

# TOWN OF SANDWICH

THE OLDEST TOWN ON CAPE COD

130 MAIN STREET  
SANDWICH, MA 02563

TEL: 508-888-4910 AND 508-888-5144

FAX: 508-833-8045

E-MAIL: [selectmen@townofsandwich.net](mailto:selectmen@townofsandwich.net)

E-MAIL: [townhall@townofsandwich.net](mailto:townhall@townofsandwich.net)



BOARD OF  
SELECTMEN

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TOWN  
MANAGER

**BOARD OF SELECTMEN, SCHOOL COMMITTEE, FINANCE COMMITTEE,  
CAPITAL IMPROVEMENT PLANNING COMMITTEE  
SUMMIT WORKSHOP AGENDA  
August 25, 2016 – 7:00 P.M.  
Sandwich Town Hall – 130 Main Street**

1. Convene Open Session in Auditorium
2. Pledge of Allegiance
3. Summit Workshop
  - Welcome & Introductions – Selectmen Chairman Susan James
  - Overview of Workshop Goals & Desired Outcomes
  - Break-Out Sessions
  - Reporting from Break-Out Sessions
  - Conclusion & Planned Follow-up
  - Future Meeting(s)
4. Sandwich High School Chillers
  - Overview of Problems
  - Overview of Potential Financing Options
  - Timing of Addressing Problems
5. Closing Remarks
6. Adjournment

Town of Sandwich Board of Selectmen  
"Summit" Workshop – August 25, 2016  
7:00 PM Town Hall Meeting Room

## Background

In 2009, in conjunction with the adoption of the Local Comprehensive Plan, the Board of Selectmen, in collaboration with other stakeholders, developed a Long Range Plan. Its stated goals were as follows:

1. Enhance community/government partnership
2. Achieve financial stability
3. Continuous improvement in government efficiency
4. Provide quality public health, safety, and education
5. Implement responsible growth management while maintaining community character

Over the past 7 years the Town has accomplished much, addressing priority issues within these stated goals: Initiated department reorganizations (municipal services, public safety), financed road and infrastructure improvements, begun to address erosion and beach management, begun to address water quality issues, approved a public safety plan that improves services to all parts of Town, supported public transportation and retired debt.

However, the Town has changed in many ways - demographics suggest a dramatic decrease in school population and an increase in those over 60 years of age, coastal erosion has increased, wastewater and other infrastructure needs must be addressed to facilitate economic development, and capital projects need to be identified. Each of these, along with other important operational issues, has budgetary implications. Although the BOS on an annual basis updates strategies for its LRP, it seems appropriate at this time for the Board to receive input from other stakeholders as well, in order to move the Town forward with continuing to address important priorities and identifying and accessing multiple resources in a financially responsible way. Budget assumptions can then directly relate to strategies to achieve stated goals and solve existing problems. This workshop is the first step in a process designed to inform future overall general and specific budgetary assumptions and approaches.

**Overall Goal for this Workshop:** To conduct a collaborative, data driven, process for reevaluating and/or identifying important issues and challenges that will need to be addressed over the upcoming several years.

## Outcomes

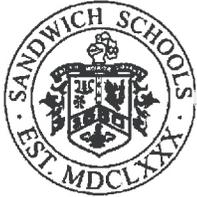
1. Describe community strengths and challenges in the following areas:
  - a. Provision of services (general government)
  - b. Public safety
  - c. Education

- d. Culture/Historical resources
- e. Environment/Community health
- d. Economics
- e. Capital needs/Infrastructure

2. Identify important Town-wide issues that arise from this analysis.
3. Describe current and needed resources to begin to address identified issues.
4. Suggest innovative strategies and efficiencies as methods of addressing community issues and priorities.

**Workshop Format:**

Small group discussion of strengths and challenges, followed by reporting and general discussion. To obtain a multifaceted participation, groups will each have representatives from the various stakeholder groups.



# SANDWICH PUBLIC SCHOOLS

## Department of Facilities and Grounds



33 Water Street, Sandwich, MA 02563

Phone 508-888-3312

Email: [jrnelson@sandwich.k12.ma.us](mailto:jrnelson@sandwich.k12.ma.us)

Date August 8th, 2016

To Dr. Pamela Gould - Superintendent of Schools; Michelle Austin - Director of Finance and Business Operations; Jay McGrail - Chair, Sandwich School Committee

From Jonathan Nelson - Head of Buildings and Grounds

Subject High School Chiller Replacement Options

### Purpose

The intent of this document is to outline the options for the Sandwich School district after the catastrophic loss of two compressors on the one functioning chiller at the High School (HS). Due to the loss, the building is experiencing extreme daily temperatures in excess of eighty-five degrees in some areas. Without some type of central cooling available, the learning environment will be severely impacted once school returns to session.

