Summary of Meetings between GICC and NCBEES Representatives on GIS Professional Practice and Its Interface with the Professional Land Surveying Community

Background

The Geographic Information Coordinating Council (GICC) chartered the Working Group for Professional Land Surveying (PLS) and GIS in July 2016 to evaluate concerns about the practice of GIS and its professional boundary with the practice of land surveying. The Working Group met in the subsequent months to discuss the issues experienced by GIS practitioners in the public and private sectors. The use case methodology was adopted to document specific examples of activities that were representative of GIS practice. During those months, a total of 40 use cases were compiled consisting of a description, an initial recommendation of whether the activity required a PLS license or not, and any reference documents that would underpin the discussion. The Working Group evaluated the 40 use cases and then combined some and reduced the total down to 22 use cases for further consideration.

Once this material had been prepared, staff to the GICC contacted the NC Board of Examiners for Engineers and Surveyors (NCBEES) to engage the Board in a discussion about the various issues facing the GIS and PLS communities where professional practice was concerned. With leadership from the Working Group Chair, Bob Brinson, several members of the working group were identified to represent the GICC. They were: Kathryn Clifton John Farley, Alex Rankin, and Kent Rothrock. Andrew Ritter, Executive Director of NCBEES, identified members of the NCBEES Surveying Committee to represent the PLS community. Those representatives were: Mike Benton, John Logsdon, David Pond, Stacey Smith, Andrew Zoutewelle.

The group met starting in September 2017 and convened six times during the next 16 months with a concluding conference call on January 19, 2019. Early meetings focused on obtaining a common understanding of terminology used by the GIS and PLS professions, respectively. For example, “spatial analysis” has a different meaning in the PLS community as compared to the GIS community. The more significant part of the time in meetings focused on a thorough evaluation and discussion of the 22 use cases. Each group provided realistic examples of work activities related to the use case. The use cases are listed below.

UC-1: Other Professional Fields
UC-2: Indoor Positioning for Resource Management
UC-4: Tax Mapping
UC-6: Bald Eagle Tracking
UC-7: Creating and Maintaining Street Centerlines
UC-8a: Digitizing and Attributing Utility Assets
UC-8b: Locating Utility Assets for Design, Engineering, Regulation, or a Legal Purpose
UC-9a: Crowdsourcing Neighborhood Safety
UC-9b: Crowdsourcing for High Water Marks for Flooding
UC-10: Indoor Positioning and Visualization of Buildings
UC-11: Spatial Statistics for Analysis
UC-12: Legislative Support
UC-13: Robot Mapping of Sea Floor
UC-14: Categorical Exclusion
UC-15: Sex Offender Web Map

UC-18a: Road Centerline Inventory and Analysis
UC-18b: Establishing or Verifying Location of Street or Railroad Centerline for Legal or Regulatory Purpose
UC-19: Create DEM in Raster Format from LiDAR Points or Create Contours (Vector) from a DEM or LiDAR Points
UC-20: Create Set of Points (x,y) Representing Manhole Covers Using Orthoimagery as Visual Reference
UC-21: Create Set of Points Representing Corners of a Property
UC-22: Create Set of Points Representing Location of Livestock Operations Using Orthoimagery as Visual Reference
UC-23: Create Inventory of Buildings Located Within Flood Hazard Areas

The remainder of this document conveys the results of each use case discussion. An initial recommendation from the Working Group for PLS and GIS was either confirmed or changed depending on the discussion once a common understanding of the use case was achieved. The final recommendation is also accompanied by a summary of key discussion items. One of the additional outcomes of the discussion was a disclaimer crafted by representatives of the GICC team and the NCBEES team. It is presented at the end of this document.

Summary of Use Case Discussions with NCBEES

UC-1: Other Professional Fields

Description
Six use cases are bundled under this title including: landscape architecture, archaeology, wildlife survey, wildlife tracking with GPS, geology analysis, and forest inventory. These professional fields use GIS as a tool for performing a portion of their work. For example, GIS may be used to analyze wildlife habitat in planning for a wind farm.

Initial Recommendation
Since the professions named have licensing boards, it seems appropriate to discuss the boundaries between GIS and those professions with those other professional boards including: NC Board of Architecture, NC Board of Examiners for Engineers and Surveyors, NC Board of Landscape Architects, NC Board for Licensing of Geologists, NC State Board of Registration for Foresters, and the NC Wildlife Commission.

Summary of Key Discussion Items
Discussion was brief and led to agreement that the GIS community should seek discussion with the licensing boards named.

Final Recommendation
The GICC will seek discussion with the respective boards.

