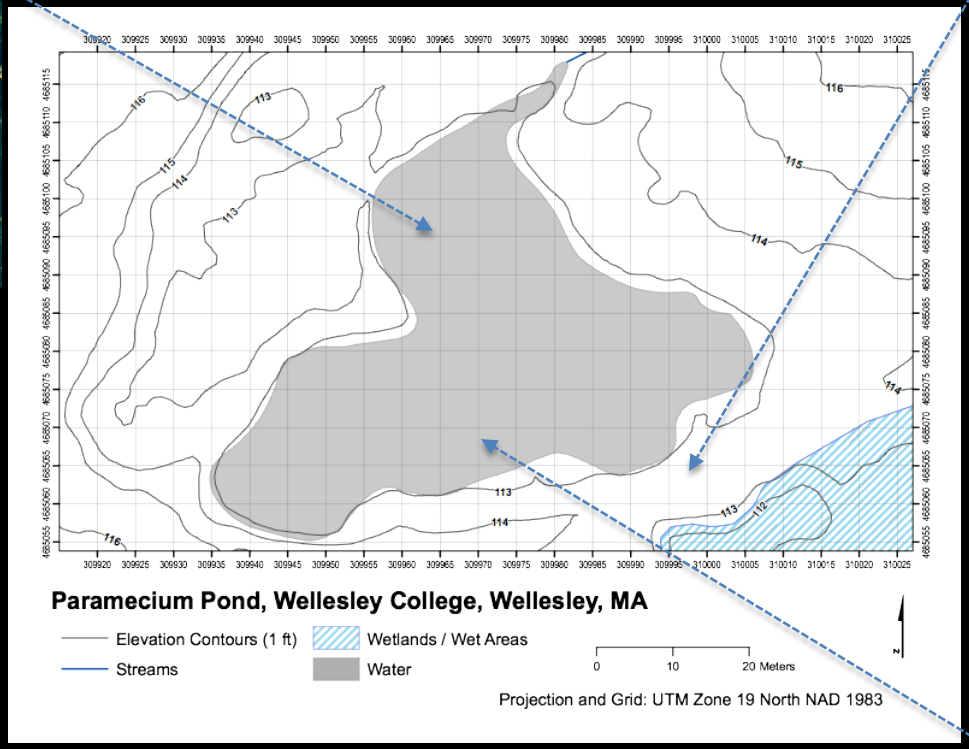
GIS Day October 28. 2015 Wellesley College

Spatial thinking in 4-D: A project-based approach to link student-collected field data, GIS mapping, and archive research



GEOS 101-F15 Teaching team:

Dan Brabander, Kathy Gilbert, and Maria Waller

Special thanks to:

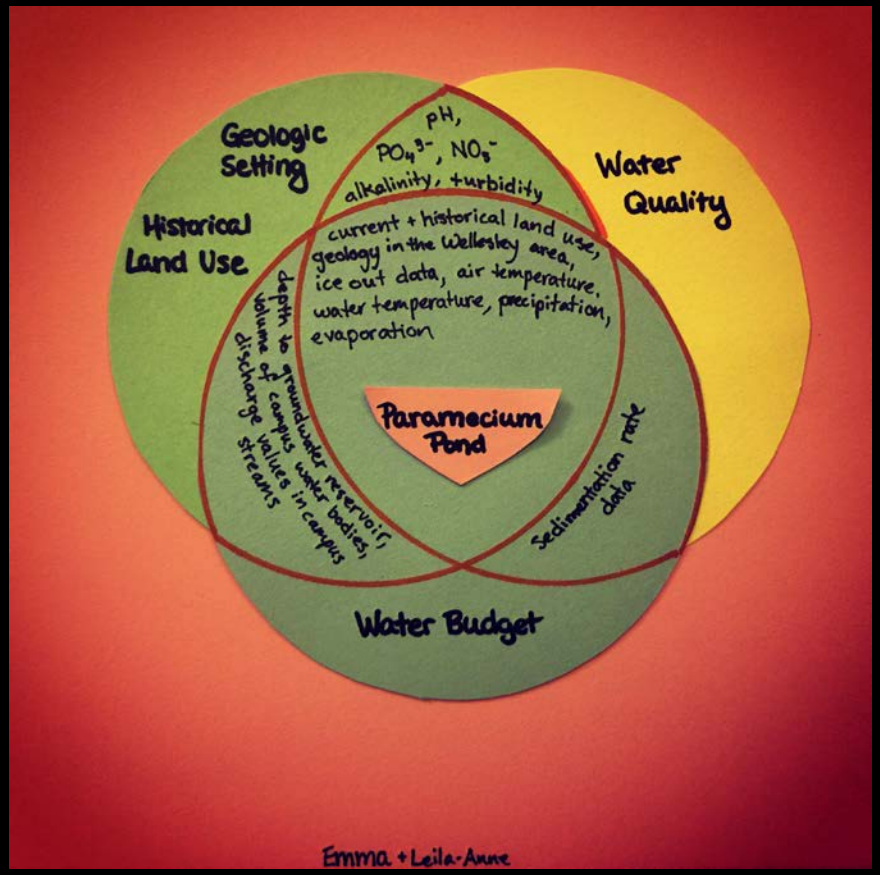
GIS Magician - **Carolin Fewerda**

Archives Expert – **Mary Yearl**

GEOS 101-F15 Earth processes and the Environment

Goals (from course syllabus)

