

evolving

**CCHS**

investing in our future

Concord-Carlisle Regional High School  
Building Committee

## Feasibility Study and Schematic Design

October 2011

# Addressing the CCHS Facility

We have known for 12+ years that facility limitations are problematic

- Impeding delivery of the curriculum
- Increasingly expensive
  - Band-aid approach, issue by issue
  - Aging infrastructure, lack of options
- Looming loss of accreditation



Exploration of long-term solution has been continuous

- Facility Study 1999
- Feasibility Study 2002
- Feasibility Study 2005
- SOIs 2006, 2007, 2008, 2009



# CCHS Facility Conditions



PONDING ON ROOF / EXPOSED PIPING



DETERIORATING ROOF TOP UNITS / MINIMAL ROOF DRAINS



OPEN SEAMS IN ROOFING



PONDING ON ROOF / DETERIORATING WOOD PLANK WALKING PADS

# Facility Conditions



1960's NONINSULATED STOREFRONT SYSTEM WITH PEELING PAINT ON METAL PANELS



DELAMINATING PLYWOOD PANELS



EXPOSED UTILITY LINES



POORLY INSULATED MASONRY WALLS WITH WEAK AIR BARRIER SYSTEM

# Facility Conditions



STAND ALONE CLASSROOM TRAILER



NONCOMPLIANT, INACCESSIBLE AREAS



EMERGENCY GENERATOR



CABLE FROM RECENT ELECTRICAL FAILURE



OUTDATED AND DETERIORATING ELECTRICAL PANELS



# Addressing the CCHS Facility

## Key milestones to advance a solution:

- Voter's approve Master Plan (April 2009)
- Voter's approve Feasibility Study and Schematic Design (April 2010)
- MSBA accepts CCHS into it's program for school building reimbursement (Sept. 2010)



# Building Project Goals

Support student learning

Address significant building deficiencies

- Long-term, comprehensive approach
- Green design that is efficient, maintainable

