AGRICULTURAL ENERGY MANAGEMENT PLAN

CARTER HILL ORCHARD

September, 2010

Client Contact Information

Name:	Mr. Robert Larocque
Address:	73 Carter Hill Road
	Concord, NH 03303
Phone:	(603) 225-2625
Total Acres of Plan:	60

Auditor Contact Information

Name:	Mr. Matthew Siska
Address:	1181 Elm Street, Suite 205
	Manchester, NH 03031
Company:	GDS Associates, Inc.
Phone:	(603) 656-0336

Producer Signature: _____ Date: _____

Auditor Signature: _____ Date: _____

NRCS Signature: _____ Date: _____

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APPENDICES

1. Introduction

This Agricultural Energy Management Plan (Ag EMP) was developed for Carter Hill Orchard on behalf of the Southern NH RC&D Area Council's NH Farm Energy Initiative. The intent of this energy management plan is to provide a strategy by which Carter Hill Orchard can clearly understand how energy is utilized on the farm, what opportunities may be available to reduce energy consumption in a cost-effective manner, and to respond to specific producer concerns.

An on-site inspection of the farm was conducted on August 2, 2010 by Matthew Siska and Drew Trafton of GDS Associates, Inc and Ralph Draper, Professor of Engineering Technology at the University of New Hampshire. Rob Larocque also attended the site inspection and provided the auditors with an overview of the farm operation including their specific concerns and areas of interest.

This report summarizes the information gathered from the site-inspection and review of utility records. GDS Associates, Inc. is providing the best cost and energy savings estimates available, using vendor quotations for costs where available, and standard engineering calculations to estimate energy savings. All calculations and assumptions are included in the Appendices to this report. The content provided in this report consists of estimations and recommendations for consideration by Carter Hill Orchard based on best practices and the best available data, but in no way guarantee energy savings or performance.

2. Background and Site Information

2.1. Producer Contact Information

Producer:	Carter Hill Orchard
Contacts:	Robert Larocque
Facility Location:	73 Carter Hill Road
	Concord, NH 03303
Mailing Address:	Same
Phone:	(603) 225-2695

2.2. Operation Description

Carter Hill Orchard grows apples, peaches, plums, blueberries and raspberries on 60 acres of land in Concord, NH. Buildings on-site include the farm house, main process building, well housing, and a retail showroom. The main process building is an approximately 50 year-old wooden building that houses the packaging operation, cold storage space, and cider press operation. Apples are harvested in September and October, and cider is produced through April. The retail showroom is operated from August through December only and is used to store and display Orchard products for retail. The farm house, which also serves as the farm

office, is located adjacent to the main process building and the retail shop and was newly constructed several years back. The well housing building is a small wooden structure that houses the well pump and a small amount of stored items but is typically not occupied at any time throughout the year.

Apple Harvest

Fifty-one of the sixty total acres are dedicated to apples. Carter Hill produces between 12,000 to 15,000 bushels of apples per year. All of Carter Hill's apples are harvested in September and October and are either packaged and sold or pressed for cider by Thanksgiving. After Thanksgiving, approximately 1,000 bushels of apples are purchased every two weeks for cider production.

The maximum volume of apples harvested from Carter Hill in any single day is 450 bushels. Typically, the apples are stored outside overnight and sprayed with well water to take advantage of evaporative cooling. The apples are loaded into cold storage the following day.

Cold Storage

Carter Hill operates a single cold storage room from September through April. The existing room is approximately 35-feet wide and 58-feet long, with 14-foot ceilings. The thermal envelope of the cold storage is extremely old and in relatively poor condition. Walls are wood framed, 8-inches thick, with old loose cellulose insulation that has reportedly settled within the wall cavities over the years. The concrete slab floor is not insulated. The ceiling of the cold storage is wood framed with plywood base and insulated with approximately 6-inches of blown cellulose.

At the peak of apple storage, only approximately one-third of cold storage space contains apples. The remainder of the space is comprised of the loading bins (for cider pressing), cider intermediate storage (pre and post pasteurization), shelving for cider storage, and access paths. The entire cold storage area is maintained at approximately 38 degrees F from September through April. Colder temperatures are desirable to Carter Hill but are not achievable in the current configuration. It should be noted that the cold storage is not controlled atmosphere; there are no specific humidity requirements for the apples because they are stored for short durations.

Cooling is accomplished by three, 3.3 HP Tecumseh compressor units. One of the compressors was recently replaced; the other two are 15+ years old. The compressor units are located within the packing/cider mill building and discharge heat to the space supplementing space heat from the wood pellet stove. Cooling is controlled by individual, old wall mounted thermostats inside the cold storage room.

Lighting in the cold storage area is comprised of two (2) 300w halogen fixtures. There are no additional lighting or ventilation systems.

Apple Packaging Operation

Harvested apples in premium condition are mechanically packaged and sold between September and December. Apples are retrieved from cold storage and are then washed, scrubbed and packaged on the packing line before shipment to customers. The apple sorting/packing line is operated approximately 20 hours per week, 15 weeks per year. The area is heated by a wood pellet stove and warm air discharged from the compressor units. Lighting is via fluorescent tube fixtures, primarily 4-foot T8.

Cider Press Operation

Carter Hill produces approximately 50,000 gallons of cider per year from September through April. Cider is pressed two times per week on Mondays and Thursdays, producing nearly 1,500 gallons on pressing days. Once through the washing and pressing machines, left over apple pulp is removed to an exterior cart where it is spread out in the fields. Pressed cider is stored in a temporary holding tank in the cold storage area. This loading/washing/pressing process is repeated until 800 gallons of cider has been stored. Then, the stored cider is sent through a hot water pasteurizer and heated to 162 Deg F. Carter Hill reported frequent maintenance issues with the plate heat exchangers in the pasteurizer due to buildup of excess pectin. To avoid these issues, Carter Hill is in the process of replacing the existing hot water pasteurization unit with an electric Ultra Violet machine that should reduce both maintenance concerns and energy consumption. Once pasteurized, the cider is again stored in a temporary holding container until the entire 800 gallons are cooled, at which time the cider is bottled by an automated machine.

Space heating in the cider press area is achieved via wood pellet stove. Lighting is primarily 300 w halogen fixtures which are lit when cider is being produced. There are also smaller fluorescent tube fixtures that are used for task lighting during the bottling process.

Retail Showroom

The retail showroom is open from August through December, 9am to 6pm. The showroom is used for resale of fruit, baked goods, and other similar items. Space heating is accomplished by a wood pellet stove. Lighting is a mixture of compact fluorescent bulbs in ceiling fan fixtures and halogen fixtures for accent lighting. There is a small walk in cooler, approximately 8' x 12' that stores cold baked goods and

Figure 1: Retail Showroom

products. The compressor unit serving the walk in cooler is a Coplematic Model EAL2-0200-CAH, 1/3 HP. There is an electric hot water heater used in the bathrooms and kitchen when the showroom is occupied. The hot water heater is a State Select Model P63020RS, 30 Gal, 4500 w element.

2.3. Resource Concerns and Special Environmental Concerns

This agricultural energy management plan focuses on the cold storage requirements and operations of Carter Hill Orchards. No special environmental concerns or resource concerns were noted. A completed CPA-52 environmental evaluation form and report of no findings from the NH Natural Heritage Bureau are included in Appendix D to this report.

2.4. Producer Concerns / Areas of Specific Interest

The specific area of interest noted repeatedly by the producer is the arrangement and use of cold storage. Carter Hill knows that the current arrangement is not efficient both in terms of the storage room thermal envelope and in the overall use of the space (cooling the entire space for the winter when only a third is used to store apples). Of specific interest to the producer are innovative options for improving the efficiency of the cold storage potentially including new cold storage spaces, segmentation, and free cooling.

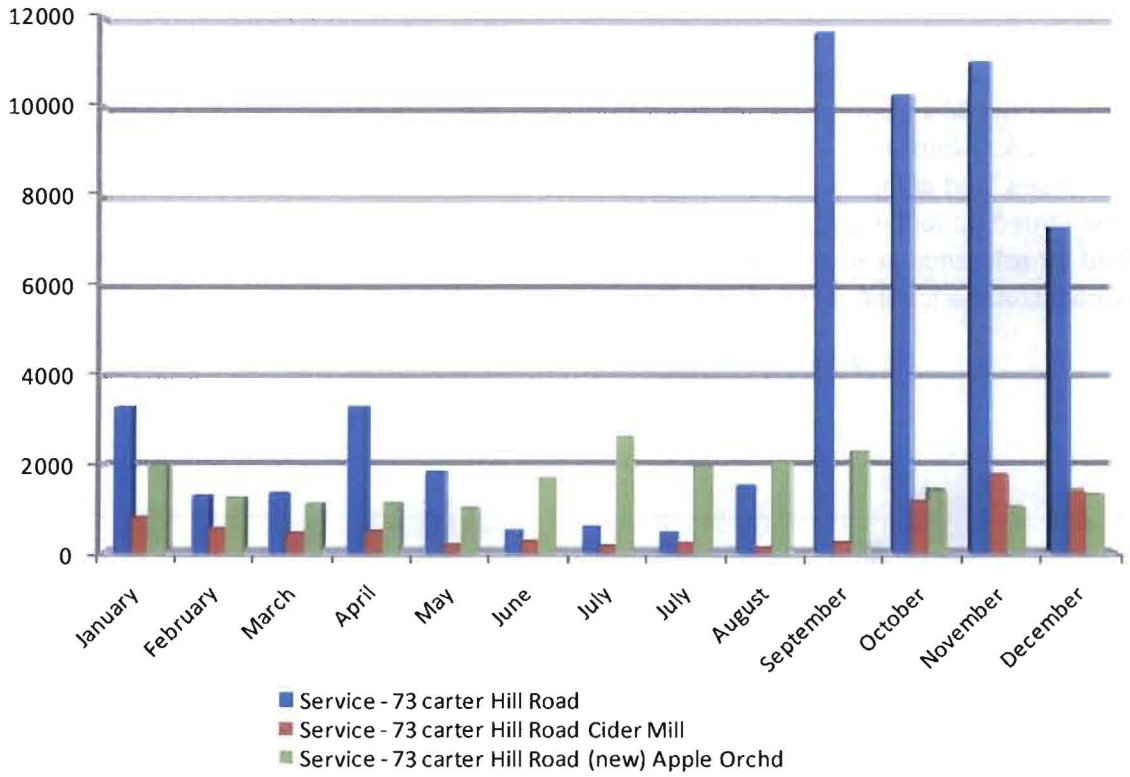
At the request of the producer, the analysis contained within this energy management plan focuses on options for the cold storage space. A number of additional opportunities for energy efficiency are discussed in this report but have not been fully developed with energy savings and cost estimates due to restrictions on time and resources.

3. Current Energy Usage

Limited utility bill information is available for Carter Hill Orchards. Current month electric bills were provided at the time of the site inspection and are the basis for the energy usage summary below. Utility bills for space heating (wood pellet) were not available. The producer estimates that Carter Hill uses 1 ton of pellets per year in the mill and 2 tons per year for the retail shop at an average cost of $230 per ton. A single month invoice for propane was obtained which indicates a per gallon price of $2.10 but does not provide an indication of seasonal trends in propane consumption.

Energy costs are clearly driven by electric usage which shows a large spike in September when the cold storage room is utilized. There are a total of three electric meters serving Carter Hill. The previous 12 months of electric consumption for each meter are illustrated in the graph below:

Figure 2: Prior 12 Months Electric Usage



The "New" service is presumed to serve the farmhouse as there is consistent annual usage with a summer peak indicative of central air conditioning. The "Cider Mill" meter serves the cider press operation only even though the sorting/packing and cold storage areas are in the same physical building. The primary service to Carter Hill includes the cold storage, sorting/packing, retail shop, and the well pump. The significant spike in electric consumption in September is consistent with the use of cold storage starting in September and lasting several months. This peak in electric usage and subsequent energy costs does support the producer's assertion that

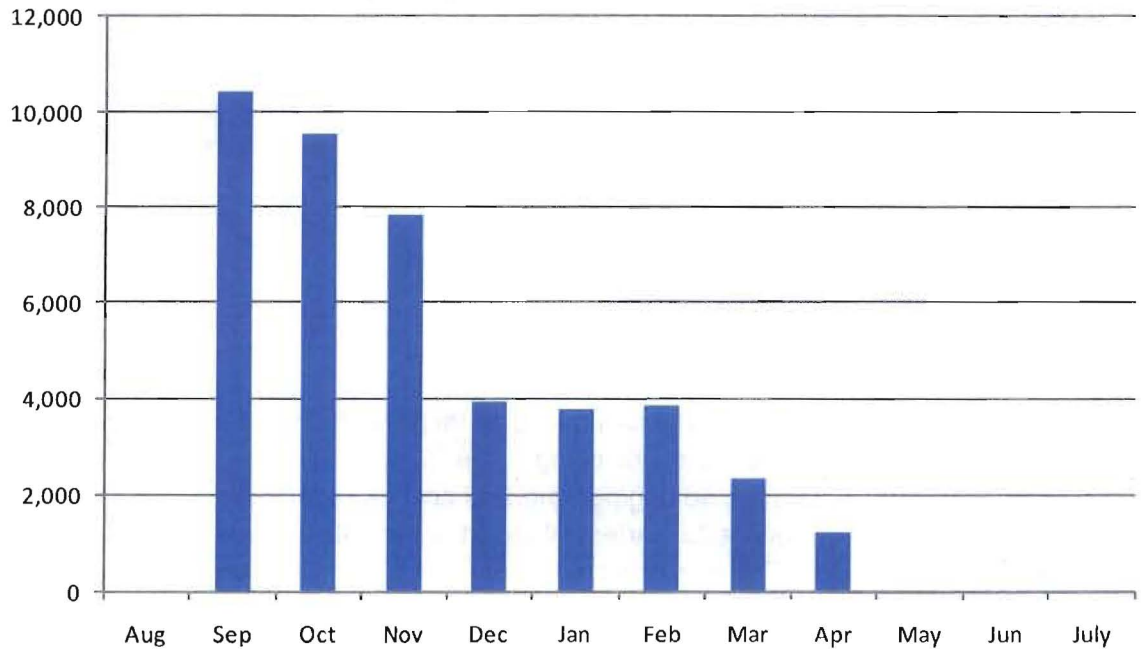
cold storage is the primary driver of energy costs and affirms the energy management approach of targeting this end use.

Electric service is provided by Unitil Service Corporation. The "new" account and the cider mill are on Domestic rate schedules while the primary service is Commercial Rate G2. There is a demand charge of $7.90 per kW and a bundled energy and delivery charge of $0.10545 per kWh. Upon review of Unitil's commercial rate offerings, it was noted that a kWh only (i.e. non-demand) rate is available for existing commercial customers. Because historical energy records were not available for analysis, we were not able to assess whether the current demand rate or kWh only rate is more financially beneficial to Carter Hill however we recommend that the producer evaluate this option with Unitil. For the purpose of energy savings calculations in this report, a bundled kWh rate of $0.15 has been used in the calculations because the monthly demand charges are not known.

3.1. Cold Storage Energy Use Baseline

For the evaluation of energy management alternatives for the cold storage, it is necessary to isolate the energy use baseline of the cold storage room. This was done by identifying the energy end uses also on the general service meter and subtracting those usages from the historical electric bills. Energy use of the cold storage was then estimated using an engineering model that takes into account the removal of field heat from the apples, thermal losses, air change losses, and compressor efficiency. The estimates for cold storage energy consumption were then trued up to the historical bills based on weather patterns. The complete calculation is provided for reference in Appendix B to this plan. The estimated baseline energy consumption for the cold storage is represented in the figure below.

Figure 3: Cold Storage Baseline Energy Use (kWh/month)



Consistent with the electric bills, energy consumption is greatest in September and October when the outside air temperatures are warmest (of the storage season) causing increased conductive and convective energy losses. There is a significant energy load created when the harvested apples are first moved into cold storage and the field heat is removed to bring the core temperature of the apples from field temperature down to storage temperature.

4. Cold Storage – Alternative Options Considered

Several potential options for modifying the existing cold storage arrangement were discussed with the producer during the site visit and were subsequently analyzed. These options are broadly described in this section with rationale for why the options are or are not recommended for Carter Hill. Three recommended scenarios (combination of options) that merit consideration by the producer are presented in Section 5.

