Chittenden County Brownfields Program
Site Nomination / Assistance Request Form

For information on types of assistance available and CCRPC's protocol for deciding if, and to what degree to assist a request, see:
http://www.ccrpcvt.org/our-work/economic-development/brownfields/

Site Name: Lot 7D

Site's Street Address/Town/Zip Code: 17 Abenaki Way

Parcel Tax ID #: AB017/SPAN 774-246-12304 Property Size (Acres): 0.644 acre

Zoning District: Downtown Core

Describe current use(s): unpaved surface parking lot

Describe former use(s): historically this site has held residences and lumber yards

Are there plans for acquisition and/or redevelopment? X Yes ___ No

If yes, attach a separate one to two-page document describing the anticipated benefits of the redevelopment such as housing units, commercial development, jobs, economic impact, recreation, etc. (see Site Evaluation Criteria at link above for the types of information to provide).

Have studies been conducted to identify or assess contamination? X Yes ___ No

If yes, please identify the title, author and date of the report, and if available, send us a PDF: 1999 Environmental Site Assessment Winooski Redevelopment Area

Potential contaminants include: ___ Petroleum X Other contaminants

What type(s) of site assessment or cleanup planning assistance are you seeking? Circle all that apply

Phase I Environmental Site Assessment	(Phase II Environmental Site Assessment)
Soil Monitoring during Construction	Archeological Site Assessment / Recon
Historic Preservation issues	Cleanup / Corrective Action Planning

Other TBD

Property Owner Information:

Name: City of Winooski Signature: H. Carrington

Mailing Address: 27 W. Allen St., Winooski, VT 05404

Phone: 802.655-6410 x 23 Email: hcarrington@winooskivt.org

Nomination Submitted By:

Name or Office: Heather Carrington Date Submitted: 11/20/18

Mailing Address: City of Winooski, 27 West Allen St. Winooski VT 05404

Phone: 802.655-6410 x 20 Email: hcarrington@winooskivt.org

Please Return Site Nomination Form (via PDF is preferred) to:
Dan Albrecht, Senior Planner
Chittenden County Regional Planning Commission 110 West Canal St., Suite 202 Winooski, VT 05404
*Phone: (802) 846-4490 Ext. *29; Email: dalbrecht@ccrpcvt.org*

CITY OF WINOOSKI

27 WEST ALLEN STREET
WINOOSKI, VERMONT 05404

(802) 655-6419
(802) 655-6414 (fax)

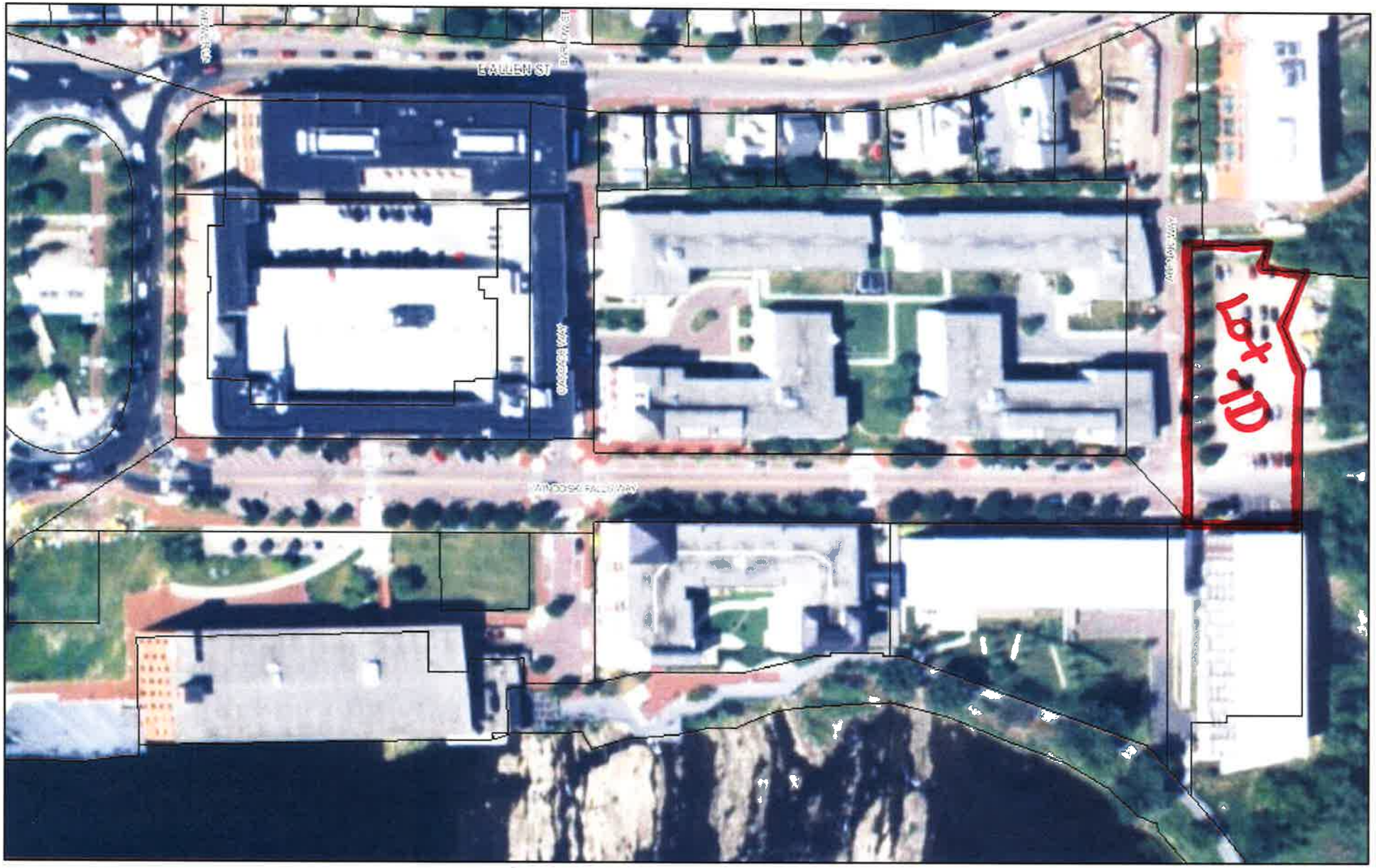
Lot 7D Brownfields Program Site Nomination

The proposed project site is a 0.644 acre site in the City of Winooski's downtown core. The site is currently underutilized, serving as an unpaved surface parking lot. The City of Winooski owns the property, and is interested in partnering with a private developer to redevelop the site as a municipal parking garage on the bottom three stories, with a four-story 95 room hotel above. The project would also improve both pedestrian and vehicular access to the adjacent 104 acre Casavant Natural Area as a condition of the development. Overall, this would represent over $5 million of investment in Winooski's state designated downtown, furthering urban density in a municipality which currently possesses the water, sewer, electric, and transportation infrastructure to support it.

