THE GASOLINE ALLEY COMMUNITY LEARNING CENTER

FEASIBILITY STUDY FOR FACILITIES EXPANSION AND RENOVATIONS FOR SUSTAINABILITY

PREPARED BY
THE GASOLINE ALLEY FOUNDATION
&
DIETZ & COMPANY ARCHITECTS

June 1, 2004

FUNDED BY
THE GREEN BUILDINGS INITIATIVE
OF THE RENEWABLE ENERGY TRUST

MASSACHUSETTS
TECHNOLOGY
COLLABORATIVE

THE GASOLINE ALLEY COMMUNITY LEARNING CENTER

FEASIBILITY STUDY FOR FACILITIES EXPANSION AND RENOVATIONS FOR SUSTAINABILITY

PREPARED BY THE GASOLINE ALLEY FOUNDATION

&

DIETZ & COMPANY ARCHITECTS, INC.

June 1, 2004

PROJECT TEAM

Owner:
The Gasoline Alley Foundation
250 Albany Street
Springfield, MA 01105
Contact: Joe Sibilia

Site Consultant/ Landscape Architect:
Elmore Design Collaborative, Inc.
1655 Main Street Suite 302
Springfield, MA 01103
Contact: Thomas Elmore

Environmental Consultant:
New England Environmental, Inc.
800 Main Street
Amherst, MA 01002
Contact: Lyons Witten

Architect:
Dietz & Company Architects
17 Hampden Street
Springfield, MA 01103
Contact: Marc Sternick

Mechanical/Electrical/Energy Consultant:
Bales Energy Associates
160 Main Street, Suite 9
Northampton, MA 01060
Contact: H. Barton Bales

Wastewater Management Consultant:
Center for Energy Efficiency and Renewable Energy (CEERE)
University of Massachusetts
College of Engineering
160 Governors Drive
Amherst, MA 01003
Contact: Eric Winkler

FUNDED BY
THE GREEN BUILDINGS INITIATIVE
OF THE RENEWABLE ENERGY TRUST

MASSACHUSETTS
TECHNOLOGY
COLLABORATIVE

NOTICE and ACKNOWLEDGEMENTS

This report was prepared by Dietz & Company Architects, Inc. in the course of performing work co-sponsored by the Renewable Energy Trust (RET), as administered by the Massachusetts Technology Collaborative (MTC) pursuant to grant number GB-FS-03-32 and the Western Massachusetts Electric Company (WMECO), Project #WM-03-C-1XX, (MTC and the other co-sponsors referred to hereafter as the "Sponsors"). The opinions expressed in this report do not necessarily reflect those of the Sponsors or the Commonwealth of Massachusetts, and reference to any specific product, service, process, or method does not constitute an implied or expressed recommendation or endorsement of it.

ABSTRACT

The core mission of the Gasoline Alley Foundation is "*to teach disadvantaged persons to be successful entrepreneurs using socially responsible/sustainable business practices, while revitalizing inner city neighborhoods*".

This project will allow the Gasoline Alley Foundation to expand their training center which is devoted to job creation and to transform their current sub-standard facilities from its current polluted industrial site into a show place demonstrating to others how companies can green "old urban buildings".

Every option for renewable or sustainable technology taken will reinforce the goals of a project that is already well underway in regards to sustainable business practices and community development and involvement. Incorporating sustainable, green technologies will complete the circle and help to educate the community about the connection between sustainable business practices, green technologies and how we can live sustainably in an urban environment.

It is the intention of the research and development team that this Study will help to generate interest and funding for technologies described in this report in order to transform the Gasoline Alley facility into the demonstration showplace that has been the Foundation's goal since its inception.

KEYWORDS

Atrium
Brownfield Redevelopment
Building Reuse
Energy Performance
Environmental Site Assessment
Gasoline Alley Foundation
Greenhouse
Industrial Brownfields Site
Renewable energy
Stormwater Collection
Stormwater Reuse
Urban Redevelopment
Wastewater Conservation
Wastewater Reuse
Water Use Reduction

TABLE OF CONTENTS

1. REPORT SUMMARY

REPORT SUMMARY

This report has been commissioned to develop recommendations for "greening" the Gasoline Alley Property, which consists of three buildings on an industrial site in Springfield, Massachusetts. The Gasoline Alley Foundation property is basically a business incubator that, in addition to helping businesses get off the ground, teaches sustainable business and environmental practices. The LEED system, developed by the U.S. Green Building Council, has been used as a basis for determining the areas of interest that were examined and reviewed in this report.

The planning for all new construction and renovation assumes that all work will meet or exceed LEED guidelines for water efficiency, energy performance, renewable energy use, indoor air quality, recycling, salvaged materials, resource efficiency and waste management. The building was analyzed and reviewed to determine the best course of action to take to green the development.

The areas of interest reviewed in this report have been broken down into nine categories. Those categories follow with a short summary of each:

I. Renovations and Additions to the Buildings

Preliminary plans for the property include modifications to the main building which consist of a new greenhouse/atrium/building entry, interior renovations to allow for a large community room on the first floor, finishing the lower level warehouse area to allow for more office space as well as the addition of wall and roof insulation, new roofing, new finishes throughout, new heating and ventilation systems and some new window openings added for daylighting. A new photovoltaic system and solar hot water systems are also reviewed for potential use.

Plans for the other two buildings include new finishes, wall and roof insulation, new roofing, and new heating and ventilation systems.

An addition is planned between the two buildings at 250 Albany Street which will house a new employee entrance, bicycle storage, bathroom with composting toilet and shower on the lower level, with a new office and deck on the level above.

The recommended building modifications mentioned above are based on the assumption that funds for the renovations will be made available. There is no payback analysis provided for these renovations, as the need has been established by the Owner, The Gasoline Alley Foundation, in its quest to develop and expand its goals. As for the proposed upgrades for energy efficient construction, it is estimated that all of the energy benefits can be obtained within a 5% margin in addition to average costs for typical, non-energy efficient construction of this type.

II. *Site analysis and Recommendations*

The site, facing onto Albany Street, is in an extremely industrial area surrounded by businesses such as metal recycling, bulk fuel storage facilities, building wreckers, etc. The site slopes steeply down from the street to the rear of the property. The rear of the property borders train tracks used on a regular basis by commercial trains. The sloped areas from the street are thickly wooded with a tangle of invasive species, vines and garbage. The site currently has several areas covered with concrete or asphalt that remain unused except for material storage.

The conceptual plan modifies the slope from the street to create a series of terraced gardens using native plantings and xeriscaping. In addition to providing an aesthetic solution to a problem area, the terraces also provide for stormwater management and erosion control. New retaining walls will serve to stabilize the slope.

Trees and gardens were developed in the lower rear portion of the site as well as a water feature, which would use a small wind mill to pump the water back up the hill. These features would help to shade and cool the site in summer months. Impervious surfaces would be reduced to help improve infiltration on site. Recycled materials would be used throughout the exterior renovations.

III. *Water and Wastewater*

Opportunities for water conservation via reuse of wastewater, waterless toilets and conventional water conservation were analyzed. Use of stormwater roof runoff was also reviewed and analyzed. Significant cost for treatment, permitting and monitoring relative to the relatively small quantity of water usage suggests that use of reclaimed wastewater will not be cost effective for this project. Storage of roof water runoff for use in watering plants in the proposed greenhouse and elsewhere on site is more cost effective and is recommended should funds be made available.

Recommendations also include the installation of a waterless toilet. Black water and greywater conservation measures including a higher efficiency washing and dishwasher are the most cost effective measures to be proposed. It is recommended that simple water conservation be considered first followed by a waterless toilet, and stormwater collection.

IV. *Energy Performance*

The bulk of the analysis contained in this report is directed at improvements to the main building, as it is the largest and most fully utilized. Planned energy-related improvements include a greenhouse addition, upgrading insulation and mechanical systems, and installing renewable energy systems, and sustainable technologies to the greatest extent possible.

Planned renovations include insulating the exterior masonry block walls with one inch of rigid insulation covered by sheet rock, thereby greatly increasing the R-value of the wall. Modeling to date indicates a projected 24.4% reduction in fossil fuel requirements would result from this action.

When the lower level of the main building is converted to office space, the installation of a high efficiency, gas-fired boiler system is recommended. A high-efficiency, non-condensing boiler could have a combustion efficiency of 87%. If a condensing boiler were selected, combustion efficiencies of 92 to 97% can be realized. As there are plans to connect the Main building to the ReStore building, behind it, it is recommended that the same boiler and heating system be brought through the addition into the rear building, as well.

The hydronic boiler system could then provide hot water to baseboard radiation or heating coils in ducted HVAC systems in the lower level and retrofitted in the ductwork on the top floor. The advantage of such a system would be that the combustion efficiency of the boiler system could be much greater than the combustion efficiencies of the current gas-fired rooftop HVAC units which may be on the order of 70 to 75%.

It is recommended that the existing three top floor thermostats be replaced with electronic time clock thermostats. Automated scheduling control of the HVAC system is also strongly recommended.

Electrical systems were reviewed. Lighting improvement options were identified and potential energy savings with improvements were calculated. The use of T8 lighting technology, electronic ballasts, and compact fluorescent technology is recommended for applicable lighting improvements.

It is recommended that existing 8-foot fluorescent fixtures be converted to operate four 4-foot T-8 lamps per each four-lamp electronic ballast installed. If the lighting layout for the building is to be more substantially revised, a variety of new fixtures can be considered. Conversion of existing eight foot T12 fixtures to four foot T8 fluorescent fixtures is also recommended. Substantial electrical use reductions can be achieved in the beauty salon portion of the complex by converting the incandescent task and accent lighting to compact fluorescent lamps or fixtures.

Preliminary estimates indicate that these changes would reduce annual electrical use by approximately 8,895 kilowatts-hours, or a reduction of approximately 11% of the total electricity used inside the building.

V. Renewable energy

Photovoltaic System:
A solar-electric system option intended to serve the building's intended environmental education mission was evaluated for the building.

The photovoltaic option reviewed for this project would consist of rack-mounted modules installed on the roof. It is anticipated that the system would have a total of twenty-four 115 wattdc modules for a total capacity of 2.76 KW of installed solar-electric capacity.

Based upon available evaluation tools, a properly oriented system of this rating (2.76 kwdc) would be expected to generate approximately 3,670 kwh per year.

The system will operate in a grid-interactive mode. No battery storage is anticipated to be included in this system. Under this "net metering" scenario, the client receives maximum economic benefit from the electricity produced because all electricity is credited at the full "retail" rate charged consumers in their bills. If electricity were "sold back" to the utility, the price paid to the client would only be at the "wholesale" rate for "electricity generation".

The total system cost for the 2.76 kwac system proposed for Gasoline Alley is estimated to be approximately $31,000 without incentives. After the installation incentive and the maximum production incentive was achieved, the final cost to the customer is estimated to be $18,322.

VI. Solar Hot Water:

After modeling the water use at the salon (the building's largest user of domestic hot water), we found that the water load, excluding the maintenance load would be well-matched to a 4-panel solar domestic hot water system piped to a solar storage tank in the basement of the building.

A preliminary estimate of the cost of such a system was made. The estimated cost of the complete installed system is $12,231. With a potential rebate from Western Massachusetts Electric Company of approximately $3,000, the cost to the building would be reduced effectively to $9,231.

Such a system would be expected to provide approximately 26,805 MBtus of useful thermal energy and to offset 347 ccf of natural gas per year and to avoid the environmental impact of burning that quantity of fuel. This represents 77% of the estimated domestic hot water load for the building.

VII. Indoor Air Quality

In the top floor areas, two rooftop air handlers currently represent the sole source of ventilation air. Since an evaluation of the hair treatment products included in this report indicates indoor pollutant concerns, a dedicated ventilation system for the salon area would be appropriate to avoid transferring these pollutants to the office area via the return air system or through ambient air transference. It is also recommended that an enclosure be constructed between the salon and adjacent use groups.

During any planned construction, development of an indoor air quality management plan that the contractor will follow can help prevent contamination of the building systems.

All new materials proposed for renovations within the existing building should be reviewed for toxicity and VOC content, both for their potential toxicity during construction and their potential for offgassing during future occupancy.

VIII. Daylighting

Although lighting loads in the current work areas are relatively small, converting the lower level into offices and providing sufficient lighting there will require additional energy use. Plans call out new openings, both for vision and for daylighting in the lower level as well as new daylighting apertures above existing windows in the wall that will open onto the proposed entry/atrium.

It is recommended that the fluorescent fixtures near these new openings be equipped with dimmable electronic ballasts which are subject to control by one or more daylighting sensors. When daylighting provides sufficient light, the controls will dim the fluorescent fixtures. Such a daylighting system will substantially reduce the electrical load in the atrium, office areas behind the rear wall of the atrium and the office areas proposed on the lower level.

IX. Environmental Site Assessment

The purpose of the environmental site assessment was to determine what obvious environmental concerns exist on the project site and what additional studies and analysis are needed to determine the full extent of the environmental cleanup on site. This site has had previous owners and neighbors who have left several environmental issues which need to be addressed by the current owners. The Gasoline Alley Foundation has expressed a commitment to removing all hazardous materials from the site.

This investigation provides a preliminary evaluation the Site for evidence of a release of oil or hazardous materials as defined by Massachusetts General Law, chapter 21E. The investigation included a Site reconnaissance visit, a review of historic fire insurance maps, and a review of selected local and regulatory files pertaining to the Site and surrounding area. The findings of our investigation are summarized in the attached report.

The report includes recommendations for additional investigation activities related to observed and potential release conditions, and estimated costs for these activities. Estimated costs for remediation are included in the Cost Estimate.

II. PROJECT DESCRIPTION

THE GASOLINE ALLEY FOUNDATION

The Gasoline Alley Foundation is a 501(c)3 non-profit community focused organization. The Foundation was created in 1994, when this property was purchased. The property consists of three commercial/industrial buildings and the lots that they occupy. The Foundation is currently expanding their training center which is devoted to job creation for the most disadvantaged citizens of their region. Their core mission is "*to teach disadvantaged persons to be successful entrepreneurs using socially responsible/sustainable business practices, while revitalizing inner city neighborhoods*". Their mission includes the environment as a core principal, as they teach an approach to business that concentrates on sustainability and community as well as profit.

The Foundation plans to be the voice of Springfield's environmental movement, as there is currently no other environmental organizations in Springfield. They plan on transforming this old, polluted industrial site into a show place demonstrating to others how companies can green "old urban buildings".

SCOPE OF THIS STUDY

This study examines sustainable technology options and reviews their viability for inclusion in the proposed renovations to the Gasoline Alley Development.

The sustainable technologies that are reviewed within this Study are as follows:

- Urban/Brownfield Redevelopment
  Reclaiming a "dirty" industrial site begins with a review of all of the current documentation available from the EPA, DEP and other agencies who have already been involved in monitoring spills and dumping in this area. This Study lays out the processes and systems necessary to clean up the site and begins to determine the financial investment and a conceptual schedule to provide the necessary work. See "Environmental Site Assessment" Section of this report.

- Alternative Transportation
  Several people currently working at the Gasoline Alley complex already walk or use a bike to commute between work and home. Plans have been developed to encourage pedestrian and bicycle use by incorporating a secure bike storage facility, showers and changing rooms into the proposed addition between the two buildings at 250 Albany Street. See Proposed Plans in Appendix B of this Section.

- Stormwater Management
  The potential for utilizing roof water runoff for non-potable reuse is reviewed in this Study. A conceptual system is designed and a cost estimate for that system is provided. Annual water savings are estimated. See Section "Stormwater Collection and Reuse" within Section V of this report.

- Water Efficient Landscaping
  A holistic approach to landscaping on the site has been undertaken and a conceptual plan has been devised which looks at issues from parking to gardens, as well as features that would not only mitigate several problems throughout the site, but would create a site that would prove to be a showplace and gathering place for the entire community. The plan incorporates the use of native, draught-resistive species, terracing and surface water run-off control as well as other systems to create a more sustainable landscape throughout the site. Refer to "Site Analysis and Recommendations" Section of this report.

- Water Use Reduction
  A thorough review of blackwater and greywater conservation measures is included in this Study. Waterless toilets and other innovative conservation measures are reviewed. See "Water and Wastewater" Section of this report.

- Optimizing Energy Performance
  The existing flat roofs on two of the three buildings making up the existing complex are built-up roofs, nearing the end of their expected lifespan. It is expected that there currently exists a minimum of insulation on some of these roofs. Adding 4 inches of extruded polystyrene insulation will result in an additional R-value of approximately 22, increasing the effective R-value of the roofs by 200% or more. Providing a white membrane roof material will help reduce cooling loads on the building. These options are reviewed and analyzed.

  Other energy optimization techniques will include energy calculations to determine the effect of adding rigid insulation to the exterior walls, reviewing the existing mechanical systems for upgrades, looking at interior and exterior lighting efficiencies and reviewing options for controls for both the mechanical and electrical systems. Long term savings will be evaluated. Costs of upgrading systems will be addressed in the "Energy Performance" Section as well as in Appendix A of the "Report Summary" Section.

- Renewable Energy
  There is a strong desire within the Gasoline Alley Foundation to provide as much of their energy from renewable sources as possible. The implementation of Photovoltaics are reviewed and analyzed as to financial and technological practicality at this site. Heating for the main building will be supplemented by the proposed greenhouse, which will be added on to the south side of the building. The potential for incorporating a solar hot water system is also reviewed. Refer to "Energy Performance / Renewable Energy" Section of this report.

- Building Reuse
  All three of the existing buildings that currently make up the complex are planned for complete renovation and reuse. Many areas that are currently raw, unfinished industrial spaces will be renovated to provide well-insulated, daylit, finished spaces for occupants who are currently outgrowing their space, as well as for new

businesses who will be welcomed into the new spaces. This study helps define the scope of those renovations.

- Resource Reuse
  Currently, one of the anchor tenants is the ReStore. This is a non-profit architectural salvage operation that receives and re-sells all types of building components. Although it is impractical to determine the extent of the reuseable materials available for use in renovations that do not yet have a start date or funding, we will be looking to partner with the ReStore in our quest to provide good quality reused components wherever possible when the renovations actually take place.

- IAQ Management
  Two components of this category are reviewed. The first is a review of the existing mechanical conditions and a determination of the adequacy of existing ventilation systems.

  The second component entails recommendations for maintaining optimum indoor air quality during and after the proposed renovations. See Section "Indoor Air Quality" within Section VI.

- Daylighting
  Additional daylighting is incorporated into the plans for both floors of the main building. On the lower level, in the rear, old, infilled masonry window openings can be reopened and new windows installed. On the upper (street) level, punching new clerestory openings in the south wall, which abuts the proposed atrium, will enable significant daylighting to reach deep into the building from the proposed addition. See Section "Greenhouse/Atrium Addition/Daylighting" Section within Section VII of this report.

DESCRIPTION OF THE PROJECT SITE

The Project is made up of three buildings, located at 250-270 Albany Street in Springfield. The project is located in an urban Brownfield site in an enterprise zone, on a street with hundreds of fuel storage tanks (thus the name "Gasoline Alley"). The total site consists of 1.56 acres. The site sits between Albany Street, in central Springfield, and active railroad lines, to the northwest. The site sits among businesses such as metal recycling, bulk fuel storage facilities, a janitorial supply company, and building wreckers along Albany Street.

The site slopes sharply down from the street to the rear of the site. The primary entrance to the main building (250 Albany Street) accesses the building from the sidewalk, at the second floor. The rear of the main building and the rear building (also considered 250 Albany Street) are both accessed from their first level. The steep hill created by the elevation change from the sidewalk down to the rail lines, along the northeast side of the main building currently is overgrown with sumac, underbrush and debris.

Along both sides of the rail line, there exists a thin border of woods and vegetation. These woods, although surrounded by highways and heavy industrial businesses, are home to a multitude of birds and wildlife. The Foundation is looking to maintain the wildlife and vegetation near the rail lines to the greatest extent possible. They have several areas along Albany Street where they have created flower beds and gardens.

EXISTING CONDITIONS OF BUILDINGS

Main Building (250 Albany Street):

The main building, facing Albany Street, has two floors; each accessed at grade at either the front or rear of the steeply sloped site. The upper (street) level is currently comprised of a large hair salon/coffee shop, business offices for several organizations (including Habitat for Humanity) and meeting rooms. The lower level is currently open, relatively unfinished, uninsulated warehouse space used by the ReStore, a non-profit architectural salvage business and a major tenant.

The total square footage for this building is 13, 572 square feet. Of that area, approximately 6,800 square feet is currently unfinished warehouse space on the lower level.

The basic structure of this building is in good condition. It is primarily a concrete block structure with concrete foundation walls. The original structure was only one tall story high. The second floor was added later. The interior structure of the original building is primarily steel posts and beams under what once was a wood framed roof with exterior masonry bearing walls.

The second floor added structure above and below the old roof and is primarily steel beams and columns. Steel bar joists span from front to back of the second floor, supporting the flat roof. The lower level has a concrete slab floor. The windows and primary doors are aluminum storefront and appear to be in good condition. The exterior cmu walls appear to be uninsulated. It is assumed that a minimal amount of rigid insulation exists over the metal roof decking and under the membrane roof, which is assumed to be nearing its expected lifespan.

Interior finishes in the upper level offices and hair salon are minimal, but in fair to good condition. Exterior walls are painted concrete block. Finishes in other spaces and on the lower level are not at a habitable level for most uses other than a warehouse. Those that do exist are in need of upgrading.

Bathrooms, mechanical equipment and lighting are covered in the Water Conservation and Energy sections of this study.

Rear Building (250 Albany Street):

The second building houses the primary retail space for the ReStore. This building, located behind the main building, is 3,285 square feet.

This structure is also in fairly good condition. It is a one-story concrete block structure with concrete foundation walls and concrete slab floor. The building consists of an original building with an addition added at a later time. The rear part of the building has a low, flat roof. The middle of the building, comprising over half of the floor area, has a taller roof. The front of the building, facing the parking area has the highest roof, but consists of only about 1/8 of the building's floor area. The floor steps down two steps where the two buildings meet, at the rear portion of the building.

The few windows are metal and the three large garage doors are uninsulated. It is assumed that a minimal amount of rigid insulation exists over the metal roof decking and under the membrane roof, which is assumed to be nearing its expected lifespan. Exterior walls are painted concrete block. Finishes are not at a habitable level for most uses other than a warehouse. Those that do exist are in need of upgrading.

270 Albany Street Building

The third building, at 270 Albany Street, contains a metal fabrication shop, pallet business and unfinished storage space. This building is 3,582 square feet. It has significant structural cracks in the rear corner of the exterior concrete block bearing walls. Investigation and repair of the structural cracking is beyond the scope of this study. It is recommended that a structural engineer be consulted prior to undertaking any major renovation work on this building.

The building appears to have been built in at least three different periods. It currently lacks a bathroom, although there is evidence of previous plumbing being active in the building. The building will require significant structural, plumbing, electrical and building code upgrades before the building can be considered for energy and mechanical upgrades.

III. PROPOSED RENOVATIONS AND CONSTRUCTION

PROPOSED RENOVATIONS AND CONSTRUCTION

For the main building at 250 Albany Street, renovation plans include a greenhouse/atrium /building entry addition (approximately 768 sf) to the south (street) side. The atrium will provide planting beds for interior plantings, as well as creating a new, highly visible public entrance which would bring people directly into the area of the complex where the new Community Room will be developed. The interior walkway of the greenhouse will be ramped (as will the exterior area leading to it) in order to provide barrier-free access to that area of the building.

Renovations to the main building include interior renovations to allow for a new, large community meeting room on the upper level, installing new roofing and upgrading insulation and mechanical systems. The lower level, currently raw warehouse space, will be renovated to allow for a finished business/office space.

Proposed new construction consists of 586 square feet of staff entry space on the lower level, bicycle storage space, a new unisex bathroom with composting toilet and shower, and stairs to the upper level. New construction on the upper level consists of a large, new office space for the Gasoline Alley Foundation Director and a new exterior deck for enjoying the proposed landscaping.

Within the Renewable Energy Systems section of this study, the implementation of water conserving systems and photovoltaic technologies is explored.

Plans for the rear building at 250 Albany Street include installing new roofing, upgrading insulation and mechanical systems, and replacing uninsulated overhead doors with insulated ones where needed and infilling the one facing the rear of the site, which is no longer used. It is assumed that the current occupant of this space, or one with similar use needs and patterns, will remain there for the foreseeable future.

At 270 Albany Street, plans include interior and exterior renovations to take the raw, unfinished storage areas of the building and convert them into finished business and office space. Upgrades to the existing metal shop are also planned. The extent of structural and code-related repairs needed to bring this building into compliance with current codes is unknown, but extensive enough to be a major factor in considering costs for upgrading this building.

CONSTRUCTION MATERIALS AND METHODOLOGY

In existing spaces to be renovated, exposed concrete block exterior walls will be furred out with metal 'z' channels and insulated with 1" of extruded polystyrene. The effect on the currently uninsulated portions of the exterior walls would be to increase their R-value over 100% (from R-4 to R-9). The newer portion of the second floor of the Main Building was constructed with insulated block and has an R-value estimated to be R-5.8. The added insulation at these locations would bring the R-value to R-11.8 (including polystyrene, gypsum board, air space and air films).

The proposed additions would be framed either with wood studs and cellulose insulation or metal studs with extruded polystyrene insulation. The exterior skin would be a combination of corrugated metal and fiber-cement panels, with an integral rain screen/ infiltration barrier, behind them. Exterior trim would be "engineered wood products" made from either wood waste or plastic waste products to conserve resources. A mono-pitch roof, utilizing metal bar joists, metal decking and either a white roofing membrane or corrugated metal roofing is proposed. The foundation and first floor slab would be comprised of high fly ash content concrete. The second floor structure would be steel bar joists and metal decking with concrete or wood truss joists with oriented strand board decking, depending on the structural framing system chosen.

Any new flooring installed would be primarily comprised of linoleum tile, an all-natural product with anti-microbial properties and great wear resistance. Carpeting in office space will be specified to be of high recycled content and non-off-gassing backing and adhesives. An alternative carpet specification would be for an all wool carpet with the same backing and adhesive components. The final decision would most likely be cost-based.

Gypsum Board is planned for the interior surfaces of the newly insulated exterior walls, as a product with relatively low embodied energy. No-VOC paints would be used on all newly painted interior surfaces. Any interior shelving or cabinetry used will be fabricated from a combination of salvaged products, FSC-certified wood products or engineered wood products with non-formaldehyde based adhesives.

The entry atrium construction is planned to consist of steel framework with safety glass or polycarbonate glazing (depending on the vandalism factor in the neighborhood at the time of construction). Exterior structural components are proposed to be stainless steel for their low-maintenance, ability to be exposed to weather without needing paint or other coatings and the knowledge that the steel fabricator/artist currently occupying 270 Albany Street works in stainless steel and could provide much of the fabrication necessary with that material.

MASTER PLAN

Currently, the Gasoline Alley Foundation is seeking funding for a Master Plan, to be conducted by Dietz & Company Architects. These plans will incorporate the findings of this Study and will also include future plans for the possibility of expanding the current business incubator and incorporating the large F.L. Roberts property directly across Albany Street.

Renovation plans for the existing three buildings on the current Gasoline Alley site are in the conceptual stage only. This Study will help to determine the scope of work necessary and help to entice funding sources which would then allow drawings to continue into the schematic design phase.

IV. ESTIMATE OF PROBABLE CONSTRUCTION COSTS

ESTIMATE OF PROBABLE CONSTRUCTION COSTS

The following construction cost estimate considers all of the items studied within this report. Several of the items are further broken down under their specific item heading (i.e. Water and Wastewater or Energy Performance).

A summary of probable costs are included below, followed by the breakdown. Note that the construction cost estimates provided are for work described in its entirety. Phasing of costs is not included in this report, as actual phasing plans will be determined by availability of funding. Many categories can be broken down and phased to allow for providing the items or systems described over a period of time. Another option to reduce costs, as necessary would be to leave some of the proposed modifications out in their entirety. Many green scenarios can be achieved without spending the entire budget described below. Discussions with the Owner, stakeholders, Design Team and funding sources will need to be undertaken to determine actual budgets, phasing schedules and scope of work.

CONSTRUCTION COST ESTIMATE SUMMARY

250 Albany Street Main Building and Rear Building

Renovations and Additions	$822,595
Solar Hot Water System (after estimated rebates)	$9,231
Photovoltaic System (after estimated rebates, but not including production incentives)	$22,306
Landscaping/Site Work (low end of estimate, not including contingency costs)	$312,000
Stormwater Collection and Storage (Roof restoration work is covered under "Renovations" heading).	$14,000
Water Conservation Measures (composting toilet, water-efficient appliances)	$9,500
Removal of Known Hazardous Materials From Site	$5,865
Additional fees for analyzing remainder of potential site contaminants and associated remediation.	$54,000
(Costs for additional remediation of hazardous material are possible, but have not yet been determined)	
Total Estimated Cost for Work Described in This Report	**$1,249,497**

Area	Proposed Architectural Modifications	Area	Estimated Cost/sf	Estimated Cost/Item	Total Estimated Cost
Main Building					
First Floor (currently ReStore Warehouse Space)		5674 sf			
	Insulate exterior walls	5,373	3.00	$16,119	
	New gwb on all exterior walls, paint	5,373	3.75	$20,149	
	Modify electrical switches and outlets on exterior walls			$2,000	
	Install new linoleum flooring	5,674	5.50	$31,207	
	Infill existing uninsulated garage door	225	16.00	$3,600	
	Install new energy-efficient lighting and wiring			$4,000	
	Install new window/daylighting openings	5 openings	2500/opening	$12,500	
	Sub-Total				**$89,575**
Second Floor (Offices and Salon)		5,704			
	Insulate exterior walls (except at Atrium)	2,870	3.00	$8,610	
	New gwb on all exterior walls, paint (except at Atrium)	2,870	3.75	$10,763	
	Modify electrical switches and outlets on exterior walls			$3,000	
	Modify interior layout for new Community Room as shown on plans, repair finishes	336	60.00	$20,160	
	Install new energy-efficient lighting			$3,000	
	New door to office addition			$2,000	
	New roof insulation and membrane	5,704	8.00	$45,632	
	Install new window/daylighting openings	10 openings	2500/opening	$25,000	
	Sub-Total				**$118,165**

Area	Proposed Architectural Modifications	Area	Estimated Cost/sf	Total Estimated Cost	
Original Portion of Main Building					
Second Floor		638			
(Salon)	Insulate exterior walls	987	3.00	$2,961	
	New gwb on all exterior walls, paint	987	3.75	$3,701	
	Modify electrical switches and outlets on exterior walls			$1,000	
	Install new energy-efficient lighting			$400	
	New roof insulation and membrane	638	8.00	$5,104	
	Sub-Total				**$13,166**
First Floor		653			
(Storage)	Insulate exterior walls	1,542	3.00	$4,626	
	New gwb on all exterior walls, paint	1,542	3.75	$5,783	
	Modify electrical switches and outlets on exterior walls			$600	
	Install new energy-efficient lighting			$200	
	Sub-Total				**$11,209**
Proposed Addition					
First Floor (Bathroom, Bike Storage, Stair)	Cost includes all new construction and necessary renovations to adjacent structures.	586	190.00	$111,340	
Second Floor (Office)		1,494	190.00	$283,860	
					$395,200
New Atrium					
(single story)	Cost includes all new construction and necessary renovations to adjacent structures	616	240.00	$147,840	
	Sub-Total				**$147,840**

Area	Proposed Architectural Modifications	Area	Estimated Cost/sf	Total Estimated Cost	
ReStore Building (Rear building at lower level of site)		3,058			
	Insulate exterior walls	3,167	3.00	$9,501	
	New gwb on all exterior walls, paint	3,167	3.75	$11,876	
	Modify electrical switches and outlets on exterior walls			$1,000	
	Install new energy-efficient lighting			$600	
	New roof insulation and membrane	3,058	8.00	$24,464	
	Sub-Total				**$47,441**
270 Albany Street					
(Single Story Building at upper portion of site)	See note 1, below.	3,223			
	Total Estimated Cost of Architectural Work				**$822,595**

NOTES:

1. 270 Albany Street: This Building is in need of substantial renovation work, including structural repairs that are beyond the scope of this report. No cost was provided for this work, as the extent of renovations and the level of finish for the interior spaces has not yet been determined.
2. Mechanical, electrical, structural, plumbing and site work costs directly related to the additions are included in the s.f. costs noted.

V. SITE ANALYSIS AND RECOMMENDATIONS

SCHEMATIC DESIGN

This Schematic Site Plan is part of a collaborative effort to prepare an Early Stage Feasibility Study for Gasoline Alley, an industrial brownfield site in Springfield, Massachusetts. The purpose of the study is to investigate and propose sustainable technologies that can be implemented by the Gasoline Alley Foundation. The proposed applied concepts will serve as a model for other area business owners and entrepreneurs. The applied sustainable technologies at Gasoline Alley will foster creative adaptation of state-of-the-art sciences and will illustrate ways in which the business community can create profitable enterprise while at the same time improving the overall health of the environment.

The proposed Schematic Site Plan prepared by Elmore Design Collaborative, Inc. will mediate environmental conditions reflective of many urban industrial and commercial sites. The main concept of the plan is inspired by the existing industrial "ruins" and reconfigures existing space into a series of garden rooms and landscape features that will generate business opportunities and improve a the landscape. Capitalizing on the steep topography, a series of terraced gardens manage stormwater run-off and wind technology creates an engaging and imaginative landmark. The proposed native plantings will reduce long-term maintenance and water requirements, while encouraging species diversity. In all, the new landscape celebrates ecological systems, promotes human activity, and improves the diversity of wildlife habitat.

The Schematic Site Plan exploits one of the main problems facing the urban environment--stormwater run-off from impervious surfaces, such as parking areas and buildings. Instead of viewing run-off as a liability, this plan utilizes the movement of water as a life-supporting element. The plan reduces the time of concentration, increases infiltration, and reduces erosion during times of heavy peak flow by creatively redirecting and channeling runoff from impervious surfaces. The retaining walls stabilize the steep and treacherous slope caused by aggressive in-fill and grading.

Additionally, the plan includes enhanced streetscaping, additional merchandise display areas, and improved vehicular and pedestrian circulation. Amenities for employees, customers, and visitors include the Observation Deck with windmill, Terrace Gardens, Formal Garden, Entrance Courtyard, Terrace, Reflecting Pool, additional display space, and an area for future development.

SITE PLAN ELEMENTS / RECOMMENDATIONS

Vegetation

Deciduous trees are planted on Albany Street, the Terrace Gardens, the Formal Garden, and near parking areas. The trees provide climatic relief with shade during the summer months and sun during the winter months. Tree plantings and increased planting areas are critical to help reduce air temperature in the urban environment where temperatures raise due to the reflective nature of most impervious surfaces. Trees will help to remove toxins from the air and encourage wildlife habitation. Specifically selected trees, shrubs, groundcover, and herbaceous plants will add visual interest throughout the year while providing a food source for wildlife.

Native vegetation will be specified to encourage species diversity and to reduce the naturalization of non-native invasive species, such as those presently existing.

The Greenhouse or Solarium offers a unique opportunity to introduce exotic species with extravagant form, color, texture, and even the potential for food and material production

Reduce Impervious Surfaces

Infiltration of groundwater is essential to a healthy ecosystem. Water infiltration is increased by decreasing impervious surfaces, while modifying existing parking areas and improving pedestrian circulation. With the exception of the asphalt parking areas and the existing concrete Terrace, all surfaces will be paved with permeable materials, which may include crushed stone, stone dust, mulch, etc.

Recycle Masonry Building Materials

This plan proposes to reuse and recycle existing materials. For example, recycled concrete and other unwanted, unused, and discarded masonry materials can be pulverizing into a reconstituted paving product that is pervious. This material will provide a readily available source of base and topcoats product for paths, display areas, the Formal Garden, and around the stormwater retention basin.

Reuse Existing Infrastructure

This plan acknowledges the history of the site by reusing the existing artifacts and urban ruins. Instead of removing or camouflaging the remains of the existing walls, foundation, and concrete pads. These features will form the basis of the design and create a series of garden rooms linked by pathways and stairs. Many of the existing walls remain and are essential elements that shape the spaces for movement, reflection, or gathering. These areas provide spaces that encourage people to enjoy the outdoors. For instance, the Terrace, which may be used for outdoor gathering and eating, is designed on the old concrete floor of a defunct loading dock and the Reflecting Pool is designed within the walls of the old truck siding.

Slope Stabilization

Due to past development, a precipitous slope runs between the western and eastern portions of the site. The resulting slope is dangerous and susceptible to further compromise from erosion and stormwater run-off. A series of terraces shaped by undulating retaining walls, grading drainage basins, swales, and selected native plants will stabilize the slope and encourage slow water infiltration. Existing non-native invasive vegetation is replaced with native plants.

Construct a Stormwater Retention Basin

A stormwater retention basis located at the bottom of the slope is designed to moderate the infiltration of water and provide storage for stormwater during periods of heavy rainfall. The basin is planted with native wetland species that will benefit the environment by reducing toxic nitrogen in the water as it moves back into the water supply. Native wetland communities are essential to a healthy ecosystem. Native plants attract native birds and other wildlife and help to re-establish species diversity, both flora and fauna.

Use Native Plants

Thousands of years of evolutionary development have created plants specifically suited and designed for the New England landscape. Although introduced plant species have significant value in both our landscape and our culture, this plan encourages the use of native species as a model illustrating botanical richness and environmental suitability. Using many different kinds of plant species will reduce the devastation associated with monoculture planting. Native plants provide appropriate and necessary foods and habitats for native birds and wildlife. Also, planting appropriate native plant species reduces long term watering requirements.

Create Wildlife Habitat

The proposed terraced gardens create a suitable habitat for native wildlife. This new habitat virtually bisects the site and will invite a rich diversity of wildlife species. With appropriate plantings, birds, small mammals, reptiles, and butterflies will be encouraged to return. Plant and wildlife diversity will be enjoyed from the scenic overlook next to the upper parking lot.

Manage Hydrology

Stormwater from the upper parking area is directed towards the upper terrace and planting beds. Swales, grading, and appropriate plantings help to disperse run-off, reduce time of concentration, increase water infiltration, and reduce peak flow of water during heavy periods of rainfall.

Wind Technology

In an effort to illustrate the potential of alternative energy sources, a windmill is situated on the Observation Deck. This windmill will be custom designed and will integrate art and technology. The purpose of the windmill is to recycle water from the pool below to the top of the slope. The windmill will provide visual interest, while the moving water will attracts birds and other wildlife. The water is pumped up from the pool and returns through a series of constructed streams and pipes along the terraced walls and various gardens. The water acts as a connective ribbon that simulates the cycle of life and the rebirth of this brownfield landscape.

