CEEn-2018CPST-012

Springville Irrigation Canal Breach Mitigation

Centilium Engineering Capstone

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Introduction

Provide Ditch #1 breach mitigation solutions

Breach location

Project Tasks and Deliverables

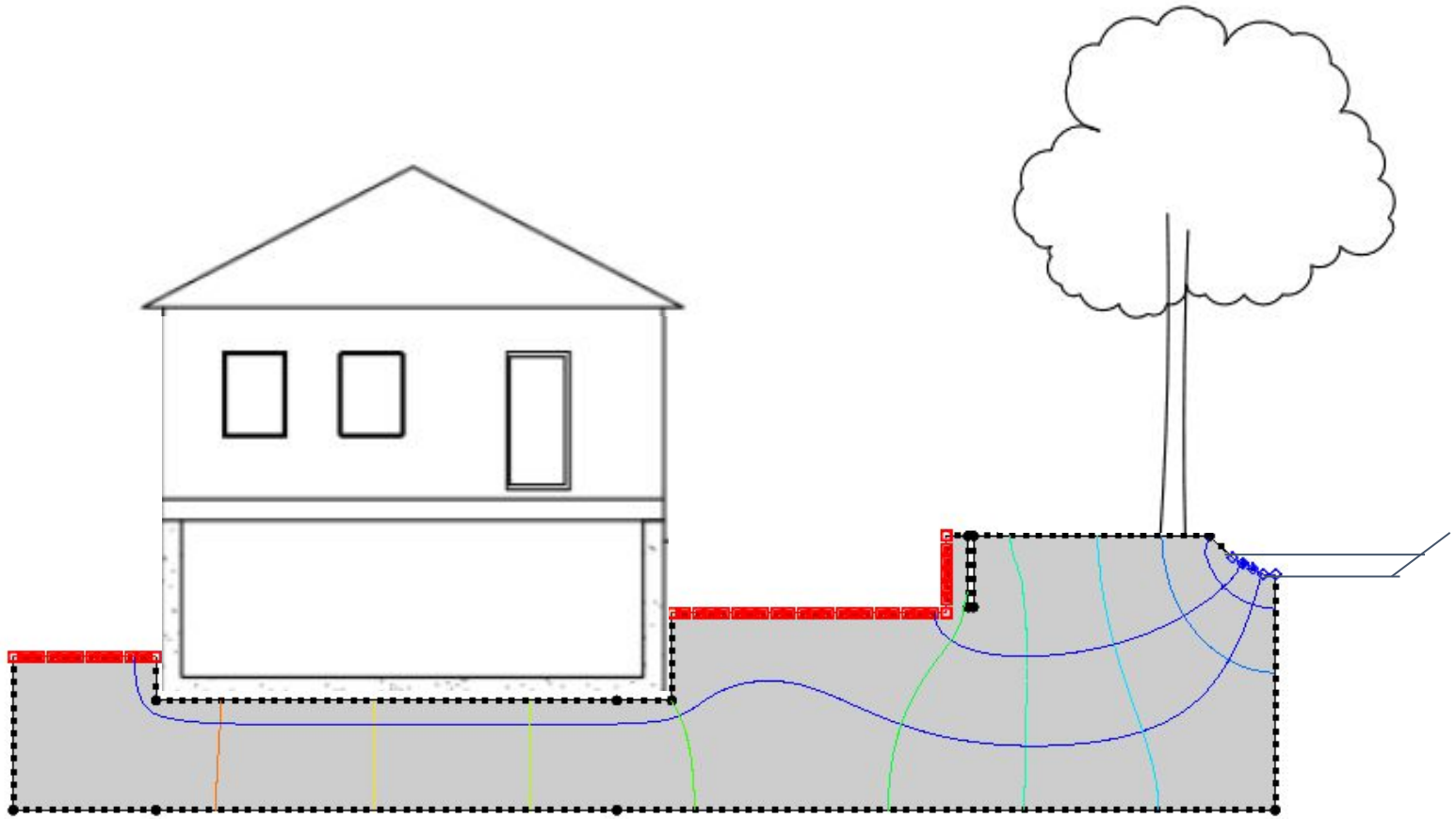
- **Tasks**
  - Provide breach mitigations solutions
  - Provide water quality improvement solutions
- **Deliverables**
  - Final report
  - Presentation
  - Analysis data

Problem Area

- Breach in rock retaining walls
- Canal runs above resident homes
- Likely Cause:
  - Tree roots
  - Muskrat holes
  - Natural spring
- Flooding is likely a recurring event