Winooski's population has a high poverty rate of 26%, vs. Chittenden County's 11.5%. The economic impacts of this project would be significant in terms of job creation, potential tax revenues, grand list growth, and anchoring existing downtown businesses. Using standard hotel employee calculations, a 95 room hotel would result in the creation of 76 jobs in the city. In addition, the hotel could have a vital economic impact on the City of Winooski through rooms and meals tax revenue, as Winooski is considering adopting a local options tax. Further tax benefits will be realized through an increased assessed property value. There is no question that the assessed value of a 95 room hotel will be well above that of an undeveloped lot, leading to an increased tax base. Lastly, and importantly, a new hotel will bring a constant stream of visitors to downtown Winooski thus anchoring the business community by supplying ongoing customers for the vibrant restaurants, bars and retail shops downtown.

The project location is one of the final remaining undeveloped parcels in the downtown Winooski TIF district. The dense, mixed use commercial development will be accomplished through a public-private partnership, and aligns with both municipal and regional plans. By using municipal funds, as well as federal grant funding, the City will leverage significant private development investment.

Winooski, Vermont



November 20, 2018

Road Name

2014 Tax Parcel Boundary

1:2,257

0 0.01 0.03 0.05 mi

0 0.02 0.04 0.08 km

DigitalGlobe

Chittenden County Regional Planning Commission

18 Abenaki Way - Existing Conditions

Image capture: Aug 2017 © 2018 Google

Winooski, Vermont

Google, Inc.

Street View - Aug 2017

Google Maps 17 Abenaki Way - Existing Conditions

Imagery ©2018 DigitalGlobe, Map data ©2018 Google 50 ft

Phase (check one)	Type (check one)
☒ Site Investigation	☐ Work Scope
☐ Corrective Action Feasibility Investigation	☒ Technical Report
☐ Corrective Action Plan	☐ PCF Reimbursement Request
☐ Corrective Action Summary Report	☐ General Correspondence
☐ Operations & Monitoring Report	

REPORT ON

ENVIRONMENTAL SITE ASSESSMENT
WINOOSKI REDEVELOPMENT AREA
MAIN AND EAST ALLEN STREETS
WINOOSKI, VERMONT

Submitted To

Winooski Community Development Corporation
27 West Allen Street
Winooski, Vermont 05404
Contact : Bill Niquette
(802) 655-6426

Submitted by
Dufresne- Henry, Inc.
Precision Park
North Springfield, Vermont 05150
Contact: F. David Deane, P.E.
(802) 886-2261

September ~~17, 1999~~
(Revised November 19, 1999)

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EXECUTIVE SUMMARY

An Environmental Site Assessment has been completed on the approximately twenty acre tract of land east of Main Street and south of East Allen Street in Winooski, Vermont ("the Site"). Most of the site is currently occupied by commercial properties and associated parking areas. The Winooski Community Development Corporation is spearheading efforts for redevelopment of the site.

The existing uses of the site pose no significant threat of environmental contamination. Past uses, from the late 1700's to urban renewal in 1972, included commercial and industrial enterprises such as a foundry, machine companies and petroleum retailers. These businesses could have left behind residual contamination that could cause problems or excessive expenses for the redevelopment effort.

The locations of various businesses with the potential to cause residual contamination were determined from historical photographs and maps. Thirteen soil borings were installed at selected locations, and samples taken for chemical analysis for a variety of materials including heavy metals, solvents, petroleum products and PCBs. Groundwater was found at three locations where monitoring wells were installed and groundwater samples taken and analyzed.

Residual contamination is present in the area of the former machine shop and foundry, and at the sites of two former gasoline stations.

- Chlorinated solvents are present in the groundwater at the former foundry site at concentrations slightly above Vermont Groundwater Enforcement Standards.
- Arsenic and petroleum contamination in the soil in this general area are above guideline concentrations.
- Residual petroleum contamination at both of the locations of the former gas stations that do not exceed the regulatory guidelines.
- No PCBs were found.

Overall, contamination on the site is neither widespread nor at what could be considered high levels.

There is little risk to human health or the environment from the contamination identified. The only identified receptors are the Winooski River and the interior air of the existing buildings. If and when the site is disturbed, there will be some risk for contact with contaminated soil or the vapors it may release, but these risks are controllable with proper precautions.

The entities involved with the redevelopment project should work with the Vermont Agency of Natural Resources to determine what additional work is necessary to characterize the contamination identified on the site.

Based on the findings of this assessment, there are measures that can be incorporated into the planning and construction of the proposed redevelopment to address monitoring and remediation of the identified contamination at reasonable cost and without unreasonable financial risk.

Purpose and Introduction

The purpose of an Environmental Site Assessment (ESA) is to determine the likelihood or threat of environmental conditions that could impact the current or future use and value of a particular property, within certain limitations and constraints. This assessment was performed on behalf of the Winooski Community Development Corporation (WCDC). Both Phase I and Phase II work were completed, including a site walkover, research into site history, installation of borings with monitoring wells, and sampling and analysis of soil and groundwater.

The work was performed in general conformance with the Scope of Work provided by WCDC. That Scope of Work was based on the "Site Investigation Guidance" document of the Agency of Natural Resources, Waste Management Division, Sites Management Section (SMS). The approach described therein is generally applicable to a site with an identified contamination problem.

Our effort consisted of:

1. Sufficient research into the history of the site to identify those areas where potential contaminants were likely used,
2. Selection of boring locations and sampling parameters deemed likely to identify residual contamination,
3. Completion of a series of thirteen soil borings, with field screening of boring cuttings, and analytical sampling for chemicals likely to remain from historical releases,
4. Installation of monitoring wells in those borings where groundwater was encountered and analytical sampling for the same general parameters as the soil,
5. Documentation of boring/well installation and compilation of the analytical data with comparisons to groundwater and soil standards and guidelines,
6. Consideration of the fate and transport of the various identified contaminants and the possible impact on identified potential receptors,
7. Consideration of additional investigations to further define the severity and extent of identified contaminants,
8. Preliminary consideration of actions to monitor or remediate identified contaminants.