COST ESTIMATE

for

SCHEMATIC SITE PLAN

for

GASOLINE ALLEY EARLY STAGE FEASIBILITY STUDY

250-270 Albany Street, Springfield, Massachusetts

January 12, 2004

Item Estimated	Cost($)
Site Survey	6,000 – 10,000
Site Preparation	25,000 – 46,000
Site Improvements	214,000 – 288,000
Vegetation (Site and Solarium)	76,000 – 125,000
Sub-total	312,000 – 469,000
25% Contingency	80,250 – 117,250
Total	**$410,250 – $586,250**

Note: *The above budget projection does not include anything related to theidentification and appropriate removal and disposal of hazardous materials. ElmoreDesign Collaborative, Inc. is not responsible for the identification and removal of hazardous materials.*

VI. WATER AND WASTEWATER

EXECUTIVE SUMMARY

The greening of the Gasoline Alley includes a number of measures that may impact energy use and environmental quality. Water use, reuse, stormwater, and wastewater treatment, are practices in commercial and/or light industrial facility requiring careful consideration. Innovative and efficient use of water and reduction of wastewater flows are two areas where both energy and environmental quality issues may be improved. The purpose of this assessment is to address the potential for innovation related to water, wastewater and stormwater at the Gasoline Alley facility. This assessment further considers a proposed greenhouse element and the potential impact on water use in the facility. General consideration is given to minimizing use of additional water as well as reuse of potable water in the maintenance of the greenhouse and other operations. In this preliminary study, we have addressed gross issues around resource use potential and opportunities for minimizing waste. Additional study and cost analysis will be required once consideration of potential options has been completed.

Opportunities for water conservation via reuse of wastewater, waterless toilets and conventional water conservation have the potential to reduce existing water use and wastewater flows by as much as 50,000 gallons per year. Use of stormwater roof runoff could potentially reduce use of city water by more than 150,000 gallons per year. Annual cost savings from such reduction are estimated to be approximately $1,500 in avoided water and sewer fees. Reuse of wastewater via treatment methods has the potential to supply a portion of water demand suitable for non-potable applications. However, significant cost for treatment, permitting and monitoring suggest that use of reclaimed wastewater will not be cost effective. Simple cost estimates suggest that payback on investments for reclamation greater than 33 years with initial costs in excess of $50,000 and may be as much as $150,000 with no reasonable payback. Stormwater collection from roof top runoff for water use in the green house has a shorter payback of 28 years with a capital cost conservatively estimated to be $34,000. Further investigation into roof retrofit requirements and potential permit restrictions on water quality of roof top runoff for use in the greenhouse could decrease projected capital improvements or prohibit use, respectively. Use of low water demand plants in the green house or reduction in planter space could also minimize the storage system requirements and reduce overall costs significantly. Cost estimates for installation of a waterless toilet suggests a payback of 25 year with a capital investment of less than $5,000. The cost and payback time may be reduced depending on the unit selected. Estimated costs for installation of black water and greywater conservation measures including a higher efficiency washing and dishwasher are the most cost effective measure with a simple payback of 4 years on a $4,500 capital cost. It is recommended that simple water conservation be considered first followed by a waterless toilet, and stormwater collection. It is not recommended that wastewater reclamation be considered.

ASSESSMENT OBJECTIVES FOR WATER USE REDUCTION AND WATER REUSE

The greening of the Gasoline Alley includes a number of measures that may impact energy use and environmental quality. Water use, reuse, stormwater, and wastewater treatment, are practices in commercial and/or light industrial facility requiring careful consideration. Innovative and efficient use of water and reduction of wastewater flows are two areas where both energy and environmental quality issues may be improved. The purpose of this assessment is to address the potential for innovation related to water, wastewater and stormwater at the Gasoline Alley facility. This assessment further considers a proposed greenhouse element and the potential impact on water use in the facility. General consideration is given to minimizing use of additional water as well as reuse of potable water in the maintenance of the greenhouse and other operations. In this preliminary study, we have addressed gross issues around resource use potential and opportunities for minimizing waste. Additional study and cost analysis will be required once consideration of potential options has been completed.

GREENHOUSE AND OTHER NON FRESH WATER USE REQUIREMENTS

Water use at the facility for plantings in the greenhouse was estimated based on projections for the proposed greenhouse. Renovations to the site include approximately 768 square feet of available greenhouse space, including walkways between planter beds and storage space. It was presumed that no more than 500 square feet of floor-space would be used for plantings. Based on these conditions an analysis was performed to determine maximum flow requirements and the capacity of a water-reuse system to supply this demand. Consideration was given to use of greywater, black water and stormwater for this use

Generally accepted loading rates for planter beds range from 2-2.5 gallons per day (GPD) per square foot, seasonally. Lesser amounts are required during slower growing periods. Based on the proposed plantings area, a range of 1,000 - 1,250 GPD water may be required per day for plantings. This number is likely to be a liberal estimate and reduced volumes are probable.
An additional 225 gallons of non-potable water has also been identified for use in flushing existing toilets and urinals and proposed new toilet facilities. Hence proposed water usage that may be serviced from reclaimed water could exceed 1400 GPD. The following discussion addresses types of water reuse option that may be used for the purposes mentioned above.

WASTEWATER REUSE AND CONSERVATION

Wastewater reuse or reclaimed water is a well-established in commercial and industrial operation. However, it is important to recognize the significant public health requirements for utilizing treated wastewater, and cost associated with on-site treatment is significant. Under commercial and industrial applications a number of considerations must be made to determine the practicality of wastewater reuse. In particular, the facility must identify a use for non-potable water (not for human or animal consumption). The Gasoline Alley project has identified a potential use for non-potable water in a proposed greenhouse and for toilet and urinal flushing. The source of wastewater for non-potable reuse on this site falls into three categories, greywater, black water, and stormwater. Greywater from this site includes flows from sinks, showers, dishwashers (no food waste), and laundry washers. A more detailed discussion of these sources follows. Black water sources of water include urinals and toilets (and certain sinks in the salon). Stormwater may come from roof surfaces (the easiest to capture) and ground runoff (may require significant treatment). The following section address greywater and black water reuse and models the potential use of these water sources for non-potable applications.

Reclaimed Water Potential and Reuse Options

Greywater is commonly considered useful for non-potable applications, including: use for flushing urinals and toilets. Use of greywater in plantings located in the green house and other locations is unlikely due to current environmental regulations and restrictive water quality criteria. Black water, water from toilets may also be reclaimed. However, as will be discussed in the next section, significant obstacles for reuse of black water are apparent, and black water will considered under a conservation section to follow.

Greywater flows were tabulated based on design flows regulated under Massachusetts 310 CMR 15 - Title 5 (1) and the existing facilities on site. Actual flows may vary from the site and should be validated in additional studies of the site. Based on these data, greywater flows total approximately 220 gallons per day.

Gasoline Alley Greywater Usage

	Flow (GPD)	Explanation
Upper Floor		
2 Sinks	50	1-5 gal/use each
(public restroom)		
1 Utility Sink	Not Considered	
1 Hose	Not Considered	
1 Sink	50	1-5 gal/use
(coffee house)		
1 Dishwasher	50	3-5 gal/use
(coffee house)		
Intermediate Level		
1 Sink	10	Minimal Use
1 Shower	Not Considered	Minimal Use
Lower Level		
1 Utility Sink	25	
1 Hose Bib	10	
Planned Addition		
1 Sink	25	1-5 gal/use
1 Shower	Not Considered	
Total Daily Flows	**220**	

Black water flows in the facility are represented in the following table. Total flows including some flows from the salon sinks and washing machine are estimated to be 338 GPD.

Gasoline Alley Black Water Usage	
	Flow (GPD)
Upper Floor	
2 Toilets	140
(public restroom)	
3 Hairwash Sinks	60
1 Washing Machine	50
(salon towels)	
Intermediate Level	
1 Toilet	17.5
Planned Addition	
1 Toilet	70
TOTALS	**338**

Reclaimed Wastewater Use Regulatory Considerations

Regulatory consideration of wastewater disposal at this site falls under the local regulatory authority as disposal is to a municipal wastewater treatment plant. Even under a reuse scenario, any further discharges must be made to the municipal wastewater treatment plant. However, rules regarding reclamation based on the site design flows, appear to fall under the jurisdiction of the Massachusetts Department of Environmental Protection (MADEP) regulations 310 CMR 15 – Title 5 (1) and MADEP Bureau of Resource Protection issued interim guidelines on reclaimed water in January of 2000 (Policy #BRP/DWM/PeP-P00-3) (2). Other local approving authority regulations may apply, e.g., Springfield Board of Health.

Under the referenced guidelines the use of reclaimed water is limited to spray irrigating golf courses, landscaping, artificially recharging aquifers and toilet flushing. The guidance does not make a distinction between greywater and black water under reuse applications. And no other regulatory programs appear to supercede the current DEP guidance. Hence it is assumed the following information may be applicable to the discussion of black water and greywater reuse.

The guidelines define reclaimed water as highly treated sanitary wastewater. The guidelines require significant treatment to the wastewater prior to use, signage to alert users that water is non-potable and not for human consumption, an education program including information available to building users, and continuous monitoring and testing. Reclaimed water use falls into several categories and has specific criteria for each use. Gasoline Alley use would be considered "Urban Reuse" and water quality criteria which applies requires significant monitoring over the life of the project. In general, reclaimed water must be "pathogen and contaminant free". These criteria suggest that tertiary wastewater treatment may be required for greywater or black water. Specific criteria are listed in the table below.

Major Water Quality Criteria for Reclaimed Water in Urban Use
pH 6-9
≤ 10 mg/l BOD
≤ 2 NTU (turbidity measure)
no detectable fecal coliform – median of no detectable colonies/100ml over continuous, running 7 day sampling periods, not to exceed 14/100ml
TSS – 5 mg/l
Total N - ≤ 10 mg/l
Class I groundwater permit standards

Despite the notion that greywater is innocuous and should require minimal treatment, other information suggests otherwise. A recent study confirms that greywater may pose a significant health and environmental risk. Veneman and Stewart, 2002, (3) sampled greywater at five different commercial locations in Massachusetts. A summary of water quality characteristics is listed in the table below:

Water Quality Characteristics of Greywater from Commercial Locations		
Parameter	**Average**	**Range**
BOD_5	128.9 mg/L	22.1 - 358.8 mg/L
TSS	53.0 mg/L	8 - 200 mg/L
TKN	11.9 mg/L	3.1 - 32.7 mg/L
Nitrate	1.5 mg/L	<0.8 - 17.5 mg/L
Orthophosphate	<0.5 mg/L (BDL)	Up to 3.6 mg/L
pH	7.0	5.3 - 10.8
Total coliform	exceeded dilution range	
Fecal coliform		0-10,000 cu/100 mL
E. Coli	nd	
(adapted from Veneman and Stewart, 2002)		

Water quality criteria for reclaimed water use in the DEP guidance is clearly directed at applications resulting in final disposal to subsurface soil based systems and groundwater protection. For the Gasoline Alley project, reuse within the facility would be generally limited to flushing toilets and urinals with final disposal to a municipal wastewater treatment plant. The guidance clearly restricts water reuse in planters. However, advanced tertiary wastewater treatment could produce pathogen and contaminant free water for reuse. An initial analysis suggests that tertiary on-site treatment would not be practicable based on projected savings. Estimated capital costs for engineering and installation of treatment technology that would meet MADEP requirements under these conditions could range from $50,000 to $150,000 (Boston Business Journal, 1998) (4). In addition permitting and ongoing monitoring a maintenance costs may be significant. Based on these factors, a more detailed engineering and cost analysis could be conducted after a thorough regulatory review is conducted. However, it is unlikely to be favorable.

Several proprietary greywater treatment systems are approved for use in Massachusetts under Title 5. A system that is representative of the required treatments for a greywater system may includes any and or all of the following units: anaerobic pre-treatment consisting of filter treatment and functions by separating large particles and fibers; aerobic pre-treatment involving a staged settling tank for sludge and grease separation, a sand filter or other media bed for biochemical reduction of nutrients, and disinfection visa vi UV or other non-chemical disinfection technology. It is likely that before any release to the environment disinfection will be a priority. Should additional efforts to consider reuse of wastewater be undertaken, consideration of several proprietary technologies should be included in the analysis.

Water Reuse Cost Analysis

Potential annual savings from use of reclaimed water is based on total design flows of 558 GPD. Savings are estimated from deferred purchase of fresh water and avoided cost for discharge of wastewater. Based on an estimate of combined water and sewer rates of $6.00/100 CF, total estimated cost savings of $1,600 per year may be achieved with water reclamation and reuse. Simple payback using the low end estimate for capital cost of $50,000 is estimated to be 33 years. Further, it is estimated that regulatory reporting and permitting on an annual basis is likely to exceed the annual savings. Hence reclamation of any wastewater is not recommended based on simple economics.

BLACK WATER AND GREYWATER CONSERVATION MEASURES

There are numerous sources of black water, more highly polluted wastewater, throughout the facility. For the purpose of this study, sinks in the salon and washing machines for salon towels have not been considered in the greywater calculations but are included in the black water analysis because of the potential presence of toxics in each. The following table lists black water use at the Gasoline Alley site, and recommendations to reduce the magnitude of flow. A total flow of 330 GPD has been identified based on regulated flow values. Instituting water saving methods as suggested may reduce flows up to 60%. Total existing black water flows could be reduced by nearly 130,000 gallons per year and represent as much as $1000 per year in avoided water and wastewater fees. Use of a waterless toilet, discussed below could reduce use by another 25,500 gallons per year representing a savings of up to $200 per year.

Black Water Conservation Measures			
	Flow (GPD)	Low Flow (GPD)	Explanation
Upper Floor			
2 Toilets (public restroom)	140	64	Low flow = 1.6gpf vs. 3.5 gpf - 20 flushes
3 Hair Wash Sinks	60	45	15 GPD reduction using water saving techniques
1 Washing Machine (salon towels)	50	17	European style washing machines use 1/3 water
Intermediate Level			
1 Toilet	17.5	8	5 flushes/day – minimal usage
Planned Addition			
1 Toilet	70	0	Planned Waterless
TOTALS	**338**	**134**	
Possible Savings/Day		**204**	

Greywater use conservation, based on existing usage has some opportunity for significant savings. Traditional water conservation measures such as faucet aerators and a higher efficiency dishwasher may reduce flows by as much as 25%. Savings of up to 20,000 gallons per year use may be achieved.

Cost Analysis for Water Conservation Measures

Estimated costs for installation of these conservation measures including a higher efficiency washing and dishwasher, but not including the waterless toilet option discussed below, are $4,500, with total cost savings of roughly $1,200 and a simple capital cost payback of 4 years.

Waterless Toilet Option

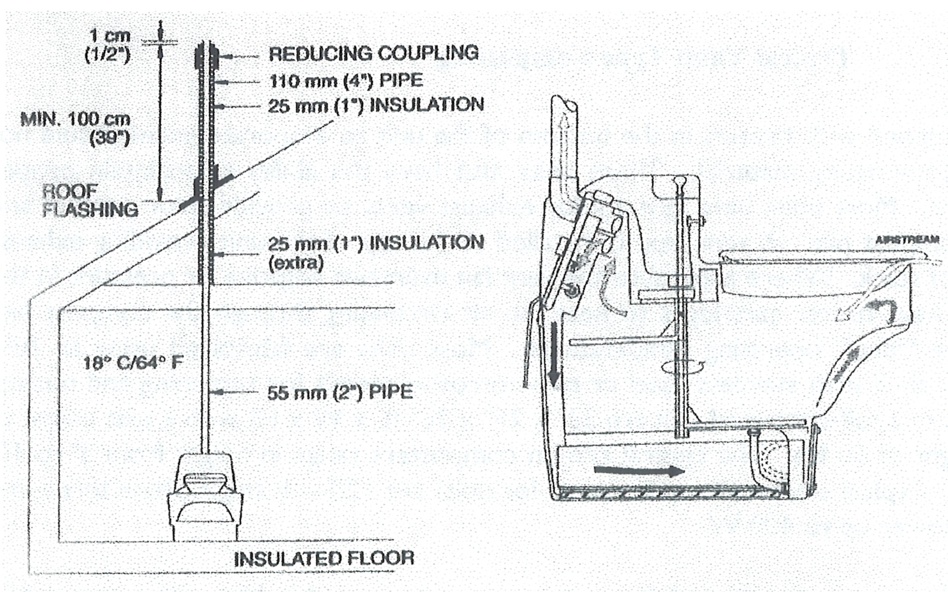
It is proposed that at least one waterless composting toilet be installed in the facility to provide reduced water use (70 GPD) and demonstrate sustainable water use. Composting toilets are generally permitted in the Commonwealth under Title 5. A detailed assessment of composting toilets approved for use in Massachusetts was prepared in 2000 (Winkler, 2000). The following is provided as background information on use of composting toilets.

Composting toilets provide biological treatment of human wastes using naturally occurring aerobic microorganisms. Feces, urine and toilet paper are collected in a bin; typically containing a starter carbon source such as wood chips, saw dust, or peat moss. Microorganisms reduce the added waste through aerobic decomposition. End products of the process are carbon dioxide, water, and humified organic matter. Composting toilets are often used in conjunction with a septic tank and soil absorption system (SAS) where other wastewater is produced from washing machines, sinks, showers, bathtubs, and dishwashers. Composting toilets come in all sizes and are capable of full time use for residential and commercial applications up to 10,000 GPD design flows.

The composting process varies between manufacturers. The larger units may be designed to provide batch treatment of wastes. In this mode, several bins located in the unit are rotated at intervals providing longer composting times. The advantage of batch process composters is the reduced likelihood of pathogenic organism survival. Other units provide a batch type process where removal of "finished" compost is remote to fresh wastes. In smaller compact units, drying prior to removal of wastes is required to "finish" the composting process.

General Description of Waterless Toilets

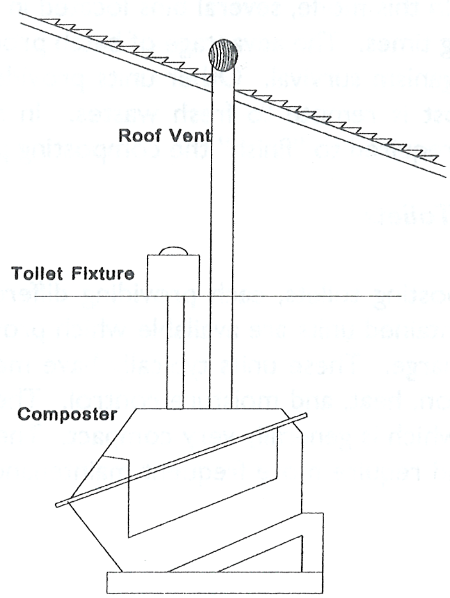
There are two basic types of composting toilets, each providing different approaches to the composting process. Several self-contained units are available which provide rapid reduction in waste volume, with zero liquid discharge. These units typically have mechanical and electrical components providing mixing, aeration, heat, and moisture control. The composter and toilet fixture are combined into one unit, which is generally very compact. These units need a power supply (electric, battery, or solar) and require more frequent maintenance and cleaning (4 - 12 times per year) than larger units.



BioLet XL Automatic Toilet (after, BioLet USA, Inc.).

The other type of composting toilets, referred to as "central system models" is relatively large and may be located at some remote distance to the toilet fixture, commonly located in a basement or outside. The composter may be connected to the toilet fixture via a straight chute from above, or it may be offset when used with foam flush or low flush toilet fixture.

These units typically have a much larger composting capacity and some have mechanical mixing, aeration, and moisture control. The storage capacity of the large composters is typically two or more years resulting in reduced maintenance.



Typical Vault Type Composting

Some units are equipped with heaters in the bottom of the unit to evaporate excess liquid not absorbed by the composting material. These units also have the ability to maintain proper moisture conditions. Most units have fans and/or exhaust vents to provide odor control and aeration for the compost pile. A vent pipe is installed at the top of the unit providing exhaust ventilation to a roof stack. Where applicable, the vent fan maintains negative air pressure in the unit. A few units have heater cartridges to heat the air circulating through the compost bin, thereby maintaining "ideal" operating temperatures. Most units are fabricated using an ABS plastic or fiberglass shell with stainless steel or non-corrosive metals for screening and mixing. Typical dimensions of a self-contained unit are 33" x 26" x 26" (L x W x H) with a seat height of 20 inches and weight of 60 lbs. The central system composters range in height from 3' to 10' and vary in widths. Typical electrical requirements for units are 120-volt single-phase three-line service providing power up to 400 W.

The humified solid wastes are collected in various types of removable bins. The centralized units, which operate in batch mode, may have up to 4 bins that can be removed without halting use of the unit. The smaller self-contained units may require some shutdown time during changes. Units with temperature control via heaters will have an adjustable thermostat. Some units have a mixing mechanism and leveling rake located in the humus bin. Mixing may operate automatically after each toilet use or manually with a crank.

Installation

Composting toilets generally require minimal preparation for installation. Under most circumstances, they can be installed anywhere a conventional toilet can be installed provided they are protected from freezing, are properly vented, and have access to electricity, if required. The centralized units require a larger space and access for periodic maintenance. Units must be vented to the outside, preferably through the roof. Composting toilets are covered under Massachusetts's building code and can be installed by a licensed plumber. Coordination with the installer and distributor should be made so that the unit is installed according to the manufacturer's instructions. Location of the unit in the waste treatment stream is illustrated below.

Operation and Maintenance

Startup of the units may require an electrical connection and the seeding of the humus bin with a starter mix. Units may use any type of carbon material. Some of these include: buckwheat hulls, wood chips, wood shavings, sawdust, coconut husk, live "soil organisms," and diatomaceous earth. Moisture levels in the composter should be monitored to ensure that the compost is maintained at optimum moisture content. Units with heaters must be adjusted to control evaporation. Some units require periodic additions of a conditioner, which is usually some carbon source. The humus bin should be emptied when the pile reaches the recommended maximum. Units with rotating bins require monitoring and rotation approximately every 6 months. On units with heaters, adjustment of operating temperature prior to waste removal (2-3 days) may be required to remove excess moisture. Solid waste should be disposed of in accordance with the local approving authority or by a qualified septage hauler. Additional starter material should be used after emptying the unit. A maintenance contract is required for the life of the toilet, with a minimum 2-year contract period. Periodic maintenance should include biannual inspections of unit integrity, motors, and electrical controls.

Product Listings and Cost

The following table is a partial listing of products and manufacturers current as of 2000. Cost estimates for toilets for smaller applications range for $1,200 to $2,500 plus installation. Installation cost will vary widely depending on size and type of unit. Estimates for these costs are likely to be equal to the cost of the equipment. Cost savings from reduced flows are estimated to be $200 per year based on 70 GPD flows. Simple payback not including operating costs is estimated to be 25 years. Depending on the type of unit payback could be shortened.

Product Name	Manufacturer	Location	Phone
AlasCan Toilet System	David Kern	Cleveland Heights, OH	216-382-4151
Aquatron	Aquatron Int.	Stockholm, Sweden	46-8-790 98 95
Bio-Sun	Bio-Sun Systems, Inc.	Millerton, PA	800-847-8840

Product Name	Manufacturer	Location	Phone
BioLet XL	BioLet USA	Concord, MA	978-287-0012
Clivus Multrum	Clivus Multrum, Inc.	Cambridge, MA	617-491-0051
DOWMUS	David Campbell	Cooroy, Q Australia	074 476342
EKOLET Caomposting Toilets	Matti Ylšsjoki	Helsinki, Finland	358-40 5464775
Ekosanic	Ekosanic Scandinavia	Tyresö, Sweden	468-745 06 30
Envirolet Composting Toilet	SanCor Industries, Ltd.	Scarborough, Ontario	800-387-5126
Jade's Composting Toilet	Jade Mountain, Inc	Boulder, CO	800-442-1972
Nature-Loo	Nature-Loo	Milton, Q Australia	07-3367-0601
Rota-Loo	Environment Equipment	Braeside, VIC Australia	03-587-2447
Sun Mar Composting Toilet	Sun Mar Corp.	Burlington, Ontario	905-332-1314
Vera/Eco-Tech Carousel	Ecotech	Concord, MA	978-369-3951
"CTS" Toilet	Composting Toilet Systems	Newport, WA	509-447-3708
"Phoenix" Composting Toilet	Advanced Composting Systems	Whitefish, MT	406-862-3854

STORMWATER COLLECTION AND REUSE

This section addresses stormwater collection and use in the greenhouse operations at the Gasoline Alley site. No specific regulations enforced by MA DEP excluded use of captured stormwater in non-potable applications. Depending on the source of stormwater and the water quality characteristic s, there are a variety of considerations for use of stormwater, including: capture, filtration/treatment, and distribution. Stormwater runoff from road surfaces and vegetated surfaces can contain contaminants at levels found in wastewater, including pathogens, nutrients, and toxic organics and metals. The following discussion will therefore be limited to consideration of rooftop runoff, which under current DEP Stormwater guidance be discharged to groundwater with no treatment. Based on this exclusion, it may be assumed that water quality criteria are not applicable for use in greenhouse operations and specifically for ornamental plantings. Other sources of stormwater will require some level of treatment and are not considered for use due to costs.

Stormwater Runoff Volume and Flows

The Gasoline Alley site has 3 buildings and rooftops on each building contribute impervious area for stormwater collection. Paved and vegetated areas not considered per this application The Restore space accounts for 3,285 sq. ft, the proposed greenhouse 768 sq ft, and the main building, 6,800 sq ft. All three buildings will require installation of a collection system and connected to a centralized storage tank. Alternatively, the main building (250 Albany St), with the greatest collection capacity, may be considered alone. This alternative may be practical as it is closest to the greenhouse and may reduce storage and distribution costs.

Rainfall data and volume calculations are shown in the Appendix A. Analysis of these data suggests that there is potential for stormwater reuse at the site. Based on all impervious roof surface area estimates and rainfall data, an annualized average stormwater flow of 800 GPD may be available. Roof runoff from the main building exclusively is 63% of the total roof area and results in an annualized average of 506 GPD. Based on an annual average basis, stormwater collection and reuse in an indoor planter bed could be practical in lieu of any other water reuse practices. Most of the precipitation between the months of November and March is unusable as it is frozen or snow. During this time watering would be solely from fresh municipal water. However, winter months may have reduced water demand due to slower growing conditions.

Stormwater Treatment and Collection Considerations

Some filtration of rooftop stormwater runoff may be recommended for removal of gross solids. A simple screen system could be fabricated to achieve this process. Other contamination issues that could result in the unsuitability of this runoff include pathogens from avian feces, bacterial growth from organic matter that may accumulate on the roof, hydrocarbons or metals that may leach from rooftop barrier materials. Additional investigation of these issues is required prior to construction of collection and distribution systems.

The stormwater collection from rooftops will require that the rooftop barrier is properly sealed and graded to avoid ponding of water on the surface and channeling to a drain terminating in a storage tank. Small particulate filtration may not be required but gross litter screens to reduce the amount of solids may be needed. A screened water pump (1/8" openings) may be satisfactory in providing gross solid filtration. The pump utilized will be sized to provide static head loss and pressure line loss over the network system but will deliver water at low pressure, <1 PSI. Storage tank sizing should consider the annualized average in rainfall volume collected and be of sufficient size to account for variations in rainfall recurrence. In Massachusetts an average recurrence interval is greater than 72 hours. In order to conservatively estimate storage needs a 3-5 day reserve of greenhouse demand is recommended equivalent to a 6,000 gallon tank.

A Gasoline Alley water use system incorporating stormwater runoff could be enhanced by design of the greenhouse and reduction of typical greenhouse water usage using non-native dry land plantings.

Stormwater Collection and Distribution Cost Analysis

Estimated costs associated with use of stormwater runoff from roof top surfaces includes: rehabilitation of roof barriers, piping to the storage tank, excavation and installation of a storage tank, pump and distribution lines to the greenhouse, and a gross solids screening device. Because the condition of the roof is unknown, an estimate of $2.00 per sq ft is proposed for a total of $20,000 for roof rehabilitation. Depending on the condition of the roof this cost could be lower of higher. Piping to the storage tank is estimated to be $1,000-$2,000. Excavation and tank installation with a 6,000 gallon pre-cast concrete tank is estimated to be $9,000. Pump, distribution lines to the greenhouse, controls and installation are estimated to be $3,000. Total cost for stormwater collection and distribution is estimated to be $34,000.

This number may be conservative depending on roof condition. Payback for use of stormwater in the greenhouse based on avoided fresh water costs for 800 GPD at $3.00/100 CF ($1,200/year) is 28 years.

GENERAL RECOMMENDATIONS

Opportunities for water conservation via reuse of wastewater, use of stormwater runoff, and waterless toilets have been considered. Reuse of wastewater via treatment methods has the potential to supply a portion of water demand suitable for non-potable applications. However, significant cost for treatment, permitting and monitoring suggest that use of reclaimed wastewater will not be cost effective. Simple cost estimates suggest that payback on investments for reclamation exceeds 33 years with initial costs in excess of $50,000 and may be as much as $150,000 with no reasonable payback. Stormwater collection from roof top runoff for water use in the green house has a shorter term payback of 28 years and with lower capital cost that are conservatively estimated to be $34,000. Further investigation into roof retrofit requirements and potential permit restrictions on water quality of roof top runoff for use in the greenhouse could decrease projected capital cost for improvements or prohibit use, respectively. Use of low water demand plants in the green house or reduction in planter space could also minimize the storage system requirements and reduce overall costs significantly. Cost estimates for installation of a waterless toilet suggests a payback of 25 year with a capital investment of less than $5,000. The cost and payback time may be reduced depending on the unit selected. Estimated costs for installation of black water and greywater conservation measures including a higher efficiency washing and dishwasher are the most cost effective measure with a simple payback of 4 years on a $4,500 capital cost. It is recommended that simple water conservation be considered first followed by a waterless toilet, and stormwater collection. It is not recommended that wastewater reclamation be considered.

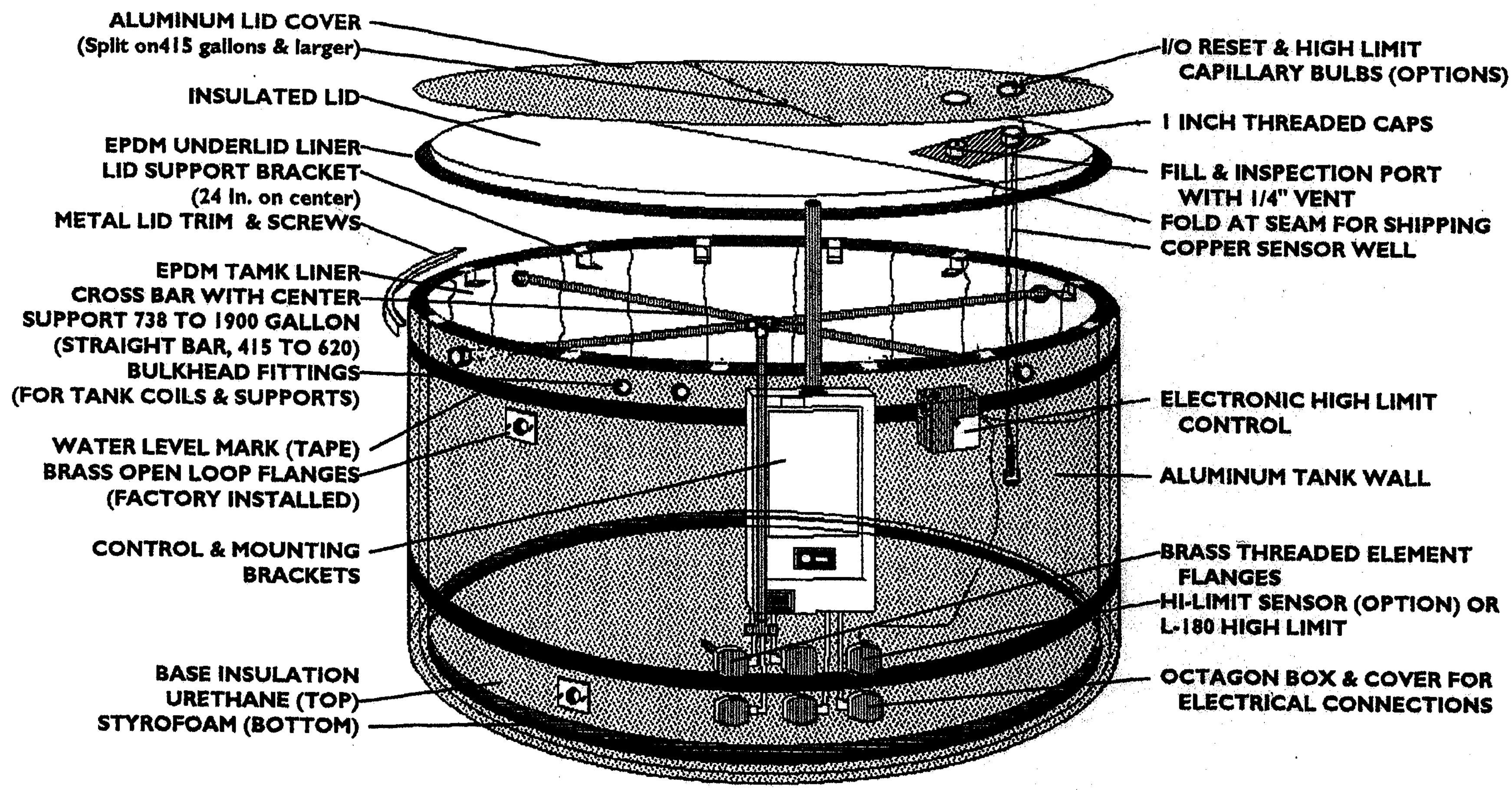
TABLE OF WATER CONSERVATION MEASURES, SAVINGS AND COSTS

Measure	Water Savings Gallons/year	Cost Savings $/year	Estimated Capital Cost	Payback
Water Reclamation	200,000	$1,600	$50,000–150,000	> 33
Water Conservation	150,000	$1,200	$4,500	4
Waterless Toilet	25,500	$200	$5,000	25
Stormwater Collection	290,000	$1,200	$34,000	28

STORAGE TANK ASSEMBLY

Assembly is the same for open and closed loop systems

STORAGE TANK EXPLODED VIEW



VII. ENERGY PERFORMANCE / RENEWABLE ENERGY / IAQ / DAYLIGHTING

INTRODUCTION

REPORT ON ENERGY SYSTEMS

Based on our site information and other information gathered about the Gasoline Alley facility to date, we provide this preliminary study which summarizes existing systems and opportunities for improvements. The goal of this study is to examine various systems and the options which are available to improve building performance. During the current scope authorized, we identified improvement opportunities on a narrative basis. For renewable options, we have provided more in-depth analysis; for some efficiency improvements we shall point to the types of improvements which are desirable. In areas for which the future use is at yet unclear, we have noted technology opportunities to keep in mind during consideration of various renovation and changed use options.

Bart Bales of Bales Energy Associates met with the entire project team on site at the inception of the project. In a separate meeting, Mr. Bales also met on-site with Marc Sternick, the lead architect for this project and the building,s sponsor and management, Meadowbrook Lane Associates, to clarify the future program intentions for the building. He also arranged for a representative of Western Massachusetts Electric Company energy efficiency company to attend in an effort to optimize future utilization of applicable utility incentive programs for any projected improvements to the building.

Mr. Bales conducted site inspections to determine existing conditions of mechanical and electrical systems, as well as to become familiar with the nature of the occupants and their usage of the space.

Mr. Bales conducted site inspections to determine existing conditions of mechanical and electrical systems, as well as to become familiar with the nature of the occupants and their usage of the space. It should be noted that available architectural drawings for the building were very limited; the consultant had access only to a floor plan layout of the building. No drawings of the existing electrical or mechanical systems were available and so such information had to be collected by site observations.

Mechanical systems at the building were examined and options for improvement were identified. Improvement options for the current use scenario included: automated scheduling control of HVAC system, potential utilization of infrared heaters in the basement ReStore warehouse area, and the addition of a solar domestic hot water heating system to serve as a preheating function to the existing domestic hot water system. Existing water uses were surveyed to determine and appropriate system sizing for the solar domestic hot water system. Based upon systems available from a regional solar energy systems integrating company a preliminary cost estimate for a turn-key solar domestic hot water system was provided.

Review of the site indicates limited heating, ventilating and air conditioning systems. For the top floor areas of 250 Albany Street, rooftop air handlers represent the sole source of ventilation air. Maintenance of outside air damper operation to assure proper levels of ventilation air is important to indoor air quality.

The generation of potential pollutants from indoor sources is also an important consideration to indoor air quality. Later in this report, we address a variety of issues with regard to current sources of indoor air pollutants. We also provide guidelines to avoid introduction of pollutants in to the building in the future. Evaluation of the nature of the hair treatment chemicals from the salon and their environmental characteristics is beyond the scope of the current study. However, depending upon their specific nature, some treatments may represent a source of unwanted indoor air pollutants. If so, a dedicated ventilation system from the salon area may be appropriate.

Electrical systems were reviewed. Lighting improvement options were identified and potential energy savings with improvements were calculated and reported. The use of T8 lighting technology, electronic ballasts, and compact fluorescent technology was recommended for applicable lighting improvements. Electrical panels were examined in an effort to determine which areas were served by which services. A solar-electric system option to serve the building's intended environmental education mission was evaluated for the building.

Annual electrical utility use, gas use, and cost information was gathered and tabulated.

The Gasoline Alley project comprises three buildings: the main building at 250 Albany Street (Building 1), the building behind it (Building 2) and the small building northeast of it at 270 Albany Street (Building 3). Th expansion proposes to interconnect Building 1 and Building 2.

Building 1: 250 Albany Street:

Most of our efforts will be directed at improvements to the main building, as it is the largest and most fully utilized. Improvements under consideration include a greenhouse addition, renovating the lower level of the main building into a finished business space, providing interior renovations to allow for a new, large community meeting room on the upper level, installing new roofing, upgrading insulation and mechanical systems, and installing renewable energy systems, and sustainable technologies to the greatest extent possible.

EXISTING CONDITIONS / RECOMMENDATIONS:

Occupants and Uses of Building:

Building 1 is a two-story structure with a total heated square footage of the building of 12,669 square feet. In this plan an addition of 2,080 square feet is proposed. In addition, a sun-tempered atrium area of 616 square feet is proposed.

On the northern end of the top floor is a beauty salon with a floor area of 3,200 square feet. The northernmost portion of the salon (640 sf) is located in the older portion of the building. The remainder (2,560 sf) is located in the newer portion of the building, an area which was formerly a café and art gallery space. For this reason, the salon still includes a very lightly used food bar area.

