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# Five-Year Review Report

## First Five-Year Review Report for the Somersworth Sanitary Landfill Superfund Site Somersworth, New Hampshire

September 2005

**PREPARED BY:**  
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**Region I**  
**Boston, Massachusetts**

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09/20/05

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## LIST OF ABBREVIATIONS

BRW	Bedrock Well
CD	Consent Decree
CE	chlorinated ethene
CTW	Chemical Treatment Wall
DCE	dichloroethene
EPA	United States Environmental Protection Agency
ft	feet
GMZ	Groundwater Management Zone
ICL	Interim Cleanup Levels
in	inch
LFG	Landfill Gas
LFGVS	Landfill Gas Venting System
NHDES	New Hampshire Department of Environmental Services
NPL	National Priorities List
O&M	Operation and Maintenance
PCE	tetrachloroethene
PID	photoionization detector
PLC	permeable landfill cover
POC	point of compliance
ppb	parts per billion
ppm	parts per million
PRA	Preferred Remedial Action
PRB	permeable reactive barrier
RA	Remedial Action
RD	Remedial Design
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
SAP	Sampling and Analysis Plan
SOW	Statement of Work
TCE	trichloroethene
$\mu\text{g/L}$	micrograms per liter
VC	vinyl chloride
VOC	volatile organic compound
WSD	Work Settling Defendants
ZVI	zero-valent iron

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## **Executive Summary**

The remedy implemented at the Somersworth Sanitary Landfill Superfund Site in Somersworth, New Hampshire included installation of a Chemical Treatment Wall (CTW) along the downgradient edge of the landfill, placement of a permeable soil cover over the landfill, installation of a bedrock extraction well and recharge of extracted groundwater into a gallery on the landfill, institutional controls, and monitored natural attenuation of contaminated groundwater down gradient of the CTW. The Site achieved construction completion on September 9, 2005. The trigger for this First Five-Year Review Report was the actual start of construction on July 17, 2000.

The remedy is considered protective in the short-term; however in order for the remedy to be protective in the long-term, follow-up actions need to be taken. Long-term protectiveness will be achieved once additional notification of property owners within the Groundwater Management Zone (GMZ) is provided in accordance with current State requirements, newly installed shallow and bedrock monitoring wells are sampled to confirm a “clean-edge” along the northern boundary of the GMZ, and the recent anomalies identified at the CTW near the CTW-20 transect are more fully understood through the monitoring of new wells installed by the Work Settling Defendants (WSD) in August 2005.

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## Five-Year Review Summary Form

SITE IDENTIFICATION		
Site name (from WasteLAN): Somersworth Sanitary Landfill		
EPA ID (from WasteLAN): NHD980520225		
Region: I	State: NH	City/County: Somersworth/Strafford
SITE STATUS		
NPL status: <input checked="" type="checkbox"/> Final <input type="checkbox"/> Deleted <input type="checkbox"/> Other (specify)		
Remediation status (choose all that apply): <input type="checkbox"/> Under Construction <input checked="" type="checkbox"/> Operating <input checked="" type="checkbox"/> Complete		
Multiple OUs?: <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	Construction completion date: 09/09/2005	
Has site been put into reuse? <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO		
REVIEW STATUS		
Lead agency: <input checked="" type="checkbox"/> EPA <input type="checkbox"/> State <input type="checkbox"/> Tribe <input type="checkbox"/> Other Federal Agency _____		
Author name: Michael Jasinski		
Author title: Superfund Section Chief	Author affiliation: EPA Region I	
Review period: 12/20/2004 to 09/23/2005		
Date(s) of site inspection: 06/15/2004 and throughout 2005		
Type of review: <div style="display: flex; justify-content: space-between; font-size: small;"> <span><input checked="" type="checkbox"/> Post-SARA</span> <span><input type="checkbox"/> Pre-SARA</span> <span><input type="checkbox"/> NPL-Removal only</span> </div> <div style="display: flex; justify-content: space-between; font-size: small;"> <span><input type="checkbox"/> Non-NPL Remedial Action Site</span> <span><input type="checkbox"/> NPL State/Tribe-lead</span> </div> <div style="display: flex; justify-content: space-between; font-size: small;"> <span><input type="checkbox"/> Regional Discretion</span> </div>		
Review number: <input checked="" type="checkbox"/> 1 (first) <input type="checkbox"/> 2 (second) <input type="checkbox"/> 3 (third) <input type="checkbox"/> Other (specify) _____		
Triggering action: <input type="checkbox"/> Actual RA Onsite Construction at OU # _____ <input checked="" type="checkbox"/> Actual RA Start at OU# __1__ <input type="checkbox"/> Construction Completion <input type="checkbox"/> Previous Five-Year Review Report <input type="checkbox"/> Other (specify)		
Triggering action date (from WasteLAN): 07/17/2000		
Due date (five years after triggering action date): 07/17/2005		

\* ["OU" refers to operable unit.]  
 \*\* [Review period should correspond to the actual start and end dates of the Five-Year Review in WasteLAN.]

## Five-Year Review Summary Form, cont'd.

### Issues:

*Resolve all comments identified through EPA and NHDES review of the "Annual Monitoring and Demonstration of Compliance Report for 2004."*

### Recommendations and Follow-up Actions:

- (a) Provide additional notification of Property Owners within the GMZ;*
- (b) Install and sample additional monitoring wells within the GMZ;*
- (c) Conduct additional evaluations of MNA within the groundwater down gradient of the CTW; and*
- (d) Perform additional monitoring of groundwater wells installed by the WSD in August 2005 near the CTW-20 transect.*

### Protectiveness Statement(s):

*The remedy is considered protective in the short-term; however in order for the remedy to be protective in the long-term, follow-up actions need to be taken. Long-term protectiveness will be achieved once additional notification of property owners within the Groundwater Management Zone (GMZ) is provided in accordance with current State requirements, newly installed shallow and bedrock monitoring wells are sampled to confirm a "clean-edge" along the northern boundary of the GMZ, and the recent anomalies identified at the CTW near the CTW-20 transect are more fully understood through the monitoring of new wells installed by the WSD in August 2005.*

## 1. INTRODUCTION

The purpose of a five-year review is to determine whether the remedy at a site is protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in Five-Year Review reports. In addition, Five-Year Review reports identify issues found during the review, if any, and identify recommendations to address them.

The Agency is preparing this Five-Year Review report pursuant the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) §121 and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). CERCLA Section 121 states:

*If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgement of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions takes as a result of such reviews..*

The Agency interpreted this requirement further in the NCP; 40 CFR §300.430(f)(4)(ii) states:

*If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after initiation of the selected remedial action.*

The United States Environmental Protection Agency (EPA), Region I, has conducted this five-year review of the selected remedy at the Somersworth Sanitary Landfill Superfund Site (the "Site") in Somersworth, New Hampshire. The review was conducted by the Section Chief for the New Hampshire/Rhode Island Superfund Section at Region I, with the assistance of the Working Settling Defendants and the State of

New Hampshire, from December 2004, through September 2005. This report documents the results of the review.

This is the first five-year review for the Site. The triggering action for this statutory review is the date of actual on-site mobilization for construction of the first phase of the remedy which was July 17, 2000. The five-year review is required due to the fact that hazardous substances, pollutants, or contaminants remain at the Site above levels that allow for unlimited use and unrestricted exposure.

## 2. SITE CHRONOLOGY

The chronology of events for the Site is presented in Table 1 below:

**Table 1: Chronology of Site Events**

Major Activity	Date	Milestone
	1981	City ceased waste disposal at Site
	Sept-1983	Site placed on National Priority List
	June-1994	Record of Decision (ROD) Signed
Bedrock Extraction Well Installation	April-1996	Installation of BRW-1
Remedial Action Design	April-1999	100% Design Approved by EPA and NHDES
	July-2000	Updated 100% Design Completed
Construction of Chemical Treatment Wall (CTW)	8-Jul-2000	Initiation of CTW Workpad Construction
	1-Aug-2000	Excavation of First CTW Panel
	11-Sep-2000	Backfilling of Final CTW Panel
	28-Sep-2000	Completion of CTW Construction Activities
Construction of Landfill Cover and Bedrock Extraction System	6-Jun-2001	Project Kick-Off Meeting and Initiation of Construction
	29-Aug-2001	Final Inspection Meeting for Cover and Bedrock Extraction
Construction of Landfill Gas (LFG) Venting System	30-Oct-2003	Pre-Construction Meeting on Site
	1-Nov-2003	Initiation of Excavation Activities for LFG Venting Trench
	12-Dec-2003	Completion of Excavation for LFG Venting Trench
	18-Dec-2003	Completion of Backfilling of LFG Venting Trench
	8-Jan-2004	Completion of Site Grading for LFG Venting Trench
	11-Jun-2004	Completion of Site Restoration for LFG Venting Trench
Pre-Final Inspection	15-Jun-2004	Pre-Final Inspection Meeting

### **3. BACKGROUND**

#### **3.1 Physical Characteristics**

The Somersworth Sanitary Landfill Superfund Site (the “Site”) is located on the north side of Blackwater Road approximately one mile southwest of the center of the City of Somersworth (the “City”) in Strafford County, New Hampshire as shown in **Figure 1**. The Site layout is shown in **Figure 2**. The dominant Site feature is a former sanitary landfill that extends over an area of approximately 26 acres. The extent of the property currently owned by the City at and around the landfill is shown on **Figure 1**.

The landfill is located entirely within the Peters Marsh Brook surface water drainage basin. The brook flows northwesterly through the wetlands at the Site into Tate’s Brook, which in turn flows into the Salmon Falls River which is located about one mile east of the Site (see **Figure 1**).

The Site is relatively flat and low lying (see **Figure 2**) except that the quarrying activities immediately to the north of the landfill have resulted in the presence of a 15 to 20-foot vertical escarpment which runs parallel to the northern edge of the waste. The western edge of the waste slopes downward toward the wetland.

