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SEATTLE PUBLIC SCHOOLS

Queen Anne Elementary

SDAT 03 :: Integrated Design Workshop



Agenda

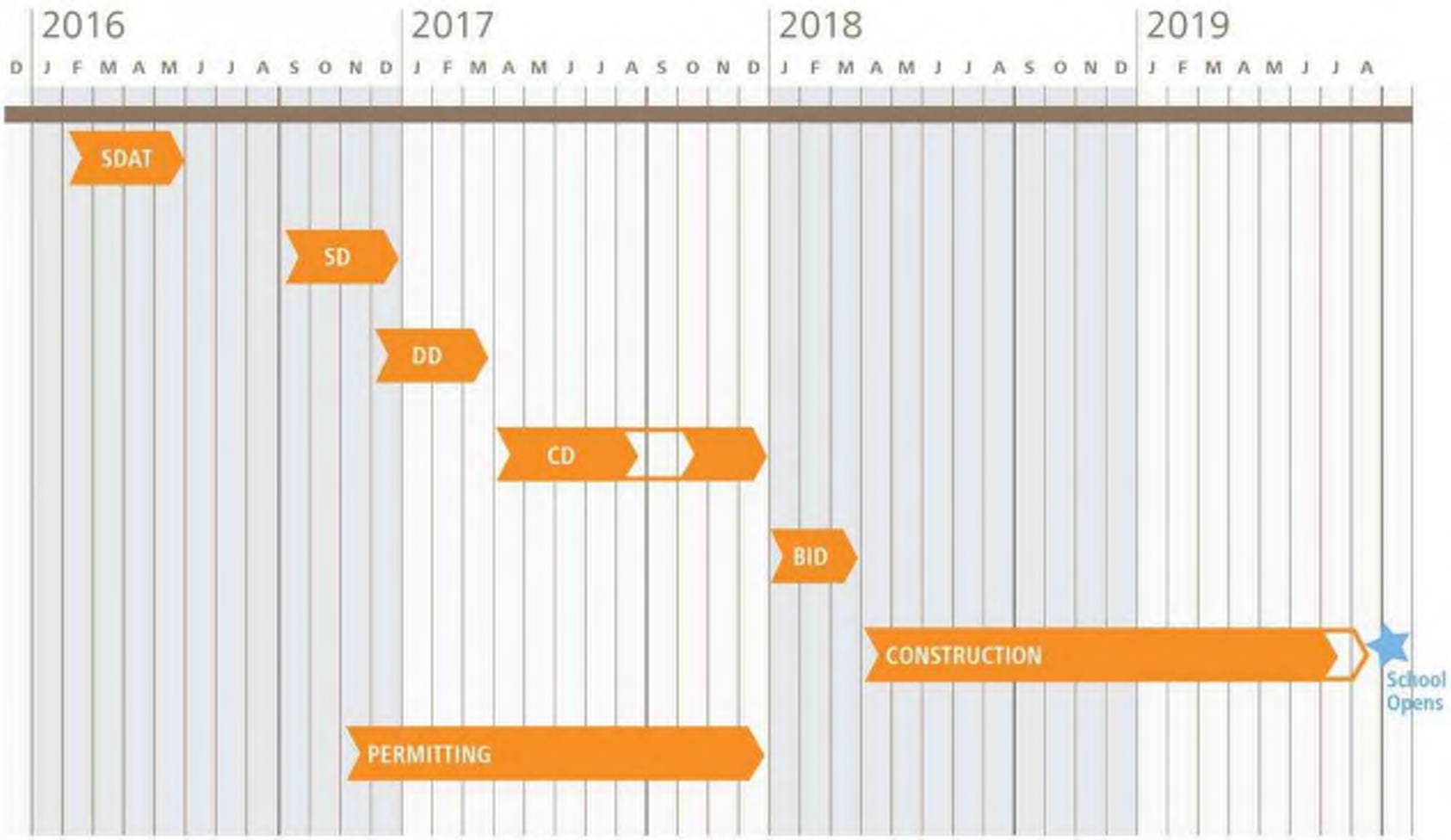
Overview, Objectives, Framework	20 min
Site & Water understanding, opportunities, strategies	45 min
Energy understanding, opportunities, strategies	45 min
Break	10 min
Healthy Indoor Learning Environments & Materials understanding, opportunities, strategies	30 min
Queen Anne Elementary's Sustainable Story	20 min

Project Overview

Build an addition with 200 seats (8 classrooms) of permanent capacity and a gymnasium to address current and projected elementary growth in Queen Anne and downtown Seattle, and reduce overcrowding at elementary schools in the area.

Total capacity of school is planned for 500 students.

Project Schedule



Overview, Objectives, Framework

Integrated Design

Team

Owner
:: district/facilities/maintenance

Users
:: teachers/staff/students/parents
:: community

Design team
:: architects/engineers

Jurisdiction

Contractor

How do we get there?

Eco-charrette

Early goal-setting & decision-making

Collaboration within design team

Research

Construction

Commissioning

User Education

Measurement and Verification

Workshop Objectives

Envision a sustainable school

Identify and prioritize sustainable strategies

Identify educational opportunities

Develop Queen Anne's Sustainable Story

Benefits of High-performance Schools

Environmental :: reduce the environmental impact of buildings

Economic :: reduce operating costs

Health :: enhance occupant comfort and health

Educational :: support environmental education

Environmental Impact of Buildings

72% of total U.S. electricity consumption

39% of total U.S. primary energy use

39% of total U.S. carbon dioxide emissions

26% of total U.S. non-industrial waste generation (160 million tons of construction and demolition waste)

15% of potable water in the U.S.

40% of raw materials use globally (3 billion tons annually)

source: www.epa.gov

Occupant Comfort and Health

Increase Student Performance

:: National Council for Educational Facilities www.edfacilities.org

Daylighting

:: Quality of daylight / improvement in learning

:: Heschong Mahone Study

Indoor Air Quality

:: Healthier, more comfortable environments

:: Reduced absenteeism

Acoustics

:: Good acoustics / good academic performance

SPS Guiding Principles

SPS Natural Resources Policies and Procedures

Washington Sustainable Schools Protocol

Green Resolution and Passive Design Principles
Passive design refers to a design approach that uses natural elements, often sunlight, to heat, cool, or light a building. (source: ecopedia)

Budget and Schedule

Natural Resources Conservation Policy

Wisely manage the use of natural resources and maintain programs that support conservation of energy and other natural resources.

Create and maintain sustainable, healthy school environments through a long-term resource management plan.

Model environmental stewardship by instituting a resource conservation management plan to:

:: Reduce the use of energy, water and other natural resources and encourage recycling.

:: Educate students, teachers & staff about the importance of conserving natural resources.

:: Lessen environmental damage attributable to natural resources consumption.

WSSP | LEED for Schools

Washington Sustainable Schools Protocol (WSSP)
Ensure that Washington schools are healthy, operate efficiently, increase student productivity, and reduce environmental impact.

United States Green Building Council
Leadership in Environmental and Energy Design (LEED)
Design and construction practices that significantly reduce or eliminate the negative impact of buildings on the environment and occupants in five broad areas: site, water, energy, materials, indoor air quality.

Living Building Challenge

A framework for design, construction and the symbiotic relationship between people and all aspects of the built environment

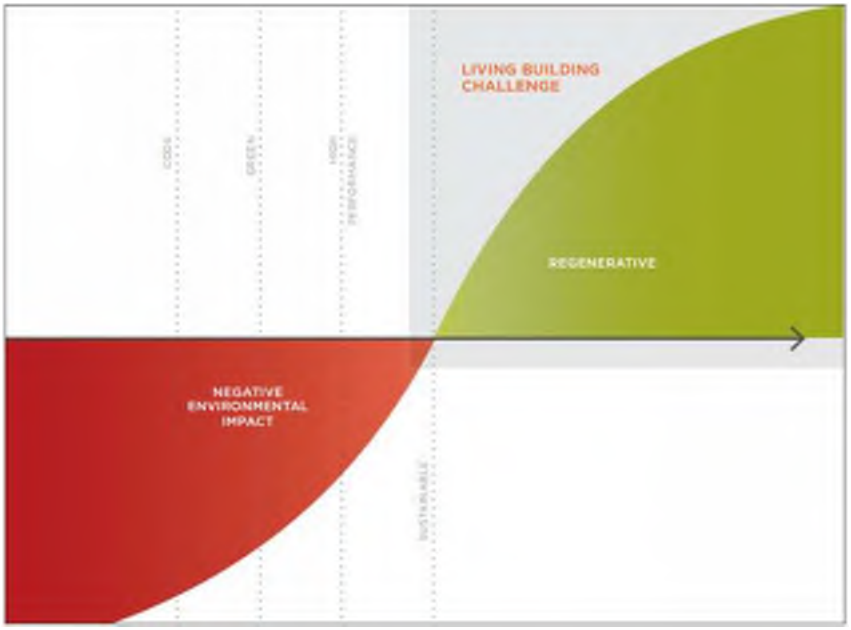
An alignment of values:

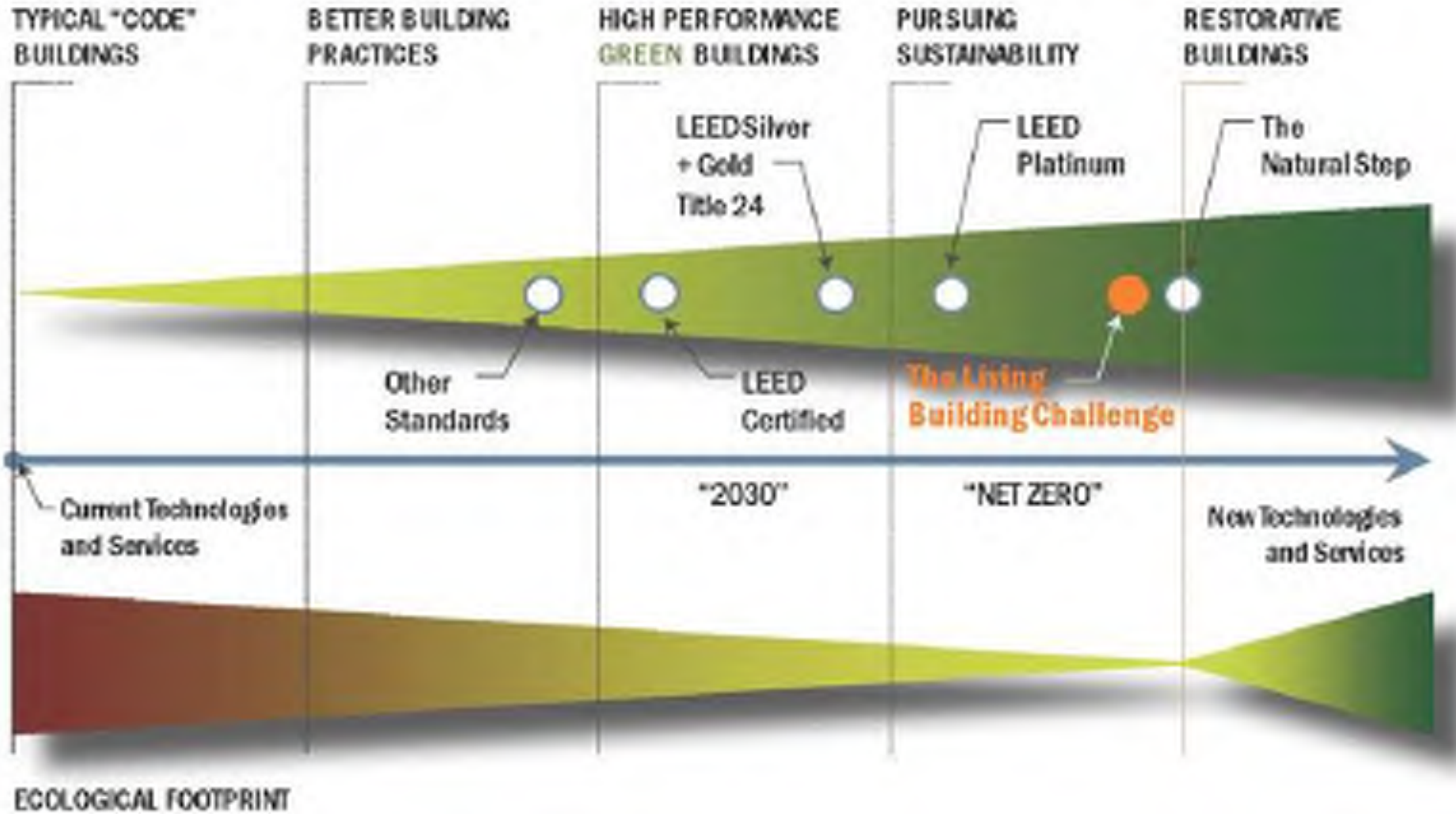
:: Environmental stewardship
:: Economic resourcefulness
:: Healthy spaces for students and staff
:: Social justice and equity

Living Building Challenge

Seven performance areas or petals:
site, water, energy, health, materials, equity, beauty

Living-future.org




TYPICAL "CODE" BUILDINGS
BETTER BUILDING PRACTICES
HIGH PERFORMANCE GREEN BUILDINGS
PURSUING SUSTAINABILITY
RESTORATIVE BUILDINGS
LEED Silver + Gold Title 24
LEED Platinum
The Natural Step
Other Standards
LEED Certified
The Living Building Challenge
Current Technologies and Services
"2030"
"NET ZERO"
New Technologies and Services
ECOLOGICAL FOOTPRINT

Water



Water

Buildings harvest sufficient water to meet the needs of the occupants, while respecting the natural hydrology of the site, the water needs of neighbors and the ecosystem they inhabit.

Net-zero Water
Ecological Water Flow



Net-zero Water

Water use reduction

Composting toilets!

Water-efficient landscapes

Innovative waste-water technologies

Greywater reuse

Rainwater harvesting

:: 3,100,000 gallons of water fall on the Queen Anne Elem. site annually

:: 1,000,000 gallons are potentially recoverable from the roof every year, incl. the planned addition

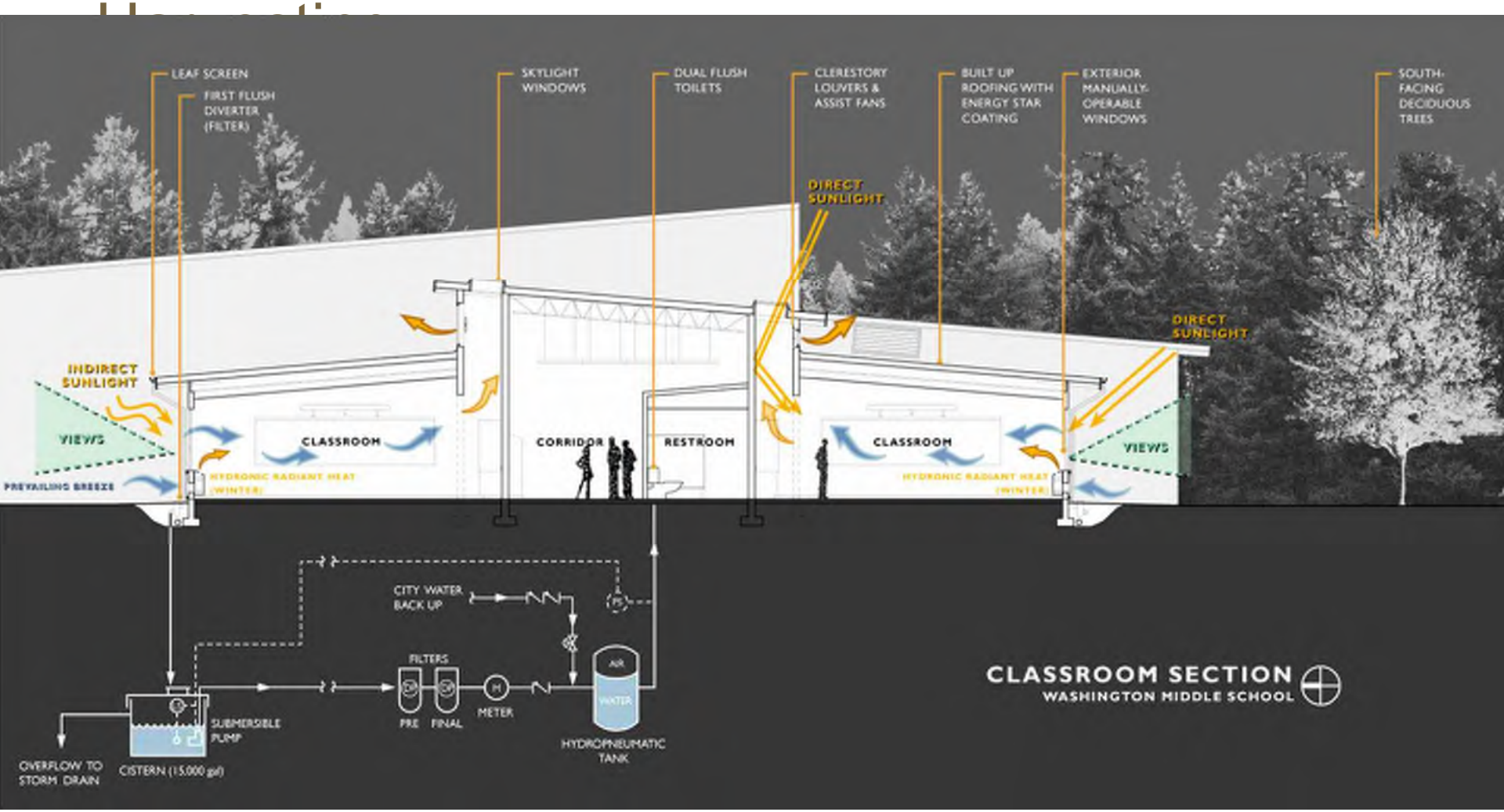
(based on +/- 37” of rain a year)




Water – Passive Strategies

Native and Drought Tolerant Planting
Low-flow Plumbing Fixtures
Rainwater Harvesting
Low-impact Development (Stormwater Management)

Rainwater Harvesting





Ecological Water Flows

Green roofs

Raingardens

Pervious paving

Bioretention cells

Potential to save on stormwater fees

:: 3,100,000 gallons of water fall on the Queen Anne Elem. site annually

:: Any water that falls on impervious surfaces needs to be managed

:: Roof runoff also needs to be managed

Soil as Stormwater Control

Soil = sponge




Water - WSSP

1) Outdoor Systems

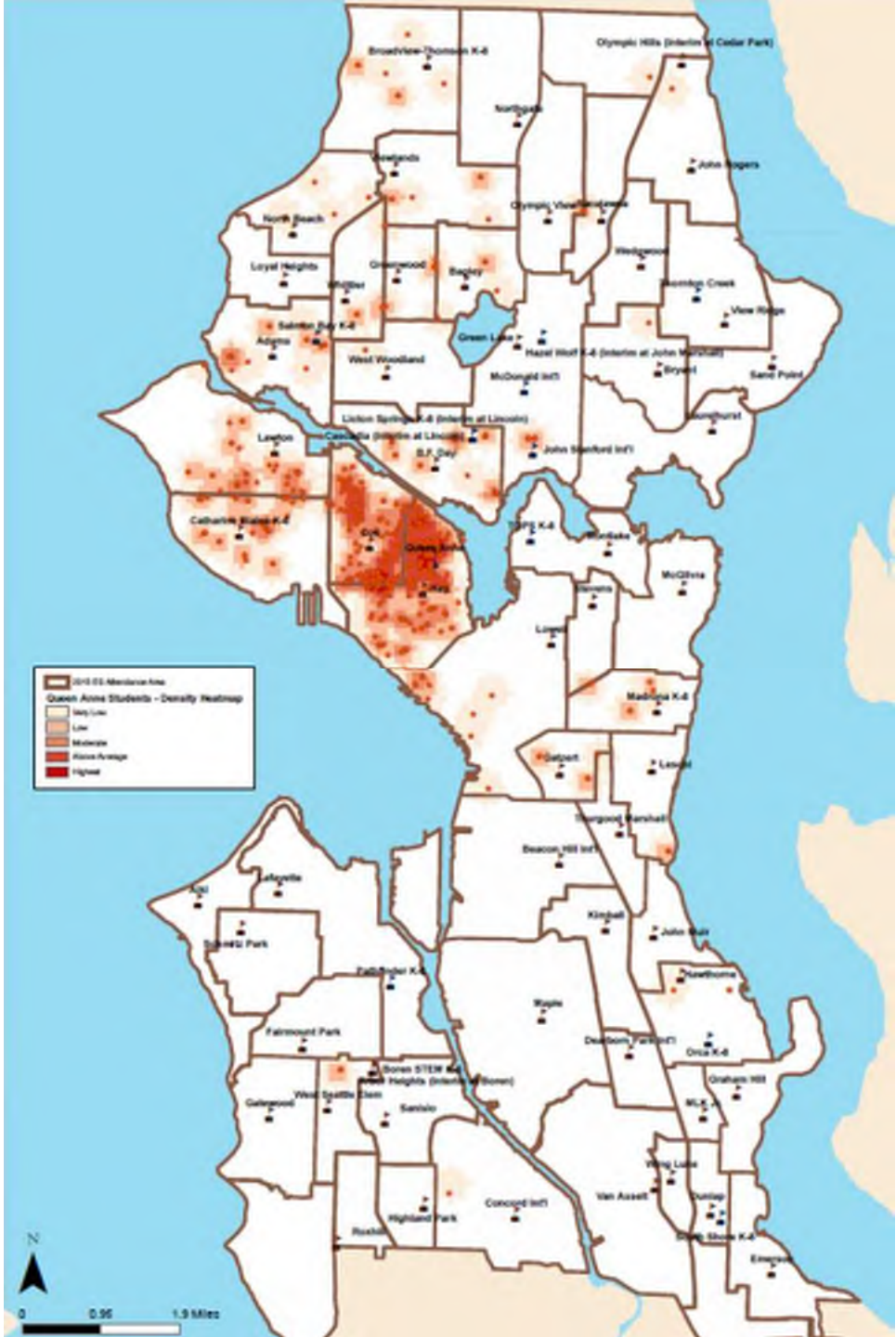
- W1.0 Outdoor Water Use Budget
- W1.1 Irrigation Water Reduction (50%, 100%)
- W1.2 Control Irrigation Water Use
- W1.3 Irrigation System Testing & Training

