We are beginning to implement STEAM projects at Belle Meade. STEAM integrates Science, Technology, Engineering, Arts, and Mathematics while applying these disciplines to real world problems and products.

The first project we are tackling is an assessment of Kilby Run stream quality. The assignment will span Math, Science, English, and Art classes. Students are responsible to plan and implement the project as a group. Staff will provide support and instruction that supports student plans to produce a professional quality investigation, quantification, and reporting of stream conditions.

Assignment Overview
Students will assess and report Kilby Run stream quality before entering Belle Meade, passing through Belle Meade property, and after leaving Belle Meade property in an attempt to determine the impact, if any, that Belle Meade has on stream quality.

Stages of Assignment
I Planning
II Data Collection
III Data Analysis
IV Presentation of Results

Stage I Planning
Students formally plan a method for achieving the assignment goal. Students determine how to perform each step of the assignment, how and where to document and organize data, assign and determine rolls of team members, and acquire materials needed. Some suggestions for each of these areas are included in the description of the remaining stages.

Stage II Data Collection
Before collecting data, the team should make plans to control for as many variables as possible, including but not limited to, method of invertebrate collection, sample size, temperature, precipitation, water flow velocity, volume and discharge, and season.

Perform three independent stream surveys each of which meet stream assessment guidelines. One survey should be above the property, one on the property, and one after the stream exits the property. Data should be clearly labeled to indicate the assessment location. Each assessment location should be 100 yards in length with samples taken from three spots within each location.

Suggested key data points include: EPA accepted standard macroinvertebrate sample and classification, streamside riparian buffer survey, plant survey, water clarity, flow speed, discharge volume, oxygen content, temperature, and movement.

The EPA's 'Streamside Biosurvey' (http://water.epa.gov/type/rsl/monitoring/stream_index.cfm,and http://water.epa.gov/type/rsl/monitoring/vms42.cfm) outlines in detail a professional standard way to accomplish this. It also provides well organized data sheets that can be placed in a three ring binder for recording data in the field.

Rappflow (http://rappflow.org/) is a local resource for expertise and could be approached about possible equipment loans.

Approprapedia has information on stream flow measurement:
(http://www.appropedia.org/How_to_measure_stream_flow_rate#Float_method)

Further information can be found at:
http://www.ecy.wa.gov/programs/wq/plants/management/joysmanual/index.html

Photo documentation of macroinvertebrates and stream conditions during data collection may be useful for reference, and creation of presentation materials in Art class.

III Data Analysis
Students will tabulate and analyze data quantifying the change in stream quality, if any, as it passes through Belle Meade. The use of spreadsheets and spreadsheet functions to organize and collate data is encouraged.

IV Presentation of Progress and Results

   A Written
   1. Scientific Paper
      Results should be published in a scientific paper. Parts of the paper, in order are: Abstract (Summary), Introduction, Methods, Data Analysis and Results. Data Analysis may be combined with Results if so desired. Examples of scientific papers on ecology can be found at ESA Ecology Journal (http://www.esajournals.org/loi/ecol).
   2. Regular articles on project submitted to local publication(s).

   B Presentation
   Results should be presented publicly and include audio, visual, and tactile components.
   1. at Belle Meade.
   2. at a local ecological event.
   3. in an academic or government ecological setting.
   4. to professional and governmental organizations that will use data as part of larger projects.

Project Evaluation Rubric--Each stage should be thoroughly documented in the project binder.

Stage	Description	Points
Planning-initial	Created a detailed plan for all stages of project. Plan includes identifying processes for accomplishing goal; clear, organized, and uniform method and location for recording each type of data; an outline of intended analysis methods, and a proposal for a method of presentation. Identified and controlled for appropriate variables.	**30**
Planning-Material	Create a comprehensive list of materials needed to complete project. Create and or obtain all materials. Prepared to for field work with materials and recording methods/forms before beginning data collection.	**30**
Data collection	Collected and recorded all appropriate data in an organized fashion that would allow replication by those verifying your work. Implement necessary controls. Sufficient data collected to meet project goal.	**100**

Data Analysis	Data organized in a professional manner. Data analysis evaluates all pertinent aspects of stream health. Data analysis tools used effectively. Analysis is verifiably accurate, includes checks, strongly supports the conclusions, and provides graphs that aid in understanding and presentation of results.	**100**
Presentation of Results - Written	Scientific paper written in a professional manner. All prescribed sections are included. Correct vocabulary and grammar used. Used graphs and diagrams to make data accessible. Conclusions drawn are well supported by data collection and analysis. Prepared well written, press releases on a regular basis to local publications.	**100**
Presentation of Results--Oral, Visual, and Tactile Presentation	Professional, comprehensive presentations that include key methodology and findings. One at each of the specified venues. Presentation includes three dimensional tactile/visual aid such as a scaled model of stream features found.	**100**
Presentation of Results-Scientific community	Worked with and submitted results to professional and governmental organizations that will use data as part of larger projects.	**40**
Budget	Within budget of $320.00 (proposed) for all stages up to but not including Presentation of Results.	**-3 for each $10 over +1 for each $10 under**
	Total	**500**