Conditional Elements
None identified.

Reference
NC General Statutes, Chapter 89C-25(1) [architecture and landscape architecture]; NCEES Model Rules (210.25, Sec. B.7)

UC-6: Bald Eagle Tracking with GPS-Capable Satellite Telemetry

Description
A device with GPS capability may be used to track wildlife to identify habitat characteristics. GIS may be used to represent habitat characteristics and interpreted extent. If the purpose is to establish a location(s) relating to property rights, legal proceedings, regulation, or direct protection of safety of the public, PLS would be required.

Initial Recommendation
This activity does not require PLS for most purposes. Disclaimer and metadata are essential to clarify sources and methods and intended use. The GIS product is not intended for and is not suitable for design or engineering.

Summary of Key Discussion Items
Minimal discussion; both groups essentially agreed as use case is stated.

Final Recommendation
This is an activity appropriate for the GIS professional unless a location needs to be established related to property rights, legal proceedings, regulation, or direct protection for public safety.

Conditional Elements
See wording in Final Recommendation.

Reference
NC General Statutes, Chapter 89C-25(7a) [if the safety of the public is directly involved]; 89C-3(6) [definition of the practice of engineering]; 89-C-3(7) [definition of the practice of surveying]

UC-2: Indoor Positioning System for Resource Management

Description
Develop a Wi-Fi network for tracking positions of safety officers at a large airport.

Initial Recommendation
This activity does not require a PLS.

Summary of Key Discussion Items
Minimal discussion.

Final Recommendation
This activity does not require a PLS.

Conditional Elements
None.

Reference
NCEES Model Rules (210.25, Sec. B.6)

UC-10: Indoor Positioning and Visualization for Buildings

Description
A technology firm has been awarded a contract for mapping the inside of three major correctional facilities and two major state universities. The consultant will install all the infrastructure and equipment necessary to establish a real-time monitoring system that will map the interiors of the facilities and then perform real-time mapping of the prisoners and university security staff.

Initial Recommendation
Monitor this evolving technology for a variety of purposes. This warrants discussion including architecture, surveying, and engineering.

Summary of Key Discussion Items
The first distinction that needs to be made is between planning and designing. Applicability of the PLS law depends on the use of the information. If one needs to absolutely locate the columns of the structure, for example, then PLS is needed. If the purpose is simply navigating through the building or managing space in an existing building, then that is possibly just an inventory and no PLS needed.

Final Recommendation
There is interest in taking this use case to the NC Board of Architecture and to the NC Board of Examiners for Engineers and Surveyors. However, given the discussion it could require a license or not.

Conditional Elements
None.

Reference
NCBEES, Signing and Sealing Building Imaging Modeling/Integrated Project Delivery (BIM/IPD) Projects Guidelines

UC-4: Tax Mapping

Description
Taxing jurisdictions use parcel mapping to maintain a parcel inventory for tax purposes. Deeds, recorded plats, and other legal documents are authoritative; features as depicted in the tax parcel inventory are not. This parcel inventory is public record, and as such is available for public use and dissemination. Its use with other layers in a GIS application, or otherwise, dilutes any implied or assumed accuracy, since the taxing jurisdiction does not retain ownership or copyright of the material disseminated.

Cadastre is a representation only. During the GIS/PLS Grandfathering process, this work was not work that qualified an individual for project credit.

Initial Recommendation
This activity does not require PLS. Cadastral data is a spatial representation of authoritative documents. The legal record of real property used for authoritative purposes is the surveyed plat map.

Summary of Key Discussion Items
Minimal discussion.

Final Recommendation
This is a GIS activity, not requiring a PLS. The group encourages jurisdictions to emphasize that tax maps are not surveys.

Conditional Elements
None.

Reference

NCEES Model Rules (210.25, Sec B.3)

UC-7: Creating and Maintaining Street Centerlines

Description
The purpose of this activity is to represent public and private roads as an inventory and a network of connected roadways. Sources may include products of surveying (e.g., orthoimagery sealed by a photogrammetrist) or locations from an instrument that has the manufacturer's recommended parameters and use, and/or in reference to other geospatial data such as cadastral.

Initial Recommendation
PLS is not required where it is not intended to indicate the precise location of fixed works. Disclaimer and metadata are essential to clarify sources and methods and intended use. GIS product is not intended for and is not suitable for design or engineering.

Summary of Key Discussion Items
Zoning at the local level often assumes a distance from the street centerline (e.g., within 200 feet of the centerline) which would make the exact location important. NCBEES stated that creation of street centerlines needs PLS but just showing it on a map does not. To clarify, it appears that creating for representation rather than for a legal or property delineation purpose does not require a PLS. However, the GIS professional must consider the Conditional Elements in determining whether the project falls under UC-7 or UC-18b.