4.1. Option 1: Segmentation

The first option considered is to segment the existing cold storage room by adding insulated partitions to enclose the portion of the existing room where apples are actually stored. Since the area where apples are stored comprises only about one-third the total volume of the room, this is an opportunity to isolate the space with the greatest cooling load. In this option, it is recommended to have closed cell spray foam installed to a depth of 4-inches on all interior wall and ceiling surfaces to reduce energy losses through the thermal envelope and to reduce air leakage. This approach possesses several key benefits over the current arrangement and other options analyzed:

- ✓ By creating a smaller space within the existing cold storage area, the insulation level and air tightness can be improved in this space alone without having to upgrade the entire larger area. This is considerably more cost effective than upgrading insulation within the entire existing cold storage room.
- ✓ A smaller space will allow for optimal air distribution whereby cool air is distributed along the top of the room and entrained down the back wall and back through the pallet skids. This continuous flow of cool air is a more efficient means of cooling compared to multiple evaporators blowing cool air into the large space with no distinct air flow patterns.
- ✓ This arrangement isolates the greatest cooling load (apples) from the remainder of the space meaning there is a lower cooling demand outside of the new enclosure.
- ✓ In the current arrangement, the cold storage room is accessed frequently for a variety of reasons that often do not include storing or removing apples. By creating a new, smaller storage space with a dedicated entrance, it will be accessed only when needed to load or unload produce

- ✓ Cooling load calculations indicate that one of the existing compressors is capable of meeting the cooling demands for a segmented cold storage space for storing apples. Using a single compressor to meet the cooling needs allows a second unit to be relegated to backup or shared capacity status, elongating the life of both units and reducing energy consumption.

4.2. Option 2: Segmentation with New Pre-cool Chamber

One potential arrangement the producer expressed interest in was to segment the existing cold storage room as discussed in Option 1, and to add a new "pre-cool" chamber in the existing garage space adjacent to existing cold storage. In most cold storage applications, the maximum cooling load occurs when the produce is harvested and placed in cold storage. Typically, the field heat must be removed from the produce in 24-48 hours to bring the crop down to the storage temperature (34 deg F for apples). This maximum cooling load is typically the driving factor in the size of the mechanical cooling system. The theory of this approach is to size a pre-cool chamber that would be capable of cooling a single day's harvest (30 bins) from field temperature to storage temperature in 24 hours. Then the cooled apples could be moved into storage. By separating the systems, the longer term storage system could be smaller as the cooling load would be less; in theory this could result in energy savings over the course of the storage season.

Upon closer examination of the existing compressor units and the maximum cooling load of the newly segmented cold storage area, it was determined that the pre-cool chamber is **not a cost effective option**. As discussed in Option 1, the existing refrigeration compressors each have sufficient capacity to meet the maximum cooling loads for the apple storage. Therefore, it is recommended to use the new segmented cold storage room as both a pre-cool chamber and long term storage room with the compressors set in series (primary and backup). This arrangement utilizes the existing equipment and involves minimal alteration. There would be very little energy savings gained by creating a new pre-cool chamber, and the capital cost of constructing a pre-cool chamber and installed a new refrigeration unit to serve it would render the project cost prohibitive.

4.3. Option 3: New Cold Storage Adjacent to Cider Mill

A third option being considered by the producer was to construct an entirely new cold storage room adjacent to the existing cider mill. The theory of this approach is that the existing cold storage room is old, poorly insulated, and large, and that it would be more effective to simply construct a new enclosure where the space is readily available.

Our analysis of Option 1, segmentation of the existing storage and enhanced insulation of that space, indicated that would be a cost effective solution to the problem. The option of constructing a new storage room adjacent to the cider mill was presumed to be cost prohibitive as the cost of constructing a new room will be significantly higher than the segmentation approach. Thus, this option is **not recommended** and was not seriously considered in this energy management plan.

4.4. Option 4: Outside Air Economizer

When the outside air temperatures are less than the set temperature of the cold storage, outside air can be used to provide free cooling in lieu of mechanical refrigeration. Outside air cooling systems can save energy and be cost effective in certain situations but are not always reliable due to uncertainty in weather conditions and typically require backup mechanical refrigeration systems. Control systems are required that can sense exterior temperatures, cold storage temperatures, and set points to determine the most effective form of cooling based on the simultaneous conditions.

Considering the physical arrangement of the existing cold storage, the proposed location of the new segmented storage room, adding a mechanism for outside cooling to the new segmented cold storage is not recommended due to added cost and complexity of duct systems and dampers. However, given that the remainder of the existing cold storage room has an exterior wall and does still require cooling throughout the winter, outside air cooling is a good option for this space. Discussions on potential products, costs and energy savings are contained in Section 5 of this energy management plan.

5. Technical Analysis

Three (3) practical and feasible scenarios for improving the energy efficiency of the cold storage area at Carter Hill Orchards are addressed in this section. Upon review of the various options presented in Section 4, independently and in combination, the scenarios presented in this section reflect our opinion of the most readily achievable and cost effective options for Carter Hill. The three scenarios are:

Scenario 1: Segment a 42-foot by 18-foot area of the existing cold storage room using wood frame partitions and insulate with 4-inches of closed cell spray foam. Utilize this smaller area for all cold storage purposes. DO NOT cool the remaining areas of the existing cold storage room[1].

Scenario 2: Segment a 42-foot by 18-foot area of the existing cold storage room using wood frame partitions and insulate with 4-inches of closed cell spray foam. Cool the remaining areas of the existing cold storage room using a single refrigeration compressor.

Scenario 3: Segment a 42-foot by 18-foot area of the existing cold storage room using wood frame partitions and insulate with 4-inches of closed cell spray foam. Cool the remaining areas of the existing cold storage room using a combination of existing mechanical refrigeration and an outside air economizer system.

[1] There would need to be alternative arrangements for storage of products that would otherwise be stored cool in the existing space. An example of a potential alternative would be a small commercial freezer.

The table below summarizes estimated project costs and energy savings for each of the three scenarios studied. Further technical information on the proposed scenarios is provided in the subsequent sections.

Table 1: Summary of Results for Alternative Options

Scenario	Description	Estimated Energy/Resource Savings		Estimated Annual Cost Savings[2]	Estimated Project Cost	Estimated Payback (years)
Scenario 1	Segment new cold storage area. Abandon cooling in remainder of existing space	27,807	kWh	$4,171	$13,314[3]	3.2
Scenario 2	Segment new cold storage area. Continue cooling remainder of existing space with mechanical refrigeration	15,835	kWh	$2,375	$13,314	5.6
Scenario 3	Segment new cold storage area. Continue cooling remainder of existing space with mechanical refrigeration and outside air economizer	19,831	kWh	$2,974	$20,314	6.8

Appendix A to this report includes a sketch showing the existing cold storage layout and the proposed location of the proposed segmented as well as the location of the outside air economizer units (Scenario 3). Energy calculations are presented in Appendix B, and cost estimates are included in Appendix C. Note that the cost estimates and estimated paybacks in Table 1 do not include any incentives which would serve to lower the initial capital investment and improve return. Opportunities for incentives are presented in Section 7 of this plan.

All three scenarios involve constructing a new partition wall to create a smaller storage area within the existing storage area. This approach will isolate the apples and other products that most need the cooling, will reduce energy loss through the thermal envelope by adding foam insulation, and will reduce energy loss through less frequent access to the space.

[2] Based on bundled energy rate of $0.15 per kWh because monthly historical demand charges were not available for review

[3] This project cost does not include additional costs involved with the purchase and operation of a new commercial refrigeration unit.

Construction of the interior partition is presumed to be wood frame construction with 2" x 6" wood studs due to the height of the wall. The wall would be installed floor to ceiling with a plywood or particle board face on the inside of the wall (facing the new storage space). Closed cell spray foam would then be sprayed within the interior of the cold storage space to a depth of at least 4-inches at all walls and along the ceiling. The spray foam will provide far superior insulation beyond the current conditions and will create an air barrier that will reduce the leakage of cold air from the space.

A benefit of this approach is that the existing refrigeration compressors/evaporators can be re-used. It is suggested to utilize two of the existing units in the new, smaller cold storage space. Minor reconfiguration of the evaporators and refrigerant piping may be necessary and has been considered in the cost estimates. Energy calculations (Appendix B) indicate that a single refrigeration unit is capable of meeting the cooling load for the new space so it is recommended to have one active and one standby compressor serving this area. The two can be cycled or can be operated in a strict lead/backup arrangement. In either case, this should extend the life of the existing units.

Bin Loading

The proper loading and unloading of pallet bins will be important to the effectiveness of air distribution and cooling in the new space[4]. Following are recommendations for loading and unloading in the new space:

- ✓ Maintain a minimum clear space of 8-10 inches at the far end of the cold storage (opposite the door) to allow cold air from the evaporators to contact the back wall and be entrained back down along the back wall. Maintain a minimum clear space of 4-6 inches at each side of the cold storage
- ✓ Try to stack bins at a uniform height, and leave 12-inches or more clearance between the top bin and the bottom of the foam insulation for air to travel over the top of the bins and be entrained back to the evaporator
- ✓ Stack pallet bins so that the skids run in the same direction as the evaporator discharge to allow air to be entrained back through the pallet skids. To the extent possible, use identical pallet bins to ensure the runner openings are continuous and aligned.
- ✓ Plan ahead how bins will be loaded and unloaded. Painting bin locations on the floor can be useful for ensure bins are loaded as planned.

Abandon Current Use

During the site inspection, it was noted that even if a segmentation approach was adopted, there was a desire to continue cooling the remainder of the existing cold storage space to 38 degrees F. This energy management plan presents two scenarios (1 and 2) simply to highlight

[4] NRAES-22, *Refrigeration and Controlled Atmosphere Storage for Horticultural Crops,* Northeast Regional Agricultural Engineering Service, 1990

the impact of that decision. The condition of the existing cold storage area is very poor and the space is accessed frequently resulting in significant energy losses. The producer is urged to consider what absolutely needs to be cooled in the existing space and in what quantity. Alternative options such as a small plug in commercial cooler may serve the producer's needs and be a highly cost effective solution.

Outside Air Economizer

If it is ultimately decided that the existing cold storage area must be cooled throughout the winter, a set of outside air economizers is recommended. Outside air economizers are systems that sense when outside temperatures are suitable for cooling (typically 4 or more degrees cooler than set point) and use a system of fans to cool the space using outside air. When outside air temperatures are not conducive to cooling, the control system triggers the mechanical refrigeration system to activate until the set point is reached.

For this energy management plan, GDS considered the Freeaire Polar Package unit as a potential solution. While GDS does not represent or promote specific products, this product was selected as the basis for the cost quotation and energy savings. Other, similar products are available and could be explored by Carter Hill. GDS spoke with Mr. Richard Travers, President and CEO of Freeaire (802.496.5205) to review product and cost information. Mr. Travers could be contacted directly for further information. Product data sheets for the Freeaire system are included for reference in Appendix E.

6. Additional Opportunities for Energy Savings

At the request of the producer, this energy management plan focused on opportunities for energy savings related to the cold storage area. However, additional opportunities were noted during the site visit and are broadly discussed below.

Evaporator Fan Motor Controls

Walk-in cooler evaporator fans typically run all the time; 24 hrs/day, 365 days/yr. This is because they must run constantly to provide cooling when the compressor is running, and to provide air circulation when the compressor is not running. However, evaporator fans are a very inefficient method of providing air circulation. Various options are available to reduce the run time of the evaporator fans ranging from simple timers to more complex control systems that modulate voltage or switch between the evaporator fan and smaller energy efficient fans. Information on available systems and technologies is readily available online.

Refrigerant Line Insulation

Insulating the refrigerant return line from the show room evaporator to the outside compressor unit is a simple way to improve energy efficiency, and requires little labor or capital investment. Without the proper insulation, there is substantial heat gain and condensation, both of which reduce the efficiency of the vapor-compression cycle. The United State Department of

Energy's Office of Building Technology Program recommends that suction lines be insulated with at least 3/8-inch thick closed-cell elastomeric foam pipe insulation. Additionally, because the line is located outside, the insulation should have waterproof covering and protection from ultraviolet radiation (i.e. sunlight).

Pre-rinse Spray Valves

Pre-rinse spray valves are sink-mounted units used to in commercial kitchens to remove large food residue before dishes are sent to the dishwasher. The installation of high efficiency pre-rinse spray valves in the showroom kitchen represents a low cost opportunity to reduce hot water consumption as well as the associated energy costs, without sacrificing cleaning performance. Traditional pre-rinse spray valves use 2 to 5 gallons per minute (gpm), whereas the premium efficiency models currently available consume as little as 0.64 gpm, substantially reducing the demand for hot water. In addition, these models are often more effective at removing food residue, as the water is ejected from the nozzle at a much greater velocity.

Energy Efficient Lighting

Another cost effective way to reduce electrical energy consumption is the replacement of inefficient lighting. Upon failure of T-12 and T-8 fluorescent bulbs in the showroom, packing line, and cider press areas, it is recommended that Carter Hill upgrade to high performance T8 fluorescent fixtures with the most up-to-date electric ballasts, matched to the installed bulb, in order to improved energy efficiency and performance. The replacement of Halogen bulbs with LED lights with similarly rated lumen outputs in the cold storage, cider press, and showroom would cost effectively reduce energy consumption due to lighting. A co-benefit of switching from Halogen bulbs to LED technology is the reduced bulb heat output. Particularly in the cold storage area, this would reduce the cooling load and yield additional energy efficiency benefits.

Point of Use Electric Water Heaters

Point-of-use electric water heaters represent an opportunity cost-effectively to reduce energy consumption and improve performance. Instead of heating a large tank of water that will incur heat loss along the perimeter of the tank, these compact systems provide hot water to single fixture, and are therefore installed in close proximity to the tap. Because of this proximity, heated water arrives almost immediately to the tap, reducing the need to run the tap while waiting for hot water. Also, point-of-use systems achieve greater energy efficiency by avoiding standby losses, as water is only heated as it is needed. Point-of-use electric water heaters are available for a wide variety of applications. In order to maximize cost-effectiveness, it is recommended that these systems be considered upon failure of existing electric hot water heater.

7. Available Incentives

A number of potential incentives are available to help offset the cost of energy related improvements. This section presents an overview of some of the most relevant incentive programs along with contact information for further consideration.

Environmental Quality Incentives Program (EQIP)

The Environmental Quality Incentives Program is a voluntary program that provides technical and financial assistance to farmers and forest land owners in order to improve the environmental quality of soil, water, soil, air, plants, and animals. The Natural Resources Conservation Service (NRCS) will provide compensation for part of the cost of establishing and maintaining conservation practices in order to meet the program's goals of improving the natural resources of the land and improving air quality.

EQIP offers payment of up to 75% of eligible costs of approved conservation practices. For more information, contact the Concord NH Field Service Center, Merrimack County Conservation District, at 603-223-6021. A program brochure can be downloaded at:

ftp://ftp-fc.sc.egov.usda.gov/NH/WWW/Programs/EQIP_NH_brochure.pdf

Unitil Service Corporation – Small Business Program

The recommended lighting improvements would qualify under Unitil's Small business Program. In this program, an auditor will visit the site to record the type, quantity and usage characteristics of the lighting systems and recommend improvements. Incentives are available from Unitil to cover up to 50% of the cost of installing the recommended improvements.

For more information on Unitil's program call them at 800-736-0978 or online at:

http://services.unitil.com/nh/bus_energy_efficiency_programs.asp?t=1

Enterprise Energy Fund

CDFA's Energy Reduction Fund is a low-interest loan and grant program available to businesses and non-profit organizations to help finance energy improvements and renewable energy projects in their buildings. The goal is to reduce energy costs and consumption, and promote economic recovery.

The program is available to finance improvements to the overall energy efficiency performance of buildings owned by businesses and non-profit organizations, thereby lowering the overall energy costs and the associated carbon emissions. These activities will include, but are not limited to the following:

- Improvements to the buildings envelope including air sealing and insulation in the walls, attics, and foundations;
- Improvements to HVAC equipment and air exchange;

- Installation of renewable energy alternatives;
- Improvements to lighting and all forms of electrical usage; and
- Conduction of comprehensive, fuel blind, energy assessments and audits.

