Commitment to Learning:
A Case Study of Three Public Schools

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Curated by Aidan Mayer and Joy Yakie

Northeast Sustainable Energy Association (NESEA)
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Building Energy Boston
Commitment to Learning | Case Study of 3 Public Schools

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HMFH ARCHITECTS
SPEAKERS

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Sustainability Leader
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Associate
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Suni Dillard
AIA, LEED AP BD+C
Senior Associate
Sustainability Leader
HMFH Architects
Break the ice...

SUSTAINABILITY VISIONING

ACTIVITY:
Consider your top priority related sustainability, or sustainable practices more generally and write it down.
Sustainability for All

Thoughtfully addressing overlapping systems requires effort and coordination between multiple design disciplines along with the project community.

Public school projects are a highly visible commitment from a community towards future generations, serving a wide range of students from diverse backgrounds and are a valuable resource to the surrounding community. Balancing strategies that fit within the goals and budget of a public institution and focused equally on energy, carbon, water, and waste can be difficult. Linking the strategies for each goal to impacts on the health and well-being of students provides a new framework for evaluating the impacts of design.
FRAME THE CONVERSATION

what is SUSTAINABILITY

SOCIAL SUSTAINABILITY
health & wellbeing
place
connectivity

ECONOMIC SUSTAINABILITY
prosperity
living infrastructure
resource regeneration

ENVIRONMENTAL SUSTAINABILITY
resource regeneration
living infrastructure
health & wellbeing

EDUCATIONAL SUSTAINABILITY
connectivity
living infrastructure
prosperity
health & wellbeing
FOCUS THE CONVERSATION

- Health + Well-being
- Materials + Social Justice
- Energy + Carbon
- Water
- Waste
## SET GOALS

<table>
<thead>
<tr>
<th>MATERIALS + SOCIAL JUSTICE</th>
<th>HEALTH + WELL-BEING</th>
<th>WASTE + WATER</th>
<th>ENERGY + CARBON</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red list Free Materials for all Touch Surfaces</td>
<td>Access to Fresh Air in all Regularly Occupied Spaces</td>
<td>% Indoor Water Use Reduction</td>
<td>No On-Site Combustion</td>
</tr>
<tr>
<td>Inclusive and Equitable Design and Process</td>
<td>Access to Daylight and Views in all Regularly Occupied Spaces</td>
<td>Comprehensive Composting Program</td>
<td>Zero Energy Building</td>
</tr>
<tr>
<td></td>
<td>Maximize Access to Educational Content through Enhanced Acoustic Performance</td>
<td>Potable Water Use Reduction</td>
<td>Maximize Incentives and Grants</td>
</tr>
<tr>
<td></td>
<td></td>
<td>On-Site Stormwater Management</td>
<td>Measure Embodied Carbon at every project phase</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Reduce Embodied Carbon - LEED Standards</td>
</tr>
</tbody>
</table>
CASE STUDIES

Bristol-Plymouth Regional Technical High School
SIZE 420,000 SQFT
GRADES 9-12
ENROLLMENT 1434
OPENS 2025

Annie E. Fales Elementary School
SIZE 72,000 SQFT
GRADES K-3
ENROLLMENT 400
OPENED 2021
Produces 11.6% More Energy than is consumed
24.9 EUI
40 Geothermal Wells @ 600'
1,354 PV Panels @ 375W / Panel
648,000 kw-hr PV Array
100% of the Learning Spaces have access to daylight and views

Bristol County Agricultural High School
SIZE 113,500 SQFT NEW 82,500 SQFT
RENO
GRADES 9-12
ENROLLMENT 640
OPENED 2020
39 pEUI for CSE
68% Water Use Reduction from code
221 metric tons carbon avoided with (3) Timber buildings compared to steel
744 metric tons carbon avoided by reusing existing buildings
92% Regularly Occupied Bldgs have access to daylight and views
BRISTOL-PLYMOUTH REGIONAL TECHNICAL HS
Sustainability and Educational Design goals

- Environmental
- Economic
- Social
- Educational

Goals:
- Site
- Daylight
- Materials
- Future Proof
- Efficient Design
- Teaching Tool
- Reduce Carbon

Focus on integrating sustainability and educational design to achieve goals in environmental, economic, social, and educational aspects.
THINKING BEYOND BUILDING OCCUPANTS
Circular Economy + Embodied Carbon
HMFH INITIATIVE

GOAL - RED List Free Materials

HMFH’s design approach creates buildings with the best possible environmental quality. We focus on standards that optimize human health without compromising the health of the natural environment. This is done by specifying non-toxic materials based on the best available information and data. Our priority is the surfaces we touch but aim for all materials on any given project.

