

Holding Pond Design for Preventing Nutrient Runoff

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Introduction

Problem Statement:

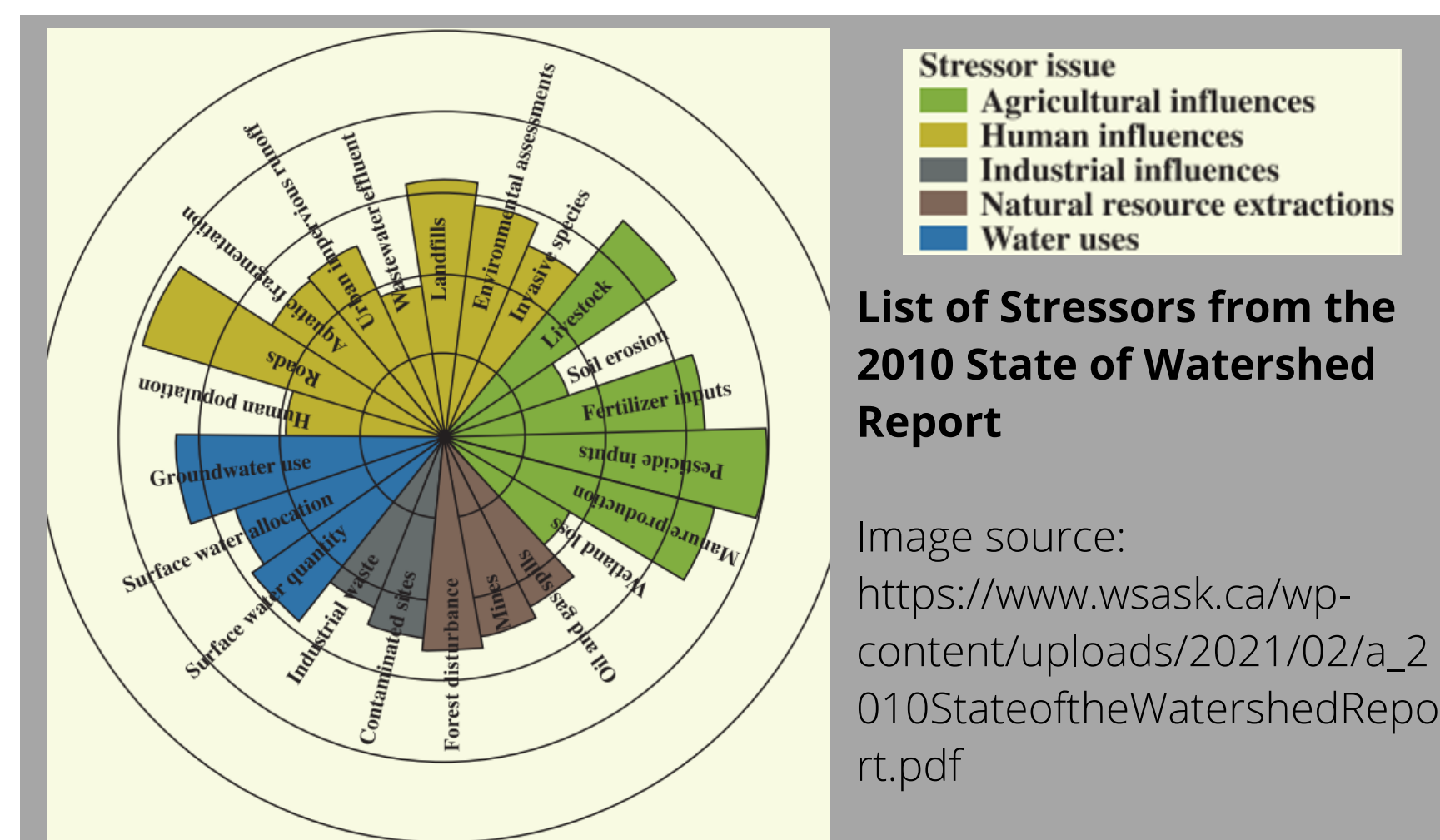
There's an on-going concern over the quality of water flowing through Lake Diefenbaker's canals. Livestock activity along surrounding canals is a major stressor for Lake Diefenbaker's water quality, since it might potentially cause nutrient runoff to pollute water flowing through the canals. Problems with water quality can possibly harm economic, environmental, and social development that relies on water flowing through canals if effective nutrient management methods are not implemented.