2) Indoor Systems

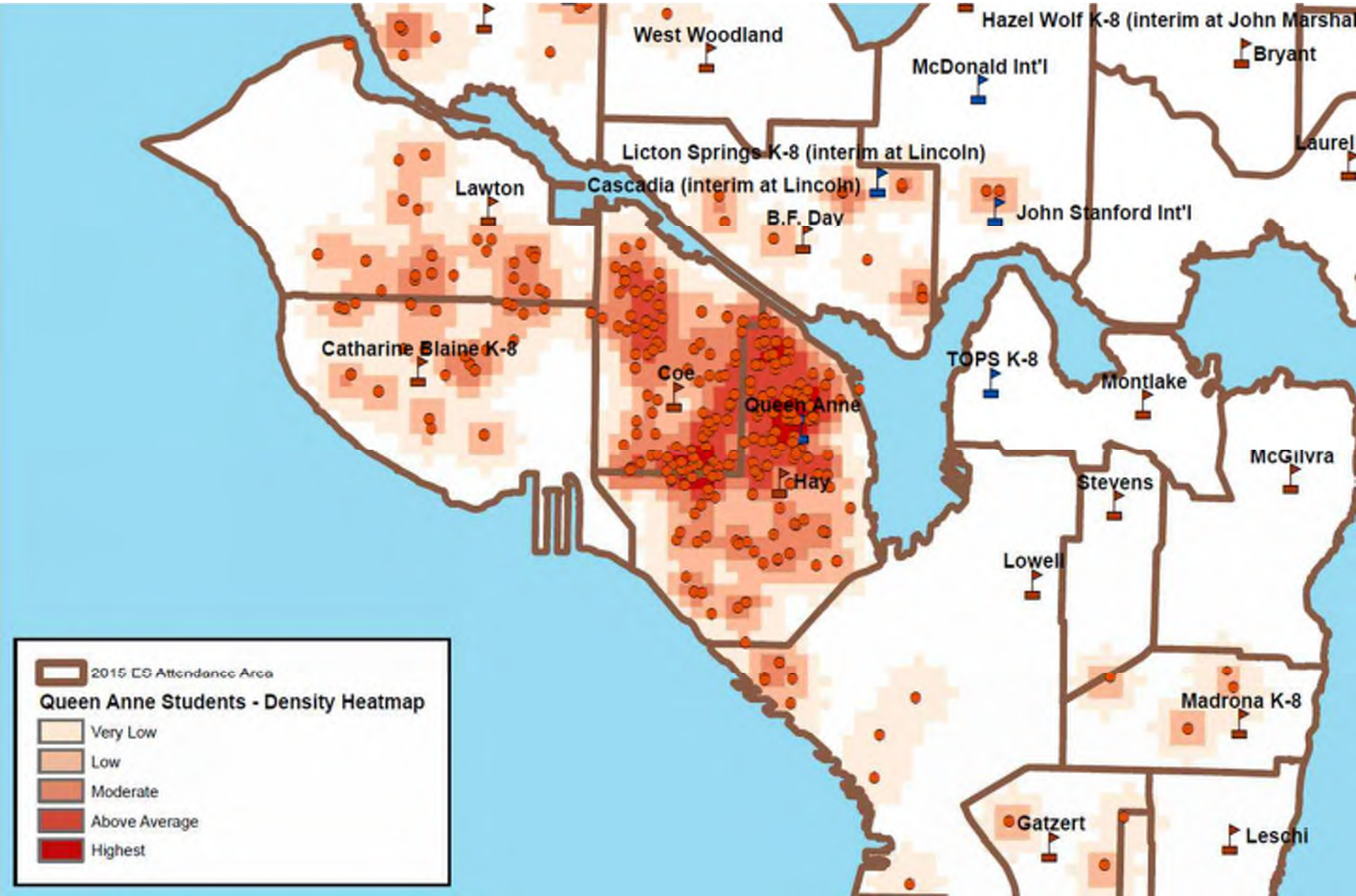
- W2.1 Potable Water Use for Bldg Sewage Reduction (25%, 45%)
- W2.2 Potable Water Use Reduction (20%, 30%, 40%)