1. **Develop systems-level thinking skills and become users and creators of concept maps**
2. **Explore the connections between human activity and geological processes**
3. **Learn to make estimations and assess geological models in order to formulate your own opinions about key current issues**



To achieve these goals you will learn to develop geological narratives. Narratives are authored by **informed observers** of the environment who **collect data**, use **quantitative modeling**, organize data to **construct graphs with agendas**, and synthesize separate lines of evidence to paint a holistic systems view of earth processes.

Course design to achieve goals

ORAL EXAM

RESEARCH POSTER

DEVILERABLES & ASSESSMENT

CONCEPTS AND PROCESSES

-Earth materials--rock formation (igneous, sedimentary, metamorphic) and weathering

-Geologic Time

-Stream Flow

-Groundwater

-Hydrosphere water budg

-Plate tectonics as a majo system control

GEOLOGICAL NARRATIVE

APPLICATION: STUDY OF SEDIMENTATION IN PONDS ON CAMPUS

-Observation and description of ponds and surroundings

-Data collection via measurements of water quality and conditions

-Construction of maps

-Modeling of data (correlate variables, construct graphs and consider)

TOOLS

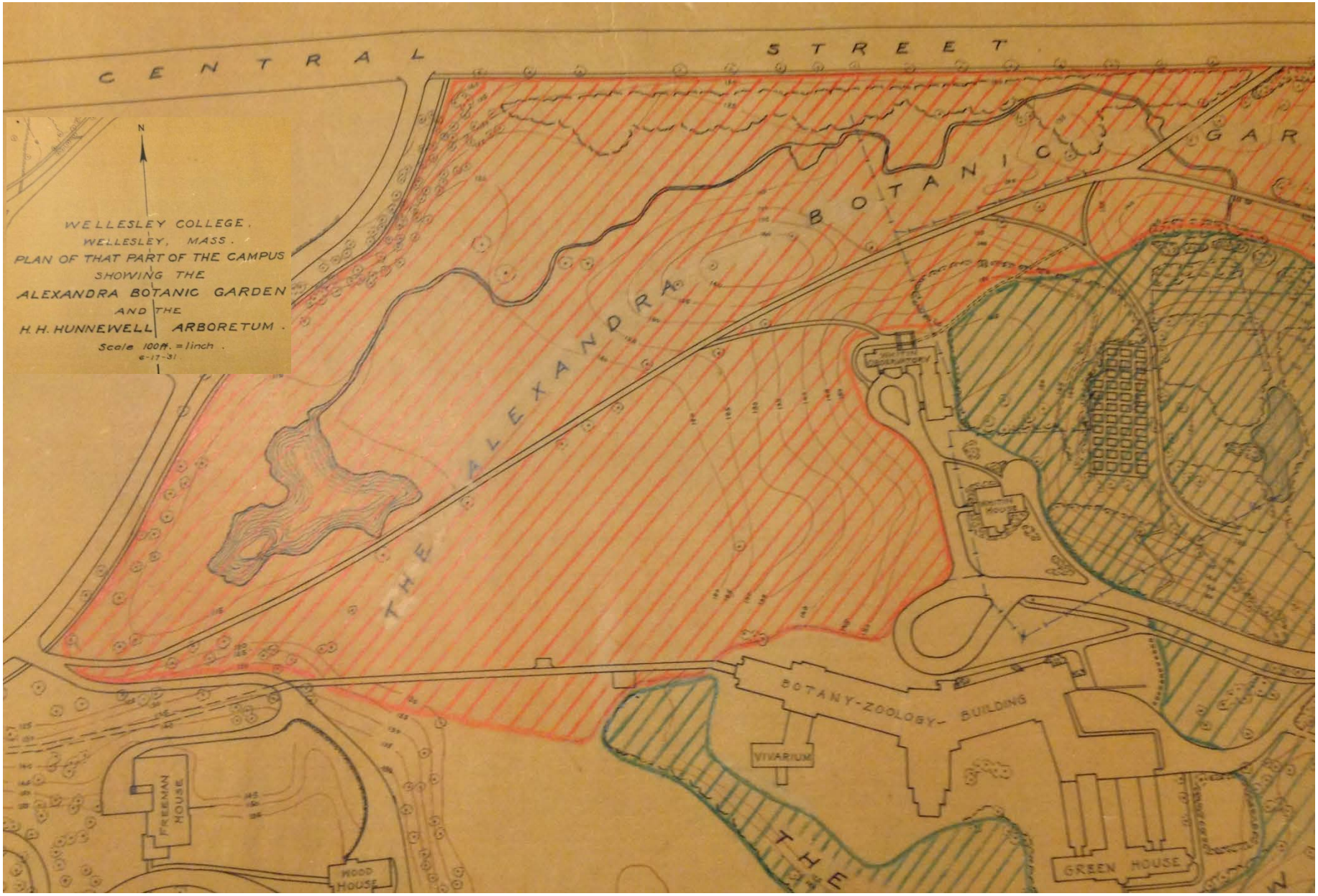
-Maps (topographic and geologic)
-Cross sections and stratigraphic columns
-GPS