The Site is underlain by an unconfined sand and gravel aquifer ranging from about 15 to 75 feet thick. Metamorphic bedrock occurs beneath the sand and gravel overburden deposits. A peat layer is present at ground surface in and near the wetland. Groundwater flows through the overburden in a northwesterly direction. The bedrock is fractured, with flow in the shallow bedrock appearing to be slightly north of west. Groundwater from both the bedrock and overburden discharges to Peters Marsh Brook and the wetland.

#### **3.2 Land and Resource Use**

The landfill accepted municipal and industrial wastes from the mid-1930’s to 1981. Initially the wastes were burned, but in 1958, the burning was stopped and the wastes were landfilled after excavating the natural soils. Soils were used to cover the wastes

daily and the landfill expanded westward. The approximate extent of the 26-acre landfill is shown on **Figure 2**.

The City of Somersworth owns the entire landfill area and much of the wetland areas to the northwest of the former landfill. Numerous residential properties exist to the south, east and west of the Site, including two apartment buildings located adjacent to the northeast corner of the Site. A National Guard Armory and fire station are also located to the east of the Site, and a cemetery is located to the northeast of the Site.

Approximately 10 acres of the eastern portion of the Site have been reclaimed by the City on their own accord (i.e., without EPA or State review or approval) for use as recreational facilities, tennis and basketball courts, ball fields, and a playground. Additional reuse options for the remaining 15+ acres of the landfill area have included the potential for soccer fields while the remaining areas of the Site are principally wetlands.

### **3.3 History of Contamination**

Groundwater sampling conducted at the Site during the Remedial Investigation and Feasibility Study (RI/FS) between 1985 and 1992 indicated the presence of the following VOCs:

- trichloroethene (also know as trichloroethylene; TCE);
- tetrachloroethene (also known as tetrachloroethylene or perchloroethylene; PCE);
- 1,1-dichloroethene (1,1-DCE);
- cis and trans isomers of 1,2-dichloroethene (cis-1,2-DCE and trans-1,2-DCE, respectively);
- 1,2-dichloroethane (1,2-DCA);
- vinyl chloride (VC);
- benzene; and
- methylene chloride (also known as dichloromethane).

Metals (specifically chromium and arsenic) were detected in groundwater samples during the RI/FS but their concentrations were similar to background levels.

Polychlorinated biphenyls (PCBs) and pesticides were not detected in the groundwater samples.

The 1994 ROD indicated that the groundwater VOC distribution had reached a steady-state condition and VOCs had extended approximately 1,700 feet down gradient of the waste.

Soils sampled during the RI/FS had low concentrations of VOCs and semi-volatile organic compounds detected while inorganic compounds were found at or below background levels. VOCs were detected in sediment and surface water samples from the wetlands in 1985 and 1986; however, no VOCs were detected during subsequent sampling of the surface water in 1992 (sediments were not re-sampled).

### **3.4 Basis for Taking Action**

The ROD for the Site (Section IV) states that, "The selected remedy was developed by combining components of different source control and management of migration alternatives to obtain a comprehensive approach for Site remediation. In summary, the remedy provides treatment of contaminated overburden and bedrock ground water with flushing of contamination from the source area. This remedial action will address the principal threat to human health and the environment posed by the site: the potential future ingestion of contaminated groundwater."

The ROD also established Interim Cleanup Levels (ICLs) for eight volatile organic compounds (VOCs) in groundwater as listed below:

• benzene	5	micrograms per liter ( $\mu\text{g/l}$ )
• methylene chloride	5	$\mu\text{g/l}$
• tetrachloroethene (PCE)	5	$\mu\text{g/l}$
• trichloroethene (TCE)	5	$\mu\text{g/l}$
• 1,1-dichloroethene (1,1-DCE)	7	$\mu\text{g/l}$
• cis-1,2-dichloroethene (cDCE)	70	$\mu\text{g/l}$
• trans-1,2-dichloroethene (tDCE)	100	$\mu\text{g/l}$
• vinyl chloride (VC)	2	$\mu\text{g/l}$

The six chlorinated ethenes (i.e., PCE, TCE, 1,1-DCE, cDCE, tDCE, and VC) in the above list are referred to as the “CEs” at the Site.

## 4. REMEDIAL ACTIONS

### 4.1 Remedy Selection

The Record of Decision (ROD) for the Somersworth Sanitary Landfill Superfund Site (the "Site") was signed on June 21, 1994 (EPA, 1994).

The remedial action objectives stated in Section VII, Part A of the ROD were:

- Prevent ingestion of contaminated groundwater by local residents;
- Prevent the public from coming into direct contact with contaminated solid wastes, surface soils, surface water, and sediments;
- Reduce or eliminate migration of contaminants from the solid wastes or soils into ground or surface water;
- Reduce or eliminate off-site migration of contaminants in excess of regulated allowable limits; and
- Ensure that the ground water and surface water have residual contaminant levels that are protective of human health and the environment.

To meet these objectives, the selected remedy described in the 1994 ROD included both source control and management of migration components to obtain a comprehensive remedy for the Site.

The source control remedial components of the preferred alternative included:

- "installation of a treatment wall composed of impermeable barrier sections and innovative, permeable, chemical treatment sections to provide in-situ (in-place), flow-through treatment of contaminated ground water at the landfill waste boundary (the compliance boundary). The barrier sections, sheet piling or slurry walls, will direct contaminated ground water through the

treatment sections where detoxification of the VOCs will occur;  
and

- placement of a permeable cover over the landfill allowing precipitation to flush contamination from the waste area. This cover will remain as long as contaminants continue to leach from the landfill waste and the chemical treatment "wall" is functioning. After cleanup levels have been achieved and can be maintained without use of the treatment "wall," EPA will evaluate an appropriate landfill cover to be installed to close the landfill."

The management of migration remedial components of the preferred and contingency remedies included:

- "installation of a pump in bedrock monitoring well B-12R to extract contaminated ground water. The contaminated ground water will be either discharged onto the landfill to enhance flushing or injected just upgradient of the chemical treatment wall to receive treatment for the preferred alternative or treated with the extracted overburden ground water for the contingency alternative. The need for bedrock ground water extraction wells down gradient of the chemical treatment wall or perimeter slurry wall will be investigated during the design. This investigation will focus on the number, location, and flow rate of the wells; the timing of their installation; and the impacts on the overall ground water cleanup; and
- natural attenuation of contaminated groundwater beyond the compliance boundary to lower contaminant concentrations through physical, chemical and biological processes until groundwater cleanup levels are met."

Additional remedial components of the selected remedy included:

- “institutional controls to ensure that the affected ground water will not be used until ground water cleanup levels have been met; and
- a detailed ground water monitoring program to be developed during remedial design. The program will address long-term monitoring of the aquifer and performance monitoring of the chemical treatment wall.”

Finally, the 1994 ROD included a contingency alternative. The contingency alternative was to be invoked if it was determined that the source control preferred alternative would not meet performance standards. The source control contingency alternative included:

- “construction of a diversion trench on the upgradient side of the landfill to intercept and divert groundwater around the landfill. To the extent practicable, this diverted groundwater will be used to recharge the downgradient wetlands. A perimeter slurry wall would be completed around the landfill waste. Permeable treatment sections of chemical treatment wall would be removed and replaced by slurry wall material. The final component would be a landfill cover which complies with RCRA C requirements. The purpose of these components is to lower the ground water to below the waste in an attempt to meet interim ground water cleanup levels in the overburden aquifer at the compliance boundary. The ground water levels would be monitored to determine if the water table would be lowered below the waste and ground water quality would be monitored to ensure that overburden ground water will meet interim ground water cleanup levels at the compliance boundary. If either of these conditions cannot be met, then extraction and treatment of overburden ground water from within the slurry wall will be implemented. The remedial design will determine the number, location and pumping rates of each well, as well as, the most appropriate treatment technology and discharge location. On-site treatment and disposal methods and pretreatment and discharge at the Somersworth wastewater treatment facility are the two options which will be evaluated.”

## 4.2 Remedy Implementation

The components of the source control and management of migration preferred remedial action (PRA) that have been implemented at the Site are described in the following subsections.

### 4.2.1 Source Control Preferred Remedial Action (PRA)

The Source Control PRA included installation of a zero-valent iron (ZVI) Chemical Treatment Wall (CTW) to provide in-situ, flow-through treatment of groundwater containing chlorinated ethenes (CEs) at the downgradient edge of the waste management area of the landfill. Construction of the CTW commenced in July, 2000 and was completed in September, 2000 at the location shown in **Figure 2**. According to the Statement of Work in the Consent Decree (EPA, 1995), the CTW must prevent all untreated overburden ground water that contains CEs at concentrations greater than Interim Cleanup Levels (ICLs) from migrating from the landfill to areas beyond the point of compliance (POC), except for insubstantial amounts of such groundwater. The POC is the edge of the waste management area, except where the CTW has been constructed, in which case it is the outer edge of the CTW

The Source Control PRA also included placement of a permeable landfill cover (PLC) over the waste management area. The purpose of the PLC is to prevent direct contact with the underlying waste material, allow for infiltration of precipitation through the landfill and control erosion. The PLC, which was installed in 2001, consists of approximately six inches of coarse backfill material and six inches of topsoil seeded with native grass. The PLC covers the portion of the landfill not currently used for recreational activities.

Finally, the Source Control PRA must also assure that groundwater migrating from the landfill to areas beyond the POC does not contain >ICL concentrations of benzene or methylene chloride (EPA, 1995).