‘The more you dig into it, you think, Oh, God.’ A growing mission seeks to reduce toxic chemicals in schools

By Kay Lazar Globe Staff, Updated May 2, 2022, 7:15 a.m.

Jack McCarthy, executive director of the Massachusetts School Building Authority, aims to slash the number of toxic chemicals used in construction and renovation projects in the state’s schools. JONATHAN WAGGS/GLOBE STAFF

The image is seared in Jack McCarthy’s mind: a group of pre-kindergarteners gathered for story time, sitting in a circle on the carpet of a classroom, amid an invisible witches’ brew of chemicals lurking in the dust on the floor.

Ever since he heard a talk a couple of years ago about health problems linked to flame retardants, stain repellents, and other potent building chemicals, McCarthy, executive director of the Massachusetts School Building Authority, has been on a mission to slash the number of such substances in the state’s schools. His vision is taking hold in a $305 million construction project for a new Bristol-Plymouth Regional
HMFH PILOT PROGRAM - INTERNAL TRACKING

Material Sorting - Tier System

TIER 1 - LBC Declare Label with Red List Free Status
Products that disclose 100% of ingredients present at or above 100ppm (0.01%) in the final product and do not contain any Red List chemicals.

TIER 2 - LBC Declare Label with Red List Approved Status
Products that disclose a minimum of 99% of ingredients present in the final product and meet the Red List Imperative requirements through one or more approved exceptions.

TIER 3 - Cradle to Cradle Gold
TIER 4 - Cradle to Cradle Silver

TIER 5 - LBC Declare Transparency Label
Products disclose 100% of ingredients present in the final product, but contain one or more Red List chemicals that are not covered by an approved exception.

Every product specified requires an HPD/EPD or letter stating they do not have an HPD/EPD.
MATERIAL SELECTION CONSIDERATIONS

Transparency
Durability
Aesthetics
Cost
Warranty
Utility
Embodied Carbon
EASY WINS
ACOUSTIC CEILING TILES
EASY WINS
CARPET
EASY WINS
RESILIENT FLOORING
CHALLENGE
PVC
CHALLENGE
INSULATION
CHALLENGE
LIGHTING
LIMITING THE PALETTE
TYPICAL CLASSROOMS

1. Wood fiber acoustic panels
2. Solid surface counter and shelves
3. Student chairs and desks
4. Wooden door
5. Plywood veneer casework
6. Borrowed light
7. Paint
8. Linear direct/indirect lighting
9. Marker board
10. Linoleum flooring
<table>
<thead>
<tr>
<th>Material</th>
<th>MEETS GOALS</th>
<th>CHALLENGING</th>
<th>MORE INFO</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACT</td>
<td><img src="#" alt="Green" /></td>
<td><img src="#" alt="Yellow" /></td>
<td></td>
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<tr>
<td>Acoustic Room Components</td>
<td><img src="#" alt="Green" /></td>
<td><img src="#" alt="Yellow" /></td>
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</tr>
<tr>
<td>Gypsum</td>
<td><img src="#" alt="Green" /></td>
<td><img src="#" alt="Yellow" /></td>
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<tr>
<td>Intumescent Paint</td>
<td><img src="#" alt="Yellow" /></td>
<td><img src="#" alt="Green" /></td>
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<tr>
<td>Lighting</td>
<td><img src="#" alt="Yellow" /></td>
<td><img src="#" alt="Green" /></td>
<td></td>
</tr>
<tr>
<td>Linoleum</td>
<td><img src="#" alt="Green" /></td>
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<tr>
<td>Lockers</td>
<td><img src="#" alt="Yellow" /></td>
<td><img src="#" alt="Green" /></td>
<td></td>
</tr>
<tr>
<td>Marker Boards</td>
<td><img src="#" alt="Yellow" /></td>
<td><img src="#" alt="Green" /></td>
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</tr>
<tr>
<td>MEP</td>
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<td><img src="#" alt="Green" /></td>
<td><img src="#" alt="Red" /></td>
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<td>Paint</td>
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<td><img src="#" alt="Green" /></td>
<td><img src="#" alt="Red" /></td>
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<tr>
<td>Spray Fireproofing</td>
<td><img src="#" alt="Green" /></td>
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<tr>
<td>Ceramic Tile</td>
<td><img src="#" alt="Green" /></td>
<td><img src="#" alt="Yellow" /></td>
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</tr>
</tbody>
</table>
MAINTAINING MATERIAL TRANSPARENCY GOALS