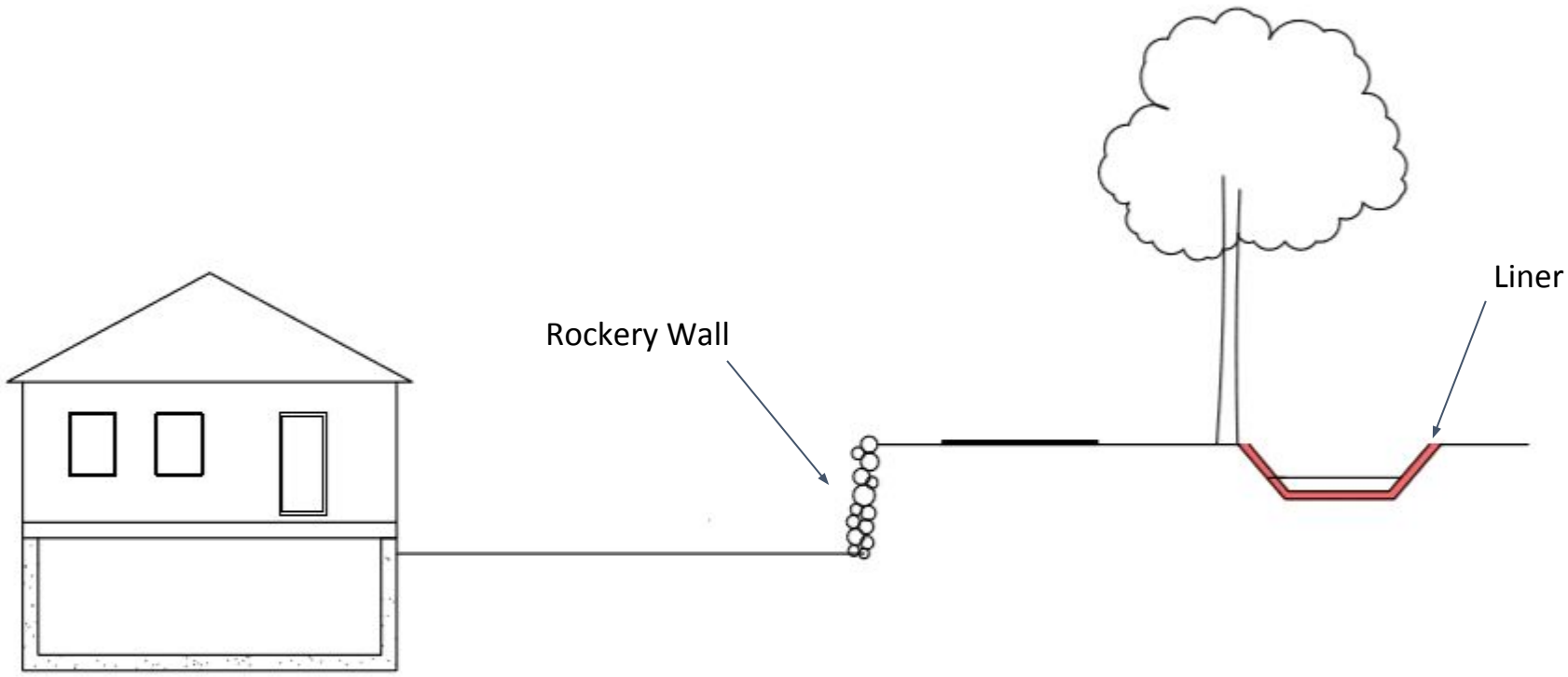
Design and Analysis

- Soil analysis
- Hydraulic model
- Flownets
- Cross sections



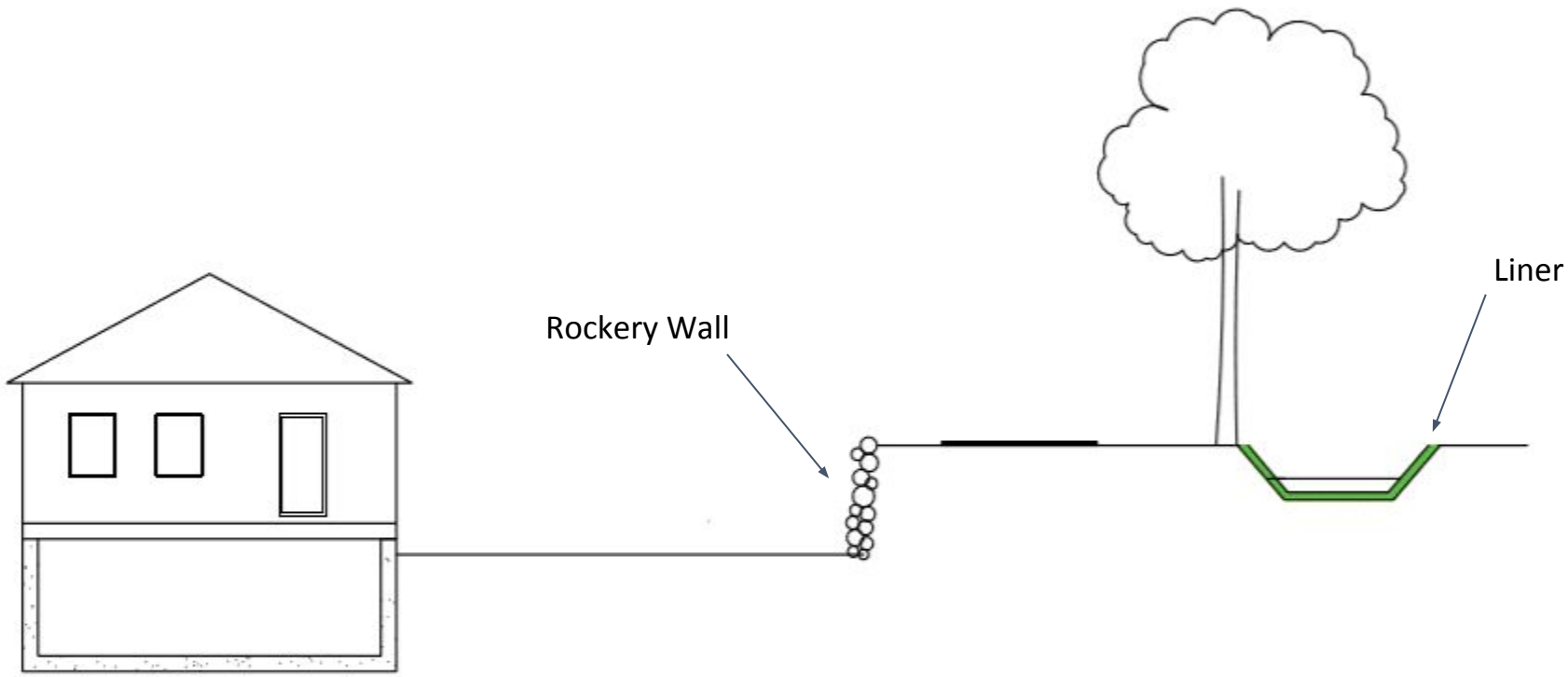
Discussion of Results

- **Breach Solution 1A: Installing a concrete liner = $426 K**
  ***20% contingency included**