Final Recommendation
The GIS professional can represent street centerlines on a map as long as precise location and a specific accuracy is not claimed.

Conditional Elements
A PLS is required if a street centerline is used for:

a) Engineering Design (Street Design and Construction Utility Layout)
b) Defining Boundaries (Lot Lines, Zoning Limits)
c) Establishing Legal Rights (Set-Backs, Rights-of-Way)

Reference
NCEES Model Rules (210.30, Sec B.2)

UC-18a: Road Centerline Inventory and Analysis

Description
This activity involves the use of a centerline inventory as reference for highway planning, economic impact analysis, vehicle routing, road closings, and similar purposes. The difference between this use case and UC-7 is its purpose for general planning and macro-level analysis, not precision.

Initial Recommendation
This use of data involves representation and interpretation for transportation planning and analysis using GIS. This does not require PLS.

Summary of Key Discussion Items
General agreement that this does not require a PLS. One example offered was the calculation of mileages using GIS to evaluate the boundaries of fire districts to determine who serves which district.

Final Recommendation
This is a GIS activity that does not require a PLS.

Conditional Elements
None.

Reference
NCEES Model Rules (210.25, Sec. B first paragraph)

UC-18b: Establishing or Verifying Location of a Street or Railroad Centerline for Legal or Regulatory Purposes

Description
Measure and establish a right-of-way from a centerline (road or rail) in support of a land transaction.

Initial Recommendation
This activity requires a PLS.

Summary of Key Discussion Items
There was full agreement with minimal discussion.

Final Recommendation
This activity requires a PLS.

Conditional Elements
None.

Reference
NCEES Model Rules (210.25, Sec. A)

UC-8a: Digitizing and Attributing Utility Assets

Description
Create a representation of a water line by digitizing from as-built drawings. Examples include adding new water and sewer lines to an existing dataset or digitizing fire hydrants.

Initial Recommendation
This is GIS asset inventory and does not require a PLS.

Summary of Key Discussion Items
A determination on this use case depends on the use of the data as a planning tool versus a management tool or for design where accuracy is important. NCBEES stated that the Board has seen situations that required putting datasets together from different sources and levels of accuracy. One example was outlined where locations of manhole covers are needed for mowing and maintenance purposes, not a precise location in simplest terms but it could lead to need for greater precision if mowing area starts to occur near an easement which could involve property rights and other legal matters which would require a PLS. Another example cited is the need for the State Fire Marshal to have the precise location of fire hydrants for insurance purposes, thereby requiring a PLS. Digitizing fire hydrants for an inventory purpose does not require a PLS.

Final Recommendation
The need for a PLS depends on the use of the data when it is collected. Disclaimers could be a key to alerting potential uses that require legal interpretation.

Conditional Elements
The use of the collected data is important for this use case.

Reference
NCEES Model Rules (210.25, Sec B.2 & B.6)

UC-8b: Locating Utility Assets for Design, Engineering, Regulation, or a Legal Purpose

Description
Establish the location and/or elevation of a facility in the field and verify the accuracy. An example is the State Fire Marshall's need for locating fire hydrants.

Initial Recommendation
This activity requires a PLS.

Summary of Key Discussion Items
There was full agreement with minimal discussion.

Final Recommendation
This activity requires a PLS.

Conditional Elements
None.

Reference
NC General Statutes, Chapter 89C-(3)(7) [definition of practice of land surveying]; NCEES Model Rules (210.25, Sec. A)

UC-9a: Crowdsourcing Neighborhood Safety

Description
This activity could involve several crowdsourcing situations such as collecting locations submitted from or collected using mobile devices of vehicle drivers to identify traffic slow-downs or information about missing street signs submitted by the public.

Initial Recommendation
This is a GIS activity not requiring a PLS.

Summary of Key Discussion Items
This is an inventory type of activity.

Final Recommendation
This activity does not require a PLS.

Conditional Elements
None.

Reference
NCEES Model Rules (210.25, Sec. B.1.e)

UC-9b: Crowdsourcing for High Water Marks from Flooding

Description
Citizens and/or local governments indicate high water marks for locations using mobile devices and a geospatial crowdsourcing application. A PLS uses the data as a source to perform field verification of flood height measurements.

Initial Recommendation
GIS may be applied for crowdsourcing information. PLS would be required to verify high water marks to a stated level of accuracy.

