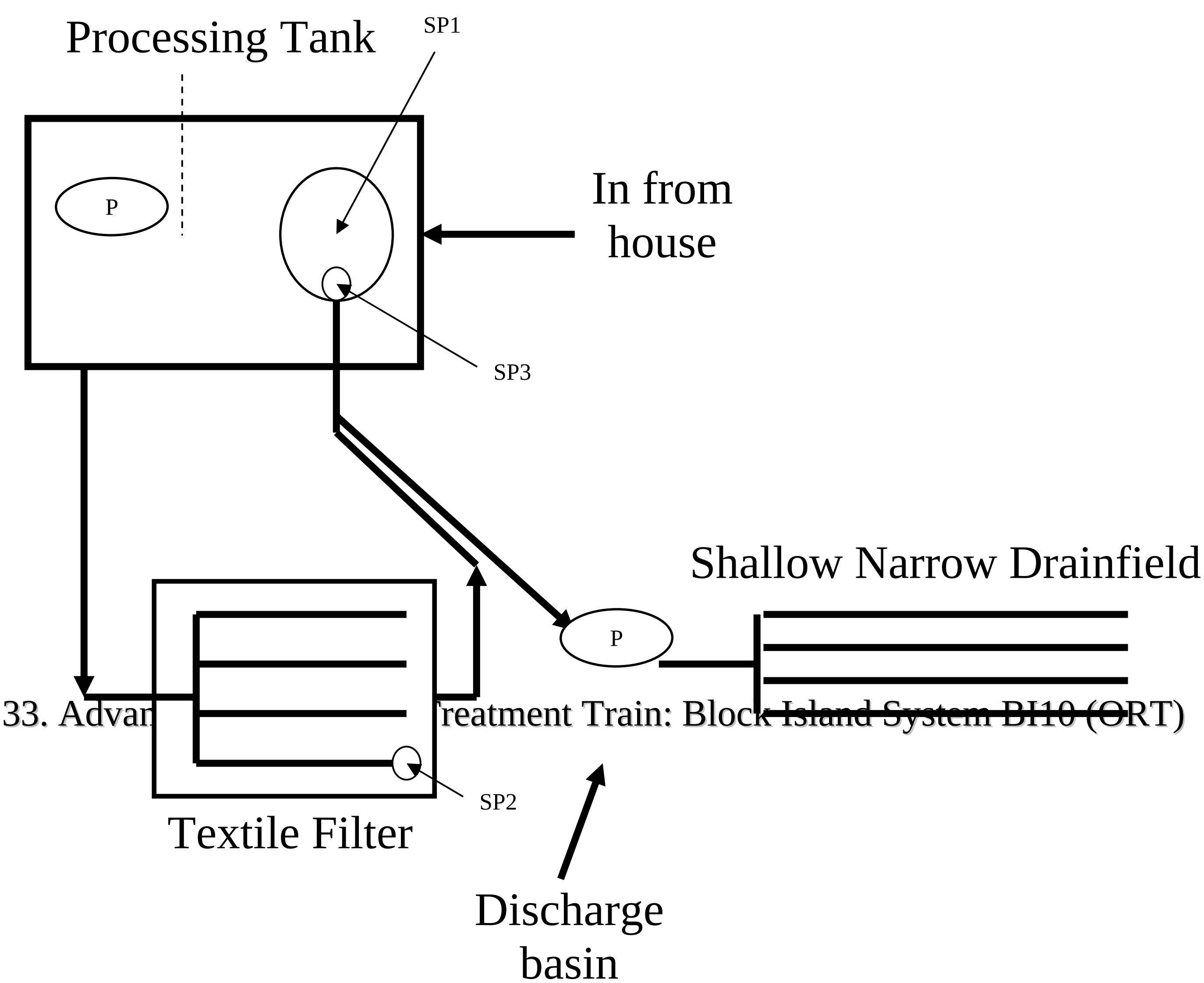


Figure 33. Advan … reatment Train: Block Island System BI10 (ORT)