The remaining southern portion of the top floor is devoted to office spaces. Meadow Brook Lane Associates uses the southernmost section of the top floor. Meadow Brook is the developer of the building and a firm involved in promoting sustainable economic development. The remaining office space, comprising 3 enclosed offices and an area for cubicle offices, serves as an incubator space and provides space for non-profit and other organizations requiring limited office space.

Currently the bulk of the lower floor is used in an industrial warehousing function by ReStore, a business which obtains and resells useful material and equipment salvaged from building renovations or demolition. ReStore also uses the building behind building 1 for the same function.

In a longer-term development scenario, the lower portion of Building 1 may be converted into office space.

Envelope:

Improvement of the building shell components: the roof, walls, windows and doors can reduce the total energy requirements of the building and reduce fuel and utility operating expenses. A reduced building heating or cooling load can allow for heating and cooling systems of reduced capacity and cost. A well-insulated building results in improved occupant comfort and productivity.

Improvement of these elements was proposed and defined by Marc Sternick. At the request of the architect, Bales Energy Associates provided a simplified model for the impact of specified changes in insulation on walls and roof.

Roof and Related Systems:

The building is a flat-roofed, concrete block structure. The main building was constructed in three phases. The oldest section is the northern most part of the building. The status of the roof above this portion of the building is uncertain, but is likely to need replacement. If so, this would be the opportunity to add insulation to the roof.

Next the bottom floor industrial area was built. More recently (approximately ten to fifteen years ago, the southern portion of the top floor was added above the industrial space. The building operator believes that there are two inches of rigid insulation included in the roof at that time.

Roof-Related Recommendations:

The architect defined envelope improvements. Based on R-value information provided by the architect, Bales Energy Associates provided simplified energy modeling services to estimate the heat load reductions associated with added insulation. **The architect also proposed to increase the roof insulation to result in a uniform insulation level of R-23.** Heat load calculations estimated that this **added roof insulation would result in an added savings of 6%** over the baseline condition.

A membrane roof is the likely roofing system to be utilized for the top surface with rigid insulation below. **Specifying roofing material, insulation type, and low or no VOC-based adhesives and sealants can help optimize the "green" or "healthy building" performance of the installed roofing system.**

In the course of determining the upgrading of the roof system, it is important to consider the requirements of the future solar-electric and solar domestic hot water systems and to plan for them in the design undertaken.

Roof Considerations with Regard a Future Solar Electric System:

One option is to mount solar-electric systems with firm attachment to the underlying roof structure. Alternately, solar electric systems may be installed on the flat roof but without penetrating the roof itself. (See the Photovoltaic System section for further discussion.) Such mounting approaches rely either on a ballasted system with added weight to hold them down or are installed at lower tilt angles to avoid wind effects.

If firm attachment to the roof is to be used, it will be wise to install mounting blocking before the membrane roof is installed and that the roofing system may be installed to cover the blocking. With the blocking in place, the solar-electric system installation requires only the limited penetrations for affixing the system to the blocking. It is very important that this type of installation is coordinated with the roofing contractor to assure maintenance of the roofing system performance and warranty.

If the roof is to be replaced, then provision of a firm mounting is probably the preferred approach in this situation. While the amount of weight added by the solar-electric system is relatively small, code review of the roof 's structural capabilities will be necessary as part of the building permit process. If the roof is not to be replaced, the methodologies which do not penetrate the roof are probably preferred. (See Photovoltaic Section for discussion of these systems.)

Wall Systems:

Walls are simply concrete block. The building operator believes that the concrete block walls in the newer top floor section include insulated cores.

The basement areas and the older portion of the salon (top floor) have concrete block walls. The newer top floor section including the newer portion of the salon and the office spaces has insulated concrete block walls.

Wall-Related Recommendations and Related Calculations:

The architect on this project has indicated good results and performance from rigid insulation applied to the interior of a concrete block structure. As described, the intended construction will install one inch of rigid insulation covered by sheet rock and thereby increase the R-value of the wall by R-6. (For the older parts of the building; for the newer top floor section, the wall value was assumed to increase to R-11.8.)

If this insulation is added, healthy building characteristics can be enhanced by careful evaluation of the insulation product and adhesives chosen used to avoid indoor air pollutants released by the products over time. Assure proper installation and detailing practices to avoid potential moisture-related issues in the wall assembly.

At the request of the architect and based upon insulating values provided, a heat load calculation to estimate the **effect of the wall insulation** on the total building load. **Modeling indicated a projected 25% reduction in fossil fuel requirements in the building if the walls are insulated as described.** (As already noted, heat load calculations suggested that this **added roof insulation would result in an added savings of 6%** over the baseline condition.)

The combined effect of the envelope improvements proposed was modeled to be approximately 31% below the current baseline condition. Heat balance calculations and modeling after wall and roof insulation will be included in the appendices.

Window and Door Systems:

The size, thermal performance, and placement of windows in a building envelope can have a marked effect on the overall energy requirements of a building. Conductive and convective heat loss through windows is typically much greater than through other envelope elements. However, on sunny days, south-facing glass can deliver significant heat gain through radiative heat transfer and can substantially offset fossil fuel heating requirements.

Windows are also a source of useful light which can substantially offset the need for electrical illumination, particularly if the electrical lighting system is designed to automatically dim or turn off lights when daylighting is sufficient.

To optimize the benefit of daylighting systems, an evaluation of window systems and electrical lighting systems must be made in an integrated fashion. Effective daylighting may be delivered in a variety of ways including vertical glazing, skylights, clerestories, and other daylighting features. An awareness of the susceptibility of horizontal glazing to significant "night sky cooling" by radiative heat transfer and potential summertime heat gain during the cooling season must be maintained in the consideration of horizontal skylights. If used, these elements should have the best thermal performance possible.

In the basement warehouse, there is a twelve-foot overhead garage door. This door is opened and closed an average of six times per day. If the area is to continue be used as a retail warehouse in the future, the installation of better fitting, well-insulated door is worthy of consideration. In addition, the installation of clear plastic air barrier strips to reduce air exchange when the garage door is opened for vehicular access. Such a system would reduce infiltration losses and improve occupant and customer comfort.

Mechanical Systems:

Heating, Ventilating, and Air Conditioning:

The top, street level floor of the main building, is served by a ducted forced air system. There are two rooftop heating ventilating and air conditioning units. One unit serves the Meadowbrook Lane offices and three other privately leased offices. The other serves the remainder of the newer portion of the top floor. Natural gas and electrical cooling provide heating in these units. Each unit is controlled by a single manual thermostat. There is no timeclock control on the system. The older portion of the salon is served by its own system and thermostat.

The bottom floor currently in use in a active retail warehousing function for re-used building products. This high-ceilinged area has large garage doors for bringing in materials. The area is heated only by ceiling-suspended gas-fired unit heater. This is controlled by a programmable electronic thermostats with scheduling capability. Temperatures are kept low in this area. Setpoints on this thermostat are 55 F for occupied periods and 45 F at night and unoccupied periods.

The approach to upgrading these systems depends upon the type of occupancy and usage projected for these areas in the future.

If the ground floor is to continue to be used in a warehouse function with periodic garage door opening and a desire to simply "temper" the space, not necessarily maintain full occupancy comfort conditions, then only limited modifications to heating system serving the area are indicated. One approach which may result in improved comfort but reduced fuel costs might be to replace the unit heater with gas-fired infrared "radiant" heaters. These would radiate directly upon the workers below without the necessity to maintain the air in the spaces at a given temperature. However, the warehousing shelving is very high so that multiple units would be required. Given the uncertainty about future specific use of the space, the intent to insulate walls, and the low temperature setpoints used in the space currently, we make no definitive recommendations with regard to this heating system..

If the space is to be renovated for a different type of use in which it is regularly occupied and is not in use in a warehouse function, a variety of heating system approaches may make sense. In this case, the installation of a high efficiency, gas-fired boiler system may make sense. A high-efficiency, non-condensing boiler could have a combustion efficiency of 87%. If a condensing boiler were selected, combustion efficiencies of 92 to 97% can be realized. (If Building 1 is to be connected to Building 2 and Building 2's heating system is to be enhanced, this system could also serve that building, as well.)

The hydronic boiler system could provide hot water to baseboard radiation, or to heating coils in ducted HVAC systems, either newly installed for downstairs applications or possibly retrofitted in the ductwork on the top floor. The advantage of such a system would be that the combustion efficiency of the boiler system could be much greater than the combustion efficiencies of the current gas-fired rooftop HVAC units which may be on the order of 70 to 75%.

TEMPERATURE CONTROL RECOMMENDATIONS:

Automatic scheduling of the temperatures for a given time of occupancy and day of the week needs to be instituted for the top floor areas. Automated temperature control in this application would be a very cost-effective approach. The systems currently serving the building are relatively simple.

Our modeling suggests that those using the building are relatively diligent in setting **the** thermostats back manually. **However, for added assurance of energy savings over time and improved occupant comfort, we recommend replacement of the existing three top floor thermostats with three electronic timeclock thermostats.** (There are more complex control approaches, but given that there is no on-site maintenance staff and that tenants largely control their energy use, we suggest the use of relatively simple controls.) Our preliminary modeling suggests that the tenants of the building tend to set temperatures back during unoccupied periods. **Use of setback controls can reduce fossil fuel use by 2% compared to current manual setback practices in this facility and can serve to assure that temperature setback occurs.**

The individuals with authority and responsibility over their area could preset the schedules in the electronic thermostats to provide for temperature set-back during night and weekend period that the building zone is not occupied. A typical setback temperature is 55 F. Temperature setback can result in large energy cost savings. To assure occupant comfort, schedules should be set to allow for adequate warm-up time prior to the actual period of occupancy. The timeclock should have the ability to have different schedules for each day of the week. For an added cost, a controller which allows for 365-day scheduling may be obtained. This can allow holidays to be scheduled in advance.

INDOOR AIR QUALITY (IAQ):

Ventilation-Related Concerns:

The Reference Guide produced by LEED, the Leadership in Energy & Environmental Design, provides useful guidance on issues affecting indoor air quality. The Guide notes (p. 218):

> Higher ventilation rates are sometimes necessary to optimize indoor air quality and this can result in higher energy use to operate the building HVAC system. However, the additional energy can be offset by improved occupant productivity and lower absentee rates and illnesses....

Increased ventilation results in greater annual energy costs. However, poor indoor air quality also causes occupant illnesses, resulting in increased expenses and liabilities for building owners, operators, and insurance companies. Personnel costs are a significant percentage of operating costs and thus, actions that affect employee attendance and productivity are significant.

Review of the site indicates limited heating, ventilating and air conditioning systems. For top floor areas, two rooftop air handlers represent the sole source of ventilation air. Maintenance of proper outside air damper operation to assure desired levels of ventilation air is important to indoor air quality. Ventilation levels should meet requirements of standard ASHRAE 62-1999, Ventilation for Acceptable Air Quality.

Potential Sources of Indoor Air Pollutants:

The basement area serves as a warehouse for useful building materials and equipment salvaged from building demolitions and renovations. The space opens immediately onto a paved area. Due care should be taken to establish operational procedures so that vehicles are oriented for loading so as to minimize the probability of vehicle exhaust entering the warehouse space. Proper procedures should be employed in the storage of any solvents, paints, and other environmentally-sensitive materials present in the basement area.

Conversations indicated that the tenants of ReStore in the basement were conscious about indoor air quality issues associates with their use of combustion-based vehicles in moving building materials. John Majercak of CET, who helps run the operation, indicated that the forklifts were only occasionally used. He said that the exhaust ventilation system was run when their truck was driven into the facility to park for the night or out of the basement in the morning to remove the exhaust. The truck is always driven in forwards because there is not sufficient clearance to back the truck in and park.

One option would be to install a carbon monoxide or dioxide sensor which would activate the exhaust fan when concentrations exceeded a given level.

An alternate approach to management of such vehicle exhaust would be to use the type of exhaust system employed in fire stations. In such cases a ventilation hose is attached to the exhaust of the vehicle; the hose is attached to an exhaust system leading to the outside. It is beyond the scope of the current report to determine whether the vehicle exhaust is of sufficient concern in this application to merit such a system..

Evaluation of the nature of the hair treatment chemicals from the salon and their environmental characteristics is beyond the scope of the current study. However, depending upon their specific nature, some treatments may represent a source of unwanted indoor air pollutants. Currently the salon and the office cubicle area are served by a common air-handling unit. If an evaluation of the hair treatment products indicates indoor pollutant concerns, a dedicated ventilation system for the salon area may be appropriate to avoid transferring these pollutants to the office area via the return air system..

Building materials, carpets, and furniture are all potential sources of indoor air pollutants. As renovation improvements are undertaken to the building, the materials to be used should be evaluated with regard to their tendency to release or off-gas unwanted indoor air pollutants. Review alternatives on the basis of environmental performance.

Volatile organic compounds (VOC's) are to be avoided as they are chemical compounds that contribute to pollution both in buildings and in the general environment. They react with sunlight and atmospheric nitrogen to form ozone which impacts lung health directly and also contributes to smog. For a greener building, LEED recommends researching and specifying low-VOC products based on performance, durability, and environmental characteristics.
Use of low VOC paints should be encouraged.

Carpeting and the adhesives used to attach it to the floor is often a source of indoor air pollutants. Carpet can also serve as a storage media for moisture and allergens. Consider alternatives to carpet. If carpeting is desired, consider carpet tiles, as these may result in a reduced off-gassing.

Wallboard, paneling, and office furniture systems differ markedly in their off-gassing characteristics depending on the material specified.

More environmentally-friendly material options are now available on the market. (Information on such products may be obtained from a variety of sources. One example is Environmental Builder's News. Information and ratings can also be obtained from the sources listed below.)

LEED identifies criteria for low-emitting materials to obtain LEED green building credits in its Reference Guide (pp. 243-5). These criteria can provide useful benchmarks for the choosing of low-emitting products. LEED's guidelines to receive credits are noted below and are worthy of consideration during a redevelopment of the 250 Albany Street site. For the following materials, LEED requires meeting or exceeding VOC limits , as noted, for carpet systems, composite wood products, adhesives, sealants, and paints.

X Carpets, flooring, drywall, adhesives, welding: Green Label from the Carpet and Rug Institute; (800) 882-8846; www.carpet-rug.com

X Paints and coatings:: Green Seal; Green Seal Organization; (800) 872-6400; www.greenseal.org

X Composite wood and agrifiber products: choose products with no added urea-formaldehyde resins

X Adhesives: Meet or exceed the VOC limits of Rule 1168 from the South Coast Air Quality Management District Rule ; (909) 396-2000; www.aqmd.gov

X Sealants and primers: Meet or exceed VOC limits of Regulation 8, Rule 51 of the Bay Area Air Quality Management District; (415) 771-6000; www.baaqmd.gov

A strong link between second hand smoke and health risks has also been demonstrated. Enforcement of no smoking policies and regulations in the building itself is important to indoor air quality. Post information on nonsmoking policies and a summary of the rationale behind them in a prominent location for building occupants and visitors to read and understand. This information can also serve to further the stated environmental mission of the Gasoline Alley Environmental Learning Center.

In addition to not allowing smoking inside buildings, policies discouraging smoking near entrances is advisable to avoid uptake into the building when the door is open and to avoid exposing those seeking to enter the building. If necessary, provide designated areas outside the building where the smoke does not enter the building or ventilation system. Be sure that this location is away from concentrations of building occupants and pedestrians.

Construction and Renovation Management Practices for Improved Indoor Air Quality:

A longer-term option under consideration for the building is the renovation of the basement area into an office space area. If this is to be done, awareness of the indoor air quality issues already discussed should of course be applied where applicable.

In addition, careful planning is needed to prevent indoor air quality problems from resulting due to the renovation/ reconstruction process itself. According to the LEED Reference guide (p. 239), building construction processes almost always include activities that contaminate building during construction. These activities can result in residual contamination that affects indoor air quality over the lifetime of the building. Particulate matter generated or released during the construction process can foul HVAC systems and remain in the systems for years. Such particulate matter includes volatile organic compounds, microorganisms, and other contaminants.

Development of an indoor air quality management plan that the contractor will follow during the reconstruction process can help prevent contamination of the building systems. Attention to proper construction management process will provide better long-term installer and occupant health and comfort.

X Protect stored on-site or installed absorptive materials from moisture damage.

X Protect ventilation components during construction and clean up contaminated components after construction.

X After reconstruction is completed, replace all HVAC air filters and other filtration media serving or affected by the reconstruction. LEED Reference Guide 2.0 (p. 237) recommends using filtration media based on a minimum efficiency (MERV) of 13 as determined by ASHRAE 52.2-1999 or other applicable standard.

X If major reconstruction is undertaken, consider conducting a minimum two-week building flush-out with new filtration media at 100% outside air after the construction and prior to occupancy to help to remove indoor pollutants which may be in the building due to the construction process and /or due to off-gassing from new materials

X Additional guidelines for an environmentally effective construction process may be accomplished by meeting the requirements of the Sheet Metal and Air Conditioning

National Contractors Association (SMACNA) IAQ Guideline for Occupied Buildings under Construction.

DOMESTIC HOT WATER:

All domestic hot water using receptacles in the main building are located on the northern end of the building. Two natural gas-fired hot water heaters located in the north-end basement, in the vicinity of the director's office provide hot water. One is an A.O. Smith unit (32 Mbtu/hr, 40-gallon tank, with a rating of 32.8 gallons per hour); the other is a State Select of similar size, but no readable nameplate data available. Space in the service closets where the domestic hot water system is located is very limited.

Domestic Hot Water System Improvements: Possible Systems and Strategies:

Solar domestic hot water is being evaluated for this project. Space in the service closets where the domestic hot water system is located is very limited. The space immediately adjacent to the service closet is a lightly used area. This area may be used for the solar hot water tank and control board. In addition, the space for a new mechanical room could be added to the renovation design. In the latter case, we would anticipate complete replacement of the existing domestic hot water heaters with other equipment.

One option would be an on-demand, gas-fired hot water heater designed to operate with a variable input water temperature, such as would be encountered with a solar domestic hot water heating system. However, the usage pattern of the salon could give rise to requirements of high water flow for short periods. This type of load will be better served by a tank-based system.

If the high-efficiency boiler system is included in the design, then it could also serve to provide the necessary back-up hot water for the proposed solar domestic hot water system.

Existing Domestic Hot Water Usage:

The largest user of domestic hot water is expected to be the beauty salon, which is located on the northern end of the building. Lavatories are also located in this region.

Primary uses for hot water are hair washing and rinsing. Secondary water uses are lavatory hand washing and sink use in former serving area. A washing machine is used for towel washing but is only connected up for cold water washing. An added maintenance use for hot water is for rinsing out the bowls used for color rinses. Rather than simply designing to meet this hot water load, we urge the salon operator examine ways to accomplish the needed cleaning task with reduced water use. Total daily domestic hot water use for a typical day was modeled and estimated to be 164 gallons per day. Allowing for days when the salon is not open, we estimated a mean usage level of 127 gallons of hot water per day. Modeling details will be included in the appendix.

To estimate the total water use, we sampled a typical day for the salon from the appointment book. For the day examined, there were 23 color treatments and 46 haircuts. The owner and top stylist indicated that water was used for 3 minutes per half-hour appointment for a color treatment and 1 minute for a hair cut appointment. (She indicated that they do very few permanents, only 3 to 5 per month. Water use is much higher for a permanent as it incorporates two 5-minute rinses per half-hour appointment, or a total of 10 minutes per half-hour appointment.)

Salon & Other Water Use

Day sampled:		12/17/03			
Hours open:		7am to 7 pm			
Hot Water Temp.	Cold water temp	Change (F)			
110	50	60			
		# of uses per day	GPM	Minutes /Use	Gallons/ Day
Salon Washing:					
Color Treatments		23	1	3	69
Cuts		46	1	1	46
			Washing Subtotal:		115
Secondary Load:					
Hairdresser hand washing		24	1	1	24
Lavatory hand washing		46	0.5	1	23
			Secondary Load:		47
			Subtotal:		162
Assume 5.5 days/week			(5.5/7) =		0.786
			Mean day		127

PROPOSED SOLAR DOMESTIC HOT WATER SYSTEM:

After modeling the water use at the salon, we found that the water load excluding the maintenance load would be well matched to a 4-panel solar domestic hot water system. Examining the building layout, a potential pathway for solar loop piping was identified. This pathway will allow for piping from the solar thermal panels on the roof to the location of the proposed solar storage tank in the basement of the oldest portion of the building.

A preliminary estimate of the cost of such a system was made. The estimated cost of the complete installed system is $12,231. It is expected and hoped that western Massachusetts Electric Company will provide a rebate for the hot water system of approximately $3,000, based upon the $1,500 incentive currently available for a two panel system through the residential program. Such an incentive has been discussed with WMECO personnel, but no final determination of the incentive amount has yet been made. If the incentive were made available, then the cost to the building would be reduced effectively to $9,231.

This is a system available from a regional solar systems integration company as a turnkey installation. The estimate was provided after consultation with Solar works, Inc, which has corporate offices in Montpelier, Vermont and representation throughout the northeast region. Product and performance information is included in the appendix.

Such a system would be expected to provide approximately 26,805 MBtus of useful thermal energy and to offset 347 ccf of natural gas per year and to avoid the environmental impact of burning that quantity of fuel. This represents 77% of the estimated domestic hot water load for the building, (excluding the maintenance water load, which may be avoided by better clean-up practices in the salon).

Given that there is sufficient load to warrant a solar domestic hot water system, the system type proposed is a closed loop system utilizing a propylene glycol solution for freeze protection. (Propylene glycol is a non-toxic, vegetable grade product.) The system would serve to warm the water in a preheat tank which would be piped in series with back-up water heating system.

Four solar panels each four feet wide by eight feet tall would be mounted at 45 to 60 degrees and located on the roof, approximately above the salon area. The solar loop piping would run through the roof and down through the building toward the mechanical room where the domestic hot water tanks were located.

The system would incorporate a direct current driven pump powered directly by a 30-watt photovoltaic panel dedicated to that function. When there is sufficient sunlight for the photovoltaic module to operate the pump, the glycol solution will be circulated and deliver the thermal energy collected by the solar thermal panel and delivered to the tank system. When the sun is brighter the pump will run faster; when the sun is less bright, the pump will run slower. When it is night or very overcast, the pump will not run. The PV-driven pump is an elegant solution to controlling the flow rate of a pump serving a solar thermal system in a way that optimizes its operation. The systems control board includes a dc-powered circulator pump, an expansion tank, and adjustable pressure relief valve, a pressure gauge, an air purging system, ball valves for isolation, a check valve, and drain and fill valves.

The system evaluated is a pressurized; antifreeze based solar hot water system with a soft-tank storage system. Solar panels are typically under manufacturer's warranty for ten years, and usually last many years beyond warranty. The soft-tank and heat exchangers in this type of application are also typically under manufacturer's warranty for ten years. The storage tank upon which this evaluation is based has a total capacity of 328 gallons. The tank is 40 inches in diameter and 4 feet in height. Two spiral heat exchangers are suspended in the water in the tank. One transfers heat from the solar loop to the storage water. The second transfers from the storage water to the potable water supply.

When there is a draw on the domestic hot water systems, cold water flows through the heat exchanger in the storage tank and out to an auxiliary water heater and then to the point of use. The system described could be connected to use the existing domestic hot water system as the auxiliary heater, or a new, high-efficiency domestic hot water heater could be used.

In this application, we would anticipate filling the tank approximately 60 to 70% full. The remaining capacity would be available for future system expansion and for overheat control in the event of an extended period of reduced or non-use of hot water during the summer season. For example, if it was known that the salon would be closed for two weeks in the summer, the storage tank could be filled to a greater depth to allow for added storage capacity without overheating.

Solar Works , Inc.
Solar Water Heating Analysis

Part I. Performance Analysis

A. Client Information:

Client: Gasoline Alley
Address: 250 Albany Street
Springfield, MA

Project Description: Closed Loop 128, PV-Powered

B. System Information:

Collector Type:	G-Series	Storage Volume:	184 gallons		
Collector Area:	128 sq ft	Draw:	127 gal/day		
Backup Fuel:	Natgas	**Yearly Estimated**	**Output:**		**27.209 MMBTU**

C. Average Solar System Output
(based on weather data for Boston Lat):

Month	Btu per Sq Ft per Day	Coll. Area (Sq Ft)	System Efficiency	Btu per Day Available	Btu per Day Needed	% Solar Contribution
Jan	1,079	128	0.35	48,324	95,310	51%
Feb	1,332	128	0.35	59,694	95,310	63%
Mar	1,491	128	0.40	76,343	95,310	80%
Apr	1,586	128	0.40	81,216	95,310	85%
May	1,681	128	0.40	86,089	95,310	90%
Jun	1,745	128	0.45	100,505	95,310	100%
Jul	1,777	128	0.45	102,332	95,310	100%
Aug	1,745	128	0.45	100,505	95,310	100%
Sep	1,618	128	0.40	82,840	95,310	87%
Oct	1,364	128	0.40	69,846	95,310	73%
Nov	983	128	0.35	44,060	95,310	46%
Dec	920	128	0.35	41,217	95,310	43%
Average	1,444			74,495	95,310	77%

Corporate Offices:
Solar Works, Inc. 64 Main Street
Montpelier, VT 05602 (802) 223-7804
Project Estimate: Closed Loop 128, PV-Powered

Client:	Gasoline Alley	**Date:**	5/5/04
Address:	Springfield, MA	**Home Phone:**	
		Work Phone:	

Solar Works, Inc., hereby submits specifications and estimates for the following:

Materials:

Qty.	Item
4	4x8 G-Series Collectors
1	DHW PAC Control Board
1	328 Gallon Unpressurized Softank
1	Inclined Mounting Rack
	Pipe, Insulation, & Plumbing Supplies
	PV-Powered Option
	Balance of System

	Matls. Subtotal	$6,393.00
	Sales Tax	$0.00
Estimate:	**Matls. Total**	$6,393.00

Installation Cost:

Labor	$5,838.00
Total Project Cost:	**$12,231.00**
Estimate: Total Project Contract Cost:	**$12,231.00**
Estimate: Net Project Cost :	**$12,231.00**
Possible WMECO Rebate:	**($3,000.00)**
Net Project Cost (after rebate):	**$9,231.00**

We propose to furnish materials and labor specified above for the sum of $12,231.00 Estimate

Standard Payment are as follows:

30% of contract amount ($3,130) upon order;
60% of contract amount ($6,260) upon system installation;
10% of contract amount ($1,043) 15 days after system commissioning;
Balance billed and due upon completion of project.

A final quotation and installation contract will be issued following site visit.

Authorized signature for Solar Works, Inc.: ______________________

Performance of the solar panels is highly dependent on local weather conditions and yearly variations in solar insulation levels. System specifications and output projections are based on 30-year average weather data for the project's location. The actual output from the solar system will vary based on specific site climatic and shading conditions.

SOLAR WORKS INC

Corporate Headquarters
64 Main St. Montpelier, VT 05602, USA
Tel: 802-223-7804   Fax: 802-223-8980
www.solar-works.com

Ballast Pan Mounting System

School Power Naturally Program

Mounting Layout: The mounting system is made up of 12 aluminum pans (4' x 8') that are ballasted with concrete blocks or existing roof gravel ballast. 20 solar electric modules are mounting on a 30-degree racking system attached to the pans. The 12 pans are bolted together upon installation to form a complete structural system that can withstand 120 mph wind loading.

Ballast System Loading: Dead weight loading is 17-1/3 (17.3) lbs per sq. ft. This figure is down approximately 20% from the initial weight loading (21.5 lbs sq. ft.) due to improvements in the ballasted pan design. This weight is all-inclusive (modules, mounting equipment, ballast).

Array Size: Length 44' Width: 7'-8"

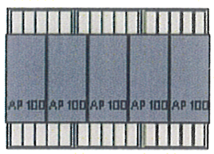
Roof Contact Area (flat, no rails or beams are used) 337.3 sq. ft. Total Weight: 5,848 lbs.

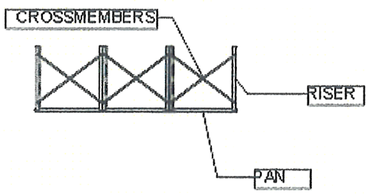
Roof Penetrations: None

Membrane Protection: None required except as specified by roofing "contractor of record".

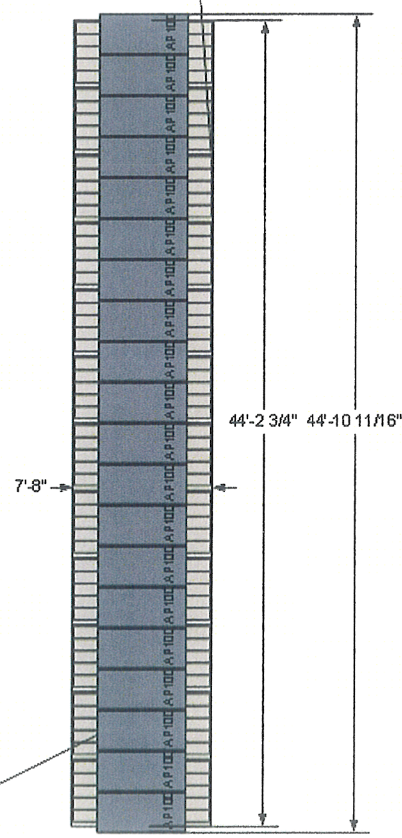
ballastpansystem.gif (769x1009x256 gif)

5 modules on 3 pans, viewed from the North side (in the Northern Hemisphere. For Southern Hemisphere systems, the pans will be reversed and South Risers will become North, etc.





This system uses a total of 12 pans bolted together at assembly to support 20 modules using 5/16-18 stainless hardware.
Each pan has two sets of risers but the hardware is shared for all but the end risers.
Each pan will have 14 blocks.



GENERAL NOTES:

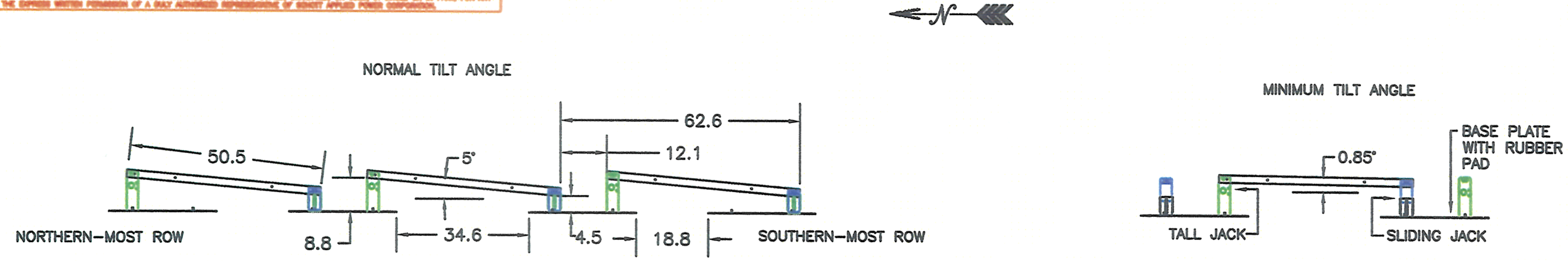
BLOCKS SHOULD WEIGH BETWEEN 22-30 LB. EACH. THEY ARE USUALLY CALLED HEAVY SOLIDS.

ALL HARDWARE SHOULD BE STAINLESS, 5/16-18 FOR 3/8" HOLES UNLESS OTHERWISE SPECIFIED.

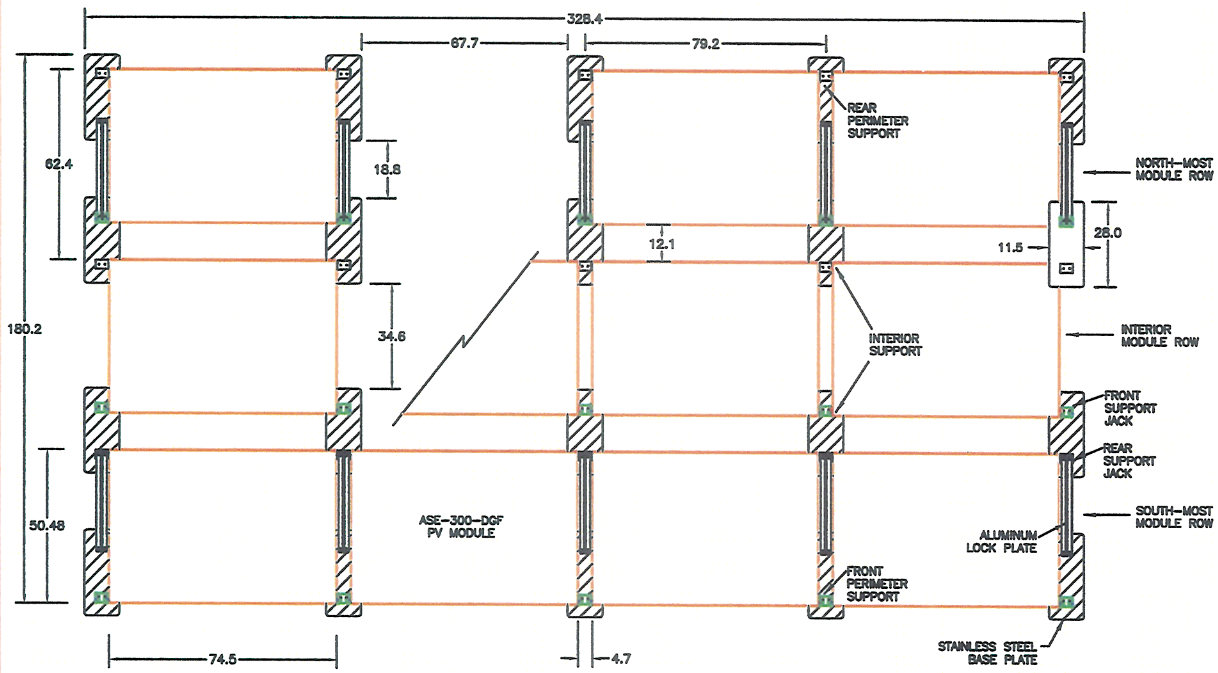
Weight computations:
Area of contact with roof: 12 pans, each 44"x92" total 337.3 square feet.
Weight of system: 20 mods @26lb, 12 pans @80lb, 168 solids @26lb, total 5848lb

5848lb/337.3sqft=17.3 lb/sqft

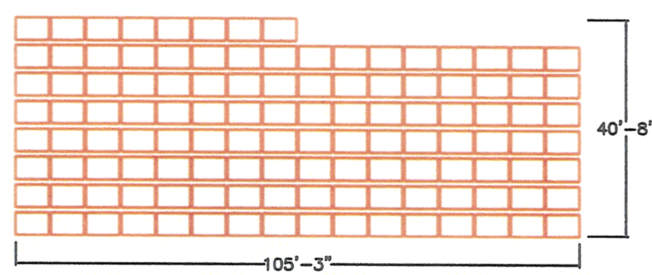
SOLAR WORKS, INC. 64 MAIN ST. MONTPELIER, VT 05602 USA 802 223 7804	CLIENT:		
	ON OF SERVICE:		
ENGINEER:	JPW	DRAWING:	Ballast pan system
DATE	03/28/03	Units: IN	NONE



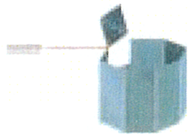
NOTES:
1. ALL DIMENSIONS ARE INCHES.
2. THE STANDARD BUILDING BLOCK IS A ROW OF 8 MODULES FOUR MODULES PER ROW SHOWN FOR CLARITY.
3. A SINGLE INTERIOR ROW HAS BEEN DEPICTED FOR CLARITY. ANY NUMBER OF INTERIOR ROWS CAN BE DEPLOYED.



	TOTAL MODULES
FS-30	120

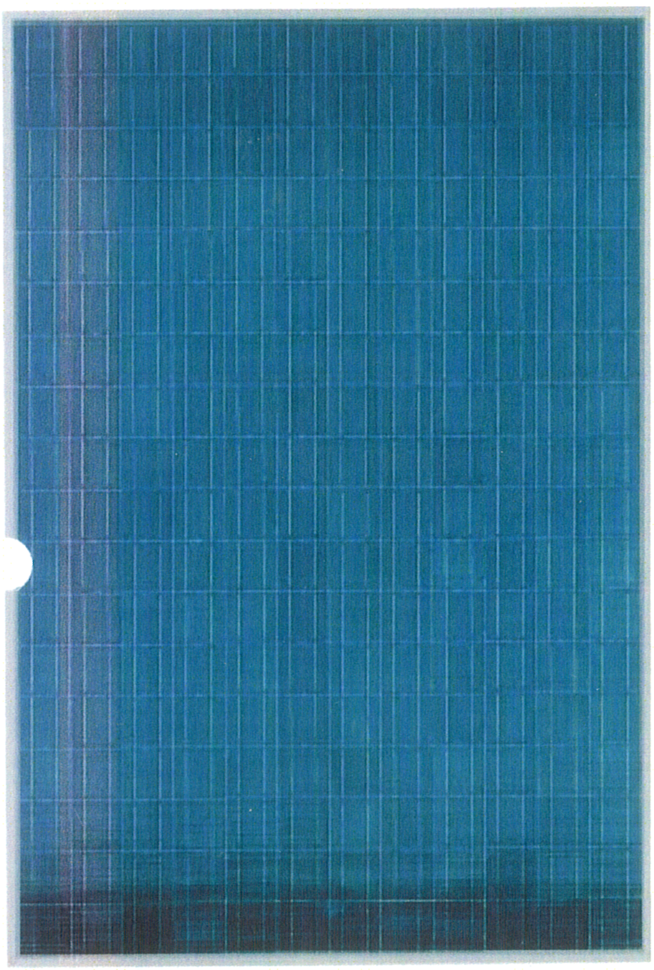


SCHOTT	SCHOTT APPLIED POWER CORPORATION 235 Bear Hill Road Waltham, MA 02451 USA Phone (781) 890-8844 Fax (781) 890-2050	NOTES:	DRAWN BY: ZAK DATE: 24 JAN 03	APPROVED BY	DESCRIPTION: ASE 300-DFG SYSTEM FS-30 COPYRIGHT © 2002 SCHOTT APPLIED POWER CORPORATION. ALL RIGHTS RESERVED.	DWG #: REV 3

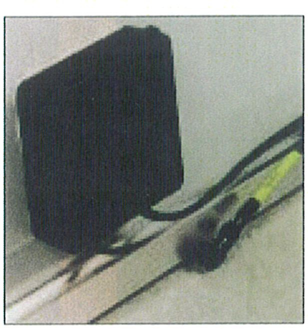


RWE
SCHOTT Solar

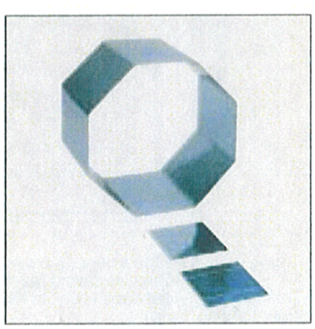
World's Most Powerful Photovoltaic Module with Crystal Clean™ EFG Cell Technology



ASE-300-DGF/50



ASE-300-DGF/50 connection box h bypass diodes, U-V resistant bles with MC®-plug.



