Pipe Loss Experiment Redesign Project 10

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Mark Frankenberg – Budget Liaison

Keith Caton – Website Manager

Michael Garelick – Project Manager

Project Description and Background

- Client: Dr. Constantine Ciocanel
- Evaluate and redesign current experiment
- Measure pressure at different points
- Current Materials
  - Copper Piping
  - ¾ Horse-power pump
  - Ball Valves
- The table is about 15 years old

Figure 1 – Current Design

Figure 2 – Dr. Ciocanel

Black Box Model

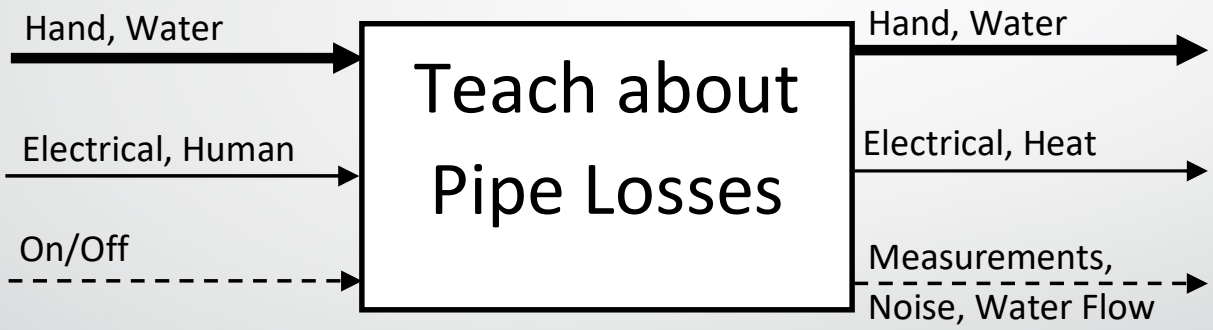

Figure 3 – Black Box Model

Functional Decompsition

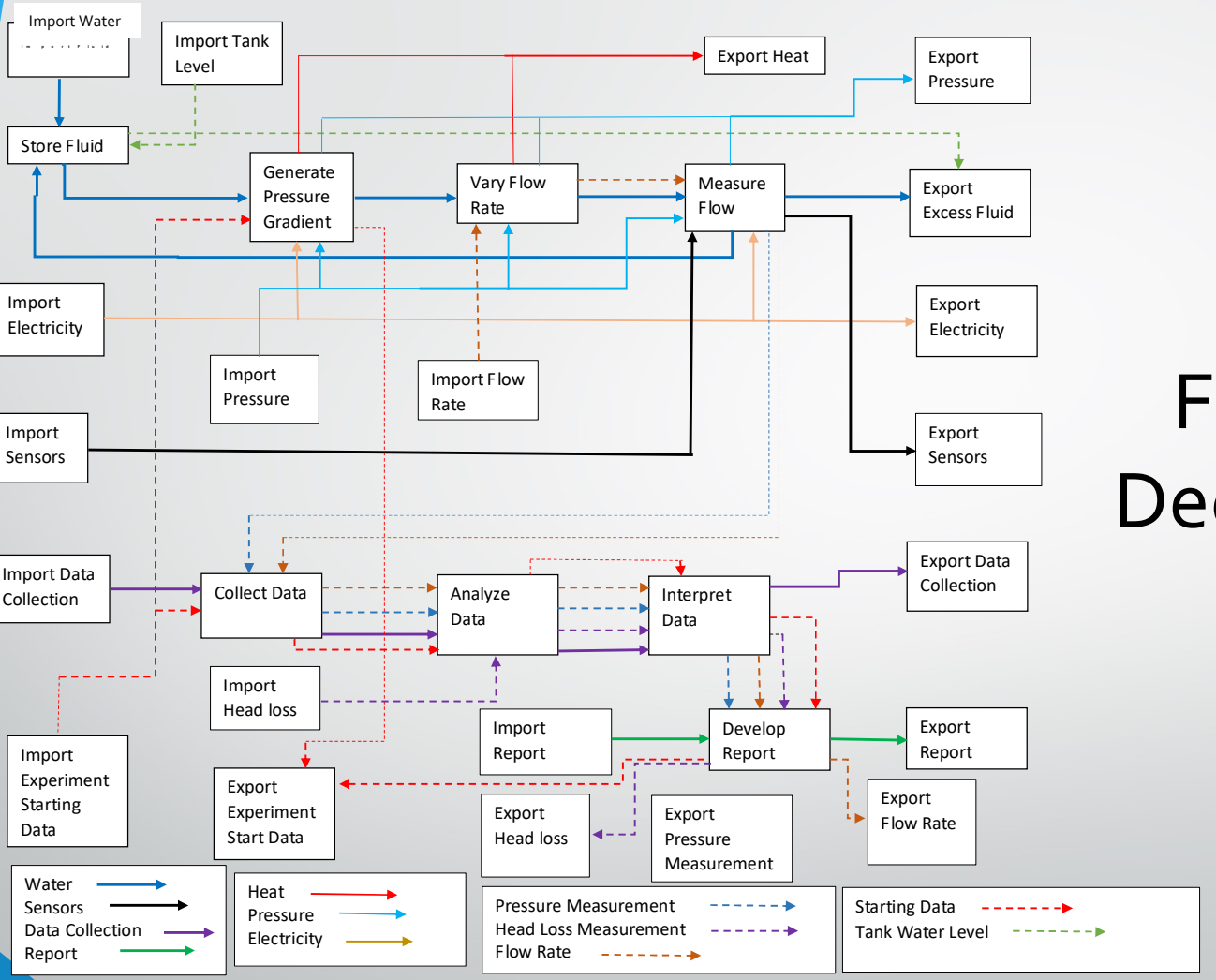

Figure 4 – Functional Decomp

Designs Considered

- Design generation techniques
  - 6-3-5 Method
  - Gallery Method
- Gallery method used for overall design
- 6-3-5 used for specific components