For more information or questions please contact:

Downtown Resources Manager
NH Community Development Finance Authority
14 Dixon Avenue, Suite 102
Concord, NH 03301
Tel: 603-717-9127
sdisano@NHCDFA.org

More in-depth program information can be found at:
http://www.nhcdfa.org/web/erp/erf/erf_overview.html

Rural Energy for America Program (REAP) (AKA the 9006 Program) - Energy Audit and Renewable Energy Development Assistance (REAP/EA & REDA)

This program will provide grants to entities that will assist farmers, ranchers, and rural small businesses in paying for energy audits/feasibility studies. Eligible entities include state, tribal or local government, institutions of higher learning, rural electric cooperatives, and public power entity. Funds received will be used to offset portions of costs to complete an energy audit or feasibility study for REAP applicants. *For all projects, the system must be located in a rural area, must be technically feasible, and must be owned by the applicant.* Grants are awarded on a competitive basis and can be up to $100,000. Recipients of an energy audit are required to pay at least 25% of the cost of the audit.

To apply for funding for the REAP Grant Program, please contact your Rural Development State Office:

www.rurdev.usda.gov/rbs/busp/REAPEA.htm

For more information please contact:

Steve Epstein
Steven.Epstein@nh.usda.

Rural Energy for America Program Guaranteed Loan Program (REAP LOAN)

The REAP Guaranteed Loan Program encourages the commercial financing of renewable energy (bio-energy, geothermal, hydrogen, solar, wind and hydro power) and energy efficiency projects. Under the program, project developers will work with local lenders, who in turn can apply to USDA Rural Development for a loan guarantee up to 85% of the loan amount. Eligible applicants must be an agricultural producer or rural small business. Agricultural producers must gain 50% or more of their gross income from their agricultural operations.

Eligible project costs include energy audits or assessments, professional service fees, feasibility studies and technical reports, business plans, retrofitting, and construction of a new energy efficient facility (call for specific requirements).

To see guaranteed loan specifications and/or to apply for funding for the REAP Grant Program please contact your Rural Development State Office:

http://www.rurdev.usda.gov/rbs/busp/9006loan.htm

For more information please contact:

Steve Epstein
Steven.Epstein@nh.usda.gov or

Scott Johnson
Scott.Johnson@nh.usda.gov

Conservation Innovation Grants

Conservation Innovation Grants (CIG) is a voluntary program intended to stimulate the development and adoption of innovative conservation approaches and technologies. Under CIG, Environmental Quality Incentives Program (EQIP) funds are used to award competitive grants to non-Federal governmental or non-governmental organizations, Tribes, or individuals. The grant's maximum is $75,000. The CIG requires a 50-50 match between the agency and the applicant and has two funding components - national and state.

This NH state CIG has six categories of natural resources concerns and five categories of technology needs for possible funding. The natural resources categories are: water resources, soil resources, atmospheric resources, grazing lands and forest health, wildlife habitat, and market-based approaches. The technology categories are: improved on-farm energy efficiency, water management, improved nutrient management to improve water quality, air quality, and conservation technology transfer to targeted groups of farmers and ranchers. Project proposals must be received either electronically through grants.gov or delivered to the NRCS NH State Office.

For links to application materials and further eligibility see:
http://www.nh.nrcs.usda.gov/programs/Farm_Bill/CIG/cig.html

For questions or more information please contact:

Jim Spielman, Resource Conservationist
Federal Building, 2 Madbury Road
Durham, NH 03824-2043
(603) 868-7581 or (603) 868-9931 ext. 115
james.spielman@nh.usda.gov

Environmental Quality Incentives Program - Air Quality Initiative

The Natural Resources Conservation Service (NRCS) is working to help farmers with conservation practices that improve air quality. NRCS will provide eligible producers with program support through the Environmental Quality Incentives Program (EQIP) to implement cost effective and innovative conservation practices that improve air quality. High-priority conservation practices to address air quality resource concerns may include: residue and tillage management; cover crops; surface irrigation; nutrient management; integrated pest management; and windbreaks, shelter belts, and biofilters.

Funds are being made available in areas whose air quality does not meet the health-based standards established for ground-level ozone pollution. In New Hampshire, this includes portions of Rockingham, Strafford, and Hillsborough Counties.

http://www.nh.nrcs.usda.gov/programs/Initiatives/2009%20%20EQIP_Air_Quality_Practice_List.pdf

Financial assistance varies from $/square foot to $/acre depending upon conservation practices. Adoption of specific practices is required to qualify for incentive/ subsidy payment.

For more information please contact:

Kim McCracken
ASTC for Technology
State Soil Scientist
Federal Building, 2 Madbury Road
Durham, NH 03824-2043
(603) 868-7581
kimberly.mccracken@nh.usda.gov

http://www.nh.nrcs.usda.gov/programs

Environmental Quality Incentives Program - Conservation Activity Plan – Energy

High-priority conservation practices that address energy conservation may include: energy audits; residue and tillage management; conservation crop rotations; cover crops; nutrient management; pest management; irrigation water management; and anaerobic digesters.

For more information please contact:

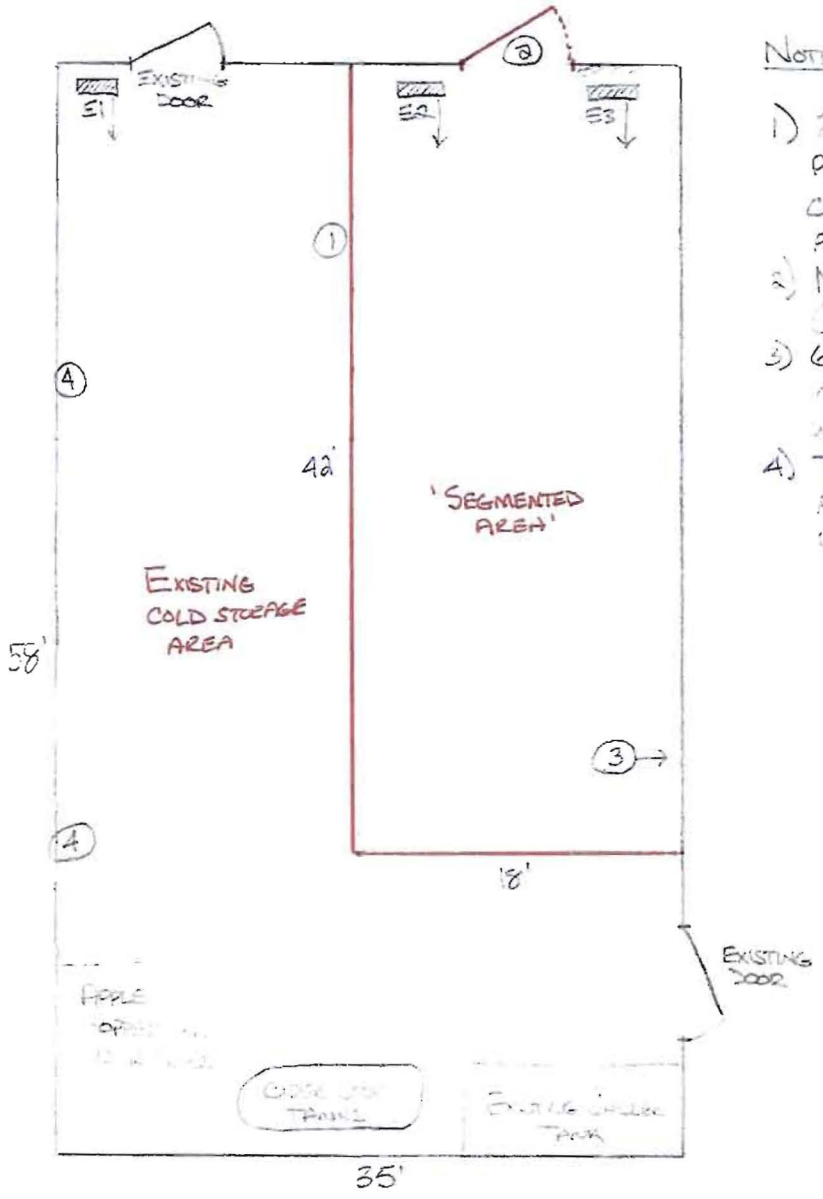
Kim McCracken
ASTC for Technology
State Soil Scientist
(603) 868-7581
kimberly.mccracken@nh.usda.gov

http://www.nh.nrcs.usda.gov/program

APPENDIX A

Sketch of Proposed Cold Storage Arrangement

CARTER HILL ORCHARDS GDS ASSOCIATES 9/15/10



NOTES:

1) 2 - 6 LYND FLAKE PARTITION FLOOR TO CEILING. DIMENSIONS PROVIDED BY CHO
2) NEW 9' LYNG ROG DOOR (SITE TBD BY CHO)
3) 6-INCHES SPRAY FOAM INSULATION COVERING WALLS AND CEILING
4) TENTATIVE LOCATION OF FREEZER POLAR PACKAGE UNITS (EXTERIOR WALL)

E1: EXISTING EVAPORATOR TO REMAIN
E2, E3: EXISTING EVAPORATORS TO BE RELOCATED TO NEW SEGMENTED STORAGE

APPENDIX B

Energy Calculations:

- Maximum cooling load
- Baseline usage calculations
- Scenario 1 calculations
- Scenario 2 calculations
- Scenario 3 calculations

Total Cooling Load - Sub-Divided Cold Storage
Carter Hill Orchard, Concord NH

1.) Assumptions

Maximum 3,000 bushels of apples stored at any one time
Maximum daily loading of apples is 30 bins (450 bushels)
* Max. cooling load occurs when all apples 2,550 bushels are stored and cooled, and the final 450 bushels need to be cooled
12,000 btu/ton-hr
2,000 lbs / ton
3,412 Btu / kilowatt-hour

2.) Calculation Inputs

Pounds of apples per bushel	48	lbm	www.unc.edu/~rowlett/units/scales/bushels
Specific heat of apples above freezing	0.86	Btu/lb°F	1998 AHSRAE Refrigeration HB. Ch. 8 Table 3
Initial Temperature of Apples entering cooler	55	Deg F	From Rob L. Pre-cooled outside overnight to
Desired Storage Temperature	36	Deg F	
Cool down time	12	Hours	
Apple respiration rate @ 60 Deg F	3,190	Btu/ton/day	NREAS-22 Table 6
Apple respiration rate @ 32 Deg F	880	Btu/ton/day	NREAS-22 Table 6

3.) Calculations

Cooling load of 2,550 bushels of apples at storage temp	2,244	Btu/hour
Cooling load of removing field heat from 450 bushels	29,412	Btu/hour
Cooling load of respiration heat heat from 450 bushels	2,871	Btu/hour
Total cooling load (sum)	34,527	btu/hour

* exludes losses through walls and ceiling
* excludes losses through open doors when accessed

4.) Max. Heat Loss Through Cold Storage Envelope

Perimeter length (42' x 18' room)	120		
Ceiling Height	14		
R-Value (4" spray foam on wood frame)	24	hr-sf-Deg F/Btu	(~6.0 hr-sf-Deg F/btu/inch)
Average outside temp	70		
Total Area	2,436	SF	
Max. heat loss through envelope	3,451	Btu/hour	

* excludes losses through open doors when accessed
* conservatively assumes all walls open to heated interior

5.) Cooling Capacity of 2 Existing Compressors

Number of compressors serving new CS area	1		
Compressor horsepower (each)	3.3	HP	
Power consumption (HP) per ton of cooling for R-22	0.707	HP/cooling ton	1997 ASHRAE Fundamentals HB. Ch. 18. Tab
Total btu/hour cooling capacity of existing compressors	56,011	btu/h	

Baseline Determination Approach
Carter Hill Orchard, Concord NH

Assumptions:

1. Cold storage in use from September until December
2. Cold storage temperature maintained at 38F
3. Humidity control not required
4. CHO apples loaded at 55 F for six weeks
5. 6 inches of cellulose on ceiling
6. 2 inches of isocyanurate in walls
7. Cold storage is 58' by 35' by 14'H
8. Only one long wall is external
9. No insulation under slab on grade floor
10. All accessesto cold storage are from interior spaces
11. Other loads on the same meter: retail store, water pump, packing area
12. Retail store operates from 9:AM to 6:PM, 7 days per week, Aug. to Dec.
13. School(w/water tank), retail store, processing building drained and unheated during off season
14. Well pump runs 2 hours per day, I hp pump, Sep thru Dec

Step 1. Estimate monthly electric usage by retail store
Step 2. Estimate monthly electric usage in packing area
Step 3. Estimate monthly electric usage in cold storage
Step 4. Compare the sum of the three with actual bills

Baseline Determination Step 1 - retail Usage
Carter Hill Orchard, Concord NH

Retail space--Base case electric usage

Inputs/Assumptions

Walk in cooler average load	1.5	ton
Total lighting load	3.03	kW
Electric Water heating	4.5	kW
Estimated water heating hrs/day	4	hours/day
Space heating (pellet)	0	kW
Operating hours / day	9	hours/day
9 hrs/day/7 days/week: Aug-Dec		
Compressor rating	0.707	HP/ton

Month	Lighting	Cooler	Water heating	Total Kw-hrs	
Aug	409	285	558	1252	* Assumes 15 day operation
Sep	818	570	540	1928	
Oct	845	589	558	1992	
Nov	818	570	540	1928	
Dec	845	589	558	1992	
Jan	0	0	0	0	
Feb	0	0	0	0	
Mar	0	0	0	0	
Apr	0	0	0	0	
May	0	0	0	0	
Jun	0	0	0	0	
July	0	0	0	0	

Baseline Determination Step 2 - packaging & well Pump Usage
Carter Hill Orchard, Concord NH

Packing Area & water pump--Base case electric usage

Inputs/Assumptions

Equipment / Machinery Load	4.0	kW
Total lighting load	0.5	kW
Space heating (pellet)	0	kW
Operating hours / day	3	hours/day
20 hrs/week, 15 weeks/year: Sept-Dec		
Irrigation pump size	1	HP
Irrigation hours/day	4	hours/day

Month	Lighting	Machinery	Well Pump	Total Kw-hrs
Aug	0	0	103	103
Sep	45	360	99	504
Oct	47	372	103	521
Nov	45	372	99	516
Dec	47	372	103	521
Jan	0	0	0	0
Feb	0	0	0	0
Mar	0	0	0	0
Apr	0	0	0	0
May	0	0	0	0
Jun	0	0		0
July	0	0		0

Baseline Determination Step 3 - Cold Storage
Carter Hill Orchard, Concord NH

Givens:

Dimensions: 58' long x 35' wide x 14' tall
8" wood frame walls with loose fill cellulosic insulation
Insulation has settled within wall cavities
2" Poly Iso foam board installed over 50% of exterior wall
6" blown cellulose insulation in attic
Currently accessed 10-15 times a day Sept-Nov
Currently accessed ~20 times week Nov-January

Inputs/Assumptions

External Wall Area	812	SF	
R-Value with 2" polyiso	20		
R-Value without 2" polyiso	10		8" loose fill cellulose, derated 50% for settling
U-Value with	0.05		
U-Value without	0.10		
Internal Wall Area	1792	SF	
R-Value	10		
U-Value	0.1		
Ceiling Area	2030	SF	
R-Value	20		
U-Value	0.05		
Air changes per hour	6.5		Estimate for leaky building
Operating hours/day	24	hours	
Interior Space temp	38	Deg F	
Adjacent Space Temp	65	Deg F	
Internal Volume	28,420	cubic feet	
A/C kW per ton of Cooling	0.9	kW/ton	
EER of refrigeration compressors	7.9		

Month	Cooling Days per month	Average Outside Temp	Average Interior Space temp	Envelope Heat Loss (btu/hr)	Air Change Heat loss (btu/hr)	Daily Removal of Field heat from 30 bins (btu/hour)	Remove heat of respiration from stored apples (btu/hour)	Total Heat transfer (Btu/hour)	A/C Load (kW)	Energy (kWh/ month)
Aug	31	63	65	0	0	0	0	0	0.0	0
Sep	30	52	60	6,216	76,201	29,412	2,640	114,469	14.5	10,433
Oct	31	40	57	3,730	65,810	29,412	2,640	101,592	12.9	9,568
Nov	30	34	53	2,038	51,955	29,412	2,640	86,046	10.9	7,842
Dec	31	19	50	-935	41,564	0	880	41,509	5.3	3,909
Jan	30	17	50	-1,260	41,564	0	880	41,184	5.2	3,754
Feb	30	22	50	-448	41,564	0	880	41,996	5.3	3,828
Mar	30	34	50	1,501	41564	0	0	43065	3.2	2,326
Apr	15	44	50	3,125	41564	0	0	44689	3.4	1,207
May	0	55	50	0	0	0	0	0	0.0	0
Jun	0	61	50	0	0	0	0	0	0.0	0
July	0	70	50	0	0	0	0	0	0.0	0