Crystalline octagonal Si tubes are drawn from the melt. There are no losses due to sawing.

Designation:

DG = Double Glass
F = Frame
/50 = Nominal Voltage at STC

The ASE-300-DGF/50 is RWE SCHOTT Solar's Flagship Module used in a wide range of applications, including the toughest military, utility and commercial settings. It is also becoming extremely popular in large pumping systems that require higher voltages. As the world's largest and most powerful PV module, installers, architects and owners credit the ASE-300 with significant cost savings and peace of mind. Give your PV system the ASE 300 advantage.

Design and Installation Advantage

We designed the ASE-300-DGF/50 to save time and cost.

- The uniquely high module voltage (Vp 50.5 volts) allows system integrators to "fine tune" a system by providing just the right number of modules to meet the specified power.
- Large area requires fewer interconnects and structural members.
- Module-module and source circuit wiring can be incorporated in the module.
- Unique ASE quick-connects reduce source circuit wiring time to minutes. We offer connector options to suit your needs.

Reliability Advantage

- Advanced proprietary encapsulation system overcomes the decline in module performance associated with degradation of traditional EVA encapsulant.
- Weather barrier system on both the front and back of the module protects against tear, penetration, fire, electrical conductance, delamination, and moisture.
- Our patented no-lead high reliability soldering system ensures long life, while making the module environmentally benign for disposal or recycling.

Quality Advantage

RWE SCHOTT Solar's quality program is focused on meeting or exceeding expected perfomance and reducing system losses:

- Each module is individually tested under RWE SCHOTT Solar's calibrated solar simulator.
- Module-module wiring losses are included in rating.
- Each of the 216 crystalline silicon cells is inspected and power matched.

Certification Advantage

- To provide our customers with the highest level of confidence, the ASE-300-DG/50 is independently IEEE 1262 and IEC 1215 certified. It is UL (Underwriters Laboratories) listed with the only Class A fire rating in the industry.

Available Versions

The standard power rating is 285 watts at STC with versions at 300 watt and 265 watt also available. We offer a variety of wiring/connector options. Modules without frames are also available.

RWE SCHOTT Solar Core Advantage

RWE SCHOTT Solar's patented EFG process (Edge-defined Film-fed Growth) produces silicon octagons of correct thickness and width. Energy, hazardous waste and material intensive wafer sawing is replaced by highly efficient advanced laser cutting.

ASE-300-DGF/50

ASE-300-DGF/50

Electrical data

The electrical data applies to standard test conditions (STC):
Irradiance at the module level of 1,000 W/m² with spectrum AM 1.5 and a cell temperature of 25° C.

Power (max.)	P_p (watts)	285 W	300 W	265 W
Voltage at maximum-power point	V_p (volts)	50.5 V	51.0 V	50.0 V
Current at maximum-power point	I_p (amps)	5.6 A	5.9 A	5.3 A
Open-circuit voltage	V_{oc} (volts)	60.0 V	60.0 V	60.0 V
Short-circuit current	I_{sc} (amps)	6.2 A	6.5 A	5.8 A

The quoted technical data refer to the usual series cell configuration.
The rated power may only vary by ± 4% and all other electrical parameters by ±10%.
NOCT-value (800 W/m², 20° C, 1m/sec.): 45° C.

Dimensions and weights

Length mm (in)	1,892.3 (74.5")
Width mm (in)	1,282.7 (50.5")
Weight kg (lbs)	46.6 ± 2 kg (107 ± 5lbs
Area	2.43 sq meters (26.13 ft sq)

Characteristic data

Solar cells per module	216
Type of solar cell	Multi-crystalline solar cells (EFG process), 10x10 cm²
Connections	14 AWG w/Single Pole Quick Connectors Optional Connections – 16AWG w/Double Pole Quick Connectors. Conventional Junction Box module comes with 6 built in bypass diodes

Cell temperature coefficients

Power	$T_K (P_p)$	- 0.47 % / °C
Open-circuit voltage	$T_K (V_{oc})$	- 0.38 % / °C
Short-circuit current	$T_K (I_{sc})$	+ 0.10 % / °C

Limits

Max. system voltage	600 V_{DC} U.S. 700 V_{DC} Europe
Operating module temperature	-40... +90° C
Test wind conditions	Wind speed of 130 km/h (120 mph)

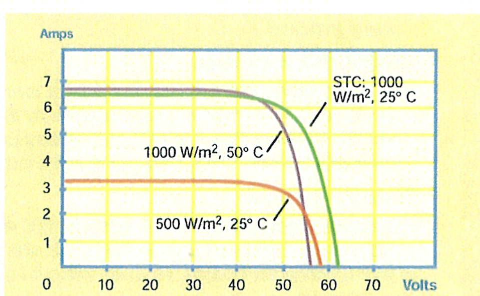
The right is reserved to make technical modifications.

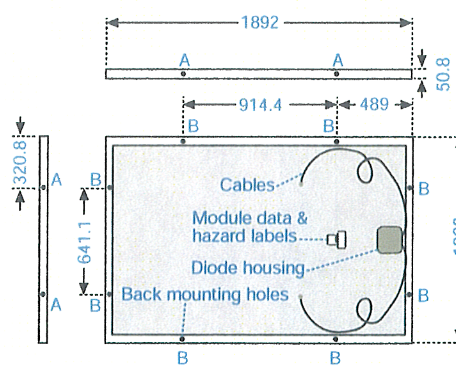
For detailed product drawings and specifications please contact your distributor or our office.

Certifications and Warranty

The ASE-300-DGF/50 has been independently certified to IEC 1215 and IEEE 1262, UL 1703 (Class A Fire rating). It meets Electrical Protection Class II and EU guidelines, e.g. EMC according to DIN EN. The ASE-300-DGF/50 comes with a 20 year power warranty (see terms and conditions for details)

Current/voltage characteristics with dependence on irradiance and module-temperature.

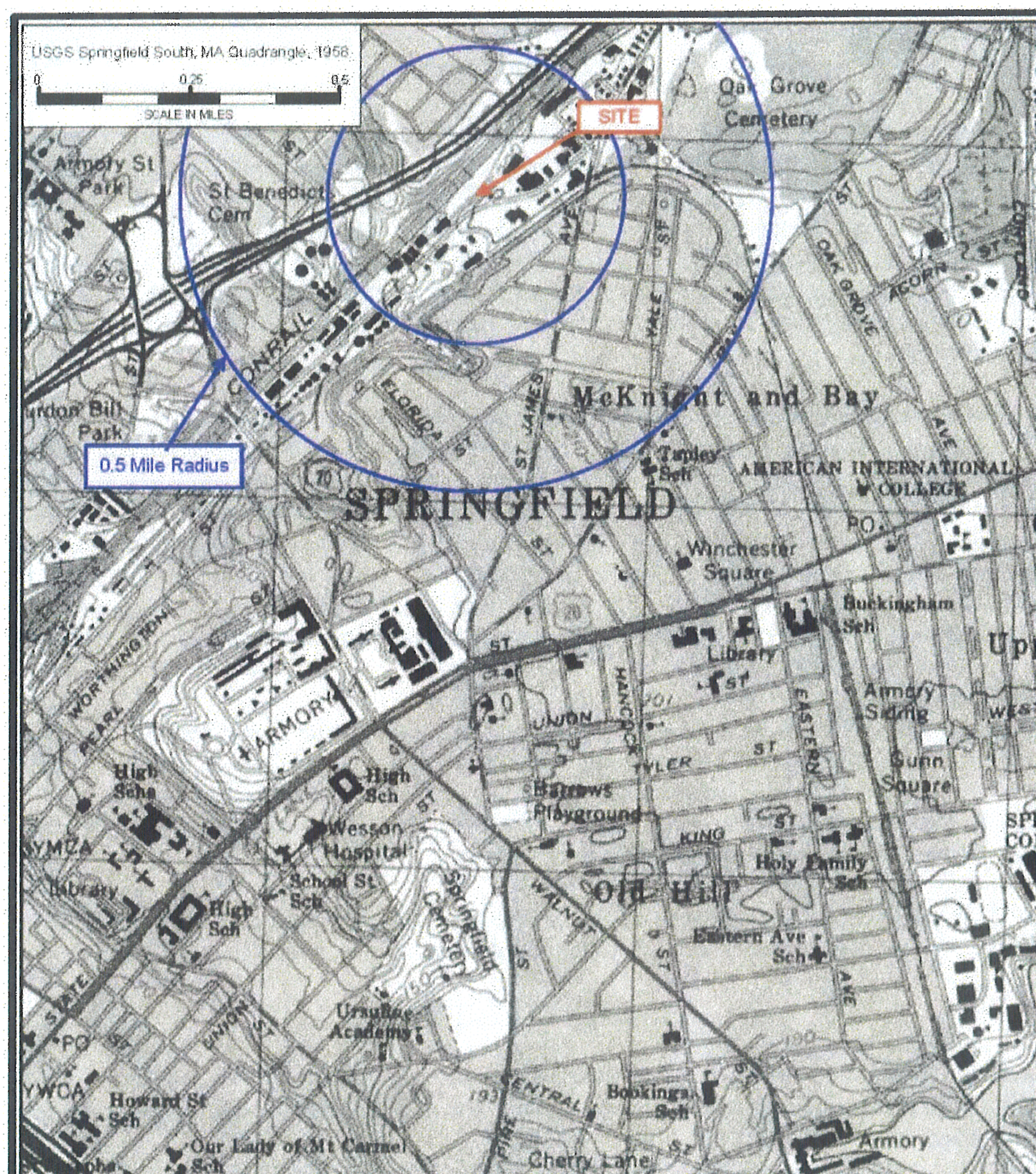




A = Side mounting holes ø = 10.5
B = Back mounting holes ø = 10.5
(all dimensions in mm)

RWE SCHOTT Solar, Inc.
4 Suburban Park Drive
Billerica, MA 01821-3980 USA
Phone 800-977-0777
978-667-5900
Fax 978-663-2868
www.asepv.com e-mail: sales@asepv.com

Photovoltaics from your specialist dealer:



New England Environmental, Inc.
Environmental Consulting Services

9 Research Drive
Amherst, MA 01002
(413) 256-0202
(413) 256-1092 Fax

NEE

Gasoline Alley ESA
250 Albany Street
Springfield, MA

NEE File #03-2181

Figure 1
Locus Map

ELECTRICAL SYSTEM:

The service to the building is currently provided through a two meters. A portion of the salon is on its own meter. Otherwise, businesses and organizations in the building do not pay for electrical service directly; the building provides electricity as part of the rent paid. As such, there is little incentive for any given tenant to be concerned with the energy use of their equipment or task lighting systems. One possible approach would be to install sub-metering to measure the salon's electrical service so that rent for the project would reflect electrical usage. This might encourage the enterprise to have an interest in higher efficiency equipment and lighting fixtures.

We have identified three electrical panels, which serve the building. The service to the building is 120/240 volts. There is a panel located in the basement of the oldest, northernmost portion of the building, which appears to serve the older portion of the salon (640 sf), the small basement area (640 sf) below, the back warehouse, and a rooftop air conditioner. For the purposes of this preliminary study, we shall assume that this panel will be the interconnection point for solar-electric system. There is available wall space for mounting the inverter, monitor, and related solar-electric controls. The area has a door and can be secured when desired. (This is the same space proposed for use as an equipment room for the solar domestic hot water storage tank.)

The panel also appears to be connected and include the main power shut-off switch for a sub-panel (and companion secondary sub-panel located in the newer section of the salon). The salon sub-panel includes the breakers for the other rooftop air conditioning unit, as well as breakers for many smaller electrica l loads, presumably the salon loads and the office space loads. There are two empty, unused slots in this panel.

The third electrical panel is located in the basement warehouse area currently occupied by ReStore. The panel is located in a relatively exposed area in the warehouse.

LIGHTING SYSTEM:

Two-lamp, 8-foot fluorescent fixtures provide the service lighting for the top floor of the building with standard lamps and magnetic ballasts. The fixtures are mounted to the open web ceiling structure.

If the placement and appearance of these fixtures is judged acceptable to the new design, then each of these 8-foot fixtures may be converted to operate four 4-foot T-8 lamps per each four-lamp electronic ballast installed. The cost and energy savings for this conversion are evaluated in this report. If the lighting layout for the building is to be more substantially revised a variety of new fixtures could be considered.

In the beauty salon, many incandescent lamps are used for task and accent lighting. Incandescent lighting is far less efficient than fluorescent lighting in terms of the amount of light delivered per kilowatt-hour of electricity required. If any of this task lighting may b acceptably replaced by compact fluorescent lamps or fixtures, substantial electrical use reductions may be achieved. It is our understanding that the task lighting is the property of the salon and not Gasoline Alley. The salon operator has expressed and interest and openness to lighting improvements.

Lighting fixtures from the former gallery were also retained for use in the salon, but were not specifically chosen for the salon application. Walls and ceilings are painted a dark color, though this is not necessarily the color preference of the salon operator. The salon operator is open to changes in both the lighting technology, as well as the color of walls and ceilings.

Lighting System Recommendations and Options:

A complete survey of the top floor lighting was made, lighting energy use for these fixtures was evaluated and improvements proposed. Lighting energy and dollar savings for fixture conversions will be presented in this report. Throughout the top floor, **conversion of eight-foot T12 fixtures to four-foot T8 fluorescent fixtures is evaluated. Conversions of incandescent lighting** used for general, task and accent lighting to compact fluorescent lighting (using 23-watt and 15-watt compact fluorescent lamps in existing fixtures) in the salon and other areas are also evaluated.

Preliminary estimates indicate that these changes would **reduce annual electrical use by approximately 8,600 kilowatts-hours, or a reduction of approximately 11%** of the total electricity used inside the building. The total estimated electrical cost saving is $946 per year for the recommended lighting improvements. The estimated cost of these improvements is $4,039. The payback based upon electrical savings is approximately 4.3 years. (See lighting improvements calculations in the appendix.)

It should also be noted that lighting effectiveness in the salon would be enhanced if the wall and ceilings currently painted dark colors were repainted in lighter colors, which would reflect more light and brighten the space. The salon operator is open and interested in changing and lightening the colors of the walls and ceilings.

GREENHOUSE / ATRIUM ADDITION / DAYLIGHTING:

A greenhouse feature is under consideration on the entrance side of the building. Such a feature could serve as a welcoming entrance to the facility and a sun-tempered connection to the outside. The building is not oriented along the cardinal directions (North, East, South and West). The southeast side of the building faces southeast onto Albany Street.

Due care must be taken with regard to a greenhouse feature located on the southerly side of the building. Sloped or horizontal glazing can result is serious overheating issues during summer months and possible condensation issues in colder weather months. A glass walled enclosure or one with a daylighting aperture located high on the wall can accomplish the intent of the "greenhouse" design concept while avoiding some of the overheating and condensation issues associated with sloped glazing.

With this concept in mind and with input form the energy consultant, the atrium is being designed by architect Marc Sternick with a continuous horizontal architectural element located approximately nine feet up the facade. This element will serve as an overhang to block some of the direct light on the southerly glass in summertime. This feature will also act as a light shelf to bounce a portion of the visible light on the light colored atrium ceiling and also the glazing elements to be located high in located in the existing southeast wall of the building..

The **design intent is to optimize the use of natural light in this space**, while including sufficient electrical lighting for night-time and overcast day conditions. The most elegant solution to this requirement is to **equip the fluorescent fixtures to be used in the atrium with dimmable electronic ballasts which are subject to control by one or more daylighting sensors serving the atrium.** When daylighting provides sufficient light, the controls will dim the fluorescent fixtures. Such a daylighting system will substantially reduce the electrical load attributable to the atrium space, while conveniently providing electrical lighting when it is required.

The dimming capability of the fixtures offers the amenity of a manual dimmer as well which could allow for variable lighting levels for mood lighting for times when the atrium area could be used for an evening event.

The architect projects adding openings in the southeast wall between the atrium and the existing office space to bring additional light into the office spaces behind the atrial area. If structural requirements allow the daylight-transmitting apertures through the wall between the atrium to be configured to allow for a continuous or near-continuous glazing element and sufficient and will-distributed light is delivered to the interior spaces, then daylighting controls with dimming ballasts may be utilized in this area as well.

Due to the size of the existing windows and use characteristics of other spaces, daylighting controls are not readily applicable to other areas in the building.

Available Financial Incentives for Solar-Electric Systems:

The Massachusetts Renewable Energy Fund, the same entity which partially funded this study, provides financial incentives for solar-electric systems. In 2003, for small systems of under 10 KW ac capacity, the total incentive provided for a system was $5 per installed watt of AC capacity. This was divided into two types of incentive: an installation incentive of $3.50/ wattac paid at the time of installation, and a production incentive of up to $1.50 per wattac paid in quarterly increments at a rate of $.38 per kilowatt-hour over a three year period. Though not yet announced, the incentives for 2004 are expected to be the same. Incentives in 2005 are expected to drop to $4.50/wattac.

PROPOSED PHOTOVOLTAIC SYSTEM:

A part of the statement that this building renovation is to make is the generation on-site of some of the energy that is required by the facility. We have already discussed the potential use of a solar thermal system to offset a portion of the domestic hot water load.

In addition, we shall evaluate the installation of a solar-electric (photovoltaic) system to provide a portion of the electrical requirements of the facility. This system will serve as another visible statement of the commitment of the organization to sustainable development, while providing useful electricity.

It should be noted that there are significant incentives available through the Massachusetts Renewable Fund to reduce the purchase price of a solar electric system. These will be discussed further later in this report.

The systems proposed for this facility would be installed on the flat roof of the main building.

As already noted, one option is to mount solar-electric systems with firm attachment to the underlying roof structure. If firm attachment is to be used, it will be wise to install mounting blocking before the membrane roof is installed and that the roofing system may be installed to cover the blocking. With the blocking in place, the solar-electric system installation requires only the limited penetrations for affixing the system to the blocking. It is very important that this type of installation is coordinated with the roofing contractor to assure maintenance of the roofing system performance and warranty. If the roof is to be replaced, then provision of a firm mounting is probably the preferred approach in this situation. While the amount of weight added by the solar-electric system is relatively small, code review of the roof 's structural capabilities will be necessary as part of the building permit process.

If the roof is not to be replaced often solar electric systems may be installed on the flat roof but without penetrating the roof itself. Such mounting approaches rely either on a ballasted system with added weight to hold them down or are installed at lower tilt angles to avoid wind effects.

With a ballasted roof mounting system", the mounting system is attached to a large tray pan which is laid directly upon the roof. The tray is then filled with "ballast", typically stone or concretes blocks of sufficient weight to anchor the system on the roof. Guy wires are sometimes run to parapet walls to prevent lateral movement due to wind effects. In such systems, it is important to verify sufficiency of roof strength in accommodating the added weight of the ballast stone. Use of a ballasted system would require a structural investigation concerning the strength of the roof.

Consideration of a Solar Electric System Using Evergreen Twenty-Four 115 Watt Modules:

One configuration investigated utilized Evergreen solar-electric modules mounted either on a ballast tray plan or in the case of roof replacement, attached to mounting blocking installed under the new membrane roof.

In this system, modules would be installed one or two rows which face to true south. The modules would be mounted on racks attached to the roof structure (as noted in the roof improvements section). The mounting angle would be between 30 and 45 degrees to the roof. It is anticipated that each row would include twelve 115 wattdc panels. Thus, the two-row system would have a total of twenty-four 115-wattdc modules for a total capacity of 2.76 KW of installed solar-electric capacity.

The system would utilize an SMA 2500U "Sunny Boy" inverter to convert the direct current produced by the solar-electric modules into alternating current usable by the building and the electrical grid. The system will be connected to the main building panel via an available circuit breaker slot. A clear area of wall space four feet wide adjacent to the electrical panel is required.

At this stage in the analysis, we assume that the solar electric system will be interconnected with the building electrical system via the electrical panel in the basement room of the northernmost portion of the building and that the inverter, monitor, and related controls will be located in this room. If, in the future, an informational kiosk interconnected with the solar-electric system and reporting its performance, is desired for the facility, it may be located anywhere in the building and interconnected by control wiring or other means to the inverter.

Based upon the Solar Works solar evaluation tool and the PV-Watts web-based solar generation estimating web-site (NREL: National Renewable Energy Lab), a properly oriented system of this rating (2.76 kwdc) would be expected to generate approximately 3,670 kwh per year.

The system will operate in a grid-interactive mode. No battery storage is anticipated to be included in this system. The system would be connected on the client's side of the meter under a net metering arrangement so that solar electricity will directly offset a portion of the electricity required from the utility by the facility. Utility bills will be based upon the net amount of electricity received from the utility. (Net electricity equals total electricity used by the facility minus that generated on-site.) Under "net metering", the client receives maximum economic benefit from the electricity produced because all electricity is credited at the full "retail" rate charged consumers in their bills. If electricity were "sold back" to the utility, the price paid to the client would only be at the "wholesale" rate for "electricity generation".

Cost for System Using Evergreen 115 watt modules and a Roof Ballasting System:

Excluding the rooftop mounting system, the system total cost for the 2.76 kwac system proposed for Gasoline Alley is estimated to be approximately $26,000. Under the current incentives, the installation incentive available would reduce the contract price to the client by $8,694. Thus, the estimated contract price would be $17,306. Under the current program, the client would also receive production incentive payments over the next 3 years at the rate of $.38/KWH for each KWH that is produced and reported. (This reporting will be automatically done via the modem included in our system.) **The maximum production incentive**

allowed is $4,184 over the 30year reporting period. With this incentive, the **net cost for the system to the facility is $13,122.**

In addition, there is value in the **"green attributes"** of the solar electricity produced. If these attributes are reimbursed at a rate of $.06 per kwh (an offering currently available) and based on the PV-Watts estimated annual electricity production, this could result in an **added payment to the facility of $218 per year**. Please note that this is in addition to the expected electrical utility cost savings accrued due to lower utility bills.

To the costs noted above must be added the cost of the rooftop mounting system. If mounting structure can be installed during roof replacement, then the added cost for mounting structure can be quite modest, as blocking may be mounted to the roof structure and then just covered by the membrane roofing.

If the roof is not being replaced, which appears to be the case at 250 Albany Street, then the roof ballasting system may be considered. Solar Works provided a materials cost estimate for a roof ballast system of $3,391. Our preliminary assumption is that the cost of delivery, lifting to the roof, net impact on labor costs, if any, will increase the cost of the roof ballasting system to approximately $5,000. Thus, total system cost for this rooftop PV system option would be approximately $31,000 without incentives The contract amount to the client would be $22,306 after the installation incentive. After the maximum production incentive was achieved, the final cost to the customer would be $18,322.

Consideration of a Solar Electric System Using 300 Watt ASE Modules With a RWE Schott Flat Roof System:

RWE Schott/ Applied Power has developed a flat roof product which requires neither roof penetrations nor added ballast material. Modules are installed at a lower tilt angle of less than 5 degrees to minimize wind effects. Installation at these essentially flat angles reduces the wattage delivered compared to the rated watts of the system. However, such a system allows solar-electric capacity to be installed on a flat roof without disturbing the existing roof and with a much reduced weight added to the existing roof.

The 2.4 Kwdc system under consideration comprises eight (8) 300-watt ASE modules with an SMA 2500 inverter, as did the other system.. Initial price estimates suggest pricing comparable to the Evergreen system for a 14% smaller system. (2.4 Kw vs.2.76 KW). The Schott system may result in a higher system cost per watt but may prove more acceptable due to its lighter weight. A structural assessment of the roof is beyond the scope of the current study. As the project moves forward in development, a structural evaluation of the roof may be required, if a ballasted system is to be employed.

It should be noted that the Schott system will deliver a lower percentage of its rated capacity due to its flattened tilt angle.

On the following pages more information about the Schott system is provided.

wd partners

Chicago
Columbus
Dallas
Los Angeles
Miami

June 23, 2003

Kevin Davies
RWE Schott Solar
4051 Alvis Court, Suite 1
Rockiin, CA 95677

Re: Wind Analysis of SunRoof FS System

Mr. Davies,

This letter serves as verification that the roof installed solar panel system, SunRoof FS, will resist all uplift and sliding forces created by wind speeds up to 130 mph when installed on a flat roof without the addition of ballast or mechanical attachment to the roof structure. The wind speed of 130 mph corresponds to that definition as provided in ASCE 7-98, Minimum Design Loads for Buildings and Other Structure, published by the American Society of Civil Engineers.

This conclusion is based upon the report provided by RWE Schott Solar entitled, Wind Testing and Analysis of the RWE SS FS PV Array Mounting System. This report contains analyses results from wind tunnel tests performed at the Massachusetts Institute of Technology (MIT) for a single unit and also computer generated computational fluid dynamics modeling (CFD) performed by Newmerical Technologies International for large solar panel arrays at various wind directions. Uplift pressures resulting from the CFD modeling were calculated using FENSAP-AIRWAKE proprietary software as developed by Newmerical Technologies.

This analysis is supported by ASCE 7-98, section 6.6, under Method 3 – Wind Tunnel Procedure, which states in section 6.6.1: Wind tunnel testing shall be permitted in lieu of Methods 1 and 2 for any building or structure. Note that methods 1 and 2 are prescriptive methods based on the equations and tabulated variables provided in this code. Also, since the 130 mph limit in maximum tolerable wind speed for this product is directly related to the definition of wind speed provided in ASCE 7-98, the wind speed map as provided on pages 34 and 35 of ASCE 7-98 provides a good indication of those areas of the United States where the wind speed exceeds 130 mph and thus where the SunRoof FS system will require modification to achieve code compliant installation.

If you have any further questions concerning the analysis or conclusions, please contact me at (614) 324-5503.

Sincerely,

Christopher P. Sekol, P.E.
Structural Engineer

Brett Gilbert, P.E.
Director of Civil Engineering

COMMONWEALTH OF MASSACHUSETTS
BRETT GILBERT
CIVIL
43078
REGISTERED
PROFESSIONAL ENGINEER

Appendices:

Much supporting information has been developed in spreadsheet form to aid in the development of the conclusions reached in this report. Some of this information is presented in this appendix. See Appendices 'H' and 'I' for additional calculations used in this report.

VIII. ENVIRONMENTAL SITE ASSESSMENT REPORT

EXECUTIVE SUMMARY

New England Environmental, Inc. (NEE) was retained by Dietz & Company Architects, Inc. to conduct a Preliminary Environmental Assessment of the Gasoline Alley Foundation property located at 250-270 Albany Street in Springfield, Massachusetts (the "Site"). This investigation included a Site reconnaissance visit, a review of historic fire insurance maps, and a review of selected local and regulatory files pertaining to the Site and surrounding area. The report includes recommendations for additional investigation activities related to observed and potential release conditions, and estimated costs for these activities. Where appropriate, estimated costs for remediation are included in the discussion.

Site Description

The Site occupies an area of 1.56 acres located west of Albany Street in the central portion of Springfield, Massachusetts. The Site is shown on Springfield Assessor's Plan No. 507, as Street No. 160, Parcels 60, 62, and 63. Assessor's records indicate that Emilio J. Sibilia (Albany Street Properties) of Springfield, MA, owns the Site. The Site is zoned "IND-A" for industrial uses. The Site is currently occupied by three commercial/industrial buildings. Several retail and professional businesses are located on the second floor of the main building. A two-bay garage building with several additions behind the main building is currently used as a used-building materials retail showroom by RESTORE, Inc. North of the garage and additions, all single story concrete block structures, is a former railroad platform serving two discontinued rail spurs that entered the Site near the northwest corner.

Potential On-site Contamination Sources

Information obtained from Springfield municipal agencies and the site visit indicates that the Site has experienced a reported release of oil or hazardous materials (OHM). A reconnaissance of the Site revealed visual evidence of staining or contamination to the ground surface in the vicinity of the 1,000-gallon aboveground storage tank. The 1,000-gallon underground storage tank (UST) is listed in Fire Department records as having been installed on December 19, 1944. There are no records indicating this 1,000-gallon UST was ever removed. The location of this tank is not noted in Fire Department Records. Evidence of likely asbestos pipe insulation was observed in the former boiler room.

Potential Off-site Contamination Sources

Information obtained from the municipal offices in Springfield and from the DEP files reviewed indicates that there is a known potential source of off-site contamination to the Site. Gulf Oil Corporation/Catamount Petroleum property to the east of the Site has an operating groundwater remediation system for petroleum contamination. This DEP Site is only partially upgradient of the subject property, and is likely to contribute little to the subject property in terms of soil contamination, and may contribute to groundwater contamination at the subject property.

Conclusions and Recommendations

Based on the information obtained during this assessment, through Federal, State, and local research, and on information provided to us by the Site contact, we conclude it is likely that a spill of OHM has occurred on the Site. NEE found evidence of recognized environmental conditions in connection with the Site. NEE concludes that the potential for contamination of soil, groundwater, or sediments with Oil or Hazardous materials (OHM), as defined by Massachusetts Oil and Hazardous Material Release Prevention and Response Act [MGL c. 21E], and the Massachusetts Contingency Plan (MCP) [310 CMR 40.0000] exists. NEE makes the following recommendations:

- Notify DEP of the release within 120 days;
- Completing the research to make this a full Phase I initial site investigation report is recommended prior to finalization of a scope of work for additional investigation activities. This includes a full municipal review, a site history review, historical topographic map and aerial photograph review, and a standard federal and state environmental database search, and can also include a complete DEP file review;
- Remove the leaking 1,000-gallon AST and evaluate soil conditions in that area;
- Locate 1,000-gallon UST and remove if found;
- Remove inactive 275-gallon AST and collection of 55-gallon drums on pallets;
- Evidence of likely asbestos pipe insulation was observed in the former boiler room. The asbestos content of this material should be confirmed and the material properly disposed of prior to other remediation/demolition/renovation activities at the Site;
- The PCB content of the 2 Westinghouse wall-mounted electric switch boxes observed in the former boiler room should be evaluated prior to planned renovation/removal of the equipment and/or the boiler room;
- The Gulf Oil Corporation/Catamount Petroleum property to the east of the Site has an operating groundwater remediation system for petroleum contamination. Additional investigation into the direction of groundwater flow, contaminants of concern and the size and location of the impacted soil and groundwater areas, as reported by the adjacent land owner to DEP, is recommended.

INTRODUCTION

New England Environmental, Inc. (NEE) was retained by Dietz & Company Architects, Inc. to conduct a Preliminary Environmental Assessment of the Gasoline Alley Foundation property located at 250-270 Albany Street in Springfield, Massachusetts (the "Site"). This investigation included a Site reconnaissance visit, a review of historic fire insurance maps, and a review of selected local and regulatory files pertaining to the Site and surrounding area. The report includes recommendations for additional investigation activities related to observed and potential release conditions, and estimated costs for these activities. Where appropriate, estimated costs for remediation are included in the discussion. The findings of our investigation are summarized in the following report.

Purpose

This investigation was conducted to provide a preliminary assessment of the Site for evidence of the potential for contamination of the structure, soil, groundwater, surface water, or sediments with oil or hazardous materials, as defined by Massachusetts Oil and Hazardous Material (OHM) Release Prevention and Response Act [MGL c. 21E], and the Massachusetts Contingency Plan (MCP) [310 CMR 40.0000].

Portions of this investigation were conducted in conformance with the ASTM Standard E1527-00 *Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process*. Research into the Site history was not included in the scope of this investigation, and therefore this is not a standard Phase I ESA or Level I ESA. However, the Site visit and terminology used in this report do conform to the ASTM standard. As noted below, additional investigation activities are recommended for this Site, and completing the Site history research is one of those activities. No subsurface explorations were conducted as part of this study.

Limitations

The site inspection and reconnaissance included the inspection of the property for evidence of recognized environmental conditions as defined by the ASTM Standard. The findings of this investigation are based, in part, on information provided by third parties. NEE provides no warranties regarding the accuracy of information provided by third parties.

Abbreviations

Abbreviations used in this report are as follows:

AST	aboveground storage tank
ASTM	American Society of Testing and Materials
AUL	Activity and Use Limitation
CERCLIS List	Comprehensive Environmental Response Compensation Liability Information System List
DEP	Massachusetts Department of Environmental Protection
DTC	DataMap Technology Corporation
EPA	United States Environmental Protection Agency
ERNS	Emergency Response Notification System
IRA	Immediate Response Actions
MCP	Massachusetts Contingency Plan
NEE	New England Environmental
NGVD	National Geodetic Vertical Datum
NPL	National Priorities List
OHM	oil and hazardous materials
ppm	parts per million
RAO	Response Action Outcome
RCRA	Resource Conservation Recovery Act
RTN	Release Tracking Number

TSD	treatment, storage, and disposal
URAM	Utility Response Abatement Measure
USGS	United States Geologic Survey
UST	underground storage tank
WMECO	Western Massachusetts Electric Company

PHYSICAL SITE DESCRIPTION

The following description of current Site characteristics is based on information provided by municipal agencies, review of the *Springfield South, Massachusetts Quadrangle* USGS 7.5 minute topographic map, a portion of which is reproduced as Figure 1, and observations made by NEE during the Site inspections on July 2 and 17, 2003. Photographs taken at the Site are included in the Photographs section. An Aerial Photograph of the Site area is presented in Figure 2.

Location and Present Ownership

The Site occupies an area of 1.56 acres located west of Albany Street in the central portion of Springfield, Massachusetts. The Site is shown on Springfield Assessor's Plan No. 507, as Street No. 160, Parcels 60, 62, and 63. Assessor's records indicate that Emilio J. Sibilia (Albany Street Properties) of Springfield, MA, owns the Site. The Site is zoned "IND-A" for industrial uses. A copy of the Assessor's records is included in Appendix J. The lot sizes and street numbers are as follows:

250 Albany Street	49,786 SF	Parcel 60
270 Albany Street	12,050 SF	Parcel 62
270 Albany Street - rear	6,153 SF	Parcel 63
Total Area =	67,989 SF or 1.56 acres	

General Site Description

On the day of the Site visits, a NEE geologist walked the Site area. NEE personnel evaluated the Site to determine local topography, drainage, vegetation and the potential presence of OHM.

The Site is currently occupied by three commercial/industrial buildings and is located between Albany Street to the east and a set of active CONRAIL railroad lines to the west (see Figure 2). The main building at 250 Albany Street has a main entrance on the street side into the second floor. Several retail and professional businesses are located on this floor, along with the offices of Mr. Stephen O'Neil of the Gasoline Alley Foundation, Inc., the property manager.

The Site topography drops steeply to the west, allowing access to the lower level from the rear of the building. A two-bay garage building with several additions behind the main building is currently used as a used-building materials retail showroom by RESTORE, Inc. North of the garage and additions, all single story concrete block structures, is a former railroad platform serving two discontinued rail spurs that entered the Site near the northwest corner (see Site

Plans). RESTORE also utilizes most of the lower level of the main building for warehouse and showroom space.
The Site topography drops slightly again at the extreme western edge of the Site into a drainage ditch adjacent and parallel to the active rail line. The eastern portion of the Site along Albany Street lies at an elevation of approximately 300 feet, relative to the 1929 National Geodetic Vertical Datum. 270 Albany Street is slightly higher than the rest of the Site and includes a steep bank with a drop of over 25 feet down to the rail lines.

Site Utilities

Municipal water and sewer services are available to the Site from the City of Springfield. No record of any septic or other sanitary waste disposal system in use at the Site was found. Electric and telephone services are provided to the Site via aboveground wires along Albany Street.

Several stormwater catch basins were observed in the lower driveways near the garage building. These and the building roof drain lines are all reported to discharge to the drainage ditch along the railroad lines. A Site Plan prepared by ECS, Inc. for the abutting property on the east side of Albany Street confirms that the on-site catch basins each join pipes that eventually flow to the RR right-of-way west of the Site (see Figure 2).

Site Drainage & Flooding

Inspection of the USGS *Springfield South* Quadrangle topographic map and the NEE Site visit indicate that the Site is located on a steeply sloping hill. Groundwater at the Site is expected to follow surface topography and flow toward the west and southwest.

Site Geology

According to the *Generalized Bedrock Geologic Map of Massachusetts* (Zen, 1983), bedrock in the vicinity of the Site lies within the Portland Formation and consists of red, pink, and gray coarse-grained, locally conglomerate arkose interbedded with brick-red shaley siltstone and fine-grained arkosic sandstone. Outcrops were not observed during the Site visit to confirm this description.

Hazardous Materials

On July 2 and 17, 2003, NEE conducted visual inspections of the Site. NEE observed the ground surface where possible. Visual evidence of staining or contamination to the ground surface was observed in the vicinity of the 1,000-gallon aboveground storage tank (AST) discussed below.

NEE observed a collection of full and partially full 55-gallon drums on pallets (see Photos #16 and #17) in the vicinity of the 1,000-gallon AST and was told an inventory of these materials had recently been conducted for the purpose of pricing disposal of the containers and their contents. The proposal from United Industrial Services of Meriden, CT to remove the containers and properly dispose of the contents provides the inventory. A copy of this proposal/inventory is included in Appendix K.

Evidence of likely asbestos pipe insulation was observed in the former boiler room. This insulation material was in poor condition, and was crumbling off the pipes and onto the floor (see Photo #21). The asbestos content of this material should be confirmed and the material properly disposed of prior to other remediation/demolition/renovation activities at the Site.

Storage Tanks

Evidence of five to six (5-6) active or former USTs or ASTs was observed at the Site. A single 275-gallon AST is known to be currently in use, and is located near the offices of the Gasoline Alley Foundation in a utility closet (see Photo #2). This AST appeared to be in good condition. The fill and vent pipes for this AST are located adjacent to the sidewalk along Albany Street (see Photo #1). According to the Fire Department records, this AST, and a 1,000-gallon UST are located at the Site. The installation date of this AST is not known.

The 1,000-gallon UST is listed in Fire Department records as having been installed on December 19, 1944. There are no records indicating this 1,000-gallon UST was ever removed. The location of this tank is not noted in Fire Department Records.