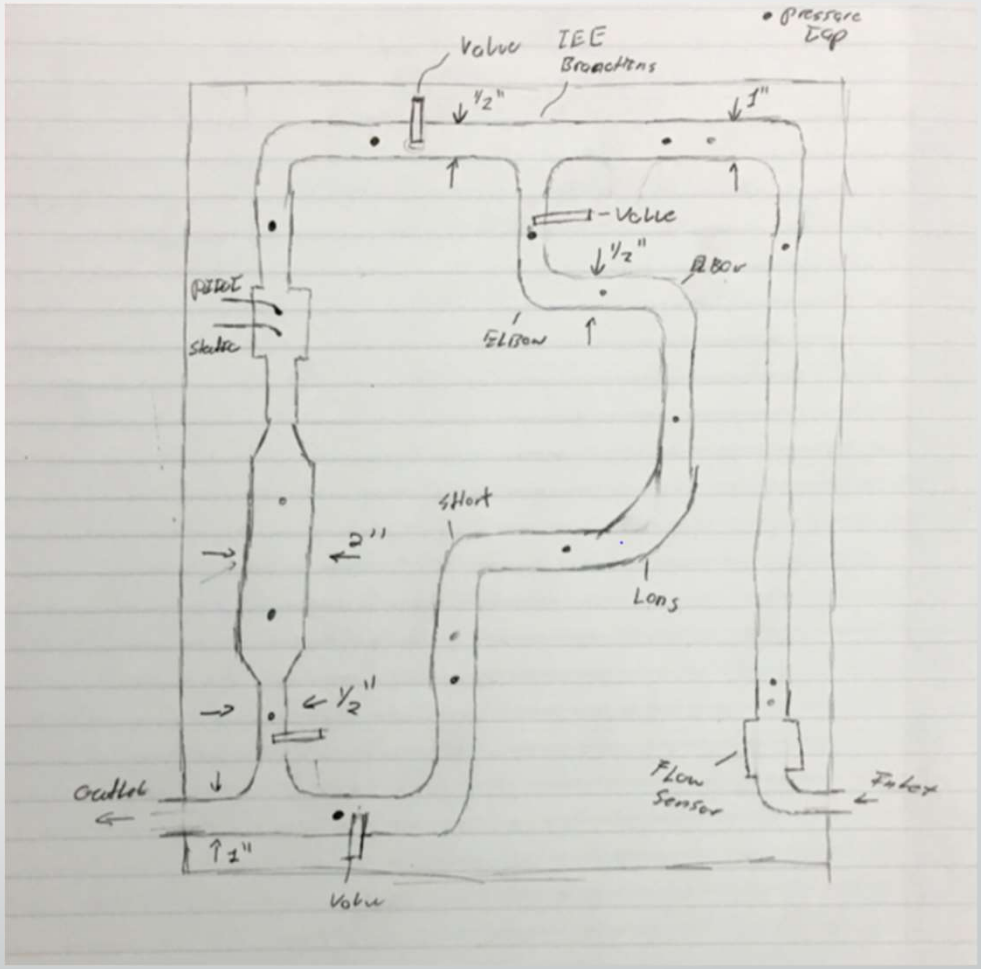

Figure 5 – Overall Layout Concept (Concept #3)

Designs Considered Continued

- 45 to 90 degree elbows
  - Long
  - Short
- Contraction joints still under analysis
- Branching tee joints
  - Still under analysis
  - Possibly changed to dividing
- Pressure taps after each minor head loss fixture
- Materials
  - Aluminum
  - Copper
  - Plastic
  - Steel
  - etc.