Site

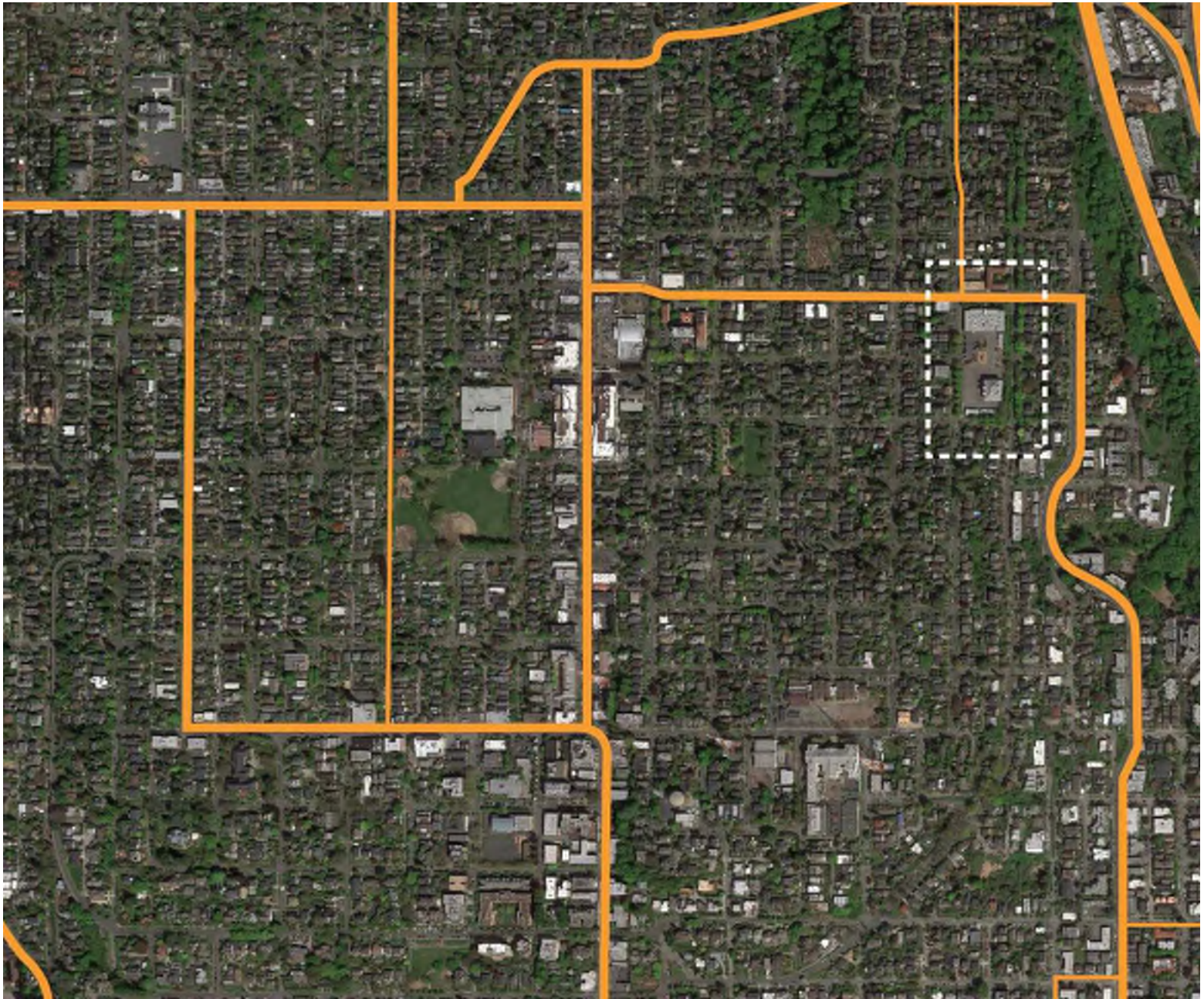
Queen Anne Elementary



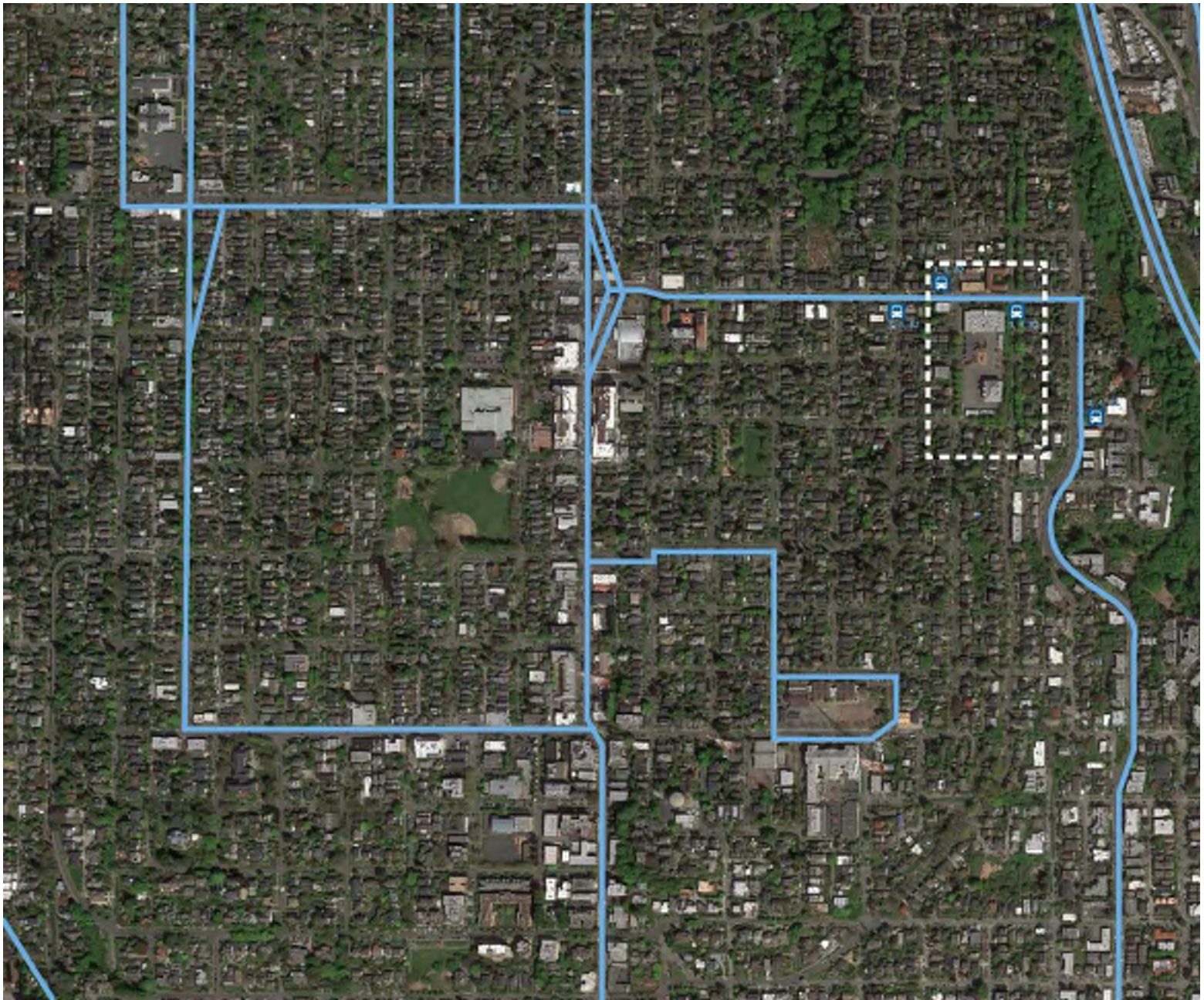
Queen Anne Elementary



Arterials



Bus Routes

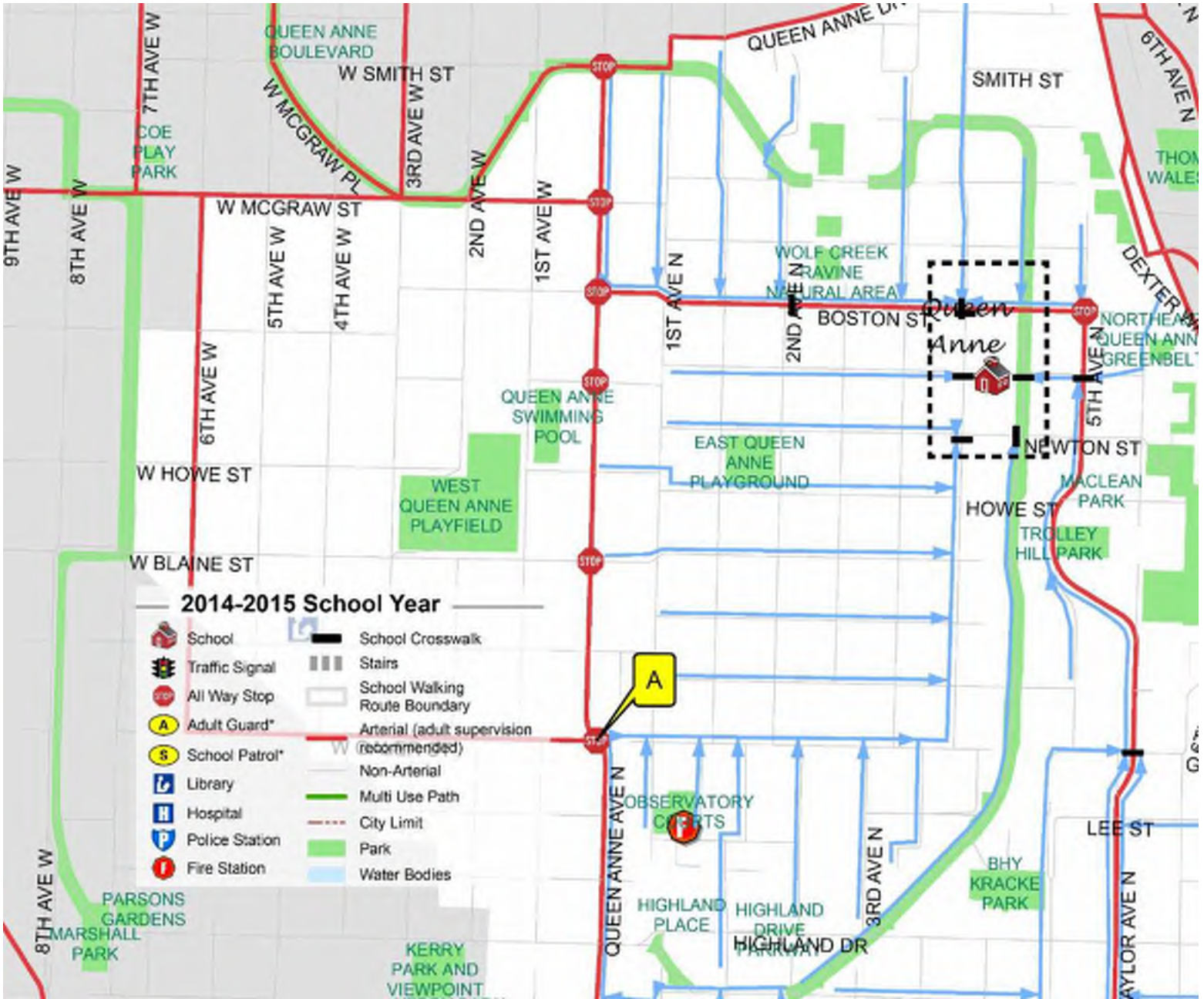


Parks and Schools

Queen Anne Crown of the Hill Greenway

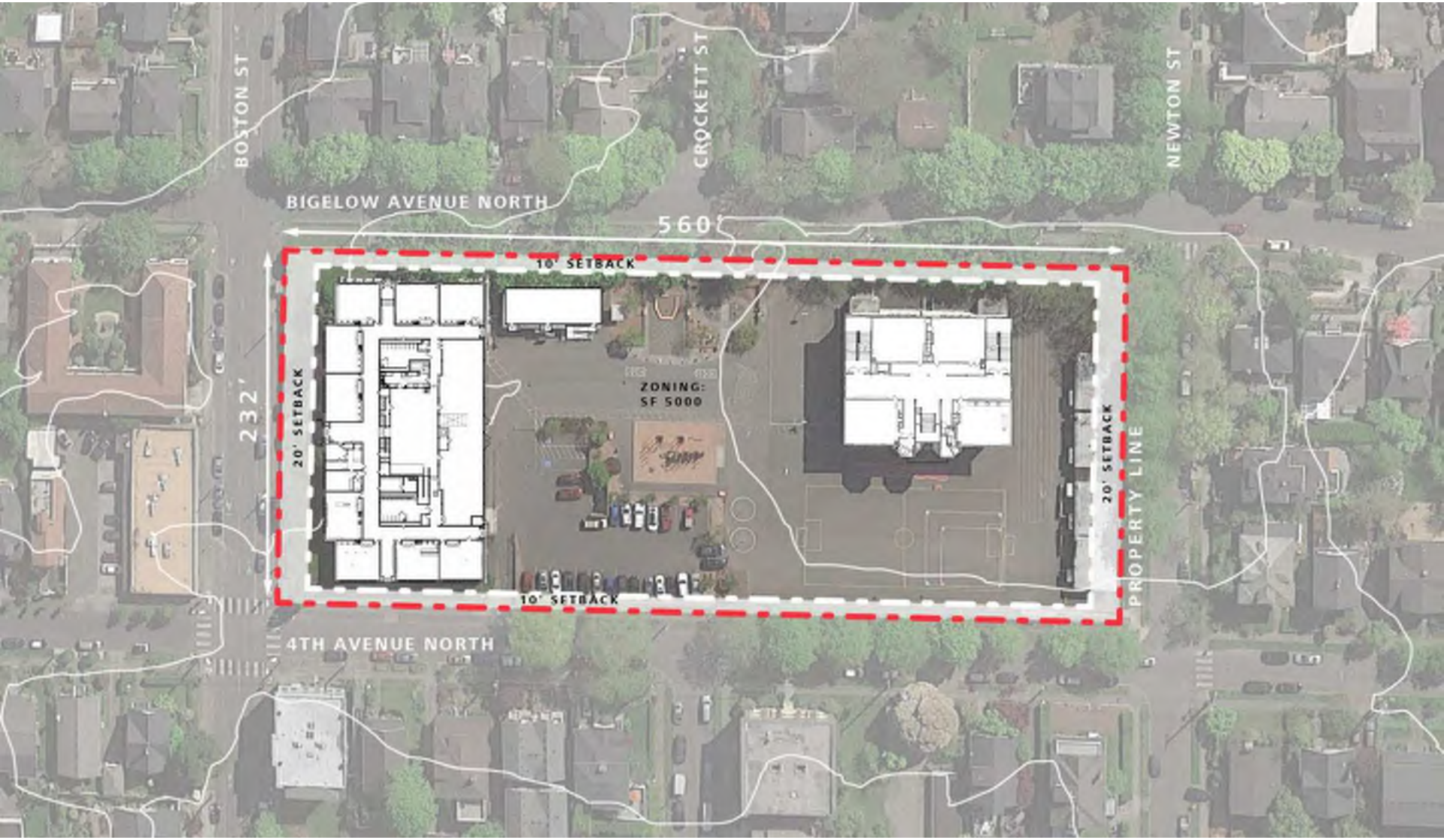
Bike Routes

Walking Routes

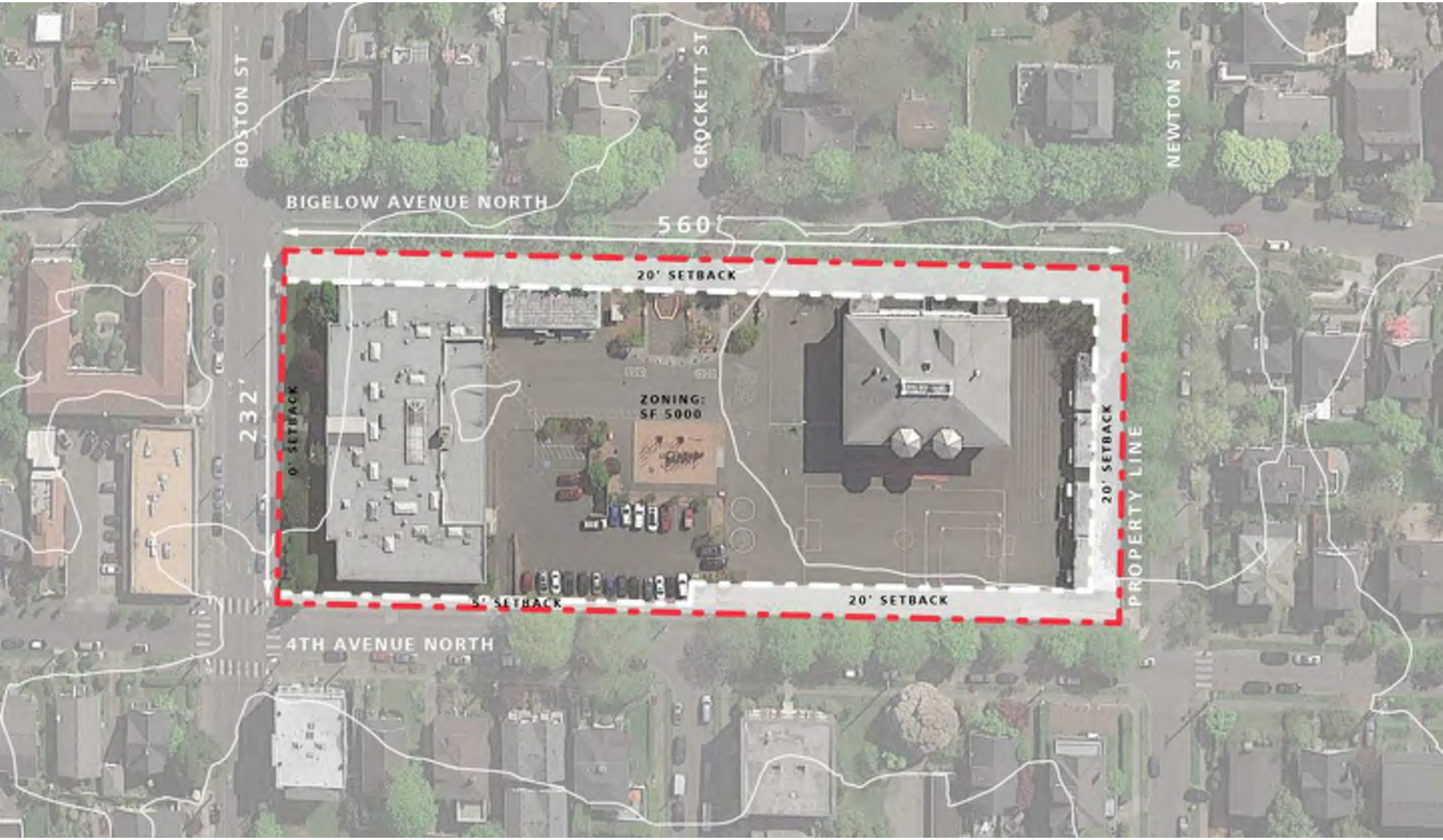


Site Features

Setbacks


BOSTON ST
CROCKETT ST
NEWTON ST
BIGELOW AVENUE NORTH
560'
10' SETBACK
20' SETBACK
232'
ZONING:
SF 5000
20' SETBACK
PROPERTY LINE
10' SETBACK
4TH AVENUE NORTH

Setbacks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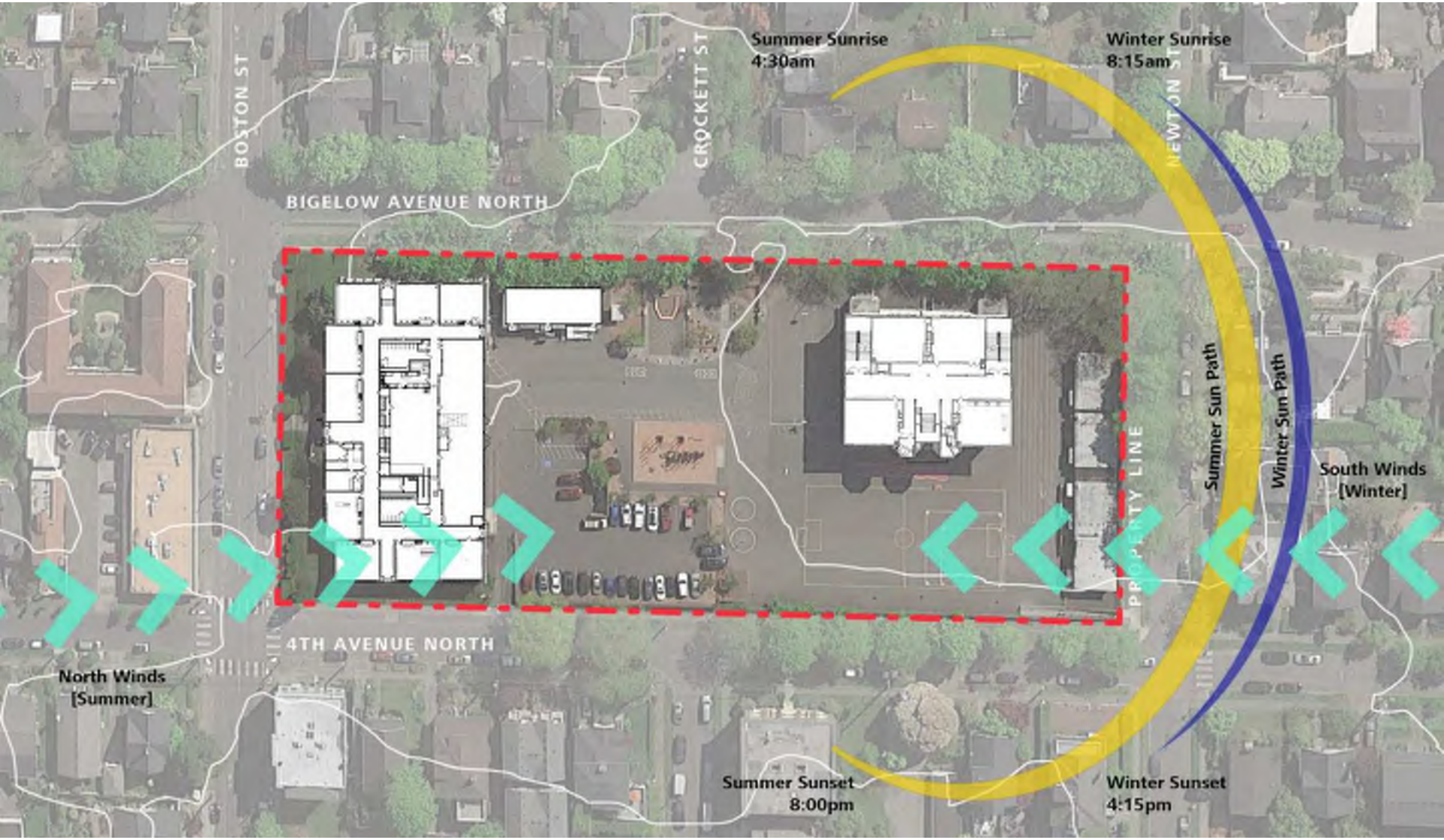
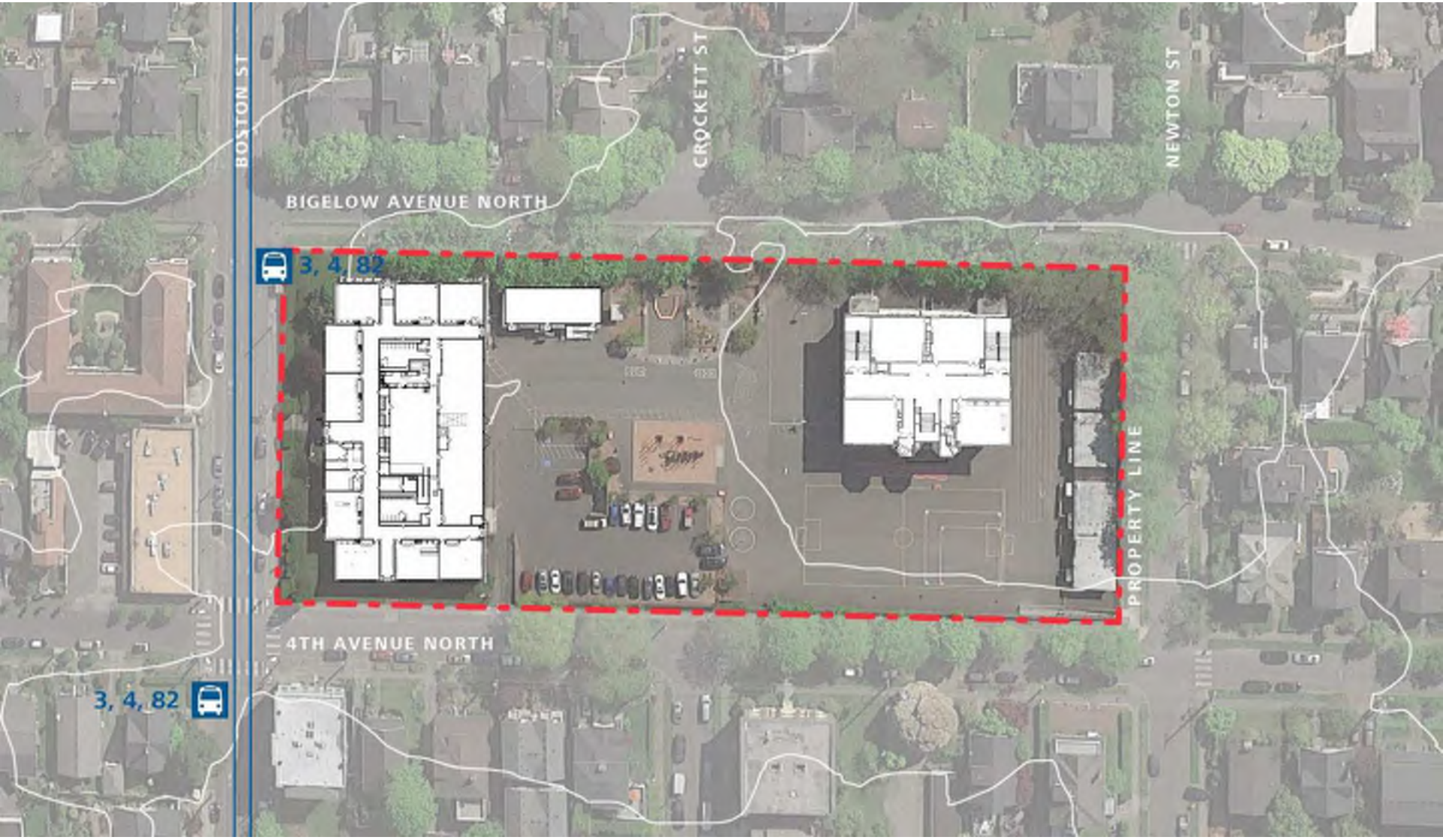
Solar and Wind Analysis