Two possible vent pipes were observed north of the garage building at 250 Albany Street, slightly obscured in thick vegetation (see Photos #11 and #12). A possible fill pipe was observed in the form of a concrete pad with a steel plate cover in it in the driveway between the garage building and the loading dock (see Photos #13 and #14). These two sets of objects are not as close as one might imagine if they are the fill and vent pipes of the same UST, but it is certainly possible. These observed objects could be evidence of the 1,000-gallon UST mentioned in the Fire Department records. Since two vent pipes were observed, it is possible that two USTs are located in this area. This area of the Site should be further evaluated for the possible presence of USTs.

A 1,000-gallon steel AST was observed on a concrete platform adjacent to the north side of the former boiler room. This tank was observed to have leaked in the past (see Photos #16 and #17) and was not covered. Soil on the surface of the concrete block platform (or within the concrete block walls of the platform if it does not have a solid surface) was observed to be stained. Staining on the interior walls of the boiler room could also be evidence of leakage through the concrete block wall. This AST is no longer active (unconnected) and active leakage from the tank was not observed.

An inactive (unconnected) 275-gallon AST was observed adjacent to the north side of the loading dock between the main building and the garage. This tank appeared to have been overfilled at one point in its life (see Photo #15), but not in its present location as no similar staining was observed on the ground under the tank. It appeared the tank was temporarily stored in this location.

Indications of PCBs

Two Westinghouse wall-mounted electric switch boxes were observed in the former boiler room (see Photo #22). These switches did not appear to still be in use. The switches appeared to be in good condition and no signs of a release of OHM related to the switches were noted. The PCB content of this equipment should be evaluated prior to planned renovation/removal of the equipment and/or the boiler room.

Chemical Use and Waste Management

Other than that noted above and household quantities of cleaning agents in janitorial closets throughout the buildings and bathrooms, NEE did not observe other chemical use or storage at the Site. The Site uses and locations that generated the inventory of chemicals noted in Section 2.6 above are not known. Research into the past uses of the Site are recommended prior to finalization of a scope of work for additional investigation activities.

<u>ADJACENT LAND USE</u>

Properties located adjacent to the Site are primarily in industrial use. Properties abutting the site to the north are used for dismantling buildings and steel storage tanks (USTs and ASTs), to the

east and south for the storage of bulk petroleum fuels and parking and maintenance of fuel oil delivery vehicles. Property to the west of the Site is used as an active rail road line, and further west as Interstate 291.

It was reported by Mr. O'Neil that the Gulf Oil Corporation/Catamount Petroleum property to the east of the Site has an operating groundwater remediation system for petroleum contamination. Three groundwater monitoring wells were observed at the Site (see Photos # 27 & #28), and these were reported to have been installed by Gulf Oil as part of the investigation/monitoring associated with the remediation system. A preliminary review of files at DEP on this abutting property indicate:

- The area was severely contaminated with petroleum in both soil and groundwater;
- Phase I, Phase II , Phase III, Phase IV Reports, and a Class C Response Action Outcome (RAO) Statement (January 2002) have all been filed with the DEP over the past 12 years. The Class C RAO indicates a temporary solution has been achieved (active groundwater remediation), but that additional environmental investigation is not required by the abutting property owner;
- An active groundwater remediation system is currently operating under Remedy Operation Status of the MCP (the temporary solution which does require regular monitoring and eventual closure with DEP, if possible);
- This DEP Site is only partially upgradient of the subject property, and is likely to contribute little to the subject property in terms of soil contamination, and may contribute to groundwater contamination at the subject property. A vast majority of

this abutting property, including most of its groundwater contamination, is cross-gradient or down-gradient of the subject property.

- Low concentrations of solvents have been detected on the subject property as part of the investigation into this abutting property. It did not appear that the source of the solvents was identified or clearly stated in the above-referenced reports during NEE's brief review of these files;
- The Site Plan from the RAO Statement was used as the base plan for Figure 2 as it shows monitoring well locations, groundwater contours, groundwater flow direction, and subsurface utilities;
- Roughly half of the 270 Albany Street property is included in an area titled "Area of Contamination" and this same area is included in a similar but slightly larger area titled "Limit of Class C RAO" for this abutting property (see Figure 2).
- This Site Plan indicates three monitoring wells (MSM-1, 2, and 3) and three soil borings (MSMB-1, 2, and 3) exist at the Site, along with two newer monitoring wells (ECS-27 and ECS-26) added as part of the investigation into the abutting property. The three original soil borings and three monitoring wells suggest that an earlier environmental investigation into the Site was performed. A copy of this report was not reviewed as part of this investigation, but further research to locate a copy is recommended as part of addition investigation into this Site.

Additional investigation into the direction of groundwater flow, contaminants of concern and the size and location of the impacted soil and groundwater areas, as reported by the adjacent land owner to DEP, is recommended.

SITE HISTORY

Complete Site history research was not part of the scope of work for this project. Selective areas of research were completed as noted below.

Site Ownership

Assessor's records indicate that Emilio J. Sibilia owns the Site. Mr. Sibilia has owned the Site since 1994. Prior ownership records as kept by the Assessor's office are included in Appendix J. Assessors records also indicate that:

- Valentine Concrete, Inc. purchased the Site on July 23, 1966. The Site was likely home to another concrete company (Valdon Corp.?) likely dating back around 1953, and that a previous structure shown on Figure 2 included a suspended concrete mixer;
- The boiler room addition to the warehouse/garage at 250 Albany Street was added in 1943. The existing AST observed to be leaking and servicing this former boiler room could therefore be 60 years old;
- The 30-foot by 27-foot sloping ramp to the suspended concrete mixer was added around 1950.
- The rear addition to the garage building abutting the former RR siding was added in 1956, and the RR siding is roughly 400 feet long;
- An addition to the garage building was added in 1986 (not clear which garage building);

- The current loading dock that interrupts access to the sloping ramp was added in 1994;
- Coughlin's Auto Repair occupied building #3 (270 Albany Street?) in 1996

Sanborn Fire Insurance Maps

Sanborn Fire Insurance Company maps of the City of Springfield for the dates 1886, 1896, 1911, 1931, and 1950 did not cover the Site area.

Aerial Photographs and Historical topographic maps

Historical topographic maps of the Site were not reviewed. Historic aerial photographs of the Site and surrounding area were not reviewed. Review of these historic resources should be part of additional research for the Site.

Interview

According to Mr. Stephen O'Neil, Property manager for the Gasoline Alley Foundation, Inc., the lower level of the main building at 250 Albany Street was constructed in 1930, and the upper floor was added in the 1950's. The property has been used in the past as a garage location for fuel oil delivery trucks.

Visual observations indicate that two rail siding spurs entered the Site from the northwest corner and one was located on either side of the platform and addition located on the north end of the garage building.

A former exterior (concrete?) truck loading dock located in a depressed driveway north of the main building was bisected by an addition off the northwest corner of this building to create an interior loading dock area with access to the lower level of the main building (the 1994 loading dock addition). The original loading dock area appears to have had access to the concrete deck on the north side of the main building.

STANDARD ENVIRONMENTAL RECORDS REVIEW

A review of standard federal and state environmental record sources pertaining to the Site and surrounding area was not conducted and should be part of additional research for this Site. Pertinent local environmental records were reviewed. The findings of this review are summarized below.

EPA Region I and Massachusetts

Not reviewed.

Local Records and Area Reconnaissance

A visual reconnaissance of the area in the vicinity of the Site was conducted in conjunction with a review of pertinent municipal files to assess past and current site usage. The files were reviewed for specific information concerning the storage, use, or release of oil or hazardous materials at the Site and properties in the vicinity of the Site.

Fire Department

NEE reviewed the Springfield Fire Department records concerning the Site. Available information indicated one active 275-gallon fuel oil AST and one 1,000-gallon fuel oil UST installed in December, 1944. This latter tank is beyond its 15-20 year normal life expectancy and should be removed. As noted in Section 2.4 above, the location of this tank is not known, but several possible clues to its location were observed at the Site. Section 2.4 discusses several other tanks at the Site, but these other tanks were not on record at the Fire Department.

Assessors Office

Assessor's records indicate that:

- Valentine Concrete, Inc. purchased the Site on July 23, 1966. The Site was likely home to another concrete company (Valdon Corp.?) likely dating back around 1953, and that a previous structure shown on Figure 2 included a suspended concrete mixer;
- The boiler room addition to the warehouse/garage at 250 Albany Street was added in 1943. The existing AST observed to be leaking and servicing this former boiler room could therefore be 60 years old;
- The 30-foot by 27-foot sloping ramp to the suspended concrete mixer was added around 1950.
- The rear addition to the garage building abutting the former RR siding was added in 1956, and the RR siding is roughly 400 feet long;
- An addition to the garage building was added in 1986 (not clear which garage building);
- The current loading dock that interrupts access to the sloping ramp was added in 1994;
- Coughlin's Auto Repair occupied building #3 (270 Albany Street?) in 1996

Physical Setting Sources

Inspection of the USGS *Springfield South* Quadrangle topographic map and the NEE Site visit indicate that the Site is located on a steeply sloping hill. The top of the hill lies at an elevation of just over 300 feet. Groundwater at the Site is expected to follow surface topography and flow toward the west and southwest.

The Flood Insurance Rate Map (FIRM) Springfield, Massachusetts, (Community Panel Number 250160 0015B, August 15, 1979) indicates that the entire Site is located in Zone C, an area of minimal flooding.

The DEP Bureau of Waste Site Cleanup Priority Resource Map of the *Springfield South, MA* Quadrangle indicates the Site is located in a Non-Potential Drinking Water Source Area. The Site is not located in an EPA Sole Source Aquifer, a DEP-Approved Zone II area, a potentially productive medium yield aquifer, or an Interim Wellhead Protection Area. The Site is not located in a mapped Salt Water or Fresh Water non-forested wetland area, non-potential drinking water source area, or Zone A of a Class A Surface Water Body. No mapped "areas of critical environmental concern" or areas of protected open space are located within 500 feet of the Site.

FINDINGS AND CONCLUSIONS

New England Environmental, Inc. has completed a Preliminary Environmental Assessment of the Gasoline Alley Foundation, Inc. property located at 250-270 Albany Street in Springfield, Massachusetts (the Site). Our findings are summarized in the following conclusions:

- The Site occupies an area of 1.56 acres located west of Albany Street and east of a set of CONRAIL rail road tracks in the central portion of Springfield, Massachusetts. The Site is shown on Springfield Assessor's Map No. 507-160-60/62/63. The Site has been developed since at least 1930 when the lower level of the main building at 250 Albany Street was built. Assessor's records indicate that Albany Street Properties of Springfield, MA owns the Site. The Site is zoned "IND-A" for industrial uses.

- The Site is currently occupied by three commercial/industrial buildings. Several retail and professional businesses are located on the second floor of the main building. A two-bay garage building with several additions behind the main building is currently used as a used-building materials retail showroom by RESTORE, Inc. North of the garage and additions, all single story concrete block structures, is a former railroad platform serving two discontinued rail spurs that entered the Site near the northwest corner.

- Information obtained from the site visit indicates that the Site has experienced a release of oil or hazardous materials (OHM). A reconnaissance of the Site revealed visual evidence of staining or contamination to the ground surface in the vicinity of the 1,000-gallon aboveground storage tank. Staining on the interior walls of the boiler room could also be evidence of leakage through the concrete block wall. Holes in the boiler room floor and oil staining on the floor indicate an additional likely avenue of migration of oil to the subsurface. Active leakage from this inactive AST was not observed. Some product remains in the tank. This release meets the requirements of 120-day notification to DEP.

- A 1,000-gallon UST is listed in Fire Department records as having been installed on December 19, 1944. There are no records indicating this 1,000-gallon UST was ever removed. The location of this tank is not noted in Fire Department Records and not known to current Site personnel.

- No electric pole-mounted transformers were observed on the Site. Two Westinghouse wall-mounted electric switch boxes were observed in the former boiler room. These switches did not appear to still be in use. The switches appeared to be in good condition and no signs of a release of OHM related to the switches were noted. Evaluation of their potential PCB content should be completed prior to their removal during planned renovations/remediation of this area of the Site.

- Visual evidence of likely asbestos pipe insulation was observed in the former boiler room. This insulation material was in poor condition, and was crumbling off the pipes and onto the floor.

- NEE observed a collection of 55-gallon drums on pallets (Photos #16 and #17) in the vicinity of the 1,000-gallon AST. The proposal from United Industrial Services of Meriden, CT to remove and properly dispose of the containers and their contents provides a copy of the inventory.

- Information obtained from Springfield municipal agencies and from the DEP files reviewed indicates properties adjacent to the Site have experienced a reported release of OHM. The Gulf Oil Corporation/Catamount Petroleum property to the east of the Site has an operating groundwater remediation system for petroleum contamination. Phase I, Phase II , Phase III, Phase IV Reports, and a Class C Response Action Outcome (RAO) Statement (January 2002) have all been filed with the DEP over the past 12 years. This DEP Site is only partially upgradient of the subject property, and is likely to contribute little to the subject property in terms of soil contamination, and may contribute to groundwater contamination at the subject property.

RECOMMENDATIONS

Based on the information obtained during this assessment, through Federal, State, and local research, and on information provided to us by the Site contact, we conclude it is likely that a spill of OHM has occurred on the Site. NEE found evidence of recognized environmental conditions in connection with the Site. NEE concludes that the potential for contamination of soil, groundwater, or sediments with Oil or Hazardous materials (OHM), as defined by Massachusetts Oil and Hazardous Material Release Prevention and Response Act [MGL c. 21E], and the Massachusetts Contingency Plan (MCP) [310 CMR 40.0000] exists. NEE makes the following recommendations:

- Completing the research to make this a full Phase I initial site investigation report is recommended prior to finalization of a Scope of Work for additional investigation activities. This includes a full municipal review, a site history review, historical topographic map and aerial photograph review, and a standard federal and state environmental database search, and should also include a complete DEP file review.

- The observed collection of 55-gallon drums on pallets in the vicinity of the 1,000-gallon AST should be removed as soon as possible to reduce potential release and long-term storage liability.

- Notify DEP of the release from the 1,000-gallon AST. The owner has 120 days to provide this notification to DEP from the date they become aware of it. Notification can be provided at any time during the 120-day period.

- Remove the leaking 1,000-gallon AST and evaluate soil conditions in that area. If this is not financially possible within the 120-day notification period, NEE recommends that an Immediate Response Action (IRA) Plan be filed with DEP that will include: 1) pumping the AST of its remaining product to remove the possibility of a further release; and, 2) covering the AST and its concrete base with a tarp in such a manner as to shed precipitation from these items until such time as the tank can be removed and the base demolished. DEP will want to know when removal of the AST and its base is anticipated to occur. The IRA Plan is a stop-gap measure to prevent further release until the tank can be removed. It is obviously better to remove the tank if financially possible.

- Locate the listed 1,000-gallon UST and remove it, if found. A ground-penetrating radar survey (GPR) survey of the RR platform and siding areas should be performed to locate USTs and other underground utilities in this area.

- Remove the inactive 275-gallon AST located near the 1,000-gallon leaking AST.

- Install eight (8) new groundwater monitoring wells in the vicinity of the leaking 1,000-gallon AST, the former boiler room, near the building at 270 Albany Street, and within the area of the GPR survey after the location of the UST(s) has been determined. The proposed locations of these wells are shown on Figure 2. Soil samples collected at the time of well installation should be analyzed for the presence of extractable and volatile petroleum hydrocarbons (EPH/VPH) and for 13 priority pollutant metals. Groundwater samples should be collected from the eight new wells and the five existing wells and should be analyzed for EPH/VPH, PP13 metals, and volatile organic compounds (VOCs).

- Evidence of likely asbestos pipe insulation was observed in the former boiler room. The asbestos content of this material should be confirmed and the material properly disposed of prior to other remediation/demolition/renovation activities at the Site.

- The PCB content of the 2 Westinghouse wall-mounted electric switch boxes observed in the former boiler room should be evaluated prior to planned renovation/removal of the equipment and/or the boiler room.

- The Gulf Oil Corporation/Catamount Petroleum property to the east of the Site has an operating groundwater remediation system for petroleum contamination. Additional investigation into the direction of groundwater flow, contaminants of concern and the size and location of the impacted soil and groundwater areas, as reported by the adjacent land owner to DEP, is recommended.

Costs associated with the above recommendations can be completed on a time and materials basis for an estimated fee of **$58,000.00** (fifty seven thousand five hundred dollars). This is based on anticipated time, materials, and expenses expended toward the project as listed below:

Task			Description	
Estimated Costs				
1	Complete background research, DEP file review		$ 1,400	- $ 1,600
2	GPR survey, Dig-Safe, HASP		$ 1,700	- $ 2,000
3	Asbestos Survey & PCB Testing		$ 1,750	- $ 4,800
4	Disposal of drums of waste oil and other drummed wastes		$ 5,875	- $ 6,750
5	Tank Removals:	1,000-gal leaking AST fuel oil	$ 2,500	- $ 7,000
		1,000-gal. UST fuel oil	$ 2,500	- $ 4,500
		275 AST fuel oil	$ 400	- $ 700
	Release Notification Form submittal to DEP		$ 300	- $ 400
	NEE Oversight		$ 3,000	- $ 5,100
6	IRA Plan submission to DEP		$ 1,100	- $ 1,500
	IRA Actions: Pump & cover the AST		$ 500	- $ 1,000
7	Subsurface Investigation			
	NEE Labor - Soil Boring & MW Installation		$ 1,400	- $ 2,300
	Drilling Contractor- labor & materials		$ 4,800	- $ 5,400
	Laboratory – Soil Analyses		$ 2,500	- $ 3,100
	NEE Labor - GW Sampling		$ 1,800	- $ 2,300
	Laboratory - GW Analyses		$ 3,625	- $ 5,950
8	Report		$ 2,850	- $ 3,600
Estimated Total =			**$38,000**	**- $58,000**

Items Not Included in Cost Estimate

The following activities are not included in the cost estimate above since they may or may not be necessary, and the variables are too great to quantify at this time.

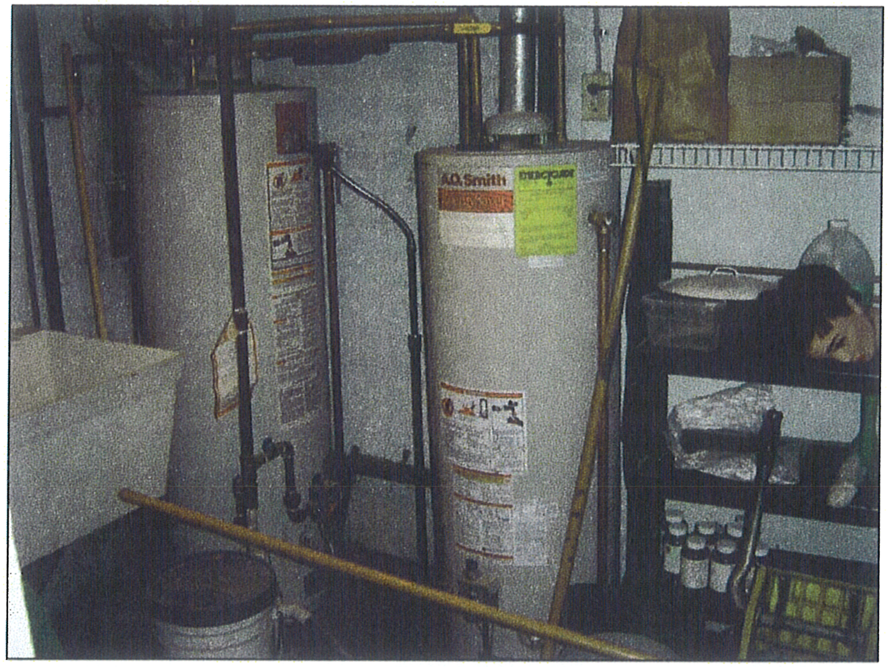
- Removal of a possible second UST (there are two vent pipes).
- Excavation and disposal of oil-impacted soil.
- Demolition/excavation and disposal of the soil and concrete under the 1,000-gallon AST.
- Demolition of a portion of the former boiler room wall that may be saturated with oil.
- Excavation or disposal of soil under the boiler room floor.
- Abatement of identified asbestos containing materials.
- Removal/disposal of PCB-containing electrical equipment.
- LSP services beyond filing an IRA Plan.

FIGURES

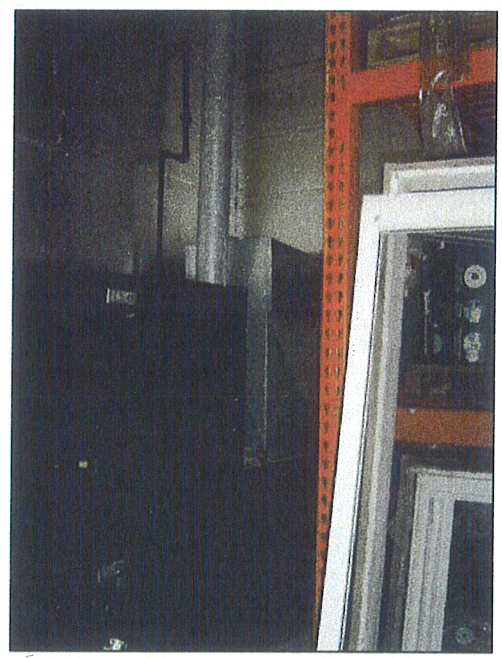
PHOTOGRAPHS

Photograph 1: Front of the main building showing vent/fill pipes for the active AST shown below.

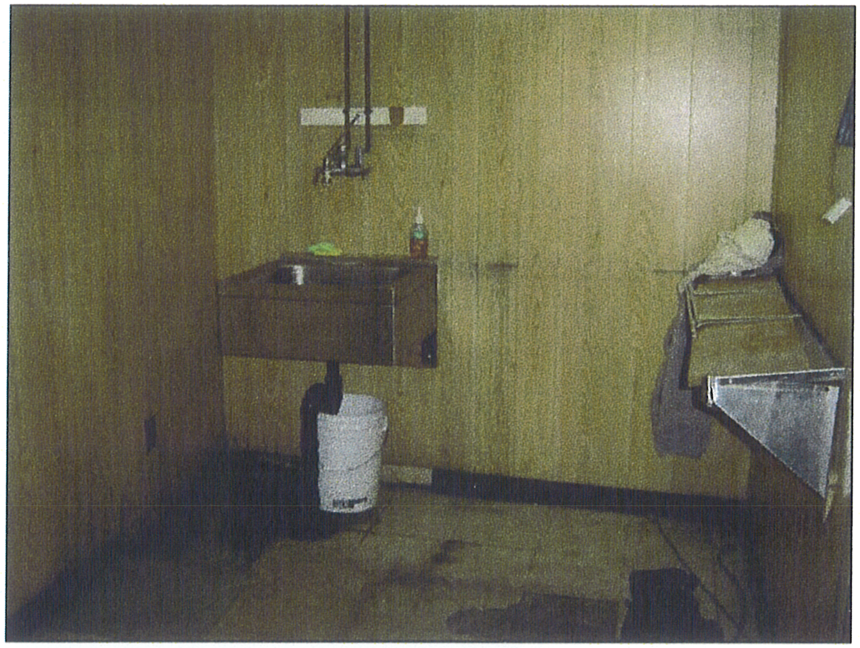
Photograph 2: View of the 275-gallon aboveground storage tank (AST) in the utility closet.



Photograph 3: View of the gas-fired hot water heaters.

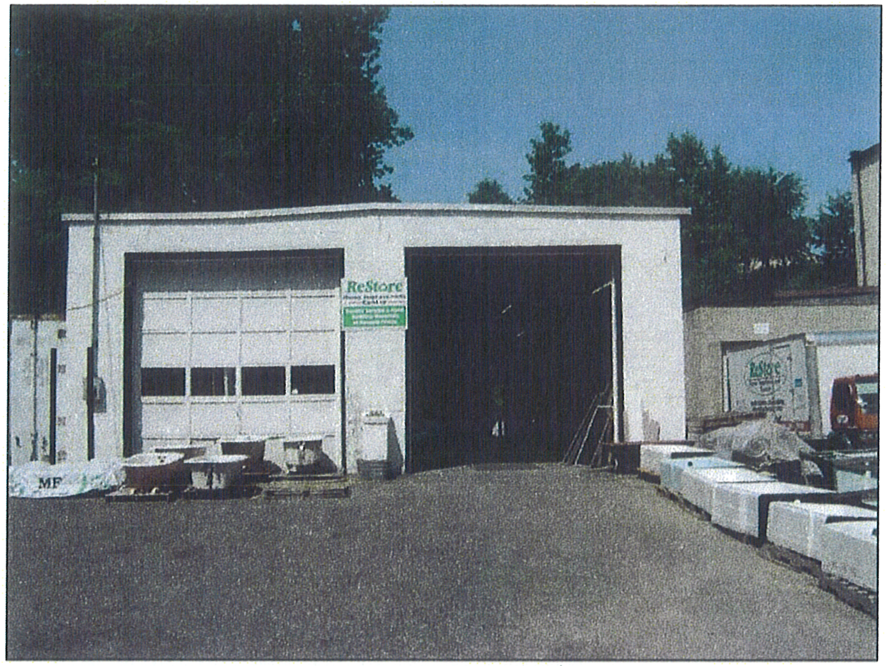


Photograph 4: View of the gas-fired hot air furnace in the RESTORE warehouse/sales room.



Photograph 5: View of the former laboratory in the lower level of the main building.

Photograph 6: View of the main warehouse/sales room of RESTORE in the lower level of the main building.



Photograph 7: View of the RESTORE garage/showroom.

Photograph 8: View of the dumpster pad, radiator storage.

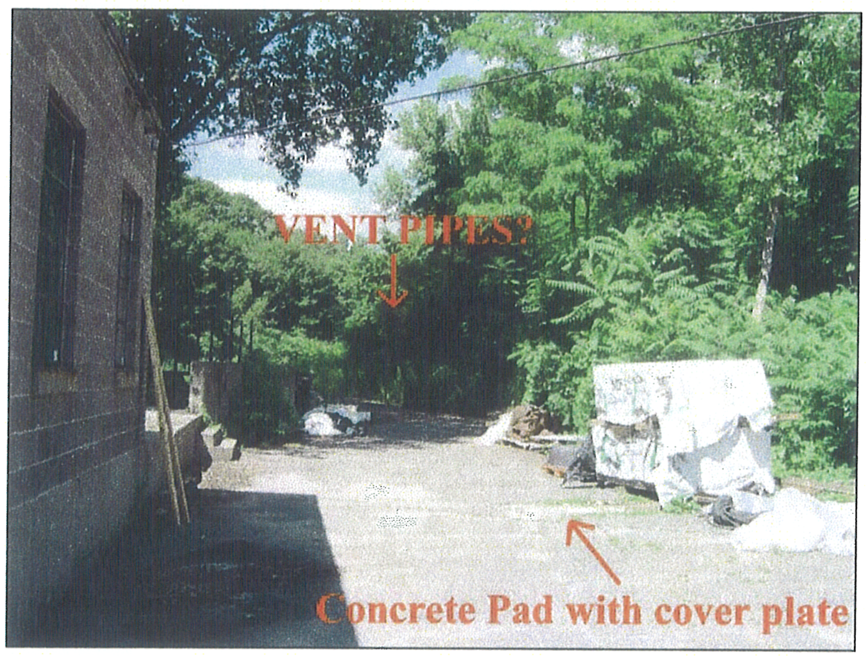
Photograph 9: View of the former RR siding platform with concrete pad foundations for former machinery/structures/tanks with the boiler room in the rear of the photo.

Photograph 10: View of the N end of the W side of the RESTORE Garage with siding storage in exterior racks and extra storage trailers near the front of the building (background of photo). Area was one of 2 former RR siding tracks.

Photograph 11: View of the RR siding track (in gravel driveway) with possible underground storage tank (UST) vent pipes in center rear of the photo.

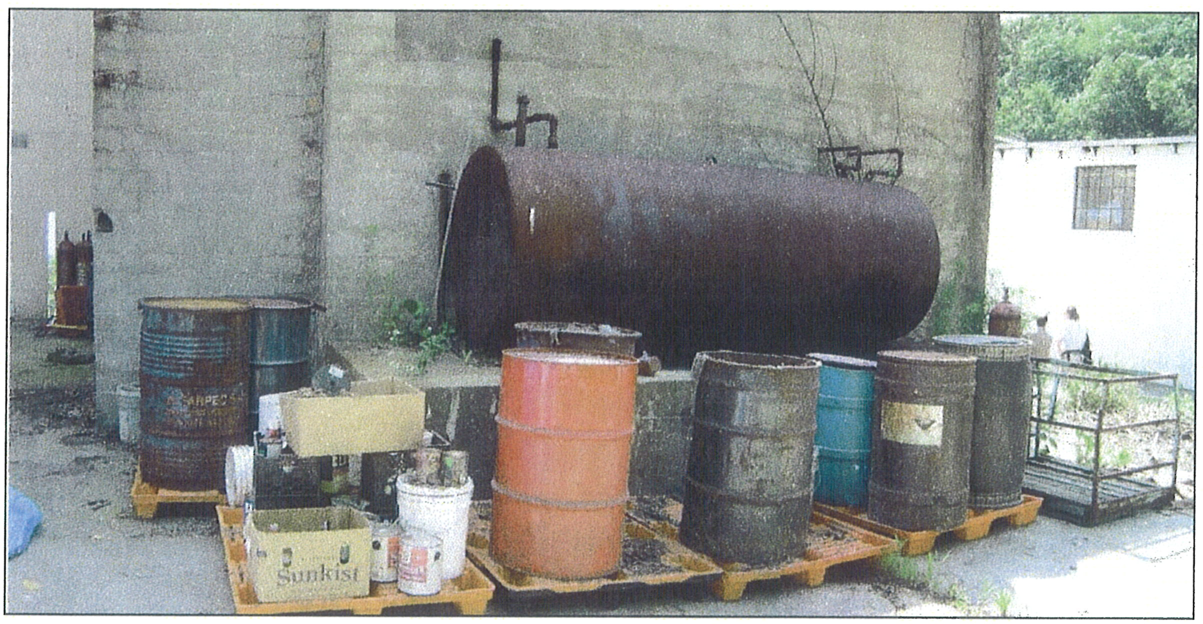
Photograph 12: View of the possible pair of UST vent pipes.

Photograph 13: View of the loading dock and driveway to N portion of lot with RESTORE garage on the left.

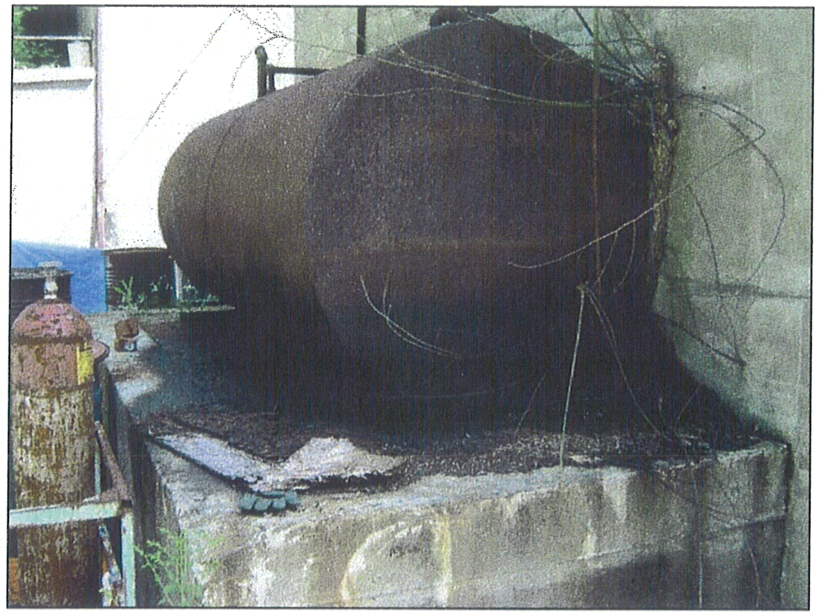


Photograph 14: View of the possible pair of UST vent pipes.

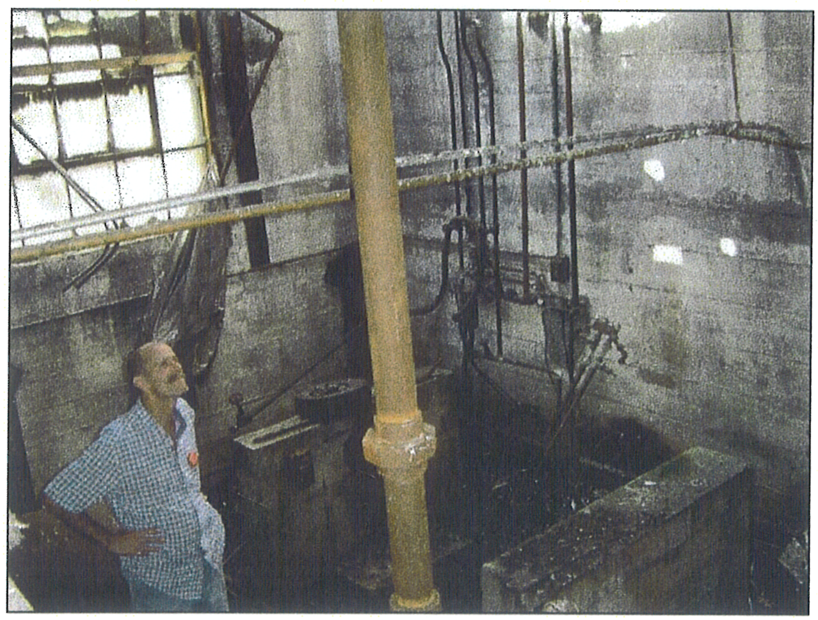
Photograph 15: View of the 275-gallon AST with staining located at the N side of the loading dock. The tank is not connected to building or currently used.



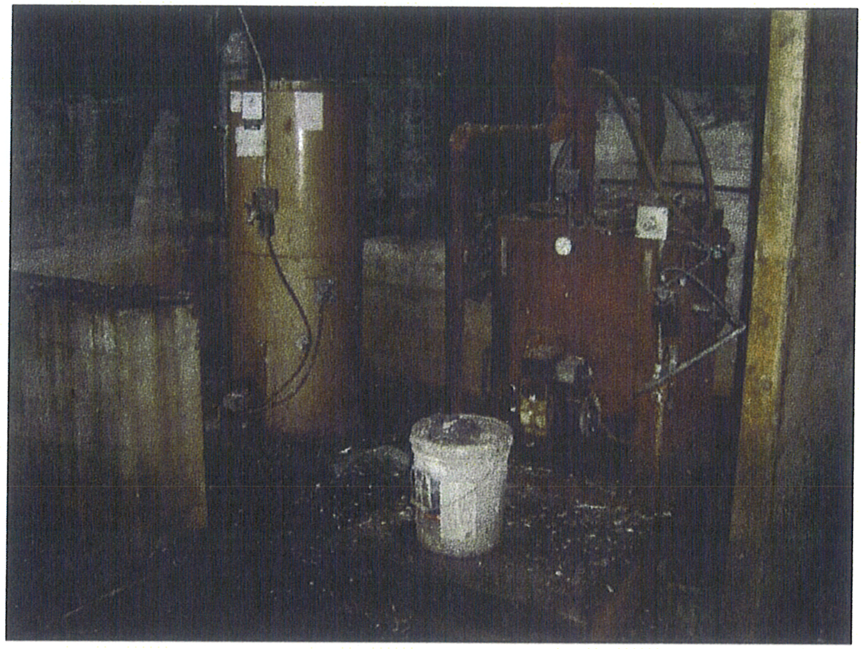
Photograph 16: View of the leaking 1,000-gallon #2 fuel oil AST located on a concrete platform. Tank is not active but was used when central boiler was active. View of the drums of various content and origin stored on fork truck pallets (orange) N of old boiler room.



Photograph 17: View of the leaking 1,000-gallon #2 fuel oil AST located on a concrete platform. Tank is not active but was used when central boiler was active.

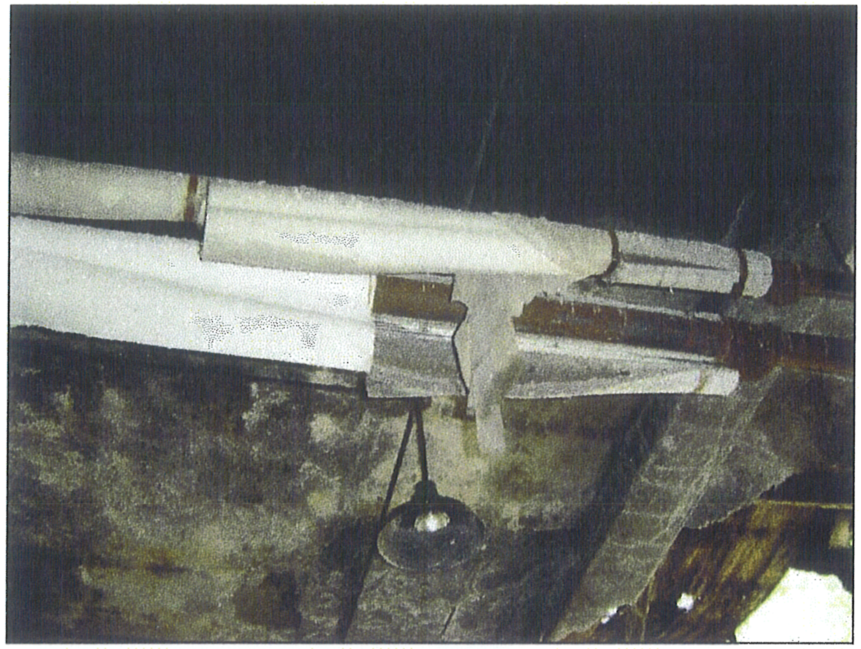


Photograph 18: View of the former boiler room. Vertical pipes on the rear wall are fill and vent pipes from the 1,000-gallon tank on the other side of the wall. Note oil stained floor and lower walls.



Photograph 19: View of the portions of a former boiler and oil-fired hot water heater inside boiler room.

Photograph 20: View of the hole in the concrete floor of the boiler room.



Photograph 21: View of the suspect asbestos-containing building materials (pipe insulation) in the former boiler room (poor condition).

Photograph 22: View of the electric equipment possibly containing PCBs.

Photograph 23: View of the northern site building containing personal storage of the owner, a wood pallet restoration business, and Metalmorphis, a metal fabrication business.

Photograph 24: View of the wood pallet restoration business in portion of N building.

Photograph 25: View of the abutting property to the N, Associated Building Wreckers shed where former USTs and ASTs are reportedly cut and burned.

Photograph 26: View of the abutting property to E, Gulf Oil bulk fuel terminal and warehouses/garages.