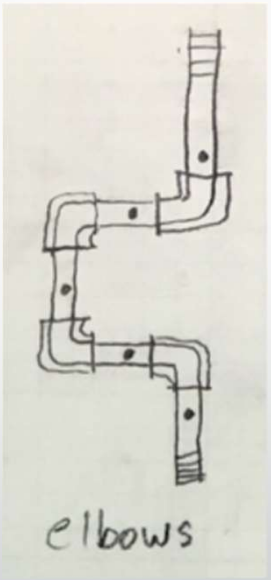

Figure 6 – Potential Elbow

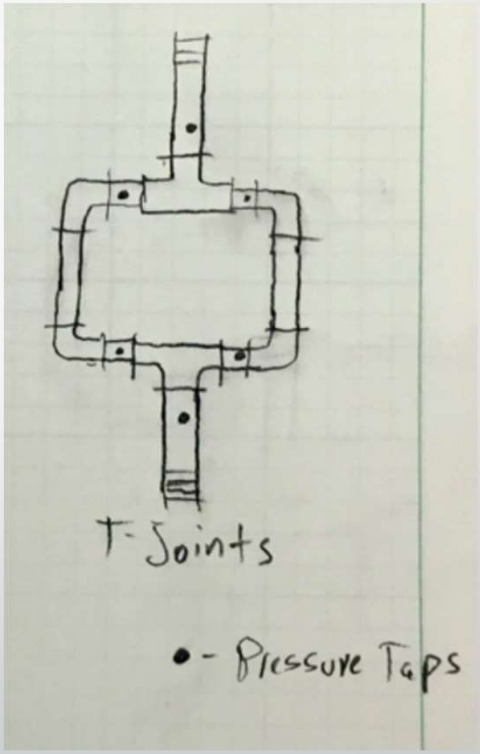

Figure 7 – Potential T-Joints

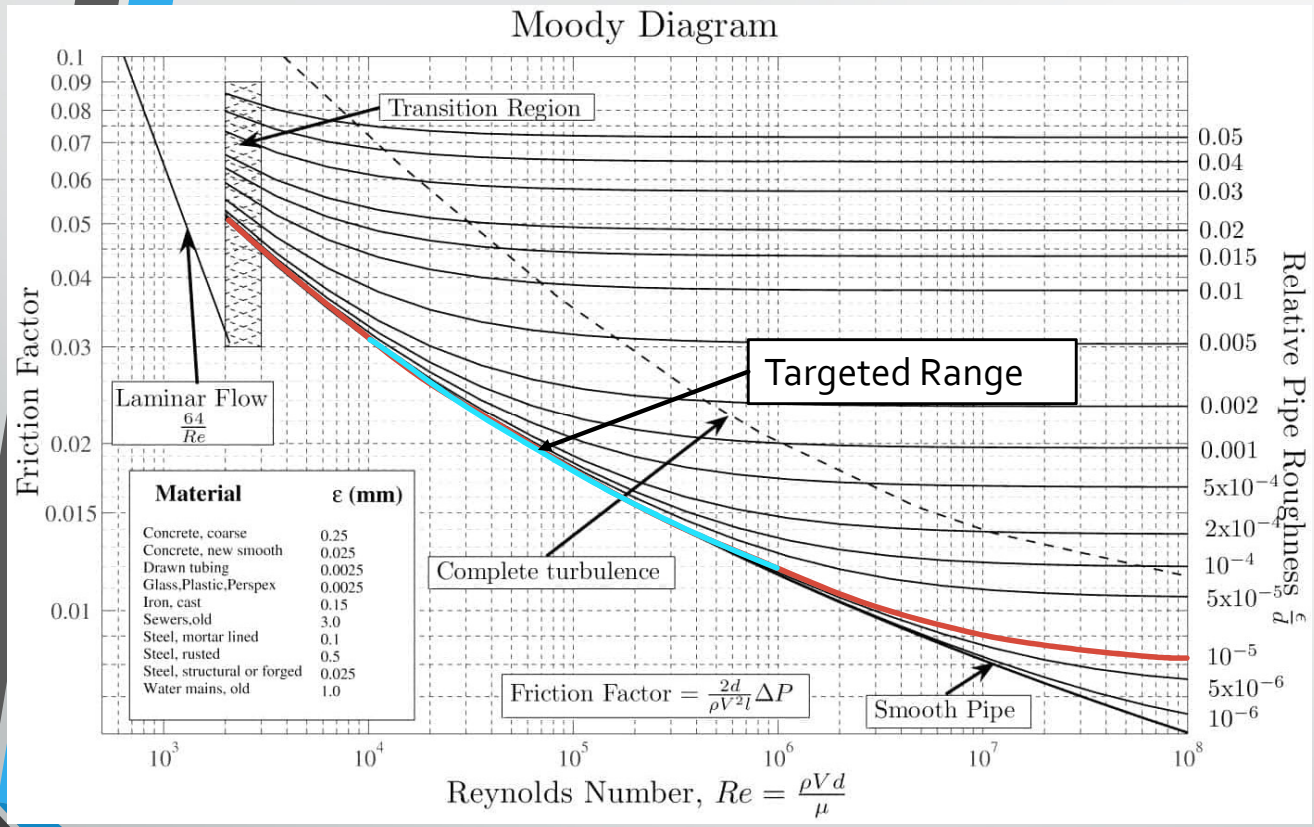

Figure 8 – Moody Chart and Target Range

Replication of Moody Diagram

- Client wants replication of Moody Chart
  - Replication of single line for selected material

Preliminary Calculations

- Head loss over two straight pipes
- Two Lengths
  - 10 ft.
  - 6 ft.
- Copper/PVC pipes
- 1 in diameter pipes