Be fiscally responsible

Be consistent with MSBA and community values of Concord and Carlisle

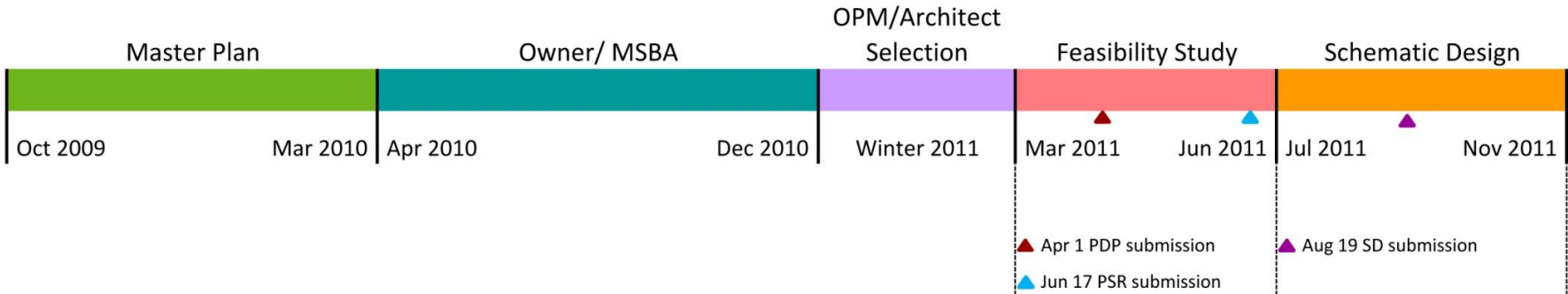


# Concord-Carlisle Regional High School





# Timeline of Completed Work



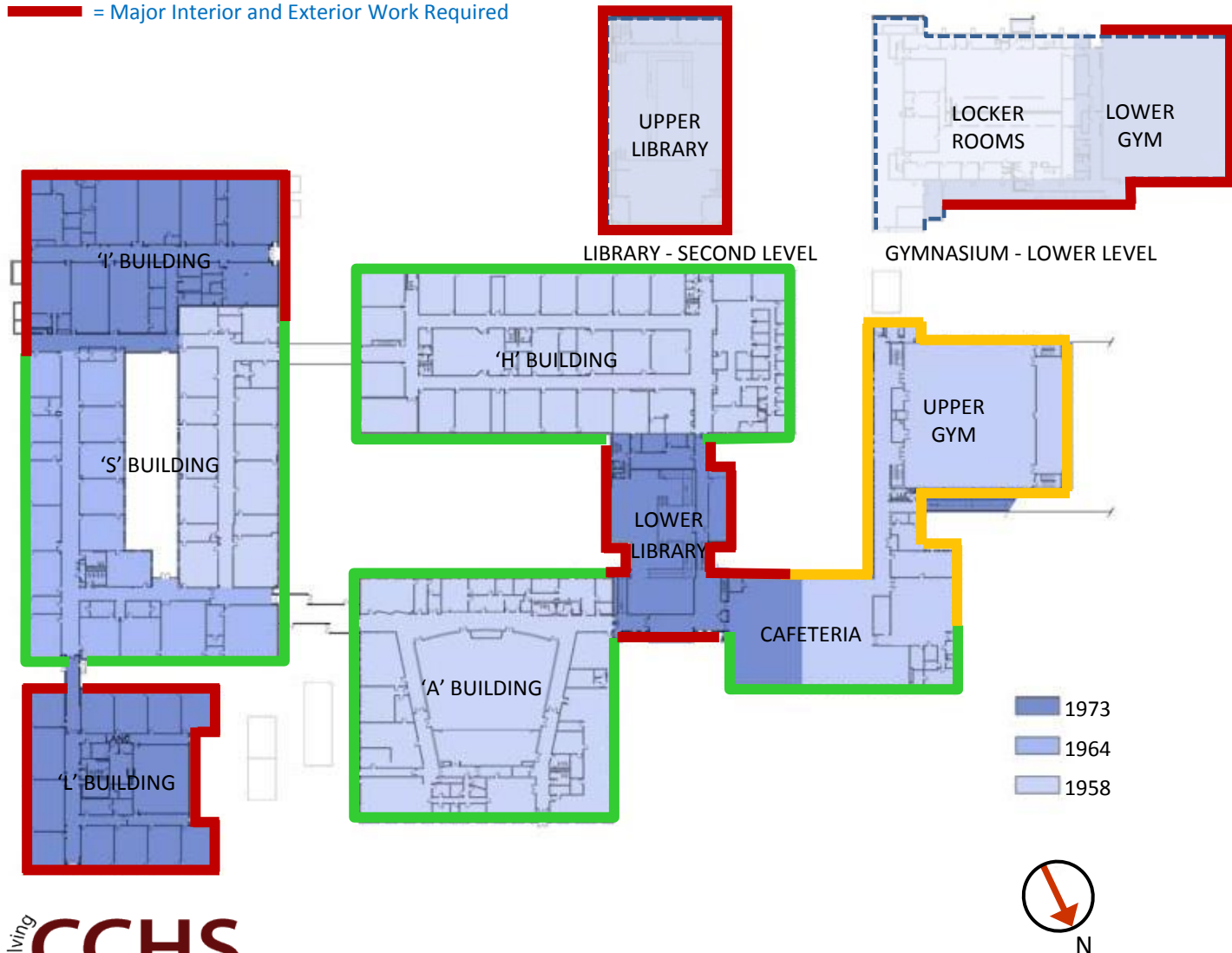
# Existing Site Conditions



- Solar Orientation and Winds for Sustainable Design
- Topography & Geology of hills surrounding building
- Site Access
- Security and Egress around the Building
- Parking Insufficient and poorly placed
- Proximity to Residential/ assumed “no build”
- Wetlands
- Need to retain Athletic Fields

# Existing Building Conditions

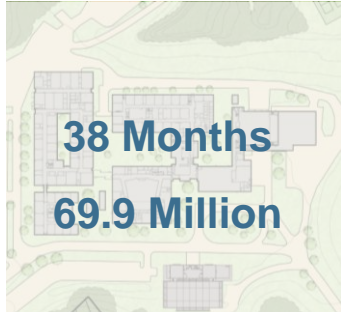
- █ = 1990 Envelope in the Best Current Physical Condition
- █ = Exterior Building Envelope System Replacement Req'd
- █ = Major Interior and Exterior Work Required



- Does not meet Energy, Building, Plumbing or MAAB codes
- Extensive Seismic and Roof structure upgrade required
- Requires all new MEP, FP, Tech, & Security
- Unsuitable Mechanical Tunnels throughout. Insufficient ceiling height for new mechanical.
- Requires all new Building Envelope for Energy Efficiency
- Hazardous Materials
- Lack of natural light in central areas
- Not organized for 21<sup>st</sup> c Team Teaching or Collaboration
- Requires substantial interior reconfiguration for educational needs

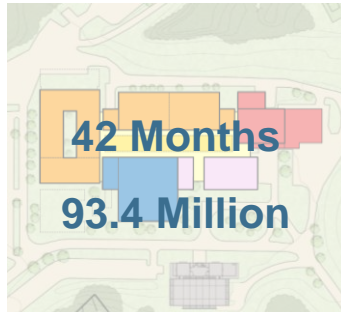
# Conceptual Design Summary

Existing Building



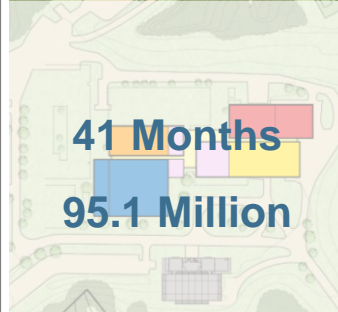
Option 1 – No Build  
(repairs)