The subject of this ESA is a tract of roughly 20 acres on the north bank of the Winooski River in the urban area of Winooski ("the Site"). At present the site includes four major buildings; one a former woolen mill dating from the early 1900's ("the Champlain Mill"), two multi-store strip mall buildings, and a bank constructed in the mid 1980s. A Site Location Map is included as Attachment A, and a Site Plan is included as Attachment B.

As there is no current industrial use, the current use of the site poses little concern for the presence of environmental contaminants. All buildings are serviced by municipal water and sewer, and use natural gas or electricity generated offsite for utilities. Waste disposal is by commercial contract, and there is no authorized on-site disposal. Chemicals used for maintenance or sold by the various businesses which currently or have recently occupied the property are typical cleaning products and

paint used for retail or residential purposes. As a result of these facts, little effort was spent on an inventory of the existing occupants or their activities.

The site is entirely within the original Winooski Urban Renewal area. In 1973, the site was entirely cleared as part of the original redevelopment plan for the site, with the Champlain Mill being the only retained structure. Prior to demolition, the site was occupied by a successional mix of industrial, commercial and residential development dating back almost 200 years. Potential residual contamination from these uses was the focus of our efforts.

Site History

The purpose of compiling a site history is to determine past uses of a property and surrounding properties. The site history provides areas for specific focus during the site walkover and subsurface investigations. Typically, the goal is to develop a description dating back at least fifty years, or to the point where the area was undeveloped or in agricultural use. Also, practices which may be suspected of using or disposing of materials that may have had an environmental impact on the site are identified.

Due to the complex nature of the title chain of the site as a result of Urban Renewal, it was deemed impractical to research individual property ownership prior to the early 1970s. The site is currently owned by five (5) parties. Property lines are shown on the Site Plan in Attachment B:

1. The City of Winooski owns park areas at the west end of the tract.
2. Charter One Bank owns about 0.7 acre near the northwest corner including a single story brick bank building and associated drive and parking areas.
3. Lake Realty owns the former woolen mill building, immediately adjacent parking areas and an additional parking area to the east of the bank property.
4. United Joint Ventures owns the two brick mini-mall buildings, adjacent drive and parking areas and an undeveloped wooded area in the northeast corner.
5. Green Mountain Power owns the southeast corner, which from west to east is occupied by a switching station, a parking area, and an undeveloped wooded area extending 100 acres to the east of the site.

As noted in the introduction, the activities of the current owners and their tenants are essentially benign with regard to threats of environmental contamination.

The aerial photographs in Attachment C and Attachment D show how the demolition effort under urban renewal fundamentally transformed the site. The 1978 photograph (Attachment C) shows the property as it existed following the demolition of urban renewal. This photograph pre-dates the renovation of the Champlain Mill building, which did not begin until 1981. There was intermittant activity at the Champlain Mill in the post-mill era, which was used by several manufacturers after woolen production ceased in 1954.

Another interesting feature of the 1978 photograph are apparent piles of material towards the easterly end of the site. We do not know where the substantial amount of debris that must have resulted from the demolition was taken.

Prior to demolition, each structure was photographed and appraised according to urban renewal guidelines. These records are stored in the Winooski City Hall. They were not reviewed as a part of this effort, but they are available to provide information to pinpoint the location of activities on certain properties, should that prove useful.

The 1962 aerial photograph in Attachment D shows the area as it existed prior to urban renewal. There appears to be activity at the mill building, indicating it was occupied at this time. There is also definitely activity at the foundry/Stevens Machine site. The structures along Main Street and East Allen Street were typical multistory mixed-use woodframe comprising both commercial and residential uses. Structures along the north side of the former East Canal Street, along both sides of the former East Center, Barlow, and East Streets are primarily single and multi family residential, with a few notable exceptions. There is an apparent business on the southeast corner of East Center and Beard Streets, and an apparent business on the southeast corner of East Center and Barlow Street. There is a service station on the southeast corner of Main and East Canal. The piles of material in the southeast area of the site as observed in the 1978 aerial are not yet there.

The aerial photographs provide an idea of what occupied where on the site, but provide little in the way of specific information. The most important documents in determining relatively specific locations of site activities that could likely have left residual contamination were the series of Sanborn Fire Insurance Maps. Attachment E is the 1942 map, which was updated by hand in 1967. This map includes the street number and in some cases detailed information on the occupants and use of each structure. For historical reference, and to show the longevity or dynamics of some of the property uses on the tract, we have also included the Sanborn Maps from 1926 (Attachment F) and 1909 and 1889 (Attachment G).

The 1942/1967 and 1926 maps were retrieved from the full-scale color originals housed in the historical collection at the Bailey-Howe Library at the University of Vermont. The 1909 and 1889 maps were retrieved from a microfilm collection at the Vermont Law Library in Montpelier. The Law Library had several additional years in their collection, but there were few significant changes from the series included here.

Coupled with information from the City Directories from 1951 to 1972, also retrieved from the historical collection at Bailey-Howe, the 1942/1967 Sanborn Map allowed identification of businesses which would have been most likely to use currently regulated substances. The list of such businesses is shown in Table 1. Although the development of the area dates back to the 1700s, it is the businesses and industry that occupied the site from the 1920s to the 1970s that were most likely to leave behind residual contamination. Most locations identified as industrial businesses were chosen for installation of borings. Borings were also planned at the indicated location of mill transformers shown on the most recent Sanborn map. The locations were scaled from the corners of

Table 1
Business Information from Burlington/Winooski City Directories

Year	Address	Business Name
1951	22 East Center Street	Vermont Fuel Oil Co.
	50 East Allen Street	Myers Auto Service
	54 East Canal Street	Burlington Iron Corp. (Foundry)
1958	41 Barlow Street	Dowding & Roy (cutting tools)
1961	54 East Canal Street	American Super Temperature Wires Inc.
	56 East Canal Street	Cellucord Corp.
	41 East Center Street	Richmond Die Casting Co.
	31 Main Street	New York Cleaners
1962	41 Barlow Street	H. A. Hadley, Inc.
	4 Main Street	Harry's Sunoco Station (opposite side of street)
	21 Main Street	Sweeney's Service Station
1963-1964	41 Barlow Street	Richmond Machine Tool a & Casting Co. Ltd.
1965-1966	54 East Canal Street	Haveg Industries Division of Super Temp Inc. Plant #2
	30 Main Street	New York Cleaners (opposite side of street)
1967	54 East Canal Street	Haveg Industries, Division of General Electric Co.,
		Branch of BGE Co.
	54 East Canal Street	New England Label Co.
1968	45 Barlow Street	Myers Storage
1969	54 East Canal Street	Lavallee & Roy
1971-1972	102 East Allen Street	Ethan Allen Motor Sales

the mill building on the maps, and then measured and marked in the field. Table 2 is the schedule for boring installation, which includes a location description and the analytical parameters run for soil samples.