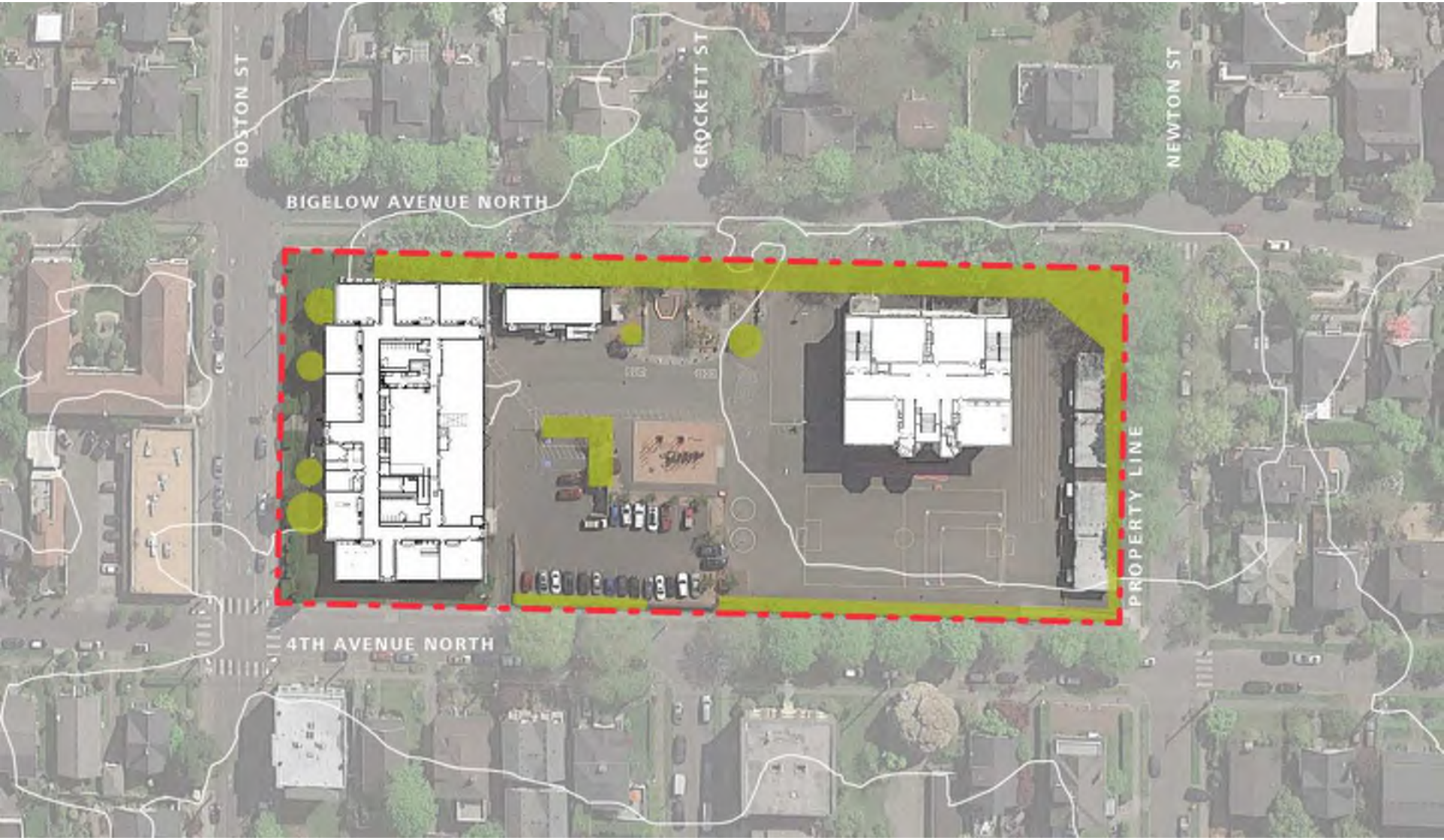


City Bus Stops

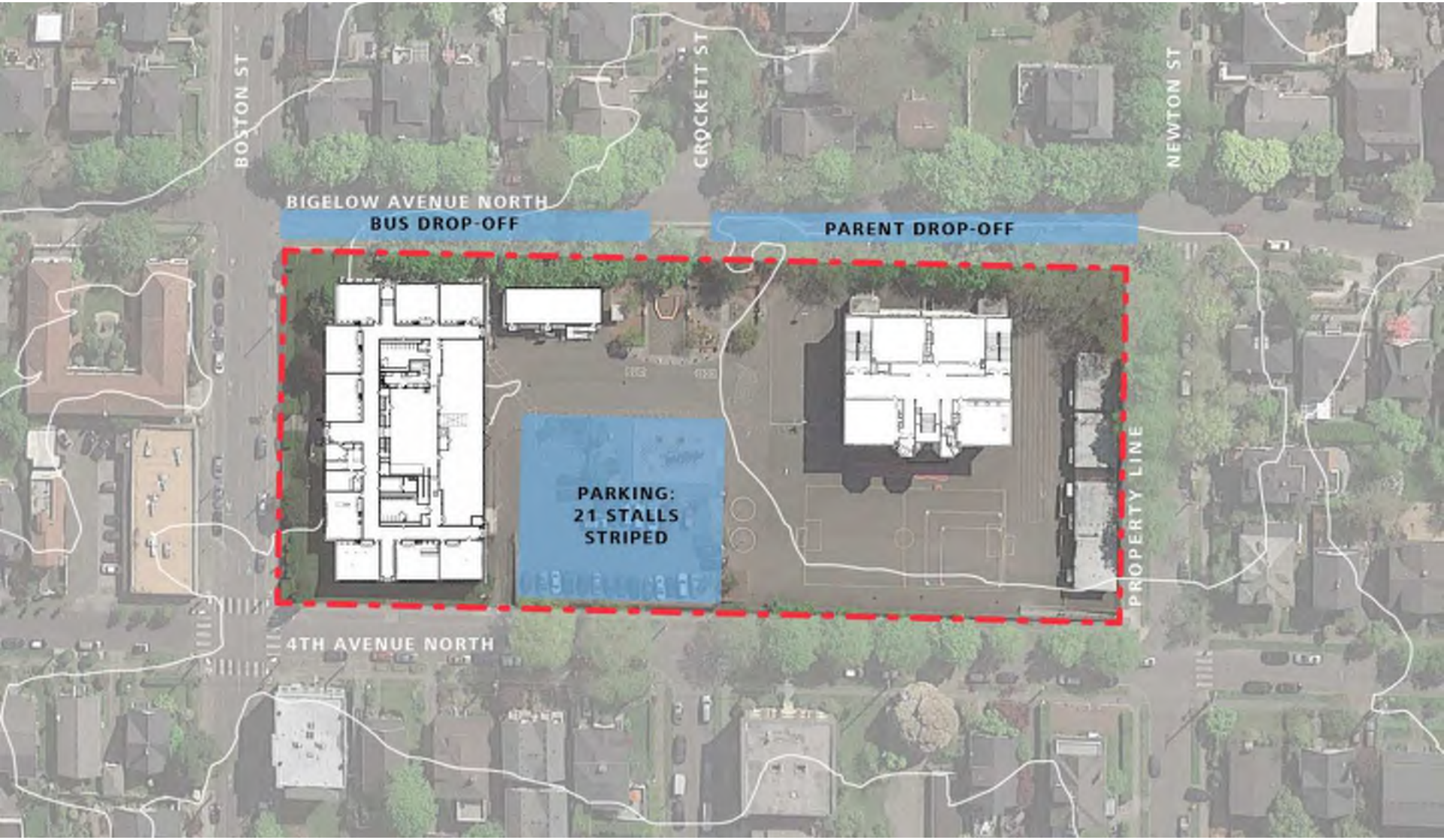


Steep Slopes

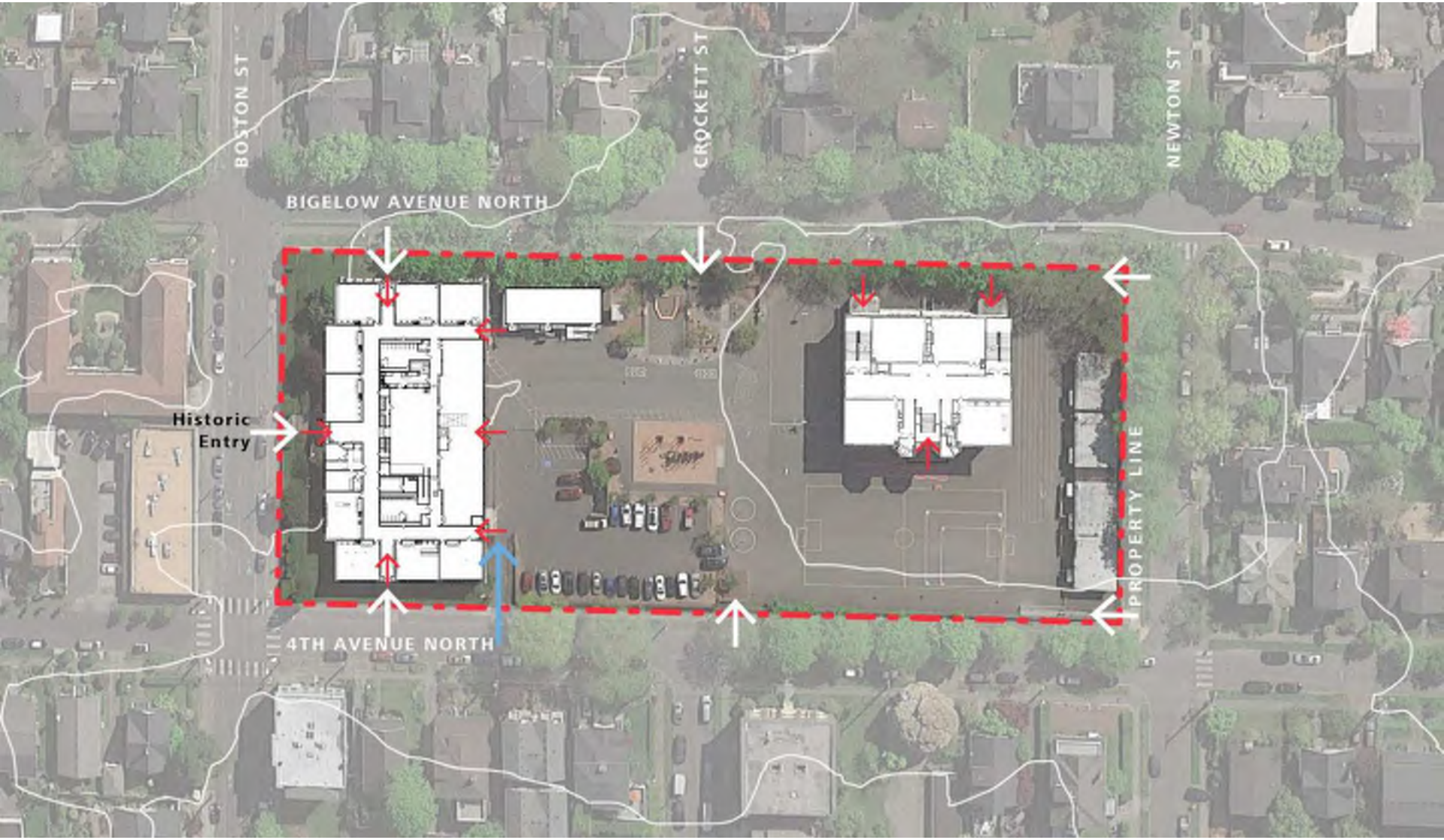
Tree Coverage



Parking and Drop-Off



Site Access


BOSTON ST
CROCKETT ST
NEWTON ST
BIGELOW AVENUE NORTH
Historic Entry
PROPERTY LINE
4TH AVENUE NORTH

Places of History/Memory

Places of History/Memory

Nancy Bevan
Amy Jessee
John Leary
Jeff Rothenberg

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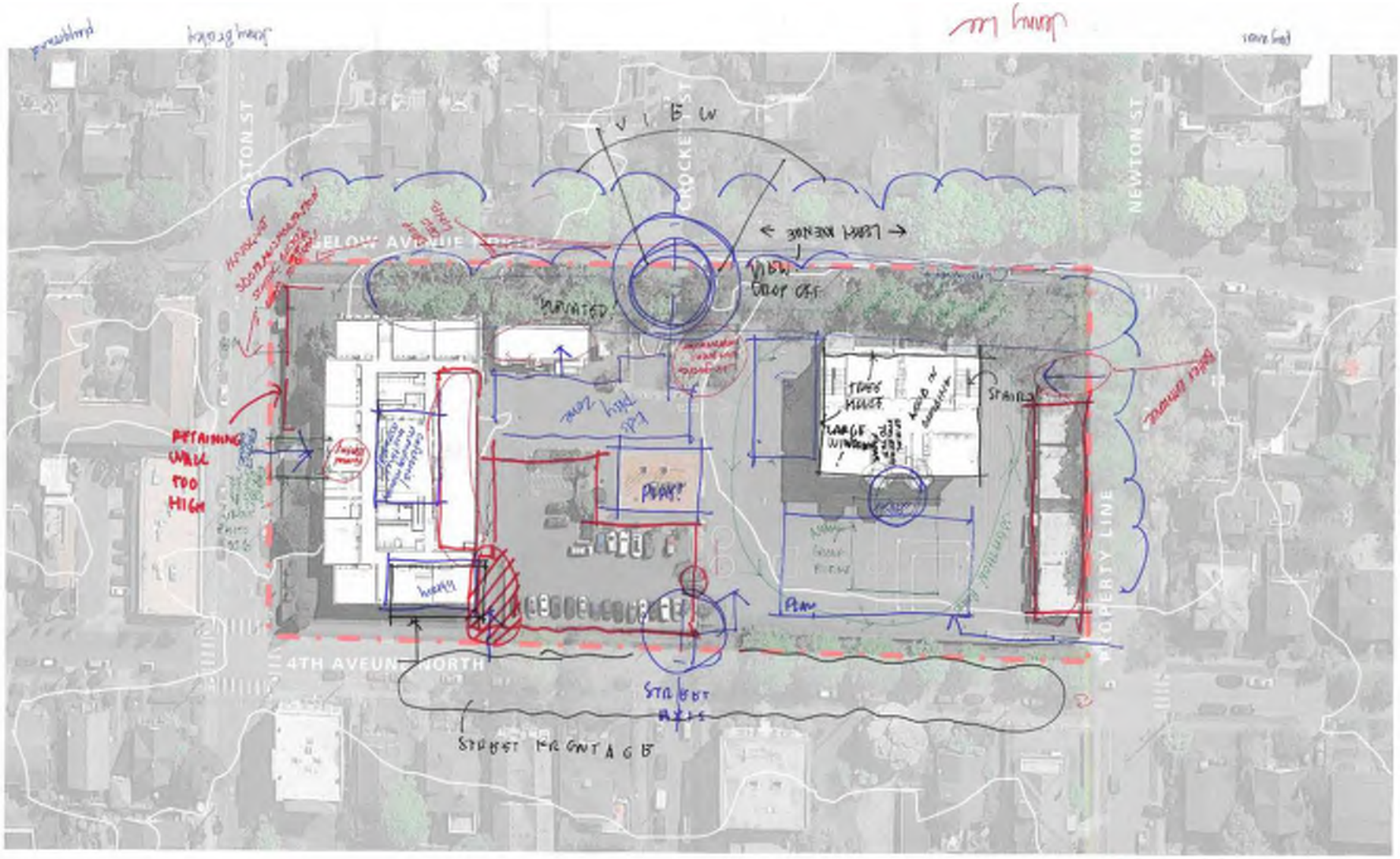
PLACES OF MEMORY/HISTORY
QUEEN ANNE ELEMENTARY SCHOOL
SEATTLE PUBLIC SCHOOLS

0 15' 30' 60'

Places of History/Memory



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PLACES OF MEMORY/HISTORY
QUEEN ANNE ELEMENTARY SCHOOL
SEATTLE PUBLIC SCHOOLS


A Green School:
Is a center of Community
Teaches Eco literacy
Is long lasting
Has a small Carbon footprint
Is beautiful
Is welcoming
Teaches and Demonstrates Stewardship
Is a responsible member of the city


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Sources: RECESS: Fernandes M and Sturm R. "The Role of School Physical Activity Programs in Child Body Mass Trajectory" Journal of Physical Activity and Health, 8(1): 114-181, February 2011. PE: Cawley J, Meyerhoefer C and Newhouse D. The correlation of youth physical activity with state policies. Contemporary Economic Policy, 26(2):1087-1065, 2007. ACHIEVEMENT: Nelson NE and Gordon-Larsen P. "Physical Activity and Sedentary Behavior Patterns Are Associated With Selected Adolescent Health Risk Behaviors." Pediatrics, 117(4): 1281-1290, April 2006. SAFE ROUTES TO SCHOOL: Sirard JR, Riner WF, Mciver KL, and Pate RR. "Physical Activity and Active Commuting to Elementary School." Medicine and Science in Sports and Exercise, 37(12): 2062-2069, 2005

At White Center Heights Elementary in Seattle, teachers reported that students who walk are *"more punctual"* and have *"fewer absences"* than students who either take the bus or are driven.

Safe Routes to School WA

http://www.saferouteswa.org/families.aspx


Walk to School
Route


SCHOOL BUS

Measures of Success

SOCIAL COHESION

Riding your bike or walking to school creates opportunities to interact with people.

Measures of Success

SAFETY

Streets are safer when more people are walking and biking on them.

Measures of Success

SUPPORTS LEARNING

Danish Mass Experiment

*Kids ages 5-19 who cycled or walked to school, rather than traveling by car or public transportation, performed measurably better on tasks demanding concentration, such as solving puzzles, and that the effects lasted for up to **four** hours after they got to school.*

http://www.theatlanticcities.com/commute/2013/02/kids-who-walk-or-bike-school-concentrate-better-study-shows/4585/

Measures of Success

Many parents pay for test prep and after-school enrichment programs to make their kids more academically competitive, and go to great lengths to schedule time for those activities.

Imagine if they invested those resources instead in something as simple as helping their children to travel safely from home to school on foot or by bike, arriving ready to learn.

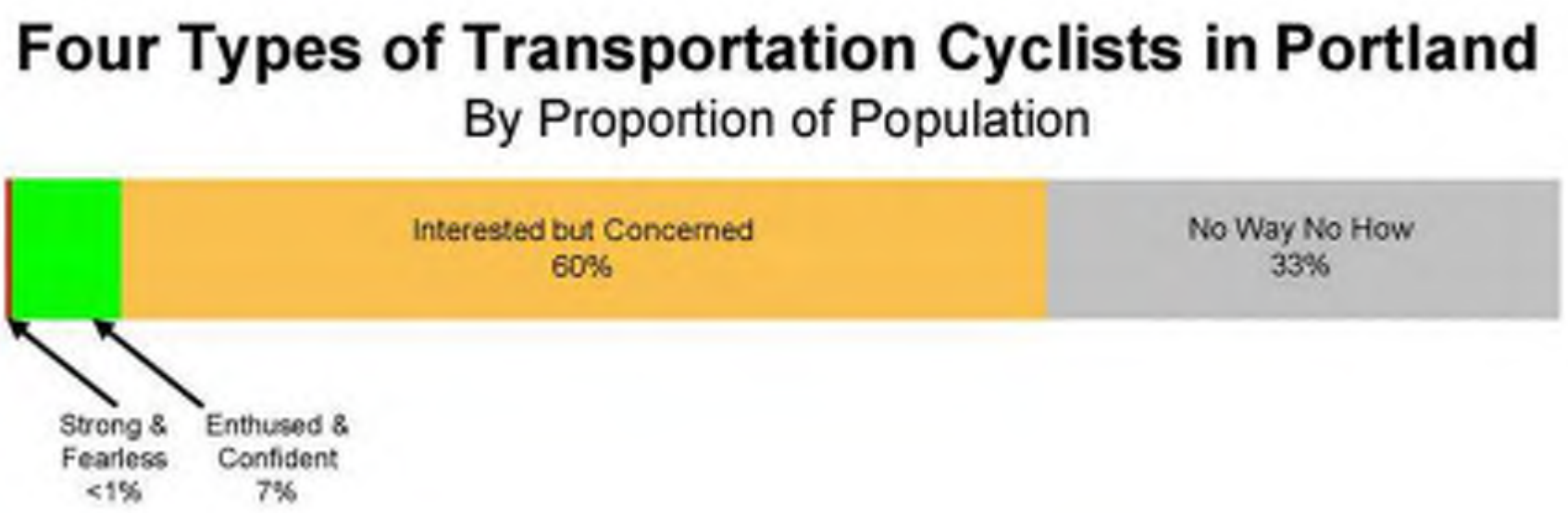
- Sarah Goodyear, *Atlantic Cities*
http://www.theatlanticcities.com/commute/2013/02/kids-who-walk-or-bike-school-concentrate-better-study-shows/4585/

BARRIERS

SAFETY + CULTURE

Davis, California
is a national leader
in bike and pedestrian facilities.
Yet…
60%
of students still arrive
to school by car.

USER TYPES



http://bikeportland.org/2006/12/07/what-type-of-cyclist-are-you-2650


1%
infocus
bmc


60%
SURLY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GOAL: Outdoor learning spaces that are age responsive, support a diversity of learning needs connect to natural systems, and are connected to community.

Food and Learning -

Trends

- THE EDIBLE SCHOOLYARD

Martin Luther King, Jr. Middle School, Berkeley, CA,
Alice Waters – Chez Panisse

National model of organic gardening and cooking to experience curricula, foster Eco-literacy, build community – and cross cultural links On the web:

- Next Gen Science Standards
- The Garden Coordinator

Food and Learning -

"Educational psychologists tell us that we retain 80% of what we do as opposed to 10-20% of what we hear and read."

Dr. Anthony Cortese, Second Nature

"Tell me, I forget,
Show me, I remember,
Involve me, I understand."

Ancient Chinese Proverb

Food and Learning and Community-

School Gardens as Teaching Stations

School Gardens as Teaching Stations


The New York Times

INTO THE WOODS WITH
EDWARD O. WILSON

A Wild, Fearsome World Under Each Fallen Leaf

Roots – Theoretical Background

Why We Like Some Landscapes:

- Lizard Brain
  - The limbic brain
- Prospect/Refuge

How We Learn:

Multiple Intelligences – Howard Gardiner, et.al.

Brain Research – John Medina

Loose Parts/Hands On/Experiential Learning/Project Based

Roots – Theoretical Background

prospect|refuge

EVOLUTION

prospect|refuge

EVOLUTION

prospect|refuge

EVOLUTION

WayFinding

paths

edges

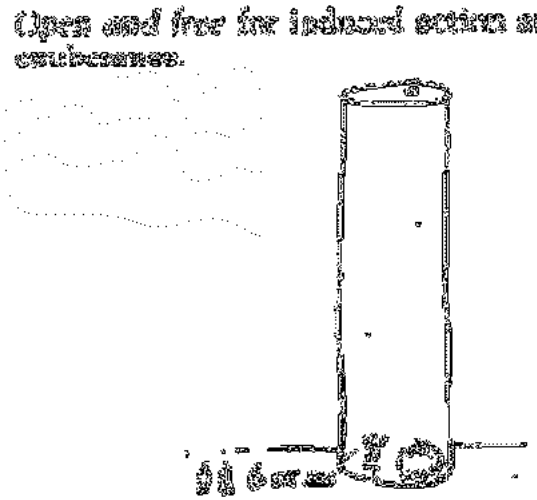
districts

nodes

landmarks

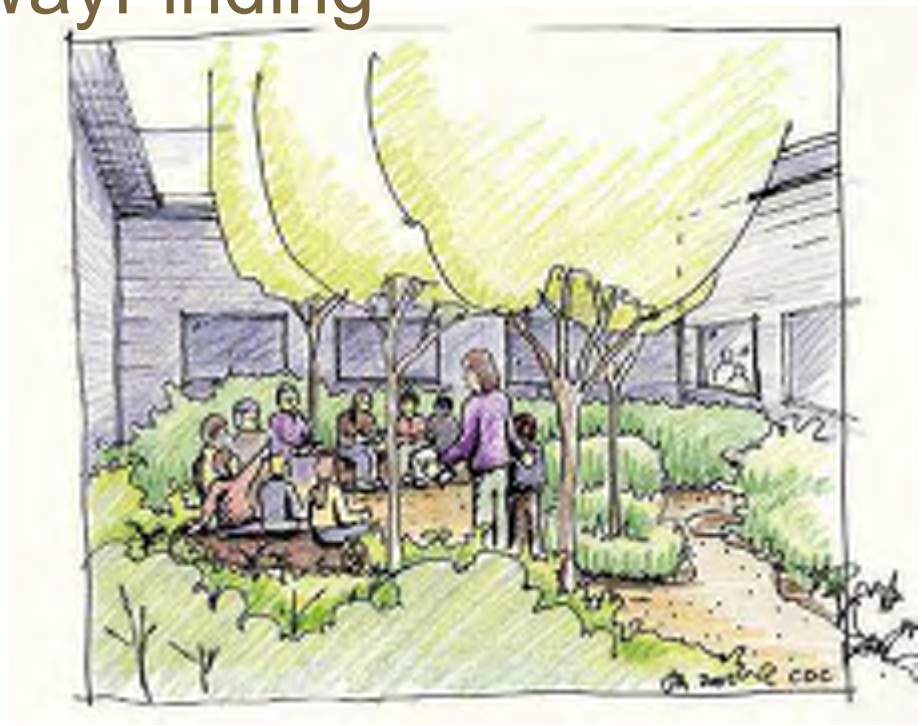
WayFinding

Edges create classroom control



Edges

WayFinding



paths and nodes

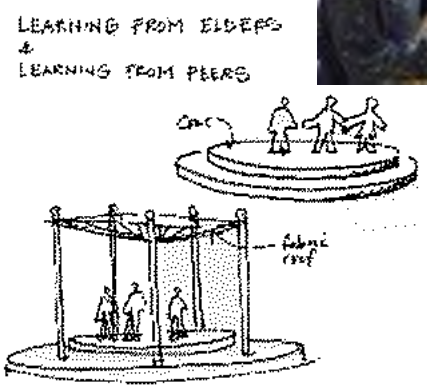
Designing outdoors for learning

Multiple Intelligences
Linguistic
Mathematic | Logical
Musical | Auditory
Bodily | Kinesthetic
Spatial
Interpersonal
Intrapersonal
Naturalist

Loose parts Play – project based, hands on

Prospect Refuge

Intelligences

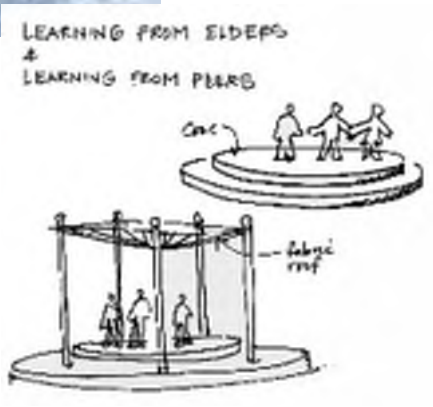


Linguistic – words – spoken and written and shared

Intelligences

Logical – measuring, observing, recording

Intelligences

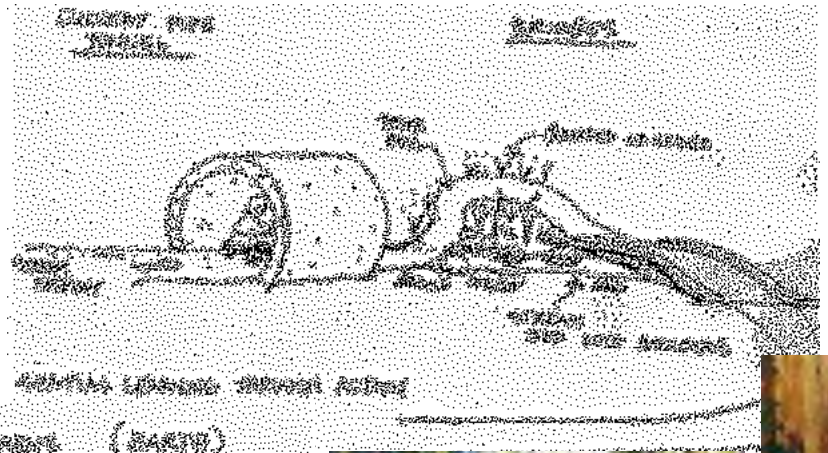


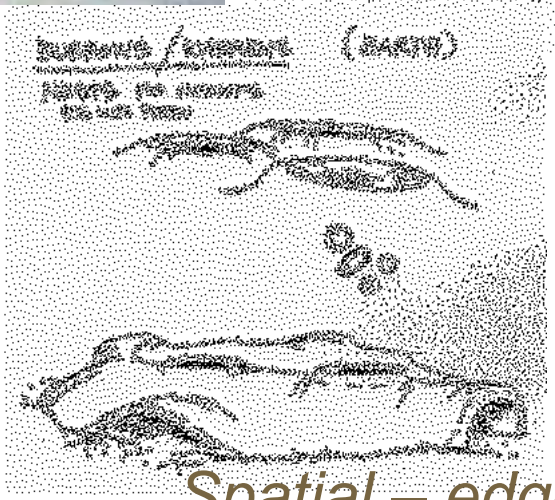
Music – auditory

Intelligences

Kinesthetic – learning by moving

Intelligences





Spatial – edges, inside-outside- prospect refuge

Intelligences - *emotional*

Interpersonal - interrelational

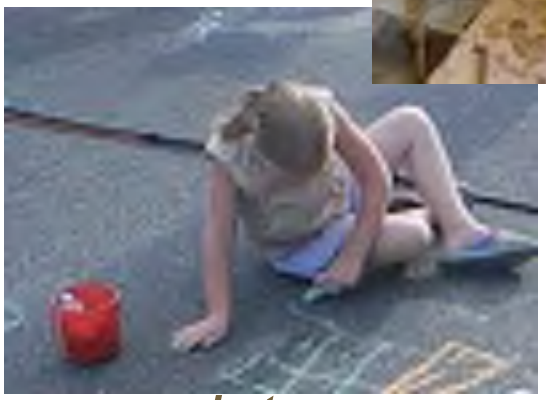
Intelligences - *emotional*





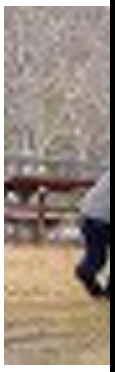


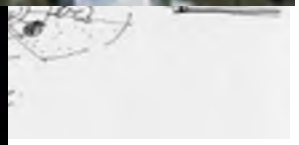




Intrapersonal – self reflection

Loose Parts Play





Explorable - aspirational

Success in small spaces?