Renovation/Minor Additions



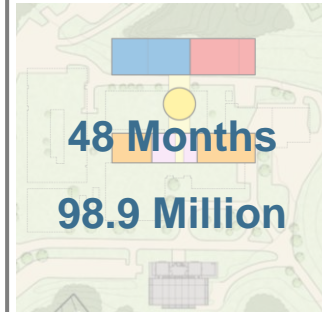
Option 3 – Full Renovation w/ Additions  
(Infill Courtyards, Remove 'L' & 'I')

Minor Renovation/ Major Additions



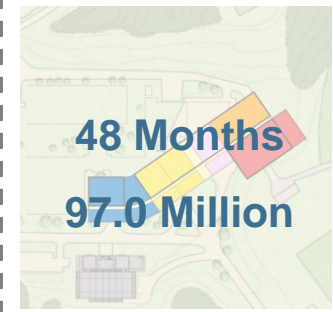
Option 5 – Minor Renovation /Major Additions  
(Keeps 'A' and Gyms)

New Building 3 Phases

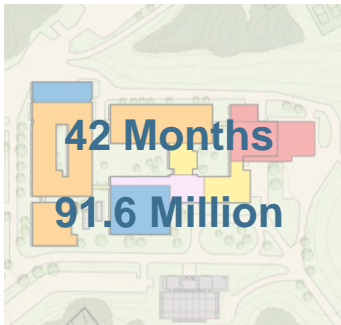


Option 7 – Phased New Building 3 Steps

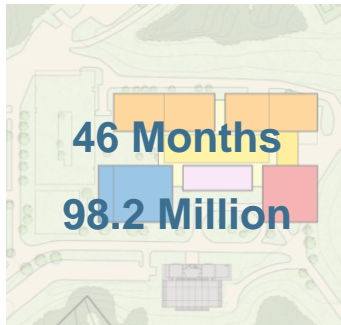
New Building 1 or 2 Phases



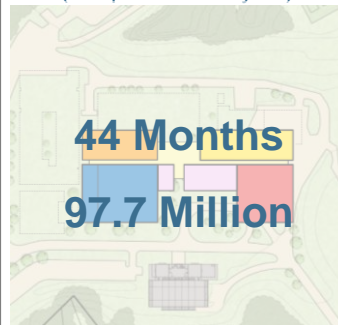
Option 9 – Phased New Building 2 Steps



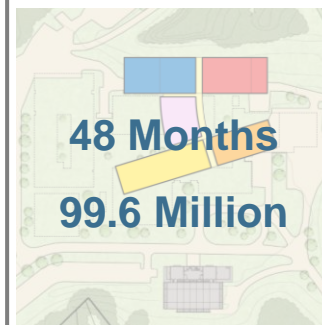
Option 2 – Full Renovation w/ Minor Additions  
(Keeps All Buildings)



Option 4 – Major Renovation/Major Additions  
(Keeps 'A', 'H', & Cafe)



Option 6 – Minor Renovation /Major Additions  
(Keeps 'A' and Cafe)



Option 8 – Phased New Building 3 Steps



Option 10 – New Building 1 Step

# Conceptual Design Summary

Existing Building

## Major Renovation Options

- + Educational Program
- Complicated MEP Upgrades
- Expansive Envelope (Cost, Energy, etc.)
- Construction Disruption to the Students
- Phasing Costs Not Reimbursable
- Not a Good Value on State's Reimbursement

38 Months  
69.9 Million

Option 1 – No Bui  
(repairs)

Option 2 – Full  
Renovation  
with minor Additions  
(Keep All Buildings)

Option 3 – Phased  
Renovation  
with minor Additions  
(Keep All Buildings)

Option 4 – Major  
Renovation/Major  
Additions  
(Keep AC, H, & Caf)

Option 5 – Minor  
Renovation/Major  
Additions  
(Keep AC and Caf)