TABLE 2

Boring and Sampling Schedule
Champlain Mill Mall Site Assessment
DH 0890008

Revision 1 08/26/99

Boring Number	Purpose	Location Description	VOC's by 8260B	TPH by 8100 mod	PAH's by 8270	Full SVOC's by 8270	PCB's by 8080	RCRA 8 Metals
B1	On south side of former Sweeney's Service Station at 21 Main Street at possible location of tanks	45' N and 105' W of NW corner of Champlain Mill Building	X	X				
B2	On west side of former Sweeney's Service Station at 21 Main Street at possible location of tanks	20' W and 35' N of B1	X	X				
B3	At former location of 25,000 +/- gallon fuel oil AST for former Vermont Fuel Oil Co. which was located at 22 E. Center Street at corner of Beard St.	250' N and 90' E of NW corner of Champlain Mill Building	X	X	X		X	
B4	At former transformer location as indicated on 1960 overlay of Sanborn Map	20' N and 3' E of Champlain Mill Building. May be close to water line.					X	
B5	At former transformer location as indicated on 1960 overlay of Sanborn Map	25' N and 85' W of NE corner of Champlain Mill Building					X	
B6	At location of former boiler building for Stevens Machine Co. and it's predecessors as indicated on 1926 and earlier Sanborn Maps	25' N and 40' W of NE corner of Champlain Mill Building	X	X		X		X
B7	At foundry area of former Stevens Machince Co. and beneath older section of American Super-Temp wires as indicated on numerous Sanborn Maps and in City Directories	85' N and 35' E of NE corner of Champlain Mill Building. Also 45' N and 20' W of southerly mini-mall building of 1974 plan	X	X		X	X	X
B8	Near former boiler building for Champlain Mill Building	Just SE of NW corner of building with Waterworks kitchen.		X	X			
B9	At location of former cutting tool mfg. and other industries which occupied 41 E. Barlow St.	130' W and 115' S of NW corner of vacant super market.	X	X		X	X	X
B10	At former oil tank location for Amercan Super-Temp wires and Stevens Machine	Up tight to building and 65' W of SE corner of mini-mall building Close to utiltiy lines. Be careful	X	X		X	X	X
B11	At location of former Myers Auto Service at 50 East Allen St. per 1960 Sanborn Map and 1951 City Directory	On corner of driveway entrance from East Allen St. (see map)	X		X			
B12	In apparent downgradient direction from former used car dealer at 102 E. Allen and former gas station at 117 E. Allen	40' N and 165' E of NE corner of vacant super market	X	X	X			X
B13	At location of Green Mountain Power switching station, a collection of utility poles located to the east of the Champlain Mill Bldg. Installed per request of William Brierly.	60' SE of SE corner of southerly mini-mall building.					X	

Test Borings and Monitoring Wells

A total of thirteen (13) test borings were completed between August 18 and 20, 1999. The borings were performed by M & W Soils Engineering, Inc., of Charlestown, New Hampshire,under the field observation of Dufresne-Henry personnel. The borings are designated TB - 1 through TB- 13, and are shown on the Site Plan in Attachment B. Investigated areas included former gasoline stations, former above ground storage tanks (ASTs), former underground storage tanks (USTs), former transformer pads, former boiler buildings, and various factories that previously occupied the site. Boring contractor logs are included as Attachment H; Dufresne-Henry boring logs are included as Attachment I.

The borings were located as close as possible to the locations noted on the schedule. Several deviations (typically less than 10') were necessary due to buried and overhead utilities. During boring advancement continuous split spoon samples were attempted starting at or just below the surface. The borings were terminated at refusal on the split spoon and/or solid stem augers. Rock coring was not conducted as part of this assessment.

All soil samples were screened for the presence of Volatile Organic Compounds (VOCs) with a Photovac HL-2000 photoionization detector (10. 6 eV lamp, calibrated on-site with 99.1 ppm Isobutylene). The screening was done at ambient temperatures in the headspace of the sample jars. A summary of test boring data, including PID readings and physical observations is presented in Table 3. Evidence of soil contamination based on visual sense, olfactory sense, and PID readings was observed in seven (7) of the thirteen (13) borings.

Monitoring wells were installed at TB-3, TB-6, and TB-9. In the majority of the borings, the water table was not encountered, or was of such limited extent that obtaining water samples was judged unlikely. Each well was constructed of 10' of 2" diameter, 0.010" machine slotted screen, backfilled with clean silica sand to a point above the screen, and a bentonite seal installed. The wells are protected at the surface by grouted-n, watertight cast iron monitoring well boxes.

Soil Sampling

Soil samples for chemical analysis were obtained from each boring during the course of the boring program. The type of analyses requested were determined from the former use(s) at the location. Analyses included: VOCs, Total Petroleum Hydrocarbons (TPHs), Semi-Volatile Organics (SVOCs), PCBs, and RCRA 8 metals. Analyses performed at each location are summarized in Table 2, and results are summarized in Tables 4, 5, & 6.

In general, if there was evidence of contamination, the soil analyzed was from the most contaminated native soil horizon encountered. The exceptions were the samples taken for PCB analysis, which were taken from the surface layer of native soil.