-Stream flow meters
-pH and temperature probes
-Stream and Groundwater models
-Concept maps, graphs and diagrams

Historical Map of Wellesley College – before Paramecium Pond (1912, 1916, 1921)

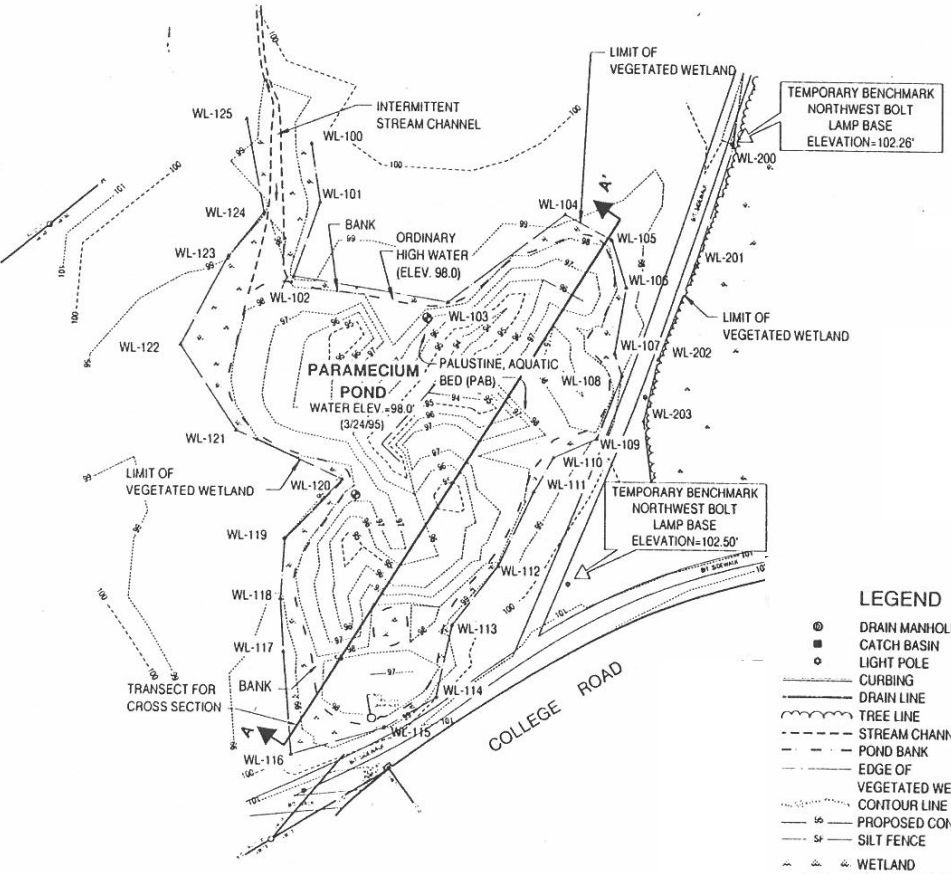
Wellesley College Archives
(photo courtesy of Sophie Kerwin)