\$28M  
State  
\$47.1M  
Concord  
\$17.4M  
Carlisle

New Building  
1 of 2 Phases

31 Months  
\$75.5 Million

Option 9 – Phased  
New Building 2 Steps

31 Months  
92.5 Million

Option 10 – New  
Building 1 Step

# Schematic Design



# Site Plan



Brister's Hill Neighborhood

Skateboard Park

Athletic Fields

Parent Drop-Off

School Entry

Outdoor Classroom

Outdoor Classroom

Parking

Parking

Service

Env. Garden

Community Entry

Athletics Entry

Parking

Env. Garden

Amph'tr

Parking

Bus Drop-Off

Parking

Existing School

Football Field

Beede Center

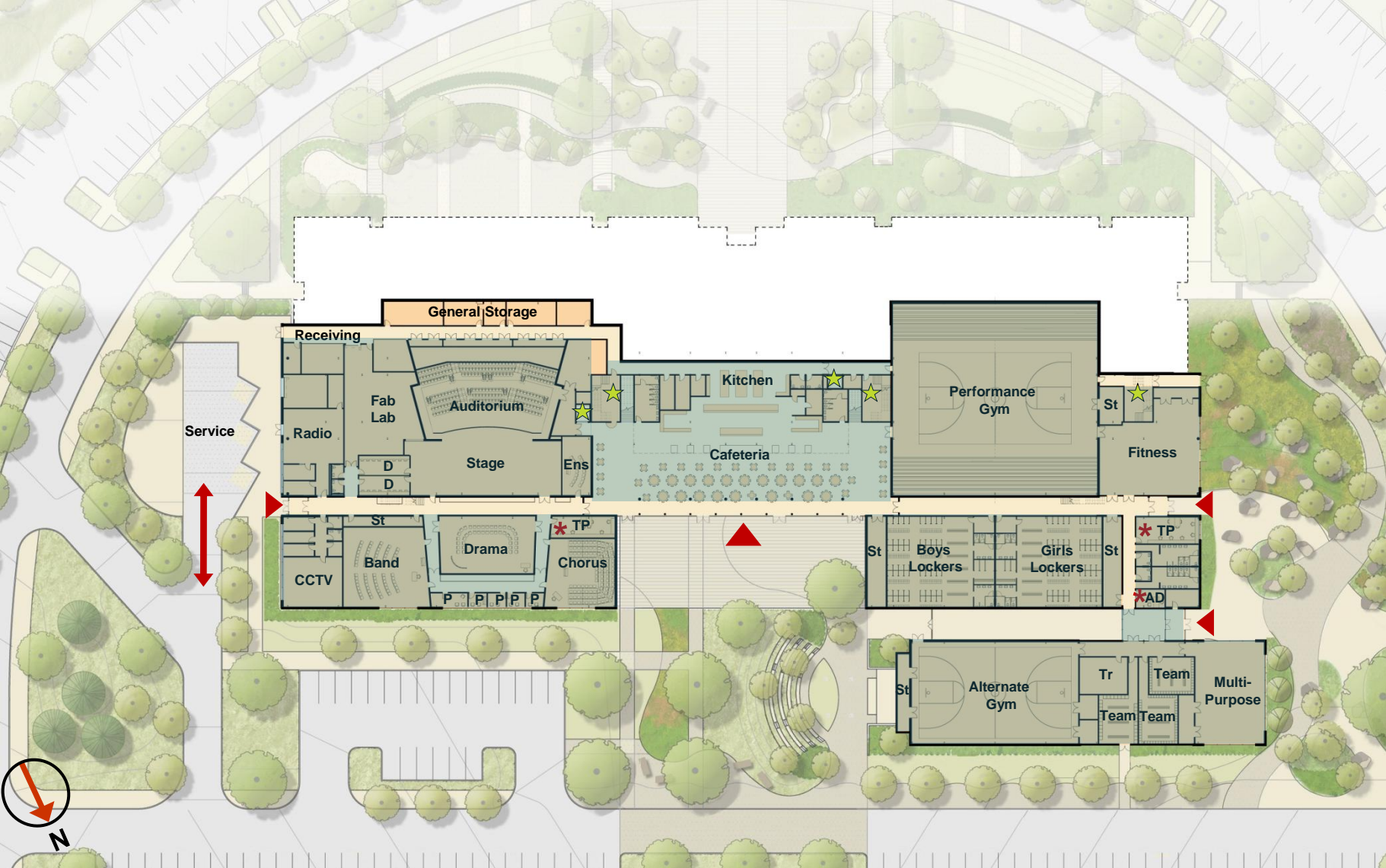


# Ground Floor Plan





# Lower Floor Plan



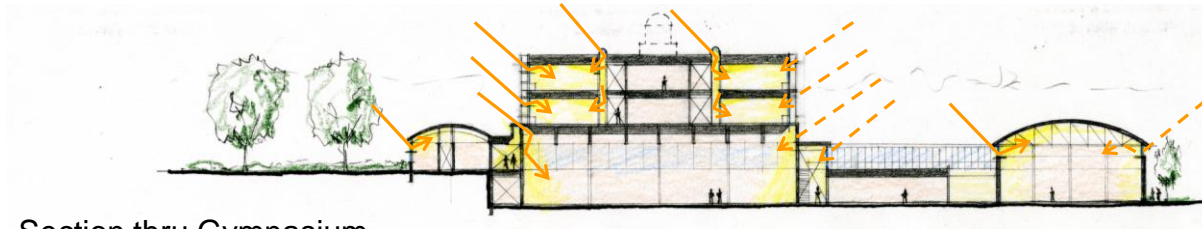
# Second Floor Plan



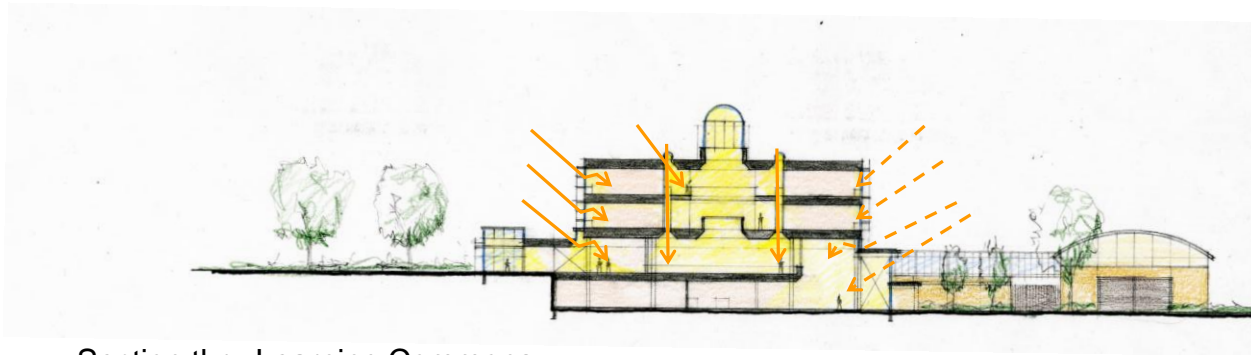
# Third Floor Plan



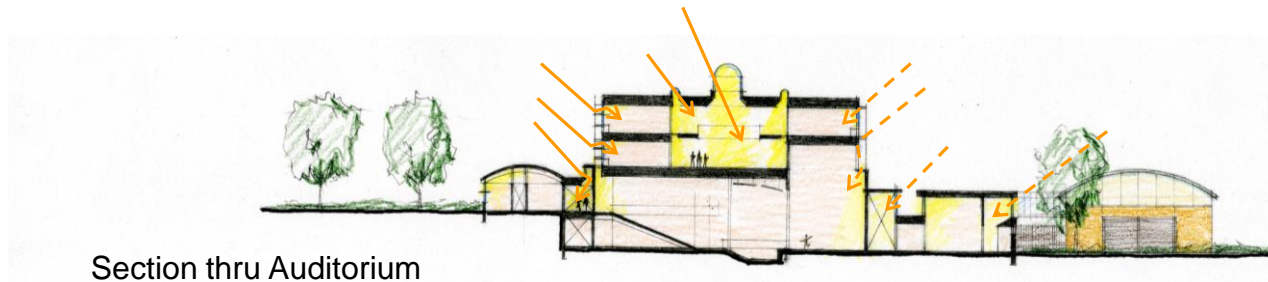