Table 3
Summary of Test Boring Data

Boring Location	Total Depth	Contaminated Interval	Odor	PID Range* (ppm)
TB-1	12'	4' - 8'+	Gasoline	35 - 1,500+
TB-2	13.17'	7' - 11.25'+	Oily gasoline	186 - 1,300
TB-3	24.92'	None	None	N/A
TB-4	9.08'	None	None	N/A
TB-5	6.17'	None	None	N/A
TB-6	20.33'	6' - 10' (?)	Unknown	24 - 26
TB-7	16.42'	10' - 16.42'	Oily, chemical	138 - 155
TB-8	6.17'	None	None	N/A
TB-9	12.08'	7' - 11'	Oily, chemical	12 - 44
TB-10	12.42'	4' - 8'	Oily	29 - 31
TB-11	10.75'	9' - 10.75'	Gasoline	1,500
TB-12	7.17'	None	None	N/A
TB-13	13.33'	None	None	N/A

*Range of PID readings in the contaminated interval

Groundwater Sampling

Groundwater samples were obtained from the three (3) monitoring wells noted above. Sampling was conducted by Dufresne-Henry personnel on August 23, 1999. Analyses requested were generally the same as the soil samples for each location, with the exception of PCBs.

Site Geology

The majority of the site had been filled from 5 feet to 10 feet or more as part of the Urban Renewal project. Surfacial geology at the site is published as till and recent alluvium. With the exception of some occasional till-like soil, the borings generally did not corroborate the mapping. Native soil under the parking lot was typically silt and clay in both varved and massive deposits. Till was generally found in the extreme eastern and western borings. It is possible that till overlain by recent alluvium is found further to the east from the eastern edge of the parking lot.

TABLE 4

Winooski Redevelopment Area
Volatile Organic Compound Analysis Results & Comparison with Standards and Guidelines

VOC	Groundwater			Vermont Groundwater Standard[1] (ug/l)	Soil									EPA RBC Soil Standard[2] (ug/kg)	NHDES Soil Standard[3] (ug/kg)
	B-3 (ug/l)	B-6 (ug/l)	B-9 (ug/l)		B-1 2'- 8' (ug/kg)	B-2 7' -11' (ug/kg)	B-3 0' - 7' (ug/kg)	B-6 (ug/kg)	B-7 10' - 16' (ug/kg)	B-9 7' - 11' (ug/kg)	B-10 (ug/kg)	B-11 9' - 11' (ug/kg)	B-12 (ug/kg)		
Vinyl chloride	<2	22[4]	<2	2	<100	<100	<20	30	<200	<20	<20	<100	<20	340	1,000
Methylene Chloride	<5	<5	<5	5	300[8]	<100	<50	<50	<200	<50	<50	<100	<50	85,000	100
trans-1,2 Dichloroethene	<2	14	<2	100	<50	<70	<10	100	<100	<10	<10	<60	<10	1,600,000	9,000
cis-1,2 Dichloroethene	<2	99	<2	70	<50	<70	<10	330	<100	<10	<10	<60	<10	780,000	2,000
Trichloroethene	<2	65	<2	5	<50	<70	<10	280	<100	<10	100	<60	<10	58,000	800
Ethylbenzene	<1	<1	<1	700	140	270	<10	<10	<100	<10	<10	7,200	<10	7,800,000	140,000
Total Xylenes	<1	<1	<1	10,000	1,000	2,060	<10	<10	<100	<10	<10	27,200	<10	1.6×10^8	1,000,000
n-Propylbenzene	<1	<1	<1	Not Listed	90	180	<10	<10	<100	<10	10	2,700	<10	780,000	[7]
1,3,5-Trimethylbenzene	<1	<1	<1	4	470	1,300	<10	<10	<100	<10	<10	7,000	<10	3,900,000	[7]
1,2,4-Trimethylbenzene	<1	<1	<1	5	1,300	3,500	<10	<10	<100	<10	<10	17,000	<10	3,900,000	[7]
sec-Butylbenzene	<1	<1	<1	Not Listed	<50	110	<10	<10	500	<10	20	300	<10	780,000	[7]
p-isopropyltoluene	<1	<1	<1	Not Listed	<50	220	<10	<10	<100	<10	<10	320	<10	Not Listed	Not Listed
Toluene	<1	<1	<1	1,000	<50	<70	<10	<10	<100	<10	<10	2,600	<10	1.6×10^7	100,000
iso-Propylbenzene	<1	<1	<1	Not listed	<50	70	<10	<10	<100	<10	<10	820	<10	Listed as Cumene 7,800,000	123,000
Napthalene	<5	<5	<5	20	250	1,100	<10	10	200	<10	<10	1,500	<10	1,600,000	5,000

[1] Primary Groundwater Quality Standard from Table 1 of Chapter 12 of Vermont GROUNDWATER PROTECTION RULE AND STRATEGY, November 15, 1997.

[2] Residential Soil Risk Based Concentration from EPA Region III RBC Table dated 4/12/1999

[3] Method 1 Category S-2 Soil Standards from NHDES Risk Characterization and Management Policy Section 7.5(2) dated 1/15/98.

[4] Positive detects are outlined. Result in **bold** indicate result higher than Vermont Groundwater Enforcement Standard or EPA RBC or NHDES Method 1 S-2 standard for soil.

[5] From Table 1 NHDES Risk Characterization and Management Policy Section 1.5(4)(c) dated 1/15/98.

[6] Secondary Groundwater Quality Standard from Table 2 of Chapter 12 of Vermont GROUNDWATER PROTECTION RULE AND STRATEGY, November 15, 1997.

[7] Sum noted chemicals as group Alkylbenzenes with a 59,000 ug/kg standard.

[8] Determined to be laboratory contamination.

TABLE 5

Winooski Redevelopment Area

TPH , PCB AND Semi Volatile Organic Compound Analysis Results & Comparison with Standards and Guidelines