Summary of Key Discussion Items
Measurement of high water marks with precision is needed because it could ultimately have an impact on flood insurance determination for those areas.

Final Recommendation
PLS is needed to verify accurate flood height; otherwise the crowdsourcing information is a GIS activity.

Conditional Elements
None other than what is stated above.

Reference
NCEES Model Rules (210.25, Sec. B.6)

UC-11: Spatial Statistics for Analysis

Description
The GIS professional uses geospatial statistical analysis to represent patterns, predictions, probability, and level of confidence. Such an analysis is not used to fix a location but rather to present information.

Initial Recommendation
This is a GIS activity, not requiring a PLS.

Summary of Key Discussion Items
Spatial analysis is often used to show concentrations of phenomena; examples include traffic engineering, crime mapping, viewshed analysis, and new store location analysis. This serves planning purposes; the data gathering and assembling process is GIS. When engineering design becomes the next step, then it needs to be under the purview of a PLS and/or engineer. It is difficult to state emphatically for all cases whether the activity requires a PLS/engineer. NCBEES believes that conceptual planning is often the purpose of GIS. Introducing the terms probability and level of confidence are problematic in their view because they could lead to a statement of accuracy.

Final Recommendation
This is a GIS activity if it is for an inventory purpose. Otherwise, it could require a PLS if the analysis becomes specific.

Conditional Elements
Like other use cases, the intended use of the analysis could drive whether a PLS is required.

Reference
NCEES Model Rules (210.25, Sec. B first paragraph)

UC-12: Legislative Support

Description
Three use cases are bundled under this use case title: attorney exhibits for non-compete agreement enforcement, legislative support, and redistricting. The latter two cases represent the bulk of requests for the use of GIS. Maps can be very helpful communication tools. GIS can also be used to do analysis when formulating policy. A simple example might be depicting buffer zones around state parks when performing a high-level review of some infrastructure proposal. Requests are fielded from legislators who are weighing proposed policies or trying to better understand an issue of concern. Redistricting is a specific activity to determine legislative and congressional boundaries based on census boundaries, population, and other data.

Initial Recommendation
Responding to these requests should consider the purpose and requirements on a case-by-case basis.

Summary of Key Discussion Items
A wide range of examples are involved in this case. For enforcement actions, a PLS may be required if an exact determination is needed. Redistricting is built from census block information which do not have a precise accuracy.

Final Recommendation
The purpose and the requirements for responding to the support request are key and could lead to either a GIS activity or a PLS requirement.

Conditional Elements
None.

Reference
NCEES Model Rules (210.25, Sec. B, first paragraph)
http://us.practicallaw.com/w-000-2726

UC-13: Robot Mapping of Sea Floor

Description

This activity could involve mapping of the area on the sea floor for a variety of purposes.

Initial Recommendation

None.

Summary of Key Discussion Items
There is no distinction between mapping the sea floor or dry land. Rules/statutes relating to surveying apply to both. Data could be collected for purposes including recreational, archaeological, educational, and natural resource. These may be inventory in nature.

Final Recommendation

Mapping of the sea floor is a PLS activity unless the data is collected for an inventory purpose.

Conditional Elements

None.

UC-14: Categorical Exclusion

Description
This case involves the preparation of an environmental "Categorical Exclusion (CE)" document as part of the National Environmental Policy Act. A Categorical Exclusion highlights certain aspects of a project or categories which do not individually or cumulatively have a significant effect on the human or natural environment. This case highlights the CE documentation of a proposed transportation/transit project.

Initial Recommendation
Categorical Exclusion is only applicable to Environmental Impact Assessments and is sealed by a licensed professional engineer. Where an engineer finds negligible impact, planning work using GIS may be excluded from PLS requirements where no land features need to be located in the field.

Summary of Key Discussion Items
There was full agreement with minimal discussion.

Final Recommendation
This is a GIS activity, not requiring a PLS.

Conditional Elements
None.

Reference
https://www.epa.gov/nepa/national-environmental-policy-act-review-process#CATEX

UC-15: Sex Offender Web Map

Description
A County Correctional Department contracts with a GIS Consultant to create a publicly facing webmap for the public's use. The public will be able to search for and find an address location and see registered sex offenders in the surrounding area. The GIS Consultant uses the Sex Offender Database as a source of addresses and geocodes the offender locations. The basemap is created using existing County basemap data such as parcels and roads. When you click on a point associated with an offender, a pop-up box appears to show the picture and category of the offense. Refer to GS 14-208.16 and GS 14-208.18 for more information.