# Site Section



Section thru Gymnasium



Section thru Learning Commons



Section thru Auditorium

# Exterior Elevations



South Elevation



North Elevation

# Exterior Elevations



East Elevation



West Elevation

# Sustainable Elements



# Site, Civil and Landscape



Reuse of Wells for Landscape Irrigation



Native Soils and Grasses



Environmental Gardens



Bike Paths and Sidewalks



Bio-Retention Stormwater Control





# Architectural Elements



- North/ South Facing Classrooms
- Day lighting & Views
- High Performance Building Envelope
- High Performance Operable Glazing
- Certified Wood Materials
- Reclaimed, Recycled, Bio-based and Low Emitting Materials
- Sustainable Maintenance & Operations

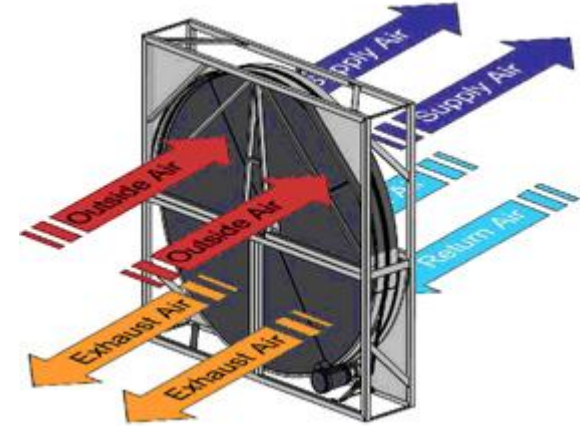
# Mechanical & Plumbing Energy Efficiency Measures