VOC	Groundwater			Vermont Groundwater Standard[1] (ug/l)	Soil													EPA RBC Soil Standard[2] (ug/kg)	NHDES Soil Standard[3] (ug/kg)
	B-3 (ug/l)	B-6 (ug/l)	B-9 (ug/l)		B-1 2'- 8'	B-2 7' -11'	B-3 0' - 7'	B4 6' - 8'	B-5 2' - 4'	B-6	B-7 10' - 16'	B-8 3' 6'	B-9 7' - 11'	B-10	B-11 9' - 11'	B-12 (ug/kg)	B-13 (ug/kg)		
Total Petroleum Hydrocarbons (ug/l) groundwater (ug/kg) soil	<500	<500	1,200	Not Established	180,000	240,000	<5,000	Not Analyzed	Not Analyzed	160,000	3,300,000	<5,000	130,000	2,900,000	Not Analyzed	<5,000	Not Analyzed	Not Listed	10,000
Poly Chlorinated Biphenyls	Not Analyzed	Not Analyzed	Not Analyzed	0.5	Not Analyzed	Not Analyzed	<100	<100	<100	Not Analyzed	<100	Not Analyzed	<100	<100	Not Analyzed	Not Analyzed	<100	320	1,000
Acid Extractable Compounds	Not Analyzed	Not Analyzed	Not Analyzed	Not Applicable	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	None Detected	None Detected	Not Analyzed	None Detected	None Detected	Not Analyzed	Not Analyzed	Not Analyzed	Not Applicable	Not Applicable
Base/Neutral Extractable Compounds	Not Analyzed	Not Analyzed	Not Analyzed	Not Applicable	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	None Detected	None Detected	Not Analyzed	None Detected	None Detected	Not Analyzed	Not Analyzed	Not Analyzed	Not Applicable	Not Applicable
Poly Aromatic Hydrocarbons (ug/kg)	Not Analyzed	Not Analyzed	Not Analyzed	Not Applicable	Not Analyzed	Not Analyzed	None Detected	Not Analyzed	Not Analyzed	See Below	None Detected	See Below	None Detected	None Detected	See Below	Not Analyzed	Not Analyzed	Not Applicable	Not Applicable
Napthalene				20						<400		<200			4,300			1,600,000	5,000
2-Methylnapthalene				Not listed						<400		<200			2,400			1,600,000	150,000
Acenapthene				Not listed						600		<200			<300			4,700,000	270,000
Fluorene				280						700		<200			<300			3,100,000	510,000
Phenanthrene				Not listed						8,800		400			<300			Not Listed	2,400[7]
Anthracene				2,100						1,400		<200			<300			2.3×10^7	1,700,000
Fluoranthene				280						7,200		500			<300			3,100,000	2,500,000
Pyrene				Not listed						7,600		400			<300			2,300,000	2,400[7]
Benzo[a]anthracene				Not listed						3,000		300			<300			870	2,000
Chrysene				Not listed						2,600		300			<300			87,000	200,000
Benzo[b]fluoranthene				Not listed						3,600		400			<300			870	20,000
Benzo[k]fluoranthene				Not listed						1,500		<200			<300			8,700	20,000
Benzo[a]pyrene				0.2						2,800		300			<300			87	700
Indeno[1,2,3-c,d]pyrene				Not listed						600		<200			<300			870	2,000
Benzo[g,h,i]perylene				Not listed						500		<200			<300			Not Listed	2,400[7]

[1] Primary Groundwater Quality Standard from Table 1 of Chapter 12 of Vermont GROUNDWATER PROTECTION RULE AND STRATEGY, November 15, 1997.

[2] Residential Soil Risk Based Concentration from EPA Region III RBC Table dated 4/12/1999

[3] Method 1 Category S-2 Soil Standards from NHDES Risk Characterization and Management Policy Section 7.5(2) dated 1/15/98.

[4] Positive detects are outlined. Result in bold indicate result higher than Vermont Groundwater Enforcement Standard or EPA RBC or NHDES Method 1 S-2 standard for soil.

[5] From Table 1 NHDES Risk Characterization and Management Policy Section 1.5(4)(c) dated 1/15/98.

[6] Secondary Groundwater Quality Standard from Table 2 of Chapter 12 of Vermont GROUNDWATER PROTECTION RULE AND STRATEGY, November 15, 1997.

[7] Total of Benzo[g,h,i]perylene, Phenanthrene and Pyrene to be less than 480,000 mg/kg forNHDES Method 1 S-2 Soil Standard

TABLE 6

Winooski Redevelopment Area
Metals Analysis Results & Comparison with Standards

Metal	Groundwater			Vermont Groundwater Standard[1] (ug/l)	Soil					EPA RBC Soil Standard[2] (ug/kg)	NHDES Soil Standard[3] (ug/kg)	NHDES Soil Background[5] (ug/kg)
	B-3 (ug/l)	B-6 (ug/l)	B-9 (ug/l)		B-6 (ug/kg)	B-7 (ug/kg)	B-9 (ug/kg)	B-10 (ug/kg)	B-12 (ug/kg)			
Arsenic	<10	<10	<10	50	**4,000[4]**	<2000	2,000	<2000	<2000	430	12,000	12,000
Barium	740	250	100	2,000	48,000	69,000	69,000	44,000	65,000	5,500,000	2,500,000	Not Listed
Cadmium	3	2	2	5	5,300	2,700	2,000	6,400	2,000	39,000	230,000	1,900
Chromium III	11	11	10	100	17,000	22,000	26,000	46,000	22,000	1.2×10^8	2,500,000	33,000
Lead	<10	20	<10	15	140,000	20,000	19,000	73,000	28,000	Not Listed	400,000	54,000
Mercury	<0.2	<0.2	<0.2	2	<200	<200	<200	<200	<200	Not Listed	7,000	330
Selenium	<50	<50	<50	50	<2000	<2000	<2000	<2,000	<2,000	390,000	2,500,000	2,200
Silver	<5	<5	<5	100[6]	<200	<200	<200	<200	<200	390,000	200,000	Not Listed

[1] Primary Groundwater Quality Standard from Table 1 of Chapter 12 of Vermont GROUNDWATER PROTECTION RULE AND STRATEGY, November 15, 1997.

[2] Residential Soil Risk Based Concentration from EPA Region III RBC Table dated 4/12/1999

[3] Method 1 Category S-2 Soil Standards from NHDES Risk Characterization and Management Policy Section 7.5(2) dated 1/15/98.

[4] Result in **bold** indicate result higher than EPA RBC or NHDES Method 1 S-2 standard.

[5] From Table 1 NHDES Risk Characterization and Management Policy Section 1.5(4)(c) dated 1/15/98.

[6] Secondary Groundwater Quality Standard from Table 2 of Chapter 12 of Vermont GROUNDWATER PROTECTION RULE AND STRATEGY, November 15, 1997.

Published mapping indicates bedrock on the site is likely to be Winooski Dolomite. Winooski Dolomite is generally described as a pink, buff, and gray dolomite in beds ranging from 4 inches to 1 foot, with thin red, pink, green, and black siliceous partings. Contacts with the Monkton Quartzite and the Danby and Potsdam Formations occur short distances to the west and east respectively. Dolomites are typically hard, brittle rocks with good potential for fracturing. The fractures may be ftirther expanded by the influence of acidic groundwater. The ages of the rocks range from Lower to Upper Cambrian. Refusal in the borings ranged from 62" to 24' 11" on probable bedrock. Possible bedrock retrieval in the split spoons and the outcrops along the river corroborate the mapping.

