Appendix A: Historic Landslide Point Update Details

This appendix describes the methods followed to add new landslide locations and/or merge new landslide information with existing landslides inside the City of Portland to the Statewide Landslide Inventory for Oregon (SLIDO) 3.2 dataset. It also details the development and use of a processing script that estimates landslide footprints from location point data.

CONTENTS

MERGING THE CITY OF PORTLAND AND SLIDO HISTORIC LANDSLIDE RECORDS

City of Portland's Landslide Records

Since 1928, records for landslide occurrences in the city of Portland (PDX) have been compiled by various departments and individuals. The Portland Bureau of Development Services scanned paper files and created a database of landslides that included landslide date, location, response information, movement type, and other notes. These records were not geolocated, nor did they record all landslides that have occurred in Portland city limits. The PDX database contains 1,484 records, and DOGAMI SLIDO-3.2 contains 820 historic landslide points within Portland city limits.

The first step in processing these new data was to compare the two datasets, match those landslide records that record the same event, and resolve any duplicate landslide records. The steps are as follows:

1) We located a Portland city landslide record in Google Maps®, using the address information provided.
2) We found this location in the SLIDO-3.2 geodatabase in Esri ArcMap®. And selected nearby SLIDO historic landslide points. We checked if the SLIDO landslides were a) in the same year and b) in the same location.
    i. If there was a match in location and date between the Portland city database and SLIDO, we recorded the corresponding Unique_IDs in a compilation spreadsheet. The information from the PDX landslide records was incorporated into the matched SLIDO record attributes, if they were determined to be the same landslide as SLIDO (same dates, addresses, etc.).
    ii. If there were multiple, potential matches between PDX and SLIDO records, these records needed further investigation. First, the PDX landslides were all digitized in Google Earth as points by using methods in the "Creating PDX Point Dataset" section below. These points were then used as a spatial reference to help determine matches between PDX and SLIDO landslides. If the PDX and SLIDO landslides had enough similar attributes (same dates, addresses, etc.) and had similar spatial locations, they were considered the same landslide. Ambiguous potential matches were flagged and resolved by committee. If they were determined not to be a SLIDO match, they were considered unique landslide points and were digitized by using methods in the "Creating PDX Landslide Location Point Dataset" section below.
    iii. If there was no match, these PDX landslides were determined to be unique landslides, not already in the SLIDO database. These records were digitized in Google Earth by using methods in the "Creating PDX Landslide Location Point Dataset" section below.
    iv. If the location description in the Portland city database was inadequate or non-locatable, the record was highlighted. These records remained in the spreadsheet but were not digitized into the SLIDO database.
    v. If the Portland city record appeared to be a duplicate within the database (i.e., matching place, year, and/or description), the record was highlighted and further investigated. These records were resolved by committee to be either unresolvable or unique and thus were added into the SLIDO database.

Additional Guidelines

- If landslides with similar locations were within the same year and there was a minimal amount of other attribute data, the landslides were generally considered to be the same landslide.
- Landslides with similar locations/dates but with drastically different landslide description data (length, width, depth, etc.) were not considered to be a match and were treated as new landslides.
- Landslides could have had different addresses but basically the same spatial locations (e.g., adjacent streets). This was checked in ArcMap after PDX landslides were digitized.

Creating PDX Landslide Location Point Dataset

PDX landslide data did not have a spatial component; location points needed to be created so that they could be incorporated into SLIDO. Google Earth was used to create spatial locations (placemarks), based on address or location information in the PDX spreadsheet. After using the address data to find the general landslide location in Google Earth, the surrounding terrain was analyzed to determine where exactly to put the placemark (i.e., steeper slopes, etc.). The steps are as follows:

1. In Google Earth, create a new folder in "My Places" (highlight "My Places" and go to Add > Folder)
2. Name the folder based on groupings of landslides (usually by Microsoft Excel® worksheet name).
3. Place a new placemark for each landslide within the new folder. Make sure to name the placemark with the correct UNIQUE_ID from the PDX spreadsheet (this UNIQUE_ID is the primary key that will allow you to join an Excel worksheet with the newly created PDX landslide shapefile).
4. When finished placing all of the landslide location points, right-click on new folder > Save Place As…
5. Save the new folder as a .kmz (.kmz should contain all of the placemarks within the "My Places" folder).

