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## Modeling Construction Site Erosion Using GeoWEPP

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## Modeling Construction Site Erosion Using GeoWEPP

### Problem Statement

The Environmental Health and Safety Storm Water Program has used the RUSLE2 model for many years to quantify success by measuring the effectiveness of the ISU campus Storm Water Management Program. RUSLE2 provided estimates of the soil loss prevented by implementing Best Management Practices (BMPs) specified in the Iowa Statewide Urban Design and Specifications for construction sites. ISU reports these estimates to the Iowa Department of Natural Resources each year in the annual report required by the Municipal Separate Storm Sewer System (MS4) permit. With the development of the newer WEPP (water erosion prediction project) model, it is beneficial to update the model used by Environmental Health and Safety as well. WEPP will help ISU stormwater managers visualize the multi-year effects of SUDAS BMPs and predict the benefits of long-term soil management.

### Disciplines

Bioresource and Agricultural Engineering | Industrial Technology

Department of Agricultural and Biosystems Engineering (ABE)

TSM 416 Technology Capstone Project

# Modeling Construction Site Erosion Using GeoWEPP

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**Client:** Business Name, Address, City, State, Zip-code, company website

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## 1 PROBLEM STATEMENT

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The Environmental Health and Safety Storm Water Program has used the RUSLE2 model for many years to quantify success by measuring the effectiveness of the ISU campus Storm Water Management Program. RUSLE2 provided estimates of the soil loss prevented by implementing Best Management Practices (BMPs) specified in the Iowa Statewide Urban Design and Specifications for construction sites. ISU reports these estimates to the Iowa Department of Natural Resources each year in the annual report required by the Municipal Separate Storm Sewer System (MS4) permit. With the development of the newer WEPP (water erosion prediction project) model, it is beneficial to update the model used by Environmental Health and Safety as well. WEPP will help ISU stormwater managers visualize the multi-year effects of SUDAS BMPs and predict the benefits of long-term soil management.

### **Business Case Statement**

Using RUSLE2 has allowed for EH&S to submit soil erosion values to the Iowa Department of Natural Resources for the past decade, but the values have not been analyzed to see if the sites still currently use these DNR mandated values. Geo-spatial Interface for the Water Erosion Prediction Project (GeoWEPP) will allow for the user to receive more specific values and to conduct site analysis per

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construction site on a regular basis rather than an annual one. The purpose of the project is to be able to create an SOP for GeoWEPP along with being able to show EH&S how to maneuver through GeoWEPP being able to have the site parameters inputted in the software. It is problematic that EH&S is unaware if the soil erosion factor they are submitting is too low. As a result, this can inhibit EH&S from implementing soil erosion prevention practices if they are unaware of whether or not there are viable values.

## 2 MAIN OBJECTIVE

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- **Main Objective(s) and Specific Objectives**

The main objective is to teach the Environmental Protection Group if the application of GeoWEPP is worth converting from RUSLE2.

- **Specific objectives include:**

- Learn how to use GeoWEPP
- Input Story County parameters into GeoWEPP
- Create an SOP for EP Group on how to use GeoWEPP
- Obtain viable data for GeoWEPP

- **Rationale**

- The client will be able to use GeoWEPP to manipulate and input values for the SE Recreation Fields
- The client will know whether or not it is worth switching from RUSLE2 to GeoWEPP

- **Project Scope**

- Learn and apply GeoWEPP to develop erosion estimates for a representative construction site (SE Univ. Blvd Recreational Fields.)
- Create a written program installation guide.
- Teach EH&S staff to navigate GeoWEPP software.
- Describe differences between RUSLE2 and WEPP modeling estimates.

## 3 METHODS/APPROACH

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The Environmental Health and Safety, Environmental Protection group, has been using RUSLE2 as a means of measuring the soil erosion on Iowa State's campus projects. This group is now wanting to update this software to GeoWEPP. Additionally, due to this value being reported annually to the Iowa DNR, it is important that this value is as specific as possible. The EH&S Environmental Protection group is unsure about how valuable the results that are currently being obtained and are wanting the values reevaluated. As a result, this estimation can cause ISU to think they are either contributing too much soil erosion to the surrounding ecosystem.

### **Methods/Approach**

#### Reference Material(s)

- *GeoWEPP for ArcGIS 9.x Full Version Manual* by Martin Minkowski, M.A and Dr. Chris Renschler, Ph.D.

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- Research Gate, <https://www.researchgate.net/publication/228907485>
- Science Direct, <https://www.sciencedirect.com/topics/earth-and-planetary-sciences/revise-universal-soil-loss-equation>

**Data collection:**

- My data collection for GEOWEPP was retrieved from IowaGeodata.gov, and the comparison data came from lecture slides from Dr. Kaleita's TSM324 class.