Analytical Results

The results of the laboratory analyses are summarized in Table 4 through 6. Laboratory reports are included as Attachment J. Vermont Groundwater Standards and two sets of soil guidelines are included for comparison. To date, Vermont does not have established soil standards, but uses the EPA Region III Risk Based Concentrations (RBCs) when evaluating soil contamination. Also included are soil standards developed by the New Hampshire Department of Environmental Services (NHDES). Both the RBC and NHDES soil concentrations are for residential soil as opposed to industrial soil. Given the proposed use of the property, the lower concentrations associated with the residential guidelines seem more appropriate.

The analytical results verified contamination at four locations. In order of concern they are:

1. The site successively occupied by a foundry, the Stevens Machine Co., and finally a wire company,
2. The former gas station on the southwest corner of East Allen and Barlow,
3. The former gas station on the southeast corner of Main and East Canal,
4. The former location of the boiler plant for the Champlain Mill.

Low levels of Total Petroleum Hydrocarbons (TPH) were found in both the groundwater and soil samples from TB-9; low enough that we do not feel it is a concern. Based on the Sanborn Maps and City Directories, this location at the former 41 Barlow Street was host to a fire station, an overshoe manufacturer, and finally a succession of manufacturers of mechanical instruments and cutting tools.

The only location where groundwater standards and soil guidelines are significantly exceeded is at the former Stevens Machine Co. That complex -- which was substantial from the mid to late 1800s and into the early 20th century -- is represented by three borings: TB-6, TB-7 and TB-10.

TB-6 is the most contaminated location identified on the site. At a depth of over 20' it is also one of the deepest borings. Nearby TB-7 is also fairly deep at about 16.5'. The depths of TB-6 and TB -7 indicate likely bedrock excavation beneath the former boiler building and the foundry/machine shop area.

Both soil and groundwater samples from TB-6 contains Trichloroethene (TCE) and its decay by-products cis- and ' trans-1,2 Dichloroethene and Vinyl Chloride. All but the trans- 1,2 DCE exceed groundwater quality standards.

TCE was used extensively as a degreaser and cleaner from the mid-1940s to the mid-1980s. From our experience, it is the most common of the chlorinated solvents found at industrial sites. While above groundwater standards, the concentrations in TB-6 are relatively low compared to heavily-contaminated industrial or disposal sites.

The indicated methylene chloride concentration of 300 μg/kg at TB-1 was discovered to be the result of laboratory contamination.

Soil samples from TB-6 also contained an elevated level of arsenic, as well as several Polyaromatic hydrocarbons (PAH's). The lack of arsenic in the groundwater sample from TB-6 indicates that it may not be in a leachable state. The Merck Index lists the element as used in metallurgy for hardening copper and lead alloys. This would explain its presence near the former site of a foundry.

PAHs were not run for the groundwater sample from TB-6, so comparison cannot be made with groundwater standards. PAHs were also found in lesser concentrations in the soil sample from TB-10. Based on photographs of the Champlain Mill and the Sanborn maps, this general area was the location of the fossil fuel power plants for both Stevens Machine (et. al.) and the Champlain Mill. The details of their use of fossil fuels are not known, but it is likely that they initially burned coal, and later switched to oil (most likely No. 6 bunker oil). Both coal and No. 6 oil can leave behind residual PAHs. A few of the PAHs detected here exceed RBC residential soil standards. Most notable is Benzo[a]pyrene, which at 2800 μg/kg significantly exceeds the RBC residential soil standard of 87 μg/kg.

Total Petroleum Hydrocarbons (TPH) were also detected in significant quantities in the soil samples from TB-7 and TB-10, and in lesser quantities in the samples from TB-6 and TB-9. TPH was below detection limits in TB-8, indicating that the PAHs observed there were likely not from No. 6 oil released at that location.

The Vermont SMS uses a guideline concentration of 1,000 mg/kg for TPH to determine the need for treatment of excavated soil. At 3,300 mg/kg from TB-7 and 2,900 mg/kg from TB- 10, both of these locations exceed the SMS guideline. TB-7 and TB-10 are roughly 100 feet apart. It is reasonable to assume that they are representative of the general condition of the underlying native soil which varies in thickness from about 3 feet to more than 10 feet. Taking an average thickness of 6 feet, and a diameter of 100 feet, we estimate a volume of soil that may exceed SMS TPH guidelines of roughly 2,000 cubic yards.

The other locations where soil contamination was observed were the two service stations. Evidence of petroleum was found at both the former Myers Auto Service on the southwest corner of East Allen and Barlow, and the former Sweeney's Service Station at the southeast corner of Main and East

Canal. Of the two, the evidence collected to date indicates that the East Allen location has levels of contamination about an order of magnitude greater than at Main Street. Groundwater was not encountered at either location.

The contaminated horizon at the East Allen location was found at the very bottom of TB-11, near the apparent bedrock surface. This indicates an upgradient petroleum release that migrated to the boring location either as free product flowing on the bedrock, or else in groundwater that had leached through the release area and carried the contaminant to the boring location. In either case, this indicates the potential for higher levels of contamination in the soil to the north of the boring location. This is also where we believe the station and tanks were located.

On the positive side, no petroleum compounds were found in any of the groundwater samples. While none of the monitoring wells are immediately downgradient of TB-11, and are several hundred feet away, this is an indication that the release identified in the soil at TB- 11 has not impacted the site as a whole.

It is worthy of note that no PCBs were detected at any location on the site.

Fate, Transport and Receptors

All of the contaminants identified on the site have been there for at least 30 years and possibly considerably longer. The concentrations of those that decay by biodegradation -- notably most of the VOCs-- were likely much higher in the past. The relatively high concentrations of the decay by-products of TCE when compared to actual TCE concentrations indicate that significant biodegradation has occurred in the vicinity of TB-6. The lack of benzene at either of the service station sites indicates biodegradation at both of those sites as well. Left alone, the VOCs would continue to decay over time, but it would likely be several more decades before they would decay to below detectable levels. The arsenic in TB-6, will, for all practical purposes, remain indefinitely, as will the TPHs and PAHs in TB-6, TB-7, TB-8 and TB- 10.

Transport is possible by physical movement, groundwater movement, or volatilization. Physical movement will not occur until the site is disturbed again. Although there was certainly some movement of contaminated soil when urban renewal occurred, the current findings do not indicate that problem areas were spread over the site as a whole.