### Background

The Chiller plant consists of two, four hundred ton air cooled chillers. Each chiller consists of four separate circuits, each with one screw compressor and related refrigerant components. The chillers contain R22 refrigerant, which is no longer allowed to be manufactured for sale outside equipment manufacturing. The original design called for both chillers to cycle on and off to maintain the proper chill water temperature to the various unit air handlers in order to provide tempered air to the building spaces. The building was designed to operate with this type of central chiller plant, and the operation of this plant is crucial to maintaining building temperature in the mild and hot spring, summer and fall months. While many schools may not have a central chiller plant, or even air conditioning throughout, the architectural design of the HS requires some type of cooling system be installed as numerous interior building spaces (including classrooms) have no windows or any available cooling method.

The chillers themselves are about sixteen years old, and were installed in the 1999/2000 remodel of the high school. It is important to note that air cooled chillers have average life expectancies of fifteen to twenty years. The chiller plant was serviced over the years by ENE, a large HVAC and controls service contractor in Massachusetts. The chillers are labeled as Chiller 1 and Chiller 2. After discussing the past history with ENE and department staff, at some point a few years ago, Chiller 1 had a few compressor failures and suffered large leaks of refrigerant, and was taken offline. The contractor and school at that time decided to cannibalize



Chiller 1 for parts for use on Chiller 2. Chiller 2 was functioning up until spring of this year, when two compressors starting making large noises, tripping electrical safety devices and failed to make temperature setpoints. The service contractor found metal shavings in two compressor's oil filters, most likely indicating that the screws in each chiller were grinding on metal surfaces. The loss of these two compressors meant the other two functioning ones would never meet the needs of the building load, and would most like cause electrical trips or safeties to trip to prevent the compressors from damaging themselves under load. The chiller was shut off at this time.

The long time service tech from ENE reported that Chiller 2 has had numerous problems over the years. Most importantly, large amounts of refrigerant were leaking from the unit. Refrigerant leaks on this type of chiller always include oil leaks as well. The oil circulates with refrigerant in certain parts of the system, primarily in the compressors. Once the chiller was unable to make temperature setpoint due to the loss of refrigerant, the decision was made by the school to add refrigerant back to the chiller. Due to budget constraints none of the major leaks were fixed, and small emergent issues; as well as, routine maintenance were completed to keep the chiller running and making temperature setpoint. Small electrical components and refrigerant valves and driers were replaced when needed or when temperature setpoint was impacted. Over the last few years, over 180 lbs of refrigerant were added to the system. Since the refrigerant type can no longer be manufactured, the refrigerant replacement costs have risen sharply.

It has also been reported that a combined 800 tons of cooling is well oversized for the building load, and were most likely over designed at the time of installation. The building has been cooled by one 400 ton chiller for years, however, the chiller plant has continuously failed to make setpoint on high demand days.

#### Alternatives Considered

In order to find a suitable, cost effective solution for replacement, numerous options were researched and investigated. The options under consideration were:

- Option 1: Do nothing
  - If the district was to do nothing at this point, the school temperatures would be extremely high and uncomfortable on the second floor in both the beginning of the school year and spring time. It is expected that numerous staff, and student issues would develop as the building would be extremely uncomfortable to work and learn in. It has been reported that students in summer camps were getting sick from the high heat, and needed to be sent home to recuperate.
  - Student and parent satisfaction will be negatively impacted by the conditions in the classrooms.



- The chillers would need to be isolated from the building, and a minimal amount of piping work would be needed to accomplish the separation. The refrigerant would need to be recovered from the circuits, and the electrical power could then be isolated from the units. Keeping these units off would reduce the electrical demand of the building during the summer months.
- Option 2A: Replace Chiller 2 with a single air cooled chiller
  - The district would contract to have the existing chillers removed and a new correctly sized chiller installed. This option would also include renting a temporary chiller to provide building cooling during the beginning of the year.
  - The actual replacement will need to be designed and bid (per Chapter 149 requirements). This would require the use of a design engineer, and proper procurement protocol. As with any new equipment purchase of this size, there would be a long lead time of ten to twelve weeks for the manufacturer to produce the unit.
  - Efficiency credits should be available from the Cape Light Compact to install a more efficient chiller unit. Installation of an efficient model will reduce long term operating electrical costs.
  - This option should be carefully designed as a single unit chiller may not meet the actual operating needs of the building and would not allow for any back-up cooling if a chiller were to be taken offline for maintenance issues.
  - This option would have at least a twenty year operating life span with proper maintenance.
- Option 2B: Replace both chillers with two new chillers appropriately sized to the building load
  - The district would contract to have both of the existing chillers removed and replaced with appropriately sized chillers for the building load.
  - This option requires renting a temporary chiller to provide building cooling during the beginning of the year.
  - The actual replacement will need to be designed and bid (per Chapter 149). This would require the use of a design engineer, and proper procurement protocol. As with any new equipment purchase of this size, there would be a long lead time of ten to twelve weeks for the manufacturer to produce.
  - Efficiency credits should be available from the Cape Light Compact to install a more efficient chiller unit. Installation of an efficient model will reduce long term operating electrical costs.
  - This option should have at least a fifteen year operating life span with proper maintenance.