Wellesley College Plan for Arboretum and Botanic Garden – 1931

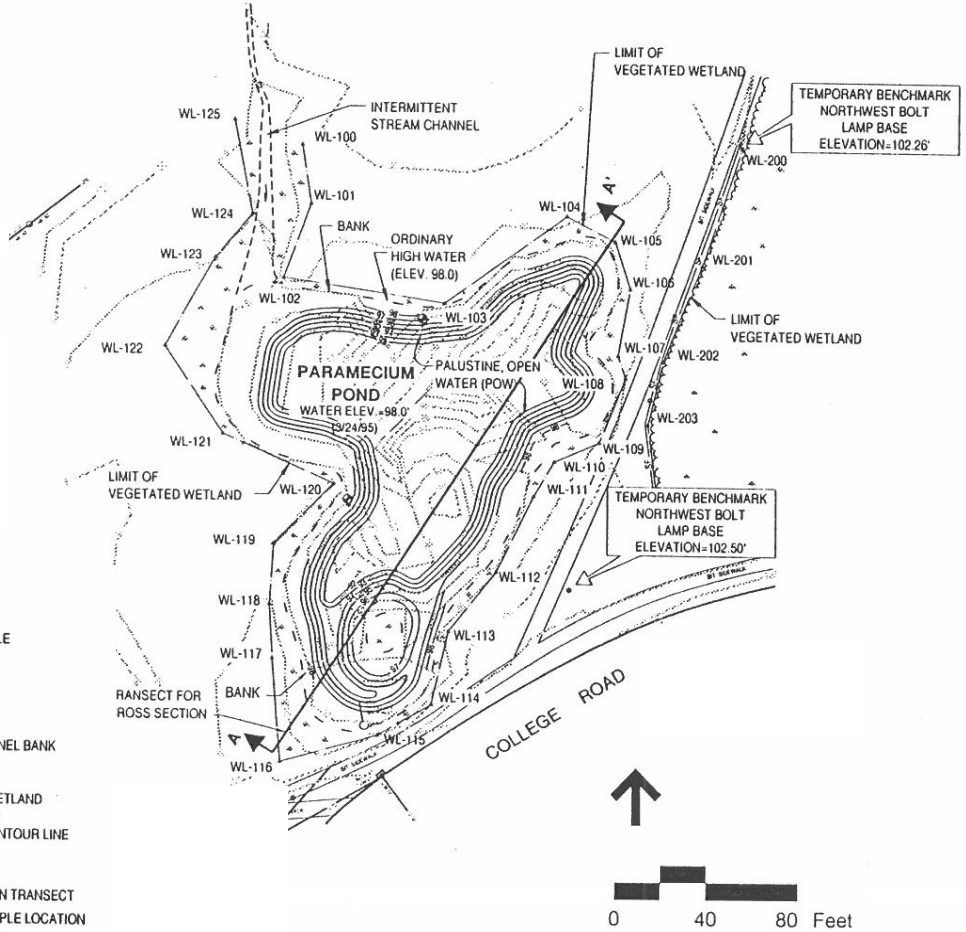


Wellesley College Archives (photo courtesy of Sophie Kerwin)

WELLESLEY COLLEGE-PARAMECIUM POND RESTORATION
EXISTING CONDITION PLAN OF LAND

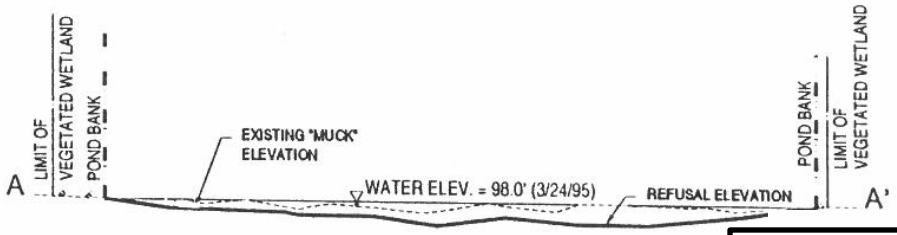


WELLESLEY COLLEGE-PARAMECIUM POND RESTORATION
PROPOSED DREDGING PLAN

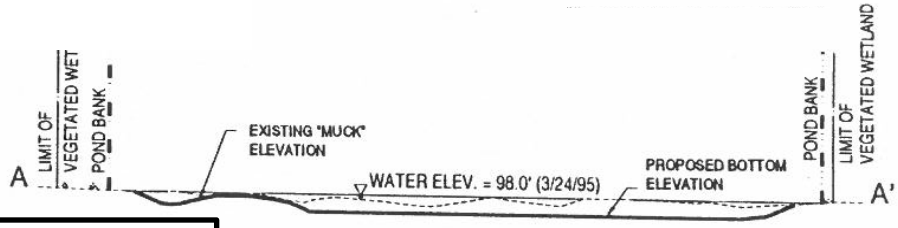


LEGEND

- DRAIN MANHOLE
- CATCH BASIN
- LIGHT POLE
- CURBING
- DRAIN LINE
- TREE LINE
- STREAM CHANNEL BANK
- POND BANK
- EDGE OF VEGETATED WETLAND
- CONTOUR LINE
- PROPOSED CONTOUR LINE
- SILT FENCE
- WETLAND
- A-A' CROSS SECTION TRANSECT
- SEDIMENT SAMPLE LOCATION



PARAMECIUM POND BOTTOM
EXISTING CONDITIONS-CROSS SECTION A-A'