The subsurface work for this investigation was conducted during an unusually dry period. Although the soil was moist toward the bottom of several other borings, enough evidence of groundwater to install wells was observed at only three locations.. The depth to groundwater was in the range of 7 feet to 12 feet. The range of depth to bedrock was slightly less, except for those locations near the former foundry, where the boring depth indicates potential bedrock excavation. Overall, it appears that the occurrence of groundwater in the soil is inconsistent at best.

The native soil beneath the sandy fill is a mix of glacial till, clays, and silt. None of these are conducive to rapid leaching or transport of contaminants by groundwater. In addition, many of the compounds observed are more inclined to stay bound to fine-grained particles of silt or clay soil than to dissolve in groundwater. They leach out very slowly. Finally, much of the site and the surrounding upgradient areas are covered with pavement or buildings, with stormwater collected and piped to the river. As a result, there is very little infiltration to promote leaching or supply groundwater. Together, all of these conditions reduce the volume and rate of transport of contaminants from the site through groundwater to the Winooski River, the ultimate receptor.

Unless disturbed, the likelihood of volatilization and transportation through air is even less likely. Concentrations of VOCs are not high enough to promote volatilization and transport through soil air. As with groundwater, the types of native soil observed -- till, silts, and clays -- are not conducive to vapor transport. Also, the presence of pavement or slab on grade construction minimizes the opportunity for volatilization or entry into structures.

There is a possibility of transportation by groundwater or volatilization through the granular backfill in utility trenches that exist throughout the site. By necessity, these locations were avoided during boring installation to prevent damage and disruption. Utilities are shown on the site plan, and several pass near locations where contamination was identified. It is believed that in general, the utilities are likely buried in fill above the native soil, which would minimize the contact with the contamination. However, this has not been verified.

Potential receptors under existing conditions are the Winooski River and the indoor air of the buildings on- site. We are unaware of any reported discharges to the river, or any complaints of fumes in the buildings. Given the levels of contamination observed, and the potential transport mechanisms discussed above, it is unlikely that observable concentrations would appear in either groundwater discharges to the river or ambient air in the existing or future site buildings.

Additional Investigations, Monitoring or Corrective Actions

Subsurface investigations have identified potentially significant residual contamination at four locations. Two of these, the former Stevens Machine and the former Champlain Mill Boiler Building, may be interrelated and are proximate enough to be considered as one site. The other two are the former service stations on Main Street and East Allen Street.

Additional work to better characterize contaminants and their potential risk requires, taking into consideration both existing and future land uses, and the need to satisfy regulatory requirements. Based on the contaminants and concentrations identified, this area will become a listed site.

The five borings already installed give reasonably good coverage of the Stevens Machine area, but additional borings and monitoring wells in the area encompassed by TB-6, TB-7, TB-8 and TB-10

could provide better definition of the conditions that exist there. Such work would also provide confirmation that the worst of the contamination has been identified.

An additional two or three borings, again with monitoring wells if possible, will be necessary to adequately characterize the conditions on East Allen Street.

The two borings with relatively low soil contaminant levels at the former service station site on Main Street are likely sufficient to consider that area adequately characterized.

With regard to active remediation, we do not expect such work to be necessary unless excavation occurs. For areas that will require excavation for the planned construction -- most notably the East Allen Street service station area -- provisions must be made for offsite disposal and/or treatment of contaminated soil.

Summary, Conclusions and Recommendations

The 20 acre tract southeast of Main and East Allen Streets in Winooski is currently occupied by several commercial buildings and associated parking areas. A combined, limited Environmental Site Assessment of the property has been completed.

Current use poses minimal threat of adverse environmental conditions. Past uses for combined industrial, commercial and residential purposes did leave behind residual contamination at several locations.

Site history was researched sufficiently to identify those areas where residual contamination was most likely to be present. Sources of information included aerial photographs, interviews with local historians, review of a series of Sanborn Fire Insurance Maps from the late 1800s to the early 1960s, and review of City Directories from the 1950s through the early 1970s.

Thirteen locations were selected for the installation of soil borings. The locations were scaled from the historical maps and then measured in the field from the corners of the existing mill building. The soil borings were installed with field screening of soil samples for VOCs. Seven of thirteen locations showed some field evidence of contamination. Sufficient groundwater existed at three boring locations to permit the installation of monitoring wells.

Soil and groundwater samples were analyzed for a variety of chemicals consistent with the type of contamination deemed likely to be present, based on historical activity. Analytical parameters included heavy metals, volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), total petroleum hydrocarbons (TPH) and poly chlorinated biphenyls (PCBs). Not all parameters were analyzed at all locations.

Analytical results were reviewed and compared to established Vermont Groundwater Enforcement Standards and soil contamination guidelines. Fate, transport, and receptors were considered based

on the contaminants present, the physical setting and current and potential future use of the property. The need for additional investigation, monitoring or remedial actions was considered.

Based on this work we offer the following conclusions:

1. There is no overall pattern of gross contamination. The two wells that were installed in apparently clean areas to characterize background conditions contained no compounds above detection limits, except for a single very low TPH reading.

2. There are minimal risks for exposure to residual contamination through direct contact, groundwater, or air.

3. The potential receptors are limited to the Winooski River and the indoor air of existing buildings. There is no evidence that either of these potential receptors is being adversely impacted.

4. Active remediation is not anticipated. with the contamination levels identified to date.

5. Contamination was identified at four locations. In order of concern they are:

    a. The former Stevens Machine Co. (et al) area, which was located immediately northeast of the Champlain Mill.
    b. The former gas station at the southwest comer of Barlow and East Allen,
    c. The former gas station at the southeast comer of Main and East Canal.
    d. The former boiler area at the east end of the Champlain Mill..

6. No PCBs were detected at any location for which they were tested.

7. The only place where both soil and groundwater standards were significantly exceeded was at the former Stevens Machine Co. Several chlorinated VOCs were present above groundwater standards. Several PAHs were present above soil standards. Arsenic was present at almost ten times the soil standard. TPH was present above the "Rule of Thumb" standard value of 1,000 μg/kg at two locations. If this area is excavated, there may be several hundred to several thousand cubic yards of contaminated soil to deal with. The most likely cost effective remedial action will likely be offsite treatment with a present estimated cost of approximately $50 to $75 per cubic yard.

8. No published soil standards were exceeded at either of the gas stations. Monitoring wells could not be installed at either location.