Success in small spaces?

Success in small spaces?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Stormwater Requirements

City of Seattle 2016 Stormwater Code : Requirements

- Combined Sewer Basin
- Detention of over 10,000 square feet new and/or replaced impervious
- No water quality required
- Onsite stormwater management
- In filtration testing
- Onsite stormwater management checklist for feasibility

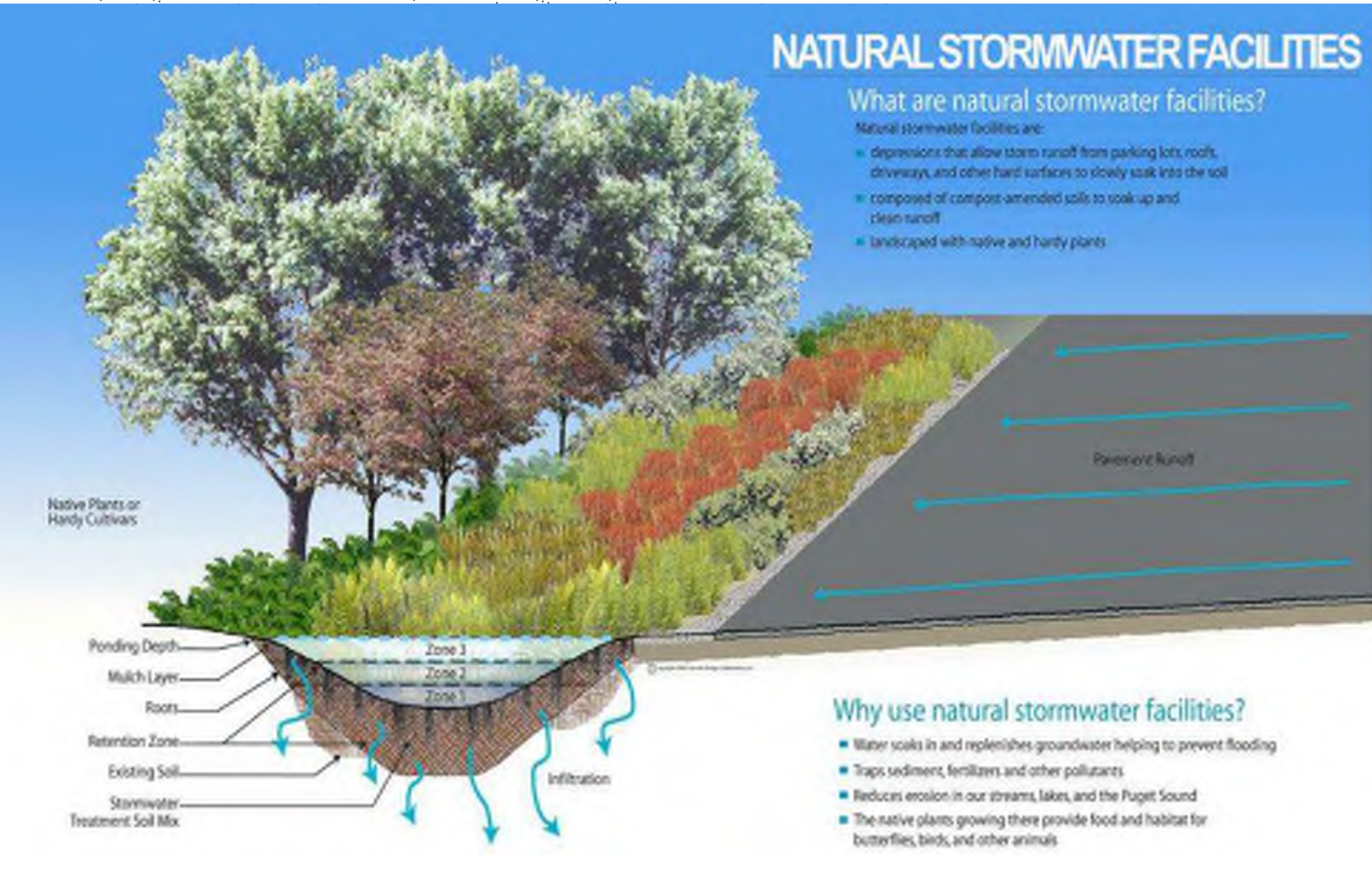
Stormwater Requirements

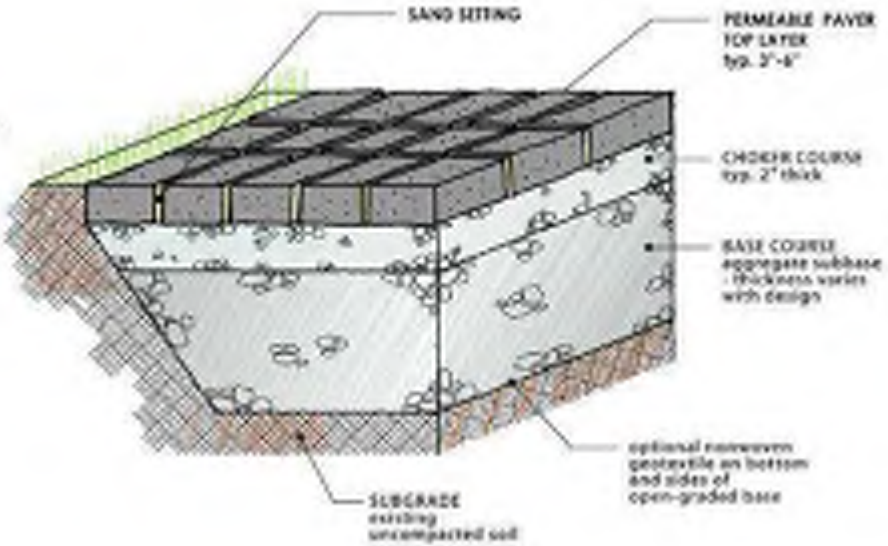
City of Seattle 2016 Stormwater Code : Requirements

Onsite Stormwater Management

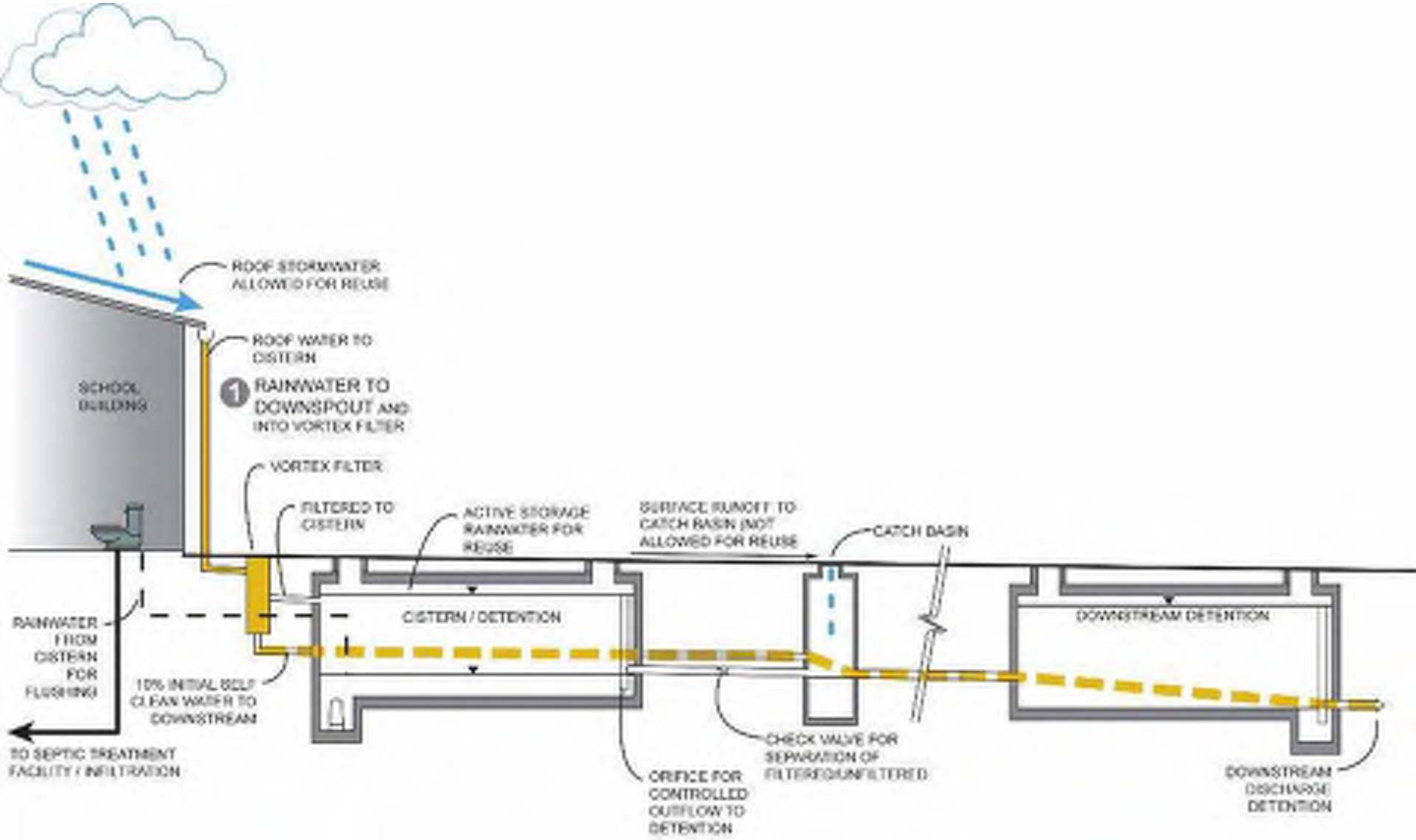
- Other Names: Green Stormwater Infrastructure (GSI), Best Management Practices (BMP)
- Dispersion & Infiltration
- Bioretention
- Pervious / Permeable Paving
- Green Roofs
- Cisterns

Turn the Requirement into an Amenity

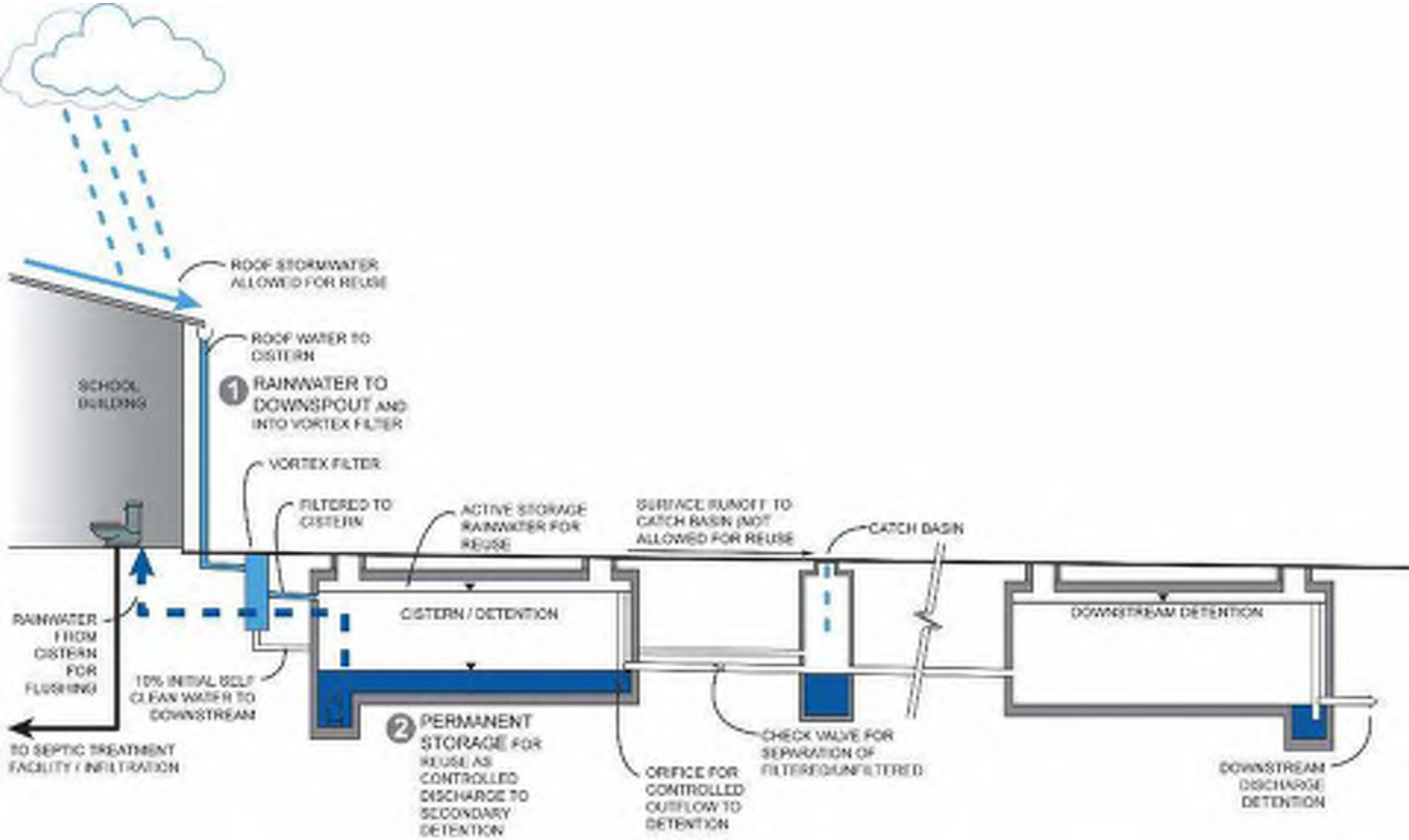

NATURAL STORMWATER FACILITIES
What are natural stormwater facilities?
Natural stormwater facilities are:
depressions that allow storm runoff from parking lots, roofs, driveways, and other hard surfaces to slowly soak into the soil
composed of compost-amended soils to soak up and clean runoff
landscaped with native and hardy plants
Native Plants or Hardy Cultivars
Pavement Runoff
Ponding Depth
Mulch Layer
Roots
Retention Zone
Existing Soil
Stormwater Treatment Soil Mix
Zone 3
Zone 2
Zone 1
Infiltration
Why use natural stormwater facilities?
Water soaks in and replenishes groundwater helping to prevent flooding
Traps sediment, fertilizers and other pollutants
Reduces erosion in our streams, lakes, and the Puget Sound
The native plants growing there provide food and habitat for butterflies, birds, and other animals


SAND SETTING
PERMEABLE PAVER
TOP LAYER
typ. 3"-4"
CHOKER COURSE
typ. 2" thick
BASE COURSE
aggregate subbase
- thickness varies
with design
optional nonwoven
geotextile on bottom
and sides of
open-graded base
SUBGRADE
existing
uncompacted soil