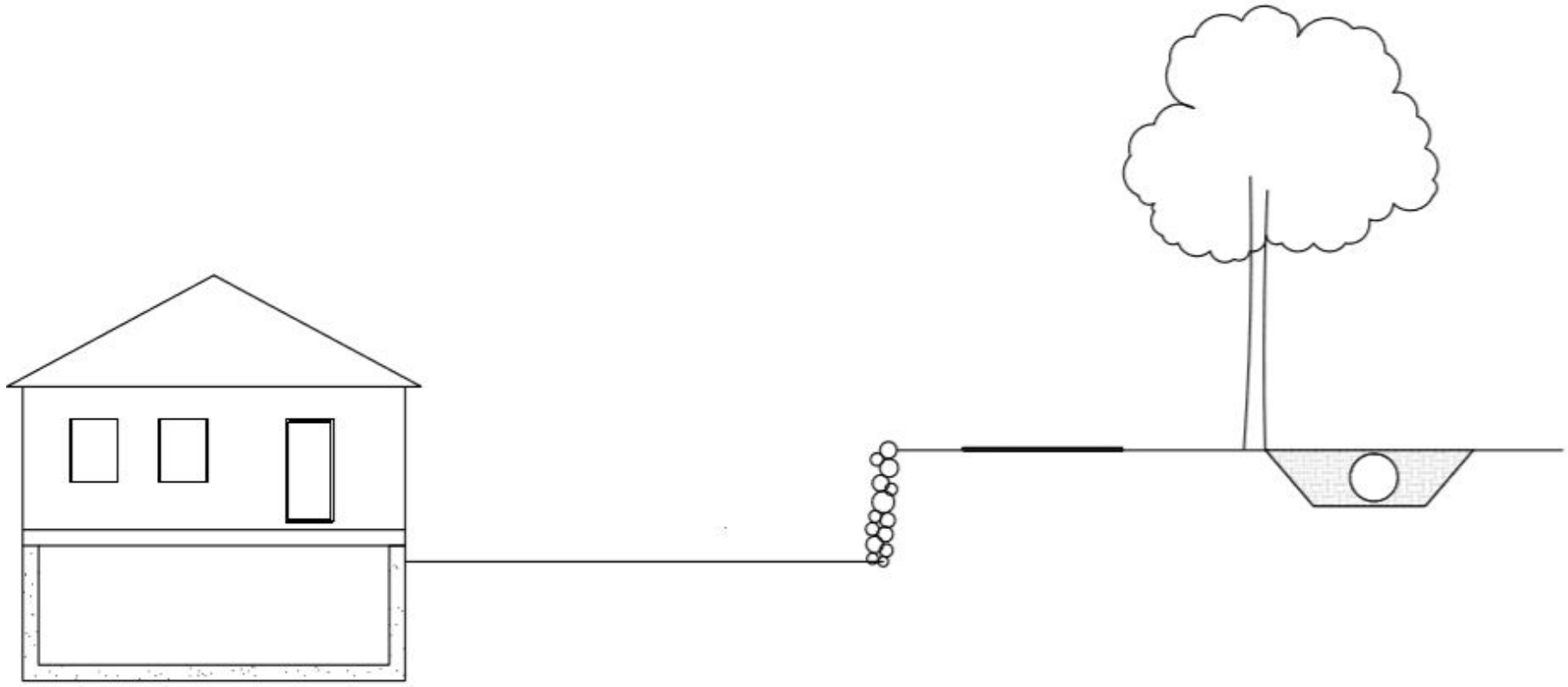
Discussion of Results Cont'd

- **Breach Solution 1B: Installing a geomembrane liner = $220 K**
  ***20% contingency included**



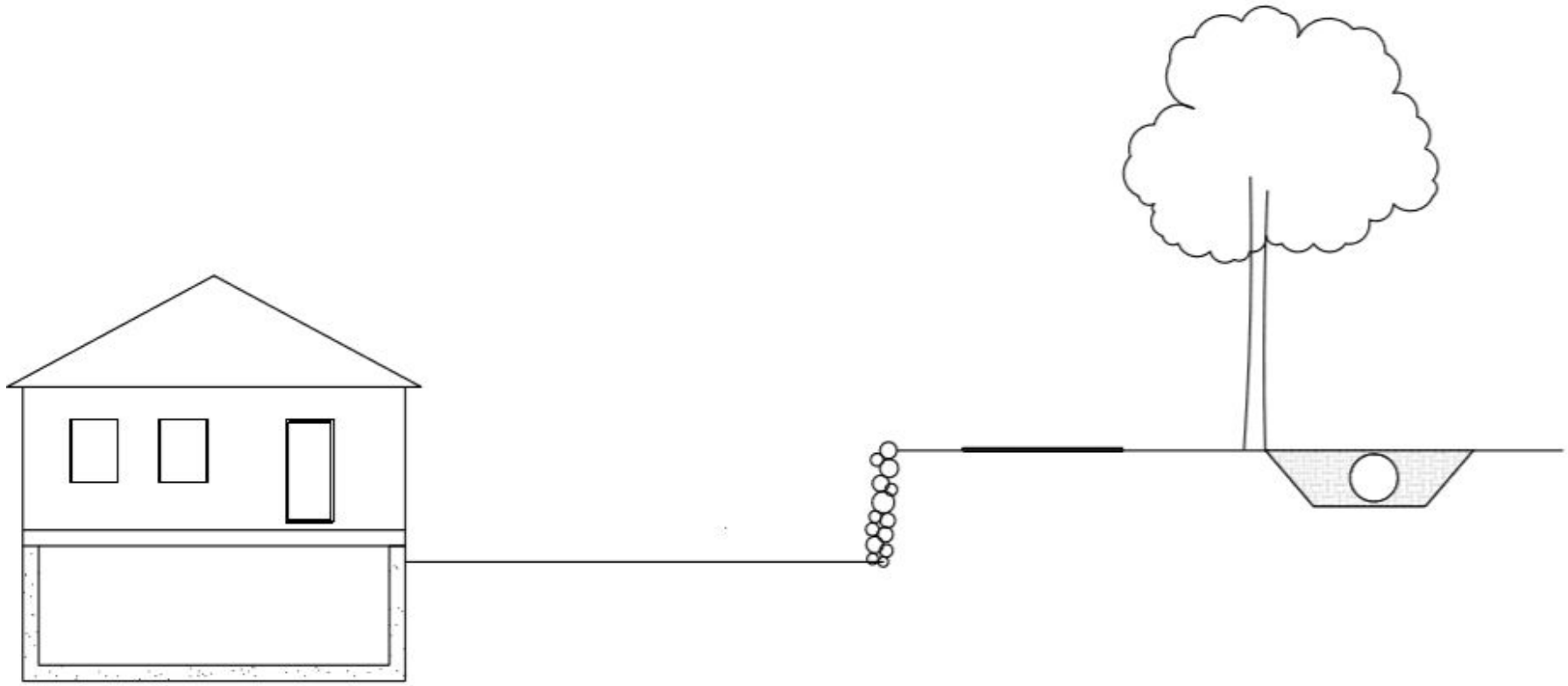
Discussion of Results Cont'd

- **Breach Solution 2A: Piping the entire ditch = $760 K**
  *20% contingency included