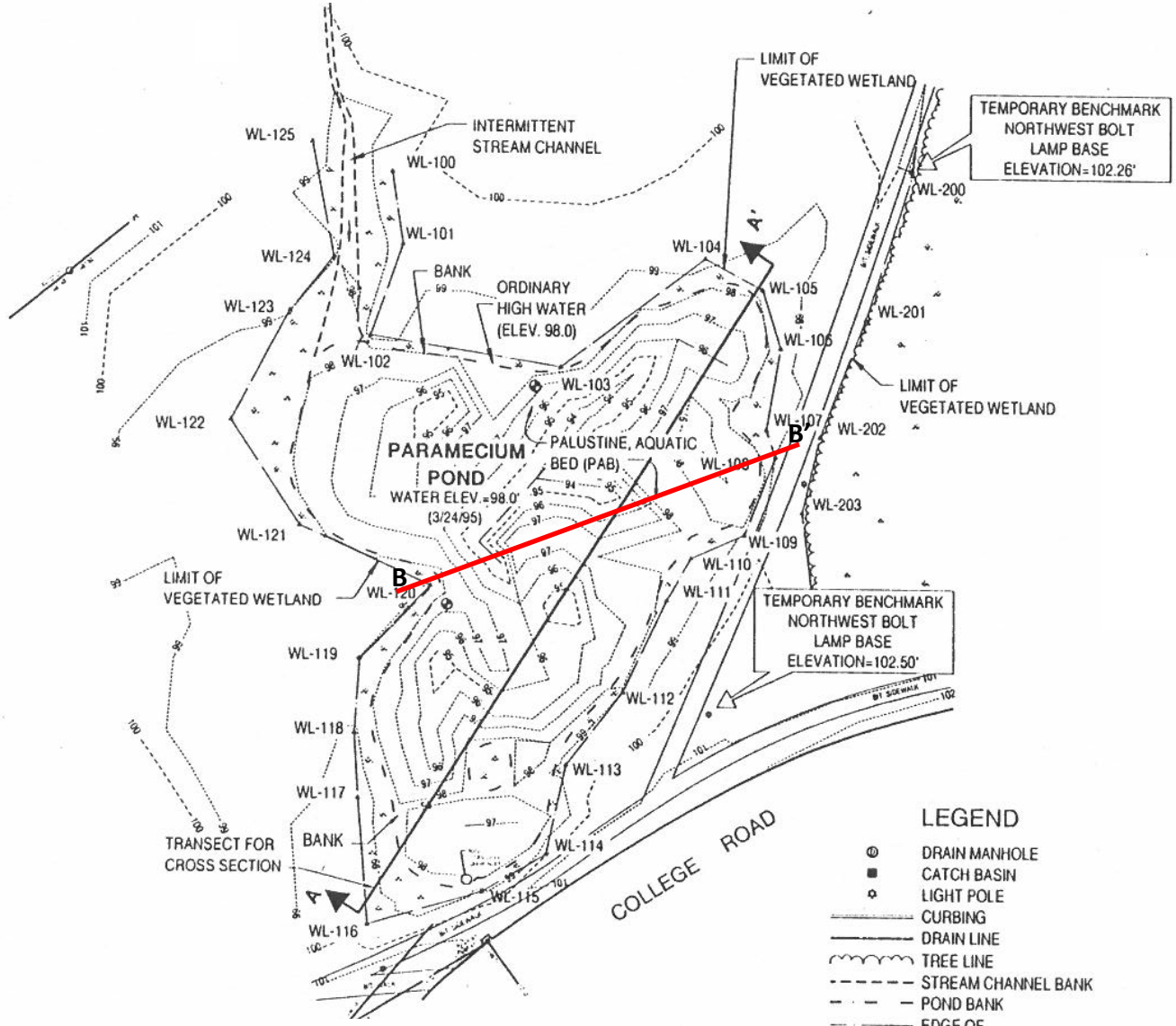
PARAMECIUM POND BOTTOM
PROPOSED CONDITIONS-CROSS SECTION A-A'

05/ 09/ 95

VHB
Vanasse Hangen Brustlin, Inc.
Transportation, Land Development and Environmental Services
101 Walnut St., P.O. Box 9151
Watertown, MA 02272
617 924-1770 · FAX 617 924-2286