Objective

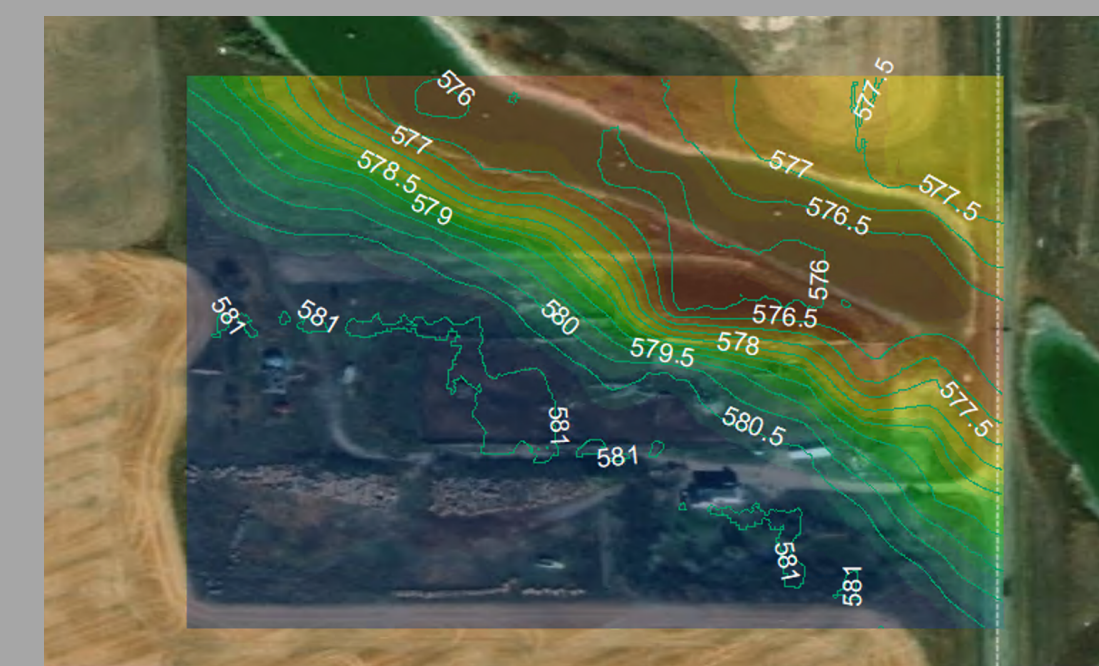
The goal of our project is to design a holding pond that can help control nutrient runoff and prevent algal blooms in a cost effective way.

The project involves:

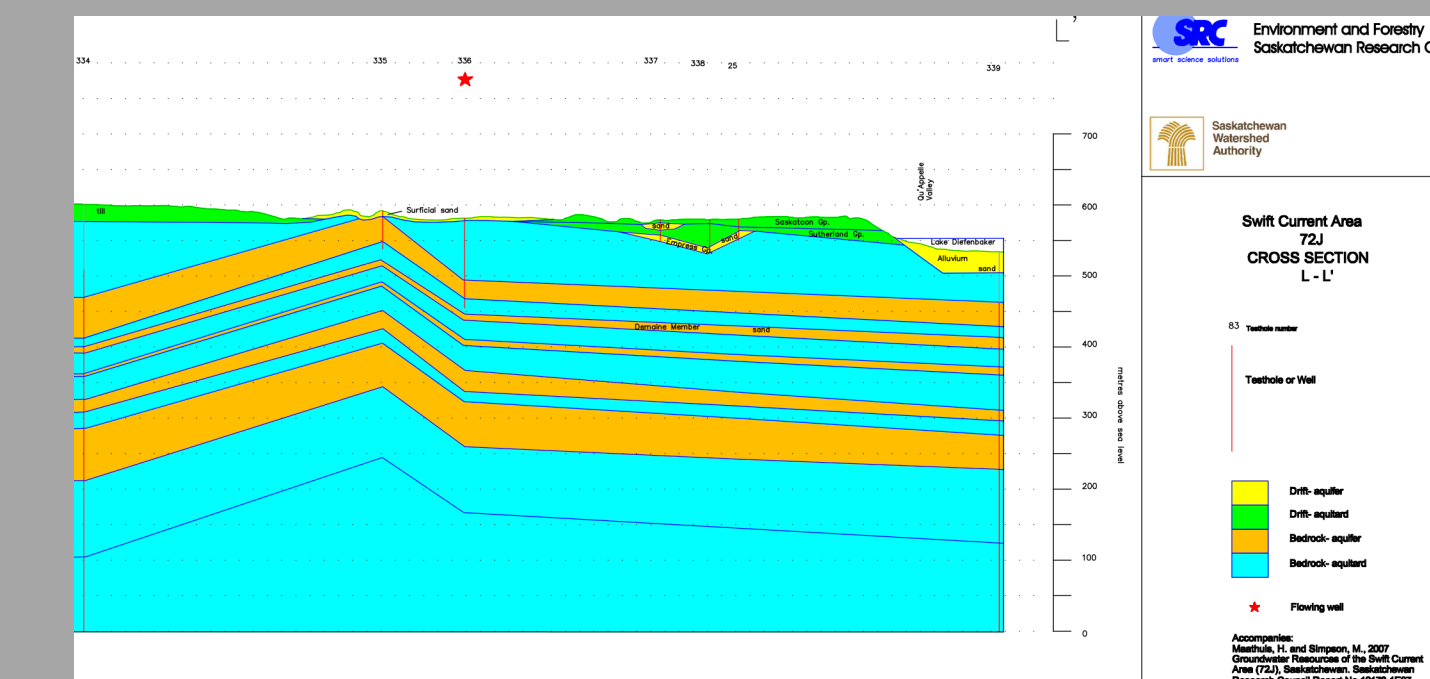
- Site selection for construction of a holding pond.
- Geological considerations to prevent groundwater contamination.
- Overall effectiveness of the design.



Methodology



Site Elevation Assessment
Source: ArcGis 10.7.1



Geological Layer of the Site
Source: WSA.
<https://www.wsask.ca/mapsheet/swift-current-mapsheet-72/>

Software/websites used for the development of the design:

- ArcGIS
- Google Earth Pro
- Saskatchewan Interactive Mapping
- Water Security Agency Website
- Sketchup Pro

Steps in making the design: We conducted elevation assessment of the site, which is necessary for siting the holding pond location. Using trial and error for design dimensions, we designed three holding pond alternatives:

- Holding pond with depth of 1.83 m (6 ft.) (35 m x 17m x 1.83 m)
- Holding pond with depth of 0.92 m (3 ft.) (60 m x 20m x 0.92 m), with grading of the operational site
- Holding pond with depth of 1.83 m, with liner

Note:

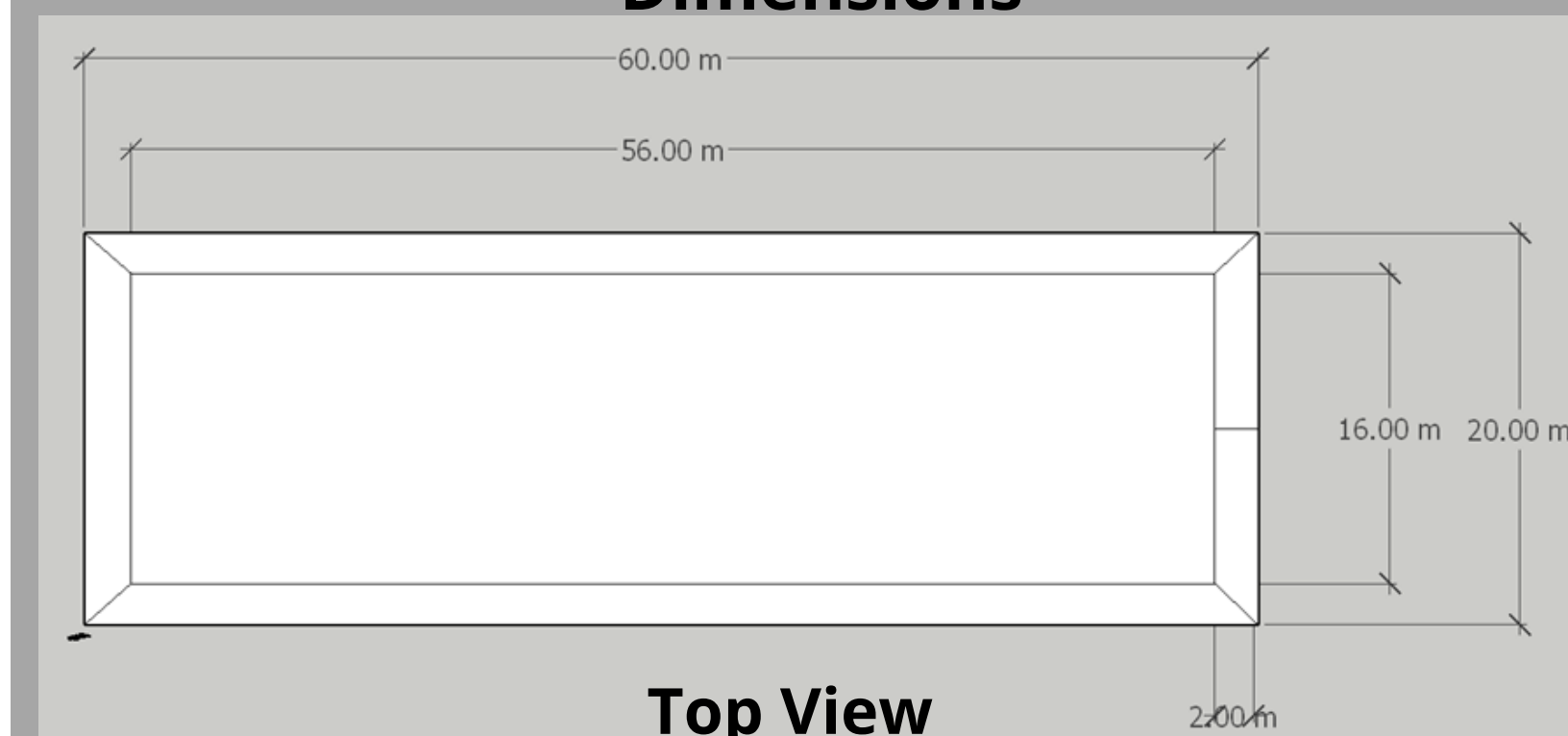
- The design was based on manure runoff of 75 mm from the operational site.
- The operational site was assumed to be an active feedlot



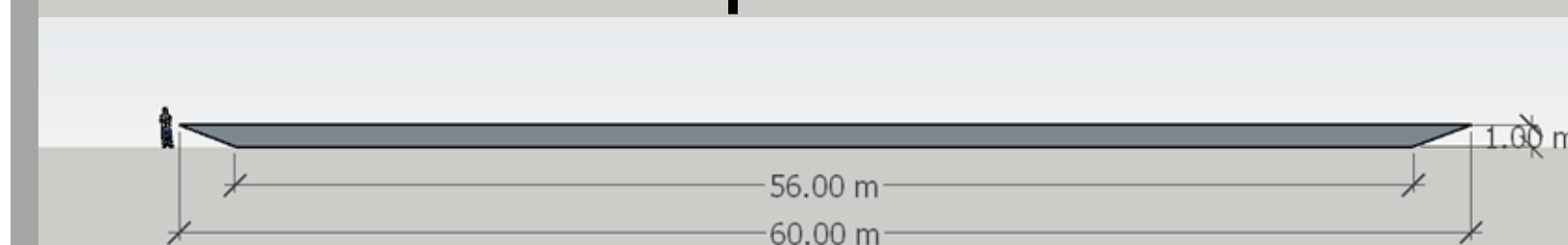
Operational Area
Source: Sask Interactive Mapping
<https://gisappl.saskatchewan.ca/Html5Ext/index.html?viewer=saskinteractive>