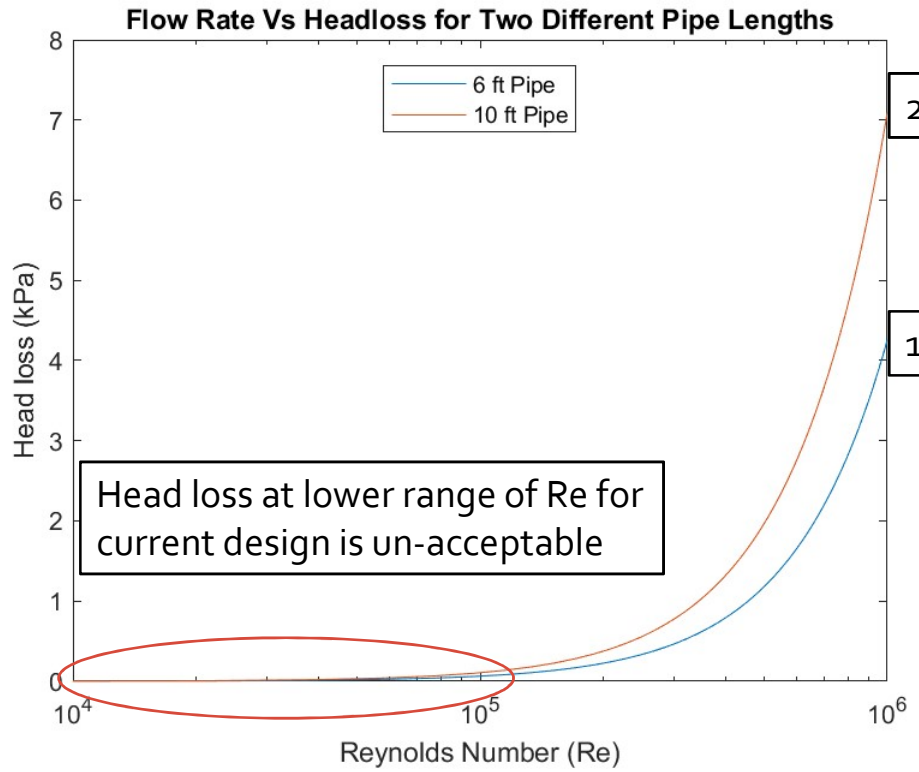

Figure 9 – Head loss of straight pipe vs Reynolds Number

Table 1 - Pugh Chart for Overall Design

Pugh Chart				
Customer Requirements	Concept #4	Concept #1	Concept #2	Concept #3
Reliabilty of Measurements	0	0	-	0
Durability of Phyical System	0	0	0	0
Three forms of flow rate measurement	0	-	-	+
1/2" min diameter	0	-	-	+
All types of fittings (Elbow, T, Step up)	0	+	-	+
Ease of use	0	0	+	-
Lab View Integration	0	0	-	0
Variable flow Rate	0	0	-	0
Total	0	-1	-5	2