### 4.2.2 Management of Migration Preferred Remedial Action (PRA)

The Management of Migration PRA included installation of a bedrock, groundwater extraction well (BRW-1), located adjacent to bedrock monitoring well B-12R, which is approximately 80 feet south of the edge of the waste (see **Figure 2**). The

extraction well was installed in April, 1996, while the infrastructure needed to extract and discharge contaminated groundwater into an infiltration gallery located on top of the landfill was completed during the summer of 2001. Bedrock groundwater extraction commenced in November, 2001, with discharge of the extracted groundwater to the infiltration gallery located upgradient of the CTW. As of January, 2005 a total of 9,075,196 gallons of groundwater has been pumped from BRW-1 and discharged through the infiltration gallery located on top of the landfill.

In addition to bedrock groundwater extraction at BRW-1 (and groundwater treatment via the CTW), natural attenuation is also a component of the Management of Migration PRA. Monitoring for natural attenuation parameters has occurred since completion of the CTW and operation of the bedrock extraction commenced, as discussed further in Section 4.2.4 below.

#### 4.2.3 Institutional Controls

The PRA also included institutional controls. The purpose of the institutional controls is to ensure that the affected groundwater will not be used for any purpose until cleanup levels have been met; the hydrology of the Site is not adversely affected by the drilling or use of any wells at or near the Site; there is no disturbance to the waste left in place and the integrity of the cap is maintained. The PRA 100% Design and Demonstration of Compliance Plan (Beak and GeoSyntec, 1999) calls for implementation of institutional controls at the Site through the installation of fencing, other physical barriers and access controls, and land and groundwater use restrictions.

Fencing and other physical barriers have been installed around active and accessible components of the PRA to discourage vandalism and tampering and provide protection to these components, as listed below.

- The control box and the underground vault for the extraction system are protected with lockable covers or doors. The infiltration gallery and extraction well have been protected by flushmount locking protective covers.
- Protective steel casings have been installed over all monitoring wells and are locked using heavy gauge padlocks (i.e., to withstand unauthorized access using bolt cutters).

- Shrubs have been planted around the soil gas vent pipes of the Landfill Gas venting system (see description below in Section 4.2.5).

Pursuant to its zoning and land use authority, The City of Somersworth, a Working Settling Defendant (WSD) under the CD, has established a Groundwater Management Zone (“GMZ”) by legislative enactment. The boundaries of the GMZ are the same boundaries as presented on the Groundwater Management Zone Overlay Map included in the PRA 100% Design and Demonstration of Compliance Plan. The withdrawal of groundwater within the GMZ for any purpose is prohibited. The City of Somersworth notified its residents of the groundwater use restrictions by publishing legal notices in area newspapers which described the restrictions and by posting these same notices at City Hall. In addition, the Somersworth City Council and Planning Board held separate and distinct public hearings with separate and distinct notifications prior to the adoption of the groundwater zoning restrictions. If the zoning ordinance is repealed or amended so that it no longer prohibits the withdrawal of groundwater within the GMZ, then other types of institutional controls will be implemented in accordance with the SOW. A copy of Chapter 19, Section 10 of the City of Somersworth Zoning Ordinance is appended to this Five-Year Review Report as Attachment C along with a copy of the Groundwater Management Zone Overlay Map.

Where access to land is required for monitoring, remedy construction or other response actions, land easements or access agreements will be used to the extent necessary, as identified in the PRA 100% Design and Demonstration of Compliance Plan. An easement has been obtained for extraction well BRW-1. Existing agreements obtained from various property owners to access existing monitoring wells for sampling and maintenance are being used throughout implementation of the PRA.

#### 4.2.4 Groundwater Monitoring

The Groundwater Monitoring Plan for the Site is described in the Sampling and Analysis Plan (GeoSyntec, 2001a) that was prepared to satisfy the monitoring requirements identified in the Statement of Work (SOW) appended to the Consent Decree (CD). The groundwater monitoring network is shown in **Figure 2**.

The purpose of this monitoring plan is to document the progress of the groundwater remediation in both the overburden and bedrock, and to determine when the

groundwater remediation has achieved the overall goals of the selected remedy. Groundwater remediation is required until the ICLs are achieved at and beyond the POC at the Site. The WSDs must demonstrate that the ICLs have not been exceeded for a period of three consecutive years at every well at and beyond the POC using the evaluation procedure defined in 40 CFR 264.97.

The current monitoring program includes sampling selected wells three times annually to evaluate whether the CTW and bedrock extraction well are meeting the ICLs. In addition, certain wells are sampled annually to evaluate natural attenuation processes beyond the POC and to evaluate the background conditions at the Site. The CTW is also hydraulically tested annually to evaluate any changes in flow conditions.

All groundwater monitoring results are reported to EPA and NHDES as part of the Annual Monitoring and Demonstration of Compliance Reports.

#### **4.3 Landfill Gas (LFG) Venting Trench**

Based on soil gas monitoring conducted in 2001 and 2002, the EPA and NHDES believed that additional actions, such as a LFG venting trench, were necessary to mitigate methane releases near the perimeter of the landfill. While this additional action was not specified as a requirement of the ROD or CD, a LFG venting trench was installed in 2003 along the southern and eastern perimeter of the landfill as shown in **Figure 2**. The LFG venting trench is a passive system that prevents landfill gas from moving away from the landfill and allows for methane gas to escape from the subsurface.

The soil gas venting trench extends down to the seasonal low groundwater level. The trench is 3 feet wide with a total depth between approximately 15 feet in the southern segment to approximately 27 feet in the northern segment.

The venting trench contains gravel (#57 stone) placed from the seasonal low groundwater table to a depth of 3 feet below ground surface. A vertical geomembrane extends down the outside wall of the trench (the wall located farthest from the landfill) to act as a barrier to soil gas migration. Above the gravel, a geotextile fabric separator, a 2.5 feet layer of compacted clay and a 0.5 foot layer of topsoil have been installed. The compacted clay is intended to limit infiltration of surface water while the geotextile separator prevents migration of sediment into the gravel filled portion of the trench.

The vent pipes are embedded vertically within the gravel and are 4 inches in diameter. The pipe in the gravel is slotted with 1/8-inch slots. The vent pipes extend 8 feet above ground surface and terminate with a wind driven turbine vent at the outlet.

Landfill gas monitoring is conducted on a quarterly basis and is reported as part of the Annual Monitoring and Demonstration of Compliance Reports.

#### **4.4 System Operations/Operations and Maintenance (O&M)**

All Operations and Maintenance (O&M) requirements of the preferred remedial action are described in the Operation and Maintenance Plan (GeoSyntec, 2004b). Generally, the O&M requirements for the Site include, in addition to the groundwater monitoring described in Section 4.2.4 above, quarterly activities as follows:

- Hydraulic testing of the CTW; and
- Inspections of the PLC, access roads, extraction well vault, pump and infiltration gallery, monitoring wells, soil gas probes, and LFG venting system.

The actual Operations, Maintenance and Monitoring (OM&M) costs from 2000 to the end of 2004 have totaled approximately \$900,000 (excluding the LFG trench whose annual O&MM costs are approximately \$50,000).

## **5. PROGRESS SINCE THE LAST FIVE-YEAR REVIEW**

This is the first Five-Year review for the Somersworth Sanitary Landfill Superfund Site.

## **6. FIVE YEAR REVIEW PROCESS**

### **6.1 Administrative Components**

In a letter dated December 20, 2004, EPA notified the WSD that a five-year review was required at the Site to review the remedy and determine whether it remains protective of human health and the environment. In this letter, EPA requested that the WSD produce a draft of the five-year review report under the terms of the CD, and that EPA would finalize the five-year review report following receipt of their draft report. Accordingly, the WSD submitted to EPA a draft five-year review report on 15 June 2005.

The Final Somersworth Sanitary Landfill Superfund Site Five-Year Review Report was completed by Michael Jasinski, the EPA Superfund Section Chief, and Andrew Hoffman, NHDES Remedial Project Manager.

### **6.2 Community Involvement**

Copies of the review are being sent to the City of Somersworth and will be placed in the information repositories, including the Somersworth City Hall. A press release will also be issued by EPA announcing the findings of this review and the availability of this report.

### **6.3 Document Review**

This five-year review consisted of a review of relevant documents including, but not limited to, the 1994 ROD, the Sampling and Analysis and Operations and Maintenance Plans, Annual reports (including all monitoring data) produced by the WSD, the Groundwater Protection District Zoning Ordinance, and Applicable and Relevant or Appropriate Requirements (ARARs). The specific documents reviewed are listed in Attachment A.

### **6.4 Data Review**

Review of records and monitoring reports covering sampling results through August 2005 indicated that the remedy is performing substantially as designed. Specific

observations from the monitoring of groundwater and soil gas, and the implementation of institutional controls at the Site are presented below:

### Groundwater Monitoring

- Two of the three monitoring transects (i.e., CTW-30 and CTW-40) have consistently shown that the CTW performance meets the compliance requirement of reducing CEs to the ICLs as groundwater passes through the CTW (see **Table 2.3**). However, cDCE and/or VC data from monitoring events in April, 2004 and July, 2004 downgradient from the third monitoring transect (CTW-20) suggests a possible anomaly in the shallow groundwater. [Note that samples collected in 2001, 2002, 2003 had no detectable concentrations of cDCE or VC for both the shallow monitoring well (CTW-23U) and deep monitoring well (CTW-23L)].
- Additional groundwater monitoring conducted in October, 2004 indicated that the elevated concentrations of cDCE and/or VC, downgradient of the CTW-20 transect, are isolated to a small area in the immediate vicinity of the CTW-20 transect. However, the cause for the elevated concentrations on the downgradient side of the CTW-20 transect has not yet been determined and continues to be evaluated.
- The hydraulic testing, geochemical and biomass data are within the ranges expected in a zero-valent iron CTW and do not indicate any significant levels of precipitation or biofouling within the CTW.
- Overall, measured vertical gradients, calculated water table mounding, measured groundwater VOC concentrations, and groundwater flux calculations show no evidence of >ICL groundwater being diverted around or beneath the CTW, except for insubstantial amounts of such groundwater.
- The analytical and water level data collected since operation of the groundwater extraction system began are consistent with the design criteria set forth in the 100% Design Report so there are no indications at this point suggesting that additional bedrock groundwater extraction is warranted. Continued monitoring will be used to evaluate if there is a need for additional bedrock groundwater extraction at the Site in the future. Additionally, recent problems observed in 2004 and 2005 with the extraction pump in bedrock well BRW-1 will need to be carefully monitored to ensure the design extraction rate is maintained in this well.