WELLESLEY COLLEGE-PARAMECIUM POND RESTORATION

EXISTING CONDITION PLAN OF LAND

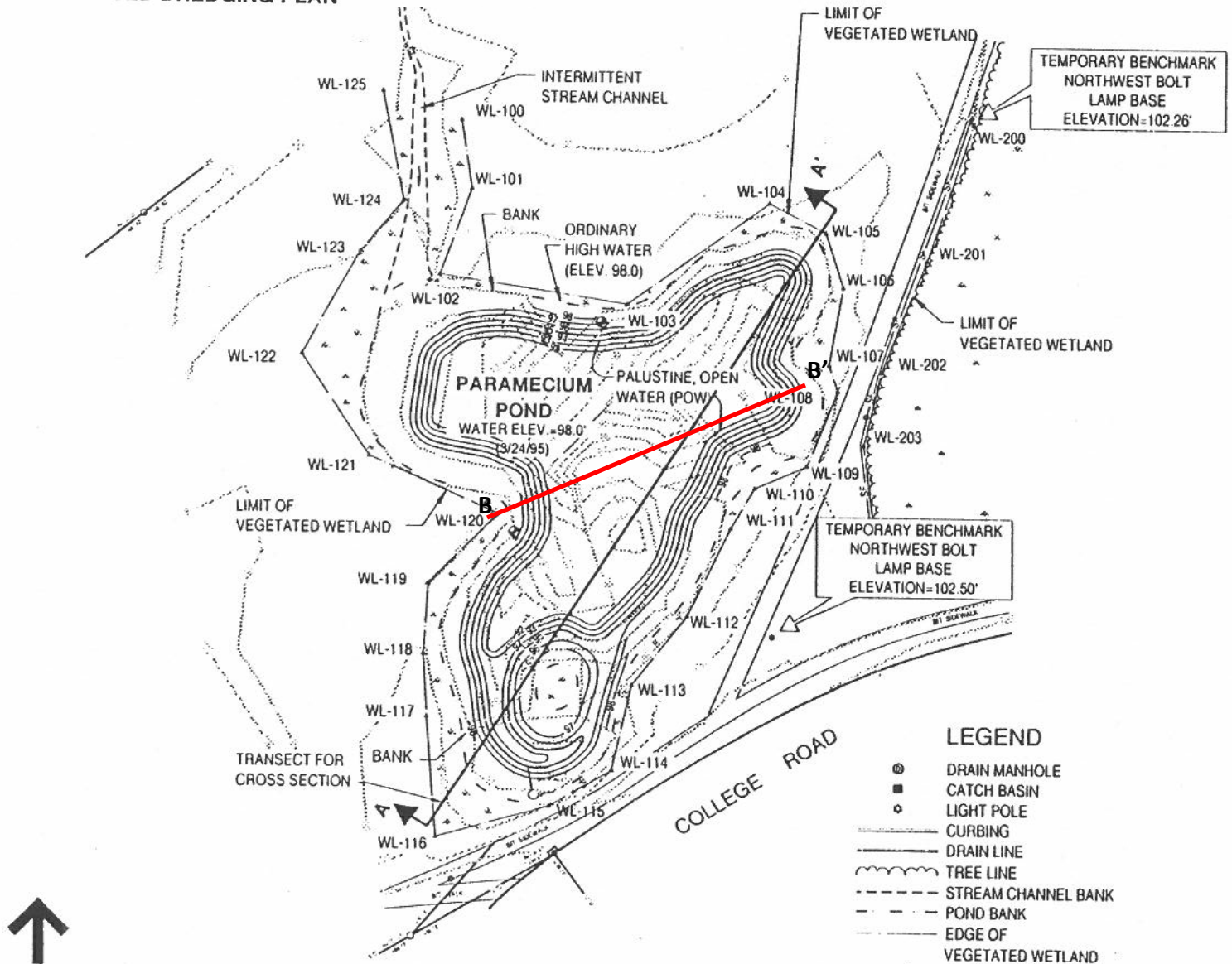


05/ 09/ 95

VHB

Vanasse Hangen Brustlin, Inc.
Transportation, Land Development and Environmental Services
101 Walnut St., P.O. Box 9151
Watertown, MA 02272
617 924-1770 • FAX 617 924-2286