High Efficiency Gas Fired  
Condensing Boilers



High Efficiency Chiller



Energy Recovery Wheels



CO2 Sensors



High Efficiency Gas Fired Water  
Heaters

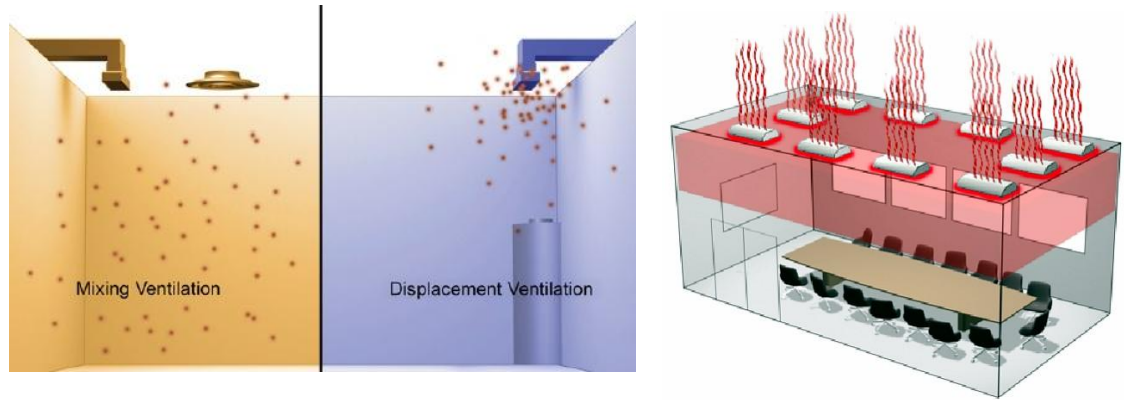


High Efficiency Plumbing Fixtures &  
Waterless Urinals

# Displacement Ventilation System

## Benefits:

- Low Noise Levels
- High Level Indoor Air Quality
- Low First Cost
- High Level of Comfort



Standard Mixed Systems    Proposed DV Systems

## Displacement Ventilation at Willard School:

- Increased Student Performance
- Significant decrease in absenteeism\*
- Decreased energy costs by 30%\*

\* Compared to Concord's two other new elementary schools of similar size



# High Efficiency Lighting & Daylight Harvesting



High Efficiency Indirect/ Direct Pendant Lighting



LED Site Lighting

Meets Electrical Energy Conservation Measures



Dual Zone Dimming Photocell Sensor



Dual Technology Occupancy Sensor

# Future Renewable Energy Possibilities



AC Energy  
&  
Cost Savings



- Requires an area of 10,000 - 100,000 sq. ft.
- Supplier must sell 15% from Renewable Sources

Station Identification	
City:	Boston
State:	Massachusetts
Latitude:	42.37° N
Longitude:	71.03° W
Elevation:	5 m
PV System Specifications	
DC Rating:	100.0 kW
DC to AC Derate Factor:	0.850
AC Rating:	85.0 kW
Array Type:	Fixed Tilt
Array Tilt:	10.0°
Array Azimuth:	180.0°
Energy Specifications	
Cost of Electricity:	15.0 ¢/kWh

Results			
Month	Solar Radiation (kWh/m <sup>2</sup> /day)	AC Energy (kWh)	Energy Value (\$)
1	2.31	6114	917.10
2	3.28	8012	1201.80
3	4.19	11120	1668.00
4	4.86	12252	1837.80
5	5.73	14267	2140.05
6	6.10	14244	2136.60
7	6.15	14784	2217.60
8	5.70	13783	2067.45
9	4.64	11043	1656.45
10	3.66	9262	1389.30
11	2.28	5561	834.15
12	1.99	5034	755.10
Year	4.25	125477	18821.55

