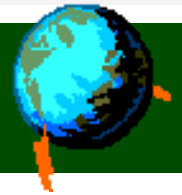
# THE GREEN HEATING AND BUILDING TEAM



# MEET THE TEAM!

ALEXANDRA RIEWER

KALEI SULLIVAN

**Other Student**

ANTHONY ROTHWELL

# INTRODUCTION

## AREAS OF CONCERN

- The library's first, second, and third floors compiled come to a total square footage of 71,000
- The library used 47,250 ccf (hundred cubic feet) of natural gas for a grand total of $43,943 at $0.93 per ccf for the year 2008
- **Heating/ Building Carbon footprint**=approximately 3,419 U.S. short tons of CO2 emissions for 2008

- Heating of the building (Specifically Winter):
  - Temperature
  - Humidity
  - Mold/mildew
  - Areas of heat loss
- Leaking Roof issue:
  - Possible long-term project
  - Green roof

# GOALS

**To determine:**

1. The heating efficiency of the building
2. A comfortable and energy efficient constant temperature
3. The amount of heat that is lost through the walls
4. A possible alternative roof to mend the ubiquitous leaking issues on the third floor of the library

**Methods:**

**1. Heat Loss  2. Internal Temperature and Heat Fluctuation  3. Green Roof**

# 1. HEAT LOSS

**Methods included:**

- Contacting Bob Snell and Facilities Department
- Using the Omega OSXL450 Infrared Thermometer guns to determine areas of heat loss
  - Walls
  - Windows
  - Vents
  - Ceilings – especially the vaulted areas
- Contacting library staff

# SECTION PLAN RESULTS

- **Windows:** ¾" thermo pane (argon filled windows)
  - Doubled paned= reduces transfer of heat inside and outside of the building
  - Block harmful UV rays, which cause **high-energy costs**, **faded flooring**, and **condensation buildup**
- **Wall insulation:** 3.5" of faced fiberglass and 2.25" of ridged insulation
  - Fiberglass insulation=cost-effective, energy saving product

# INFRARED THERMOMETER RESULTS

- Temperature decreases as you move up:
  - **1ST FLOOR**: 71˚F
  - **2nd FLOOR**: 52˚F to 61˚F
  - **3rd FLOOR**: 49˚F to 64˚F.
- Vaulted Ceiling areas significantly cooler than the rest of the ceiling area
  - **Middle ceiling area** (1st floor): average of 72˚F
  - **Vaulted areas:** average of 64˚F