- The VOC concentration trends downgradient of the POC indicate that natural attenuation processes are ongoing at the Site. Recent sampling for natural attenuation parameters (GeoSyntec, 2004a) provides additional evidence that natural attenuation is occurring at the Site. However, a more thorough evaluation of the lines of evidence to support the conclusions that natural attenuation is functioning as expected is necessary.
- The concentrations of VOCs in some of the compliance wells downgradient of the CTW have not yet been reduced below ICLs. At this early stage in the operation of the CTW, it is still too early to expect that VOC concentrations in groundwater will be below the ICLs at many of the wells. However, wells B-13WT, OB-4U and R, and OB-6R have achieved compliance. Other wells have demonstrated compliance (several of the CTW transect wells, CTW-10U and OB-7U and R) but monitoring of these wells will be continued to address monitoring objectives related to performance of the CTW (CTW transect wells and CTW-10U) and the potential for VOCs to migrate onto the Site (background wells OB-7U and R).
- VOCs continue to be present in the landfill waste, as indicated by the presence of >ICL groundwater at wells OB-16U and OB-17U. Additional monitoring of these specific wells is necessary to better understand the potential seasonal variations in the groundwater VOC concentrations and to possibly help explain (or not) the anomaly observed at the CTW-20 transect noted above.

#### Landfill Gas Monitoring

- Methane concentrations measured in soil gas probes before and after the installation of the LFG venting system indicate that the system is performing as designed and cutting off the migration of landfill gases out from the landfill.
- The total emissions of VOCs from the LFG venting system pipes has been estimated to be 13 pounds per year which is considered to be an insignificant amount.

## Institutional Controls

A review of the physical barriers (e.g., fencing) and administrative institutional controls implemented at the Site to date has determined that, for the most part, all requirements have been satisfied. However, EPA and NHDES have identified to the WSD a need to replace a former monitoring well cluster within the GMZ to ensure that a “clean-edge” still exists along the northern boundary of the GMZ. The WSD have agreed to install two additional monitoring wells based on a recent request of EPA in order to better define the northern boundary of the GMZ. Furthermore, under current NHDES permitting requirements, additional notification of property owners within the GMZ is necessary. The WSD have agreed to a request from EPA and NHDES to provide additional notification of property owners within the GMZ.

### **6.5 Site Inspection**

Representatives of EPA and NHDES participated in a Pre-Final Inspection meeting at the Site on 15 June 2004. During this inspection, the condition of the following components of the remedy were observed: groundwater monitoring wells, soil gas vent pipes, soil gas probes, bedrock groundwater extraction system vault, and the permeable landfill cover. No significant problems were observed during the 2004 inspection. In addition, EPA and NHDES personnel visited the Site on several occasions in 2005 to observe well installation and sampling activities, and general Site conditions. While some damage was observed to a few soil gas probes, they have been subsequently repaired based on an annual Site inspection performed by GeoSyntec, Inc. personnel for the WSD on August 25, 2005.

### **6.6 Interviews**

No interviews were conducted as part of this five-year review since community interest at the Site has been minimal to date.

## **7. TECHNICAL ASSESSMENT**

### **7.1 Is the remedy functioning as intended by the decision documents?**

Yes. A review of all available documents, ARARs, risk assumptions and the results of several Site inspections indicates that the remedy is functioning substantially as intended by the ROD. The CTW is providing flow-through treatment of contaminated groundwater; however, the data from recent sampling events from the downgradient side of the CTW at transect CTW-20 suggests a possible anomaly, the cause of which is under evaluation. The PLC is stable and has achieved the remedial action objective of preventing exposure to the landfill wastes while allowing flushing of the waste management area.

While natural attenuation processes are occurring at the Site, further detailed evaluations are required. Additionally, implementation of institutional controls by the City of Somersworth appears to have prevented current exposures to, or ingestion of, contaminated groundwater, but further notification of affected property owners appears to be warranted at the Site to ensure that no long-term exposures will exist in the future.

Finally, the bedrock groundwater extraction system has generally operated within the design parameters that were approved when the system became operational in November, 2001. However, periodic maintenance is essential to ensure that the system continues to extract contaminated groundwater south of the waste management area.

### **7.2 Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy selection still valid?**

Yes. There have been no changes in land use at the Site which would change the exposure assumptions contained in the ROD or affect the protectiveness of the remedy.

**7.3 Has any other information come to light that could call into question to protectiveness of the remedy?**

Yes. Refer to discussion in Section 7.1 above.

## 8. ISSUES

The following issue was identified as a result of this Five-Year review:

**Table 2: Issue**

<b>Issue</b>	<b>Affects Current Protectiveness (Y/N)</b>	<b>Affects Future Protectiveness (Y/N)</b>
Resolve all comments identified through EPA and NHDES review of the "Annual Monitoring and Demonstration of Compliance Report for 2004"	N	Y

## 9. RECOMMENDATIONS AND FOLLOW-UP ACTIONS

The following recommendations have been made based on the data review for the Site.

**Table 3: Recommendations and Follow-up Actions**

Issue	Recommendations and Follow-Up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness (Y/N)	
Resolve all comments identified through EPA and NHDES review of "Annual Monitoring and Demonstration of Compliance Report for 2004"	<p>(a) Provide additional notification of Property Owners within GMZ;</p> <p>(b) Install and sample additional monitoring wells within GMZ;</p> <p>(c) Conduct additional evaluations of MNA within groundwater downgradient of CTW; and</p> <p>(d) Continue to sample additional wells installed by the WSD in August 2005 near CTW-20 transect.</p>	Working Settling Defendants	EPA and NHDES	September 2006	N	Y

## **10. PROTECTIVENESS STATEMENT**

The remedy is considered protective in the short-term; however in order for the remedy to be protective in the long-term, follow-up actions need to be taken. Long-term protectiveness will be achieved once additional notification of property owners within the Groundwater Management Zone (GMZ) is provided in accordance with current State requirements, newly installed shallow and bedrock monitoring wells are sampled to confirm a “clean-edge” along the northern boundary of the GMZ, and the recent anomalies identified at the CTW near the CTW-20 transect are more fully understood through the monitoring of new wells installed by the WSD in August 2005.

## **11. NEXT REVIEW**

The next five-year review for the Somersworth Sanitary Landfill Superfund Site is required by September 2010, five years from the date of this review.

**ATTACHMENT A**

**LIST OF DOCUMENTS REVIEWED**

## **ATTACHMENT A**

### **LIST OF DOCUMENTS REVIEWED**

Beak International Incorporated (Beak). 1998. Design Investigation Report for the Pilot Study and Site Groundwater Monitoring Program. Remedial Design for Preferred Remedial Action at the Somersworth Sanitary Landfill Superfund Site, New Hampshire. Draft Report. July 1998.

Beak International Incorporated and GeoSyntec Consultants International, Inc. (Beak and GeoSyntec). 1999. Preferred Remedial Action 100% Design and Demonstration of Compliance Plan. Somersworth Sanitary Landfill Superfund Site, New Hampshire. Final Report. 23 April 1999.

GeoSyntec Consultants International, Inc. (GeoSyntec). 2000. 100% Design Update # . . Preferred Remedial Action 100% Design and Demonstration of Compliance Plan. Somersworth Sanitary Landfill Superfund Site, New Hampshire. 17 July 2000.

GeoSyntec Consultants International, Inc. (GeoSyntec) 2001a. Sampling and Analysis Plan (SAP) for Groundwater Monitoring During Preferred Remedial Action; Part 1 of 2, Field Sampling Plan. 19 March 2001.

GeoSyntec Consultants International, Inc. (GeoSyntec) 2001b. Chemical Treatment Wall Construction Completion Report. Draft. 30 May 2001.

GeoSyntec Consultants International, Inc. (GeoSyntec) 2003. Annual Monitoring and Demonstration of Compliance Report for 2002. DRAFT. 31 January 2003.

GeoSyntec Consultants International, Inc. (GeoSyntec) 2004a. Annual Monitoring and Demonstration of Compliance Report for 2003. DRAFT. 2 March 2004.

GeoSyntec Consultants International, Inc. (GeoSyntec) 2004b. Operations and Maintenance Plan for Preferred Remedial Action at the Somersworth Landfill Superfund Site. 30 April 2004.

GeoSyntec Consultants International, Inc. (GeoSyntec) 2004c. Annual Monitoring and Demonstration of Compliance Report for 2004 (Volumes I and II). Draft. 14 March 2005.