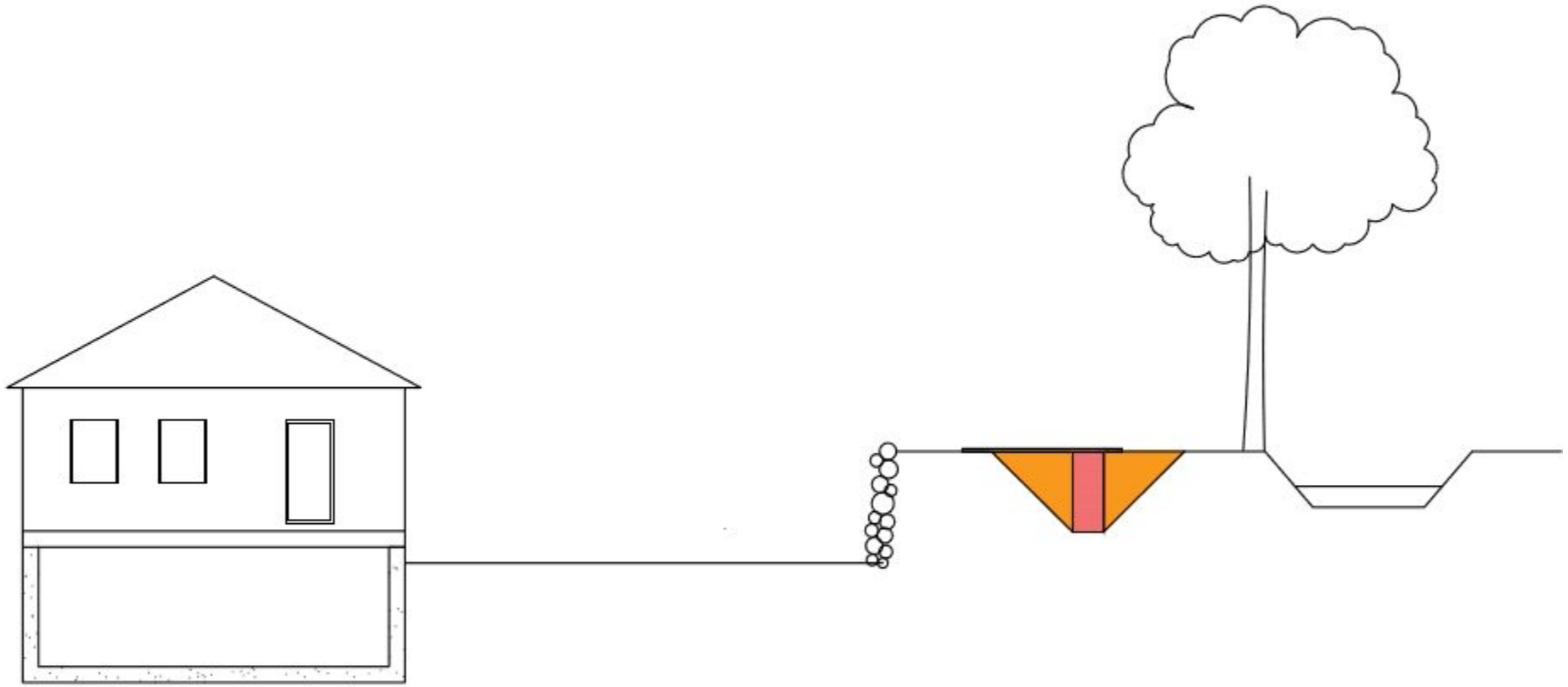
Discussion of Results Cont'd

- **Breach Solution 2B: Piping the western 300 feet of the ditch = $248 K**
  ***20% contingency included**



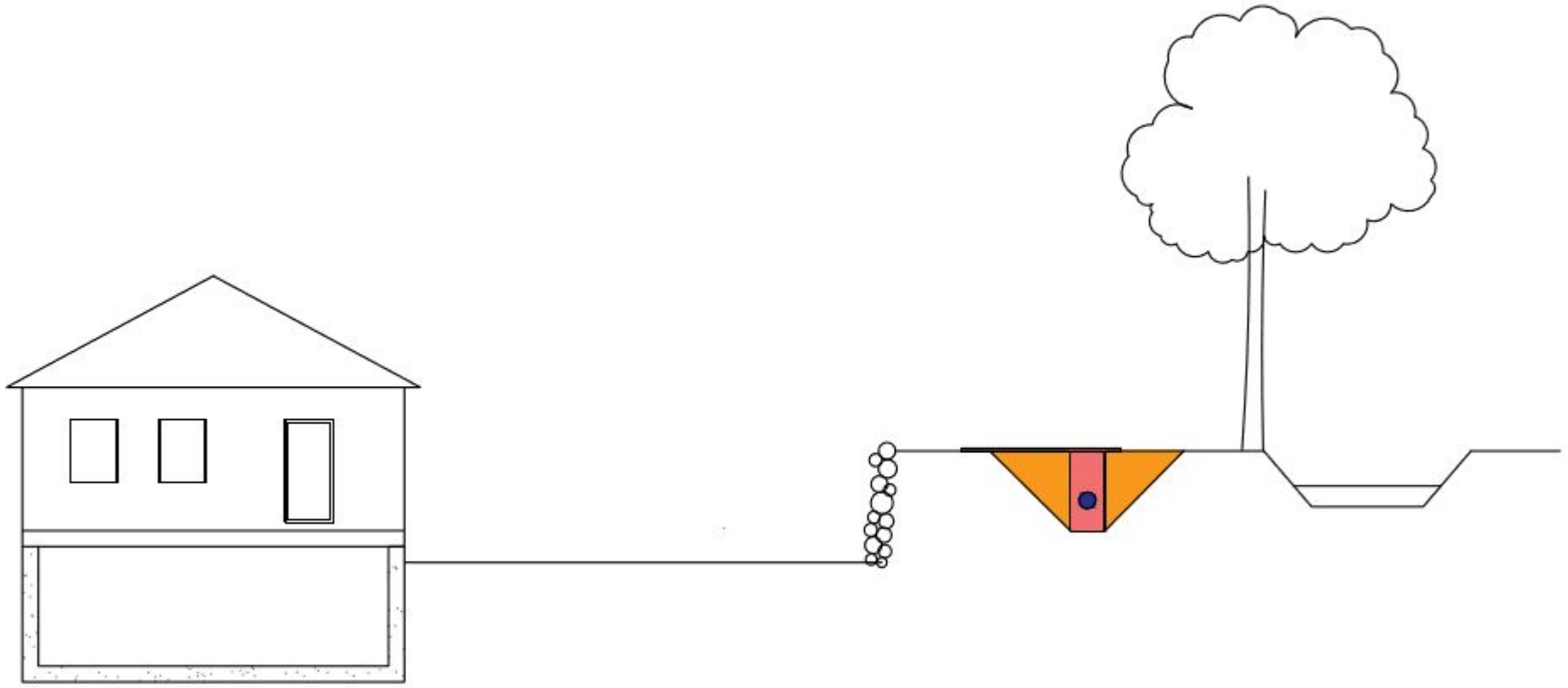
Discussion of Results Cont'd

- **Breach Solution 3A: Installing a clay cut-off wall = $522 K**
  ***20% contingency included**