WELLESLEY COLLEGE-PARAMECIUM POND RESTORATION
PROPOSED DREDGING PLAN

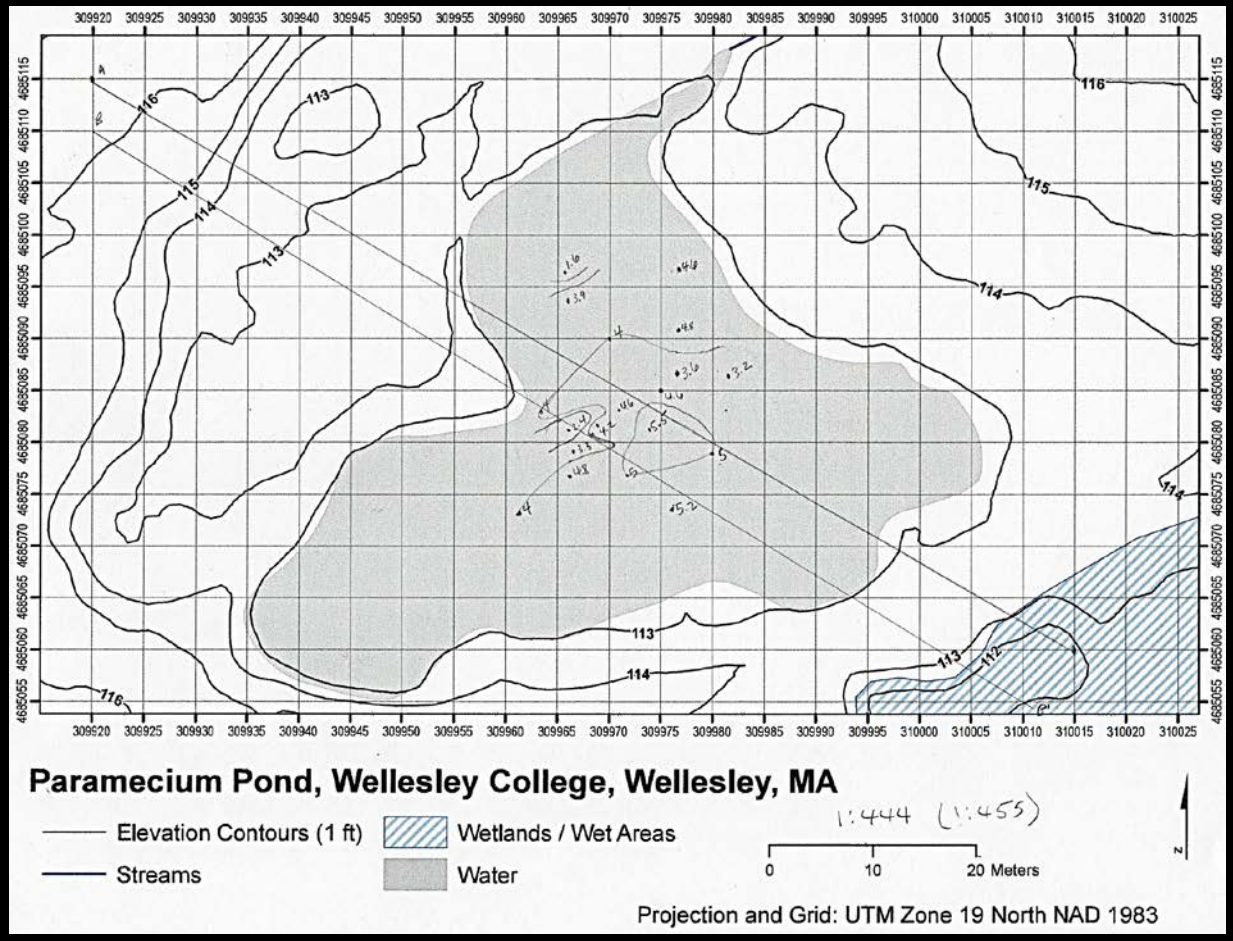


05/ 09/ 95

VHB

Vanasse Hangen Brustlin, Inc.
Transportation, Land Development and Environmental Services
101 Walnut St., P.O. Box 9151
Watertown, MA 02272
617 924-1770 - FAX 617 924-2286