Carter Hill orchards
Utility Bill Comparison

Service - 73 carter Hill Road			Baseline - retail		Baseline - Packing/Well		Baseline - CS			
Month	Year	kWh	Month	kWh	Month	kWh	Month	kWh	total estimate	total variance
July	2009	420								
August	2009	1469	Aug	1252	Aug	103	Aug	0	1,355	-114
September	2009	11647	Sep	1928	Sep	504	Sep	10433	12,865	1,218
October	2009	10251	Oct	1992	Oct	521	Oct	9568	12,081	1,830
November	2009	11028	Nov	1928	Nov	516	Nov	7842	10,286	-742
December	2009	7295	Dec	1992	Dec	521	Dec	3909	6,422	-873
January	2010	3240	Jan	0	Jan	0	Jan	3754	3,754	514
February	2010	1283	Feb	0	Feb	0	Feb	3828	3,828	2,545
March	2010	1345	Mar	0	Mar	0	Mar	2326	2,326	981
April	2010	3259	Apr	0	Apr	0	Apr	1207	1,207	-2,052
May	2010	1794	May	0	May	0	May	0	0	-1,794
June	2010	462	Jun	0	Jun	0	Jun	0	0	-462
July	2010	561	July	0	July	0	July	0	0	-561

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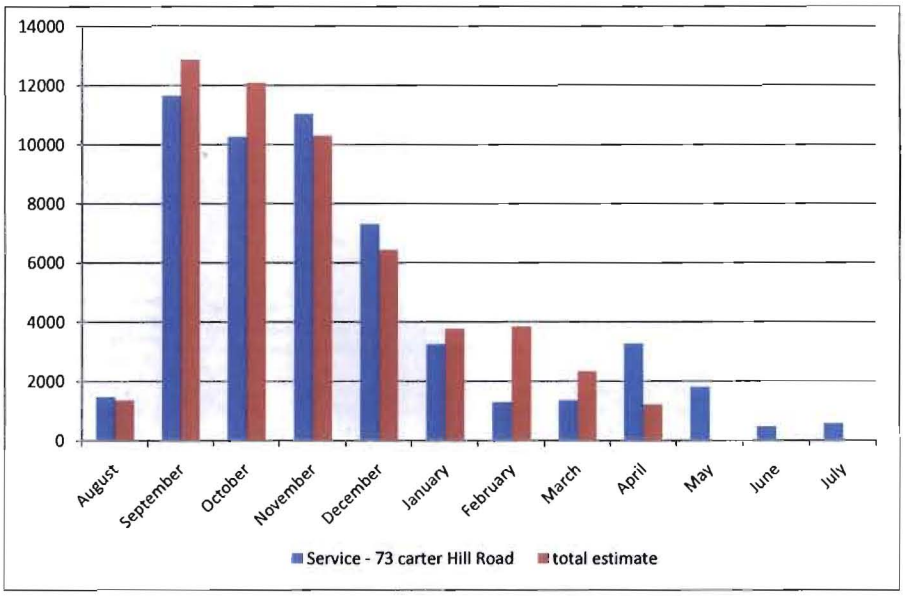


Option 1 - Segmented Cold Storage
Carter Hill Orchard, Concord NH

A.) Segmented Area

Givens:
Dimensions: 45' long x 18' wide x 14' tall
6" wood frame walls with 4" spray foam insulation
6" blown cellulose insulation in attic
Accessed 2 x day Sept-January

Inputs/Assumptions

Internal Wall Area	1764	SF	
R-Value	24		
U-Value	0.042		
Ceiling Area	864	SF	
R-Value	56		
U-Value	0.018		
Air changes per hour	2.0		estimate for air tight enclosure
Operating hours/day	24	hours	
Interior Space temp	34	Deg F	
Internal Volume	11,340	cubic feet	
A/C kW per ton of Cooling	0.9	kW/ton	
EER of refrigeration compressors	7.9		

Month	Cooling Days per month	Average Outside Temp	Average Interior Space temp	Envelope Heat Loss (btu/hr)	Air Change Heat loss (btu/hr)	Daily Removal of Field heat from 30 bins (btu/hour)	Remove heat of respiration from stored apples (btu/hour)	Total Heat transfer (Btu/hour)	A/C Load (kW)	Energy (kWh/ month)	Delta from Baseline (ignoring remainder of space)
Aug	31	63	65	0	0	0	0	0	0.0	0	0
Sep	30	52	60	2,189	11,057	29,412	2,640	45,297	5.7	4,128	-6,304
Oct	31	40	57	1,783	9,781	29,412	2,640	43,616	5.5	4,108	-5,460
Nov	30	34	53	1,397	8,080	29,412	2,640	41,528	5.3	3,785	-4,057
Dec	31	19	50	945	6,804	0	880	8,629	1.1	813	-3,097
Jan	30	17	50	914	6,804	0	880	8,598	1.1	784	-2,970
Feb	30	22	50	991	6,804	0	880	8,675	1.1	791	-3,037
Mar	30	34	50	1,176	6804	0	0	7980	0.6	431	-1,895
Apr	15	44	50	1,330	6804	0	0	8134	0.6	220	-987
May	0	55	50	0	0	0	0	0	0.0	0	0
Jun	0	61	50	0	0	0	0	0	0.0	0	0
July	0	70	50	0	0	0	0	0	0.0	0	0
										total	-27,807 kwh

Option 1 - Segmented Cold Storage
Carter Hill Orchard, Concord NH

B.) Remaining Area Usage

Givens:
Dimensions: 58' long x 35' wide x 14' tall (less 42' x 18' segment)
8" wood frame walls with loose fill cellulosic insulation
Insulation has settled within wall cavities
2" Poly Iso foam board installed over 50% of exterior wall
6" blown cellulose insulation in attic
Currently accessed 10-15 times a day Sept-Nov
Currently accessed ~20 times week Nov-January

Inputs/Assumptions

External Wall Area	812	SF	
R-Value with 2" polyIso	20		
R-Value without 2" polyIso	10		8" loose fill cellulose, derated 50% for settling
U-Value with	0.05		
U-Value without	0.10		
Internal Wall Area	462	SF	
R-Value	10		
U-Value	0.1		
Internal Wall Area (adj. new storage)	840	SF	
R-Value	36		
U-Value	0.028		
Ceiling Area	1274	SF	
R-Value	20		
U-Value	0.05		
Air changes per hour	4.0		Estimate for leaky building. Reduced by new air tight enclosure, reduced access
Operating hours/day	24	hours	
Interior Space temp	38	Deg F	
Adjacent Space Temp (new storage)	34	Deg F	
Internal Volume	17,080	cubic feet	
A/C kW per ton of Cooling	0.9	kW/ton	
EER of refrigeration compressors	7.9		

Month	Cooling Days per month	Average Outside Temp	Average Interior Space temp	Envelope Heat Loss (btu/hr)	Air Change Heat loss (btu/hr)	Daily Removal of Field heat from 30 bins (btu/hour)	Remove heat of respiration from stored apples (btu/hour)	Total Heat transfer (Btu/hour)	A/C Load (kW)	Energy (kWh/ month)	Total Energy w/ Segmented (kWh/ month)	Total Delta from Baseline (kWh/Mo)
Aug	31	63	65	0	0	0	0	0	0.0	0	0	0
Sep	30	52	60	2,667	28,182	0	0	30,849	3.9	2,812	6,940	-3,493
Oct	31	40	57	1,034	24,339	0	0	25,373	3.2	2,390	6,497	-3,070
Nov	30	34	53	101	19,215	0	0	19,316	2.4	1,760	5,545	-2,297
Dec	31	19	50	-1,906	15,372	0	0	13,466	1.7	1,268	2,081	-1,828
Jan	30	17	50	-2,156	15,372	0	0	13,216	1.7	1,205	1,988	-1,765
Feb	30	22	50	-1,533	15,372	0	0	13,839	1.8	1,261	2,052	-1,776
Mar	30	34	50	-37	15372	0	0	15335	1.2	828	1,259	-1,067
Apr	15	44	50	1,209	15372	0	0	16581	1.2	448	667	-539
May	0	55	50	0	0	0	0	0	0.0	0	0	0
Jun	0	61	50	0	0	0	0	0	0.0	0	0	0
July	0	70	50	0	0	0	0	0	0.0	0	0	0
											total	-15,835 kWh

Freeaire Calcualtion
Carter Hill Orchard, Concord NH

1.) Calculation based on Efficiency Vermont Technical Reference Manual (TRM) Dated 2/19/10. Equation and inputs below:

Carter Hill Inputs:
3.3 Compressor HP
2,996 run hours (TRM assumption)
50% compressor duty cycle
1 evaporator fan
TRM assumptions

Energy Savings
With Fan Control Installed

$$\Delta kWh = [HP \times kWh_{Cond}] + [((kW_{Evap} \times n_{Fans}) - kW_{Circ}) \times Hours \times DC_{Comp} \times BF] - [kW_{Econ} \times DC_{Econ} \times Hours]$$

Without Fan Control Installed

$$\Delta kWh = [HP \times kWh_{Cond}] - [kW_{Econ} \times DC_{Econ} \times Hours]$$

Where:

ΔkW	= gross customer connected load kW savings for the measure (kW)
ΔkWh	= gross customer annual kWh savings for the measure (kWh)
HP	= Horsepower of Compressor
kWh_{Cond}	= Condensing unit savings, per hp. (value from savings table in Reference Tables section of this measure write-up)
Hours	= Number of annual hours that economizer operates. 2,996 hrs based on 38° F cooler setpoint, Burlington VT weather data, and 5 degree economizer deadband.
DC_{Comp}	= Duty cycle of the compressor (Assume 50%)[1]
kW_{Evap}	= Connected load kW of each evaporator fan (Average 0.123 kW)[2]
kW_{Circ}	= Connected load kW of the circulating fan (0.035 kW)[3].
n_{Fans}	= Number of evaporator fans
DC_{Econ}	= Duty cycle of the economizer fan on days that are cool enough for the economizer to be working (Assume 63%)[4].

[1] A 50% duty cycle is assumed based on examination of duty cycle assumptions from Richard Travers (35%-65%), Cooltrol (35%-65%), Natural Cool (70%), Pacific Gas & Electric (58%). Also, manufacturers typically size equipment with a built-in 67% duty factor and contractors typically add another 25% safety factor, which results in a 50% overall duty factor.
[2] Based on an a weighted average of 80% shaded pole motors at 132 watts and 20% PSC motors at 88 watts.
[3] Wattage of fan used by Freeaire and Cooltrol. This fan is used to circulate air in the cooler when the evaporator fan is turned off. As such, it is not used when fan control is not present.
[4] Average of two manufacturer estimates of 50% and 75%.

APPENDIX C

Cost Estimates

Segmentation

	Unit	Unit Cost	# Units	Extended	References
New Wood Framed Partition (14', 2x6, 16" o.c.) Labor and materials	LF	$22	60	$1,320	RS Means. Escalated for 14' ceiling and inflation
Spray Foam Installed (4")	SF	$4	2436	$9,744	Colonial Green Products, Jaffrey NH (603.532.7005)
New insulated swinging access door (6' x 8')	each	$1,250	1	$1,250	Estimate
Minor reconfigurations to refrigerant lines, evaporator positioning, etc.	each	$1,000	1	$1,000	Estimate
			Total	**$13,314**	

Outside Air Economizer

	Unit	Unit Cost	# Units	Extended	References
Freeaire Polar Package Unit, including equipment, controls and installation	each	$3,500	2	$7,000	Freeaire, Richard Travers (CEO), 802.496.5205
			Total	**$7,000**	

APPENDIX D

CPA-52 Form

National Heritage Bureau Review Letter

610.70 Environmental Evaluation Worksheet

U.S. Department of Agriculture Natural Resources Conservation Service **ENVIRONMENTAL EVALUATION WORKSHEET**	NRCS-CPA-52 4-22-2009	**A. Client Name:** Carter Hill Orchard **B. Conservation Plan ID #** (as applicable): **Program Authority** (optional):
D. Client's Objective(s) (purpose): Agricultural Energy Management Plan- to improve energy efficiency in Orchard operations. Focus on cold storage optimization		**C. Identification #** (farm, tract, field #, etc as required): Carter Hill Orchards, Concord NH

E. Need for Action:	**G. Alternatives**		
	No Action √ if RMS ☐	***Alternative 1*** √ if RMS ☑	***Alternative 2*** √ if RMS ☑
Greater energy efficiency throughout Carter Hill Orchard's operations.	Orchard operations (cold storage) remain in current inefficient state.	Energy efficiency through the segmentation of primary cold storage space with added insulation	Energy efficiency through the segmentation of primary cold storage space with added insulation, plus outside air economizers

Resource Concerns & Special Environmental Concerns

In Section "F" below, analyze, record, and address concerns identified through the Resources Inventory process. (For *Resource Concerns* see FOTG Section III - Resource Quality Criteria for guidance. For *Special Environmental Concerns* complete and attach applicable Environmental Procedures Guide Sheets for documentation. Items with a "•" may require a federal permit or consultation/coordination between the lead agency and another government agency. In these cases, effects may need to be determined in consultation with another agency. Planning and practice implementation may proceed for practices not involved in consultation.)

F. Concerns and Existing/Benchmark Conditions (Analyze and record the existing/benchmark conditions for each identified concern)	**H. Effects of Alternatives**											
	No Action				***Alternative 1***				***Alternative 2***			
	Trend		Amount, Status, Description	√ if meets QC or needs action	Trend		Amount, Status, Description	√ if meets QC or needs action	Trend		Amount, Status, Description	√ if meets QC or needs action
	short	long			short	long			short	long		
SOIL												
No resource concern identified				meets ☐ QC				meets ☐ QC				meets ☐ QC
				meets ☐ QC				meets ☐ QC				meets ☐ QC
				meets ☐ QC				meets ☐ QC				meets ☐ QC
				meets ☐ QC				meets ☐ QC				meets ☐ QC
Prime and Unique Farmlands			Not Applicable	needs ☐ action			Not Applicable	needs ☐ action			Not Applicable	needs ☐ action
WATER												
No resource concern identified				meets ☐ QC				meets ☐ QC				meets ☐ QC
				meets ☐ QC				meets ☐ QC				meets ☐ QC
				meets ☐ QC				meets ☐ QC				meets ☐ QC
•Clean Water Act/Waters of the U.S.			Not Applicable	needs ☐ action			Not Applicable	needs ☐ action			Not Applicable	needs ☐ action
•Coastal Zone Management Areas			Not Applicable	needs ☐ action			Not Applicable	needs ☐ action			Not Applicable	needs ☐ action
Floodplain Management			Not Applicable	needs ☐ action			Not Applicable	needs ☐ action			Not Applicable	needs ☐ action
Riparian Area			Not Applicable	needs ☐ action			Not Applicable	needs ☐ action			Not Applicable	needs ☐ action
•Wetlands			Not Applicable	needs ☐ action	+	+	Not Applicable	needs ☐ action			Not Applicable	needs ☐ action
•Wild and Scenic Rivers			Not Applicable	needs ☐ action			Not Applicable	needs ☐ action			Not Applicable	needs ☐ action