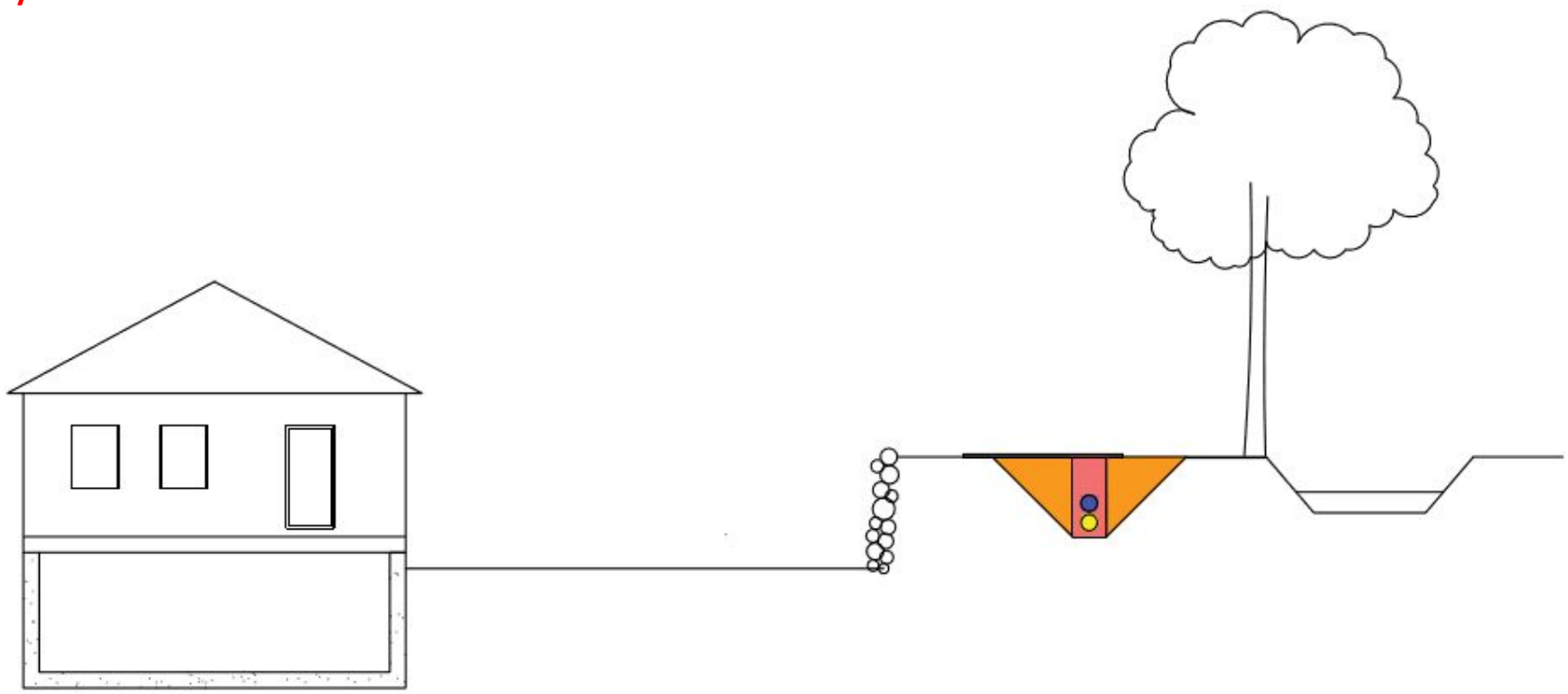
Discussion of Results Cont'd

- **3B: Installation of clay cut-off wall and long Strawberry = $1.705 M**
  ***20% contingency included**



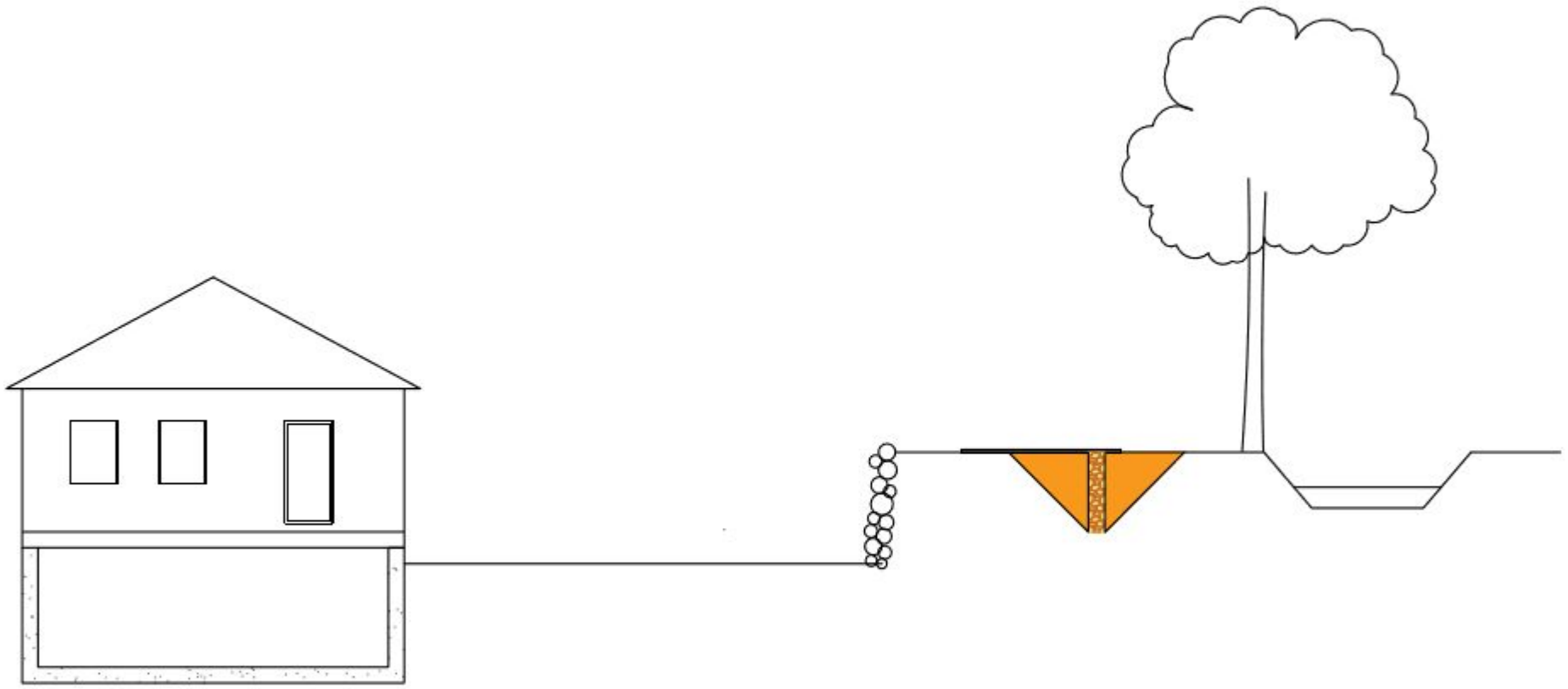
Discussion of Results Cont'd

- **3C: Installation of a clay cut-off wall, long Strawberry and piping entire ditch = $1.75 M**
  ***20% contingency included**