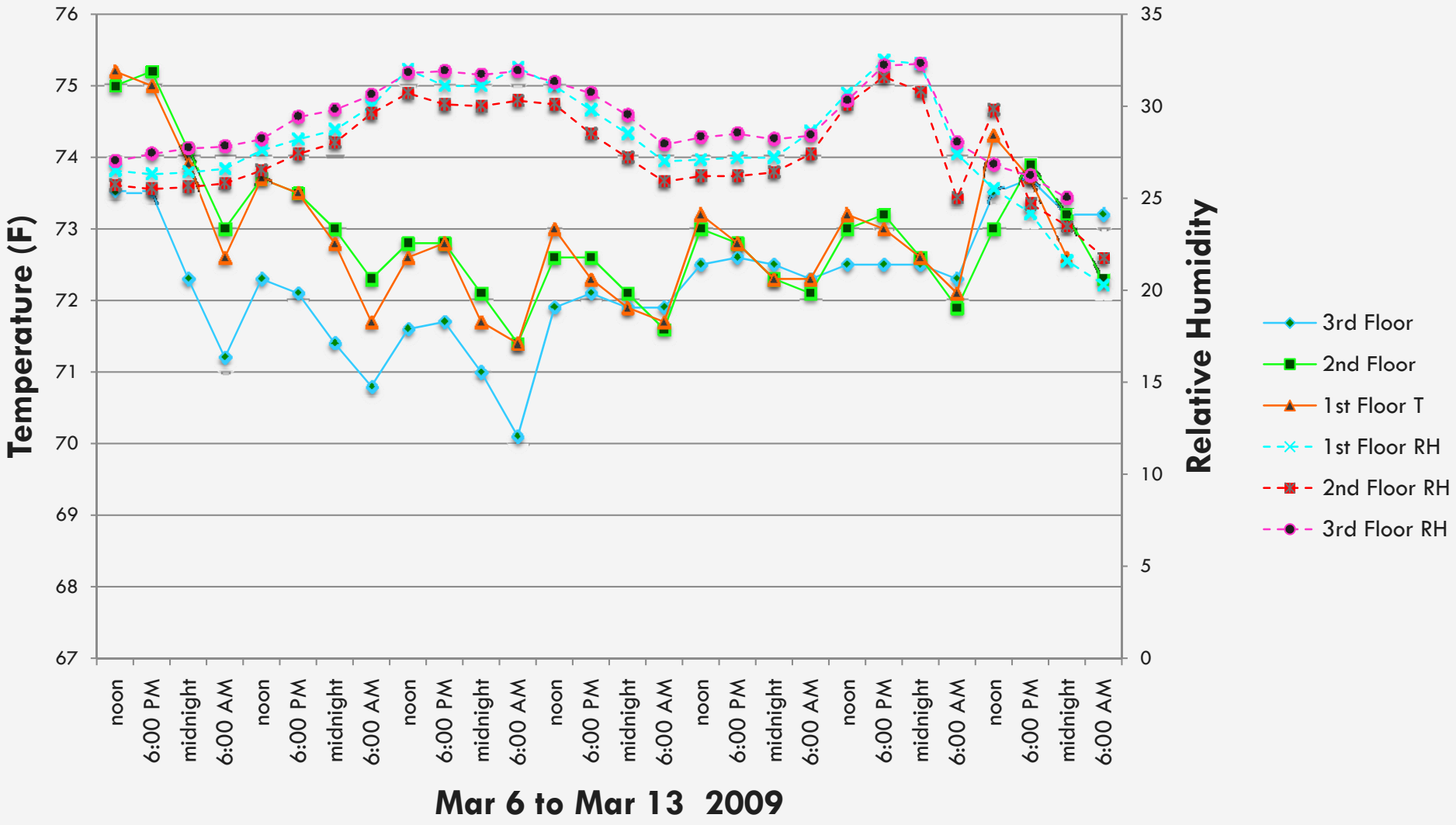
# LIBRARY STAFF RESPONSES

- Heating and cooling is completely uneven
- Different floors and offices vary in temperature
- The library runs on an HVAC system (heating, ventilation, air conditioning)
  - This system is inadequate
  - problem since it was installed; parts have been replaced and very costly to the University
- Issues have been addressed to the Facilities Department; the problem seems to lie in the HVAC system

