Queen Anne Elementary
SDAT 03 :: Integrated Design Workshop
Agenda

Overview, Objectives, Framework 20 min
Site & Water 45 min
understanding, opportunities, strategies
Energy 45 min
understanding, opportunities, strategies
Break 10 min
Healthy Indoor Learning Environments & Materials 30 min
understanding, opportunities, strategies
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

2016
- SDAT

2017
- SD
- DD
- CD

2018
- BID
- CONSTRUCTION

2019
- School Opens

PERMITTING
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
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
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
Setbacks
Solar and Wind Analysis
City Bus Stops
Steep Slopes
Tree Coverage
Parking and Drop-Off

- BUS DROP-OFF
- PARENT DROP-OFF
- PARKING: 21 STALLS STRIPED
Site Access
Places of History/Memory
Places of History/Memory
Places of History/Memory
A Green School:

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

- Is a center of Community
- Teaches Eco literacy
- Teaches and Demonstrates Stewardship
- Has a small Carbon footprint
- Is long lasting
- Is a responsible member of the city
- Is beautiful
- Is welcoming
**Measures of Success**

**RECESS**
Students who get at least 20 minutes of recess per day have a lower body mass index percentile than their peers.

**SAFE ROUTES TO SCHOOL**
Students who walked to school every day had 24 more minutes of physical activity per day.

**ACHIEVEMENT**
Teens who were active in school were 20% more likely to earn an "A" in math or English.

Active Living Research
www.activelivingresearch.org

Sources:
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
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.
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/
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

Four Types of Transportation Cyclists in Portland
By Proportion of Population

Interested but Concerned: 60%
No Way No How: 33%

Strong & Fearless: <1%
Enthused & Confident: 7%
Tools for what's between the buildings

A Green School: TEACHES

- 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
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
“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
School Gardens as Teaching Stations
School Gardens as Teaching Stations

A Wild, Fearsome World Under Each Fallen Leaf

[Image of a forest floor with various wildlife and plants]
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
EVOLUTION

prospect|refuge
WayFinding

- paths
- edges
- districts
- nodes
- landmarks
Edges create classroom control

Open and free for induced action and engagement.

Volumes may be structured to impact specific predetermined emotional and intellectual impacts.
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?

- Activation of edges and nooks
- Create special moments
- Use every square foot
- Multiple use = multiple benefit
Success in small spaces?

• Activation of edges and nooks
• Create special moments
• Use every square foot
• Multiple use = multiple benefit
Success in small spaces?

• Activation of edges and nooks
• Create special moments
• Use every square foot
• Multiple use = multiple benefit
A Green School: TEACHES

- Is a center of Community
- Is beautiful
- Is welcoming
- Teaches Eco literacy
- Teaches and Demonstrates Stewardship
- Has a small Carbon footprint
- Is long lasting
- Is a responsible member of the city
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
Stormwater As Amenity

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

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
Tools for what's between the buildings

Low Impact Development:

- Bioretention/Raingardens
Stormwater Facility As Pavement

- Sand Setting
  - Permeable Paver Top Layer: typ. 2”-6”
  - Choker Course: typ. 2” thick
- Base Course: aggregate subbase; thickness varies with design
- Subgrade: existing uncompacted soil or optional geomembrane geotextile on bottom and sides of open-graded base
LID: pavement
Stormwater Facility As Pavement
Stormwater Facility As Pavement - Maintenance
Stormwater Facility As Building Amenity
1. Rainwater to downspout and into vortex filter
2. Permanent storage for reuse as controlled discharge to secondary detention
3. Detention
4. To toilets

School building:
- Roof stormwater allowed for reuse
- Roof water to cistern
- Initial self-clean water to downstream
- To septic treatment facility / infiltration

Flowchart:
- Rainwater from cistern for flushing
- Cistern / detention
- Active storage rainwater for reuse
- Surface runoff to catch basin (not allowed for reuse)
- Check valve for separation of filtered/unfiltered
- Orifice for controlled outflow to detention
- Downstream discharge detention
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.
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
Daylighting Studies
Civilized Environment / 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 polyethylene
Wood treatments containing creosote, arsenic, pentachlorophenol
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 mtl, 10%/8 mtl)
   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?
Queen Anne Elementary
SDAT 03 :: Integrated Design Workshop