Saving the placemarks data from Google Earth outputs a .kml file. Then transform this to an Esri shapefile (.shp) in ArcMap:

1. In ArcToolbox, open "KML to Layer" tool (Conversion Tools > From KML > KML to Layer) and input the .kmz file that you exported out of Google Earth. The Arc tool will input either .kml or .kmz without effecting the output.
2. Save a new layer (.lyr) file and add it to ArcMap.
3. In ArcMap, right-click on the .lyr file and go to Data > Export Data. Save as a shapefile (.shp). Add the new shapefile to ArcMap.
4. Open the attribute table of the new shapefile. Check to make sure that there is a field that includes the UNIQUE_ID (usually called "Name"). Delete all of the other fields using the "Delete Fields" tool (ArcToolbox > Data Management > Fields > Delete Fields).
5. At this point, the new shapefile will be projected in GCS_WGS_1984. It should be re-projected into NAD_1983_HARN_Oregon_Statewide_Lambert_Feet_Intl.

Formatting Excel Spreadsheet to Match SLIDO Attribute Table

At this point in the process, there is a shapefile representing all new PDX points, with UNIQUE_ID field (called "Name") values and UNIQUE_ID values matching those in the PDX spreadsheet. The shapefile will eventually be joined to the finalized PDX landslide spreadsheet based on this UNIQUE_ID field. This section describes how to format the PDX landslide spreadsheet and get it ready for the join.

PDX to SLIDO Formatting

NOTE: The PDX landslide spreadsheet had to be reformatted to match the fields used in the SLIDO dataset. These reformatting changes were resolved before joining the table to the shapefile. First, the format of the SLIDO geodatabase feature class is outlined. Then, the steps to bring the Excel workbook data into the SLIDO geodatabase is outlined. This section provides detailed formatting information and tools used to join the PDX data into the spatial SLIDO geodatabase.

SLIDO Formatting Specifics

The table below details SLIDO 3.2 attribute field formatting. In order to join new data to the SLIDO dataset, the new data's attribute table must be formatted exactly as described in the chart.

FIELD	TYPE	LENGTH	PRECISION	SCALE	NULL
FID	Object ID				Yes
Shape	Geometry				Yes
OBJECTID_1	Long				Yes
REF_ID_COD	Text	50			Yes
UNIQUE_ID	Text	50			Yes
DATA_SOURC	Text	100			Yes
LOC_METHOD	Text	100			Yes
ORIG_ID	Text	25			Yes
SLIDE_NAME	Text	50			Yes
DATE	Text	25			Yes
LENGTH_ft	Float		0	0	Yes
WIDTH_ft	Float		0	0	Yes
DEPTH_ft	Float		0	0	Yes
SLOPE	Float		0	0	Yes
TYPE_MOVE	Text	50			Yes
MOVE_CLASS	Text	50			Yes
CONTR_FACT	Text	100			Yes
TYPE_MTRL	Text	25			Yes
AREA_ft2	Float		0	0	Yes
VOLUME_ft3	Float		0	0	Yes
DEEP_SHAL	Text	25			Yes
DAMAGES	Text	254			Yes
LOSSES	Text	50			Yes
COMMENTS	Text	254			Yes
Annual_Cos	Float		0	0	Yes
Repair_Cos	Float		0	0	Yes
Year	Short		0		Yes
Date_Range	Text	25			Yes
Reactivati	Text	50			Yes
Month	Text	2			Yes
Day	Text	2			Yes

SLIDO Table to ArcMap Table Idiosyncrasies

A new top row was added to the Excel spreadsheet and populated with a “1” for numeric fields and an “x” for text fields. ArcGIS looks at the first 8–10 values within a field and, if they are blank, none of the field values are be included.

From Esri: “ArcMap scans the first eight rows to determine the field type that should be used. If there are other types of data in those rows, the field is converted to text when the table is in ArcMap.”