Photograph 27: View of the existing monitoring well at NE corner of 250 Albany St. building.

Photograph 28: View of the existing monitoring well at S side of driveway along S property line. Another MW exists in the driveway at rear of photo.

APPENDIX A – AREAS AND R-VALUES

GASOLINE ALLEY
Square Footages and Assumed R-Values
3/31/04

	Existing Sq. Ft.	Existing R-Value	Proposed Sq. Ft.	Proposed R-Value	
MAIN BUILDING					
First Floor (currently ReStore Space)					
Floor Area =	5,674	2.00	5,674	2.00	
Window Area =	140	2.00	300	2.50	
Door Area =	184	2.00	120	3.50	
Exterior Walls =	5,373	4.00	5,277	9.00	
Second Floor (Offices and Salon)					
Floor Area =	5,704	2.00	5,704	2.00	heated space, below
Window Area =	262	2.00	342	2.50	
Door Area =	83	2.00	83	2.50	
Exterior Walls =	3,290	5.80	3,210	11.80	
Total Roof Area =	6,051	12.00	6,051	23.00	
ORIGINAL MAIN BUILDING					
First Floor (Storage)					
Floor Area =	653	2.00	653	2.00	
Window Area =	24	2	24	2.50	
Door Area =	40	2	40	2.50	
Exterior Walls =	1,542	4.00	1,542	9.00	
Second Floor (Salon)					
Floor Area =	638	2.00	638	2.00	heated space, below
Window Area =	91	2.00	91	2.50	
Door Area =	20	2.00	20	2.50	
Exterior Walls =	987	4.00	987	9.00	
Total Roof Area =	638	6.00	638	23.00	
PROPOSED ADDITION					
First Floor (Bathroom, Bike Storage, Stair)					
Floor Area =			586	7.50	
Window Area =			58	2.50	
Door Area =			20	2.5	
Exterior Walls =			1,410	27.00	
Second Floor (Office)					
Floor Area =			1,494	2.00	heated space, below
Window Area =			428	2.50	
Door Area =			40	2.5	
Exterior Walls =			1,384	27.00	

Total Roof Area =			1,494	23.00

NEW ATRIUM

Floor Area =			616	7.50
Window Area =			768	2
Door Area =			20	2.50
Exterior Walls =			408	12.00
Total Roof Area =			616	23.00

RESTORE BUILDING (Rear Building at lower level)

Floor Area =	3,058	2.00	3,058	2.00
Window Area =	191	2.00	191	2.50
Door Area =	451	2.00	451	2.50
Exterior Walls =	3,167	4.00	3,167	9.00
Total Roof Area =	3,058	6.00	3,058	23.00

270 ALBANY STREET (Building 2)

Floor Area =	3,223	2.00	3,223	2.00
Window Area =	52	2.00	52	2.50
Door Area =	553	2.00	553	2.50
Exterior Walls =	3,836	4.00	3,836	9.00
Total Roof Area =	3,223	6.00	3,223	23.00

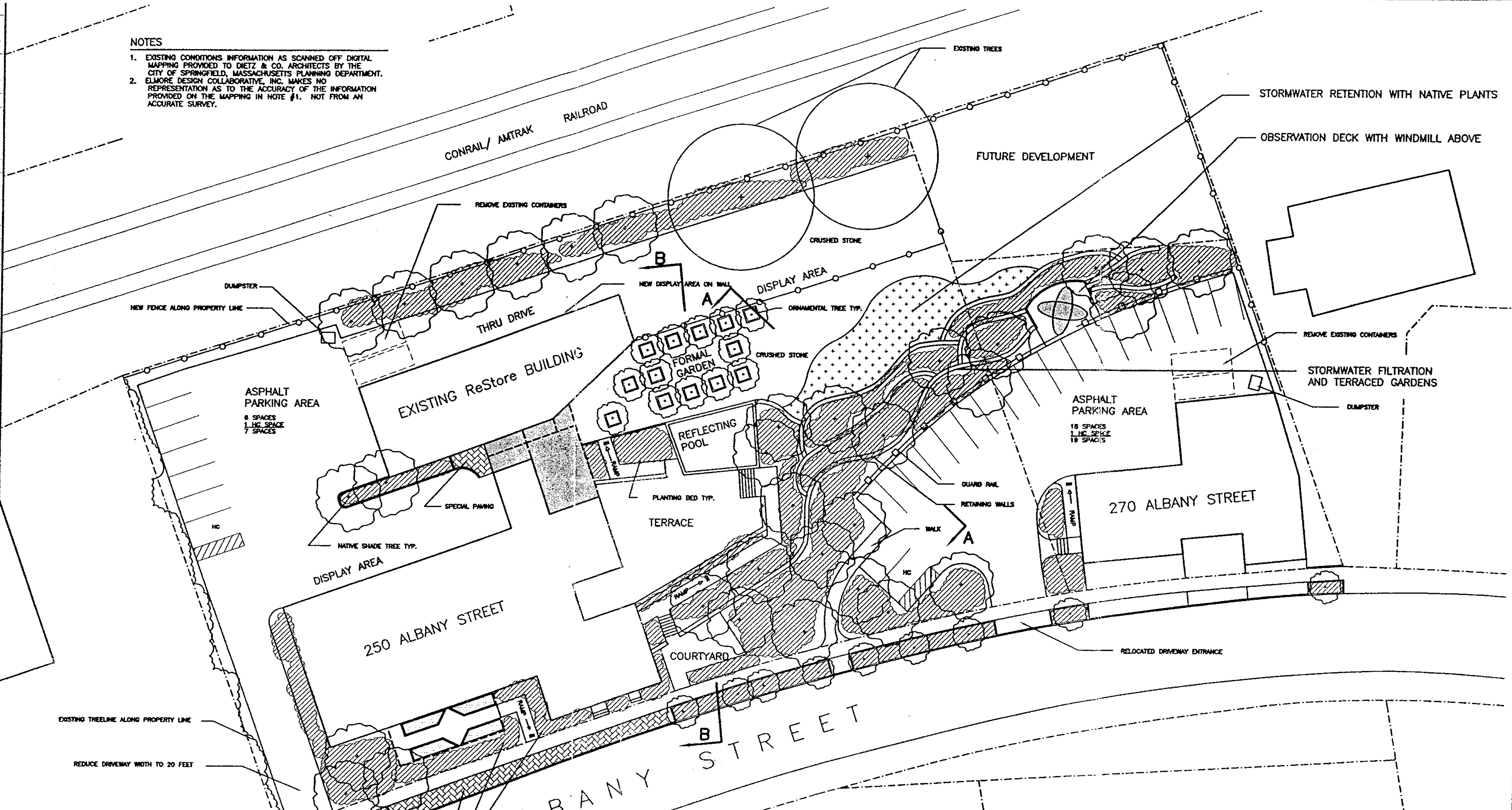
APPENDIX B – BUILDING FLOOR PLANS

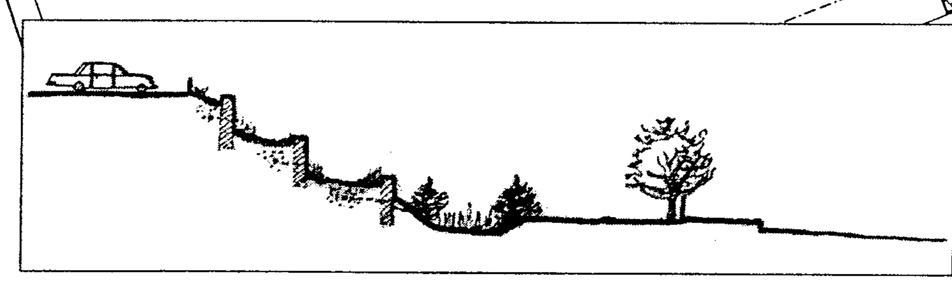
POTENTIAL PLANT PALETTE
(Native and Zone Hardy Plants)

BOTANICAL NAMES	COMMON NAMES
Trees	
Acer rubrum 'October Glory'	Red Maple
Acer saccharum	Sugar Maple
Aesculus octandra	Yellow Buckeye
Betula papyrifera	Paper Birch
Betula nigra 'Heritage'	River Birch
Carpinus caroliniana	American Hornbeam
Celtis occidentalis	Common Hackberry
Cercis canadensis	Eastern Redbud
Cladastris kentukea	Yellowwood
Fagus grandifolia	American Beech
Fraxinus americana	White Ash
Fraxinus pennsylvanica 'Newport'	Green Ash
Gymnocladus dioicus	Kentucky Coffee Tree
Halesia carolina	Carolina Silverbell
Liquidamber styraciflua	Sweet Gum
Liriodendron tulipifera	Tuliptree
Magnolia virginiana	Sweetbay Magnolia
Nyssa sylvatica	Tupelo, Black Gum
Pinus strobus	White Pine
Pinus strobus	White Pine
Quercus alba	White Oak
Quercus bicolor	Swamp Oak
Quercus coccinea	Scarlet Oak
Quercus palustris	Pin Oak
Quercus rubra	Red Oak
Tilia americana 'Redmond'	Redmond Linden
Shrubs	
Amelanchier x grandiflora 'Robin Hill'	Robin Hill Serviceberry
Cephalanthus occidentalis	Buttonbush
Clethra alnifolia	Summersweet
Clethra alnifolia 'Hummingbird'	Summersweet
Clethra alnifolia 'Rubyspice'	Pink Summersweet
Comptonia peregrina	Sweet Fern
Cornus alternifolia	Alternate-leaved Dogwood
Cornus sericea	Red-osier Dogwood
Cornus sericea 'Flaviramea'	Yellowtwig Dogwood
Fothergilla gardenii	Dwarf Fothergilla
Hamamelis x intermedia 'Arnold's Promise'	Witchhazel
Sambucus canadensis	Common Elderberry
Vaccinium corymbosum	Highbush Blueberry
Viburnum cassinoides	Wild Raisin
Viburnum dentatum	Northern Arrowwood
Viburnum lentago	Nannyberry
Viburnum prunifolium	Blackhaw Viburnum
Viburnum trilobum	American Cranberrybush
Herbaceous Plants	
Matteuccia struthiopteris	Ostrich Fern
Onoclea sensibilis	Sensitive Fern
Osmunda cinnamomea	Cinnamon Fern
Osmunda regalis	Royal Fern
Caltha palustris	Marsh Marigold
Eupatorium maculatum	Joe-Pye Weed
Lobelia cardinalis	Cardinal Flower

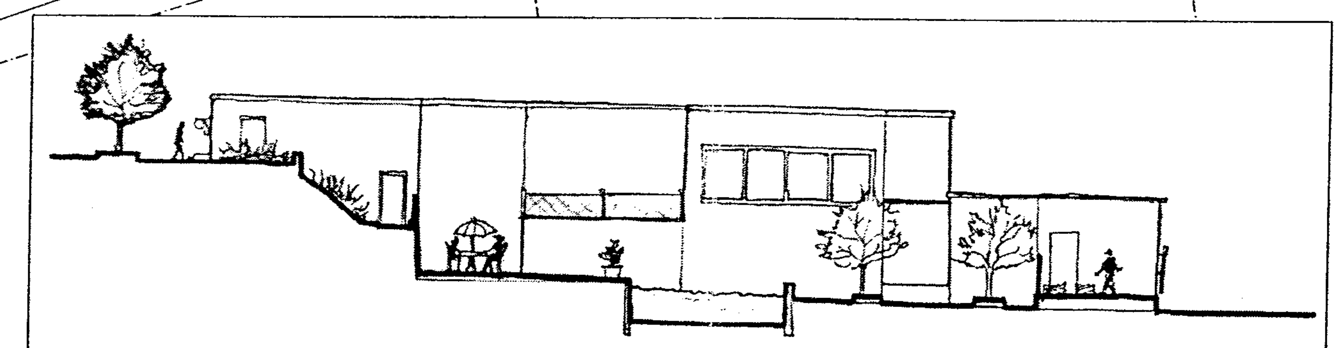
NOTES

1. EXISTING CONDITIONS INFORMATION AS SCANNED OFF DIGITAL MAPPING PROVIDED TO DIETZ & CO. ARCHITECTS BY THE CITY OF SPRINGFIELD, MASSACHUSETTS PLANNING DEPARTMENT.
2. ELMORE DESIGN COLLABORATIVE, INC. MAKES NO REPRESENTATION AS TO THE ACCURACY OF THE INFORMATION PROVIDED ON THE MAPPING IN NOTE #1. NOT FROM AN ACCURATE SURVEY.





SECTION A–A



SECTION B–B

GASOLINE ALLEY EARLY STAGE FEASIBILITY STUDY

250–270 ALBANY STREET, SPRINGFIELD, MASSACHUSETTS 01105

GASOLINE ALLEY FOUNDATION

250 ALBANY STREET, SPRINGFIELD, MASSACHUSETTS 01105

ELMORE DESIGN COLLABORATIVE, INC.

Landscape Architecture: Site Planning & Design, Historic Preservation

1655 Main Street, Suite 302, Springfield, MA 01103

Tel. 413-827-7071 Fax. 413-827-7063

E-Mail TJE@Elmore-Design.com

sheet title: *SCHEMATIC SITE PLAN*

scale: 1" = 20'-0" (0 10' 20' 40')

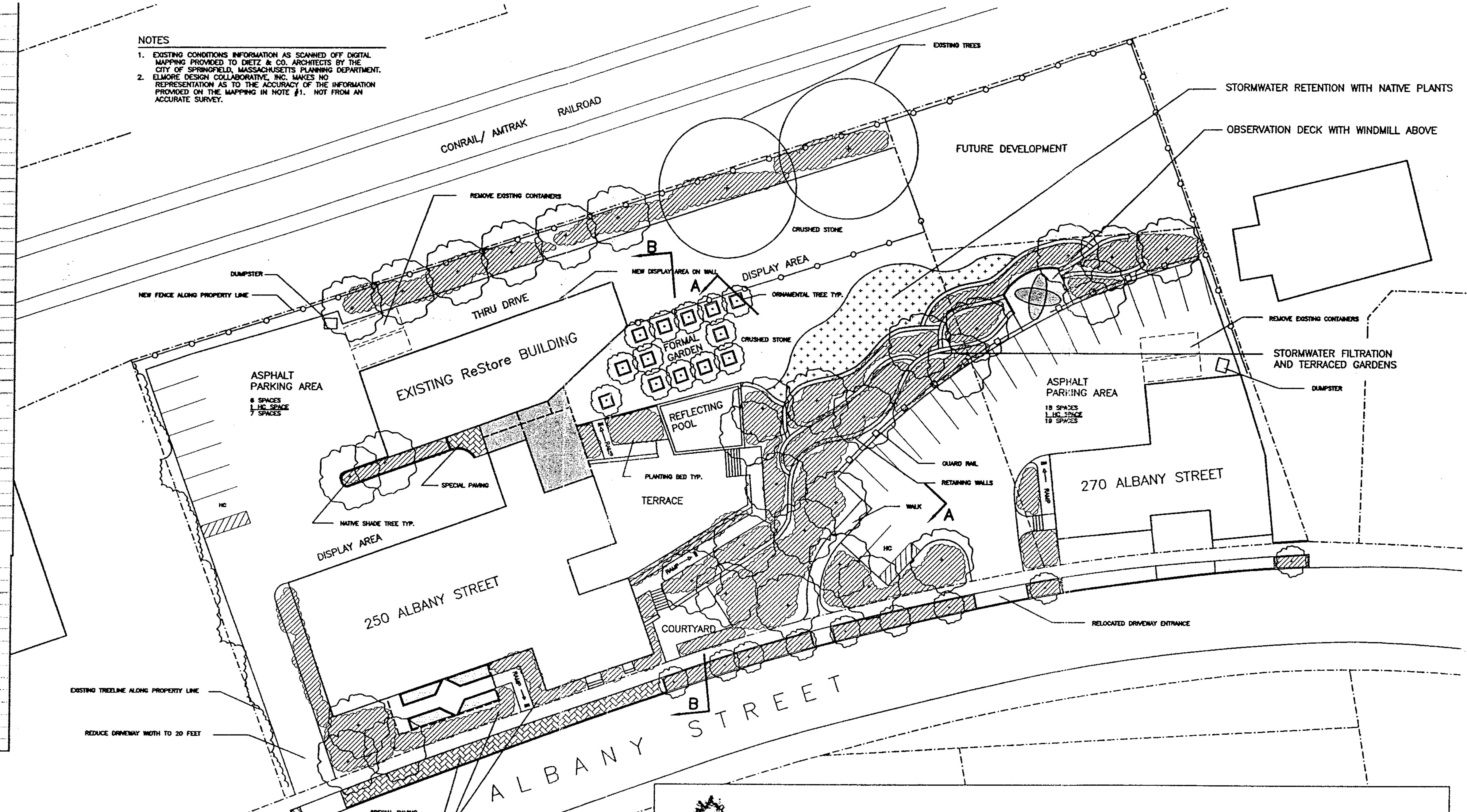
date: JANUARY 12, 2004

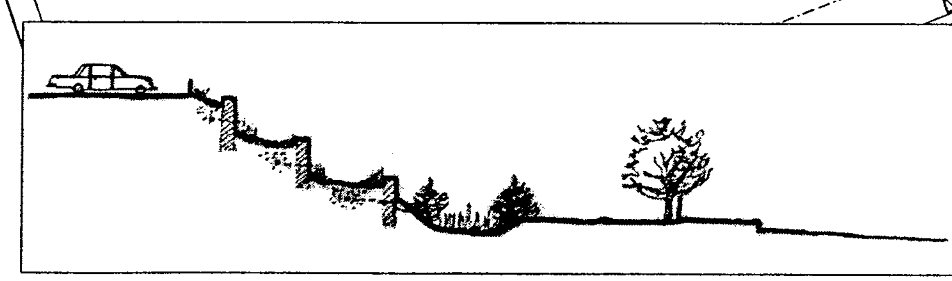
sheet: *1*

POTENTIAL PLANT PALETTE

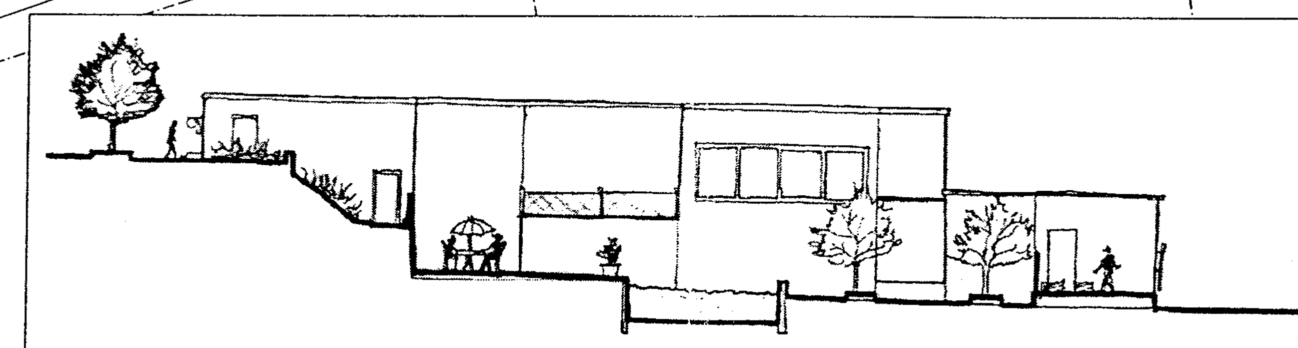
(Native and Zone Hardy Plants)

BOTANICAL NAMES	COMMON NAMES
Trees	
Acer rubrum 'October Glory'	Red Maple
Acer saccharum	Sugar Maple
Aesculus octandra	Yellow Buckeye
Betual papyrifera	Paper Birch
Betula nigra 'Heritage'	River Birch
Carpinus caroliniana	American Hornbeam
Celtis occidentalis	Common Hackberry
Cercis canadensis	Eastern Redbud
Cladestris kentukea	Yellowwood
Fagus grandifolia	American Beech
Fraxinus americana	White Ash
Fraxinus pennsylvanica 'Newport'	Green Ash
Gymnocladus dioicus	Kentucky Coffee Tree
Halesia carolina	Caroline Silverbell
Liquidamber styraciflua	Sweet Gum
Liriodendron tulipifera	Tuliptree
Magnolia virginiana	Sweetbay Magnolia
Nyssa sylvatica	Tupelo, Black Gum
Pinus strobus	White Pine
Pinus strobus	White Pine
Quercus alba	White Oak
Quercus bicolor	Swamp Oak
Quercus coccinea	Scarlet Oak
Quercus palustris	Pin Oak
Quercus rubra	Red Oak
Tilia americana 'Redmond'	Redmond Linden
Shrubs	
Amelanchier x grandiflora 'Robin Hill'	Robin Hill Serviceberry
Cephalanthus occidentalis	Buttonbush
Clethra alnifolia	Summersweet
Clethra alnifolia 'Hummingbird'	Summersweet
Clethra alnifolia 'Rubyspice'	Pink Summersweet
Comptonia peregrina	Sweet Fern
Cornus alternifolia	Alternate-leaved Dogwood
Cornus sericea	Red-osier Dogwood
Cornus sericea 'Flaviramea'	Yellowtwig Dogwood
Fothergilla gardeni	Dwarf Fothergilla
Hamamelis x intermedia 'Arnold's Promise'	Witchhazel
Sambucus canadensis	Common Elderberry
Vaccinium corymbosum	Highbush Blueberry
Viburnum cassinoides	Wild Raisin
Viburnum dentatum	Northern Arrowwood
Viburnum lentago	Nannyberry
Viburnum prunifolium	Blackhaw Viburnum
Viburnum trilobum	American Cranberrybush
Herbaceous Plants	
Matteuccia struthiopteris	Ostrich Fern
Onoclea sensibilis	Sensitive Fern
Osmunda cinnamomea	Cinnamon Fern
Osmunda regalis	Royal Fern
Caltha palustris	Marsh Marigold
Eupatorium maculatum	Joe-Pye Weed
Lobelia cardinalis	Cardinal Flower





SECTION A–A



SECTION B–B

GASOLINE ALLEY EARLY STAGE FEASIBILITY STUDY

250–270 ALBANY STREET, SPRINGFIELD, MASSACHUSETTS 01105

GASOLINE ALLEY FOUNDATION

250 ALBANY STREET, SPRINGFIELD, MASSACHUSETTS 01105

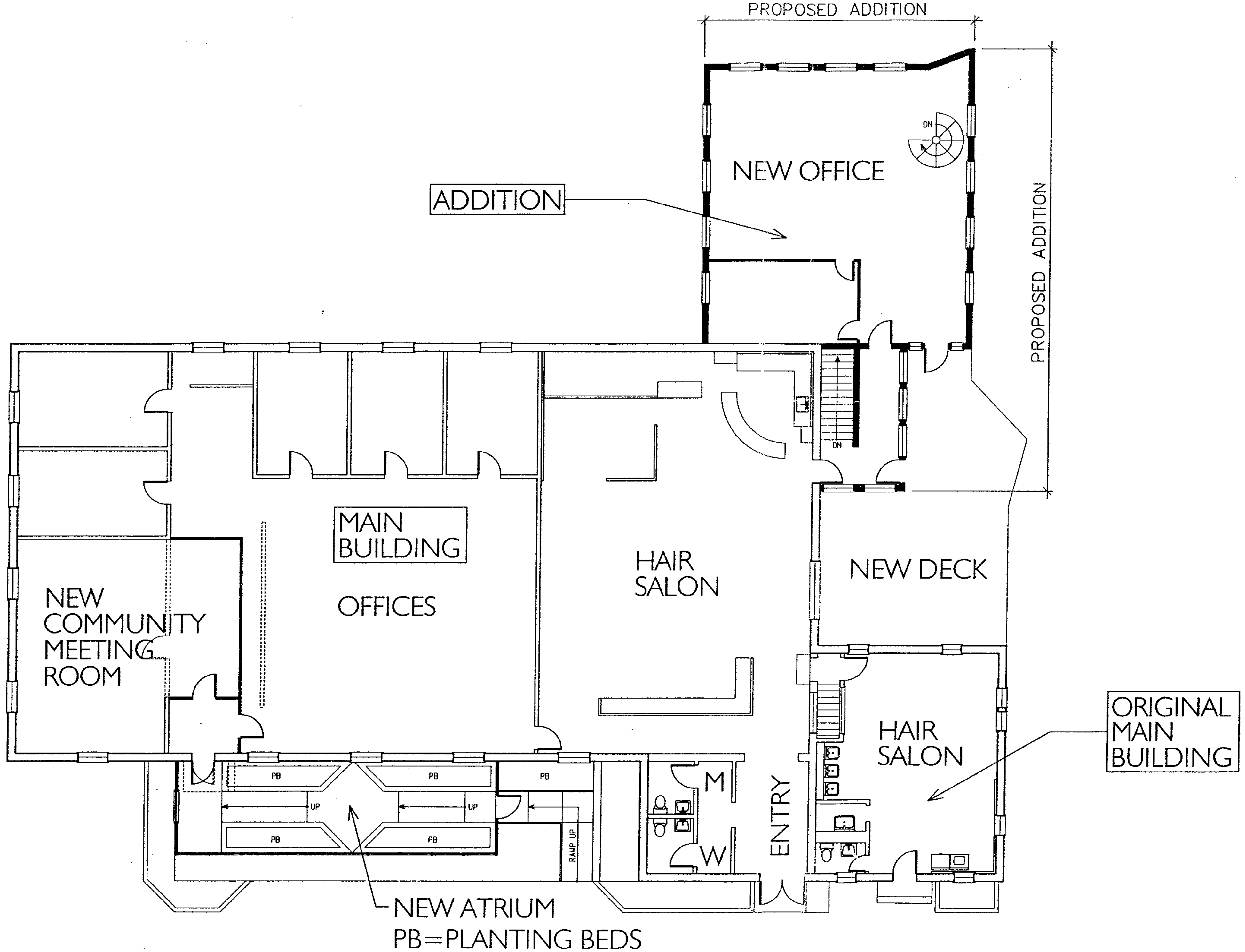
ELMORE DESIGN COLLABORATIVE, INC.
Landscape Architecture: Site Planning & Design, Historic Preservation
1655 Main Street, Suite 302, Springfield, MA 01103
Tel. 413-827-7071 Fax. 413-827-7063
E-Mail TJE@Elmore-Design.com

sheet title: *SCHEMATIC SITE PLAN*

scale: 1" = 20'-0" (0 10' 20' 40')

date: JANUARY 12, 2004

sheet: 1



PROPOSED SECOND FLOOR PLAN-250 ALBANY STREET

A1

1/16" = 1'-0"

DIETZ & CO Architects INCORPORATED

17 HAMPDEN ST
SPRINGFIELD, MA
01103
(413) 733-6798

GASOLINE ALLEY FOUNDATION

250, 270 ALBANY STREET PROPOSED PLANS

250, 270 ALBANY STREET, SPRINGFIELD, MA

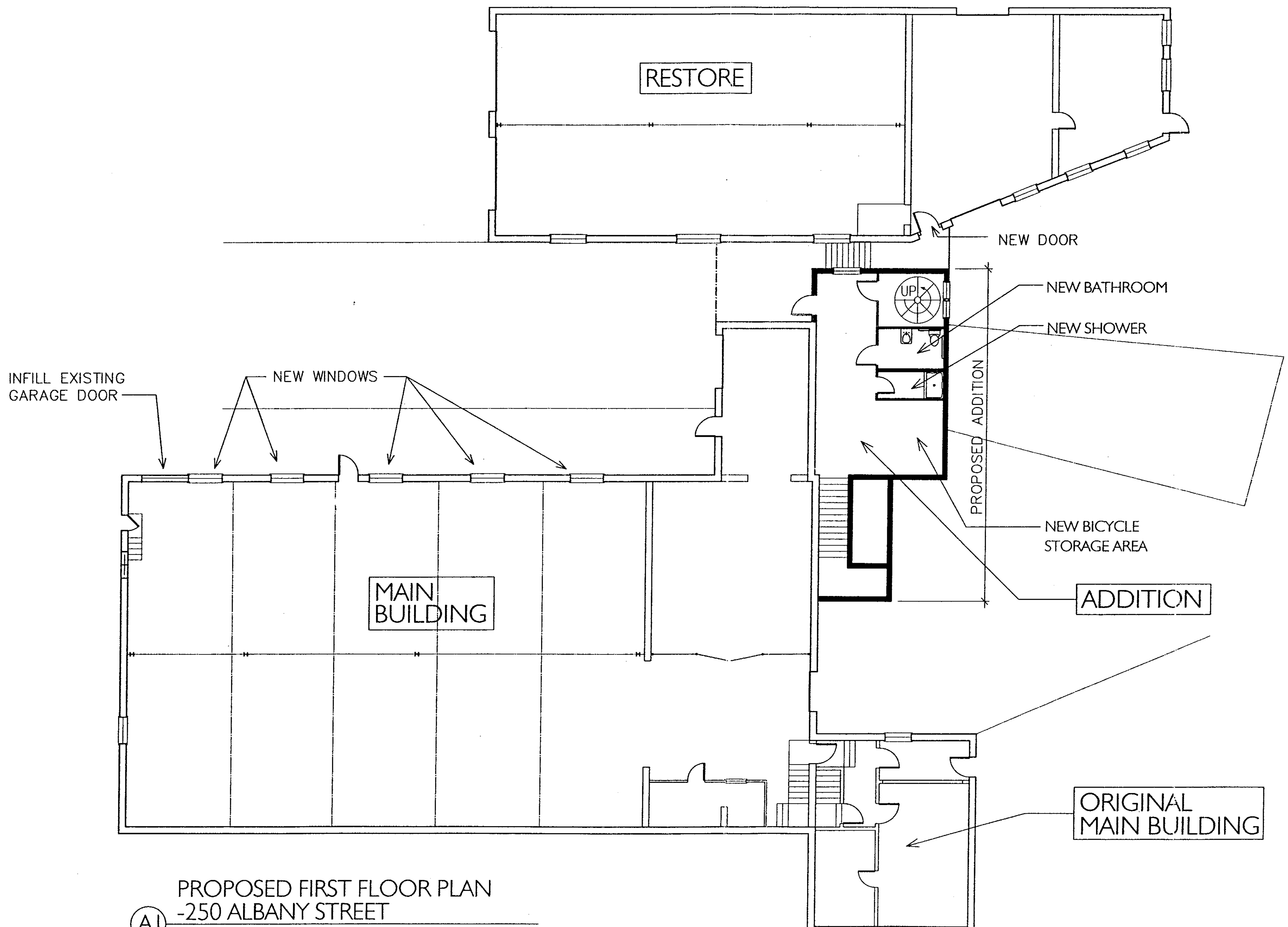
MARK	DATE	DESCRIPTION

PROJECT NO: 20047
CAD FILE: A-120-B1
DRAWN BY: JP
CHK'D BY: MS

SHEET TITLE
2ND FLOOR PLAN

A-120-B1

COMPUTER NAME: MARCS CURRENT USER NAME:marcs
PLOT DATE: 2/25/2004 PLOT TIME:9:58 AM PATH\NAME: \20047 – Gasoline Alley Foundation\CAD\CAD\20047-A-120-B1.Dc5



A1 PROPOSED FIRST FLOOR PLAN
-250 ALBANY STREET
1/16" = 1'-0"

DIETZ & CO Architects INCORPORATED
17 HAMPDEN ST
SPRINGFIELD, MA
01103
(413) 733-6798

GASOLINE ALLEY FOUNDATION
250, 270 ALBANY STREET
PROPOSED PLANS
250, 270 ALBANY STREET, SPRINGFIELD, MA

MARK	DATE	DESCRIPTION

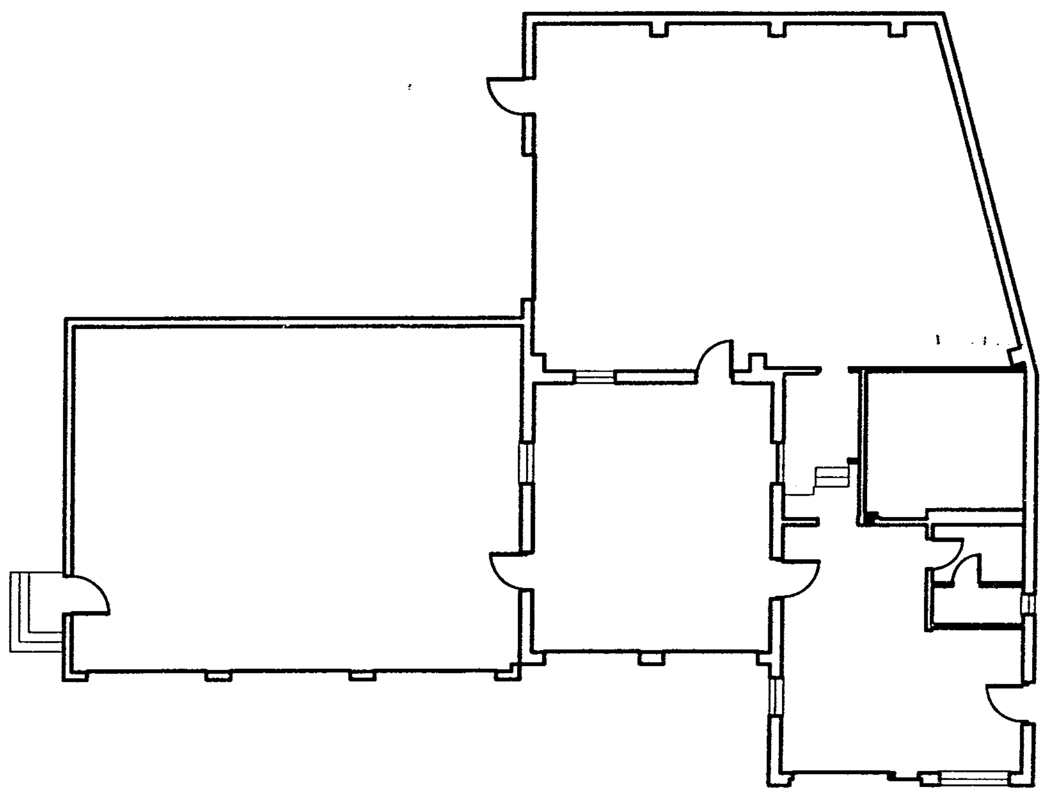
PROJECT NO: 20047
CAD FILE: A-110-B1
DRAWN BY: JP,PD
CHK'D BY: MS

SHEET TITLE
1ST FLOOR PLAN

A-110-B1

COMPUTER N: MARCS CURRENT USER NAME:marcs
PLOT DATE: 2/25/2004 PLOT TIME:9:56 AM PATH\NAME: \20047 - Gasoline Alley Foundation\CAD\CAD\20047-A-110-B1.Dc5

COMPUTER N_ MARCS CURRENT USER NAME:marcs
PLOT DATE:2/_/2004 PLOT TIME:9:58 AM PATH\NAME:\20047 - Gasoline Alley Foundation\CAD\CAD\20047-A-110-B2.Dc5



(B1) FIRST FLOOR PLAN-270 ALBANY ST.
1/16" = 1'-0"

DIETZ & CO
Architects
INCORPORATED
17 HAMPDEN ST
SPRINGFIELD, MA
01103
(413) 733-6798

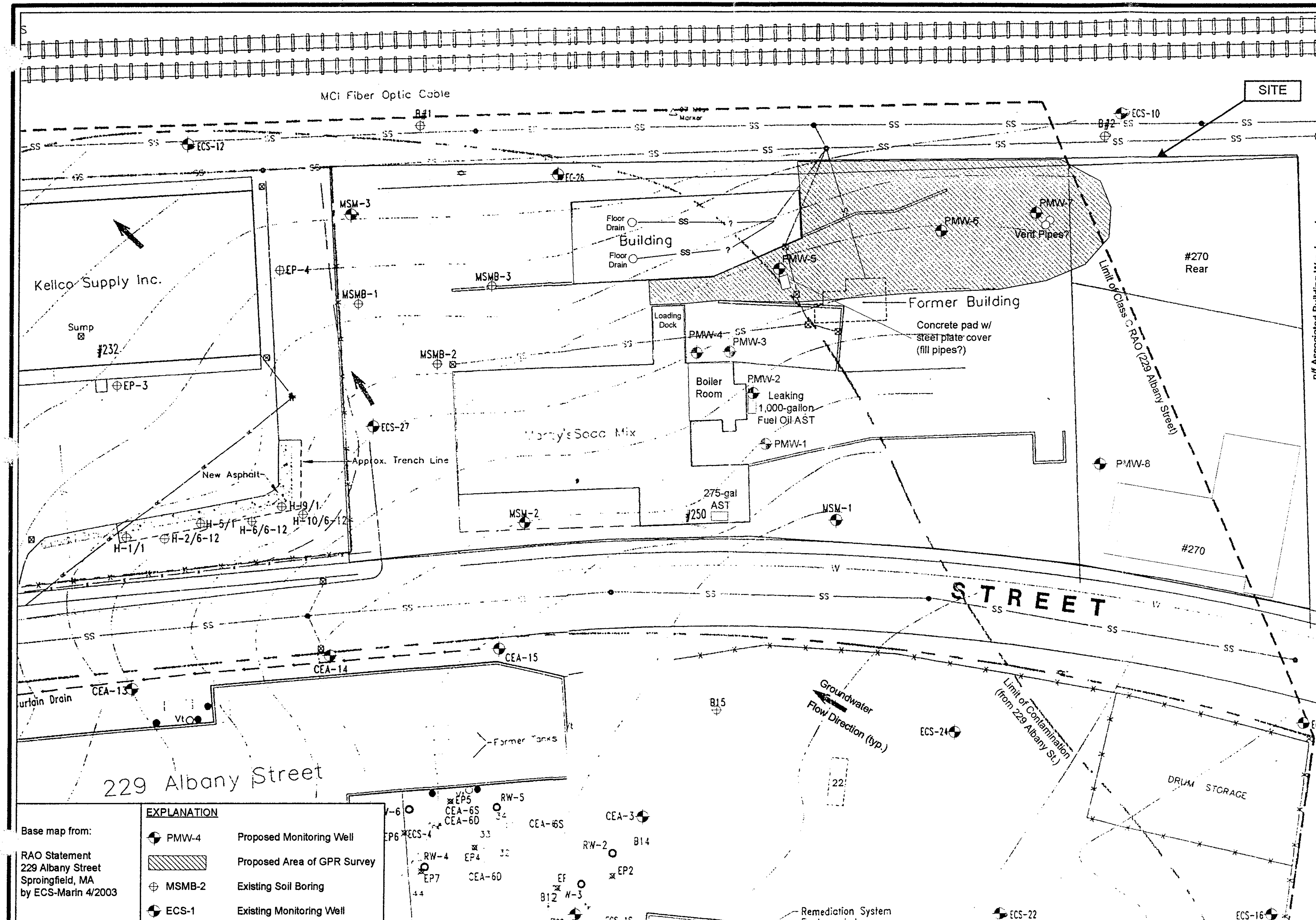
GASOLINE ALLEY FOUNDATION
250, 270 ALBANY STREET
PROPOSED PLANS
250, 270 ALBANY STREET, SPRINGFIELD, MA

MARK	DATE	DESCRIPTION
	04/18/2003	

PROJECT NO: 20047
CAD FILE: A-110-B2
DRAWN BY: JP
CHK'D BY: MS

SHEET TITLE

A-110-B2



New England Environmental, Inc.
Environmental Consulting Services
9 Research Drive
Amherst, MA 01002
(413) 256-0202
(413) 256-1092 Fax

NEE File #03-2181

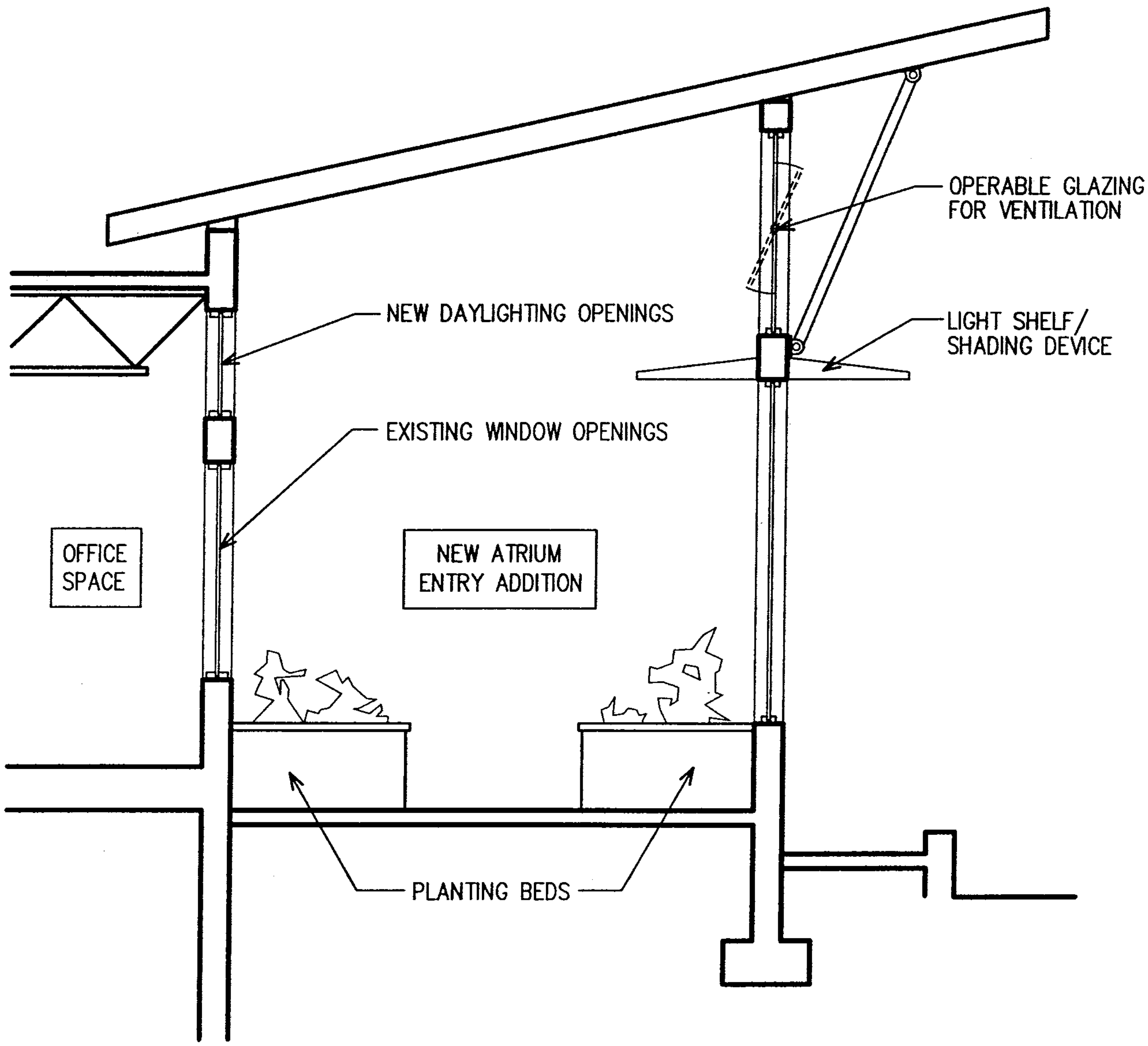
GASOLINE ALLEY FOUNDATION, INC.