**Skills:**

- User will need to be able to follow an SOP and have basic software skills

**Solutions:**

- The solution for the problem was to create an SOP for GeoWEPP and allow the user to insert their site parameters to get a new soil erosion factor.

**Organization:**

- The organization would be using this on a site-to-site basis.

## 4 RESULTS

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**Results/Deliverables**

- Develop a software installation guide.
- Develop user guide.
- Prepare written report of modeling efforts for ISU's 2019 Annual DNR Stormwater Report
- Develop training materials for continuity.

**Recommendations**

- For construction site analyzation, I would recommend implementing the use of GeoWEPP.

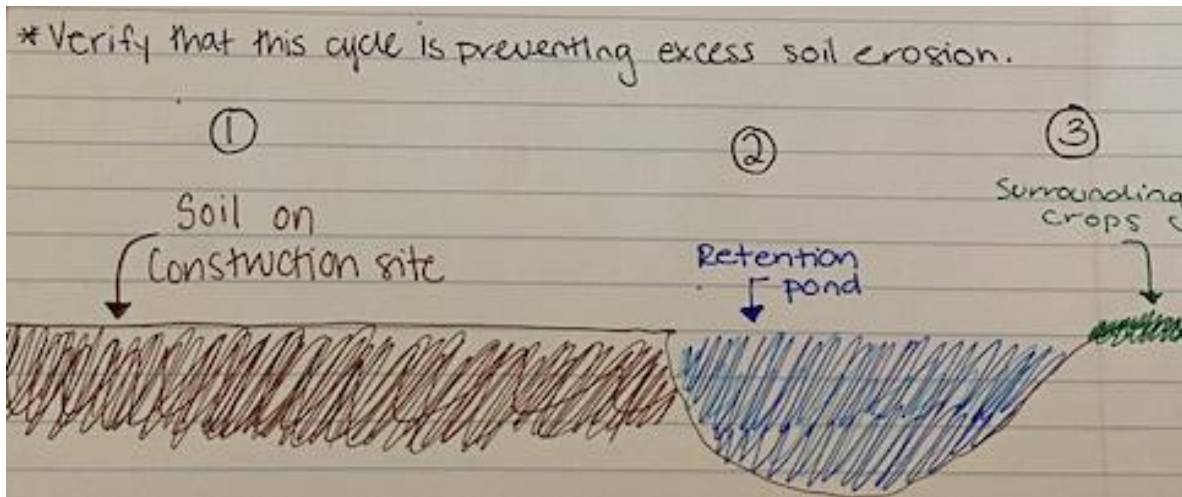
## 5 BROADER OPPORTUNITY STATEMENT

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The project could have potential appeal to the average person because it is an easy-to-follow guide. This is due to the SOP providing steps with both screenshots and descriptions. Anybody that could potentially want to navigate through GeoWEPP could easily do so. This project not only provides users with a guide to navigate GeoWEPP; with consideration of the SOP, it provides soil erosion measurement comparisons for people wanting to compare soil erosion various software. Ultimately, monitoring soil erosion is important to not only the site but also the surrounding environment. Without knowing if there is too much soil erosion, the land could potentially become depleted of soil nutrients. Therefore, the application could potentially be used by construction companies or organizations that manipulate the soil.

## 6 GRAPHICAL ABSTRACT

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## 7 REFERENCES

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- Clay Miller, Environmental Health & Safety, [cmiller@iastate.edu](mailto:cmiller@iastate.edu)
- Dr. Brian Gelder, Agriculture & Biosystems Engineering, [bkgelder@iastate.edu](mailto:bkgelder@iastate.edu)
- Dr. Kaleita, Agricultural & Biosystems Engineering, [akalieta@iastate.edu](mailto:akalieta@iastate.edu)
- GeoWEPP, <http://geowepp.geog.buffalo.edu/>
- Research Gate, <https://www.researchgate.net/publication/228907485>
- Science Direct, <https://www.sciencedirect.com/topics/earth-and-planetary-sciences/revised-universal-soil-loss-equation>
- *GeoWEPP for ArcGIS 9.x Full Version Manual* by Martin Minkowski, M.A and Dr. Chris Renschler, Ph.D.

## 8 APPENDIXES

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*Include any pertinent documents that your client will need to understand your deliverables. (i.e. mechanical drawings/prints, quotes from vendors, flowcharts documenting your processes, etc.) **No page limit to this section.***

- SUDAS; <https://iowasudas.org/>
- Municipal Separate Storm Sewer System (MS4) permit (<https://www.ehs.iastate.edu/sites/default/files/uploads/publications/reports/swar18.pdf>)

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