610.70 Environmental Evaluation Worksheet

F. Concerns and Existing/Benchmark Conditions (Analyze and record the existing/benchmark conditions for each identified concern)	H. (continued)											
	No Action				*Alternative 1*				*Alternative 2*			
	Trend		Amount, Status, Description	√ if meets QC or needs action	Trend		Amount, Status, Description	√ if meets QC or needs action	Trend		Amount, Status, Description	√ if meets QC or needs action
	short	long			short	long			short	long		
AIR												
No resource concern identified				meets ☐ QC				meets ☐ QC				meets ☐ QC
				meets ☐ QC				meets ☐ QC				meets ☐ QC
				meets ☐ QC				meets ☐ QC				meets ☐ QC
•Clean Air Act			Not Applicable	needs ☐ action			Not Applicable	needs ☐ action			Not Applicable	needs ☐ action
PLANTS												
No resource concern identified				meets ☐ QC				meets ☐ QC				meets ☐ QC
				meets ☐ QC				meets ☐ QC				meets ☐ QC
				meets ☐ QC				meets ☐ QC				meets ☐ QC
				meets ☐ QC				meets ☐ QC				meets ☐ QC
•Endangered and Threatened Species			See Attached Documentation	needs ☐ action			See Attached Documentation	needs ☐ action			See Attached Documentation	needs ☐ action
Invasive Species			Not Applicable	needs ☐ action			Not Applicable	needs ☐ action			Not Applicable	needs ☐ action
Natural Areas			Not Applicable	needs ☐ action			Not Applicable	needs ☐ action			Not Applicable	needs ☐ action
Riparian Area			Not Applicable	needs ☐ action			Not Applicable	needs ☐ action			Not Applicable	needs ☐ action
ANIMALS												
No resource concern identified				meets ☐ QC				meets ☐ QC				meets ☐ QC
				meets ☐ QC				meets ☐ QC				meets ☐ QC
				meets ☐ QC				meets ☐ QC				meets ☐ QC
Coral Reefs			Not Applicable	needs ☐ action			Not Applicable	needs ☐ action				needs ☐ action
•Endangered and Threatened Species			Not Applicable	needs ☐ action			Not Applicable	needs ☐ action				needs ☐ action
•Essential Fish Habitat			Not Applicable	needs ☐ action			Not Applicable	needs ☐ action				needs ☐ action
Invasive Species			Not Applicable	needs ☐ action			Not Applicable	needs ☐ action				needs ☐ action
•Migratory Birds/Bald and Golden Eagles			Not Applicable	needs ☐ action			Not Applicable	needs ☐ action				needs ☐ action
Riparian Area			Not Applicable	needs ☐ action			Not Applicable	needs ☐ action				needs ☐ action

610.70 Environmental Evaluation Worksheet

F. Concerns and Existing/Benchmark Conditions (Analyze and record the existing/benchmark conditions for each identified concern)	H. (continued) No Action Trend short	Trend long	Amount, Status, Description	√ if meets QC or needs action	Alternative 1 Trend short	Trend long	Amount, Status, Description	√ if meets QC or needs action	Alternative 2 Trend short	Trend long	Amount, Status, Description	√ if meets QC or needs action
HUMAN												
•Cultural Resources	0	0	No Effect-see documentation	needs ☐ action	0	0	No Effect-see documentation	needs ☐ action	0	0	No Effect-see documentation	needs ☐ action
Environmental Justice			Not Applicable	needs ☐ action			Not Applicable	needs ☐ action			Not Applicable	needs ☐ action
Scenic Beauty			Not Applicable	needs ☐ action			Not Applicable	needs ☐ action			Not Applicable	needs ☐ action
Other:				needs ☐ action				needs ☐ action				needs ☐ action

I. Economic and Social Considerations (For guidance see FOTG Section I and Form Instructions)	No Action			Alternative 1			Alternative 2		
Land Use	0	0	Maintain current land use	0	0	Maintain current land use	0	0	Maintain current land use
Capital	0	0	No investment	0	+	Initial cost to landowner - repaid through energy savings	0	+	Higher initial cost to landowner - repaid through higher energy savings
Labor	0	0	Maintain current status	0	0	Maintain current status	0	0	Maintain current status
Management Level	0	0	Maintain current status	0	+	Concentrated storage of primary cop (apples) will facilitate loading and	0	+	Concentrated storage of primary cop (apples) will facilitate loading and
Profitability	0	0	Maintain current status	0	+	Producer will save money on electric bills.	0	+	Producer will save money on electric bills.
Risk	0	0	minimal	0	0	Minimal	0	0	Minimal
Social Well-Being	0	0	No issues	0	+	Increased profitability is client's main priority, which will be achieved with	0	+	Increased profitability is client's main priority, which will be achieved with
Other:									

J. Other Agencies and Broad Public Concerns	No Action	Alternative 1	Alternative 2
Easements, Permissions, or Permits Required and Agencies Consulted	Not Applicable	Not Applicable	Not Applicable
Identify any additional environmental, resource-protection, or land use laws or regulations or concerns to address:	Not Applicable	Not Applicable	Not Applicable
K. Mitigation	Not Applicable	Not Applicable	Not Applicable

L. Preferred Alternative	√ preferred alternative	☐	☑	☐
	Supporting reason			

M. The information recorded above is based on the best available information:

Signature | Title | Date

THE FOLLOWING SECTIONS ARE TO BE COMPLETED BY THE RESPONSIBLE FEDERAL OFFICIAL (RFO). Sections "N" & "O" do not need to be completed when only Technical Assistance is provided (e.g. conservation plan development).

The RFO is to use the NRCS-CPA-52 to determine whether there are significant adverse environmental effects or "extraordinary circumstances" that would preclude the applicability of a categorical exclusion or the tiering process. Review definitions below of significance and extraordinary circumstances as defined by context and intensity (40 CFR Part 1508.27).

610.70 Environmental Evaluation Worksheet

N. Context (Record context of alternatives analysis) **local**

The significance of an action must be analyzed in several contexts such as society as a whole (human, national), the affected region, the affected interests, and the locality.

O. Determination of Significance or Extraordinary Circumstances

Intensity: Refers to the severity of impact. Impacts may be both beneficial and adverse. A significant effect may exist even if the Federal agency believes that on balance the effect will be beneficial. Significance cannot be avoided by terming an action temporary or by breaking it down into small component parts.

If you answer ANY of the below questions "yes" then contact the State Environmental Liaison as there may be extraordinary circumstances and significance issues to consider and a site specific NEPA analysis may be required.

Yes	No	
☐	☑	• Is the preferred alternative expected to cause significant affects on public health or safety?
☐	☑	• Is the preferred alternative expected to significantly effect unique characteristics of the geographic area such as proximity to historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas.the unique characteristics of the geographic area?
☐	☑	• Are the effects of the preferred alternative on the quality of the human environment likely to be highly controversial?
☐	☑	• Does the preferred alternative have highly uncertain effects or involve unique or unknown risks on the human environment?
☐	☑	• Does the preferred alternative establish a precedent for future actions with significant impacts or represent a decision in principle about a future consideration?
☐	☑	• Is the preferred alternative known or reasonably expected to have potentially significant environment impacts to the quality of the human environment either individually or cumulatively over time?
☐	☑	• Will the preferred alternative likely have a significant adverse effect on ANY of the special environmental concerns? Use the Evaluation Procedure Guide Sheets to assist in this determination. This includes, but is not limited to, concerns such as cultural or historical resources, endangered and threatened species, environmental justice, wetlands, floodplains, coastal zones, coral reefs, essential fish habitat, wild and scenic rivers, clean air, riparian areas, natural areas, scenic beauty, and invasive species.
☐	☑	• Will the preferred alternative threaten a violation of Federal, State, or local law or requirements for the protection of the environment?

P. NEPA Compliance Finding (check one)

The preferred alternative:		Action required
☑	1) is **not a federal action** subject to NRCS regulations implementing NEPA (7 CFR Part 650)	Document in "Q" below. No additional analysis is required
☐	2) is a federal action that is **categorically excluded** from further environmental analysis **and** there are no extraordinary circumstances.	Document in "Q" below. No additional analysis is required
☐	3) is a federal action that has been **sufficiently analyzed** in an existing published NRCS state, regional, or national NEPA document **and** there are no predicted significant adverse environmental effects or extraordinary circumstances.	Document in "Q" below. No additional analysis is required.
☐	4) is a federal action that has been sufficiently analyzed in another Federal agency's NEPA document (EA or EIS) that addresses the proposed NRCS action and its' effects **and has been formally adopted by NRCS**. NRCS is required to prepare and publish the agency's own Finding of No Significant Impact for an EA or Record of Decision for an EIS when adopting another agency's EA or EIS document.	Contact the State Environmental Liaison for list of NEPA documents formally adopted and available for tiering. Document in "Q" below. No additional analysis is required
☐	5) is a federal action that has **NOT** been sufficiently analyzed or may involve predicted significant adverse environmental effects or extraordinary circumstances and may require an EA or EIS.	Contact the State Environmental Liaison. Further NEPA analysis required.

Q. Rationale Supporting the Finding	EE been developed for an Agricultural Energy Management Plan (Conservation Activity Plan). NRCS has not committed to funding any of the practices in the plan, therefore it is not a federal action.

I have considered the effects of the alternatives on the Resource Concerns, Economic and Social Considerations, Special Environmental Concerns, and Extraordinary Circumstances (as outlined in the NECH 610.22).

R. Signature of Responsible Federal Official:

Signature	Title	Date

New Hampshire Natural Heritage Bureau

To: Matthew Siska
GDS Associates
1181 Elm Street
Suite 205
Manchester, NH 03031

Date: 9/20/2010

From: NH Natural Heritage Bureau

Re: Review by NH Natural Heritage Bureau of request dated 9/20/2010

NHB File ID: NHB10-2319

Applicant: Matthew Siska

Address: 73 Carter Hill Road
Concord

Project Categories:
Buildings and Related Structures: Single commercial building lot

The NH Natural Heritage database has been checked for records of rare species and exemplary natural communities near the area mapped below. The species considered include those listed as Threatened or Endangered by either the state of New Hampshire or the federal government. We currently have no recorded occurrences for sensitive species near this project area.

A negative result (no record in our database) does not mean that a sensitive species is not present. Our data can only tell you of known occurrences, based on information gathered by qualified biologists and reported to our office. However, many areas have never been surveyed, or have only been surveyed for certain species. An on-site survey would provide better information on what species and communities are indeed present

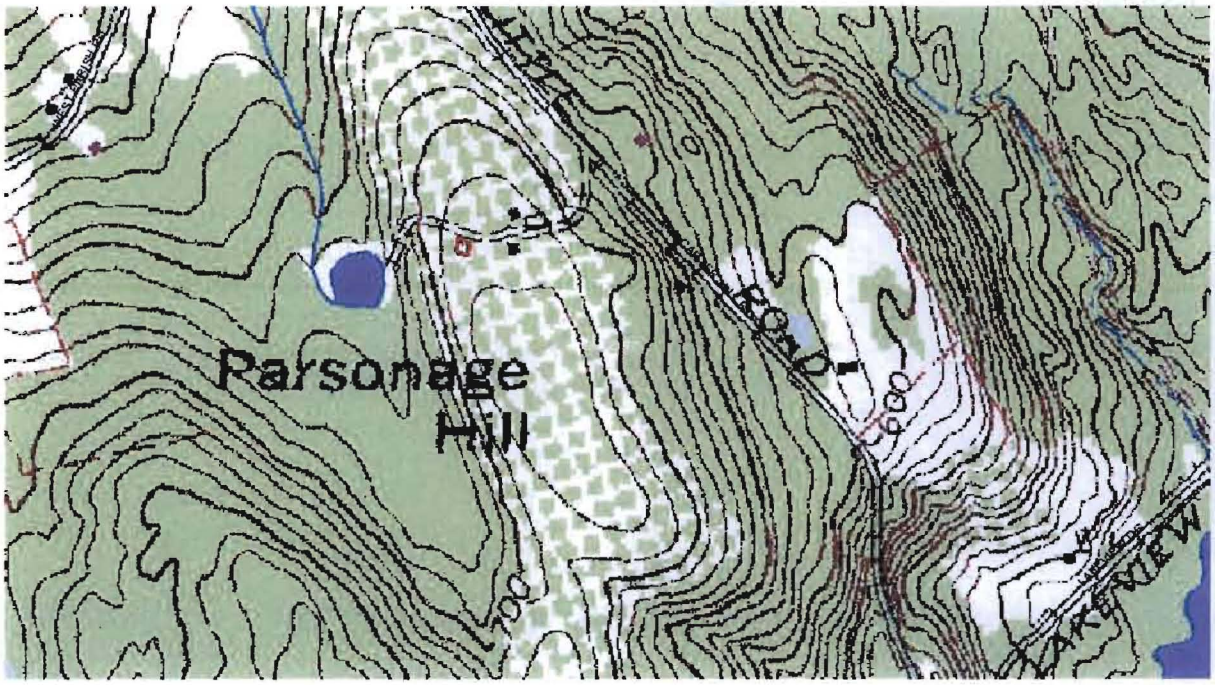
This review is valid through 9/20/2011.

Department of Resources and Economic Development
Division of Forests and Lands
(603) 271-2214 fax: 271-6488

DRED/NHB
PO Box 1856
Concord NH 03302-1856

New Hampshire Natural Heritage Bureau

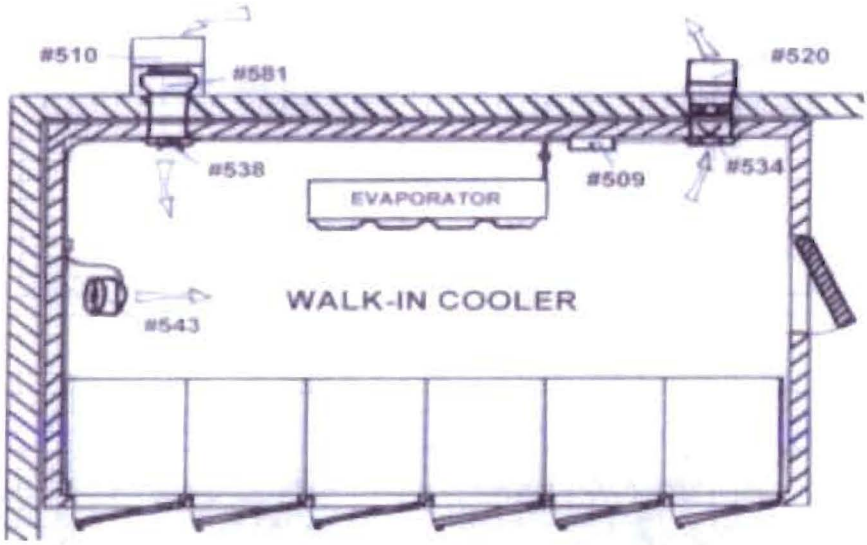
MAP OF PROJECT BOUNDARIES FOR: NHB ID# NHB10-2319



Department of Resources and Economic Development
Division of Forests and Lands
(603) 271-2214 fax: 271-6488

DRED/NHB
PO Box 1856
Concord NH 03302-1856

A Freeaire Refrigeration system uses several components that integrate with the refrigeration system of a walk-in cooler or freezer. The seven Freeaire components, including a Polar Package for outside air, are shown here installed in a typical walk-in cooler in a cold climate. Other layouts are possible.



Cooler Controllertm, **model 2100 (item #13100)** The electronic controller uses 24-volt dc power to operate the low voltage coils of relays, each controlling up to 10 amps of 120-240V line voltage load and located at each refrigeration component, including evaporator fans, compressor controls (usually a liquid line solenoid), electric defrost heaters, door heaters, door lights, and outside air intake and exhaust fans.

Features: An LCD screen displaying temperatures, setpoints, and information, 6 blue LED "power on" lights and manual on/off switch that, when switched off, automatically reverts control to a Bypass Thermostat and other controls supplied by others.

Patent Protection: U. S. Patent #5,239,834. and Canadian Patent #2,100,280.

Electrical Enclosure: 16 gauge steel box: 9"H x 8"W x 1.75"D; blue powder coated finish; mounted on wall inside or outside walk-in cooler or outside a walk-in freezer.

Electrical Rating: 24VDC, .08 A. Protected by a 250V, 1A, slow-blow fuse. System is supplied with a 24VDC, 40W, 1.7A, UL-listed switching power supply from Triad Magnetics, model # AWSP40-24 in a 7"x5"x2.5" ABS NEMA enclosure, Hammond Mfg.

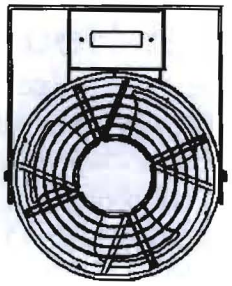
Sensors: Digital; Standard: #DS1631A temperature-only sensors from Maxim/Dallas (accuracy: +/-.5°C; operating range: -55°C to 125°C). Optional: #SHT11 humidity and temperature sensors from Sensiron (accuracy: +/- 3% RH,.4°C; Operating range: 0 to 100% RH, -40°C to 123°C). Inside walk-in temperature-only sensor is encased in a pvc container filled with plasticene clay to simulate food. A 2nd sensor senses the evaporator coil temperature to control defrost cycles. A 3rd sensor remotely senses outside air temperature only or temperature and humidity when outside air is used. A 4th sensor measures the humidity near reach-in doors for door heater control. Each sensor has a quick disconnect for a 1, 5, or 10 meter M12 extension cable. Longer distances achieved with M12 patch cables.