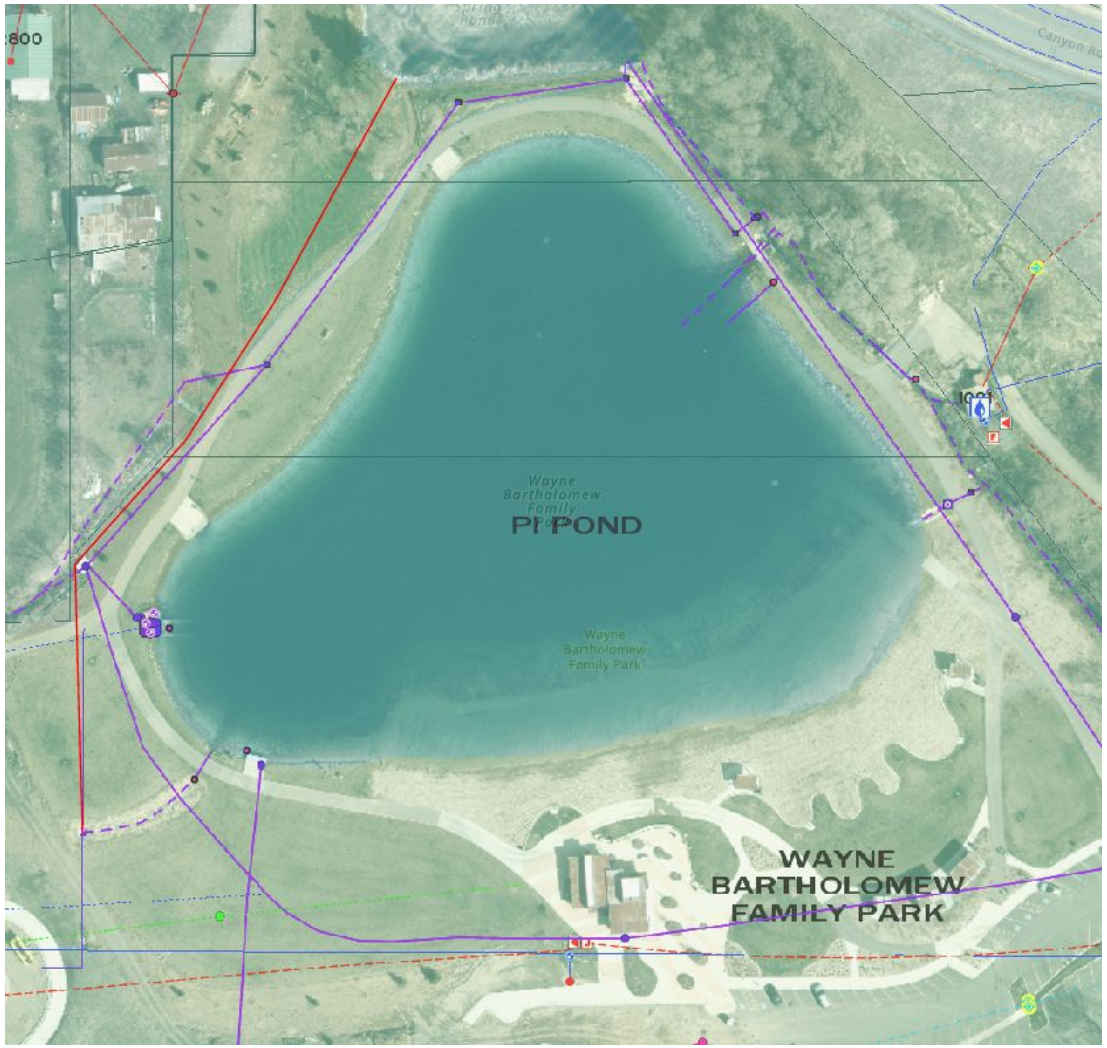
Discussion of Results Cont'd

- **Breach Solution 5: Installation of a French-Drain = $200 K**
  ***20% contingency included**