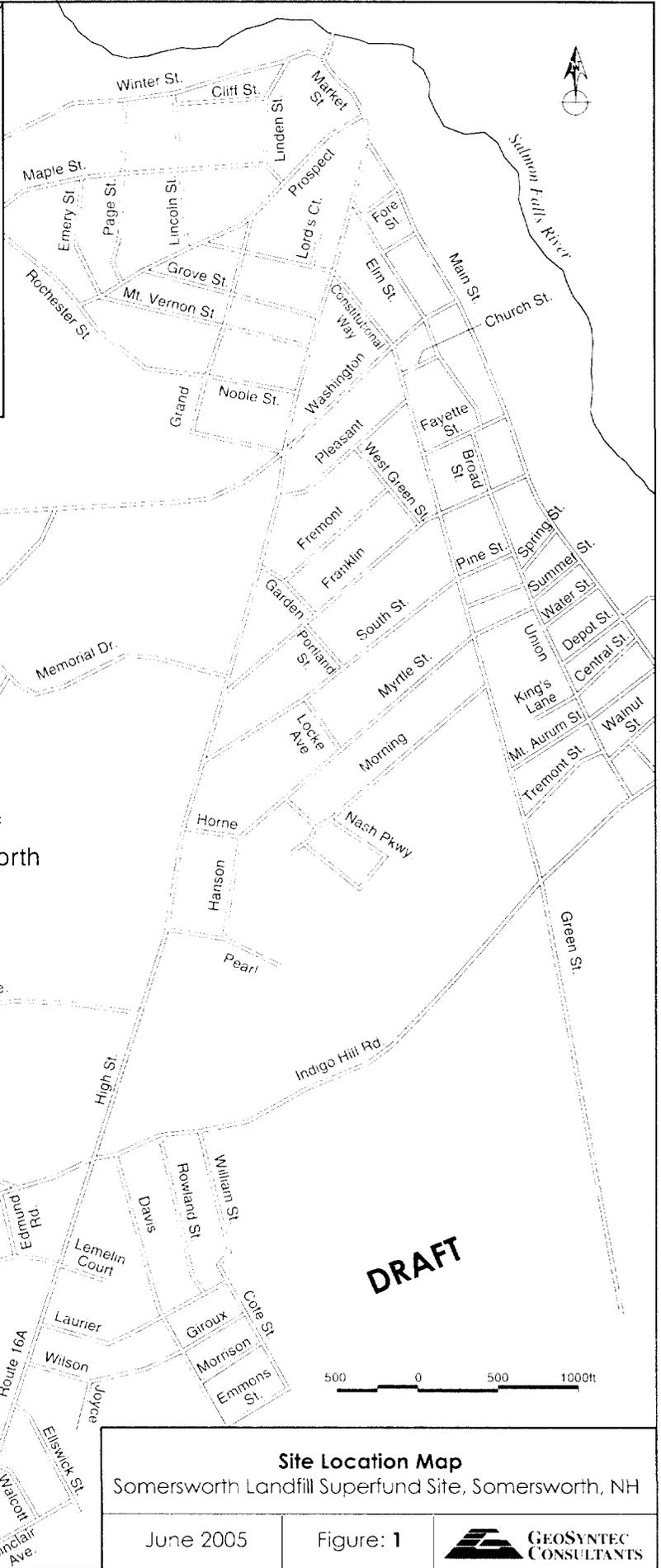
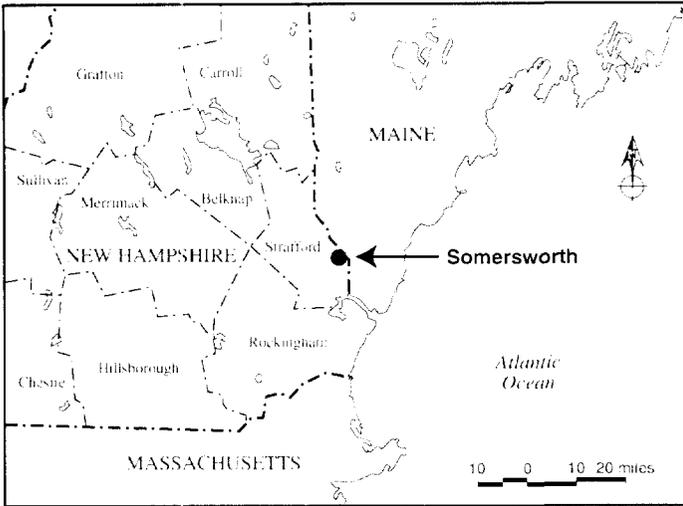
GeoSyntec Consultants International, Inc. (GeoSyntec) 2005. Draft Remedial Action Report for Preferred Remedial Action at the Somersworth Sanitary Landfill Superfund Site. 15 March 2005.

United States Environmental Protection Agency New England (Region I) (EPA). 1994. Record of Decision, Somersworth Sanitary Landfill Superfund Site.

United States Environmental Protection Agency New England (Region I) (EPA). 1995. Consent Decree for Remedial Design/Remedial Action at the Somersworth Sanitary Landfill Superfund Site, Somersworth, New Hampshire.

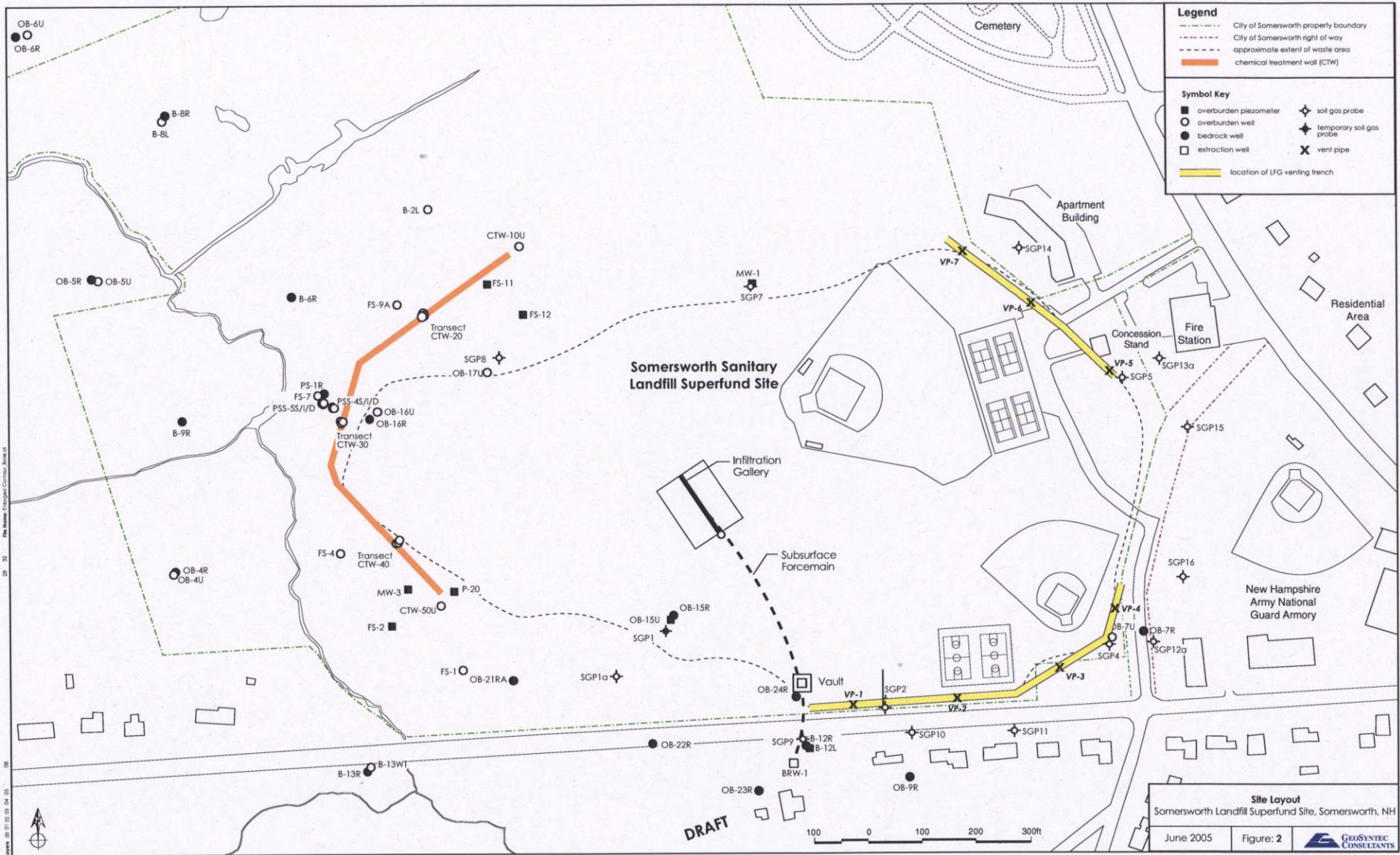
**ATTACHMENT B**

**FIGURE 1 - SITE LOCATION  
AND  
FIGURE 2 – SITE PLAN  
AND  
TABLE 2.3 FROM 2004 ANNUAL REPORT**



11/11/05

<b>Site Location Map</b>		
Somersworth Landfill Superfund Site, Somersworth, NH		
June 2005	Figure: 1	 <b>GEOSYNTEC CONSULTANTS</b>



**TABLE 2.3**  
**GROUNDWATER DATA FOR OBJECTIVE 1A - EVALUATE**  
**GROUNDWATER PASSING THROUGH CTW**  
**Somersworth Sanitary Landfill Superfund Site, New Hampshire**

Well ID	Sample Date	QA/QC Sample Type	1,1-DCE 7* (µg/L)	cDCE 70* (µg/L)	tDCE 100* (µg/L)	PCE 5* (µg/L)	TCE 5* (µg/L)	VC 2* (µg/L)
CTW-23L	28-Mar-01	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	26-Apr-01	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	17-Jul-01	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	16-Oct-01	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	<b>9.7</b>
	25-Apr-02	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	24-Jul-02	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	14-Oct-02	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	21-Apr-03	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	23-Jul-03	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	15-Oct-03	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	20-Apr-04	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	21-Jul-04	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	<b>15</b>
	20-Oct-04	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
Mean 2001			0.48	0.66	0.57	0.50	0.54	3.8
Mean 2002			0.48	0.66	0.57	0.50	0.54	0.79
Mean 2003			0.48	0.66	0.57	0.50	0.54	0.79
Mean 2004			0.37	0.49	0.50	0.31	0.48	5.3
CTW-25U	28-Mar-01	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	26-Apr-01	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	<b>2.1</b>
	17-Jul-01	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	16-Oct-01	Field Duplicate	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	16-Oct-01	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	25-Apr-02	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	<b>2.1</b>
	24-Jul-02	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	15-Oct-02	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	21-Apr-03	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	23-Jul-03	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	15-Oct-03	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	15-Oct-03	Field Duplicate	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	20-Apr-04	--	5.0 U	47	5.0 U	5.0 U	5.0 U	<b>43</b>
21-Jul-04	--	5.0 U	<b>81</b>	5.0 U	5.0 U	5.0 U	<b>64</b>	
20-Oct-04	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U	
Mean 2001			0.48	0.66	0.57	0.50	0.54	1.2
Mean 2002			0.48	0.66	0.57	0.50	0.54	1.2
Mean 2003			0.48	0.66	0.57	0.50	0.54	0.79
Mean 2004			0.37	43	0.50	0.31	0.48	36