Design(s) Selected – Layout

Layout Design Selected

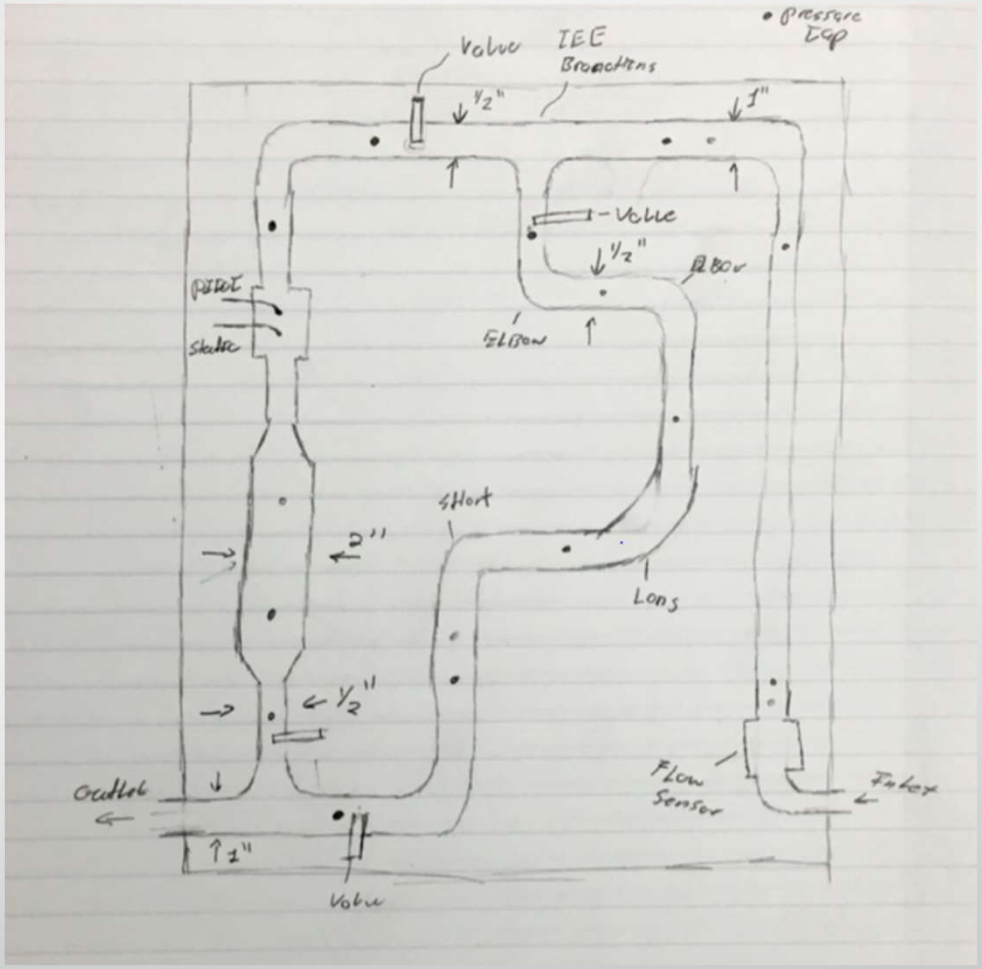

Figure 10 – Overall Layout Concept Selected

Material Decision Matrix

Table 2 – Decision Matrix

Decision Matrix								
Materials	Cost	Corrosion Resistance	Roughness	Strength	Sizes avaiable	Ease of Fitting	Life Span	Weighted Total
Weights	3	5	5	3	5	4	3	
Aluminum	4	3	1	3	4	3	4	85
Concrete	3	4	3	2	1	2	5	78
Copper	2	4	1	4	4	4	4	91
Clay	1	5	5	1	1	2	4	81
Glass	2	5	1	2	3	1	5	76
Plastic	4	4	1	2	4	5	3	92
Steel	3	1	3	5	3	3	4	83

Schedule

- The due date schedule same.
- Client meetings from every 2 weeks to every week.
- The group roles have not changed.
- On schedule for class assignments.
- Behind schedule for client assignments.

Gantt Chart

Name	Begin date	End date	Coordinator
Team Charter	1/18/18	1/25/18	All
Website Version 1	1/26/18	2/23/18	Keith
Website Version 2	2/26/18	3/29/18	Keith
Website Version 3	3/30/18	5/1/18	Keith
Presentation 1	1/26/18	2/8/18	All
Meet With Client 1	1/26/18	1/31/18	All
Project Description	2/1/18	2/7/18	Cole