250-270 ALBANY STREET
SITE PLAN

250-270 ALBANY STREET, SPRINGFIELD, MA

Figure 2

APPENDIX C – CONCEPTUAL RENDERINGS OF ENTRY ATRIUM



DIETZ & CO Architects INCORPORATED

17 HAMPDEN ST
SPRINGFIELD, MA
01103
(413) 733-6798

GASOLINE ALLEY FOUNDATION

250 ALBANY STREET

PROPOSED NEW ATRIUM / ENTRY ADDITION

250, 270 ALBANY STREET, SPRINGFIELD, MA.

MARK	DATE	DESCRIPTION

PROJECT NO: 20047
CAD FILE:20047-SK-A02

DRAWING REFERENCE:
NONE

SHEET TITLE
ATRIUM / ENTRY SECTION

SKA-01

PLOT DATE: 5/27/2004
PLOT TIME: 12:59 PM
PATH\NAME:V:\20047 - Gasoline Alley Foundation\CAD\CAD\20047-SK-A02.Dc5

APPENDIX – D – SCHEMATIC SITE PLAN

APPENDIX E – WASTE AND WASTEWATER REFERENCES

References

1. Massachusetts Department of Environmental Protection, Title 5, 310 CMR 15.000

2. MADEP Bureau of Resource Protection issued interim guidelines on reclaimed water in January of 2000 (Policy #BRP/DWM/PeP-P00-3) (2)

3. Greywater Characterization and Treatment Efficiency, Final Report for The Massachusetts Department of Environmental Protection, Bureau of Resource Protection. Veneman, P.L. and B. Stewart, University of Massachusetts Amherst, 2002.

4. Web page http://www.greywater.com, 2003

5. Boston Business Journal, 1998. http://boston.bizjournals.com/boston/stories/1998/10/05/story5.html?page=34.

6. Innovative and Alternative On-Site Wastewater Treatment Technologies Handbook. Winkler, E.S., 2000. UMASS Extension Bulletin Center, University of Massachusetts at Amherst. Amherst, MA. pp.131.

7. TUR in the Cosmetology Vocational Department - Health and Beauty Can Go Hand-in-Hand, A Project of the Western Massachusetts Coalition for Occupational Safety and Health (COSH), 2001-2002

8. The Massachusetts Department of Environmental Management Office of Water Resources – Precipitation Database

APPENDIX F – STORM WATER ANALYSIS CHART

APPENDIX G – TOXICS USE REDUCTION IN THE SALON INDUSTRY

TOXICS USE REDUCTION IN THE SALON INDUSTRY

The purpose of looking at toxics use reduction in the salon industry is two-fold. Clients benefit from less hazardous applications from a health standpoint. In addition, water treatment and the viability of water reuse are beneficially effected when the presence of toxic material in the wastewater stream is reduced. In order to improve raw wastewater effluent, it is essential to look into greener alternatives in the salon industry.

The harmful chemicals found in cosmetology are unique to each process for which they are used. Bleaching, hair coloring, hair relaxing, nail care and application, and permanents all rely on a host of hazardous materials. Identifying the chemicals posing the greatest risk in each process and utilizing safer alternatives is the first step in ensuring a greener salon. A study funded by the Toxics Use Reduction Institute and performed by the Western Massachusetts Coalition for Occupational Safety and Health has identified chemicals of concern and healthy practices in cosmetology.

Bleaching

Bleaching involves a lightening process that uses hydrogen peroxide as an oxidizing agent, mixed with ammonia as an alkali. There are three types of lighteners: oil bleaches, cream lighteners, and powder bleaches. Oil bleaches are the mildest and least hazardous, as they are shampoo-based with a hydrogen peroxide and ammonia solution. Cream lighteners are also shampoo based but contain a hydrogen peroxide solution up to 20% by volume (COSH, 2002). In addition, cream lighteners use either a protinator or an activator that contain an alkali or oxidizer. Protinators and activators can contain sodium metasilicate (high pH), and either: potassium persulfate, ammonium persulfate, or urea peroxide (oxidizers). Powder bleaches contain ammonia and hydrogen peroxide and are used in high concentrations that can pose significant skin and respiratory distress.

Recommendations

Safe use of lightening formula includes capping bottles immediately after usage, quick use to prevent deterioration, and the disposal of unused lighteners. The safest storage of lightening products is not in the vicinity of acids, bleaches, or flammables. Less toxic alternatives include boosters, which use bleach. Potassium persulfate boosters are a safer alternative than ammonium persulfate boosters. The use of less concentrated products reduces the percentage of hydrogen peroxide as well as the associated hazard. As a general rule powdered bleaching work the fastest, but are also the most hazardous, unless a dustless bleaching powder is used. Alternative lightening processes that reduce hazardous exposures include blonding rather than bleaching, and highlighting rather than bleaching the entire head.

Hair Coloring

Hair coloring involves the use of hazardous dyes, the type depending on the nature of the coloring process. Temporary coloring uses the least hazardous of the dyes, generally food grade dyes and FDA approved. These dyes are flammable, however, and can contain dyes that are not approved by the FDA. Permanent hair dyes often use aniline derivative tints from para-phenylediamines. These are derived from coal and contain more phenylediamine as they get darker. Health effects include skin, respiratory and allergic distress, as well as a mutagenic risk when mixed with peroxide. Oxidative permanent hair coloring involves the use of ammonia and resorcinol, both very toxic. Semi-permanent dyes contain azo colors, which are derived from the carcinogen benzene, and demi-permanent coloring involves the use of aniline derivative dyes of concern such as monoethanolylamine (MEA) or amino methylpropanol (AMP). Non-oxidative permanent dyes contain vegetable tints that are made from plant materials and henna, metallic dyes, and/or compound dyes (combinations of the three). Metallic dyes are metallic salts from lead acetate, lead, copper, cobalt, or silver nitrate. They are not used professionally as health concerns include skin and neurological distress, as well as being potentially fatal. Compound dyes are a mix of vegetable tints and metallic dyes and are generally not used professionally. Vegetable tints, while the safest option for hair coloring, can cause asthma and other allergic reactions.

Recommendations

Greener alternatives include the use of plant-derived dyes such as henna, chamomile for lightening, saffron, and beet juice. The use of semi-permanent dyes without ammonia or resorcinol also reduces the amount of toxins. Alternative coloring processes as mentioned with bleaching require a minimal amount of harmful dyes as well.

Hair Relaxing

Hair relaxing involves the use of a hair relaxer, neutralizer, conditioner, and petroleum cream. Relaxers contain sodium hydroxide, ammonium thioglycate, or an acid based with bisulfate. Sodium hydroxide is the strongest and most hazardous, while bisulfate-based acid as the least hazardous of the three. Other ingredients of concern in the hair relaxing process are calcium oxide, cetyl alcohol, isopropyl alcohol, camphor, ammonia, propylene glycol, sodium peroxide, titanium dioxide, hydrogen peroxide, and boric acid.

Recommendations

Use an acid based bisulfate relaxer and/or one without lye.

Nails

There are five types of nail applications: acrylic, porcelain, gel, wrap, and tip. Materials used in the process are: solvents, primers, glues, and finishes. Acetone and Toluene are both solvents, with toluene as the more hazardous of the two. Methacytic acid (MAA) is in primers and is very corrosive, but may be used in diluted form. A retention brand acrylic is alcohol-based and can be used as an alternative to a primer. Ethyl cyanoacrylic is used in glues and is of concern as it breaks down to formaldehyde and cyanoacrylase when heated by tissue. A chemical of concern in acrylic nails is methyl methacrylate (MMA). OSHA lists MMA as a hazardous substance and it has been banded by the FDA since 1974 (COSH, 2002). Its effects are chronic and acute. Ethyl methacrylate is an alternative to MMA, but also poses health risks. Nail finishes contain phthalates, formaldehyde, and solvents.

Recommendations

Alternative products are available that are phthalate, toluene, and formaldehyde free. Reducing the risk of nail application is possible by reducing the exposures. Addressing indoor air quality, choosing ventilated tables, practicing proper dispensary and storage practices, and use of personal protective equipment are all methods to reduce the amounts of toxics released into the environment.

Permanents

Permanents involve the use of processing lotion, a neutralizing lotion, and a waving lotion. Waving solutions contain ammonium thioglycolate (ATG) or the less damaging glycerol monothioglycolate (GMTG). Triethanolamine (TEA), diethanolamine (DEA), and monoethanolamine (MEA) are all pH adjusters and should be avoided as they react with nitrites to form nitrosamines. Other ingredients of concern are ammonia, hydrogen peroxide, phosphoric acid, and benzyl alcohol.

Recommendations

Safer alternatives to these compounds include the use of ammonium thioglycolate instead of glycerol mono thioglycolate. Waving solutions that have been buffered to a lower pH of 6.5-6.9, as well as the use of hydrogen peroxide neutralizer instead of bromates or perborate are both less hazardous alternatives in the permanent process.

APPENDIX H – HEAT BALANCE CALCULATIONS

HEAT BALANCE INFORMATION:

DESCRIPTIVE INFORMATION

Building Name: 250 Albany Street   # of Full-time occupants: 20

Name of wing/area description
1 Left Top Floor
2 Right Top Floor
3 Left Bottom Floor
4 **Right Bottom Floor**

Temperature Information

Total Htng Days 212
Outdoor Winter Temperature 34.7

	Wing name	Occupied Temp.	Unoccupied Temp. Night	Unoccupied Temp. Weekend	Htg System Occ. Hrs per day	Actual Occ.	Occ Htg Days
1.	Left Top Floor	70	60	58	12.0	Tu-F:13;Sa: 8	151
2.	Right Top Floor	70	60	58	12.0	Tu-F:13;Sa: 8	151
3.	Left Bottom Floor	65	60	58	12.0	Tu-F:13;Sa: 8	151
4.	Right Bottom Floor	55	46	45	8.8	Tu-F: 9-6;Sat:8-4	151

Window Solar Heat Gain

Window Orientation	Solar Heat Gain Factor (BTU/SF) Heating Season 40 N Latitude	Window Area	Shading Factor (Max = .52)	Total BTU per Heating Season *E6
North	37,730			
Northeast	58,231	30	0.49	0.9
South	315,304			
Southeast	256,605	146	0.49	18.4
East	150,216			
Northwest	58,231	275	0.49	7.8
West	150,216			
Southwest	256,605	76	0.49	9.6
Total		527		36.6

Heat Gain from Occupants

255 BTU/hr-occ	20	*	9	*	151
/	100000				
	=	6.9	BTU (E6)		

Electrical Heat Gain (during heating season)

Electrical Usage * 3413 Btu/KWH* (1 - frac.lost)/1000000

38,879	KWH *	3413 BTU/KWH	* (1 -	0.05	)=	126.1

HEAT LOSS COEFFICIENTS

Building Section	U-Value (BTU/hr-sf-F)	Area (sf)	UA-Value (BTU/hr-F)
1 Left Top Floor			
Roof	0.17	638	106
Walls-above grade	0.25	987	247
Walls-below grade	0.14	0	0
Doors	0.50	20	10
Windows - w/ storms	0.5	91	46
	Wing UA Total		408.6
2 Right Top Floor			
Roof	0.08	5704	274
Walls-above grade	0.17	3,290	567
Walls-below grade	0.10	0	0
Doors	0.50	83	42
Windows - w/ storms	0.5	262	131
	Wing UA Total		1013.9
3 Left Bottom Floor			
Roof	0.15	0	0
Walls-above grade	0.25	514	129
Walls-below grade	0.14	1,028	146
Doors	0.50	40	20
Windows - w/ storms	0.5	24	12
			0
	Wing UA Total		307.0
4 Right Bottom Floor			
Roof	0.15	0	0
Walls-above grade	0.25	2,687	672
Walls-below grade	0.14	2,687	383
Doors	0.50	184	92
Windows - w/ storms	0.5	140	70
	Wing UA Total		1216.5

CONDUCTION LOSSES

#	AREA	UA	HOURS/ DAY	DAYS/ SEASON	TEMP DIFF	LOSSES (* 1E6)	Sub Totals
1	Left Top Floor	409	12	151	35.3	26	
		409	12	151	25.3	19	
		409	24	61	23.3	14	58.8
2	Right Top Floor	1,014	12	151	35.3	65	
		1,014	12	151	25.3	46	
		1,014	24	61	23.3	35	145.9
3	Left Bottom Floor	307	12	151	30.3	17	
		307	12	151	25.3	14	
		307	24	61	23.3	10	41.4
4	Right Bottom Floor	1,216	8.8	151	20.3	33	
		1,216	15.2	151	11.3	32	
		1,216	24	61	10.3	18	82.7
					Conduction Total		328.8

INFILTRATION LOSSES

AREA	VOLUME	ACH	HRS/ DAY	DAYS/ YR	0.018	TEMP DIFF	LOSSES (* 1E6)	Sub Totals
Note Infiltration modeled for occupied period for 2 of 4 zones								
1 Left Top Floor	6,316	0.50	12	151	0.018	25.3	2.6	
	6,316	0.50	24	61	0.018	23.3	1.9	
Occ.	6,316	0.00	12	151	0.018	35.3	0.0	4.5
2 Right Top Floor	56,470	0.50	12	151	0.018	25.3	23.3	
	56,470	0.50	24	61	0.018	23.3	17.3	
Occ.	56,470	0.00	12	151	0.018	35.3	0.0	40.6
3 Left Bottom Floor	4,702	0.50	12	151	0.018	25.3	1.9	
	4,702	0.50	24	61	0.018	23.3	1.4	
Occ.	4,702	**0.50**	12	151	0.018	30.3	2.3	5.7
4 Right Bottom Floor	71,492	0.45	15.2	151	0.018	11.3	15.0	
	71,492	0.45	24	61	0.018	10.3	8.7	
Occ.	71,492	**1.00**	8.8	151	0.018	20.3	34.7	58.5
			Infiltration Total					109.4

VENTILATION LOSSES

#	Area Name	CFM	1.08	HOURS/ DAY	DAYS/ SEASON	TEMP DIFF	LOSSES (* 1E6)
1	Left Top Floor	200	1.08	12	151	35.3	13.8
2	Right Top Floor	706	1.08	12	151	35.3	48.8
3	Left Bottom Floor		1.08	12	151	30.3	0.0
4	Right Bottom Floor		1.08	8.8	151	20.3	0.0
					Ventilation Total:		62.6

HEAT BALANCE SUMMARY

GAINS AND LOSSES	BTU/HEATING SEASON*1E6	
CONDUCTION LOSSES	-328.8	
INFILTRATION LOSSES	-109.4	
VENTILATION LOSSES	-62.6	
		-500.8
SOLAR GAIN	37	
OCCUPANT GAIN	7	
ELECTRICAL GAIN	126	
NET HEATING DEMAND	-331	

Heating Season
Seasonal Efficiency

Energy Required/	Energy Consumed	= HSSE
331 E+06 /	513.8 E+06 /	64.5%

HEAT LOSS COEFFICIENTS After Walls Insulated

Building Section	U-Value (BTU/hr-sf-F)	Area (sf)		UA-Value (BTU/hr-F)
1 Left Top Floor				
Roof	0.17	638		106
Walls-above grade	0.10	987		99
Walls-below grade	0.06	0		0
Doors	0.50	20		10
Windows - w/ storms	0.5	91		46
	Wing UA Total		260.5	
2 Right Top Floor				
Roof	0.08	5704		274
Walls-above grade	0.08	3,290		279
Walls-below grade	0.05	0		0
Doors	0.50	83		42
Windows - w/ storms	0.5	262		131
	Wing UA Total		725.5	
3 Left Bottom Floor				
Roof	0.15	0		0
Walls-above grade	0.11	514		57
Walls-below grade	0.06	1,028		65
Doors	0.50	40		20
Windows - w/ storms	0.5	24		12
				0
	Wing UA Total		154.2	
4 Right Bottom Floor				
Roof	0.15	0		0
Walls-above grade	0.11	2,687		299
Walls-below grade	0.06	2,687		170
Doors	0.50	184		92
Windows - w/ storms	0.5	140		70
	Wing UA Total		630.6	

CONDUCTION LOSSES
After Walls Insulated

#	AREA	UA	HOURS/ DAY	DAYS/ SEASON	TEMP DIFF	LOSSES (* 1E6)	Sub Totals
1	Left Top Floor	261	12	151	35.3	17	
		261	12	151	25.3	12	
		261	24	61	23.3	9	37.5
2	Right Top Floor	725	12	151	35.3	46	
		725	12	151	25.3	33	
		725	24	61	23.3	25	104.4
3	Left Bottom Floor	154	12	151	30.3	8	
		154	12	151	25.3	7	
		154	24	61	23.3	5	20.8
4	Right Bottom Floor	631	8.8	151	20.3	17	
		631	15.2	151	11.3	16	
		631	24	61	10.3	10	**42.9**
					Conduction Total		205.6

HEAT LOADS AFTER WALLS INSULATED

GAINS AND LOSSES	BTU/HEATING SEASON*1E6		
CONDUCTION LOSSES	-205.6		
INFILTRATION LOSSES	-109.4		
VENTILATION LOSSES	-62.6		
		-377.6	
	Baseline Value:	/500.8 =	0.754
	Load Reduction:	0.246	
		24.6%	

HEAT LOSS COEFFICIENTS After Walls & Roof Insulated

Building Section	U-Value (BTU/hr-sf-F)	Area (sf)	UA-Value (BTU/hr-F)
1 Left Top Floor			
Roof	0.04	638	28
Walls-above grade	0.10	987	99
Walls-below grade	0.06	0	0
Doors	0.50	20	10
Windows - w/ storms	0.5	91	46
	Wing UA Total		181.9
2 Right Top Floor			
Roof	0.04	5704	143
Walls-above grade	0.08	3,290	279
Walls-below grade	0.05	0	0
Doors	0.50	83	42
Windows - w/ storms	0.5	262	131
	Wing UA Total		594.4
3 Left Bottom Floor			
Roof	0.15	0	0
Walls-above grade	0.11	514	57
Walls-below grade	0.06	1,028	65
Doors	0.50	40	20
Windows - w/ storms	0.5	24	12
			0
	Wing UA Total		154.2
4 Right Bottom Floor			
Roof	0.15	0	0
Walls-above grade	0.11	2,687	299
Walls-below grade	0.06	2,687	170
Doors	0.50	184	92
Windows - w/ storms	0.5	140	70
	Wing UA Total		630.6

CONDUCTION LOSSES
After Walls & Roof Insulated

# AREA	UA	HOURS/ DAY	DAYS/ SEASON	TEMP DIFF	LOSSES (* 1E6)	Sub Totals
1 Left Top Floor	182	12	151	35.3	12	
	182	12	151	25.3	8	
	182	24	61	23.3	6	26.2
2 Right Top Floor	594	12	151	35.3	38	
	594	12	151	25.3	27	
	594	24	61	23.3	20	85.5
3 Left Bottom Floor	154	12	151	30.3	8	
	154	12	151	25.3	7	
	154	24	61	23.3	5	20.8
4 Right Bottom Floor	631	8.8	151	20.3	17	
	631	15.2	151	11.3	16	
	631	24	61	10.3	10	42.9
				Conduction Total		175.4

HEAT LOADS AFTER ROOF & WALLS INSULATED

GAINS AND LOSSES	BTU/HEATING SEASON*1E6		
CONDUCTION LOSSES	-175.4		
INFILTRATION LOSSES	-109.4		
VENTILATION LOSSES	-62.6		
		-347.3	
	Baseline Value	/500.8	0.693
	Reduction:		0.307
	Reduction %:		30.7%

DESCRIPTIVE INFORMATION
After Controls Improvements

Building Name: 250 Albany Street # of Full-time occupants: 20

Name of wing/area description
1 Left Top Floor
2 Right Top Floor
3 Left Bottom Floor
4 Right Bottom Floor

Temperature Information

Total Htng Days 212
Outdoor Winter Temperature 34.7

	Wing name	Occupied Temp.	Unoccupied Temp. Night	Unoccupied Temp. Weekend	Htg System Occ. Hrs per day		Occ Htg Days
1.	Left Top Floor	70	58	55	12.0	Tu-F:13;Sa: 8	151
2.	Right Top Floor	70	58	55	12.0	Tu-F:13;Sa: 8	151
3.	Left Bottom Floor	65	60	58	12.0	Tu-F:13;Sa: 8	151
4.	Right Bottom Floor	55	46	45	8.8	Tu-F: 9-6;Sat:8-4	151

CONDUCTION LOSSES
After Controls, Walls, Roof

# AREA	UA	HOURS/ DAY	DAYS/ SEASON	TEMP DIFF	LOSSES (* 1E6)	Sub Totals
1 Left Top Floor	193	12	151	35.3	12	
	193	12	151	23.3	8	
	193	24	61	20.3	6	26.2
2 Right Top Floor	594	12	151	35.3	38	
	594	12	151	23.3	25	
	594	24	61	20.3	18	80.8
3 Left Bottom Floor	154	12	151	30.3	8	
	154	12	151	25.3	7	
	154	24	61	23.3	5	20.8
4 Right Bottom Floor	631	8.8	151	20.3	17	
	631	15.2	151	11.3	16	
	631	24	61	10.3	10	42.9
				Conduction Total		170.7

INFILTRATION LOSSES After Controls, Walls, Roof

AREA	VOLUME	ACH	HRS/ DAY	DAYS/ YR	0.018	TEMP DIFF	LOSSES (* 1E6)	Sub Totals
Note Infiltration modeled for occupied period for 2 of 4 zones								
1 Left Top Floor	6,316	0.50	12	151	0.018	23.3	2.4	
	6,316	0.50	24	61	0.018	20.3	1.7	
Occ.	6,316	0.00	12	151	0.018	35.3	0.0	4.1
2 Right Top Floor	56,470	0.50	12	151	0.018	23.3	21.5	
	56,470	0.50	24	61	0.018	20.3	15.1	
Occ.	56,470	0.00	12	151	0.018	35.3	0.0	36.6
3 Left Bottom Floor	4,702	0.50	12	151	0.018	25.3	1.9	
	4,702	0.50	24	61	0.018	23.3	1.4	
Occ.	4,702	**0.50**	12	151	0.018	30.3	2.3	5.7
4 Right Bottom Floor	71,492	0.45	15.2	151	0.018	11.3	15.0	
	71,492	0.45	24	61	0.018	10.3	8.7	
Occ.	71,492	**1.00**	8.8	151	0.018	20.3	34.7	58.5
			Infiltration Total					104.8

HEAT LOADS AFTER CONTROLS (& Wall & Roof Insulation)

GAINS AND LOSSES	BTU/HEATING SEASON*1E6	
CONDUCTION LOSSES	-170.7	
INFILTRATION LOSSES	-104.8	
VENTILATION LOSSES	-62.6	
		-338.1

Baseline Value:	/500.8	0.675
Reduction:		0.325
Reduction Percent:		32.5%

VENTILATION LOSSES

#	Area Name	CFM	1.08	HOURS/ DAY	DAYS/ SEASON	TEMP DIFF	LOSSES (* 1E6)
1	Left Top Floor	200	1.08	12	151	35.3	13.8
2	Right Top Floor	706	1.08	12	151	35.3	48.8
3	Left Bottom Floor		1.08	12	151	30.3	0.0
4	Right Bottom Floor		1.08	8.8	151	20.3	0.0
					Ventilation Total:		62.6

		TABLE 1:	CURRENT ENERGY CONSUMPTION AND COST			
	Through Nov			250 Albany Street Left		
Ref Year:	2003	Main Account	Meter #		Main Account	
	Customer ID:	29978923	01289397		29978923	
MONTH/YR	Elec Cust charge	Electrical Consumption KWH	Elec. Cost $	Metered Demand KW	Billed Elec Demand KW	Demand Cost $
Dec-02	$32	4,290	$405	15.2	13.0	$124
Jan-03	$32	4,813	$400	15.4	13.5	$129
Feb-03	$32	5,043	$332	16.8	15.0	$143
Mar-02	$32	4,700	$310	16.7	14.5	$138
Apr-03	$32	5,117	$337	26.0	24.0	$229
May-03	$32	4,106	$271	22.9	21.0	$200
Jun-03	$32	5,077	$335	25.2	23.0	$219
Jul-03	$32	8,184	$539	29.7	27.5	$262
Aug-03	$32	8,630	$569	31.3	29.5	$281
Sep-03	$32	5,684	$375	25.9	24.0	$229
Oct-03	$32	4,394	$290	24.6	22.5	$214
Nov-03	$32	4,441	$293	20.2	18.0	$172
TOTALS	$319	64,479	$3,649		245.5	$2,340

Outdoor Lighting S1 rate

Electrical Consumption KWH	Cost $	Gas Consumption CCF	Cost $	Total $ Energy Costs
673	$88	701	$679	$1,327
660	$88	864	$880	$1,529
556	$88	1,103	$1,181	$1,776
554	$88	958	$1,143	$1,711
472	$88	300	$426	$1,112
427	$88	106	$153	$743
382	$88	14	$29	$702
410	$88	9	$24	$945
458	$88	9	$24	$993
509	$88	9	$25	$748
591	$88	38	$55	$679
629	$88	207	$233	$818
6,322	$1,056	4,318	$4,850	$13,082

TABLE 2: CURRENT ENERGY CONSUMPTION AND COST

250 Albany Street Right - Eileens'

Ref Year: Through Nov 2003

Customer ID: 34134817

MONTH/YR	Electrical Consumption KWH	Billed Elec Demand KW	Total Elect Cost $	Gas Consumption CCF	Cost $	Total $ Energy Costs
Dec-02	791	4.2	$102	128	$135	$135
Jan-03	845	4.0	$106	134	$147	$147
Feb-03	855	3.9	$107	154	$174	$174
Mar-02	804	3.8	$104	157	$194	$194
Apr-03	918	5.3	$126	110	$159	$159
May-03	803	5.0	$113	93	$125	$125
Jun-03	1,176	5.7	$143	77	$91	$91
Jul-03	1,559	6.2	$173	61	$75	$75
Aug-03	1,685	6.2	$181	57	$71	$71
Sep-03	1,052	5.8	$139	65	$79	$79
Oct-03	962	5.5	$129	63	$77	$77
Nov-03	906	4.4	$115	71	$87	$87
TOTALS	12,356	60.0	$1,538	1170	$1,413	$1,413

APPENDIX I – LIGHTING SAVINGS CALCULATIONS

ECM DETAIL SHEET

Building: 250 Albany Street, Springfield

1. NAME OF MEASURE: Lighting Fixture Improvements

2. TYPE OF MEASURE: __ Envelope _X Lighting __ Mechanical
__ DHW __ Renewable __ Other:________

3. ESTIMATED TOTAL PROJECT IMPLEMENTATION COST: $3,899
(incl. design services, acquisition, installation, & other costs.
Detailed breakout of costs & specific sources attached.)
Plus Disposal Costs: $4,039

4. ESTIMATED ENERGY/COST SAVINGS:

Fuel Types	Annual Fuel Savings	Units	Annual Energy Savings (MBTUs)	First Year Energy Cost Savings ($)
El. Cons.	8,600	KWH	29,353	$946
Elec. Demand	32	KW		Combined
		TOTALS:	29,353	$946

5. SIMPLE PAYBACK PERIOD:

TOTAL PROJECT COST /	FIRST YEAR ENERGY COST SAVINGS =	PAYBACK (YEARS)
$3,899	$946	4.1
$4,039	$946	4.3

6. Estimated useful life of this project: 10 + years

7. Estimated increase/decrease (+/-) in operating or maintenance costs due to measure: NA

8. Estimated salvage value (+) or disposal cost (-) of the measure at end of useful life: NA

9. Would the implementation of this project require preparation of an environmental notification form, pursuant to Massachusetts General Law Chapter 30, Section 61 through 62H? [ ] Yes [X] No

Calculations:

Electronic Ballasts and T-8 Lamps:

Two-lamp 8-foot T12 fixtures shall be converted to use four 4-foot T8 lamps. Four lamp electronic ballasts shall power the 4 T8 lamps.

	Watts
Wattage draw for a 4-lamp instant start ballast operating 4 32 watt lamps:	112
Wattage per existing 8 foot 2-lamp fixture operating on a magnetic ballast	133
Wattage per 23 watt compact fluorescent, including ballast requirements	25
Wattage per 15 watt compact fluorescent, including ballast requirements	17

LIGHTING SCHEDULE:

AREA	# of Fixtures	Original Watts/fix	Original KW	New Fixtures	New Watts/fix	New KW
Convert standard 8-foot fluorescents to 4-foot fluorescents with T-8 lamps and electronic ballasts. In one office, Denise's office, convert a 4-lamp standard fixture to use T8 lamps and an electonic ballast:						
Office Cubicle Area	15	133.0	1.995	15	112.0	1.680
Office 1 Cat Jakus	2	133.0	0.266	2	112.0	0.224
Office 2	2	133.0	0.266	2	112.0	0.224
Office 3 Habitat	2	133.0	0.266	2	112.0	0.224
Meadowbrook Lane:						
Denise's Office	3	149.0	0.447	3	112.0	0.336
Joe's Office	Lts not used	149.0	0.000	Lts not used	112.0	0.000
Salon: (new section)	16	133.0	2.128	16	112.0	1.792
Convert Incandescent Fixtures to Compact Fluorescent Fixtures:						
Track Lighting:						
Main Entrance	2	65.0	0.130	2	17.0	0.034
Salon (old section)	17	65.0	1.105	17	25.0	0.425
Food Bar Area	1	120.0	0.120	1	25.0	0.025
Back Area	3	65.0	0.195	3	25.0	0.075
Styling Area	15	65.0	0.975	15	25.0	0.375
SUMS:	78		7.893	78		5.414

AREA	# of Fixtures	Original Watts/fix	Original KW	New Fixtures	New Watts/fix	New KW
Convert Other Incandescents to Compact Fluorescents:						
Lav 1 Hanging Fixture	1	60.0	0.060	1	25.0	0.025
Old Salon Ceiling Mt	3	65.0	0.195	3	25.0	0.075
Food Bar Pendant	1	65.0	0.065	1	25.0	0.025
	5		0.320	5		0.125

AREA	KW Saved	Hours In Use	KWH Saved	Mean $/KWH	$
Convert standard 8-foot fluorescents to 4-foot fluorescents with T-8 lamps and electronic ballasts.					
Office Cubicle Area	0.315	2080	655	$0.110	$72
Office 1 Cat Jakus	0.042	1248	52	$0.110	$6
Office 2	0.042	1248	52	$0.110	$6
Office 3 Habitat	0.042	1248	52	$0.110	$6
Meadowbrook Lane:					
Denise's Office	0.111	2080	231	$0.110	$25
Joe's Office	0.000	400	0	$0.110	$0
Salon: (new section)	0.336	3600	1,210	$0.110	$133
Convert Incandescent Fixtures to Compact Fluorescent Fixtures:					
Track Lighting:					
Main Entrance	0.096	3600	346	$0.110	$38
Salon (old section)	0.680	3600	2,448	$0.110	$269
Food Bar Area	0.095	3600	342	$0.110	$38
Back Area	0.120	3600	432	$0.110	$48
Styling Area	0.600	3600	2,160	$0.110	$238
Convert Other Incandescents to Compact Fluorescents:					
Lav 1 Hanging Fixture	0.035	1248	44	$0.110	$5
Old Salon Ceiling Mt	0.120	3600	432	$0.110	$48
Food Bar Pendant	0.040	3600	144	$0.110	$16
	2.7		8,600		$946
	12	Months/yr			
	32.1				

Estimated Cost:

	#	$/unit	Materials
4-lamp electronic ballasts	40	$17.59	$704
T-8 lamps	160	$2.26	$361
Installation Labor	40	$16.00	$640
	Cost per fixture: (incl: O&P)	$51.14	
Compact Fluorescent Lamps:			
For Track Lights, reflector, frosted lens:			
23 watt	39	$24.47	$954
Installation	39	$5.00	$195
	Cost per fixture:	$35.36	
15 watt	2	$21.83	$44
Installation	2	$5.00	$10
	Cost per fixture: (incl: O&P)	$32.20	
Twist bulbs:			
15 watt	2	$18.19	$36
Installation	2	$5.00	$10
	Cost per fixture: (incl: O&P)	$27.82	
			$2,954
			$591
	$3,545		$3,545
	$354		$354
	$3,899		$3,899

Compact Fluorescents:
Hampden-Zimmermann
274 Taylor St.
Springfield, MA
413-734-6407, Clint

T-8 Lamps & Ballasts:
CLS
338 Memorial Avenue
Springfield, MA 01089
Voice: 800-704-5483

	20	5	$100
	LF		
	160	0.25	$40
Disposal Subtotal:			$140
Grand Total:		$4,039	

Payback:

	Cost	/Savings	Payback
Without disposal	$3,899	$946	4.1
Incl. Disposal	$4,039	$946	4.3

APPENDIX J – ASSESSOR'S RECORDS

00160-0 Q1101

PROPERTY ADDRESS 250 ALBANY ST 346

PAVED PUB ROLLING CURB&GUT

BRIEF DESCRIPTION

ST CLASS 316

LAND DATA & COMPUTATIONS

	ACTUAL FRONTAGE	EFFECTIVE FRONTAGE	EFFECTIVE DEPTH	DEPTH FACTOR	ACTUAL UNIT PRICE	EFFECTIVE UNIT PRICE	FRONTAGE RATE	INFLUENCE FACTOR	LOT VALUE
"86"	49786	SQ FT							
PRIMARY	~~1.56~~	~~ACRE~~			~~20000~~				31200

TOTAL LAND VALUE 31200

DWELLING DATA & COMPUTATIONS

STORY HEIGHT/ATTIC		
GROUND FLOOR AREA		
EXTERIOR WALLS		
ADJUSTED BASE		
BASEMENT		
HEAT & A/C		
PLUMBING	FIXTURES	
EXTERIOR TRIM		
RECROOM		
FIN BSMT LIVING AREA		
WBFP/WOOD BURNER (CENTRAL)		
BASEMENT GARAGE		
UNFIN AREA		
SUBTOTAL		
GRADE		
C&D FACTOR		
RCN		
PERCENT GOOD		
TOTAL DWELLING VALUE		

OTHER BUILDINGS & YARD

QTY	CSN	YR	SIZE	AREA	GRD	RATE	COND	MOD CD	RCN	

TOTAL OB & Y

MEMORANDUM

1986-12,050# assessed as:
270 Albany St. Par. 62
1986-6153# assessed as:
Rear 270 Albany St. Par. 63
1985- Petition for Partition
Reassessed for "FY 86"

NARRATIVE

ADDITIONS

ID	LL	1	2	3	AREA	PTS

TOTAL

ENTRANCE CODE 0 CALLS
LIST

APPR COST VAL 85900
MKT VAL 124100
RSN=0 12/09/82 CST

CITY OF SPRINGFIELD, MA.