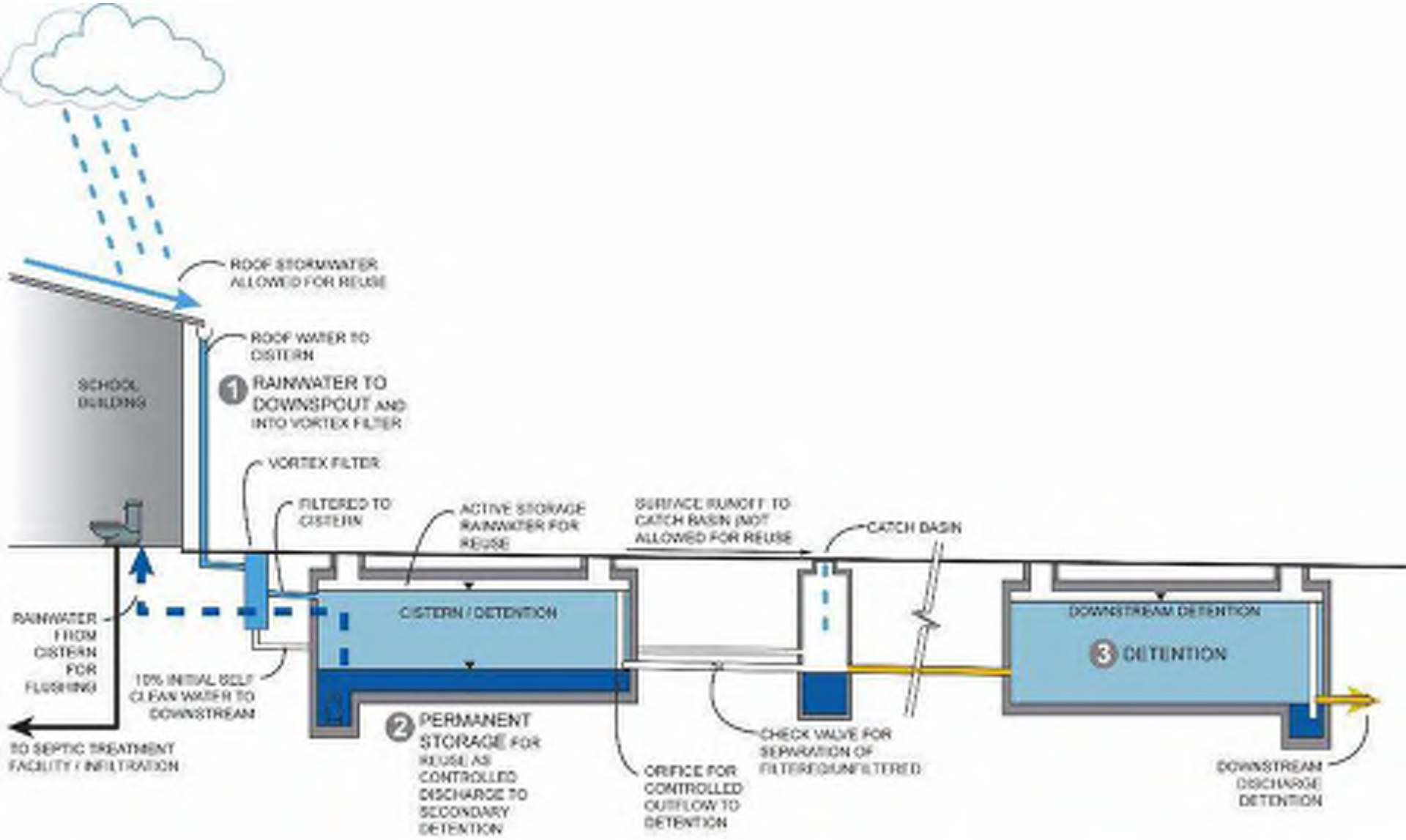

TURFCO



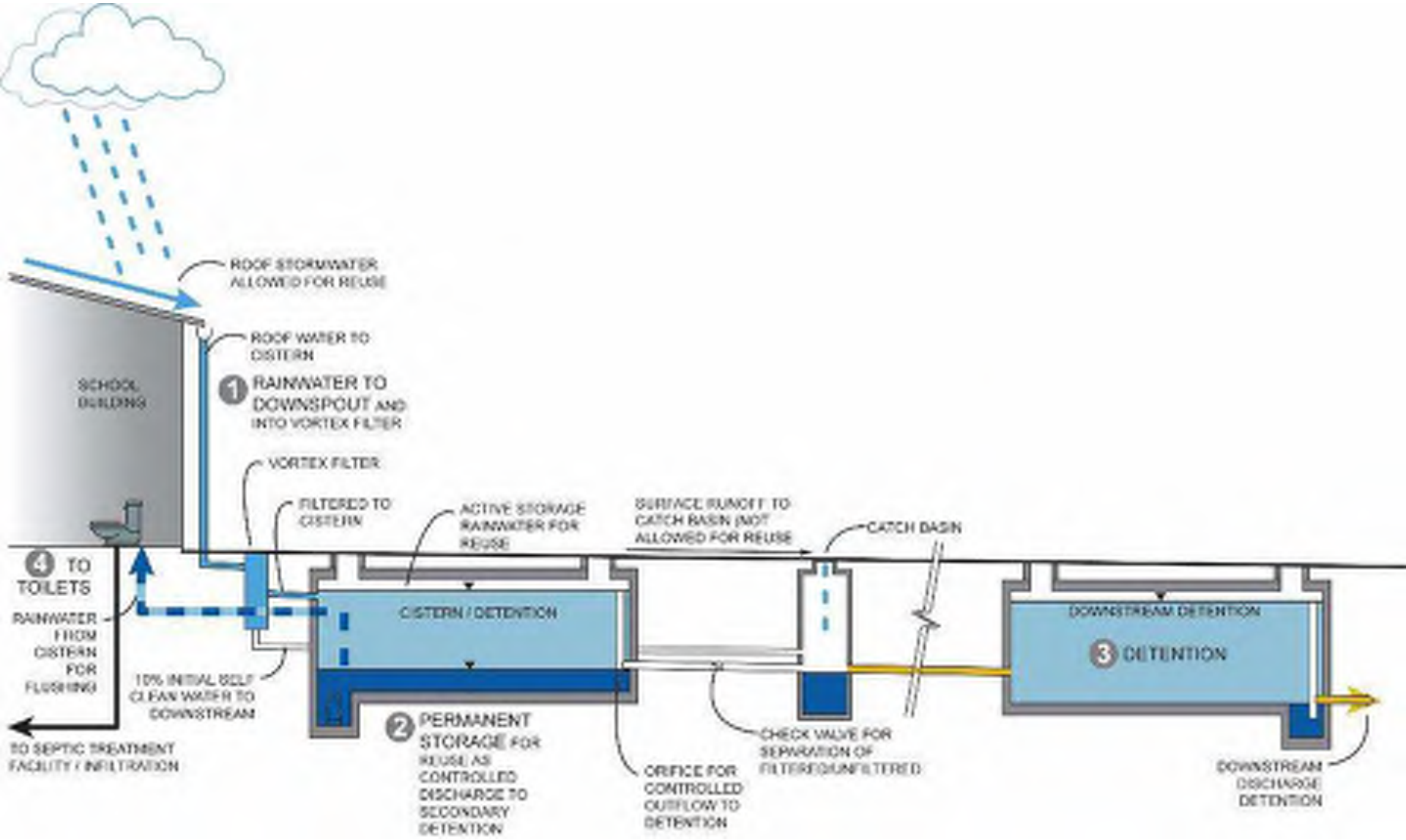
LPD engineering plc



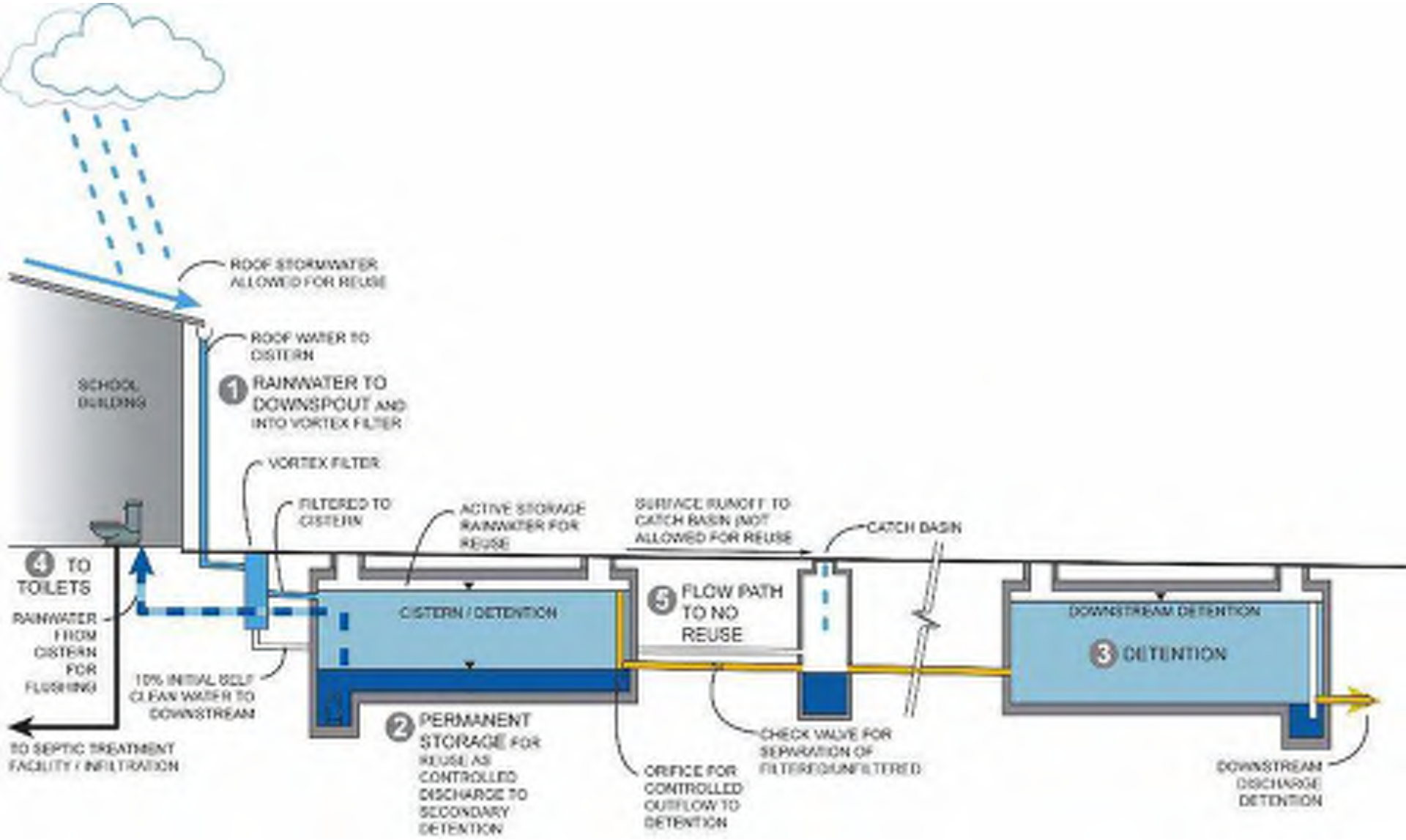
LPD engineering plic



LPD engineering plic



LPD engineering plic



LPD engineering plic

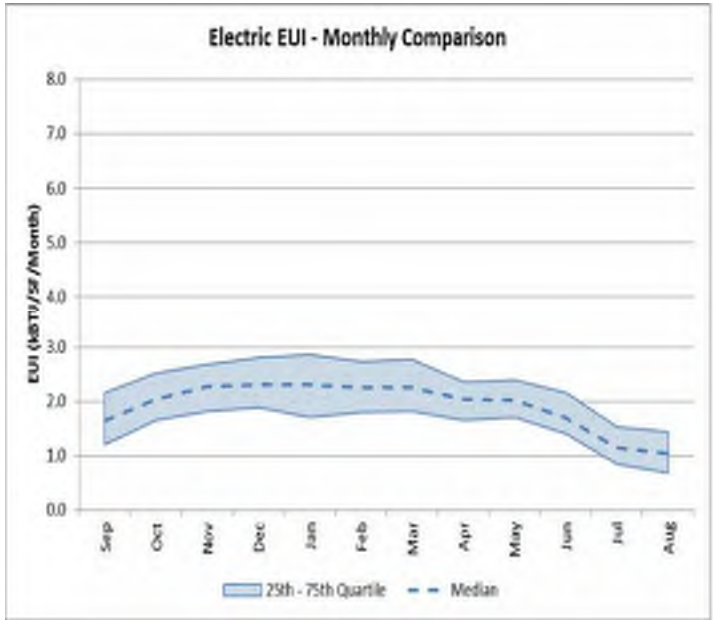
Energy

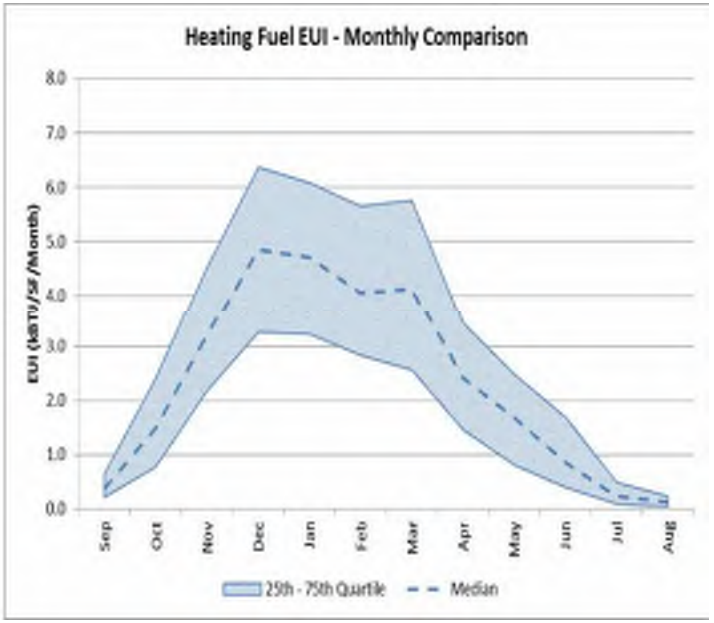
Living Building Challenge - Energy Petal

- Primary Energy Petal goal is a Net Zero / Positive building
- Living Building Challenge requires no combustion (gas fired) equipment
  - Recent existing building system improvements
- Net Zero Strategy Considerations
  - Impacts to users
  - Maintenance
  - Initial Costs

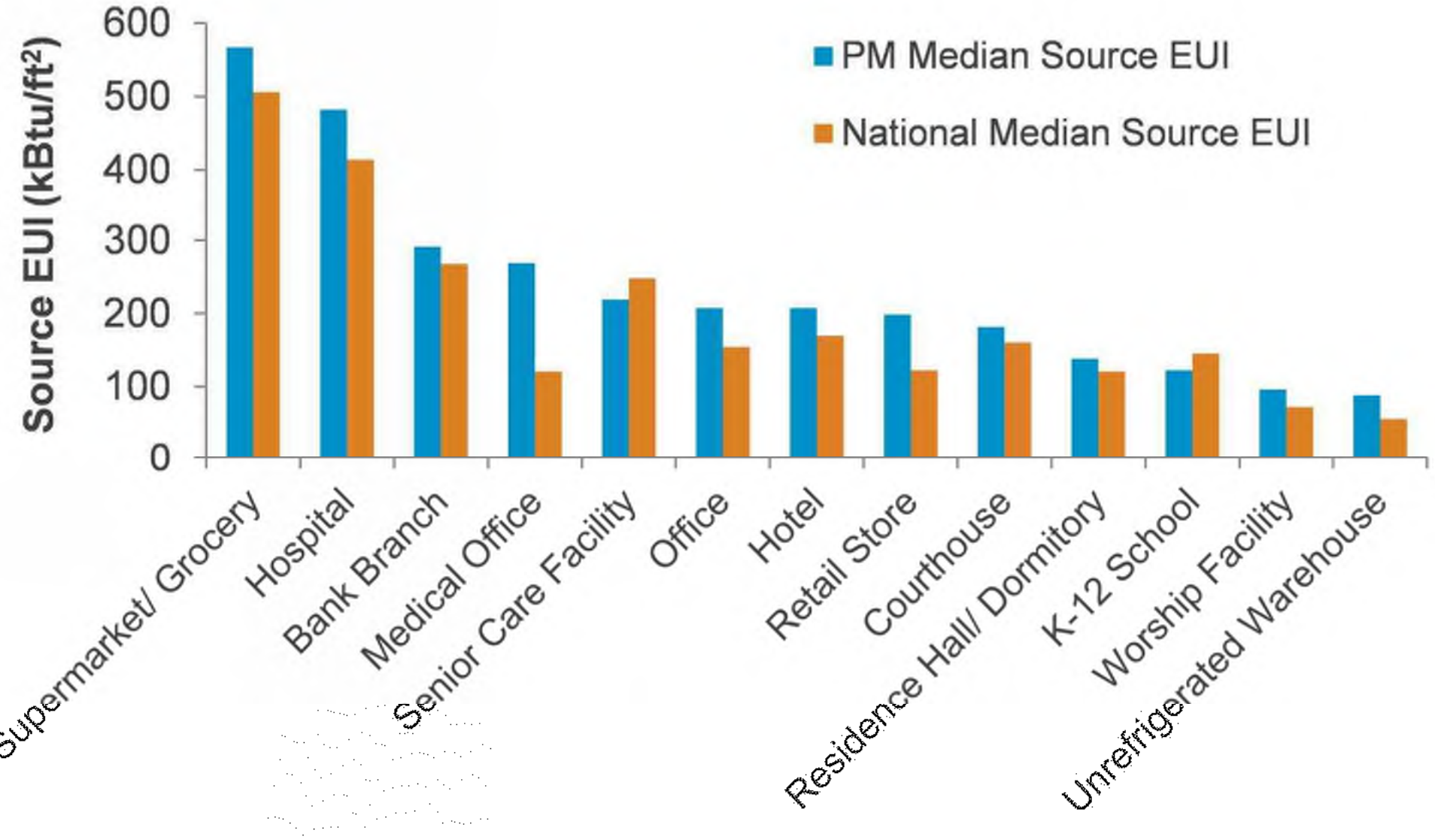
Net Zero – What does this Mean?

$$EUI = \frac{\text{Annual Energy Use (kBTU)}}{\text{Building Area (ft}^2\text{)}}$$



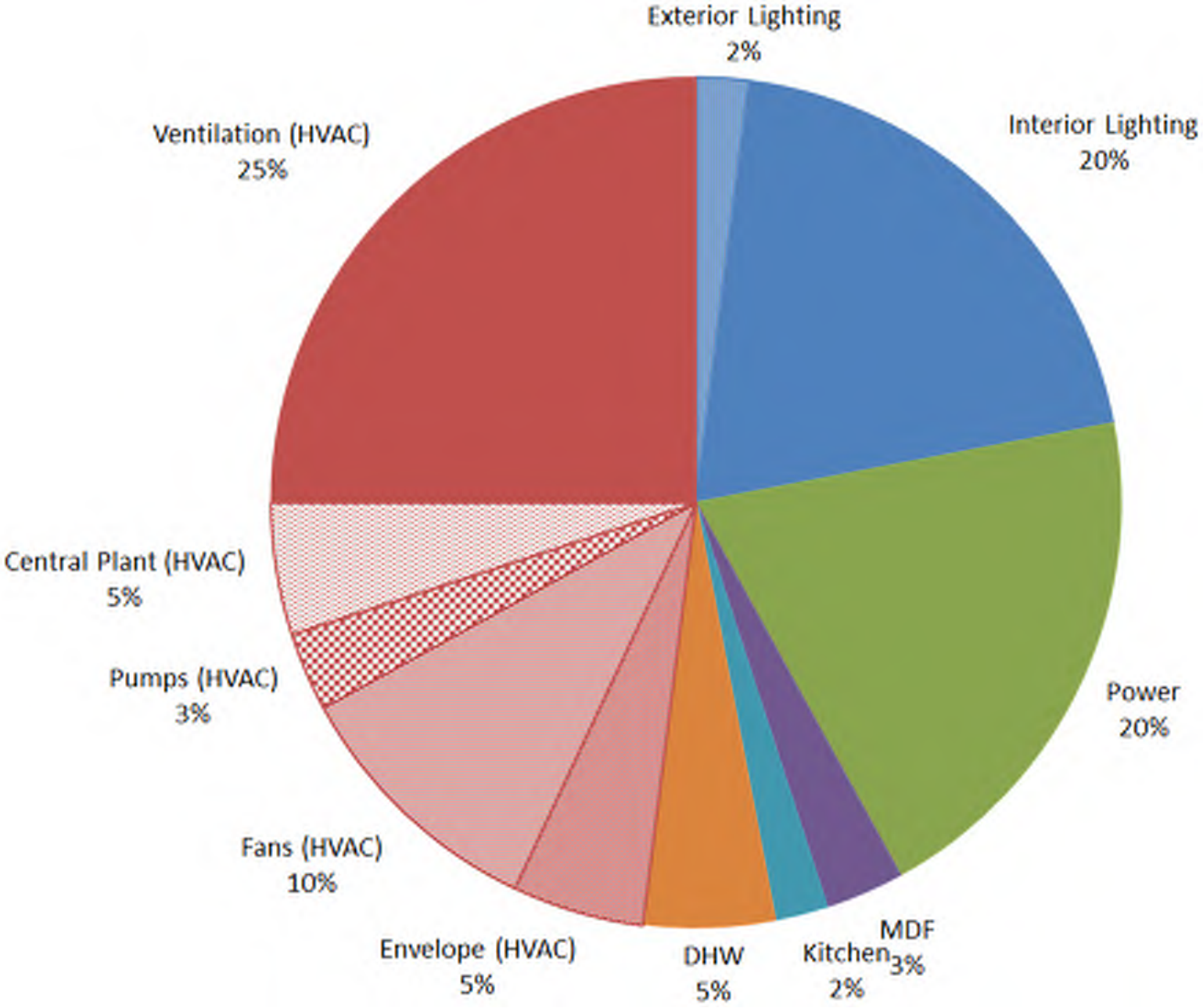


- EUI = Energy Use Intensity
- Provides comparison for buildings of different sizes
- Current Queen Anne ES EUI = 32



Some building types excluded due to inadequate data and/or EUI values beyond this range

End-Use Breakout Summary – 2012 WSEC Minimum



Lighting Systems

Issue – Provide energy efficient lighting to reduce operation and maintenance costs.