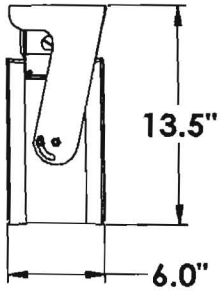
Installation: Wiring between components and the Cooler Controller to be 3- and 4-wire cable with 22 AWG wires run in flexible 1/2" blue ENT ("Smurf") tubing.

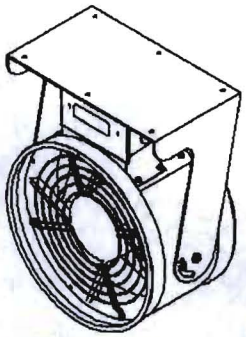
Shipping info: 12"H x 12"W x 6"L, 6 lbs.

Adjustable Circ$_{tm}$Fan (item #30100)

This can be mounted on the ceiling or wall and can move air vertically, horizontally or diagonally to circulate air however it needs to move to keep the temperature even throughout the space when the evaporator fans are off. Powered by 120VAC, controlled by a 10A RIB relay with a 24VDC coil. **Fan:** 10" diam. x 3.5" axial fan; 665 cfm (free air); 115 volts; 23 watts; 1600 rpm; Dayton brand; polybutylene terephthalate fan blades; aluminum housing; thermally protected PSC motor; UL Component Recognized and CSA Certified; two finger guards. Housing: Galvanized 20 gauge 10.25" diameter x 6" long cylinder swivels inside an 1/8" galvanized steel bracket. **Shipping info:** 14"H x 12"W x 6"D, 13 lbs.

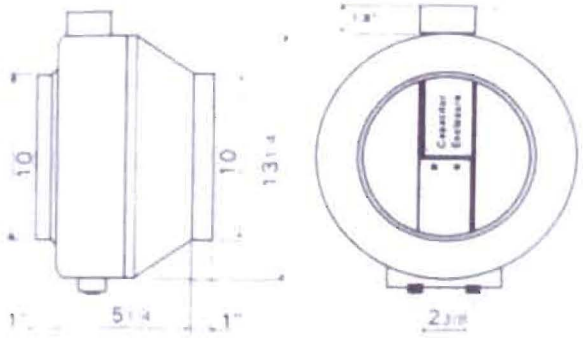






Intake Fan: (item #40100)

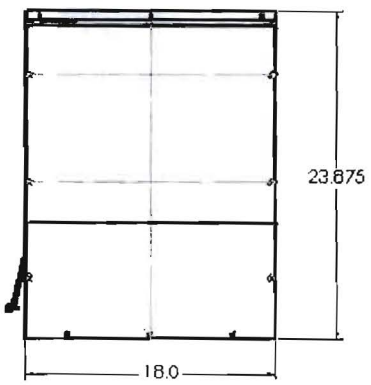
Fantech Model FG-10 inline centrifugal fan; 120 volts; 1.43 max amps; 138 watts; permanent split capacitor motor; ebm-papst external rotor motor impeller; 513 cfm (free air); 3000 rpm; UL listed; CSA certified; Energy Star rated; airtight galvanized steel housing; 10" diameter inlet and outlet. 13-3/8" diameter body x 7"H; To be mounted inside the Intake Hood outside the cooled space to prevent condensation and hard-wired to the Intake Damper Housing. **Shipping info:** 12"H x 16"W x 16"L, 12 lbs.

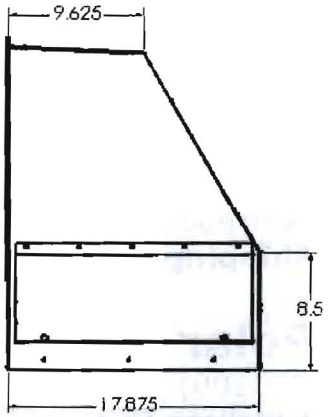


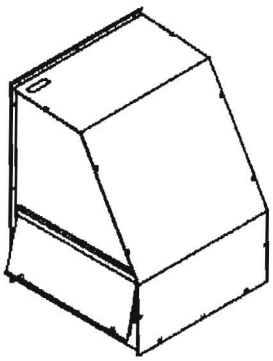
Intake Hood: (item #20100);

20 gauge galvanized sheetmetal housing; a 3/4" gasketed flange all around for mounting on flat surface; insulated hinged filter access door with two captive screw closures; 1" rigid urethane insulation for heated space mounting. Can be mounted on the roof or wall panel of the walk-in or on a flat wall or ceiling. Important: at least 16" of unobstructed room must be left to the left side of the filter access door for removing and replacing the filter. Double filter track allows two-stage filtration. Shipped with one MERV 8 high capacity pleated filter (item #517) in place. Will also accept optional MERV 7 carbon filter (item#517-C) for further filtration and odor removal of incoming air.

Shipping info: 18"H x 18"W x 24"L, 34 lbs.



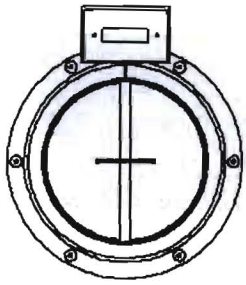


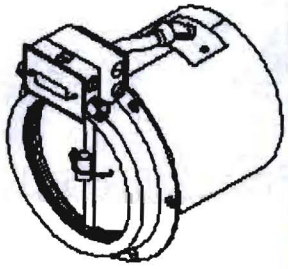


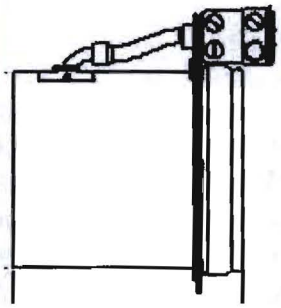
Intake Damper Housing: (item #20400)

To be mounted inside the walk-in cooler in the wall or ceiling. Connected to 120VAC and Intake Fan, which is controlled by a UL-listed 10A RIB relay with a 24VDC coil. Fully insulated and gasketed for minimal air leakage, 10" diameter x 12" x 20 gauge galvanized housing with 13" diameter, cast aluminum mounting ring; insulated aluminum backdraft dampers open with fan pressure; spring closed. Finger guard attached. Will accept optional summer plug (item #527) for an airtight seal, and an adjustable elbow (item #525)for directional aiming of the incoming air. **Shipping info:** 14"H x 14"W x 8"L, 15 lbs.

Exhaust Fan Housing: item#20300



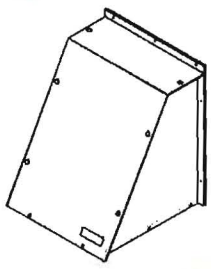


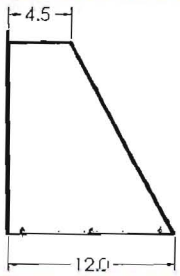


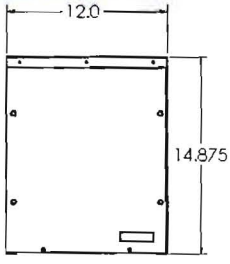
To be mounted inside the walk-in cooler in the wall or ceiling. Fully insulated and gasketed for minimal air leakage. Housing: 10" diameter x 12" x 20 gauge galvanized housing with 13" diameter, cast aluminum mounting ring flange; insulated aluminum backdraft dampers open with fan pressure; spring-closed. Will accept optional summer plug (item #527) for an airtight seal. **Fan:** 10" diameter x 3.5" axial fan; 665 cfm (free air); 115 volts; 23 watts; 1600 rpm; Dayton brand; polybutylene terephthalate fan blades; aluminum housing; thermally protected PSC motor; UL Component Recognized and CSA Certified; finger guard. Powered by 120VAC, controlled by a UL-listed 10A RIB relay with a 24VDC coil. Fan is mounted so that insulated dampers are between it and the walk-in so that condensation is avoided. **Shipping info:** 14"H x 14"W x 14"L, 18 lbs.

Wallcap: (item #20200)

Can be used for exhaust or intake. 14-7/8"H x 12"W x 12"D, 20 gauge galvanized sheetmetal; 1/4" bird and rodent screen over opening, 10-1/4" diameter opening. **Shipping info:** 10"Hx12"Wx16"L,8 lbs.







Polar Package:

Includes 1 Intake Fan (item#40100), 1 Intake Hood (item #20100), 1 Intake Damper Housing (#20400), 1 Exhaust Fan Housing (#20300) and 1 Wallcap (#20200). **Shipping info:** 5 boxes, 95 lbs.

Single Relay J-Box: (item #30800)

Consists of a single gang weatherproof electrical box and box extension with a SPDT RIBMN24C relay (from Functional Devices) with a 24VDC coil to control the evaporator fans or door heaters or door lights. 5"L x 3"W x 4"H. **Shipping info:** 8"H x 6"W x 4"L, 2 lbs.

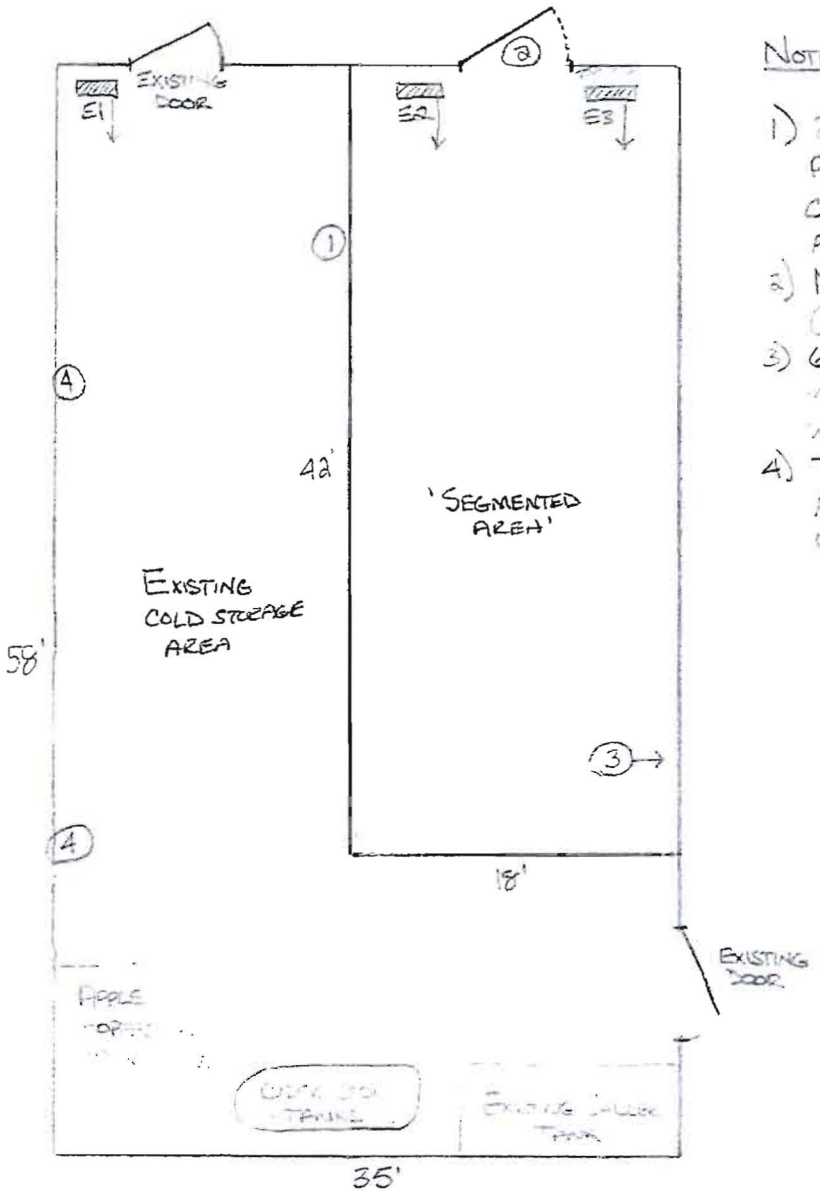
Double Relay J-Box: (item #30900)

Consists of a double gang weatherproof electrical box and box extension with a DPDT RIBMU2C relay (from Functional Devices) with 24VDC coils to control the compressor control and bypass thermostat or door heaters and door lights. 5"L x 5"W x 4"H. **Shipping info:** 8"H x 6"W x 4"L, 3 lbs.

APPENDIX A

Sketch of Proposed Cold Storage Arrangement

CARTER HILL ORCHARDS GDS ASSOCIATES 9/15/10



NOTES:

1) 2 × 6 WOOD FRAMED PARTITION FLOOR TO CEILING. DIMENSIONS PROVIDED BY CHO
2) NEW SWINGING DOOR (SIZE TBD BY CHO)
3) 6-INCHES SPRAY FOAM INSULATION COVERAGE OF THE FULL CEILING.
4) TENTATIVE LOCATION OF FREESTYLE POUCH PACKAGE UNITS (EXTERIOR WALL)

E1 & EXISTING EVAPORATIVE TO REMAIN
E2 } EXISTING EVAPORATIVES TO BE
E3 } RELOCATED TO NEW SEGMENTED STORAGE

APPENDIX B

Energy Calculations:

- Maximum cooling load
- Baseline usage calculations
- Scenario 1 calculations
- Scenario 2 calculations
- Scenario 3 calculations

Total Cooling Load - Sub-Divided Cold Storage
Carter Hill Orchard, Concord NH

1.) Assumptions

Maximum 3,000 bushels of apples stored at any one time
Maximum daily loading of apples is 30 bins (450 bushels)
* Max. cooling load occurs when all apples 2,550 bushels are stored and cooled, and the final 450 bushels need to be cooled
12,000 btu/ton-hr
2,000 lbs / ton
3,412 Btu / kilowatt-hour

2.) Calculation Inputs

Pounds of apples per bushel	48	lbm	www.unc.edu/~rowlett/units/scales/bushels
Specific heat of apples above freezing	0.86	Btu/lb°F	1998 AHSRAE Refrigeration HB. Ch. 8 Table 3
Initial Temperature of Apples entering cooler	55	Deg F	From Rob L. Pre-cooled outside overnight to
Desired Storage Temperature	36	Deg F	
Cool down time	12	Hours	
Apple respiration rate @ 60 Deg F	3,190	Btu/ton/day	NREAS-22 Table 6
Apple respiration rate @ 32 Deg F	880	Btu/ton/day	NREAS-22 Table 6

3.) Calculations

Cooling load of 2,550 bushels of apples at storage temp	2,244	Btu/hour
Cooling load of removing field heat from 450 bushels	29,412	Btu/hour
Cooling load of respiration heat heat from 450 bushels	2,871	Btu/hour
Total cooling load (sum)	**34,527**	btu/hour

* exludes losses through walls and ceiling
* excludes losses through open doors when accessed

4.) Max. Heat Loss Through Cold Storage Envelope

Perimeter length (42' x 18' room)	120		
Ceiling Height	14		
R-Value (4" spray foam on wood frame)	24	hr-sf-Deg F/Btu	(~6.0 hr-sf-Deg F/btu/inch)
Average outside temp	70		
Total Area	2,436	SF	
Max. heat loss through envelope	**3,451**	Btu/hour	

* excludes losses through open doors when accessed
* conservatively assumes all walls open to heated interior

5.) Cooling Capacity of 2 Existing Compressors

Number of compressors serving new CS area	1		
Compressor horsepower (each)	3.3	HP	
Power consumption (HP) per ton of cooling for R-22	0.707	HP/cooling ton	1997 ASHRAE Fundamentals HB. Ch. 18. Tab
Total btu/hour cooling capacity of existing compressors	**56,011**	btu/h	

Baseline Determination Approach
Carter Hill Orchard, Concord NH

Assumptions:

1. Cold storage in use from September until December
2. Cold storage temperature maintained at 38F
3. Humidity control not required
4. CHO apples loaded at 55 F for six weeks
5. 6 inches of cellulose on ceiling
6. 2 inches of isocyanurate in walls
7. Cold storage is 58' by 35' by 14'H
8. Only one long wall is external
9. No insulation under slab on grade floor
10. All accesses to cold storage are from interior spaces
11. Other loads on the same meter: retail store, water pump, packing area
12. Retail store operates from 9:AM to 6:PM, 7 days per week, Aug. to Dec.
13. School(w/water tank), retail store, processing building drained and unheated during off season
14. Well pump runs 2 hours per day, I hp pump, Sep thru Dec