**TABLE 2.3**  
**GROUNDWATER DATA FOR OBJECTIVE 1A - EVALUATE**  
**GROUNDWATER PASSING THROUGH CTW**  
**Somersworth Sanitary Landfill Superfund Site, New Hampshire**

Well ID	Sample Date	QA/QC Sample Type	1,1-DCE 7* (µg/L)	cDCE 70* (µg/L)	tDCE 100* (µg/L)	PCE 5* (µg/L)	TCE 5* (µg/L)	VC 2* (µg/L)
CTW-33L	28-Mar-01	Field Duplicate	5.0 U	8.6	5.0 U	5.0 U	5.0 U	<b>8.3</b>
	28-Mar-01	--	5.0 U	8.8	5.0 U	5.0 U	5.0 U	<b>8.7</b>
	25-Apr-01	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	<b>2.5</b>
	17-Jul-01	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	<b>2.1</b>
	17-Oct-01	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	25-Apr-02	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	23-Jul-02	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	15-Oct-02	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	21-Apr-03	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	23-Jul-03	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	15-Oct-03	--	5.0 U	5.4	5.0 U	5.0 U	5.0 U	<b>3.8</b>
	20-Apr-04	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	21-Jul-04	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	19-Oct-04	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
Mean 2001			0.48	0.66	0.57	0.50	0.54	1.8
Mean 2002			0.48	0.66	0.57	0.50	0.54	0.79
Mean 2003			0.48	2.2	0.57	0.50	0.54	1.8
Mean 2004			0.37	0.49	0.50	0.31	0.48	0.50
CTW-35-U	28-Mar-01	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	25-Apr-01	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	<b>4.8</b>
	17-Jul-01	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	17-Oct-01	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	25-Apr-02	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	23-Jul-02	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	15-Oct-02	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	21-Apr-03	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	23-Jul-03	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	15-Oct-03	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	20-Apr-04	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	21-Jul-04	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	20-Oct-04	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	20-Oct-04	Field Duplicate	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
Mean 2001			0.48	0.66	0.57	0.50	0.54	<b>2.1</b>
Mean 2002			0.48	0.66	0.57	0.50	0.54	0.79
Mean 2003			0.48	0.66	0.57	0.50	0.54	0.79
Mean 2004			0.37	0.49	0.50	0.31	0.48	0.50

TABLE 2.3  
**GROUNDWATER DATA FOR OBJECTIVE 1A - EVALUATE**  
**GROUNDWATER PASSING THROUGH CTW**  
**Somersworth Sanitary Landfill Superfund Site, New Hampshire**

GeoSyntec Consultants

Well ID	Sample Date	QA/QC Sample Type	1,1-DCE 7* (µg/L)	cDCE 70* (µg/L)	tDCE 100* (µg/L)	PCE 5* (µg/L)	TCE 5* (µg/L)	VC 2* (µg/L)
CTW-43L	28-Mar-01	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	25-Apr-01	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	17-Jul-01	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	17-Oct-01	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	24-Apr-02	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	24-Apr-02	Field Duplicate	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	23-Jul-02	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	16-Oct-02	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	7.2
	21-Apr-03	Field Duplicate	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	21-Apr-03	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	23-Jul-03	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	15-Oct-03	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	15-Oct-03	Field Duplicate	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	20-Apr-04	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	21-Jul-04	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
20-Oct-04	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U	
Mean 2001			0.48	0.66	0.57	0.50	0.54	0.79
Mean 2002			0.48	0.66	0.57	0.50	0.54	2.9
Mean 2003			0.48	0.66	0.57	0.50	0.54	0.79
Mean 2004			0.37	0.49	0.50	0.31	0.48	0.50
CTW-43U	28-Mar-01	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	25-Apr-01	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	17-Jul-01	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	17-Oct-01	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	24-Apr-02	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	23-Jul-02	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	15-Oct-02	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	21-Apr-03	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	23-Jul-03	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	15-Oct-03	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	20-Apr-04	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
	21-Jul-04	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U
20-Oct-04	--	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	2.0 U	
Mean 2001			0.48	0.66	0.57	0.50	0.54	0.79
Mean 2002			0.48	0.66	0.57	0.50	0.54	0.79
Mean 2003			0.48	0.66	0.57	0.50	0.54	0.79
Mean 2004			0.37	0.49	0.50	0.31	0.48	0.50

**TABLE 2.3**  
**GROUNDWATER DATA FOR OBJECTIVE 1A - EVALUATE**  
**GROUNDWATER PASSING THROUGH CTW**  
**Somersworth Sanitary Landfill Superfund Site, New Hampshire**

**Notes:**

- All wells shown in this table were also sampled on February 15, 2001 but samples were concluded to be not representative and results are not shown (R-qualified).

U - indicates compound not detected; associated value is the quantitation limit

µg/L - micrograms per litre

CTW - chemical treatment wall

\* ICL - Interim Cleanup Levels

Annual mean chlorinated ethene (CE) concentrations were calculated for 2001 using the April, July and October 2001 data. For subsequent years, the April, July and October data for that year are used to calculate the mean, so that each annual mean is based on data from three seasons. When a field duplicate was conducted, the data for the duplicates were averaged first to obtain a single value for that sampling event, which was then used to calculate the mean for the year.

The method detection limit (MDL) for the appropriate year was substituted for non-detects. If a sample was diluted, the MDL was multiplied by the dilution factor.

- MDLs:

2001 - 2003 Trichloroethene (TCE) = 0.54 µg/L  
 Tetrachloroethene (PCE) = 0.50 µg/L  
 cis-1,2-dichloroethene (cDCE) = 0.66 µg/L  
 trans-1,2-dichloroethene (tDCE) = 0.57 µg/L  
 1,1-dichloroethene (1,1-DCE) = 0.48 µg/L  
 Vinyl Chloride (VC) = 0.79 µg/L

2004 Trichloroethene (TCE) = 0.484 µg/L  
 Tetrachloroethene (PCE) = 0.305 µg/L  
 cis-1,2-dichloroethene (cDCE) = 0.487 µg/L  
 trans-1,2-dichloroethene (tDCE) = 0.50 µg/L  
 1,1-dichloroethene (1,1-DCE) = 0.371 µg/L  
 Vinyl Chloride (VC) = 0.503 µg/L

**ATTACHMENT C**

**CITY OF SOMERSWORTH GROUNDWATER PROTECTION  
DISTRICT ZONING ORDINANCE**

CITY OF SOMERSWORTH, NEW HAMPSHIRE

CHAPTER 19 - ZONING ORDINANCE



ADOPTED BY SOMERSWORTH CITY COUNCIL - AUGUST 30, 1989

AMENDED:

MARCH, 1990	OCTOBER, 1995	OCTOBER 21, 2002
AUGUST, 1990	JANUARY, 1996	MAY 3, 2004
SEPTEMBER, 1990	JULY 15, 1996	MARCH 21, 2005
JANUARY, 1991	JUNE 2, 1997	
APRIL, 1991 MAY,	APRIL 6, 1998	
1991	JUNE 1, 1998	
SEPTEMBER, 1991	JANUARY 18, 1999	
MAY, 1992	OCTOBER 19, 1999	
SEPTEMBER, 1992	JANUARY 10, 2000	
JULY, 1993	APRIL 17, 2000	
SEPTEMBER, 1993	AUGUST 14, 2000	
FEBRUARY, 1994	DECEMBER, 2000	
APRIL, 1994	MARCH, 2001	
JULY, 1994	MAY 21, 2001	
FEBRUARY, 1995	OCTOBER 7, 2002	

CITY OF SOMERSWORTH  
CHAPTER 19 – ZONING ORDINANCE

Amended March, 1990:

Pages 1, 2, 3, 13, 14, 52, 56, 60 through 74, 83, 84, 85. Also, tables 4.A.1; 4.A.2; 4.A.3; 4.A.4; 4.A.5. Note #5; 5.A.1.; 5.A.2.

Amended August, 1990:

Section 7, pages 16 thru 23.

Amended September, 1990:

Section 17, pages 63 thru 67. Table 5.A.1 and Table 5.A.1 Notes.

Amended January 7, 1991:

Section 20, page 89 - Zoning Board of Adjustment.

Amended April 1, 1991:

Section 18.C.4.e. - Political Signs.

Amended May 20, 1991:

Section 3.D., Page 5 - Commercial/Industrial District; Table of Uses, Tables 4.A.2; 4.A.3; 4.A.4; 4.A.5; 5.A.1.

Amended September 16, 1991:

Section 12, pages 46 thru 54 - Wetlands Conservation Overlay District.

Amended May 4, 1992:

Section 13, pages 53 thru 58 - Historic District.

Amended September 21, 1992:

Section 8, pages 24, 26 and 28 - Home Occupations.

Amended July 26, 1993:

Section 21, page 93 - Definitions; Table 4.A.4.

Amended September 7, 1993:

Section D.2., page 5 - Commercial/Industrial District.

Amended February 28, 1994:

Section 3. D.2., pages 5 & 6 - Commercial/Industrial District. Section 14, pages 60 thru 62 - Sexually Oriented Businesses (new). Section 18, page 71 on (19 pages) - Sign Regulations. Table of Uses - Table 4.A.5 (at end of chapter)

Amended April 4, 1994:

Table of Uses - Table 5.A.1 and Table 5.A.1 Notes.