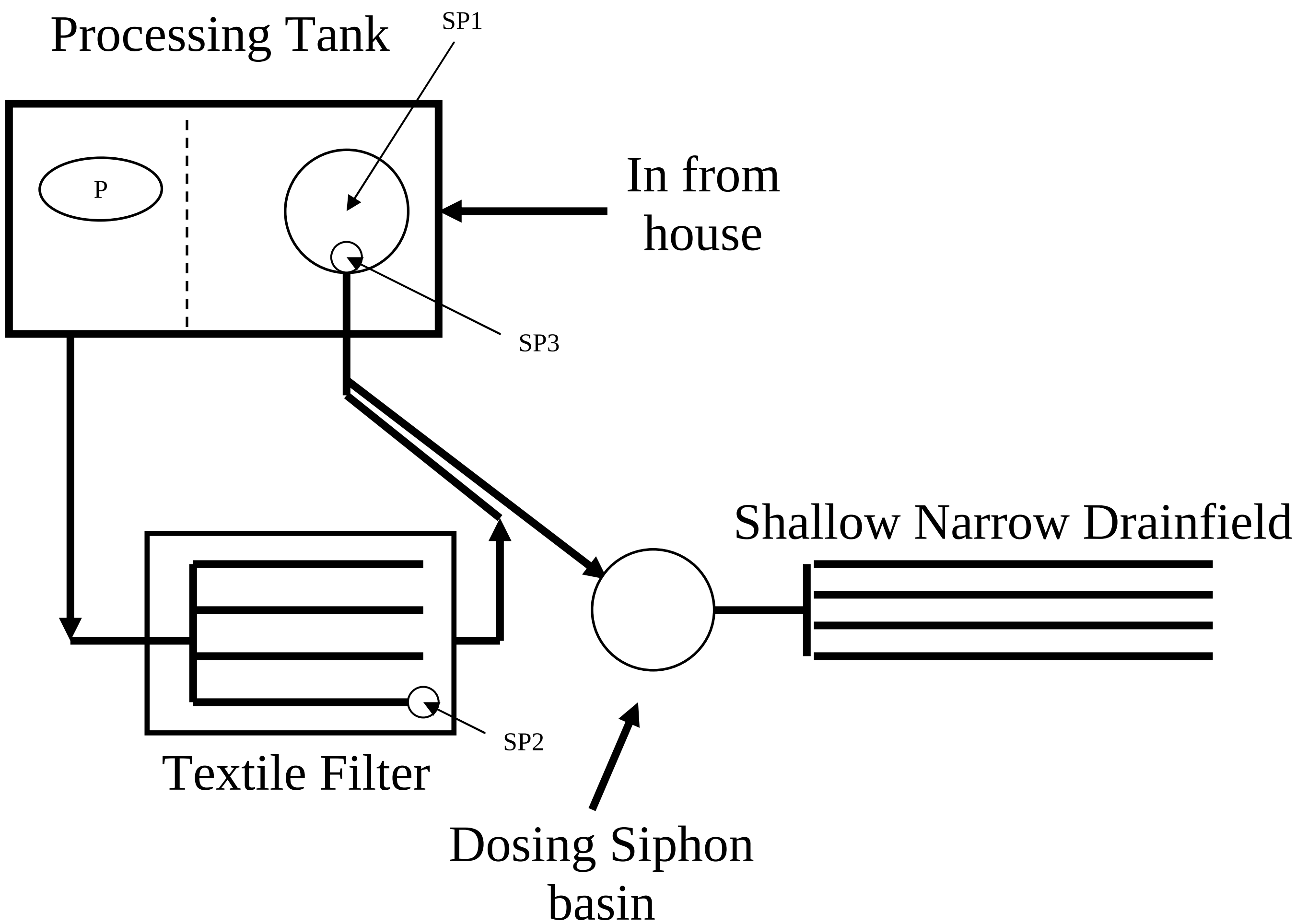


Figure 34. Advantex Textile Filter Treatment Train for Block Island System BI 11 (DER)