Sample PV Watts Calculation

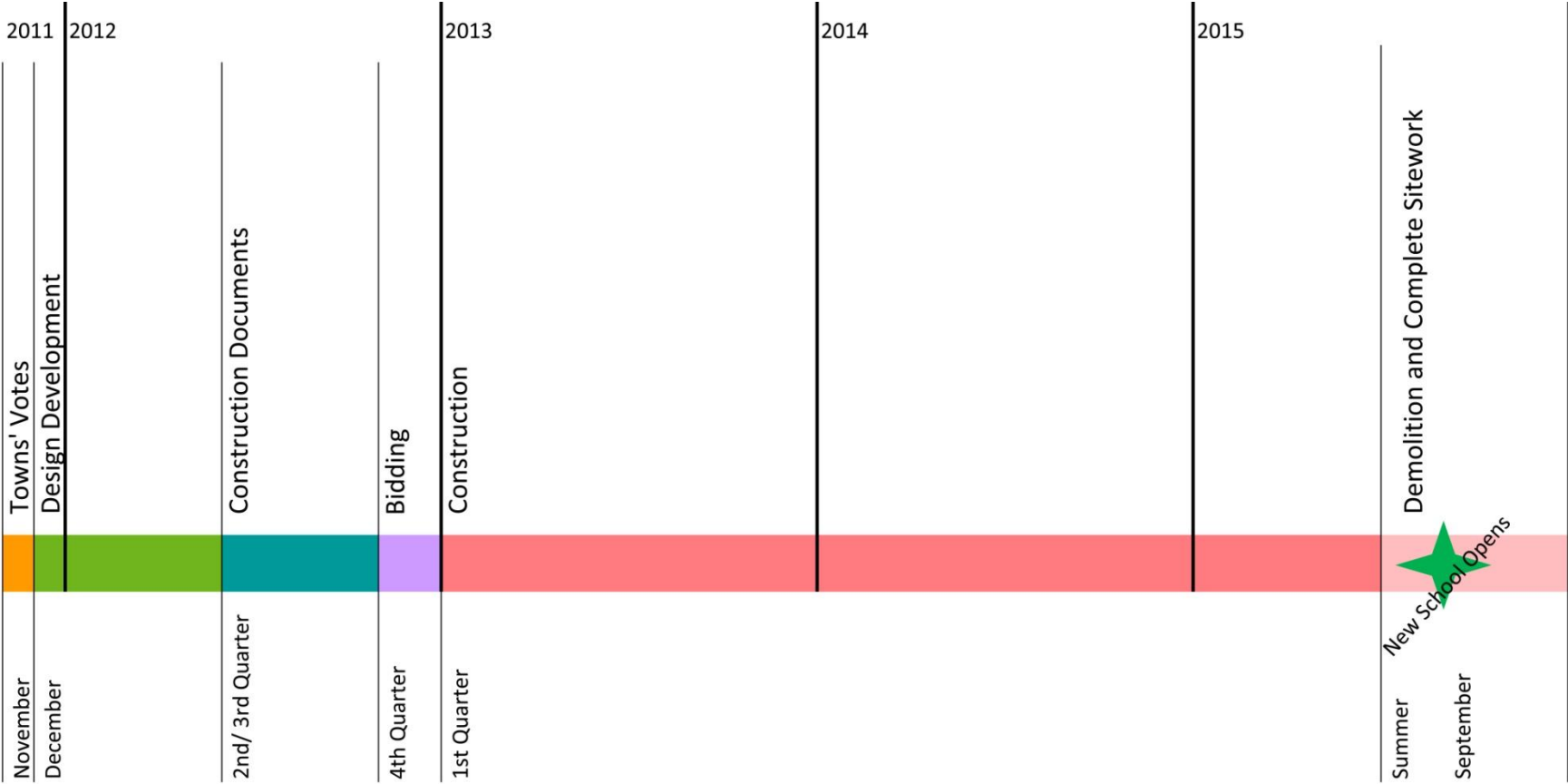
100- 1000kw Photovoltaic System w/ Data Acquisition System

# Energy Savings Analysis

	Const. Cost	Energy Savings	Pay Back
<b>MA Energy Code</b>	-	-	-
<b>Towns' Energy Code (Stretch)</b>	0	20%	0
<b>Stretch Code (Plus)</b> * Base System	\$231,300	46.8%	4 years
<b>Superior Envelope</b> * Base System + R40 c.i. roof, R15 c.i. walls, Dbl pane glazing w/ heat mirror film	\$735,322	53.5%	9 years
<b>Superior Envelope w/ PV</b> 200 kw PV System with * Base System + R40 c.i. roof, R15 c.i. walls, Dbl pane glazing w/ heat mirror film	\$735,322 + PV @ \$800,000 = \$1,535,322	61.6% "Architecture 2030"	14 years
<b>Superior Envelope w/ PV</b> 1750 kw PV System * Base System + R40 c.i. roof, R15 c.i. walls, Dbl pane glazing w/ heat mirror film	\$735,322 + PV @ \$7,000,000 = \$7,735,322	100% "Net Zero"	Not Achievable

\* Base System: Displacement ventilation, perimeter radiant panels, ventilating units with energy recovery, AHU's with terminal VAV's, high efficiency water cooled chillers, high efficiency gas fired condensing boilers, high efficiency light fixtures, stretch code - roof R25, stretch code - wall insulation R7 (1.5 c.i. w/ R13 batt), and stretch code - windows (1" insulated glass).

# CCHS Proposed Schedule



Note: This timeline is based on current assumptions and will be fine tuned in the Design Development phase.