Amended July 18, 1994:

Sections 11.B.4. & 11.B.5. (page 39); 11.B.8.f.& 11.B.9. (Pages 42 & 43); 11.c.(Pages 45 & 45A).

Amended February 21, 1995:

All pages renumbered to correspond with section numbers.

Table of Contents.

New Section added - "Section 15, Commercial Node District" (pages 15.1 thru 15.3).

Section 15 through Section 23 renumbered to Section 16 through Section 24.

Add Section 3.B.16. (page 3.3).

Add Section 3.D.8. (page 3.9).

Section 20.A.1. (page 20.1).

Section 20.B.3. (pages 20.1 & 20.2).

Section 20.B.3.h. (page 20.3).

Section 22 (pages 22.1 thru 22.9).

Tables 5.A.1&5.A.2

Amended October 2, 1995:

Added new Section 11 - Excavation of Earth Products (pages 11.1 to11.4)

Section 11 through Section 24 renumbered to Section 12 through Section 25.

Amended January 10, 1996:

Add Section 3.B. 15 (page 3.3).

Add new Section 16 - Recreation District (pages 16.1 thru 16.3).

Renumber all sections and pages after section 16 to reflect this change.

Section 24 (page 24.2).

Table 5.A. 1 Notes (page 8).

Amended July 15, 1996:

Delete Section 20 - Landscaping and Buffer Requirements, in its entirety.

Delete Section 22 - Circulation and Parking Regulations and replace with Section 21 – Circulation And Parking Regulations (page 21.1).

Renumber Section 23 through Section 26 to Section 22 through 25.

Amended June 2, 1997:

Section 8.D. (page 19:18)

Section 8.F.3. (page 19:18)

Section 8.F.6. (page 19:19) delete second paragraph

Table 4.A.3 & Note #6 (page 19:77)

Amended April 6, 1998:

Section 23 - Definitions (pages 68 and 70)

Table 4.A.3 and 4.A.5

Amended June 1, 1998:

Section 20 Sign Regulations - page 60.

Amended January 18, 1999:

Table 4.A.4 and 4.A.5

Amended October 19, 1999:

Added new Section 23 Naming of Public Streets and Rights of Way – pages 72-75

Renumbered Section 23 Definitions to Section 24 - pages 76-82. Renumbered Section 24 Administration & Enforcement to Section 25 - page 83. Renumbered Section 25 Interpretation, Conflicts & Separability to Section 26 - pages 84&85.

Amended January 10, 2000:

Section 8 Home Occupations - pages 18,19 & 21.

Section 10 Groundwater Protection District - pages 25 & 26.

Amended April 1, 2000:

Section 8 Home Occupations - pages 18,19 & 21.

Amended August 14, 2000:

Section 9 - Manufactured Housing District - pages 23 thru 24C. Table 4.A.5-  
pages 91 & 92.

Amended December 11, 2000:

Section 12 - Flood Plain District - pages 32 thru 38A.

Amended March 19, 2001:

Section 3.A. - Districts - page 1.

Section 3.B.7. (deleted) - page 2.

Section 3.D.10. and 3.D.10.a. - (new) - page 7.

Section 24.NN. and 24.PP (delete) - page 79 and 80.

Tables 4.A.1. through 5.A.2 - pages 86 through 94.

Amended May 21, 2001:

Section 19.3.A. - Districts - page 1.

Section 19.3.B.14. - Purpose of Districts - page 3.

Section 19.3.D.11. - District Boundaries - page 7.

Section 19.3.D.12. - District Boundaries - pages 7 & 8.

Section 19.21. - Circulation & Parking Regulations - page 70.

Tables 4.A.1,4.A.2,4.A.3,4.A.4,4.A.5,5.A.1 - pages 85 thru 92.

Amended October 7, 2002:

Added new Section 24 Common Driveway Subdivision – pages 78 and 79.

Renumbered Section 24 thru Section 26 to Section 25 thru Section 27.

Amended October 21, 2002:

Table 4.A.3. – page 90

Amended 5/03/2004:

Section 7, Cluster Subdivision – pages 12 thru 17. Changed Cluster Subdivision to read Conservation Residential Development throughout Section.

Sections 20.D.2.a, 20.D.2.e, 20.D.2.f – page 68.

Section 20.D.4 – page 70.

Section 25, Definitions – pages 80 thru 84.

Added new Section 26, Telecommunication Facilities – pages 86 thru 93.

Amended Table of Uses (Table 4.A.3), page 98.

Amended Table of Uses (Table 4.A.5), pages 101 & 102.

Amended 3/21/2005:

Section 19.12.A. Flood Plain District, Applicability – page 34.

Section 19.14.H.2. Historic District, Appeal Process – page 52.

Section 19.20.B.13. Sign Regulations, Flashing Sign – page 61.

Section 19.20.C.2.e. Sign Regulations – page 63.

Section 19.20.C.4.a. Sign Regulations – Banner Signs – page 64.

Section 19.25.Y. Definitions, Dwelling Unit – page 82.

Section 19.25.DD. Definitions, Frontage – page 82.

Section 19.27.C. & 19.27.E. Administration & Enforcement – page 94.

Table 4.A.1. – page 96.

## Section 10 Groundwater Protection District

- 19.10.A. AUTHORITY. In accordance with New Hampshire Revised Statutes Annotated (RSA) Chapter 4-C:22 III, as the same may be subsequently amended, the City of Somersworth hereby adopts the following Groundwater Protection District.
- 19.10.B. PURPOSE. The purpose of this ordinance is, in the interest of public health, safety and general welfare, to protect, preserve and maintain the existing and potential groundwater supply and groundwater recharge areas within the known aquifer from adverse development, land use practices or depletion, and to allow for the restoration of degraded ground water by the establishment of a "Ground Water Management Zone".<sup>1</sup>
- 19.10.C. LOCATION.
- 19.10.C.1. The boundaries of the Groundwater Protection District shall be the outermost edge of the out wash deposits of the "Lily Pond Aquifer", as designated in the "Report on Aquifer Definition Lily Pond Aquifer Somersworth, New Hampshire," prepared by BCI Geonetics, Inc., and included in the Water Master Plan Update dated June 1984. The Ground Water Management Zone is designated by the Ground Water Management Zone Overlay Map included in the Preferred Remedial Action 100% Design and Demonstration of Compliance Plan prepared by Beak International, Inc. and Geo Syntec Consultants International, Inc.<sup>1</sup>
- 19.10.C.2. When the actual boundary of the Groundwater Protection District is in dispute by any owner or abutter actually affected by said boundary, the Planning Board, at the owner/abutter's expense and request, may engage a professional geologist or hydrologist to determine more accurately the precise boundary of said Groundwater Protection District.
- 19.10.D. APPLICABILITY.
- 19.10.D.1. All land use activities and development conducted within the Groundwater Protection District shall be regulated by the standards established herein.
- 19.10.D.2. The standards established herein shall constitute the rules of an overlay zone and shall be superimposed over other zoning districts or portions thereof. The provisions herein shall apply in addition to all other applicable ordinances and regulations. In the event of a conflict between any provision herein and any other ordinance or regulation, the more restrictive requirement shall control.
- 19.10.E. DEFINITIONS.
- 19.10.E.1. Animal Feed Lots. A plot of land on which 25 livestock or more per acre are kept for the purpose of feeding.
- 19.10.E.2. Groundwater. Water in the subsurface zone at or below the water table in which all pore spaces are filled with water.
- 19.10.E.3. Groundwater Management Zone (GMZ). The subsurface volume in which ground water contamination associated with a discharge of a regulated contaminant is contained. (State of NH Groundwater Protection Rules - Env - WS410.)<sup>2</sup>

<sup>1</sup> Amended 1/10/2000.

<sup>2</sup> Passed 1/10/2000

- 19.10.E.4. Hazardous and Toxic Materials. Those materials that pose a present or potential hazard to human health and the environment when improperly stored, transported or disposed of. These materials include those listed in the New Hampshire Hazardous Waste Regulations. Third Edition. Appendixes 1-4, 1985, New Hampshire Dept. of Environmental Services, Concord, as the same may be subsequently amended.
- 19.10.E.5 Impervious Surface. A surface covered by any material (such as pavement, cement, roofing) that prevents surface water from penetrating the soil directly.
- 19.10.E.6. Leachable Wastes. Waste materials including solid wastes, sewage, sludge, and agricultural wastes that are capable of releasing waterborne contaminants to the surrounding environment.
- 19.10.E.7. Solid Waste. Discarded solid material with insufficient liquid content to be free flowing. This includes but is not limited to rubbish, garbage, scrap materials, junk, refuse, inert fill material and landscape refuse.
- 19.10.F. PROHIBITED USES. The following uses are expressly prohibited from the Groundwater Protection District:
- 19.10.F.1. Within the Lily Pond Aquifer<sup>1</sup>
- 19.10.F.1.a. The disposal of solid waste including landfills and sewage lagoons, excepting disposal of stumps and brush;
- 19.10.F.1.b. Storage of road salt or other deicing chemicals except in a property constructed shelter for use on site;
- 19.10.F.1.c. Dumping of snow containing road salt or other deicing chemicals;
- 19.10.F.1.d. Motor vehicles service or repair shops;
- 19.10.F.1.e. Junk and salvage yards;
- 19.10.F.1.f. Animal feedlots;
- 19.10.F.1.g. Commercial or industrial handling, disposal, storage or recycling of hazardous or toxic materials or wastes; and
- 19.10.F.1.h. Underground storage or petroleum or any refined petroleum product. All existing underground tanks, including those under 1,100 gallons, must be registered with the Somersworth Fire Department within six months of the enactment of this regulation. Existing tanks over 1,100 gallons are subject to Water Supply and Pollution Control Commission regulation, pursuant to New Hampshire Code of Administration No. W5411.
- 19.10.F.2. Within the Groundwater Management Zone:
- 19.10.F.2.a. The requirements, restrictions, and prohibition of the underlying Zoning District shall continue to apply to the extent that they are not inconsistent with the provision of this section; and
- 19.10.F.2.b. Pumping of ground water from any well, trench, sump or other structure for residential, irrigation, agricultural or industrial purpose is prohibited.<sup>2</sup>
- 19.10.G. SPECIAL CONDITIONS. The following conditions shall apply to all uses in the Groundwater Protection District:

Added 1/10/2000.  
Passed 1/10/2000.