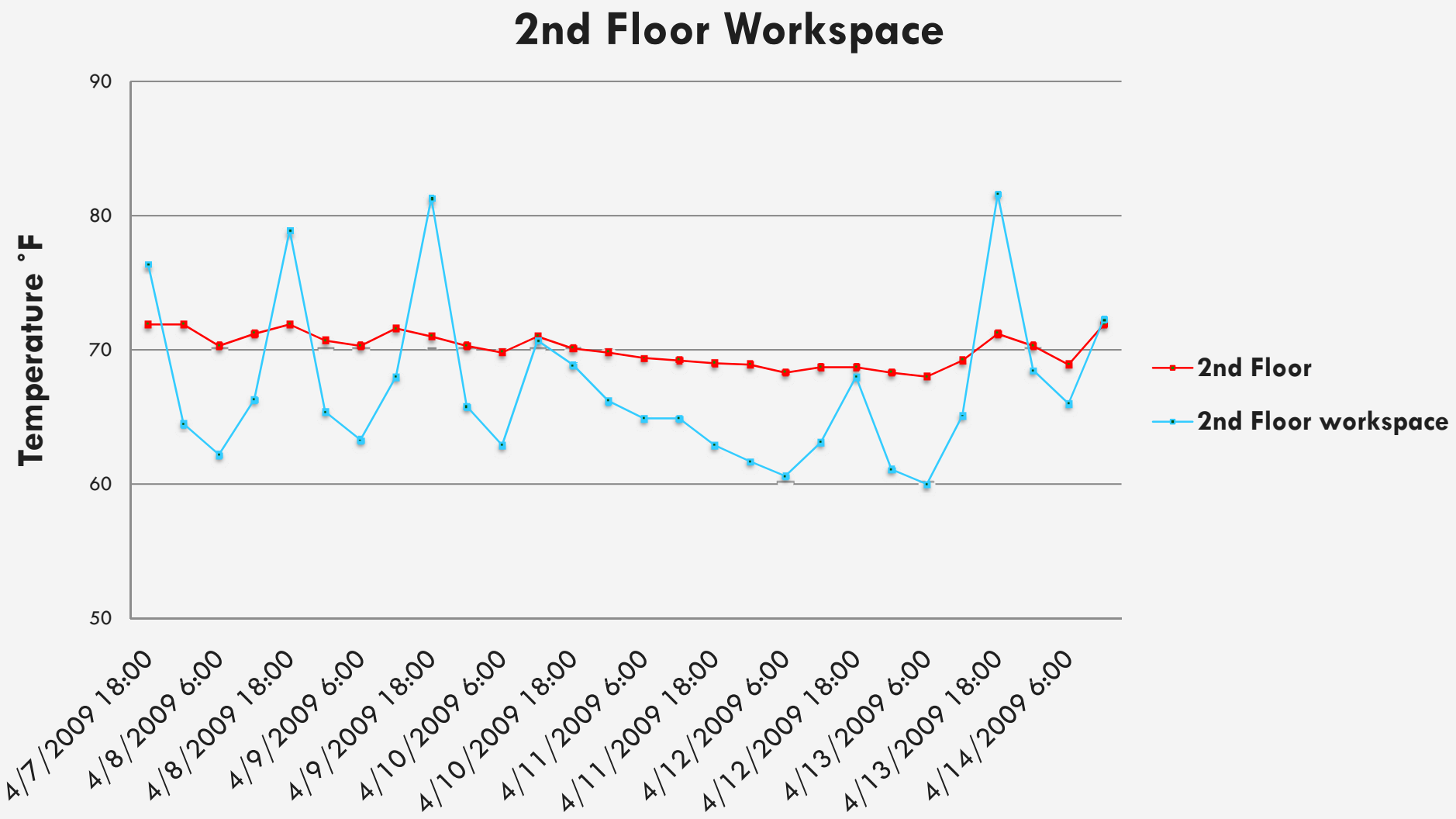
# 2. INTERNAL TEMPERATURE AND HEAT FLUCTUATION

- **Methods Included:**
  - 3 Extech Instrument Humidity and Temperature Dataloggers
    - Measure temperature and humidity over time
    - Placing these portable devices in different areas of the library, and graphing this data
    - Areas of concern are near windows and doors, offices, seating areas, and the archives

# FIRST TRIAL


Temperature (F)
76
75
74
73
72
71
70
69
68
67
Relative Humidity
35
30
25
20
15
10
5
0
noon
6:00 PM
midnight
6:00 AM
Mar 6 to Mar 13 2009
3rd Floor
2nd Floor
1st Floor T
1st Floor RH
2nd Floor RH
3rd Floor RH