Net Zero Strategy -

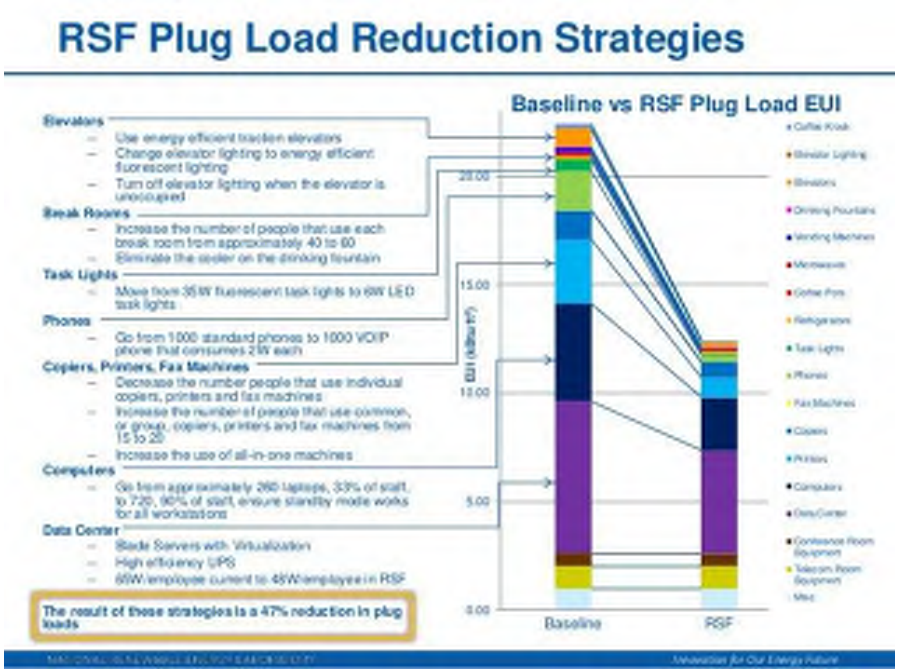
- Provide LED luminaires for both interior and exterior spaces
- Incorporate daylight harvesting in day-lit areas
- Dim parking lot luminaires to 50% when unoccupied

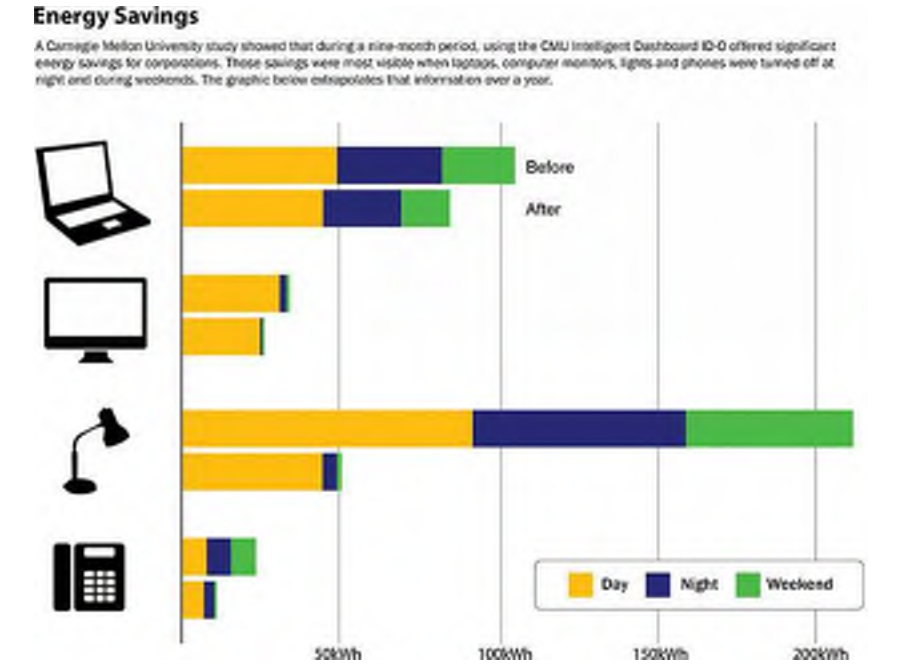
Power Distribution Systems

Issue – Provide controlled receptacles to reduce overall energy use.

Net Zero Strategy -

- 50% of all receptacles in classrooms, offices, conference rooms, and break rooms shall be controlled by the building energy management system.



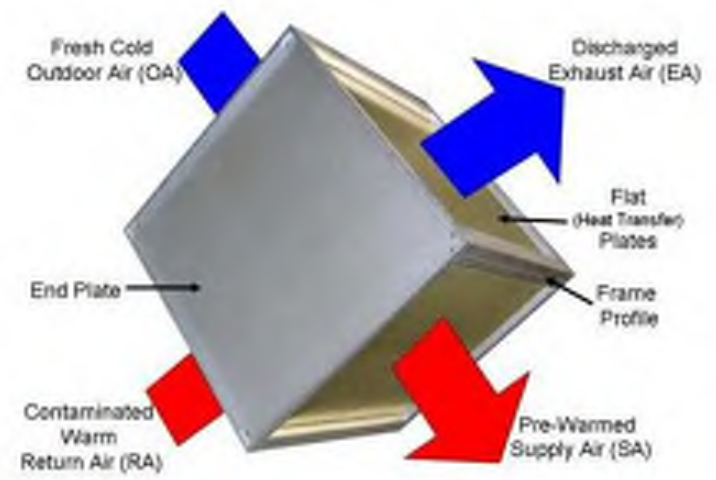


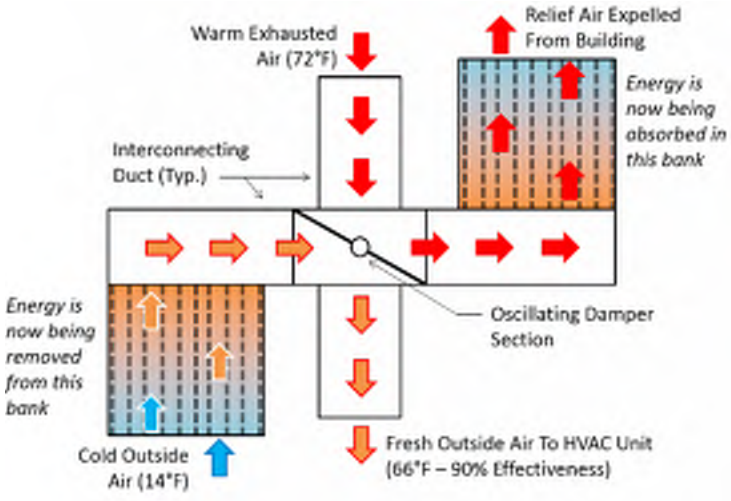
Ventilation Energy Recovery

Issue - Existing system has no heat recovery equipment

Net Zero Strategy

- 50% or 90% Heat Recovery Everywhere
- Capture exhaust heat



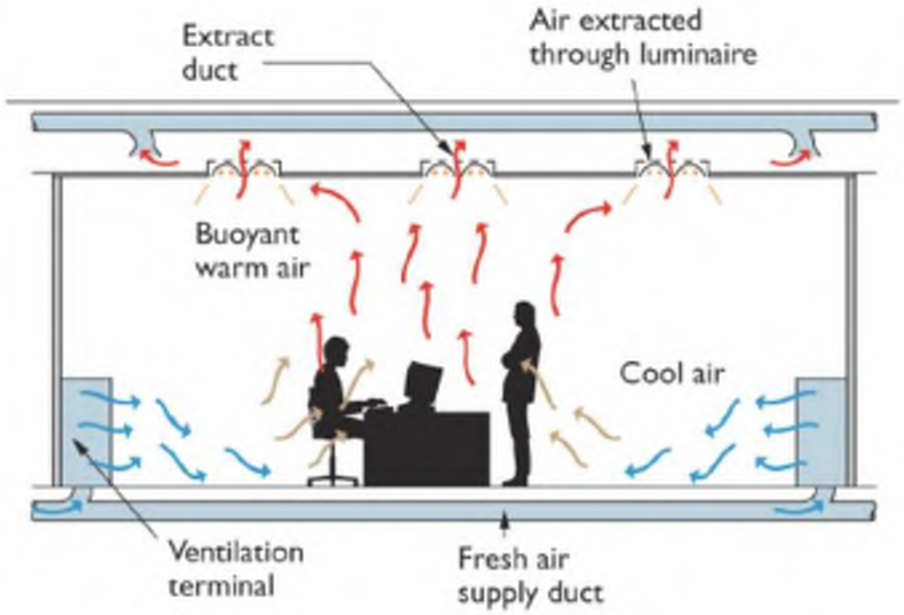


Air Distribution Method

Issue – Improve indoor air quality while saving energy

Net Zero Strategy

- Utilize displacement ventilation air distribution
- Conditions occupied zone
- Increased fresh air effectiveness

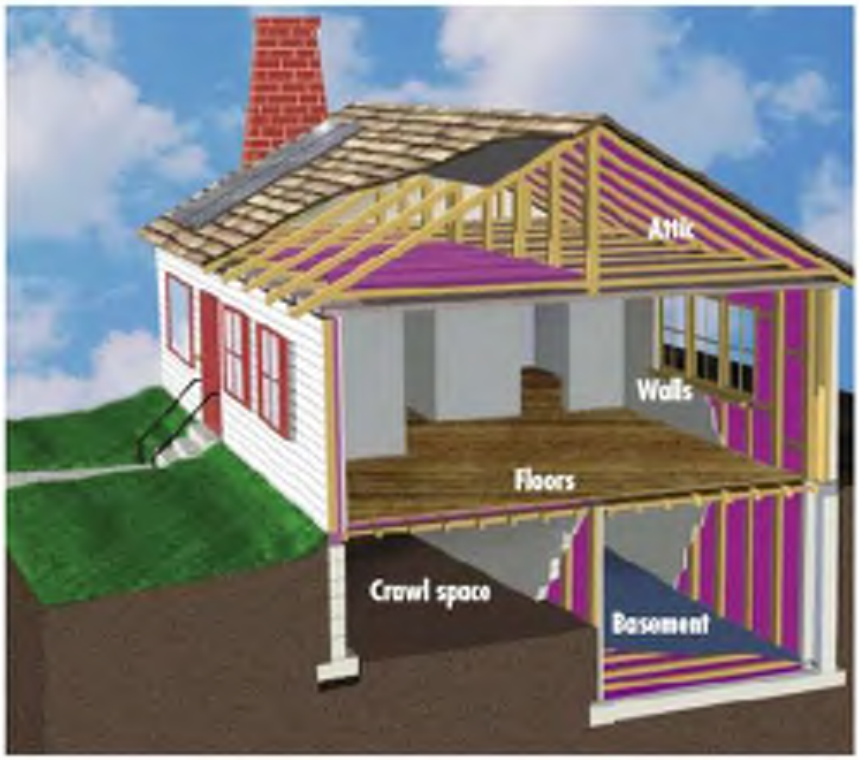


Building Envelope

Issue – Reduce energy through passive means

Net Zero Strategy

- Increase building insulation values to above minimum code level
  - R-45 Roof
  - R-29 Wall
  - R-5 Windows



Renewables

Net Zero Strategy

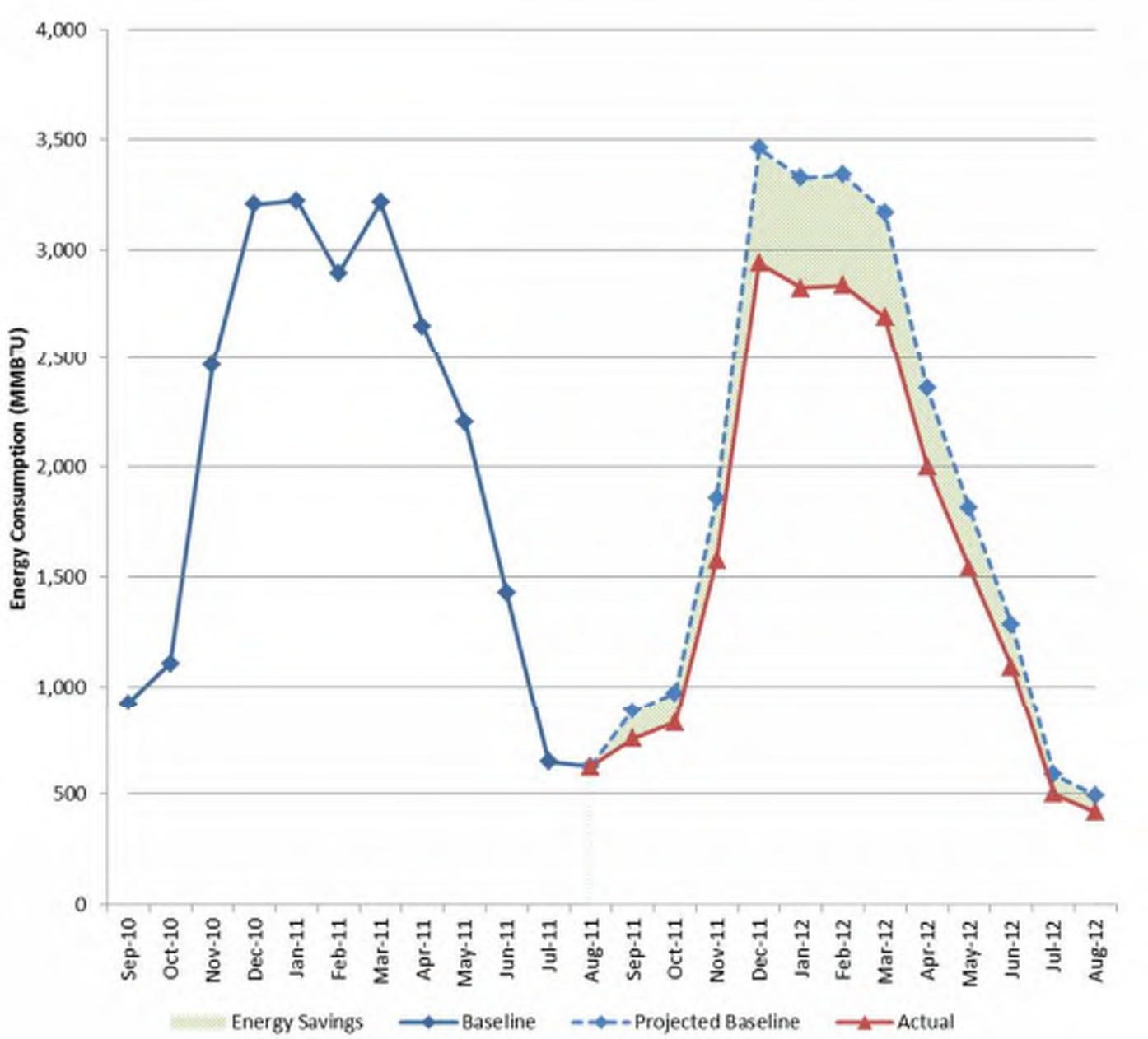
- Integrate photo voltaic (PV) to offset building electrical energy usage

- Integrate solar water heating to offset gas and electrical energy usage for domestic water heating.

Occupant User Controls & Interface

- Plug Loads – Minimize usage of heaters, refrigerators, etc
- Turn lights off and reduce heating thermostat setting
- Manual Blinds – Educate to open and close
- Custodial Use
  - Reduce lighting and ventilation loads
- Dashboard for energy usage display and sustainable learning

Efficient Occupant User Control Energy Savings



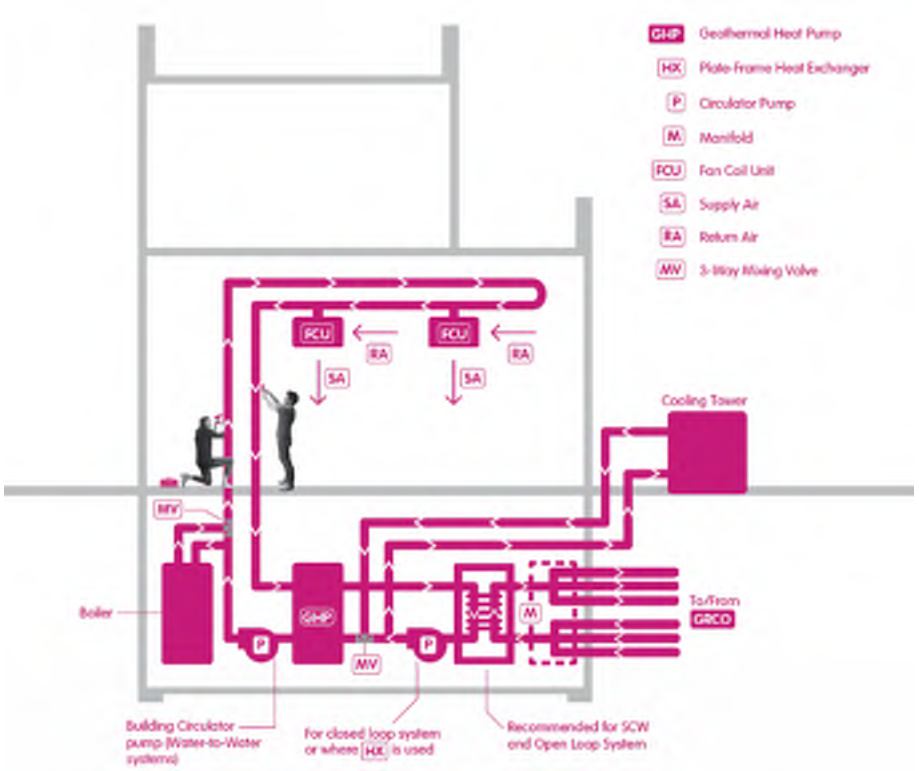
Additional Net Zero Strategies

Heating & Cooling

- Geothermal /w electric boiler
- Optimize pump energy savings

Fan Energy

- Fan Array Technology
- ECM motors



Technology / Building Network Energy

- Utilize condenser water for cooling
- Virtualize servers
- Utilize tablets and thin client computers
- Utilize Energy star monitors

Additional Net Zero Strategies

Lighting

- Provide daylight harvesting beyond code minimum
- Provide dimming control and “tuning” of luminaires to code minimum for a majority of spaces.

Power Distribution

- Provide plug load control in locations above those required by code.
- Provide more aggressive control schedules for controlled receptacles.

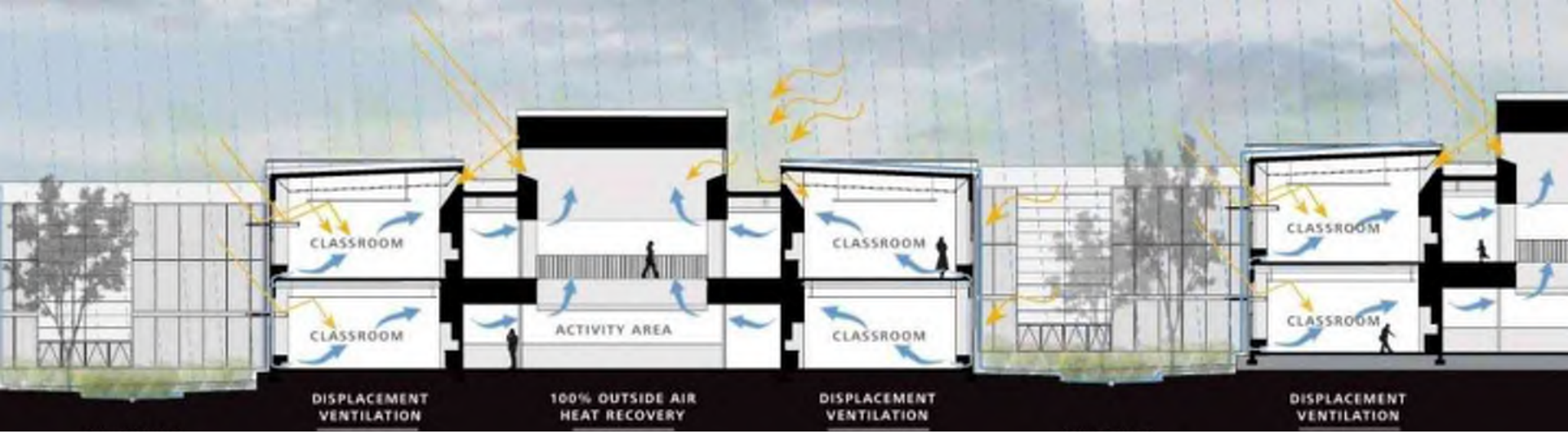
Health

Health

Maximizing physical and psychological health and well-being.