Preliminary Contouring of Bathymetry Data GEOS 101-F15 101

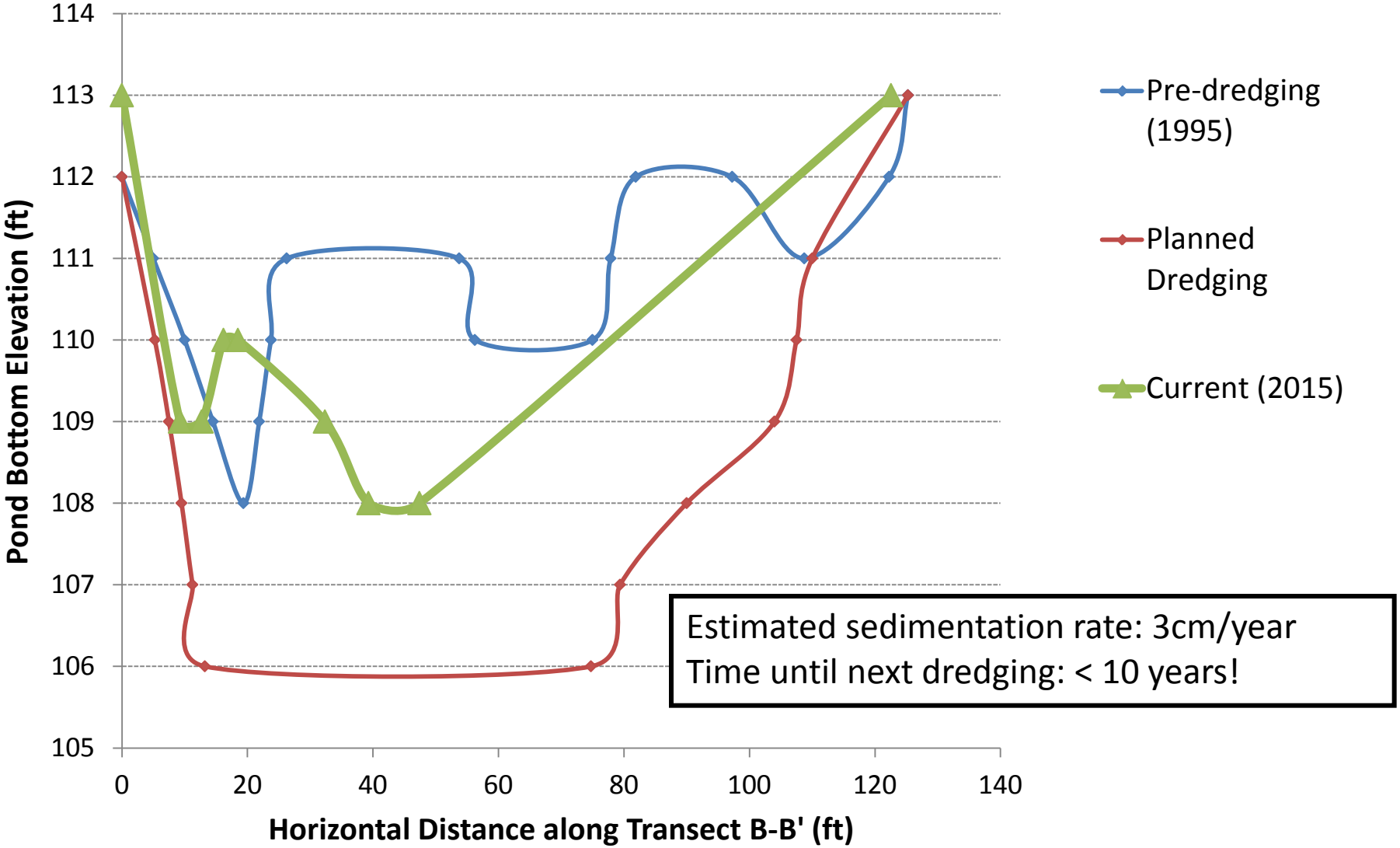


Student experiences:

1. Collection of spatially identified data using GPS
2. Plotting and contouring data to prepare bathymetric map
3. Drawing cross sections separated over time

4. Use tools to estimate sedimentation rates

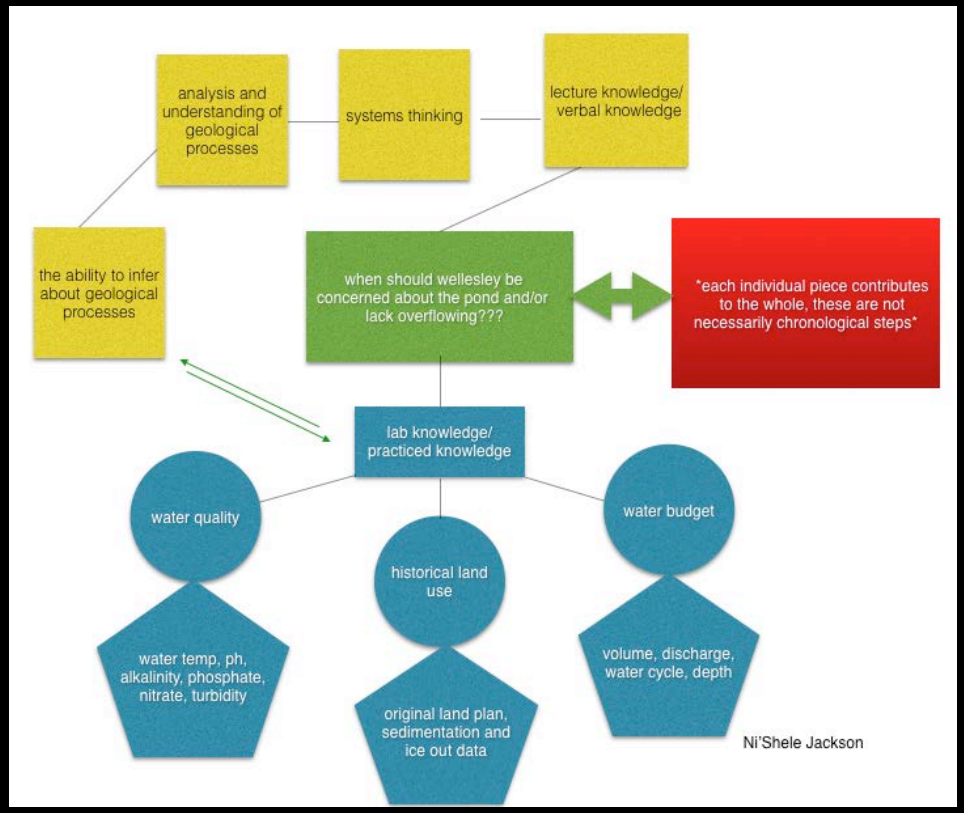
Paramecium Pond Bottom Profiles
GEOS 101-F15



Estimated sedimentation rate: 3cm/year
Time until next dredging: < 10 years!

Challenges and Opportunities

1. Logistics of engaging 23 introductory STEM students (first years to seniors) in authentic research across two lab sections organized in three teams.
2. Sustaining motivations across the arc of the semester when expectation is science takes place in neatly offered three hour blocks.
3. Well-designed research can scaffold across years and result in significant outcomes that can inform how the college manages its landscape.
4. **Early applied research experiences have been shown to aid in retention of URM students. As a community there is much room for improvement - Maps and GIS is one tool that may help!**



To see how the narrative ends
Come to the poster session:
Dec 7th 9:50 OBS 112