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omrarchitects



- Facility is way past its useful life and is in difficult shape
- A number of renovation options were studied at length including repair-only and renovation/addition schemes

the most cost-effective option is **building new**

*“The funding partnership we have forged with the school district was based on a collaboration and shared desire to identify the most efficient, sustainable, and cost effective high school possible for present and future generations of students in the region.”*

*~ State Treasurer Steven Grossman*

- Proposed building is roughly same square footage, far more efficiently utilized
- No new programs are being added, existing programs are preserved



# Estimated Project Cost

<b>CCHS Building Project</b>		<b>(\$ millions)</b>
Total Project Cost		\$ 92.5
MSBA reimbursable component	approximately	\$ 81.0
Existing space not reimbursed by MSBA		\$ 11.5
Reimbursement ratio	35.58%	
State reimbursement	approximately	\$ 28.0
<b>Cost to communities</b>		
Project cost less reimbursement		\$ 64.5
Cost to Concord		\$ 47.1
Cost to Carlisle	assessment ratio 27%	\$ 17.4

Based on using Construction Manager at Risk Program and an estimated maximum grant of \$28.78M.  
Reimbursement is subject to change based on final project cost and MSBA project audit.

# Comparison

High School Project	Constuction Type	Number of Students	Gross Sq. Ft.	Overall Project Cost (mm)	Construction Cost/ Sq. Ft.	Total cost/ Sq. Ft.	Cost/ Student	Sq. Ft./ Student	Under Construction	Amount Not Reimbursable	Percentage of Budget
<b>Concord Carlisle (proposed)</b>	<b>New</b>	<b>1,225</b>	<b>238,000</b>	<b>\$93</b>	<b>\$317</b>	<b>\$389</b>	<b>\$75,510</b>	<b>194</b>	<b>No</b>	<b>\$12</b>	<b>12.4%</b>
Duxbury (middle/high school)	New	1,735	339,000	\$129	\$311	\$381	\$74,222	195	No	N/A	N/A
West Springfield	New	1,303	258,000	\$108	\$340	\$419	\$82,886	198	No	\$22	20.4%
East Bridgewater (middle/high school)	New	935	211,000	\$77	\$310	\$365	\$82,353	226	No	\$10	13.0%
Maynard	New	400	121,000	\$46	\$294	\$380	\$115,000	303	Just started	\$3	6.5%
Methuen	New	1,807	369,000	\$99	\$203	\$269	\$54,787	204	No	\$5	5.1%
Wayland	New/reno	900	195,000	\$71	\$288	\$363	\$78,667	217	Yes	\$8	11.3%
Wellesley	New	1,500	280,000	\$131	\$381	\$468	\$87,333	187	Yes	\$23	17.6%
Longmeadow	New/reno	1,000	236,000	\$78	\$270	\$331	\$78,000	236	Yes	\$13	16.7%
Danvers	New/reno	1,000	251,000	\$80	\$250	\$319	\$80,000	251	Yes	\$5	6.3%
Natick	New	1,281	254,000	\$89	\$289	\$350	\$69,477	198	Yes	\$7	7.9%
Plymouth	New	1,053	267,000	\$92	\$282	\$345	\$87,369	254	Yes	\$13	14.1%
Tewksbury	New	977	219,000	\$84	\$311	\$384	\$85,977	224	Yes	\$10	11.9%
Southbridge (middle/high school)	New	1,050	200,000	\$77	\$314	\$383	\$73,333	190	Yes	\$10	13.0%
Minnechaug	New	1,257	231,000	\$79	\$287	\$341	\$62,848	184	Yes	\$3	3.8%
<b>Average- All projects</b>					<b>\$296</b>	<b>\$366</b>	<b>\$79,184</b>	<b>217</b>			<b>11.4%</b>
<b>Average- Recent projects</b>					<b>\$314</b>	<b>\$387</b>	<b>\$85,994</b>	<b>223</b>			<b>11.3%</b>

# Tax and Project Financing Overview

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## Tax Implication

<b>Town</b>	<b>Estimate Peak</b>	<b>Estimated Tax at Peak</b>
Concord	FY 2016-2022	\$393
Carlisle	FY 2016-2022	\$612

## Financing

A combination of temporary short term Bond Anticipatory Notes (BANs) and permanent 25 year term, level principal Bonds will be used to fund the project

The timing and amounts of the borrowings are aligned with the project's cash flow analysis prepared by the Owner's Project Manager reflecting receipts of MSBA reimbursement

\* Tax impact based on market interest rates as of September 16, 2011  
and median single family home values

# Why Now?

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The facility needs at CCHS are **real** and **urgent**

We will receive **\$28 Million** in state aid

We achieve a better outcome

- First rate educational facility
- Built to last 50+ years
- Operational savings, reduced energy costs
- Favorable construction environment



1. We need to address CCHS facility – we've known this for 12+ years
2. We have an opportunity to receive \$28 M in state aid if we **act now**
3. Proposed project is most **cost-effective solution** and will deliver the **best outcome** for students and the town