- Option 3: Replace the failed two compressors on Chiller 2 with new, warranted compressors
  - This option could most likely be procured as an emergency procurement, and could be done by quickly by receiving quotes for replacement.
  - There would be a short lead time associated with this work, of three or four weeks.
  - A contractor would remove/replace both failed compressors on the failed circuits, and then would replace all refrigerant and oil, repair all leaking valves and fittings, flush and inspect internal pipe ways on all circuits.
  - While the two compressors to remain would be inspected for operation and condition, there would be no guarantee they would remain operational for the long term. Also, when the two compressors failed, metal shavings were sent throughout the system. No contractor would fully guarantee that all metal shavings were completely removed from the system, and could cause issues in both the heat exchangers and new compressors. This puts the best case life expectancy of the chiller overall at three to five years.



Alternative Costs

Option 2A (Single Unit Replacement) Cost

Item	Cost	Note
Engineering	\$50,000	Estimated at this time, project would need to be designed and bid.
Replacement with single unit	\$360,000	Estimates received include: ENE \$283,000 for one 400 ton unit; York \$328,000 for a 450 ton chiller; BLW Engineers gave a range of \$350 to \$400 for replacement. Unit would have to be bid, and that could impact final price
Contingency	\$102,500	Too many variables at this stage to reduce any further, assumes 25% contingency
<b>Total Cost</b>	<b>\$512,500</b>	
Rental Unit for August through October	\$46,000	Estimate received from Sunbelt Rentals, district to rent direct. Includes \$10,000 in ancillary temp services cost (electrical and plumbing). Two month rental
Estimated Rebates from CLC	\$20,000.00	Place holder as final rebate is yet to be determined
<b>Estimated Total Real Cost</b>	<b>\$538,500</b>	
Option 2B (Dual Unit Replacement) Costs		

Item	Cost	Note
Engineering	\$60,000	Estimated at this time, project would need to be designed and bid.
Replace with two chiller units	\$648,000	Increase in price from one unit is estimated to be between 50% and 80%. Number allows for 80%
Contingency	\$212,400	Too many variables at this stage to reduce any further, assumes 30% contingency
<b>Total Cost</b>	<b>\$920,400</b>	
Rental Unit for August through October	\$46,000	Estimate received from Sunbelt Rentals, district to rent direct. Includes \$10,000 in ancillary temp services cost (electrical and plumbing). Two month rental
Estimated Rebates from CLC	\$20,000.00	Place holder as final rebate is yet to be determined



<b>Estimated Total Real Cost</b>	<b>\$946,400</b>	
Option 3 (Compressor Repair)		
<b>Item</b>	<b>Cost</b>	<b>Note</b>
Cost to replace two compressors (2&4)	\$74,300.00	Replace both bad compressors only
Replacement of 4 new discharge isolation valves	\$6,250.00	Replace all leaking valves on unit
Cost to replace 4 TXV valves	\$19,000.00	Replace as new to prevent any additional damage or issues
Cost of new refrigerant	\$21,660.00	R22 is expensive as it is no longer manufactured
Contingency	\$14,932.50	Contingency set at 15%
<b>Total Cost</b>	<b>\$136,142.50</b>	
Estimated Rebates from CLC	\$0.00	No rebates available

### Analysis of the Alternatives

After speaking with numerous contractors, design engineers, and the engineers from the Cape Light Compact; as well as, considering all costs outlined above, some options can be ruled out very quickly. Option 1 would create a very poor indoor environment, and would greatly impact the learning environment of the school. The school was designed to have a central chiller plant, and numerous spaces lack interior windows that allow for free cooling. It would not be unreasonable to think interior space temperatures could reach the upper eighties on hot and humid days. Since the large air handlers provide outside air exchange, shutting the units off is not an option. This is not a viable option.