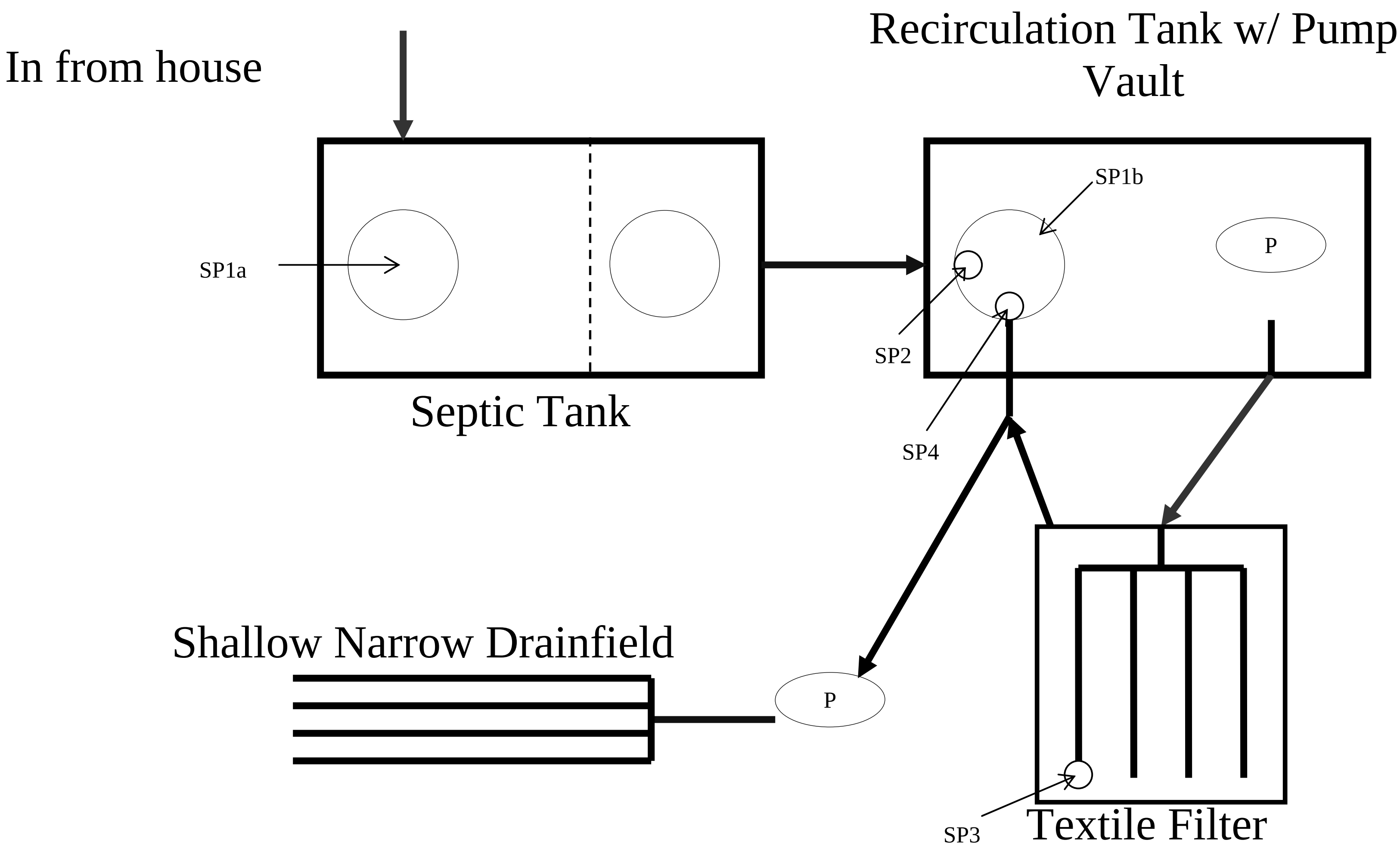


Figure 35. Advantex Textile filter Treatment Train for Block Island System BI 12 (FLA)