SALES DATA

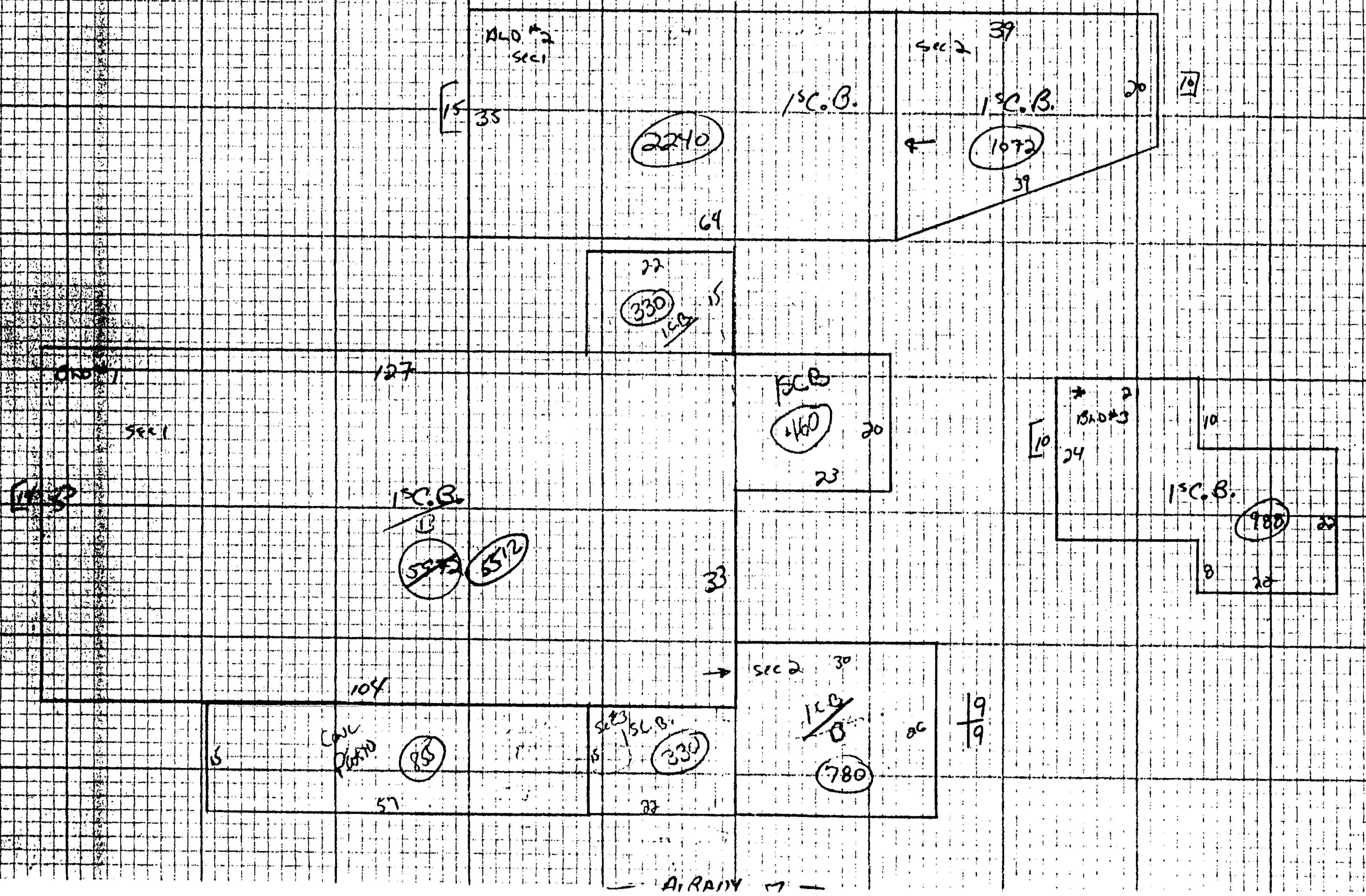
VALUES	OLD	APPRAISAL	CURRENT ASSMT	VALUE
LAND	27190	31200	24,700	
BLDG	42500	72900	76,490	
TOTAL	69690	124100	101,190	

250 Albany St. 160-60

ACCT. NO.	RECORD OF OWNER AND ADDRESS	REVENUE STAMPS	BOOK	PAGE	DATE
954690	Wheeler, Donald R. WD	171.00	5481	376	8-11-83
	250 Albany St.				
	(12,050# assessed as 270 Albany St. Par. 62) Bousquet, Kenneth and Joseph Hetzel	68.40	5546	181	12-20-83
	(6,153# Assessed as Rear 270 Albany St. Par. 63) Bousquet, Kenneth and Joseph Hetzel	9.12	5575	221	3-1-84
833346	Sibilia, Emilio + Shirley WD TE Reassessed for "FY86"	218.88	5699	466	10-15-84
	141 Sweet Fern Dr. West Spfld. Ma.				
	STRPAR 00160-0060-2 DATE 111286 BOOK 6286 PAGE 0526 W.D.-J.T.				
833384	GRANTEE SIBILIA EMILIO J SR & EMILIO J JR P.O. Box 4596	—			
	STRPAR 00160-0060-3 DATE 121792 BOOK 8278 PAGE 0436 WD JT	—			
	GRANTEE SIBILIA EMILIO J SR & SHIRLEY A + Theodore				
833330	Sibilia, Emilio J. Jr. + Emilio J. Sr. + Shirley A + Theodore		—		1994
	P.O. Box 4596 01101				
	STRPAR 00160-0060-4 DATE 012993 BOOK 8324 PAGE 0417 WD				
833330	GRANTEE SIBILIA EMILIO J JR				
	11 Meadowbrook Lane Hampden, Ma 01036				

* COUGHLIN AUTOBODY BLD#

Bldg #2 Assessed on 270 Albany St. Par. 62



01036

ST. CLASS 390

LAND DATA & COMPUTATIONS

ACTUAL FRONTAGE	EFFECTIVE FRONTAGE	DEPTH	DEPTH FACTOR	UNIT PRICE	EFFECTIVE UNIT PRICE	RATE	INFLUENCE FACTOR	LOT VALUE
~~Pdm~~	6153							

TOTAL LAND VALUE

DWELLING DATA & COMPUTATIONS

FIXTURES

OTHER BUILDINGS & YARD ITEMS

QTY	CSN	YR	SIZE	AREA	GRD	RATE	COND	MOD CD	RCN

TOTAL OB & Y

TOTAL OTHER IMPROVEMENT

PROPERTY ADDRESS: REAR 270 ALBANY ST. — —

MEMORANDUM

1986 - Bought of Donald R. Wheeler
1985 - Assessed with:
250 Albany St. Par. 60 (1.56 Ac.)
1985 - Petition for Partition

86 — 6100

NARRATIVE

ADDITIONS

ID	LL	1	2	3	AREA	PTS

TOTAL

ENTRANCE CODE | CALLS | LIST

APPR

CITY OF SPRINGFIELD, MA.

SALES DATA

VALUES	OLD	APPRAISAL	CURRENT ASSMT.	VALUE SFLA
LAND		3,050		
BLDG		0		
TOTAL		3,050		

270 Albany St. 160-62

T. NO.	RECORD OF OWNER AND ADDRESS	REVENUE STAMPS	BOOK	PAGE	DATE
		Omitted in Copying til "FY 86"			
	Bousquet, Kenneth and Joseph Hetzel QC TC	68.40	5546	181	12-20-83
	Bousquet, Kenneth WD	15.96	5593	418	3-23-84
573	Bousquet, Gary H. WD	285.00	5654	123	7-20-84
	270 Albany St.				
	Springfield, City of 1990 TAX TAKING	—	8185	296	9-30-92
	1990 Tax Redemption	—	9224	84	8-23-95
573	Bousquet, Gary H.				1994
	270 Albany Street				
30	STRPAR 00160-0062-0 DATE 062695 BOOK 9165 PAGE 0570 WD	547.20			
	GRANTEE SIBILIA EMILIO J JR				
	11 Meadowbrook Ln Hampden 01036				

210 ALBANY ST.

316

LAND DATA & COMPUTATIONS

ACTUAL FRONTAGE	EFFECTIVE FRONTAGE	EFFECTIVE DEPTH	DEPTH FACTOR	ACTUAL UNIT PRICE	EFFECTIVE UNIT PRICE	FRONTAGE RATE	INFLUENCE FACTOR	LOT VALUE
Prim	12,050							

TOTAL LAND VALUE

DWELLING DATA & COMPUTATIONS

STORY HEIGHT/ATTIC
GROUND FLOOR AREA
EXTERIOR WALLS
ADJUSTED BASE
BASEMENT
HEAT & A/C
PLUMBING
FIXTURES
SUBTOTAL
GRADE
C & D FACTOR
RCN
PERCENT GOOD
TOTAL DWELLING VALUE

OTHER BUILDINGS & YARD

QTY	CSN	YR	SIZE	AREA	GRD	RATE	COND	MOD CD	RCN

TOTAL OB & Y

TOTAL OTHER IMPROVEMENT

MEMORANDUM

1986 - Bought of Donald R. Wheeler
1985 - Assessed with:
250 Albany St. Par. 60 (1.56 Ac.)
1985 - Petition for Partition
1990 - June Assessment - Additional - $5[illegible].32
1992 - WATER LIEN 247.43 ABATED 8-21-92 (16[illegible]B)
1992 SEWER LIEN 247.43. ABATED 8-21-92 - (1680[illegible])

NARRATIVE

ADDITIONS

ID	LL	1	2	3	AREA	PTS

TOTAL

ENTRANCE CODE
LIST
APPR

CITY OF SPRINGFIELD, MA.

SALES DATA

VALUES	OLD	APPRAISAL	CURRENT	VALUE SFLA
LAND		6,000		
BLDG		24,000		
TOTAL		30,000		

Rear 270 Albany St.

160-63

NO.	RECORD OF OWNER AND ADDRESS	REVENUE STAMPS	BOOK	PAGE	DATE
	Bousquet, Kenneth and Joseph Hetzel QC TC	9.12	5575	221	3-1-84
	Bousquet, Kenneth WD	—	5583	418	3-23-84
4573	Bousquet, Gary H. WD	—	5654	123	7-20-84
	270 Albany St.				
	1990 TAX TAKING	—	8185	297	9-30-92
	Springfield, City of 1990 Tax Redemption	—	9224	62	8-23-95
4573	Bousquet Gary H.				1994
	270 Albany Street				
330	STRPAR 00160-0063-0 DATE 062695 BOOK 9165 PAGE 0570 WD	—			
	GRANTEE SIBILIA EMILIO J JR				
	11 Meadowbrook Ln Hampden 01036				

APPENDIX K – UNITED INDUSTRIAL SERVICES PROPOSAL

UNITED
INDUSTRIAL
SERVICES
DIVISION OF UNITED OIL RECOVERY INC.

EST MAIN STREET
. BOX 902 MERIDEN CT 06450-0902
LEPHONE (203) 238-6745

n Equal Opportunity Employer"

lay 27, 2003

ls. Constance Finnegan
asoline Alley Foundation, Inc.
50 Albany Street
pringfield, MA 01105

S20030523RV1 - Revised
Site: Albany Street Springfield, MA

ear Ms. Finnegan:

nited Industrial Services is pleased to present the following proposal to provide labor, equipment and materials to package, ansport and dispose of various waste materials located at the above address.

ımp contents of one 1,000 gallon and one 275 gallon above ground # 2 fuel oil tank, cut access hold into tanks, remove sludge, ash and remove tanks as scrap. United will also sweep up and drum speedy dry/ sludge under tank for disposal.

ıbor, Equipment and Materials:	$3,350.00	
isposal of # 2 Fuel Oil/ Water Mixture: ıcludes up to 3% pumpable sludge/sediment)	$0.38/ gallon (approximately 1,000 gallons)	$380.00

<u>nsportation and Disposal of Drums/ Pails:</u>

5 gallon pail of Texaco Lube Oil	$35.00 each	
vo 5 gallon pails of Latex Paint	$50.00 each	$100.00
ıe 5 gallon pail of Latex Solids	$50.00 each	
ıe 5 gallon pail of Non Hazardous Pellets	$50.00 each	
ıe 55 gallon drum of Naptha	$125.00/ drum	
ıe 55 gallon drum of Waste Oil (non hazardous)	$75.00/ drum	
vo 55 gallon drums of Carbon	$150.00/ drum	$300.00
ıe 55 gallon drum of Corrosive Solids	$275.00/ drum	
ıe 55 gallon drum of Oily Solids (from under the tank)	$150.00/ drum	
vo 55 gallon drums of Apple Concentrate (non hazardous)	$125.00/ drum	$250.00
ıe 55 gallon drum of Carbon/Spill Debris	$150.00/ drum	

ansportation:	$100.00 Stop fee, includes one free hour on site		$100.00
murrage:	$80.00/ hour, thereafter		
anifest:	$12.00 each (2)		$24.00
ass Transporter Fee:	$0.182/ gallon or $0.0182/ pound (if applicable)	(Estimated)	$230.00
% Insurance Surcharge:		(Estimated)	$221.00

tal Estimated Project Cost: $5,865.00

<u>mments</u>

All pricing is strictly budgetary until sample has been confirmed and signed profiles received and approved.
All pricing is contingent on facility review and acceptance of material.
Pricing is based on the material being received at our facilities matching the description provided on the waste stream profile sheet. Off-specification charges may result if analytical and/or material is not representative of approved profile.
nless otherwise noted, all pricing is before any applicable tax(es) or fee(s).
Minimum load charges may apply.
United activities are in accordance with all applicable federal, state and local regulations.
If additional analytical is required, pricing will be on a case by case basis.

?omments, cont.

- All drums must be nonleaking, free of exterior residue and in DOT shippable condition.
- Multi service discounts may apply.
- Surcharges for fuel or insurance may apply.

?redit Terms

Net thirty (30) days from invoice date with 1.5% finance charge per month on any overdue invoicing. In the event of default of hese payment terms, the client will be responsible for all collection costs and attorney's fees. Credit Terms are subject to credit ipproval.

?hank you, Ms. Finnegan, for the opportunity to be of service to you. If you have any questions about any of our services or vould like to schedule, please call your Account Coordinators, Stacy or Elizabeth, at (888) 276-0886.

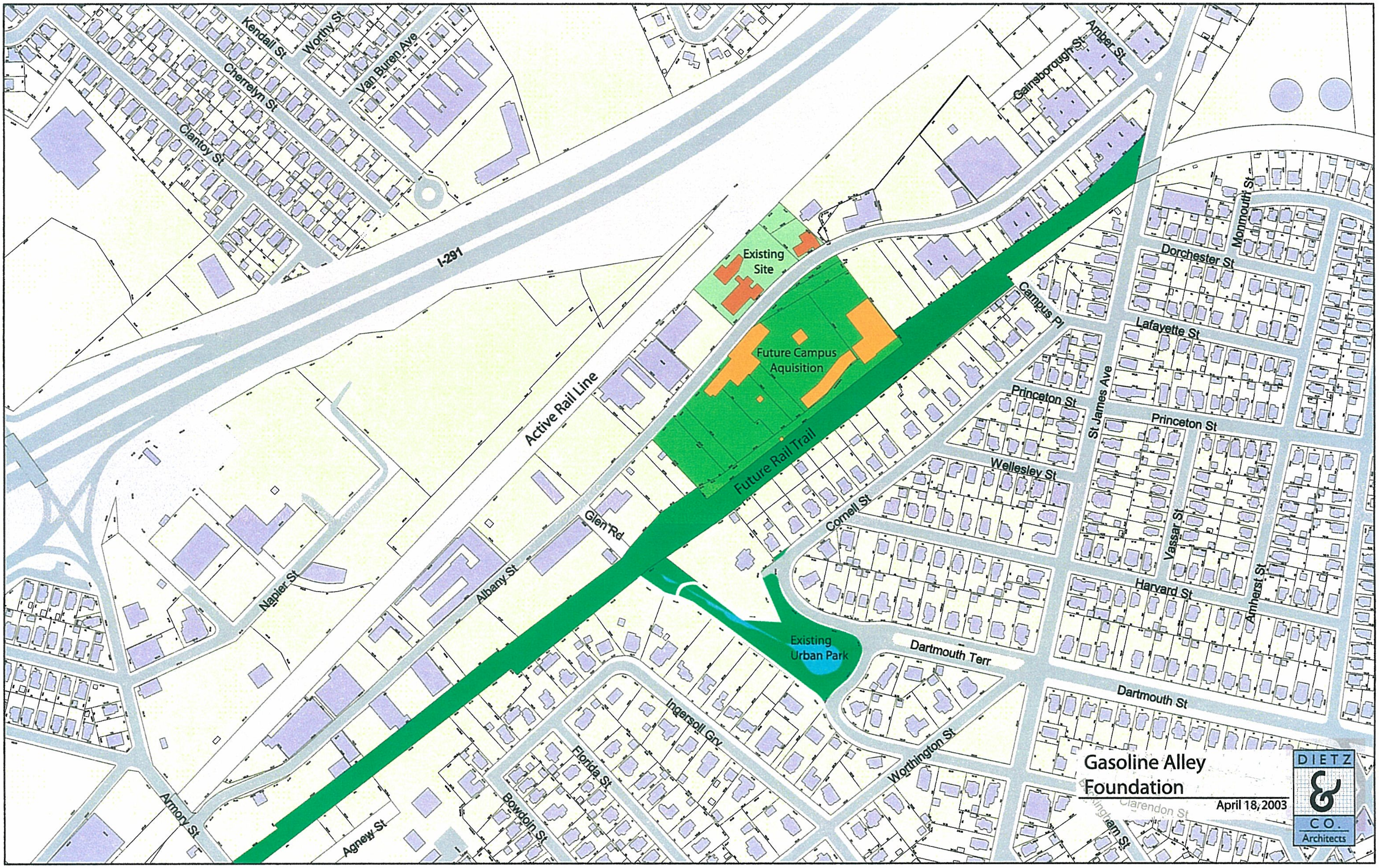
Sincerely,

Richard Vovcsko

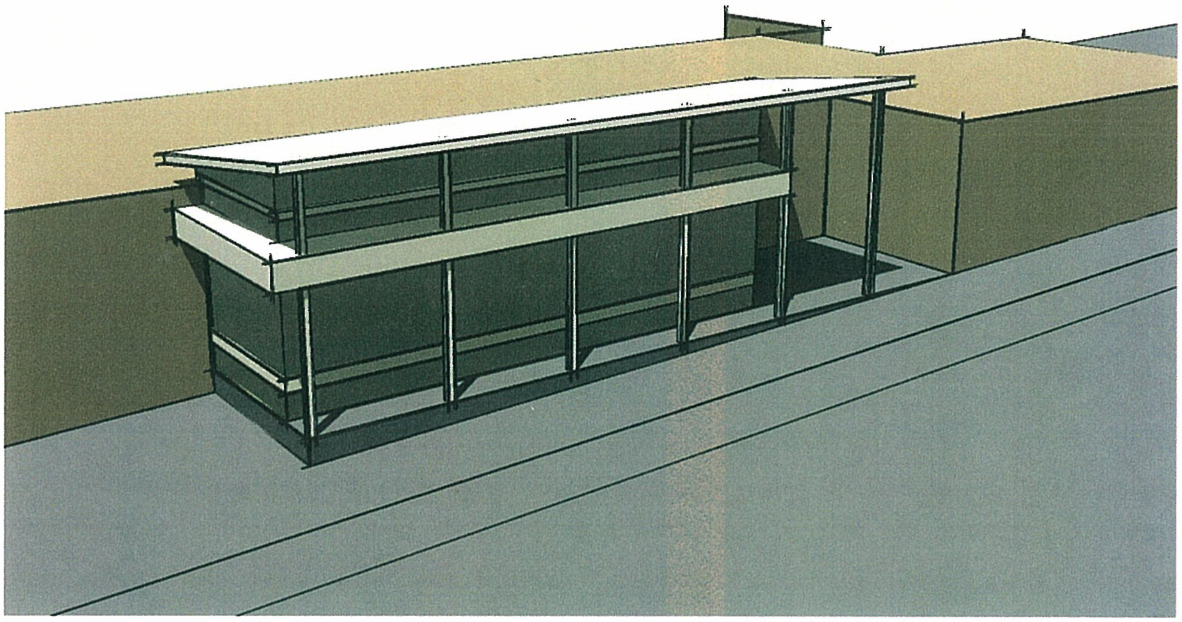
Richard S. Vovcsko
Senior Engineer
Sales and Marketing

RSV/srm

APPENDIX L – SITE PHOTOGRAPHS


Gasoline Alley
Foundation
April 18, 2003
DIETZ & CO. Architects
Existing Site
Future Campus Aquisition
Future Rail Trail
Existing Urban Park
Active Rail Line
I-291
Kendall St
Worthy St
Van Buren Ave
Cherrelyn St
Clantoy St
Gainsborough St
Amber St
Monmouth St
Dorchester St
Lafayette St
Campus Pl
Princeton St
St James Ave
Wellesley St
Vassar St
Harvard St
Amherst St
Cornell St
Glen Rd
Albany St
Napier St
Dartmouth Terr
Dartmouth St
Ingersoll Grv
Florida St
Bowdoin St
Worthington St
Armory St
Agnew St
Clarendon St
Buckingham St

birds eye.jpg (1100x728x24b jpeg)



Gasoline Alley Stormwater Analysis

		Monthly Rainfall (inches)											
Location		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Amherst		3.3	2.9	3.6	3.5	3.7	3.7	4.1	4.1	3.8	3.4	3.6	3.4
Holyoke		3.3	3.1	3.8	3.7	3.7	3.8	3.8	3.9	3.8	3.4	3.7	3.5
Ludlow		3.4	3.1	3.6	3.4	3.8	3.8	4.1	4.1	3.8	3.5	3.7	3.5
Average		3.3	3.0	3.7	3.5	3.8	3.8	4.0	4.0	3.8	3.4	3.6	3.5
		Estimated Monthly Rainfall Volumes (cubic feet)											
Building Areas	**Sq ft**	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
ReStore	3285	909	827	1002	969	1029	1034	1092	1095	1034	934	997	955
Greenhouse	768	212	193	234	227	241	242	255.4	256	242	218	233	223
250 Albany Street Main Building (estimated)	6800	1881	1712	2074	2006	2129	2141	2261	2267	2141	1933	2063	1977
Total Roof Area	10853												
		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Estimated Collection Volume (cubic feet)		3002	2732	3310	3201	3398	3417	3609	3617	3417	3084	3293	3155
Estimated Collection Volume (gal)		22214	20216	24492	23686	25146	25283	26707	26769	25283	22824	24367	23350
Average Daily Volume by Month (gal)		740	674	816	790	838	843	890	892	843	761	812	778
Yearly Average Daily Volume (gal)	**807**												

street at main bldg 2.jpg (1600x1200x24b jpeg)

front door - main bldg.jpg (1600x1200x24b jpeg)

street elev3.jpg (1600x1200x24b jpeg)

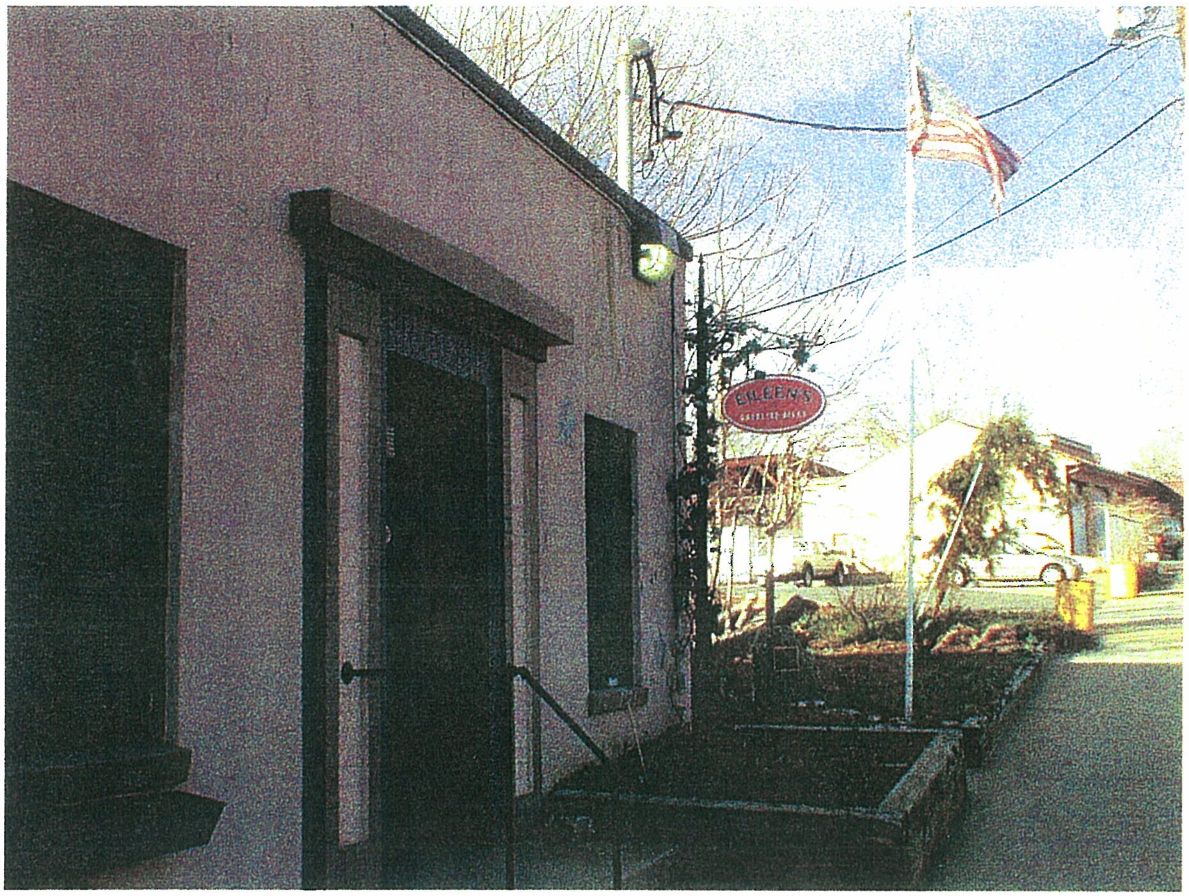
area between front & rear bldgs (1600x1200x24b jpeg)

dscn0003.jpg (1600x1200x24b jpeg)

boiler room.jpg (1600x1200x24b jpeg)

main bldg - front.jpg (1600x1200x24b jpeg)

front door - main bldg 2.jpg (1600x1200x24b jpeg)

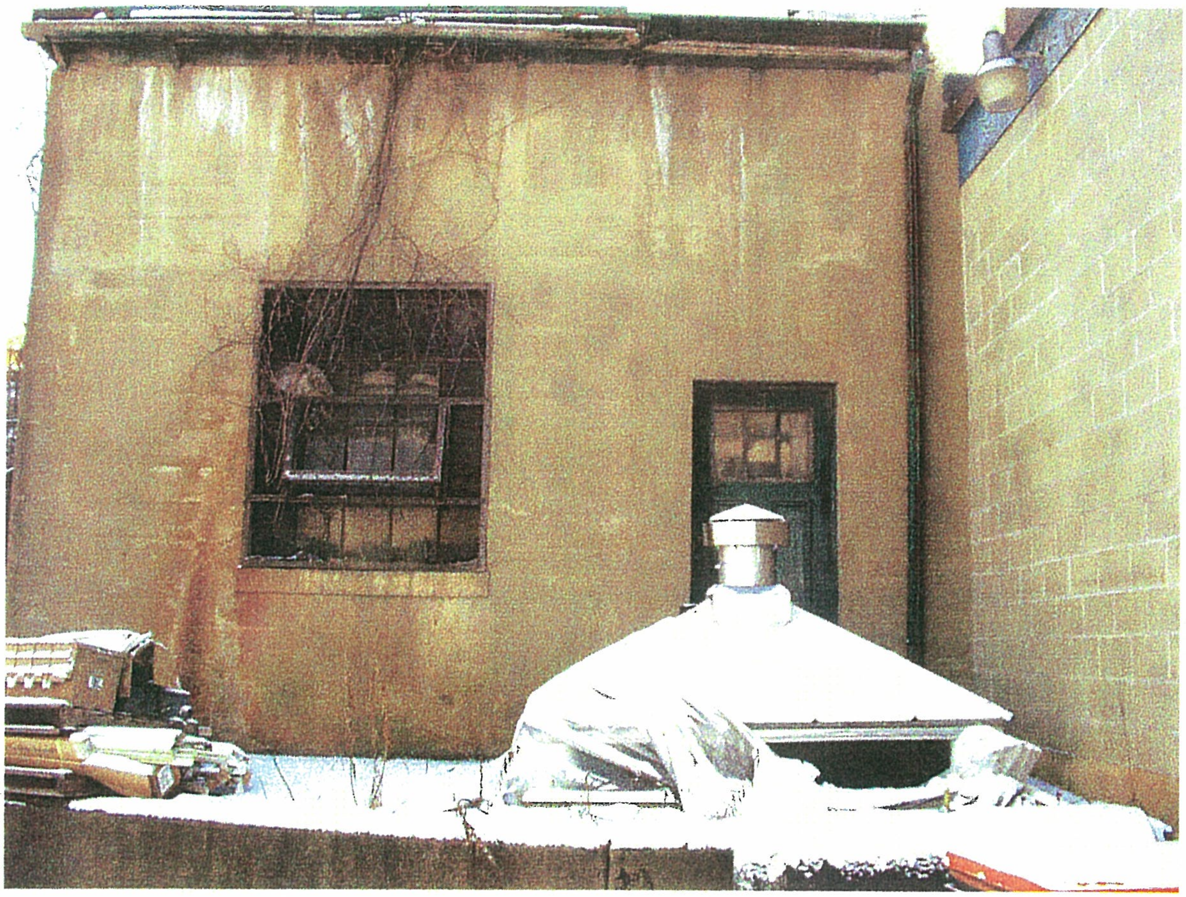


street at main bldg.jpg (1600x1200x24b jpeg)

side of main bldg1.jpg (1600x1200x24b jpeg)

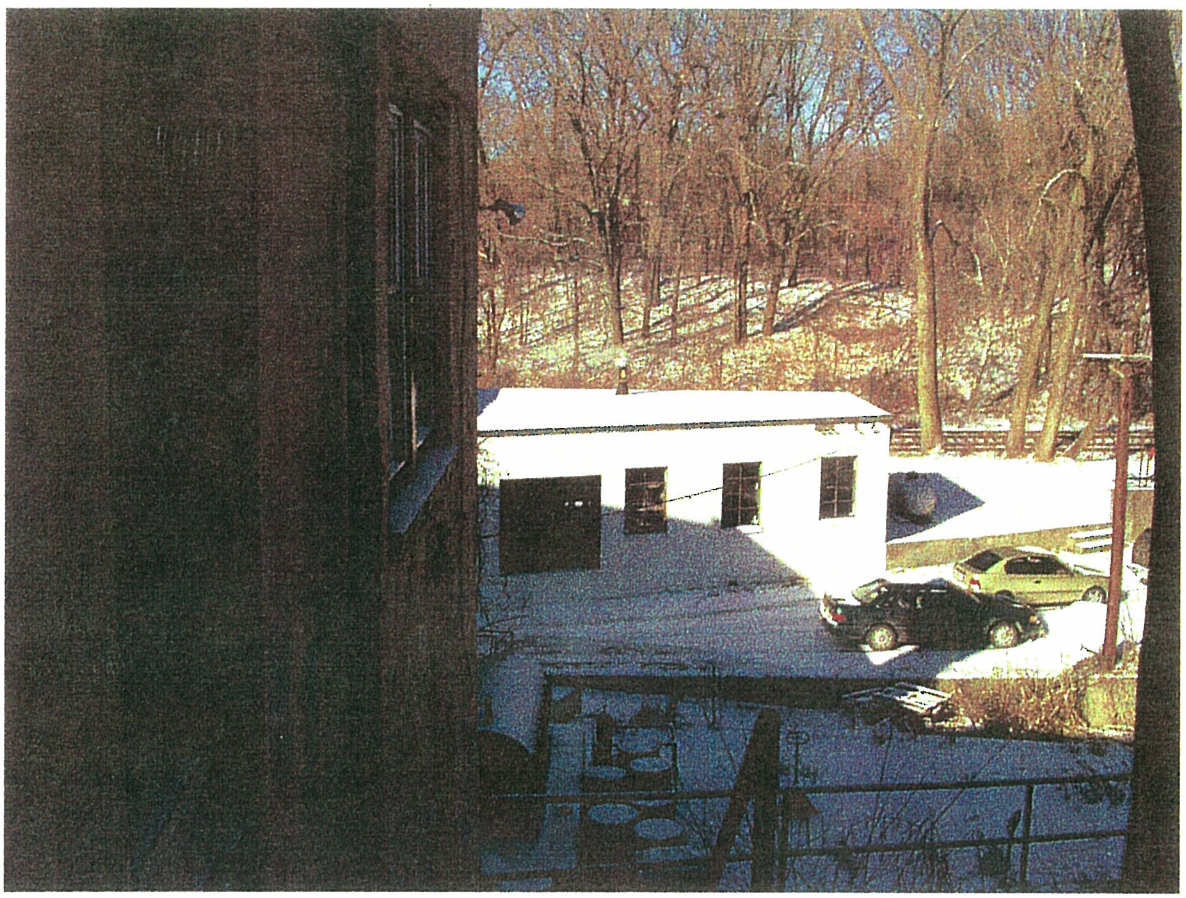
rear of front bldg2.jpg (1600x1200x24b jpeg)

boiler room2.jpg (1600x1200x24b jpeg)



rear of front bldg - ne.jpg (1600x1200x24b jpeg)

rear bldg from street.jpg (1600x1200x24b jpeg)

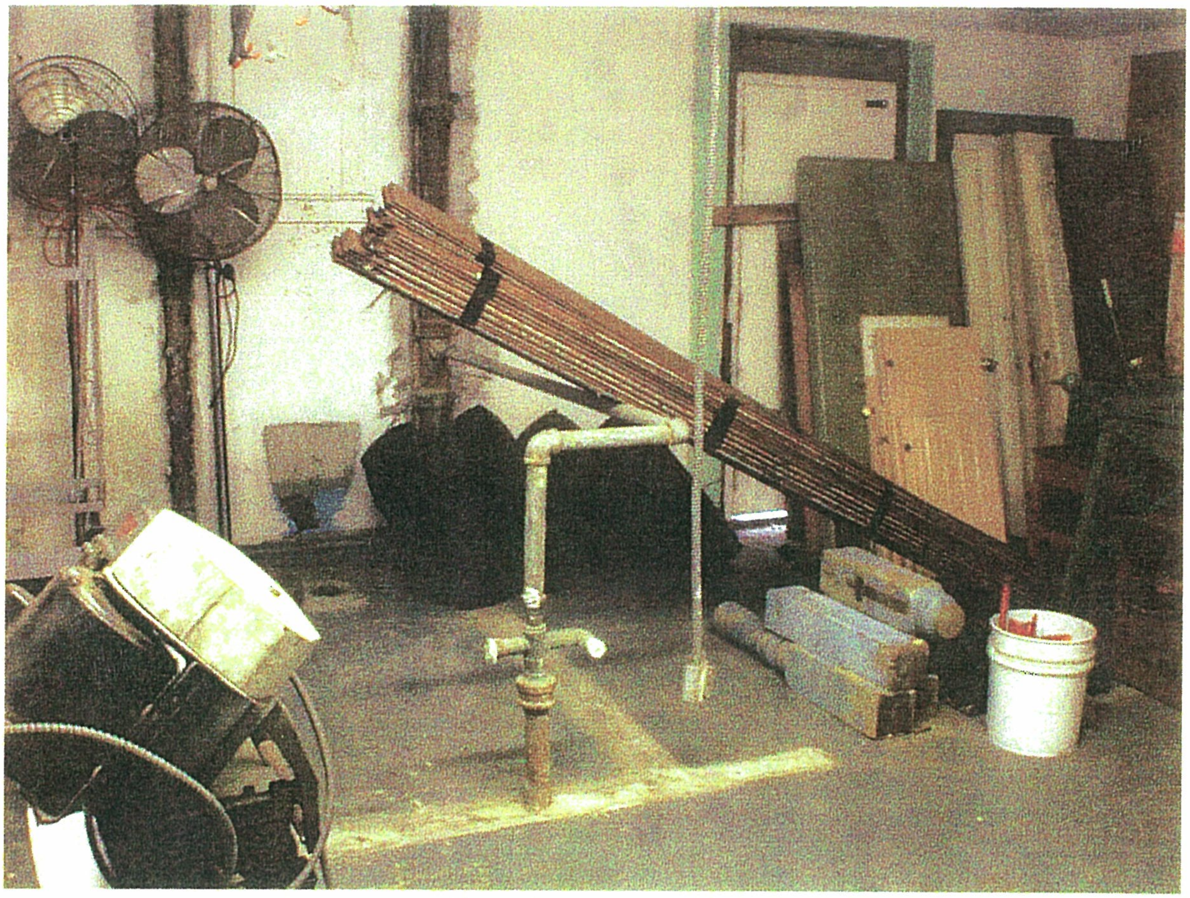


ne side of main bldg.jpg (1600x1200x24b jpeg)

front of 270 albany.jpg (1600x1200x24b jpeg)

side of 270.jpg (1600x1200x24b jpeg)

interior of 270 4.jpg (1600x1200x24b jpeg)



interior of 270.jpg (1600x1200x24b jpeg)

across albany street.jpg (1600x1200x24b jpeg)

adjacent site.jpg (1600x1200x24b jpeg)

dscn0006.jpg (1600x1200x24b jpeg)

dscn0008.jpg (1600x1200x24b jpeg)