PRE-DESIGN

DESIGN

GOAL SETTING

CONSTRUCTION

OCCUPANCY
CLOSING THE LOOP
ADVOCACY
Annie E. Fales Elementary School
WESTBOROUGH, MA
ANNIE E. FALES ELEMENTARY SCHOOL

Sustainability and Educational Design Goals

- Connect to Nature
- Design for Young Children
- Maintain an Intimate, Neighborhood School
- Achieve Net Zero Energy
Connections to surrounding nature and fostering environmental stewardship
ENERGY GOAL

for this project Zero Net Energy is defined as:
producing on-site renewable energy equal to the
energy used to operate the building annually

How did we get there?
1. Reduce energy use as much as possible
2. Produce as much energy as possible
COMPONENTS OF ENERGY USE

Fales Total Energy Use Intensity (EUI) = 24.9

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
<th>Percentage</th>
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</thead>
<tbody>
<tr>
<td>Ventilation</td>
<td>4.30</td>
<td>17%</td>
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<tr>
<td>Heating</td>
<td>2.35</td>
<td>9%</td>
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<tr>
<td>Cooling</td>
<td>1.97</td>
<td>8%</td>
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<tr>
<td>Pumps</td>
<td>4.44</td>
<td>18%</td>
</tr>
<tr>
<td>Hot Water</td>
<td>0.28</td>
<td>1%</td>
</tr>
<tr>
<td>Lights</td>
<td>3.13</td>
<td>13%</td>
</tr>
<tr>
<td>Plug Load</td>
<td>7.95</td>
<td>32%</td>
</tr>
<tr>
<td>Exterior</td>
<td>0.46</td>
<td>2%</td>
</tr>
<tr>
<td>HVAC</td>
<td>52%</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>48%</td>
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</tbody>
</table>
Balancing Energy Goals
Strategies for Implementation
AIR DISTRIBUTION

TYPE F RETURN GRILLE

MINIMUM 5-FT DUCT LINER PRIOR TO BRANCH TO ROD'S

VOLUME DAMPERS ACCESSIBLE FROM LOWER CEILING

TYPE E1 DISPLACEMENT DIFFUSER
EASY WINS
GEOTHERMAL WELLS
CHALLENGES
GEOTHERMAL PUMPS

NOTE:
VERIFY BASE SIZE WITH PUMP MANUFACTURER. REFER TO SPECIFICATIONS FOR VIBRATION ISOLATION REQUIREMENTS OF BASE MOUNTED PUMPS.

4" CONCRETE BASE (BY GC)
FINISHED FLOOR
SUPPORT
SPRING ISOLATOR (TYP.)
BASE PLATE
FLEXIBLE COUPLING WITH GUARD
REDUCER AS REQUIRED
BALL VALVE (TYP.)
GLOBE TYPE SILENT CHECK VALVE
FLEXIBLE CONNECTION (TYP)
1/4"
GAGE TREE
END SUCTION DIFFUSER (WITH STRAINER)
FROM SYSTEM
TO SYSTEM
BUTTERFLY VALVE (TYP.)
HIGH EFFICIENCY EQUIPMENT
EASY WINS
SITE STRATEGIES
ENVELOPE STRATEGIES

- R30 for walls, R40 for roofs
- 25% window to wall ratio
- Triple glazed windows & skylights
- Balance solar heat gain & visible light

South, West, East Facades:
U-Value = 0.13
Solar Heat Gain = 0.23
Daylight Transmission = 54%
UV Transmission = 20%

North Facade:
U-Value = 0.13
Solar Heat Gain = 0.33
Daylight Transmission = 60%
UV Transmission = 28%
LIGHTING
Control and Analysis