Character Limits: *“ArcMap can only read the first 255 characters of a cell. If you have more characters than that, ArcMap converts the field to a BLOB type and you won't be able to read its contents.”*

Table to Table

Joining a table (spreadsheet) directly to a shapefile in ArcMap can be problematic. The method used to join a large table to a large shapefile with minimal errors was to import the table to a File Geodatabase first. The steps below describe this method.

1. Create an empty File Geodatabase in ArcCatalog.
2. In ArcToolbox, open “Table to Table” tool (Conversion Tools > To Geodatabase > Table to Table)
3. Input Rows > the Excel worksheet with new attributes (may need to convert Excel to a .csv first)
4. In “Table to Table” tool, right-click on each of the fields in the Field Map window and re-format each field so that it is similar to the SLIDO attribute table fields (see table in “SLIDO Formatting Specifics” chapter). Make sure that you set NULL = No.

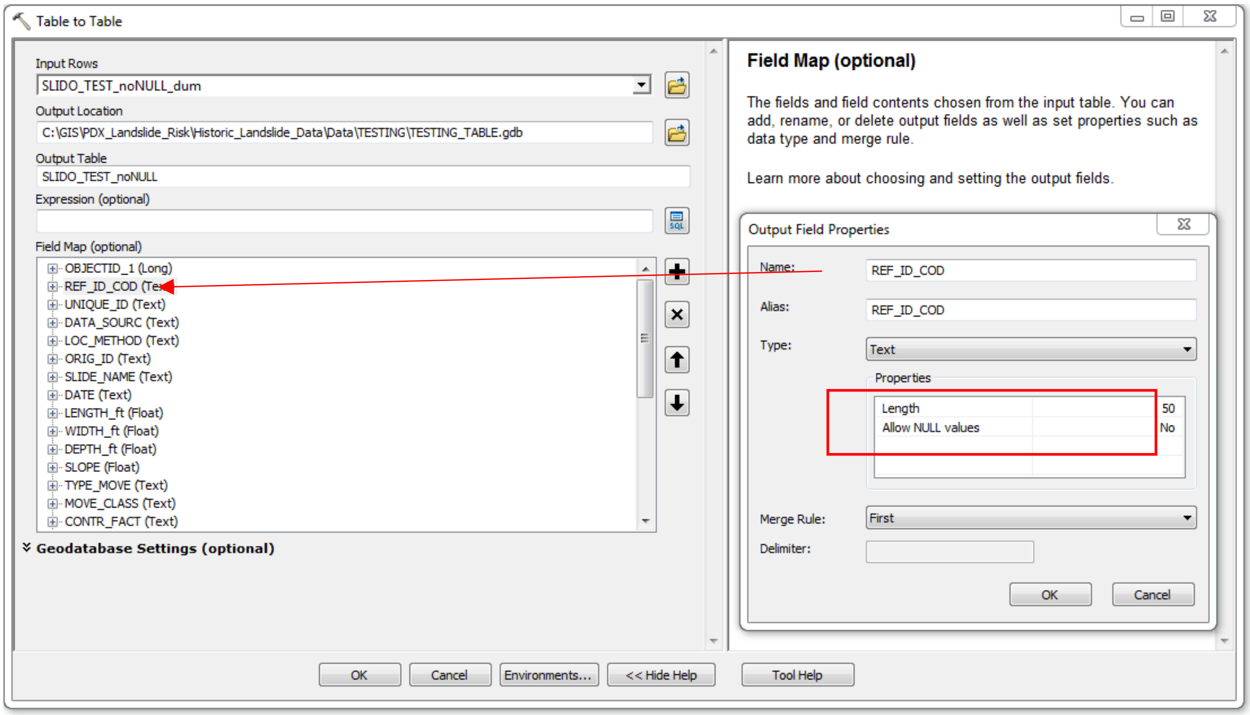

Table to Table

Input Rows: SLIDO_TEST_noNULL_dum

Output Location: C:\GIS\PDX_Landslide_Risk\Historic_Landslide_Data\Data\TESTING\TESTING_TABLE.gdb