With an estimated cost of \$136,000, Option 3 does not appear to viable. Most reliable engineering associations and publications, including the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) estimate screw chiller average life expectancy at twenty years (ASHRAE Life Expectancy chart attached as Attachment A). Properly maintained equipment, especially larger equipment, may be run for an additional three to five years (extending the life expectancy of a chiller out to twenty-three to twenty-five years) if proper maintenance costs including minor capital repairs are performed during the lifetime of the



unit. The overall Chiller 2 unit is sixteen years old, and is within the normal life expectancy for air-cooled chillers. After considering the history of the unit, life-expectancy for the two compressors not replaced in this option will most likely not exceed four or five years, and may be less. The life expectancy of the chiller as a whole may be even less based on the damage that has been done to the system by failed compressors when the age of the units are taken into account. Once metal shavings are found in the compressor oil filter, it is safe to assume metal shavings are distributed throughout the system. No amount of flushing the internal pipe-ways and passages can fully guarantee complete debris removal. These shavings can impact copper tubing and other mechanical components creating leaks or other damage. It would be impossible to guarantee any years of reliable service without additional capital repairs being needed. Even the manufacturer, York, a subsidiary of Johnson Controls, recommended that replacement is the most favorable option. Investing this amount of capital in this machine will not address longer term reliability concerns.

Option 2A is an ideal solution for both optimal maintenance downtime and efficient operation. The two smaller chillers would cycle on and off and cycle up and down as needed to meet the needs of the building at any given point. This would most likely provide a more cost effective operating solution in terms electrical costs, however, the original upfront cost is at least fifty percent greater and may be as much as 80% (80% carried in cost estimates above). This solution may incur higher long term maintenance costs than a single chiller option, but will most likely reduce overall long term electrical operating costs.

#### Proposed Alternative

The most cost effective and efficient alternative at this point is Option 2A; remove and scrap both existing chillers and install one single unit. While this will impact longer term maintenance procedures, it will meet the needs of the district and has a lower upfront capital cost. Hiring an engineer will be necessary to perform proper load calculations, and to appropriately design the modifications needed to make a new efficient chiller work in the existing system. Numerous items must be considered and will have to be evaluated including but not limited to; building load, electrical needs, pump sizes, piping sizes, chiller options and efficiencies, etc.

The project team will work closely with the Cape Light Compact's consulting firm Rise Engineering. Rise can help determine the most efficient design, with the largest credit available. Today's available technology means almost any replacement chiller will be more efficient than the current installed model. It is impossible at this point to place an estimated cost on the rebates available without having more information on proposed system design. A place holder of \$20,000.00 has been carried for this in the above budgets.

Further, Rise will help analyze other design options not originally studied in this assessment. Discussions directly with Rise included a design that decentralized the chiller plant, or the



installation of a variable refrigerant flow system. Unfortunately, more time is needed to study these options. Any of these other replacement alternatives should fit within the cost assumptions of Option 2A.

Option 2A includes the cost of a rental chiller. The assumption of including this in the total cost of replacement is that the chiller is essential to HS operations and should have adequate cooling when School returns to session.

#### Service History

Attached to this document (as Attachment B) is the service history that is readily available on the chiller for the last few years. There are no service contracts or agreements in place for the chiller specifically, as is a trending standard in the industry. The service history included shows a pattern replacing refrigerant as needed, without repairing the leaks due to the high cost and budget constraints.

#### Summary

Due to the critical failure of two compressors on Chiller 2 of the High School chiller plant, the building environment will be severely impacted by hot temperatures. This chiller provides cooling to the entire building except for a few administrative office areas, and is essential to the operational mission of the school. The existing air cooled chiller plant, consisting of two chillers, is sixteen years old and within the estimated life-expectancy range of air cooled chillers. This current plant provides a total of 800 tons of cooling, and is oversized for the current building load. After evaluating options for replacement or repair, the most favorable option is to replace one single chiller unit with a new efficient unit. There appears to be too much risk in investing capital to repair the chiller where overall unit reliability would still be questionable. The estimated cost for the total option to replace is estimated to be \$512,000. During the design phase of the project, the project team will work closely with the Cape Light Compact to determine the most efficient replacement options that fit within the proposed budget. Due to the long lead time of the chiller (on average ten weeks), a rental unit will be provided for the late summer/early fall season, and the project should be bid no later than December 31 2016 in order to have the unit operational for the spring/summer 2017 cooling season. Proper maintenance of installed equipment is key, and maintenance will be properly planned, budgeted and performed in accordance with manufacturer guidelines.