Position glazing for **Daylight Autonomy (DA)**

\[ DA = \text{percent of operating hours that an area can be lit exclusively with daylight} \]

**Control Artificial Lighting**
- Daylight and occupancy sensors
- Fixtures zoned to balance daylight
- Master controls linked to BMS

**Low Light Power Density (LPD)**
- Benchmark LPD is 1.2 watts per sf
- Target LPD is 0.43 watts per sf
Establishing Target Energy Use Intensity (EUI)

**EUI** = the amount of energy per square foot to operate the building over the course of a year

- benchmark for US K-12 schools = 75 EUI
- typical for a net-zero school = 20-25 EUI
- Fales target = 27.5 EUI

Projected Annual Energy Use = 2,178,000 kBTU
## RENEWABLE ENERGY

### Solar PV

<table>
<thead>
<tr>
<th></th>
<th>Back-of-the-Envelope</th>
<th>Final Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy Use Intensity:</td>
<td>27.5 EUI</td>
<td>24.9 EUI</td>
</tr>
<tr>
<td>Annual Energy Use:</td>
<td>638,000 kW-hr</td>
<td>585,000 kW-hr</td>
</tr>
<tr>
<td>Annual Energy Production:</td>
<td>638,000 kW-hr</td>
<td>648,000 kW-hr</td>
</tr>
<tr>
<td>Size of PV System:</td>
<td>580 kW</td>
<td>508 kW</td>
</tr>
<tr>
<td>Watts per Panel:</td>
<td>320 W</td>
<td>375 W</td>
</tr>
<tr>
<td>Size of Array</td>
<td>32,000 sf</td>
<td>24,000 sf</td>
</tr>
</tbody>
</table>
CHALLENGES
CONFLICTING GOALS

Energy Production and Energy Reduction
- Skylights and Solar PV competing for roof area
- Traditional skylights have poor insulating values

Optimal for solar

Optimal for daylight

Combined strategies
ROOF MASSING OPTIONS

Parallel
Rotated Parallel
Triple - Pleat
Quadruple - Pleat
SAWTOOTH ROOF

Benefits

- Expands roof surface area by 18% over flat roof
- Brings more natural light into interior spaces
- Architectural expression of zero energy strategy
### Achieving Net Zero Energy

**Fales Elementary School**

#### Energy Strategies - Summary

<table>
<thead>
<tr>
<th></th>
<th>Easy Win</th>
<th>Challenge</th>
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</thead>
<tbody>
<tr>
<td>Low Flow Fixtures</td>
<td><img src="image.png" alt="Green" /></td>
<td></td>
</tr>
<tr>
<td>Limited Irrigation</td>
<td><img src="image.png" alt="Green" /></td>
<td><img src="image.png" alt="Yellow" /></td>
</tr>
<tr>
<td>Mechanical Crawlspace</td>
<td><img src="image.png" alt="Green" /></td>
<td><img src="image.png" alt="Yellow" /></td>
</tr>
<tr>
<td>All Electric, No Gas Cooking</td>
<td><img src="image.png" alt="Green" /></td>
<td><img src="image.png" alt="Yellow" /></td>
</tr>
<tr>
<td>No Gas Cooking</td>
<td><img src="image.png" alt="Green" /></td>
<td><img src="image.png" alt="Yellow" /></td>
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<tr>
<td>Geothermal HVAC System</td>
<td><img src="image.png" alt="Green" /></td>
<td><img src="image.png" alt="Yellow" /></td>
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<tr>
<td>Limiting Plug Load</td>
<td><img src="image.png" alt="Green" /></td>
<td><img src="image.png" alt="Yellow" /></td>
</tr>
<tr>
<td>Window - Wall Ratio of 20%</td>
<td><img src="image.png" alt="Green" /></td>
<td><img src="image.png" alt="Yellow" /></td>
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<tr>
<td>Sawtooth Roof</td>
<td><img src="image.png" alt="Green" /></td>
<td><img src="image.png" alt="Yellow" /></td>
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<tr>
<td>School as a teaching tool</td>
<td><img src="image.png" alt="Green" /></td>
<td><img src="image.png" alt="Yellow" /></td>
</tr>
</tbody>
</table>
BRISTOL COUNTY AGRICULTURAL HS

Thoughtfully addressing overlapping (water) systems requires effort and coordination between multiple design disciplines.