Step 1. Estimate monthly electric usage by retail store
Step 2. Estimate monthly electric usage in packing area
Step 3. Estimate monthly electric usage in cold storage
Step 4. Compare the sum of the three with actual bills

Baseline Determination Step 1 - retail Usage
Carter Hill Orchard, Concord NH

Retail space--Base case electric usage

Inputs/ Assumptions

Walk in cooler average load	1.5	ton
Total lighting load	3.03	kW
Electric Water heating	4.5	kW
Estimated water heating hrs/day	4	hours/day
Space heating (pellet)	0	kW
Operating hours / day	9	hours/day
9 hrs/day/7 days/week: Aug-Dec		
Compressor rating	0.707	HP/ton

Month	Lighting	Cooler	Water heating	Total Kw-hrs	
Aug	409	285	558	1252	* Assumes 15 day operation
Sep	818	570	540	1928	
Oct	845	589	558	1992	
Nov	818	570	540	1928	
Dec	845	589	558	1992	
Jan	0	0	0	0	
Feb	0	0	0	0	
Mar	0	0	0	0	
Apr	0	0	0	0	
May	0	0	0	0	
Jun	0	0	0	0	
July	0	0	0	0	

Baseline Determination Step 2 - packaging & well Pump Usage
Carter Hill Orchard, Concord NH

Packing Area & water pump--Base case electric usage

Inputs/ Assumptions

Equipment / Machinery Load	4.0	kW
Total lighting load	0.5	kW
Space heating (pellet)	0	kW
Operating hours / day	3	hours/day
20 hrs/week, 15 weeks/year: Sept-Dec		
Irrigation pump size	1	HP
Irrigation hours/day	4	hours/day

Month	Lighting	Machinery	Well Pump	Total Kw-hrs
Aug	0	0	103	103
Sep	45	360	99	504
Oct	47	372	103	521
Nov	45	372	99	516
Dec	47	372	103	521
Jan	0	0	0	0
Feb	0	0	0	0
Mar	0	0	0	0
Apr	0	0	0	0
May	0	0	0	0
Jun	0	0		0
July	0	0		0

Baseline Determination Step 3 - Cold Storage
Carter Hill Orchard, Concord NH

Givens:
Dimensions: 58' long x 35' wide x 14' tall
8" wood frame walls with loose fill cellulosic insulation
Insulation has settled within wall cavities
2" Poly Iso foam board installed over 50% of exterior wall
6" blown cellulose insulation in attic
Currently accessed 10-15 times a day Sept-Nov
Currently accessed ~20 times week Nov-January

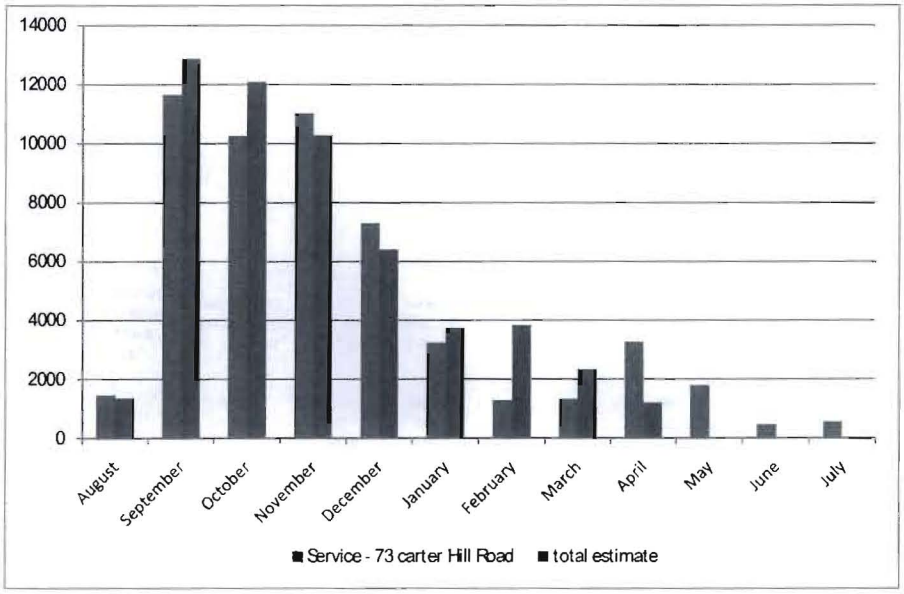
Inputs/ Assumptions

External Wall Area	812	SF	
R-Value with 2" polyiso	20		
R-Value without 2" polyiso	10		8" loose fill cellulose, derated 50% for settling
U-Value with	0.05		
U-Value without	0.10		
Internal Wall Area	1792	SF	
R-Value	10		
U-Value	0.1		
Ceiling Area	2030	SF	
R-Value	20		
U-Value	0.05		
Air changes per hour	6.5		Estimate for leaky building
Operating hours/day	24	hours	
Interior Space temp	38	Deg F	
Adjacent Space Temp	65	Deg F	
Internal Volume	28,420	cubic feet	
A/C kW per ton of Cooling	0.9	kW/ton	
EER of refrigeration compressors	7.9		

Month	Cooling Days per month	Average Outside Temp	Average Interior Space temp	Envelope Heat Loss (btu/hr)	Air Change Heat loss (btu/hr)	Daily Removal of Field heat from 30 bins (btu/hour)	Remove heat of respiration from stored apples (btu/hour)	Total Heat transfer (Btu/hour)	A/C Load (kW)	Energy (kWh/ month)
Aug	31	63	65	0	0	0	0	0	0.0	0
Sep	30	52	60	6,216	76,201	29,412	2,640	114,469	14.5	10,433
Oct	31	40	57	3,730	65,810	29,412	2,640	101,592	12.9	9,568
Nov	30	34	53	2,038	51,955	29,412	2,640	86,046	10.9	7,842
Dec	31	19	50	-935	41,564	0	880	41,509	5.3	3,909
Jan	30	17	50	-1,260	41,564	0	880	41,184	5.2	3,754
Feb	30	22	50	-448	41,564	0	880	41,996	5.3	3,828
Mar	30	34	50	1,501	41564	0	0	43065	3.2	2,326
Apr	15	44	50	3,125	41564	0	0	44689	3.4	1,207
May	0	55	50	0	0	0	0	0	0.0	0
Jun	0	61	50	0	0	0	0	0	0.0	0
July	0	70	50	0	0	0	0	0	0.0	0

Carter Hill orchards
Utility Bill Comparison

Service - 73 carter Hill Road			Baseline - retail		Baseline - Packing/Well		Baseline - CS			
Month	Year	kWh	Month	kWh	Month	kWh	Month	kWh	total estimate	total variance
July	2009	420								
August	2009	1469	Aug	1252	Aug	103	Aug	0	1,355	-114
September	2009	11647	Sep	1928	Sep	504	Sep	10433	12,865	1,218
October	2009	10251	Oct	1992	Oct	521	Oct	9568	12,081	1,830
November	2009	11028	Nov	1928	Nov	516	Nov	7842	10,286	-742
December	2009	7295	Dec	1992	Dec	521	Dec	3909	6,422	-873
January	2010	3240	Jan	0	Jan	0	Jan	3754	3,754	514
February	2010	1283	Feb	0	Feb	0	Feb	3828	3,828	2,545
March	2010	1345	Mar	0	Mar	0	Mar	2326	2,326	981
April	2010	3259	Apr	0	Apr	0	Apr	1207	1,207	-2,052
May	2010	1794	May	0	May	0	May	0	0	-1,794
June	2010	462	Jun	0	Jun	0	Jun	0	0	-462
July	2010	561	July	0	July	0	July	0	0	-561



Option 1 - Segmented Cold Storage
Carter Hill Orchard, Concord NH

A.) Segmented Area

Givens:
Dimensions: 45' long x 18' wide x 14' tall
6" wood frame walls with 4" spray foam insulation
6" blown cellulose insulation in attic
Accessed 2 x day Sept-January

Inputs/ Assumptions

Internal Wall Area	1764	SF	
R-Value	24		
U-Value	0.042		
Ceiling Area	864	SF	
R-Value	56		
U-Value	0.018		
Air changes per hour	2.0		estimate for air tight enclosure
Operating hours/day	24	hours	
Interior Space temp	34	Deg F	
Internal Volume	11,340	cubic feet	
A/C kW per ton of Cooling	0.9	kW/ton	
EER of refrigeration compressors	7.9		

Month	Cooling Days per month	Average Outside Temp	Average Interior Space temp	Envelope Heat Loss (btu/hr)	Air Change Heat loss (btu/hr)	Daily Removal of Field heat from 30 bins (btu/hour)	Remove heat of respiration from stored apples (btu/hour)	Total Heat transfer (Btu/hour)	A/C Load (kW)	Energy (kWh/ month)	Delta from Baseline (ignoring remainder of space)
Aug	31	63	65	0	0	0	0	0	0.0	0	0
Sep	30	52	60	2,189	11,057	29,412	2,640	45,297	5.7	4,128	-6,304
Oct	31	40	57	1,783	9,781	29,412	2,640	43,616	5.5	4,108	-5,460
Nov	30	34	53	1,397	8,080	29,412	2,640	41,528	5.3	3,785	-4,057
Dec	31	19	50	945	6,804	0	880	8,629	1.1	813	-3,097
Jan	30	17	50	914	6,804	0	880	8,598	1.1	784	-2,970
Feb	30	22	50	991	6,804	0	880	8,675	1.1	791	-3,037
Mar	30	34	50	1,176	6804	0	0	7980	0.6	431	-1,895
Apr	15	44	50	1,330	6804	0	0	8134	0.6	220	-987
May	0	55	50	0	0	0	0	0	0.0	0	0
Jun	0	61	50	0	0	0	0	0	0.0	0	0
July	0	70	50	0	0	0	0	0	0.0	0	0
										total	-27,807 kwh

Option 1 - Segmented Cold Storage
Carter Hill Orchard, Concord NH

B.) Remaining Area Usage

Givens:
Dimensions: 58' long x 35' wide x 14' tall (less 42' x 18' segment)
8" wood frame walls with loose fill cellulosic insulation
Insulation has settled within wall cavities
2" Poly Iso foam board installed over 50% of exterior wall
6" blown cellulose insulation in attic
Currently accessed 10-15 times a day Sept-Nov
Currently accessed ~20 times week Nov-January

Inputs/ Assumptions

External Wall Area	812	SF	
R-Value with 2" polyiso	20		
R-Value without 2" polyiso	10		8" loose fill cellulose, derated 50% for settling
U-Value with	0.05		
U-Value without	0.10		
Internal Wall Area	462	SF	
R-Value	10		
U-Value	0.1		
Internal Wall Area (adj. new storage)	840	SF	
R-Value	38		
U-Value	0.028		
Ceiling Area	1274	SF	
R-Value	20		
U-Value	0.05		
Air changes per hour	4.0		Estimate for leaky building. Reduced by new air tight enclosure, reduced access
Operating hours/ day	24	hours	
Interior Space temp	38	Deg F	
Adjacent Space Temp (new storage)	34	Deg F	
Internal Volume	17,080	cubic feet	
A/C kW per ton of Cooling	0.9	kW/ton	
EER of refrigeration compressors	7.9		

Month	Cooling Days per month	Average Outside Temp	Average Interior Space temp	Envelope Heat Loss (btu/ hr)	Air Change Heat loss (btu/ hr)	Daily Removal of Field heat from 30 bins (btu/ hour)	Remove heat of respiration from stored apples (btu/ hour)	Total Heat transfer (Btu/ hour)	A/C Load (kW)	Energy (kWh/ month)	Total Energy w/ Segmented (kWh/ month)	Total Delta from Baseline (kWh/ Mo)
Aug	31	63	65	0	0	0	0	0	0.0	0	0	0
Sep	30	52	60	2,667	28,182	0	0	30,849	3.9	2,812	6,940	-3,493
Oct	31	40	57	1,034	24,339	0	0	25,373	3.2	2,390	6,497	-3,070
Nov	30	34	53	101	19,215	0	0	19,316	2.4	1,760	5,545	-2,297
Dec	31	19	50	-1,906	15,372	0	0	13,466	1.7	1,268	2,081	-1,828
Jan	30	17	50	-2,156	15,372	0	0	13,216	1.7	1,205	1,988	-1,765
Feb	30	22	50	-1,533	15,372	0	0	13,839	1.8	1,261	2,052	-1,776
Mar	30	34	50	-37	15372	0	0	15335	1.2	828	1,259	-1,067
Apr	15	44	50	1,209	15372	0	0	16581	1.2	448	667	-539
May	0	55	50	0	0	0	0	0	0.0	0	0	0
Jun	0	61	50	0	0	0	0	0	0.0	0	0	0
July	0	70	50	0	0	0	0	0	0.0	0	0	0
											total	-15,835 kWh

Freeaire Calcualtion
Carter Hill Orchard, Concord NH

1.) Calculation based on Efficiency Vermont Technical Reference Manual (TRM) Dated 2/19/10. Equation and inputs below:

Carter Hill Inputs:
3.3 Compressor HP
2,996 run hours (TRM assumption)
50% compressor duty cycle
1 evaporator fan
TRM assumptions

Energy Savings

With Fan Control Installed

$$\Delta kWh = [HP \times kWh_{Cond}] + [((kW_{Evap} \times n_{Fans}) - kW_{Circ}) \times Hours \times DC_{Comp} \times BF] - [kW_{Econ} \times DC_{Econ} \times Hours]$$

Without Fan Control Installed

$$\Delta kWh = [HP \times kWh_{Cond}] - [kW_{Econ} \times DC_{Econ} \times Hours]$$

Where:

ΔkW	= gross customer connected load kW savings for the measure (kW)
ΔkWh	= gross customer annual kWh savings for the measure (kWh)
HP	= Horsepower of Compressor
kWh_{Cond}	= Condensing unit savings, per hp. (value from savings table in Reference Tables section of this measure write-up)
Hours	= Number of annual hours that economizer operates. 2,996 hrs based on 38° F cooler setpoint, Burlington VT weather data, and 5 degree economizer deadband.
DC_{Comp}	= Duty cycle of the compressor (Assume 50%)[1]
kW_{Evap}	= Connected load kW of each evaporator fan (Average 0.123 kW)[2]
kW_{Circ}	= Connected load kW of the circulating fan (0.035 kW)[3].
n_{Fans}	= Number of evaporator fans
DC_{Econ}	= Duty cycle of the economizer fan on days that are cool enough for the economizer to be working (Assume 63%)[4].

[1] A 50% duty cycle is assumed based on examination of duty cycle assumptions from Richard Travers (35%-65%), Cooltrol (35%-65%), Natural Cool (70%), Pacific Gas & Electric (58%). Also, manufacturers typically size equipment with a built-in 67% duty factor and contractors typically add another 25% safety factor, which results in a 50% overall duty factor.
[2] Based on an a weighted average of 80% shaded pole motors at 132 watts and 20% PSC motors at 88 watts.
[3] Wattage of fan used by Freeaire and Cooltrol. This fan is used to circulate air in the cooler when the evaporator fan is turned off. As such, it is not used when fan control is not present.
[4] Average of two manufacturer estimates of 50% and 75%.