# SECOND TRIAL



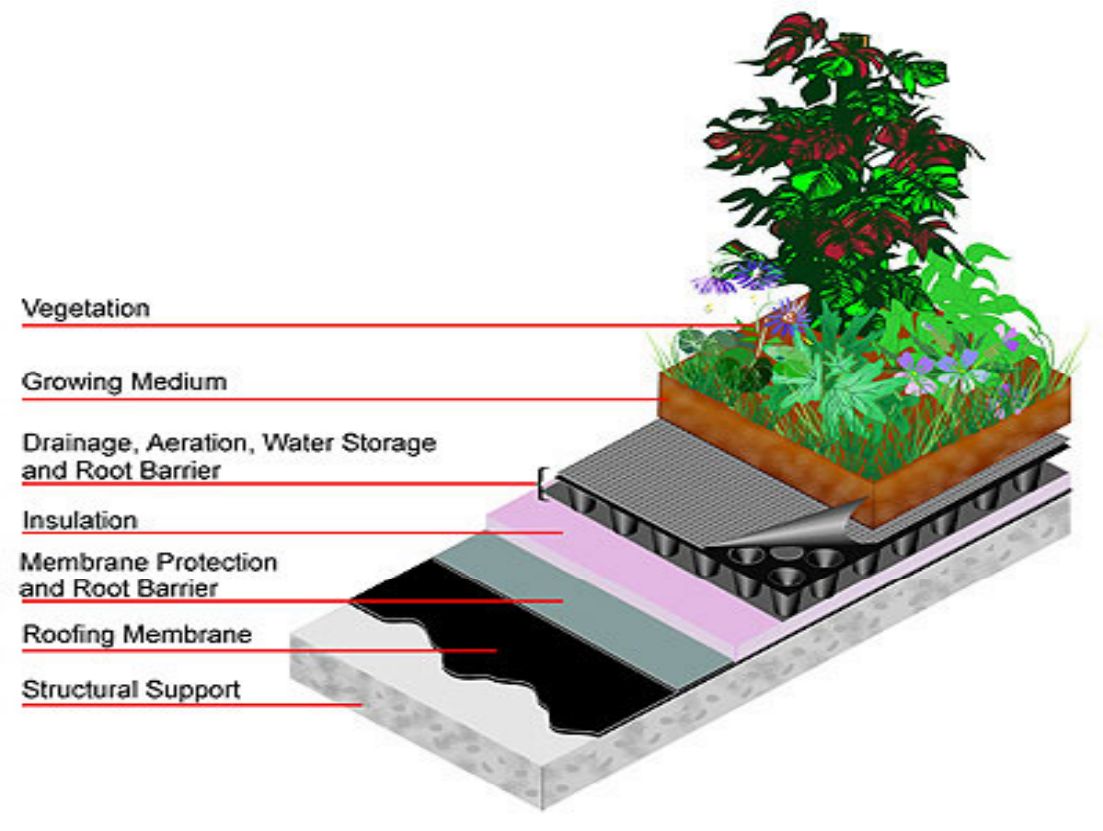
# 3. GREEN ROOF

- **Methods Included:**
  - Acquiring the Mckillop Library's roof blueprints and calculating an estimate of its square footage
  - Researching the costs and benefits of installing a green roof
  - Estimating costs for library green roof replacement

**The Minneapolis Central Library**

# WHAT IS A GREEN ROOF?

- A **green roof** is an extension of the existing roof which involves structural support, roofing membrane, membrane protection and root barrier, insulation, drainage, aeration, water storage, lightweight growing medium, and vegetation



# BENEFITS

- ★Reduced energy cost
- ★Storm water management
- Reduced heat island affect
- Improved air quality
- ★Extended roof life
- ★Raised property value
- Wildlife habitats
- ★Sound insulation

# BENEFITS

## Reduced Energy Costs

- Can reduce the temperature of the roof from a regular 160° to 80° (summer)
- Cooling roof decreases the amount of energy need to cool the building which will reduce the energy costs
- Plants absorb $C0_2$- reduces carbon footprint

## Storm water Management

- slows the velocity of runoff volume to sewer systems 60 – 90%
- Newport's average rainfall per year= 46 in.
- It can be estimated that a green roof would be capable of managing 27.6-41.4 inches of the years average rainfall

# POTTER LEAGUE FOR ANIMALS
## MIDDLETOWN, RI

- Recently completed their intensive green roof for the shelter over this past year
- This intensive green roof was built by **Apex Green Roofs** of Sommerfield, Massachusetts

# APEX GREEN ROOFING

- **Extensive roof** ranges in price from approximately $9 - $13 per square foot with two years of basic maintenance
- **Intensive roof** ranges in price from approximately $13 - $30 per square foot also with two years of basic maintenance

**Library roof=18,194 sq/ft.**

- **Extensive Roofing Estimates:** $163,746- $236,522
- **Intensive Roofing Estimates:** $236,522- $545,820

# RECOMMENDATIONS

## 1. HEAT LOSS

- In the long run, it seems as though the only solution would be to completely replace the HVAC system, which would be very costly during a time when money is awfully tight. For the full responses from the library staff, please see Appendix B of the final report

## 2. INTERNAL TEMPERATURE AND HEAT FLUCTUATION

- Invest in a heating system that would allow more control of heat in different areas of the building
- Another solution might be to install quality shades in these high sun areas so the temperature inside remains stable