Architect HMFH Architects

Stormwater Management

Civil Engineer Samiotes

Landscape Architect Halvorson, Tigh & Bond

Potable Water Use Reductions and Storm Water Reuse

Plumbing Engineer Garcia Galuska DeSousa

Landscape Architect with Irrigation Consultant Irrigation Consulting, Inc.
EXISTING CAMPUS

220 acre working farm along the Taunton River

Public career technical vocational high school

Agricultural and science based curriculum

22 Sending communities

Combined educational and sustainability goals
BRISTOL COUNTY AGRICULTURAL HIGH SCHOOL
Sustainability and Educational Design goals

• All new facilities should be highly energy efficient, set net zero as a goal!
• Promote sustainable agricultural practices and sustainability curriculum
• Grow more food for students

• Achieve 10% better than code
• Make each building/structure a champion for specific sustainability measures
• Center for science and the environment will be a ‘living lab’ for the students and the community
• Design the dairy barn to be NZE
• No impact on the taunton river watershed
NEW SITE PLAN

Project includes 6 buildings: 4 NC and 2 Renovations. Of the NC, 3 were timber (2 Mass Timber).

Center for Science and the Environment (CSE)

Dairy Barn (DB)

Student Commons (SC)

Ag Mech (AG)

Floriculture

Gilbert Hall (GH)

Landscape/Arbor (LA)
WATER GOAL

Do no harm to the Taunton River

The Taunton River is a federally designated Wild and Scenic River (NPS)

Bristol Aggie is situated along the river where it is brackish - a sensitive ecotone and major contributor to the students educational journey
TAUNTON WATERSHED

Dighton’s water supply comes from 5 groundwater wells.

In recent years the well water levels have dropped significantly due to lack of recharge.

The town had to issue a complete watering ban in 2020.
Water Conservation
Strategies for Implementation
SITE WATER STRATEGIES

STORMWATER MANAGEMENT
GROUNDWATER RECHARGE STRATEGIES
1. Rain chain and splash block
2. Surface water run-off captured in bioswale
3. Subsurface infiltration structure
4. Overflow pipe from subsurface structure
5. Infiltration basin
EASY WIN SITE WATER

Use Reduction

Green Roofs

Rainwater harvesting:
40,000 gal. cistern.
20,100 roof captured
22,000 sf irrigated landscape

Limited irrigation area

Water efficient planting
EASY WIN  SITE WATER
Groundwater Recharge

Rain Chain and Basin
Bioswale
Subsurface infiltration Structure
Infiltration Basin
BUILDING WATER STRATEGIES

STORMWATER MANAGEMENT
1. Incoming rain
2. Dry swale
3. Underground irrigation cistern
4. Rain chain

GREEN ROOFS
1. Intensive green roof
2. Extensive green roof

COMPOSTING TOILET SYSTEM
1. Composting toilets
2. Composters
3. Exhaust vents
EASY WIN  GREEN ROOFS

COMPONENTS OF A VEGETATIVE ROOF

PLANTS
- Growing area with soil depth

IRRIGATION
- Irrigation system or drip system

GROWING MEDIUM
- Ensures proper drainage
- Depth of soil varies between 12"-15" based on calculated capacity of root system