Civilized environment
:: Access to fresh air and daylight for all

Healthy air
:: Ventilation, contaminate exhaust and walk-off mats



Civilized Environment/Healthy Air

Daylight and views

:: Maximize northern & southern exposure

:: Preserve views of natural areas

:: Reduce glare, diffuse and distribute daylight (balance)

Healthy air

:: Natural ventilation and cooling

:: Mechanical ventilation

:: Filtration & walk-off mats

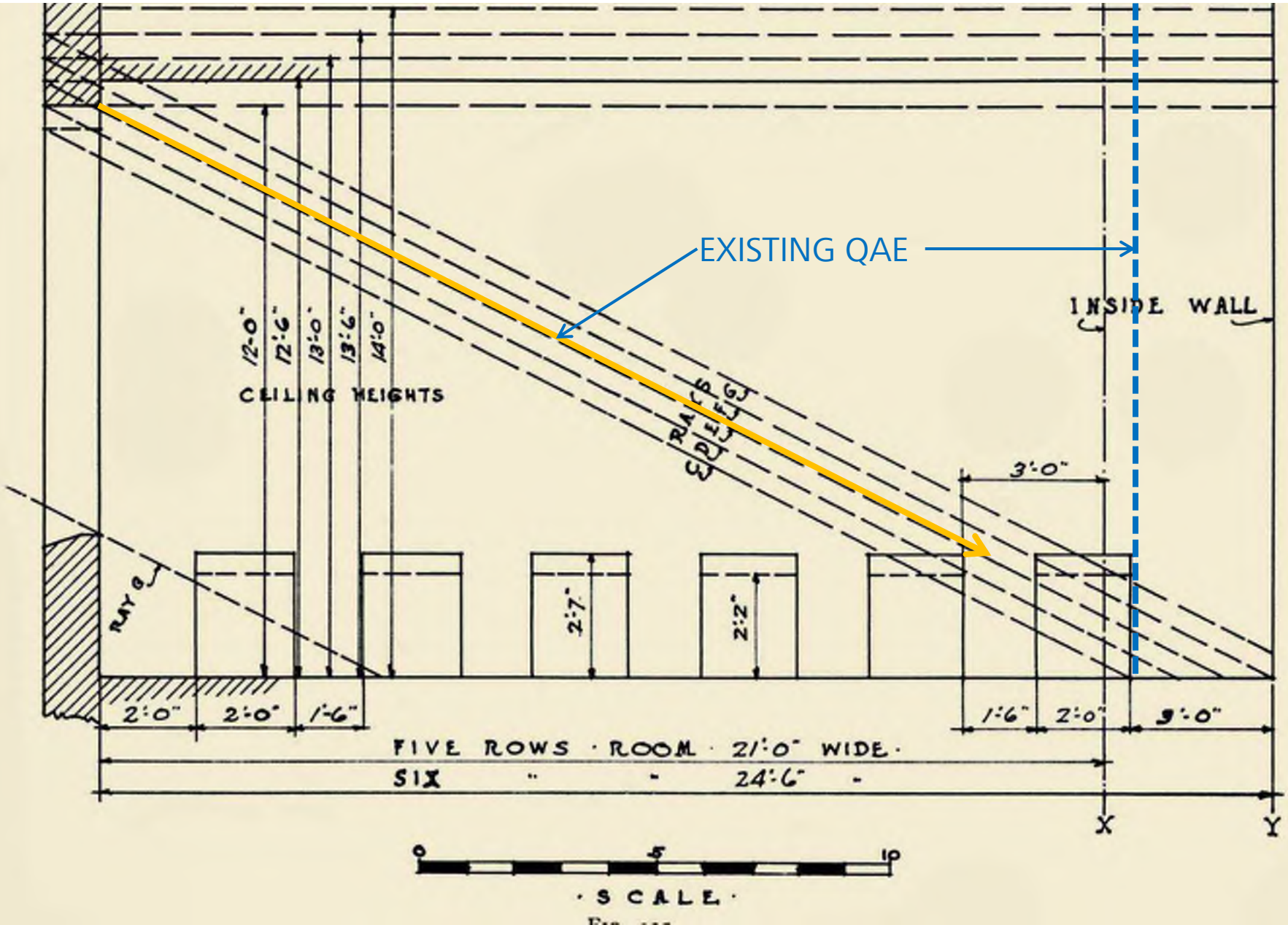
:: Thermal comfort and control – users operate the building

:: Non-toxic materials

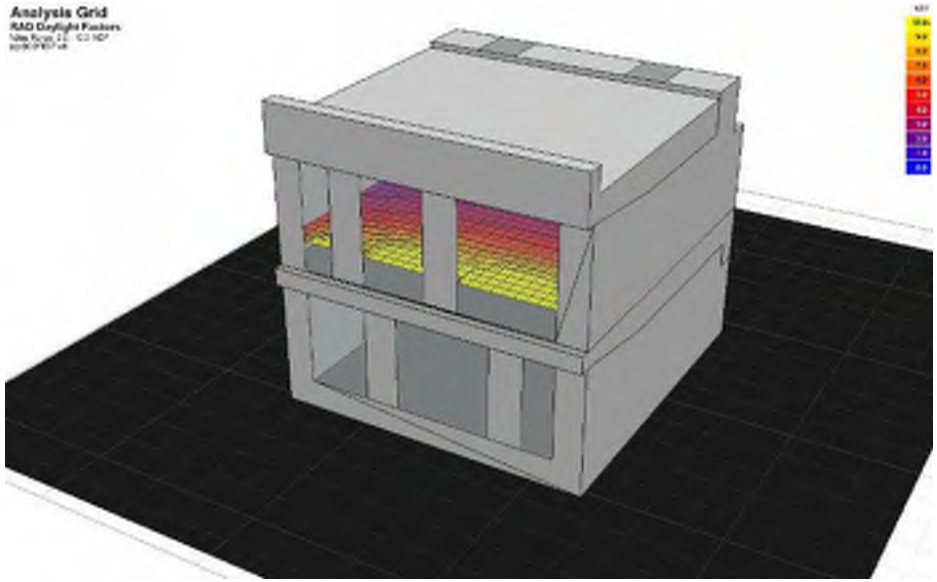
Civilized Environment

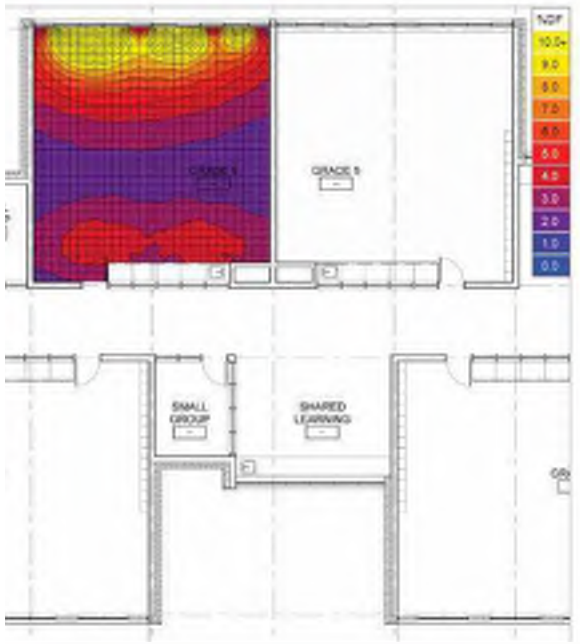
Civilized Environment

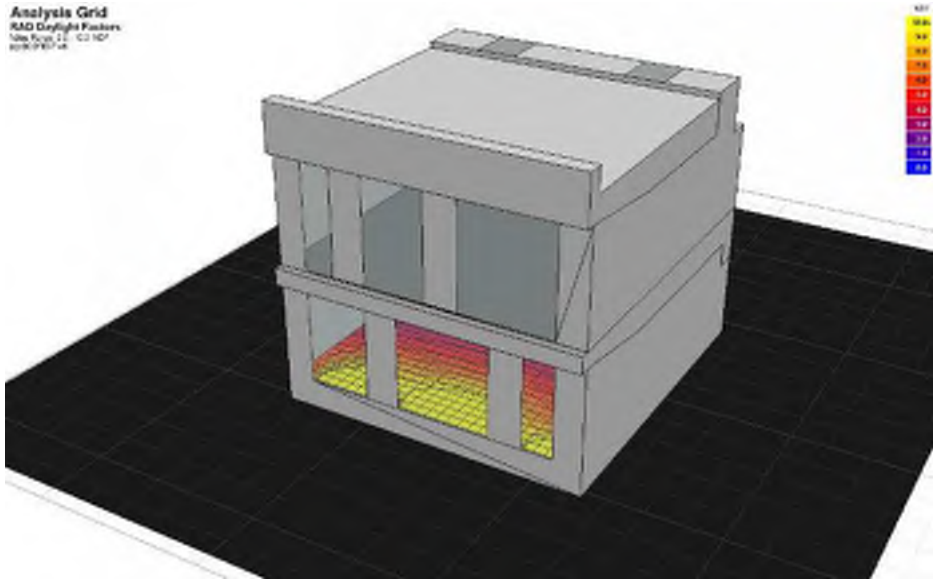
Civilized Environment

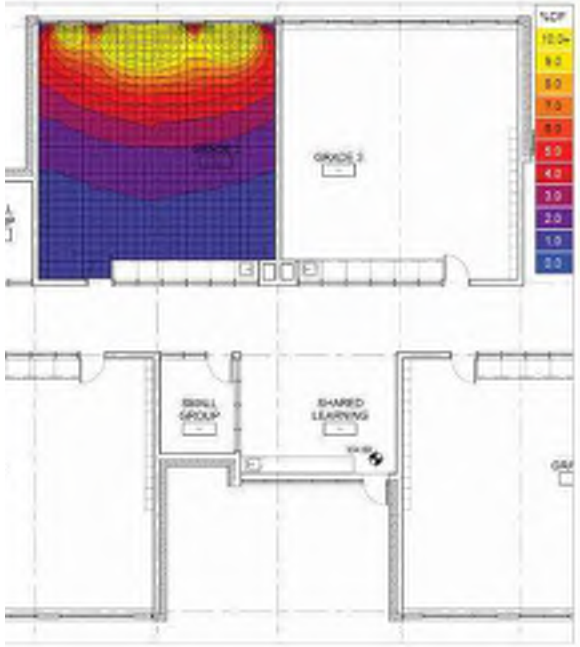


Daylighting Studies

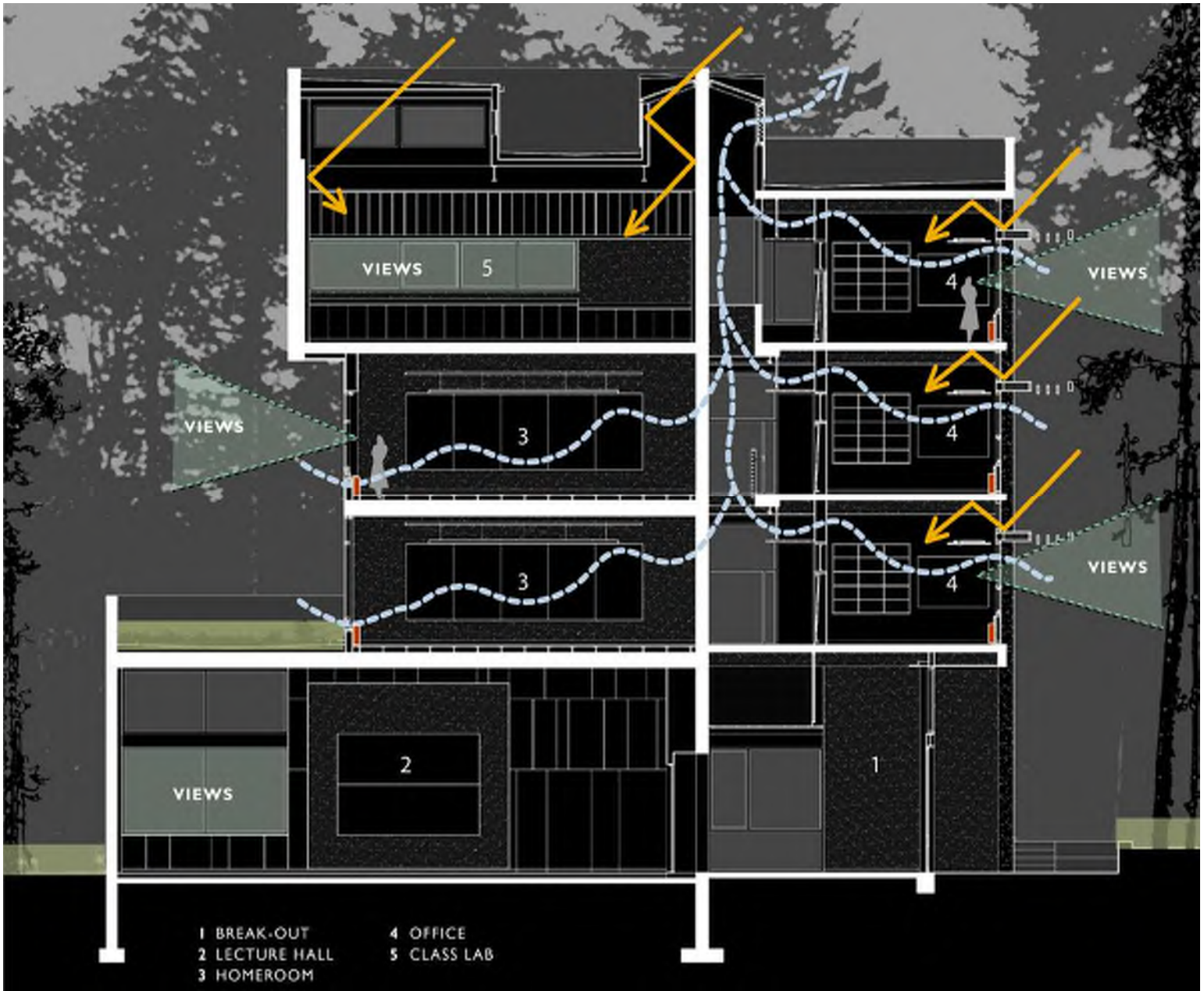








Civilized Environment / Healthy Air



Healthy Air

Indoor Environmental Quality(IEQ) - WSSP + Passive Design

1) Daylighting

IEQ1.1 Daylighting
(25%, 50%, 75%, 100%)
IEQ1.2 Permanent Shading
IEQ1.3 Views

2) Electric Lighting Quality

IEQ2.1 Electric Lighting Quality

3) Indoor Air Quality

IEQ3.0 Ventilation, Filtration, & Moisture Control Minimums
IEQ3.1 Low-Emitting Interior Finishes
IEQ3.2 Low-Emitting Materials Furniture
IEQ3.3 Source Control
IEQ3.4 Ducted HVAC Returns
IEQ3.5 Particle Arrestance Filtration
IEQ3.6 Construction IAQ Management
IEQ3.7 Natural Cooling



Indoor Environmental Quality(IEQ) - WSSP + Passive Design

4) Acoustics

IEQ4.0 Minimum Acoustic Performance
IEQ4.1 Improved Acoustical Performance
IEQ4.2 Enhanced Audio

5) Thermal Comfort

IEQ5.0 Thermal Code Compliance

6) User Controls

IEQ6.1 User Control- windows
IEQ6.2 User Control - temperature and lights

Materials



Materials

Remove, from a health and pollution standpoint, the worst known offending materials, and reduce the environmental impacts associated with the construction process

Red list

Embodied Carbon Footprint

Responsible Industry
:: FSC-certified wood

Appropriate sourcing

Conservation + Reuse



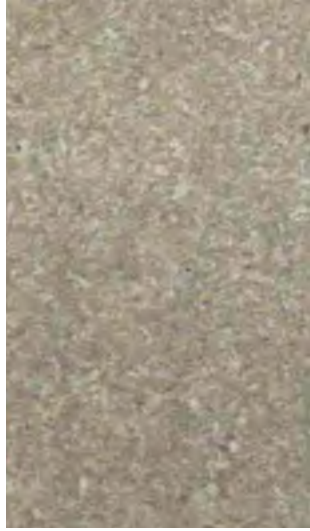
Materials Red List

Asbestos
Formaldehyde (added)
Halogenated flame retardants
Polyvinyl chloride (PVC)
Mercury
CFC's / HCFC's
Cadmium
Chloroprene (neoprene)
Chlorinated polyethylene
Chlorosulfonated polyethlene
Wood treatments containing creosote, arsenic, pentchlorophenal
Lead
Phthalates
Petrochemical fertilizers

Materials

Materials

Conservation and Reuse



Embodied Carbon Footprint / Responsible Industry

Educational opportunities during construction

Product certification standards

FSC-certified wood – becoming more available and affordable

Pine beetle wood

Agricultural fiber (straw)



Appropriate Sourcing

Ideas	12,430 miles
Renewable-energy technologies	7,000 miles
Consultant travel	1,500 miles
Light materials	1,000 miles
Medium materials	500 miles
Heavy materials	250 miles

Life-Cycle Assessment

Materials - WSSP

1) Waste Reduction & Efficient Material Use

- M1.0 Storage and Collection of Recyclables
- M1.1 Construction Site Waste Mgmt (50%,75%)
- M1.2 Bldg. Reuse - Structure/Shell (50%, 75% 95%)
- M1.3 Bldg. Non-structure/shell Reuse (50%)
- M1.4 Materials Reuse (5%, 10%)
- M1.5 Resource Reuse - Furniture (30%)

2) Sustainable Materials Procurement

- M2.1 Recycled Content (5%/4 mtls, 10%/8 mtls)
- M2.2 Rapidly Renewable Materials
- M2.3 Certified Wood (50%, Chain of Custody)
- M2.4 Environmentally Preferable Products
- M2.5 Regional/Local Materials (10%, 20%)

Equity & Beauty

Equity

Supporting a just and equitable world

Beauty

Design features intended solely for human delight and the celebration of culture, spirit and place; supporting a just and equitable world.

Human scale + humane places

:: Child-sized spaces

:: Support for special ed

Universal Access to Nature & Place

:: Universal Design

:: Community access

:: Rights to nature

Beauty and spirit

Inspiration and education

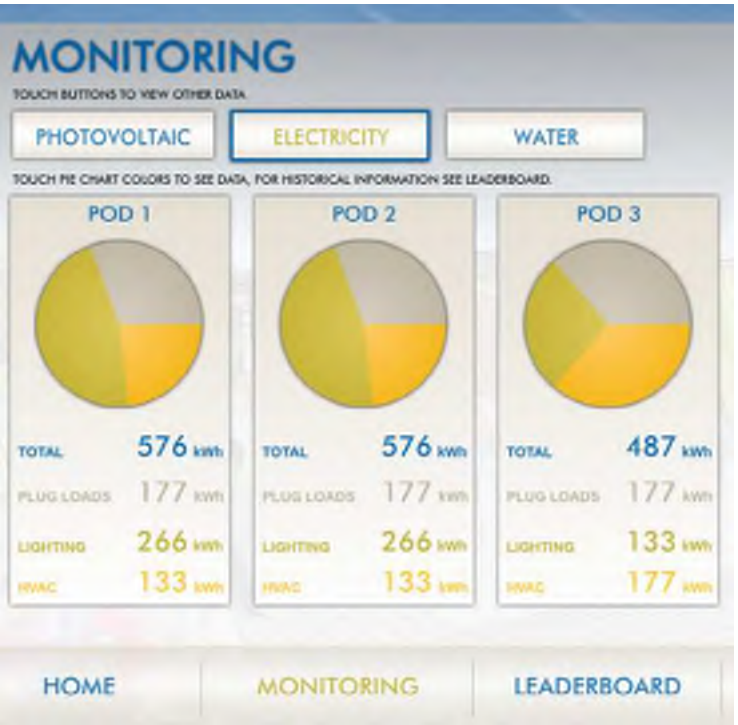
Universal Access to Nature and Place

Human Scale and Humane Places

Beauty and Spirit

Inspiration and Education

Inspiration and Education






Educational Opportunities

How can the Building and Site be a learning tool and a resource for staff, students and the community?

Site/Outdoor Learning Environment
Healthy Indoor Learning Environment
Energy Efficiency
Water Efficiency
Materials




Educational Opportunities

What are you doing today?

What are new opportunities that you see?

What are the resources and support you need to make those opportunities a reality?

Sustainable Story

Sustainable Story

The new Queen Anne Elementary has been open for three years. Student achievement continues to improve and the waitlist to attend continues to grow. A reporter from the Seattle Times visits the school to better understand what is happening at Queen Anne. They have heard it is a ‘green’ school.

What do they see and what is the headline of the article in the paper the next day?

mahlum

SEATTLE PUBLIC SCHOOLS

Queen Anne Elementary

SDAT 03 :: Integrated Design Workshop