Benchmarking	2/1/18	2/7/18	Mark
Gantt Chart Version 1	2/1/18	2/7/18	Michael
QFD Version 1	2/1/18	2/7/18	Keith
Budget Version 1	2/1/18	2/7/18	Mark
Peer Evaluation 1	2/8/18	2/8/18	All
Presentation 2	2/9/18	3/1/18	All
Conceptual Report	2/9/18	3/1/18	All
Meet With Client 2	2/9/18	2/14/18	All
Functional Decomposi...	2/9/18	2/12/18	All
Consider Designs	2/13/18	2/16/18	All
Meet With Client 3	2/15/18	2/21/18	All
Select Design	2/16/18	2/23/18	All
Pugh Chart	2/16/18	2/19/18	Cole
Decision Matrix	2/19/18	2/23/18	Keith
Gantt Chart Version 2	2/16/18	2/23/18	Michael
Budget Version 2	2/16/18	2/23/18	Mark
Presentation 3	3/2/18	4/19/18	All
CAD Version 1	3/2/18	4/17/18	Michael
Bill of Materials Versio...	3/2/18	4/17/18	Cole
Design Requirements	3/2/18	4/17/18	Keith
Gantt Chart Version 3	3/2/18	4/17/18	Michael
Budget Version 3	3/2/18	4/17/18	Mark
Analysis Memo	3/2/18	3/15/18	All
Analytical Reports	3/16/18	4/5/18	All
Peer Evaluation 2	4/6/18	4/10/18	All
Final Report	4/6/18	4/26/18	All
Prototype Demonstrati...	4/20/18	5/3/18	All