Design: Holding Pond & Grading The Operational Area

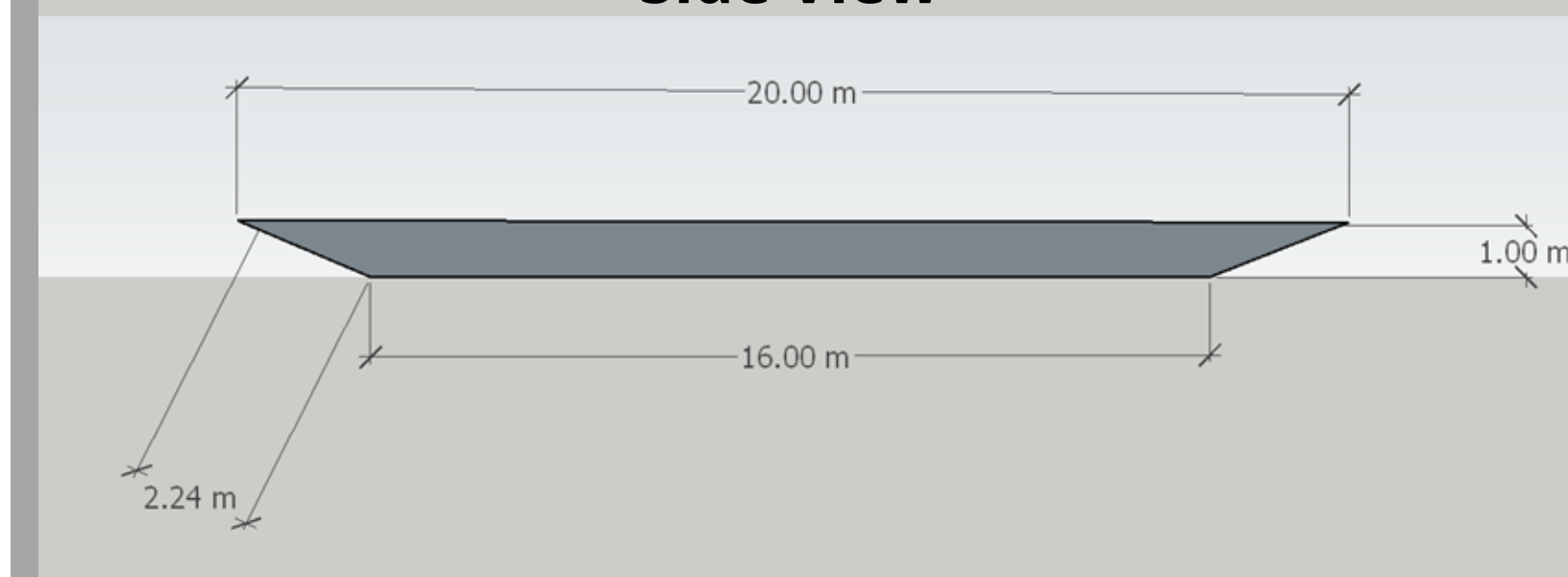
Dimensions



Top View



Side View



Project Cost

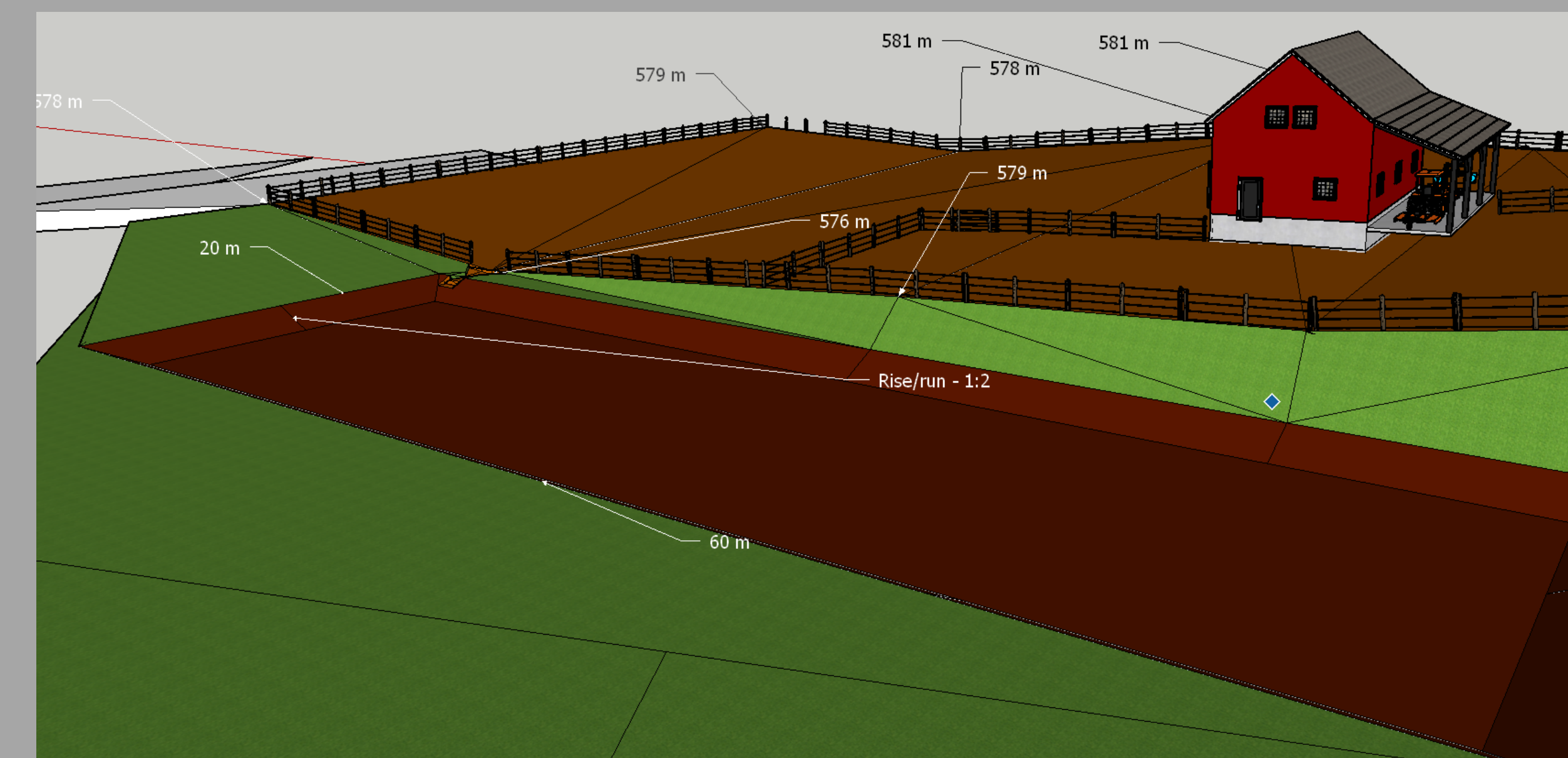
7-Day Rental	
Excavator	3820
Skidsteer	1675
2 Dump Trucks (3 yd ³)	3470
Compactor	1925
Foreman with truck	4742.08
Spotter	2184.00
Total Cost (\$)	17816.08
Unit cost/m ³ (\$/m ³)	9

Dugout Volume: 1045 cubic meter
Water Volume: 601 cubic meter
Volume of Cut: 1258 cubic meter
Volume of Fill: 657 cubic meter

Conclusion

We selected this design alternative because:

- Most effective in terms of collecting surface manure runoff due to larger area of coverage on lower elevation points of the operational site.
- Less maintenance when using drainage systems.
- Shallower depth, which reduces seepage (can be improved with vegetation (i.e. grass) along the slopes).
- Easier management of surface runoff by grading the operational site.



Recommendations:

- Geosynthetic liner may be used depending on the properties of soil material on site.
- Berm is required when building a holding pond above ground surface.
- Operators may seed the pond to grass for holding pond with shallow depth.
- The use of suitable building procedures considerably improves soil performance.
- An engineer will be able to offer building solutions that will assure groundwater safety after a more thorough site examination.