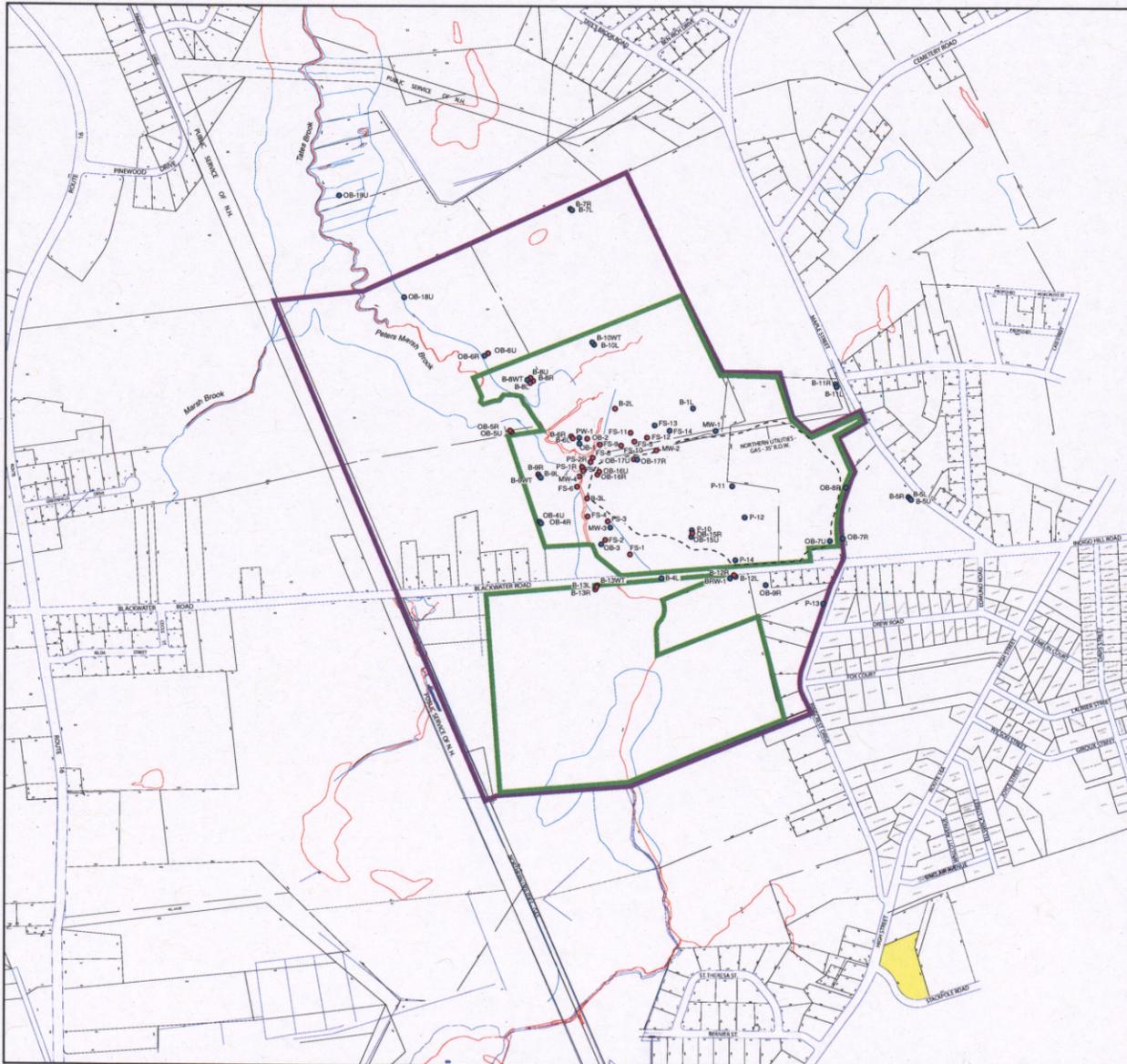
- 19.10.G.1. A lot shall not be rendered more than ten percent (10%) impervious. A proposed development plan which will incorporate a stormwater drainage plan, approved by the City of Somersworth Planning Board and prepared by a professional engineer certified to practice in the State of New Hampshire shall be provided. The plan shall provide for the on-site retention and percolation of all development generated stormwater runoff from a ten (10) year storm. Furthermore, the stormwater drainage plan shall provide for the filtering of parking area runoff to remove oil, gasoline and other impurities prior to retention and percolation of the runoff;
- 19.10.G.2. Development or land use activities proposed within the Groundwater Protection District shall be connected to the municipal sewage disposal system and the municipal water system;
- 19.10.G.3. Any use retaining less than thirty percent (30%) of lot area, regardless of size, in its natural vegetative state with no more than minor removal of existing trees and vegetation shall require a special permit;
- 19.10.G.4. Mining operations, including sand and gravel removal, shall require an Earth Removal Permit, pursuant to New Hampshire Revised Statutes Annotated Chapter 155-F, which is herein incorporated by reference. Such excavation or mining shall in no case be carried out within eight (8) vertical feet of the seasonal high water table; and
- 19.10.G.5. The storage of petroleum or related products in a freestanding fuel oil tank within or adjacent to a residential structure which is used for the normal heating of said structure shall be permitted pursuant to the conditions outlined in subsection H below, and all applicable state regulations. All tanks shall be protected from internal and external corrosion and shall be of a design approved by the Somersworth Fire Department. All freestanding tanks shall be placed on an impermeable surface such as a concrete pad. No tank may be abandoned in place. A tank shall be disposed of after emptied of all hazardous materials if it has been out of service for a period in excess of twelve (12) months. The product and the tank shall be disposed of by the property owner as directed by the Somersworth Fire Department and all applicable state laws. All leaking tanks must be emptied by the owner or operator within twelve (12) hours after detection of the leak and removed by the owner and or operator as per above.

19.10.H. ADMINISTRATION.

- 19.10.H.1. Development or land use activities proposed within the Groundwater Protection District that require a special permit, as provided in subsection G above, shall be reviewed by both the Planning Board and the Somersworth Conservation Commission. The Planning Board shall either approve, conditionally approve or disapprove a special permit only after it determines that the proposed land use development and or activities comply with the purpose of this regulation. In making such a determination, the Planning Board shall give consideration to the simplicity, reliability and feasibility of the control measures proposed and the degree of threat to ground water quality if the control measures failed.
- 19.10.H.2. Development or land use activities proposed within the Groundwater Protection District that require subdivision or site plan approval from the Planning Board shall also be reviewed by the Somersworth Conservation Commission. The Planning Board and the Conservation Commission shall verify that the proposed activity will conform to the provisions of this regulation ordinance prior to action by the Planning Board to approve, conditionally approve or disapprove the application.

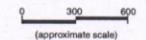
- 19.10.H.3. The Building Inspector shall not issue a building permit for development or land use activities until such time as he/she verifies that the proposed activity will conform to the provisions of this ordinance. The Building Inspector may consult with the Planning Board and or Conservation Commission as he/she deems necessary.
- 19.10.H.4. Land use activities that do not require the receipt of Planning Board approval or building permits shall nonetheless be subject to the requirements and standards established herein.
- 19.10.H.5. A hydrogeologic study may be required by the Planning Board and or the Conservation Commission to investigate the impacts a proposed development or land use activity will have on an existing or future groundwater supply. A qualified professional hydrologist or geologist shall be chosen by the City of Somersworth and the applicant for approval shall pay any and all costs incurred.
- 19.10.H.6. For all freestanding fuel oil tanks as permitted per Section 7. E., the property owner shall file with the City of Somersworth the following information prior to the installation of a tank:
- 19.10.H.6.a. The size of the tank;
  - 19.10.H.6.b. The type of tank;
  - 19.10.H.6.c. The type of material being stored and its quantity;
  - 19.10.H.6.d. The location of each tank on the premises, complete with a sketch map; and
  - 19.10.H.6.e. The age of each tank.
- 19.10.I. ENFORCEMENT. If the Planning Board and or the Building Inspector finds that any of the requirements and standards established herein are in violation, the Building Inspector shall order the owner, in writing, to make such corrections as he/she deems necessary to bring the development and activities into compliance with the provisions of this ordinance. Such order shall be complied with within twenty-four (24) hours of the original notice to the owner. Where the owner fails to comply with the order of the Building Inspector, a fine of one hundred dollars (\$100) per day, or the maximum amount which is authorized by statute, may be levied against said owner. The fine shall be retroactive and shall begin to accrue on the date on which the property owner receives written notice from the Building Inspector that he/she is in violation of this ordinance.

Layers: 00 01 03 04 05A 05 06 08 SCHWEDD/05/06/07/08



- State Well Records Indicate a Water Supply Well on this Lot
- City Owned Land Within Groundwater Management Zone
- Approximate Edge of Waste
- Boundary of Groundwater Management Zone
- Between 1996 - 1998 ICLs were exceeded for at least one CE
- Between 1996 - 1998 ICLs were not exceeded for any CE

CE - Chlorinated Ethenes (tetrachloroethene, trichloroethene, cis- and trans-1,2-dichloroethene and vinyl chloride)



**Groundwater Management Zone**  
Somersworth Landfill Superfund Site, Somersworth, NH