Output Table: SLIDO_TEST_noNULL

Expression (optional):

Field Map (optional)

- OBJECTID_1 (Long)
- REF_ID_COD (Te
- UNIQUE_ID (Text)
- DATA_SOURC (Text)
- LOC_METHOD (Text)
- ORIG_ID (Text)
- SLIDE_NAME (Text)
- DATE (Text)
- LENGTH_ft (Float)
- WIDTH_ft (Float)
- DEPTH_ft (Float)
- SLOPE (Float)
- TYPE_MOVE (Text)
- MOVE_CLASS (Text)
- CONTR_FACT (Text)

Geodatabase Settings (optional)

Field Map (optional)

The fields and field contents chosen from the input table. You can add, rename, or delete output fields as well as set properties such as data type and merge rule.

Learn more about choosing and setting the output fields.

Output Field Properties

Name: REF_ID_COD

Alias: REF_ID_COD

Type: Text

Properties

Length	50
Allow NULL values	No

Merge Rule: First

Delimiter:

5. Check the table for data dropouts and compare to the Excel spreadsheet.
6. Output the table into the new File Geodatabase.

Joining Table to Shapefile

After a new table based on the SLIDO-formatted PDX shapefile was created in the File Geodatabase, it was ready to be joined to the PDX landslide shapefile. This is done in ArcMap.

1. Bring the shapefile into ArcMap and right-click on shapefile > Joins and Relates > Join. In the Join Data Window, choose "Join attributes from a table" and "Keep only matching records" in the Join Options.
2. Right-click on the PDX landslide shapefile with the table join and save as new shapefile.
3. **TROUBLESHOOT:** Do multiple checks to the new PDX landslide shapefile. Compare the attribute table to the Excel worksheet to make sure that all of the values are included.

CREATING LANDSLIDE POLYGONS

The exposure analysis relies on landslide polygons overlapping with generalized taxlot values. However, the historic landslide points from the PDX and SLIDO datasets lack polygon extents. In some of the landslide records, the landslide length and width were recorded and this information was used to create estimated landslide polygons. This section explains the tools and steps used to turn landslide points to polygons.

Python Script

Using the Python scripting language, a processing script was designed that creates a separate landslide polygon for each point in the landslide point dataset. These polygons are then merged into one final landslide shapefile. The inputs are the historical landslide point dataset and a DEM. The point shapefile must contain three fields in order to work properly: "LENGTH_ft", "WIDTH_ft", and "OBJECT_ID" (or some type of unique ID).

Assumptions

The script was designed with two assumptions. If these assumptions are not applicable for the scope of the research, don't use the script.

1. Each point in the landslide point dataset represents the top of the landslide.
2. The lowest point in the first (circular) buffer defines the direction of the landslide. This might not be correct, as the terrain within the buffer might lead the landslide to flow in a different direction.

Input Data Needed

The data needed to run the script include the landslide point dataset (.shp) and a DEM (1-m resolution) that covers the extent of the point dataset. Within the attribute table of the point dataset, there must be values for the LENGTH_ft and WIDTH_ft fields. It is possible that additional historical landslide data would have to be modified to conform to the processing script requirements.

How the Script Works

This describes the design of the script and what it does (using one landslide location point as an example).

1. It buffers the landslide location point using the LENGTH_ft value as the "Distance" input in the "Buffer" tool. This creates a circular polygon around the landslide point where the radius is equal to the landslide's attribute LENGTH_ft.
2. Because landslides tend to move downward, the script uses the DEM to determine the lowest elevation cell within the circular buffer and create a point in that location. Now there are two

points, one representing the landslide location and the other representing the lowest elevation at a specific length from the landslide point.

3. Next, it creates a line between those two points.
4. Then it buffers the line using half the value of the WIDTH_ft value as the “Distance” input in the tool.
5. Each of these output polygons is then merged into one final shapefile.

Final Output

The final output of the script is a polygon for each landslide that has the length and width equal to the LENGTH_ft and WIDTH_ft attribute values contained in the attribute table. Each polygon has an OBJECT_ID field with a value that is equal to the landslide point’s UNIQUE_ID.