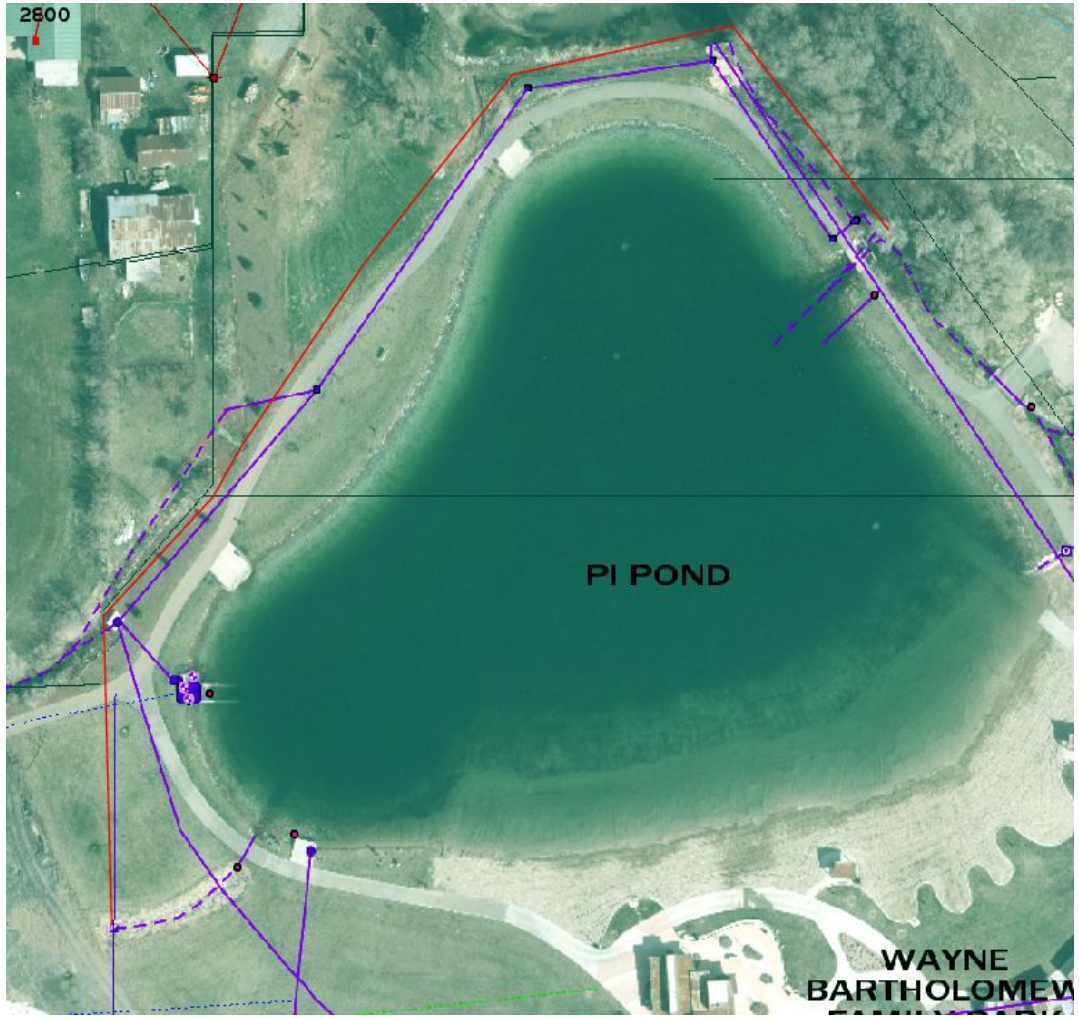
Discussion of Results Cont'd

- **Short Strawberry = $337 K**
  *20% contingency included
- **Circulates water**
- **Improves water quality**



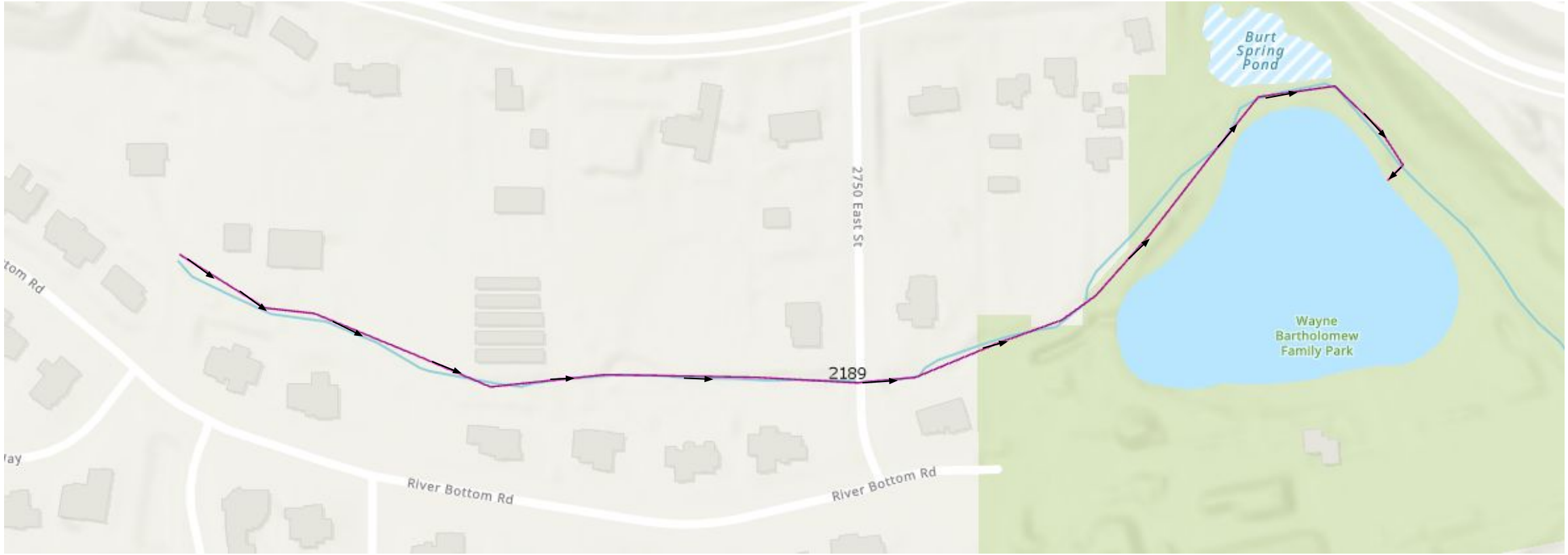
Discussion of Results Cont'd

- **Medium Strawberry = $458 K**
  *20% contingency included
- **Improves circulation**
- **Larger water quality improvement**