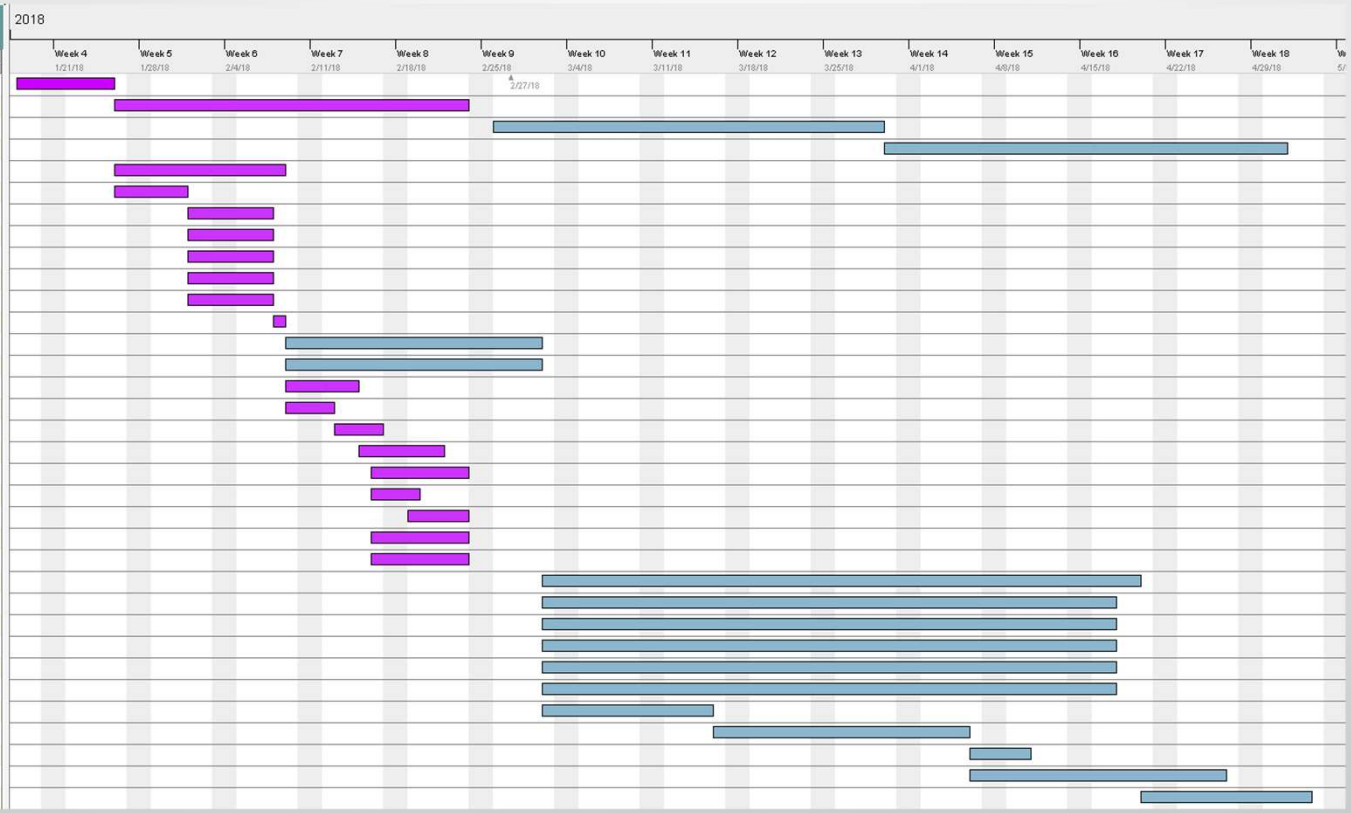

Figure 11 – Gantt Chart Schedule

Budget

- Sensors will not be purchased with Capstone funds
- All sensors will be proposed to client
- Client will determine best sensors and will purchase
- Pump is largest expected expense
  - Expected around $500
- Nothing has been purchased to date

Questions?