#### Schedule of Attachments

- Attachment A: American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) Equipment Life Expectancy Chart
- Attachment B: Chiller Service History
- Attachment C: Proposals from ENE for options 2A and 3 and York for Option 2A

## SHS CHILLERS REPLACEMENT – PRELIMINARY LIST OF FUNDING OPTIONS

1. The FY'17 School Department budget could be used to fund all or a portion of the cost of addressing the HVAC issues at Sandwich High School (SHS). The School could consider how much of the full replacement cost and/or temporary use of portable units could be funded, possibly in combination with other sources of funding outlined below. This would give the respective boards and staff time to determine the most appropriate course of action and how this will be funded. This decision could be made by the School Department.
2. Based on the final FY'17 estimated Cherry Sheet figures released by the Department of Revenue late last week, it appears the School Department will be receiving an additional \$162,800 in Ch. 70 funding above level funding. In order to access these funds, a Town Meeting vote would be needed to increase the FY'17 School Department appropriation and the School Department would need to decide to spend the additional funds on this expense. Town Meeting action would need to be taken before the FY'17 tax rate is set in mid-November.
3. Based on the final FY'17 estimated Cherry Sheet figures released by the Department of Revenue late last week, it appears that the Town's discretionary aid will be higher than planned (\$160K) and our Sending Tuition assessments will be lower than planned (\$180K). The difference between these two amounts and what was voted at Town meeting is roughly \$340,000. In order to appropriate these funds for the SHS Chillers, or any other purpose, a Town Meeting vote is required. Town Meeting action would need to be taken before the FY'17 tax rate is set in mid-November.
4. If Options #2 and #3 are combined, the total available funding would equal roughly \$502,800. If this combination was chosen, perhaps the FY'17 School Department budget or the FY'17 Reserve Fund could make up the difference. Again, Town Meeting votes and School Department and/or Finance Committee concurrence would be needed for this combination. Town Meeting action would need to be taken before the FY'17 tax rate is set in mid-November.
5. The Town could delay making a final funding decision until our Free Cash was certified. Typically this occurs in the fall (last year = November 10). Once this certification was known, Town Meeting could vote to spend a portion of the Free Cash on the SHS Chillers. By taking this action, whatever Free Cash funding is appropriated would not be available to assist the FY'18 Budget. If Free Cash is used to fund the project, Town Meeting could vote this action any time after certification was received.

6. The Finance Committee could consider a FY'17 Reserve Fund transfer to pay all or portion of the replacement expense. The total amount available in the Reserve Fund is \$500,000, but any funds used for this purpose would take away any balance for future deficits that may occur later in the fiscal year. This option, other than taking funds from the School Department FY'17 budget, is the fastest funding source and would only require the approval of the Finance Committee. Potentially, if funding was approved from the Reserve Fund, a future Town Meeting could vote to add funding to the FY'17 Reserve Fund to replenish the account. The source of funding for this replenishment would dictate when the Town Meeting action would be needed. If the source was Free Cash, Town Meeting could vote any time after certification, including at the May's Annual Town Meeting.
  
7. A decision could be made to delay permanent repairs or replacement until the regular FY'18 Capital Budget process is followed working toward the 2017 Annual Town Meeting next May. This option would restrict the School Department from doing any permanent repairs or solution until after Town Meeting votes in May. Based on likely HVAC needs next spring and summer, this would increase the amount needed for portable service with the more permanent repair taking place next summer ideally before school commences in September 2017.
  
8. The Town could decide to fund the expense through a Stabilization Fund transfer. This would require a 2/3 approval at Town Meeting. There is no time restriction on when this vote would have to take place.
  
9. A capital outlay expenditure exclusion could be placed before the voters to fund the full project. This action would need to be approved by 2/3 of the Board of Selectmen, a majority of Town Meeting, and the majority of voters at a Town-wide ballot question. Timing would fluctuate depending on when the Selectmen wanted to ask the voters, etc.

**GHD Comment:** Virtually any combination of all these options could be considered and I can think of other funding alternatives, as well. That said, the options listed here are the most realistic to consider. Obviously, no input has been provided yet by the Board of Selectmen, School Committee, or Finance Committee so whatever alternative or combination of alternatives that gets considered could change with a final determination to be made a later date. Each option listed above has its own merits and detriments which I can explain in more detail when the work is discussed. Also, if the Selectmen decide to call a Special Town Meeting this fall before the FY'17 tax rate is approved, I would expect this would be in the mid-October to mid-November timeframe.