APPENDIX C

Cost Estimates

Segmentation

	Unit	Unit Cost	# Units	Extended	References
New Wood Framed Partition (14', 2x6, 16" o.c.) Labor and materials	LF	$22	60	$1,320	RS Means. Escalated for 14' ceiling and inflation
Spray Foam Installed (4")	SF	$4	2436	$9,744	Colonial Green Products, Jaffrey NH (603.532.7005)
New insulated swinging access door (6' x 8')	each	$1,250	1	$1,250	Estimate
Minor reconfigurations to refrigerant lines, evaporator positioning, etc.	each	$1,000	1	$1,000	Estimate
			Total	**$13,314**	

Outside Air Economizer

	Unit	Unit Cost	# Units	Extended	References
Freeaire Polar Package Unit, including equipment, controls and installation	each	$3,500	2	$7,000	Freeaire, Richard Travers (CEO), 802.496.5205
			Total	**$7,000**	

APPENDIX D

CPA-52 Form

National Heritage Bureau Review Letter

610.70 Environmental Evaluation Worksheet

U.S. Department of Agriculture Natural Resources Conservation Service NRCS-CPA-52 4-22-2009 **ENVIRONMENTAL EVALUATION WORKSHEET**	**A. Client Name:** Carter Hill Orchard **B. Conservation Plan ID #** (as applicable): **Program Authority** (optional):
D. Client's Objective(s) (purpose): Agricultural Energy Management Plan- to improve energy efficiency in Orchard operations. Focus on cold storage optimization	**C. Identification #** (farm, tract, field #, etc as required): Carter Hill Orchards, Concord NH

E. Need for Action:	**G. Alternatives**		
	No Action √ if RMS ☐	***Alternative 1*** √ if RMS ☑	***Alternative 2*** √ if RMS ☑
Greater energy efficiency throughout Carter Hill Orchard's operations.	Orchard operations (cold storage) remain in current inefficient state.	Energy efficiency through the segmentation of primary cold storage space with added insulation	Energy efficiency through the segmentation of primary cold storage space with added insulation, plus outside air economizers

Resource Concerns & Special Environmental Concerns

In Section "F" below, analyze, record, and address concerns identified through the Resources Inventory process. (For *Resource Concerns* see FOTG Section III - Resource Quality Criteria for guidance. For *Special Environmental Concerns* complete and attach applicable Environmental Procedures Guide Sheets for documentation. Items with a "•" may require a federal permit or consultation/coordination between the lead agency and another government agency. In these cases, effects may need to be determined in consultation with another agency. Planning and practice implementation may proceed for practices not involved in consultation.)

F. Concerns and Existing/Benchmark Conditions (Analyze and record the existing/benchmark conditions for each identified concern)	**H. Effects of Alternatives**											
	No Action				***Alternative 1***				***Alternative 2***			
	Trend		Amount, Status, Description	√ if meets QC or needs action	Trend		Amount, Status, Description	√ if meets QC or needs action	Trend		Amount, Status, Description	√ if meets QC or needs action
	short	long			short	long			short	long		
SOIL												
No resource concern identified				meets ☐ QC				meets ☐ QC				meets ☐ QC
				meets ☐ QC				meets ☐ QC				meets ☐ QC
				meets ☐ QC				meets ☐ QC				meets ☐ QC
				meets ☐ QC				meets ☐ QC				meets ☐ QC
Prime and Unique Farmlands			Not Applicable	needs ☐ action			Not Applicable	needs ☐ action			Not Applicable	needs ☐ action
WATER												
No resource concern identified				meets ☐ QC				meets ☐ QC				meets ☐ QC
				meets ☐ QC				meets ☐ QC				meets ☐ QC
				meets ☐ QC				meets ☐ QC				meets ☐ QC
•Clean Water Act/Waters of the U.S.			Not Applicable	needs ☐ action			Not Applicable	needs ☐ action			Not Applicable	needs ☐ action
•Coastal Zone Management Areas			Not Applicable	needs ☐ action			Not Applicable	needs ☐ action			Not Applicable	needs ☐ action
Floodplain Management			Not Applicable	needs ☐ action			Not Applicable	needs ☐ action			Not Applicable	needs ☐ action
Riparian Area			Not Applicable	needs ☐ action			Not Applicable	needs ☐ action			Not Applicable	needs ☐ action
•Wetlands			Not Applicable	needs ☐ action	+	+	Not Applicable	needs ☐ action			Not Applicable	needs ☐ action
•Wild and Scenic Rivers			Not Applicable	needs ☐ action			Not Applicable	needs ☐ action			Not Applicable	needs ☐ action

610.70 Environmental Evaluation Worksheet

F. Concerns and Existing/Benchmark Conditions (Analyze and record the existing/benchmark conditions for each identified concern)	H. (continued)											
	No Action				*Alternative 1*				*Alternative 2*			
	Trend		Amount, Status, Description	√ if meets QC or needs action	Trend		Amount, Status, Description	√ if meets QC or needs action	Trend		Amount, Status, Description	√ if meets QC or needs action
	short	long			short	long			short	long		
AIR												
No resource concern identified				meets ☐ QC				meets ☐ QC				meets ☐ QC
				meets ☐ QC				meets ☐ QC				meets ☐ QC
				meets ☐ QC				meets ☐ QC				meets ☐ QC
•Clean Air Act			Not Applicable	needs ☐ action			Not Applicable	needs ☐ action			Not Applicable	needs ☐ action
PLANTS												
No resource concern identified				meets ☐ QC				meets ☐ QC				meets ☐ QC
				meets ☐ QC				meets ☐ QC				meets ☐ QC
				meets ☐ QC				meets ☐ QC				meets ☐ QC
				meets ☐ QC				meets ☐ QC				meets ☐ QC
•Endangered and Threatened Species			See Attached Documentation	needs ☐ action			See Attached Documentation	needs ☐ action			See Attached Documentation	needs ☐ action
Invasive Species			Not Applicable	needs ☐ action			Not Applicable	needs ☐ action			Not Applicable	needs ☐ action
Natural Areas			Not Applicable	needs ☐ action			Not Applicable	needs ☐ action			Not Applicable	needs ☐ action
Riparian Area			Not Applicable	needs ☐ action			Not Applicable	needs ☐ action			Not Applicable	needs ☐ action
ANIMALS												
No resource concern identified				meets ☐ QC				meets ☐ QC				meets ☐ QC
				meets ☐ QC				meets ☐ QC				meets ☐ QC
				meets ☐ QC				meets ☐ QC				meets ☐ QC
Coral Reefs			Not Applicable	needs ☐ action			Not Applicable	needs ☐ action				needs ☐ action
•Endangered and Threatened Species			Not Applicable	needs ☐ action			Not Applicable	needs ☐ action				needs ☐ action
•Essential Fish Habitat			Not Applicable	needs ☐ action			Not Applicable	needs ☐ action				needs ☐ action
Invasive Species			Not Applicable	needs ☐ action			Not Applicable	needs ☐ action				needs ☐ action
•Migratory Birds/Bald and Golden Eagles			Not Applicable	needs ☐ action			Not Applicable	needs ☐ action				needs ☐ action
Riparian Area			Not Applicable	needs ☐ action			Not Applicable	needs ☐ action				needs ☐ action

610.70 Environmental Evaluation Worksheet

F. Concerns and Existing/Benchmark Conditions (Analyze and record the existing/benchmark conditions for each identified concern)	H. (continued)											
	No Action				*Alternative 1*				*Alternative 2*			
	Trend		Amount, Status, Description	√ if meets QC or needs action	Trend		Amount, Status, Description	√ if meets QC or needs action	Trend		Amount, Status, Description	√ if meets QC or needs action
	short	long			short	long			short	long		
HUMAN												
•Cultural Resources	0	0	No Effect-see documentation	needs ☐ action	0	0	No Effect-see documentation	needs ☐ action	0	0	No Effect-see documentation	needs ☐ action
Environmental Justice			Not Applicable	needs ☐ action			Not Applicable	needs ☐ action			Not Applicable	needs ☐ action
Scenic Beauty			Not Applicable	needs ☐ action			Not Applicable	needs ☐ action			Not Applicable	needs ☐ action
Other:				needs ☐ action				needs ☐ action				needs ☐ action

I. Economic and Social Considerations (For guidance see FOTG Section I and Form Instructions)	No Action			*Alternative 1*			*Alternative 2*		
Land Use	0	0	Maintain current land use	0	0	Maintain current land use	0	0	Maintain current land use
Capital	0	0	No investment	0	+	Initial cost to landowner - repaid through energy savings	0	+	Higher initial cost to landowner - repaid through higher energy savings
Labor	0	0	Maintain current status	0	0	Maintain current status	0	0	Maintain current status
Management Level	0	0	Maintain current status	0	+	Concentrated storage of primary cop (apples) will facilitate loading and	0	+	Concentrated storage of primary cop (apples) will facilitate loading and
Profitability	0	0	Maintain current status	0	+	Producer will save money on electric bills.	0	+	Producer will save money on electric bills.
Risk	0	0	minimal	0	0	Minimal	0	0	Minimal
Social Well-Being	0	0	No issues	0	+	Increased profitability is client's main priority, which will be achieved with	0	+	Increased profitability is client's main priority, which will be achieved with
Other:									

J. Other Agencies and Broad Public Concerns	No Action	*Alternative 1*	*Alternative 2*
Easements, Permissions, or Permits Required and Agencies Consulted	Not Applicable	Not Applicable	Not Applicable
Identify any additional environmental, resource-protection, or land use laws or regulations or concerns to address:	Not Applicable	Not Applicable	Not Applicable
K. Mitigation	Not Applicable	Not Applicable	Not Applicable

L. Preferred Alternative		No Action	*Alternative 1*	*Alternative 2*
	√ preferred alternative	☐	☑	☐
	Supporting reason			

M. The information recorded above is based on the best available information:

Signature	Title	Date

THE FOLLOWING SECTIONS ARE TO BE COMPLETED BY THE RESPONSIBLE FEDERAL OFFICIAL (RFO). Sections "N" & "O" do not need to be completed when only Technical Assistance is provided (e.g. conservation plan development).

The RFO is to use the NRCS-CPA-52 to determine whether there are significant adverse environmental effects or "extraordinary circumstances" that would preclude the applicability of a categorical exclusion or the tiering process. Review definitions below of significance and extraordinary circumstances as defined by context and intensity (40 CFR Part 1508.27).

610.70 Environmental Evaluation Worksheet

N. Context (Record context of alternatives analysis) **local**

The significance of an action must be analyzed in several contexts such as society as a whole (human, national), the affected region, the affected interests, and the locality.

O. Determination of Significance or Extraordinary Circumstances

Intensity: Refers to the severity of impact. Impacts may be both beneficial and adverse. A significant effect may exist even if the Federal agency believes that on balance the effect will be beneficial. Significance cannot be avoided by terming an action temporary or by breaking it down into small component parts.

If you answer ANY of the below questions "yes" then contact the State Environmental Liaison as there may be extraordinary circumstances and significance issues to consider and a site specific NEPA analysis may be required.

Yes	No	
☐	☑	• Is the preferred alternative expected to cause significant affects on public health or safety?
☐	☑	• Is the preferred alternative expected to significantly effect unique characteristics of the geographic area such as proximity to historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas.the unique characteristics of the geographic area?
☐	☑	• Are the effects of the preferred alternative on the quality of the human environment likely to be highly controversial?
☐	☑	• Does the preferred alternative have highly uncertain effects or involve unique or unknown risks on the human environment?
☐	☑	• Does the preferred alternative establish a precedent for future actions with significant impacts or represent a decision in principle about a future consideration?
☐	☑	• Is the preferred alternative known or reasonably expected to have potentially significant environment impacts to the quality of the human environment either individually or cumulatively over time?
☐	☑	• Will the preferred alternative likely have a significant adverse effect on ANY of the special environmental concerns? Use the Evaluation Procedure Guide Sheets to assist in this determination. This includes, but is not limited to, concerns such as cultural or historical resources, endangered and threatened species, environmental justice, wetlands, floodplains, coastal zones, coral reefs, essential fish habitat, wild and scenic rivers, clean air, riparian areas, natural areas, scenic beauty, and invasive species.
☐	☑	• Will the preferred alternative threaten a violation of Federal, State, or local law or requirements for the protection of the environment?

P. NEPA Compliance Finding (check one)

The preferred alternative:		**Action required**
☑	1) is **not a federal action** subject to NRCS regulations implementing NEPA (7 CFR Part 650)	Document in "Q" below. No additional analysis is required
☐	2) is a federal action that is **categorically excluded** from further environmental analysis **and** there are no extraordinary circumstances.	Document in "Q" below. No additional analysis is required
☐	3) is a federal action that has been **sufficiently analyzed** in an existing published NRCS state, regional, or national NEPA document **and** there are no predicted significant adverse environmental effects or extraordinary circumstances .	Document in "Q" below. No additional analysis is required.
☐	4) is a federal action that has been sufficiently analyzed in another Federal agency's NEPA document (EA or EIS) that addresses the proposed NRCS action and its' effects **and has been formally adopted by NRCS**. NRCS is required to prepare and publish the agency's own Finding of No Significant Impact for an EA or Record of Decision for an EIS when adopting another agency's EA or EIS document.	Contact the State Environmental Liaison for list of NEPA documents formally adopted and available for tiering. Document in "Q" below. No additional analysis is required
☐	5) is a federal action that has **NOT** been sufficiently analyzed or may involve predicted significant adverse environmental effects or extraordinary circumstances and may require an EA or EIS.	Contact the State Environmental Liaison. Further NEPA analysis required.

Q. Rationale Supporting the Finding	EE been developed for an Agricultural Energy Management Plan (Conservation Activity Plan). NRCS has not committed to funding any of the practices in the plan, therefore it is not a federal action.

I have considered the effects of the alternatives on the Resource Concerns, Economic and Social Considerations, Special Environmental Concerns, and Extraordinary Circumstances (as outlined in the NECH 610.22).

R. Signature of Responsible Federal Official:

Signature	**Title**	**Date**

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2292!Fm!Tusffu
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OI C!Gjsfl!JE; OI C21.342:

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!!!!!Cvjmejoht!boe!Sfbufe!Tusvduvsft;!Tjohmf!dpn nfsdjbmcvjmejoh!rpu

The NH Natural Heritage database has been checked for records of rare species and exemplary natural communities near the area mapped below. The species considered include those listed as Threatened or Endangered by either the state of New Hampshire or the federal government. We currently have no recorded occurrences for sensitive species near this project area.

A negative result (no record in our database) does not mean that a sensitive species is not present. Our data can only tell you of known occurrences, based on information gathered by qualified biologists and reported to our office. However, many areas have never been surveyed, or have only been surveyed for certain species. An on-site survey would provide better information on what species and communities are indeed present

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Department of Resources and Economic Development
Division of Forests and Lands
(603) 271-2214 fax: 271-6488

DRED/NHB
PO Box 1856
Concord NH 03302-1856

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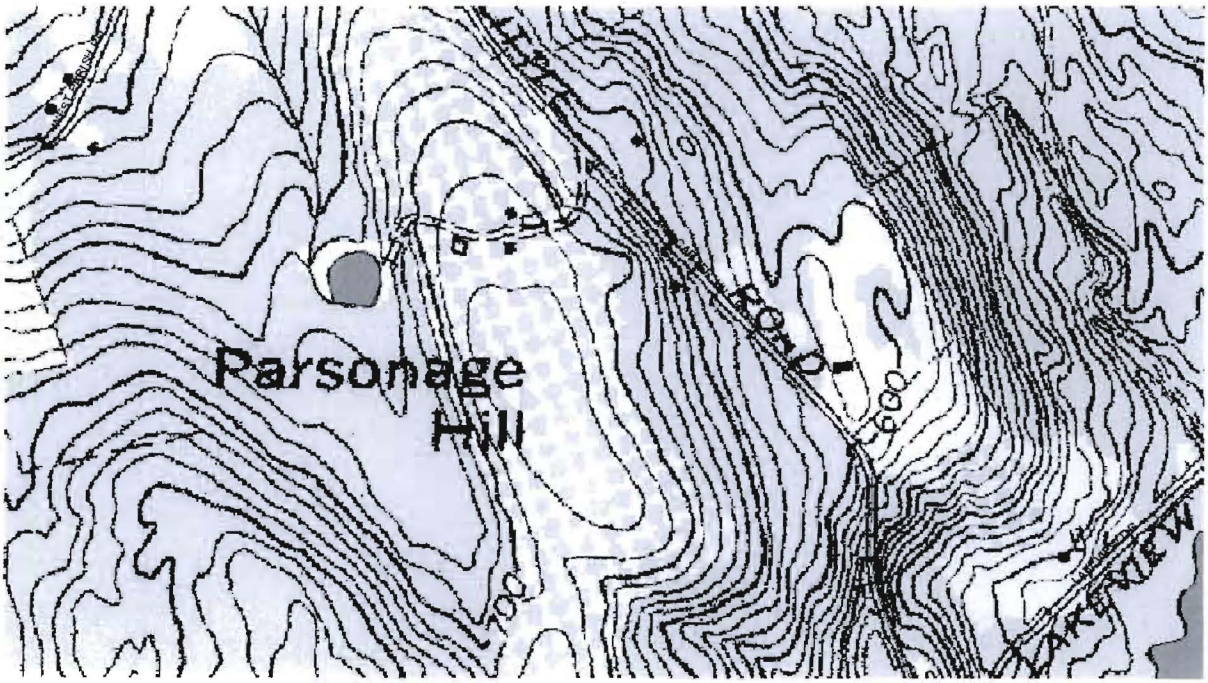

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