PERCOLATION LAYER - FILTER FABRIC
- Alleviates water flow in the root area

WATER RETENTION/DRAINAGE MAT
- prevents water from entering the structure

CONTAINMENT
- Keeps soil in the root area

ROOT BARRIER
- Prevents soil from washing off the roof during heavy rainfall

THERMAL INSULATION
- Insulates building from heat

VAPOUR CONTROL MEMBRANE
- Prevents moisture from entering the building

STRUCTURE - COMPOSITE DECK
- Metal or wood frame that can be used as a base for the vegetation
<table>
<thead>
<tr>
<th>Fixture Type</th>
<th>Average Flow Before 1994</th>
<th>Minimum Standard After 1994</th>
<th>% Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toilet</td>
<td>3.5 gal/flush</td>
<td>1.28 gal/flush</td>
<td>63</td>
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<tr>
<td>Urinal</td>
<td>1.5 gal/flush</td>
<td>0.125 gal/flush</td>
<td>92</td>
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<tr>
<td>Lav Sinks</td>
<td>3 gal/min</td>
<td>0.35 gal/min</td>
<td>88</td>
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<tr>
<td>Hand Sprays</td>
<td>1.75 gal/min</td>
<td>1 gal/min</td>
<td>43</td>
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<tr>
<td>(lever triggered)</td>
<td></td>
<td></td>
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<tr>
<td>Clevis Multrum</td>
<td>3.5 gal/flush</td>
<td>.023 gal/flush (not tributary to Bristol Aggie Pump Station)</td>
<td>99</td>
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<tr>
<td>Classroom Sinks</td>
<td>3.5 gal/min</td>
<td>0.5 gal/min</td>
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<tr>
<td>Laboratory Sinks</td>
<td>3.5 gal/min</td>
<td>.74 gal/min</td>
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<tr>
<td>Showers</td>
<td>3 to 4 gal/min</td>
<td>1.5 gal/min</td>
<td></td>
</tr>
<tr>
<td>Kitchen Dishwasher</td>
<td>5.4 gal/min</td>
<td>1.8 gal/min</td>
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<tr>
<td>Wash sink (trough)</td>
<td>7 to 8 gal/min</td>
<td>Eliminated in post-development program</td>
<td>N/A</td>
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<tr>
<td>4 head – manually operated</td>
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</tbody>
</table>

**EASY WIN LOW FLOW FIXTURES**


There are some fixtures that are so archaic that they most likely exceed the range of pre-1992 published (or anticipated) flow rates.
BRISTOL AGGIE WATER USAGE
Code Baseline Comparison

FLUSH FIXTURES
FLOW FIXTURES

GALLONS PER YEAR

225,000
150,000
75,000

BASLINE WATER CONSUMPTION
DESIGN WATER CONSUMPTION

LOW FLOW WC

GALLONS PER YEAR

225,000
150,000
75,000

BASLINE WATER CONSUMPTION
DESIGN WATER CONSUMPTION

COMPOSTING TOILET

22% Water Use Reduction
32% Water Use Reduction
68% Water Use Reduction
32% Water Use Reduction
COMPOSTING TOILETS

- Waste, Air, Bulking Material
- CO₂
- Composting Waste
- Finished Compost
- Urea → Ammonia → Nitrate
- Waste + Bulking Agent + Biomass
- Mineralization
- Further Mineralization
- Finished Compost
- Composting Waste Layers
### WATER STRATEGIES - SUMMARY

<table>
<thead>
<tr>
<th></th>
<th>EASY WIN</th>
<th>CHALLENGE</th>
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<tbody>
<tr>
<td>Low Flow Fixtures</td>
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<tr>
<td>Limited Irrigation</td>
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<td></td>
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<tr>
<td>Drought Tolerant Planting</td>
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<tr>
<td>Green Roofs</td>
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<tr>
<td>Rainwater harvesting - Irrigation</td>
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<tr>
<td>Rainwater harvesting - Tlts</td>
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<tr>
<td>Rain Gardens</td>
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<tr>
<td>Infiltration Structures</td>
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<tr>
<td>Composting Toilets</td>
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<tr>
<td>School as a teaching tool</td>
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</tbody>
</table>

*With minor additional coordination all strategies above could easily be achieved. The challenge often lies in the additional cost water strategies require, whether infrastructure or energy costs.*
Holistic Design
Connecting Strategies
OVERLAPPING STRATEGIES

MATERIALS + SOCIAL JUSTICE

- Red list Free Materials for all Touch Surfaces
- Inclusive and Equitable Design and Process

HEALTH + WELL-BEING

- Access to Fresh Air in all Regularly Occupied Spaces
- Access to Daylight and Views in all Regularly Occupied Spaces
- Maximize Access to Educational Content through Enhanced Acoustic Performance

WASTE + WATER

- % Indoor Water Use Reduction
- Comprehensive Composting Program
- Potable Water Use Reduction
- On-Site Stormwater Management

ENERGY + CARBON

- No On-Site Combustion
- Zero Energy Building
- Maximize Incentives and Grants
- Measure Embodied Carbon at every project phase
- Reduce Embodied Carbon - LEED Standards
Q&A

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