Discussion of Results Cont'd

- **Long Strawberry = $1.16 M**
  *20% contingency included

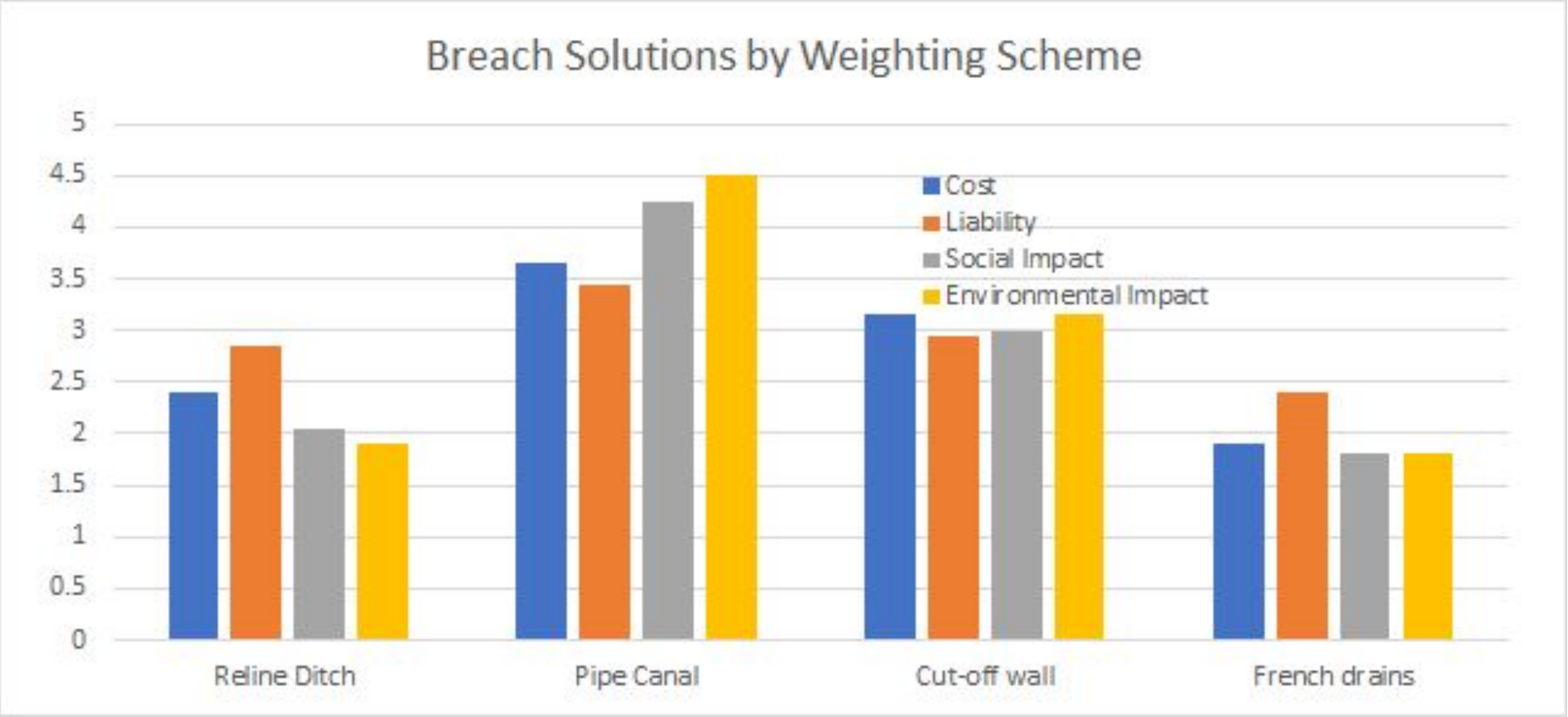


Areas of Concern

- Cost
- Public Opinion
- Environmental Impact
- Speed of Implementation
- Aesthetic
- Liability
- Maintenance

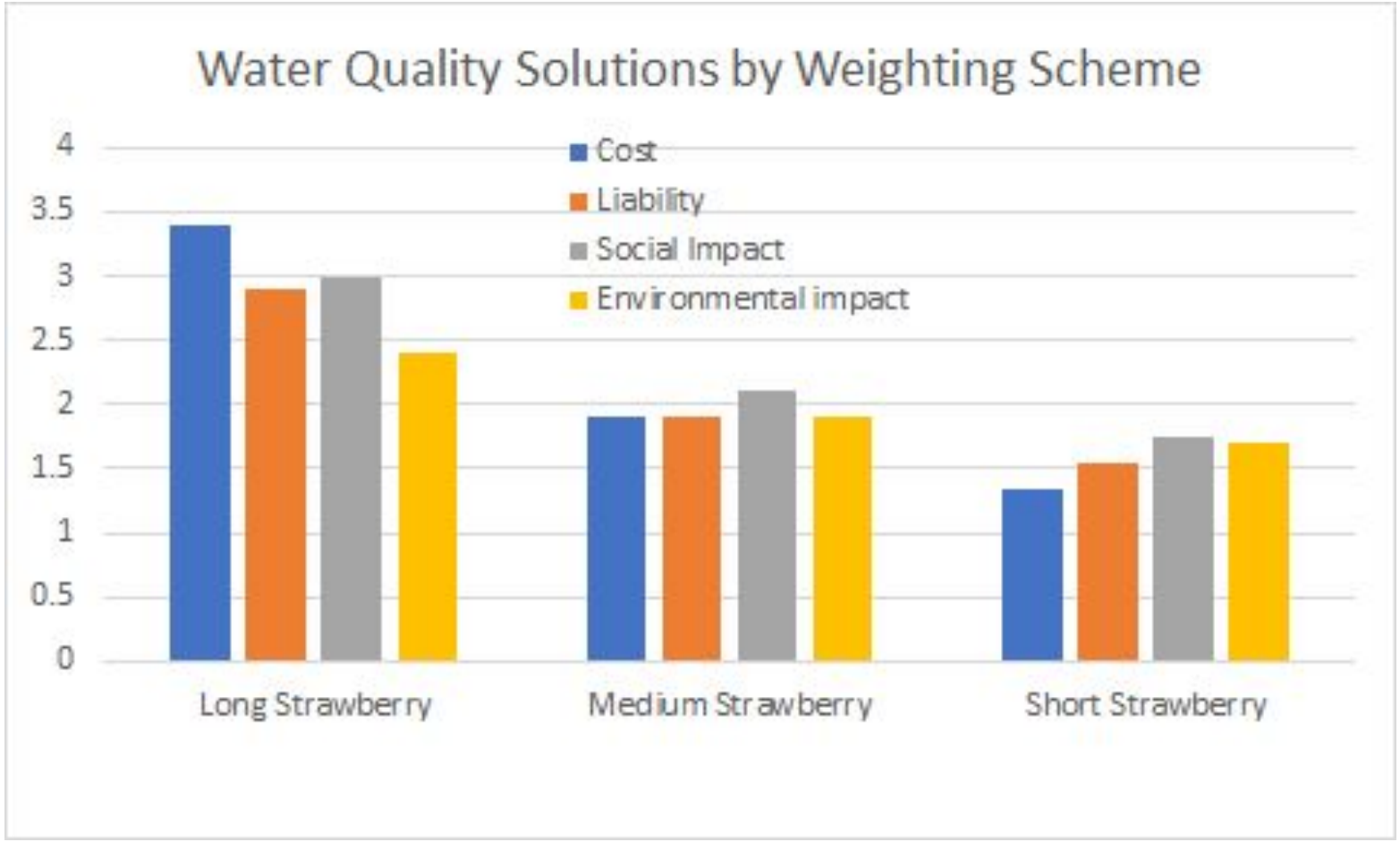
Design and Analysis Cont'd

- **Solution Ranking**
  - **1 - best**
  - **5 - worst**



Design and Analysis Cont'd

- **Solution Ranking**
  - **1 - best**
  - **5 - worst**



Design and Analysis Cont'd

Low probability high risk events

- Overtopping/flooding risk
- Accidental death

Design and Analysis Cont'd

- **Risk of overtopping: low but significant**
- **Recurring flood costs > piping costs**

Conclusions

- Problem: Breach/ water quality
- Cause: Canal flow
- Turbulent flow risk: Low
- Heaving risk: Low
- Overtopping: Low risk/high cost

Recommendations

- **Breach Mitigation**

1. **Pipe full length of canal**
   a. **Pros- Low Maintenance, Lowest risk option**
   b. **Cons- Large initial cost**

2. **French drain**
   a. **Pros- Cheap, minimal construction impact**
   b. **Cons- No low probability/ high risks, high maintenance**

Recommendations Cont'd

- **Strawberry Water Quality Solutions**

1. **Short Strawberry**
   a. **Pros- inexpensive, effective**
   b. **Cons- may not circulate water as well as other options**