Initial Recommendation
The data used is provided by the County, and the knowledge, skills and abilities needed to perform the project are technology skills. This type of work is GIS inventory in nature and should not require board licensure.

Summary of Key Discussion Items
This use case represents a GIS inventory of areas of concern. NCBEES agreed unless there is a need to measure exactly where the offender is located in relation to a school or other facility that is covered under the law. A disclaimer is needed that states the map was not created by a surveyor and no statement of accuracy can be claimed.

Final Recommendation
If an accurate determination must be made it requires a PLS.

Conditional Elements
The view of the recommendation is dependent on whether a government entity or a private company performs the work and whether the distance to an identified location is critical.

Reference
NCEES Model Rules (210.25, Sec. B.6)

UC-19: Create Digital Elevation Model (DEM) in Raster Format from LiDAR Points or Create Contours (Vector) from a DEM or from LiDAR Points

Description
Desktop tools enable creation of DEM from LiDAR points or creation of contours from either a DEM or LiDAR points. The quality and stated accuracy of a DEM depends on an understanding of the source LiDAR points. The stated accuracy and validity of a set of contours depends on an understanding of the source DEM/LiDAR.

Initial Recommendation
More consideration needed: (1) recommend PLS for creation of DEM and contours and/or (2) recommend practices for creation by non-PLS requires documentation including a proper disclaimer, as described in NCEES Model Rules.

Summary of Key Discussion Items
The Working Group for PLS and GIS provided an example of a landowner who wants a private GIS company to produce a map of a 1,000-acre property with aerial photography, contours, parcels, and roads for conceptual planning purposes.

GIS representatives in the Working Group expressed the position that, if a GIS professional is simply creating a map to show information based on a sealed LiDAR product, that should be acceptable. Further, the use of the DEM for conceptual planning purposes should also be acceptable with the proper disclaimers and reference to the source of the original (sealed) data.

The NCBEES representatives expressed a concern that the manipulation of raw LiDAR information to create either a DEM or contour lines involves an understanding of the underlying data and the application of professional judgment, requiring a PLS. Specifically, modifying electronic data, including the creation of break lines, falls within the definition of the "practice of land surveying" in GS 89C-3(7)(a)(7), which states:

> "Creating, preparing, or modifying electronic or computerized data, including land information systems and geographic information systems relative to the performance of the practice of land surveying."

The group debated this issue extensively before reaching a consensus.

Final Recommendation
The creation of a digital elevation model or contour lines from LiDAR data points requires a PLS. Nothing in this recommendation is intended to limit a GIS professional from importing DEM or contour lines from either (i) a map or report signed and sealed by a PLS, or (ii) contour lines or DEMs that are publicly available (e.g., from NC OneMap).

Conditional Elements
None.

Reference
NCEES Model Rules (210.25, Sec A.1 and B.2); NC General Statutes, Chapter 89C-3 (7)(a)(7)

UC-20: Create a Set of Points (x,y) Representing Manhole Covers Using Orthoimagery as a Visual Reference

Description
Orthoimagery is a sealed photogrammetric source to use as reference for an inventory of assets. This method is described in the GNSS data collection standard adopted by the GICC.

Initial Recommendation
This is a GIS inventory activity using a photogrammetric source for non-design, non-engineering purposes.

Summary of Key Discussion Items
The group agreed that collecting for an inventory purpose using an orthoimagery source is a GIS activity but NCBEES questioned a potential alternative method of collecting manhole covers in the field using GPS. The group reflected on the earlier discussion about UC-8a (Digitizing and Attributing Utility Assets) and the fact that whether a PLS is required depends on the intended use of the data.

Final Recommendation
This is a GIS inventory activity unless the intended use reaches beyond the inventory purpose.

Conditional Elements
Cited above.

Reference
Geographic Information Coordinating Council, NC Statewide Global Navigation Satellite System (GNSS) Data Collection and Documentation Standards (Part 6); NCEES Model Rules (210.25, Sec B.2 and B.6)

UC-21: Create a Set of Points Representing the Corners of a Property

Description
The corners of a property need to be determined to establish property rights and/or for legal proceedings. Precision and accuracy are important in this process.

Initial Recommendation
This activity requires a PLS.

Summary of Key Discussion Items
There was full agreement with minimal discussion.

Final Recommendation
This activity requires a PLS.

Conditional Elements
None.

Reference
NC General Statutes, Chapter 89C-(3)(7) [definition of practice of land surveying]; NCEES Model Rules (210.25, Sec. A.1)

UC-22: Create a Set of Points Representing the Location of Livestock Operations (Structures and /or Driveway Access) Using Orthoimagery as a Visual Reference

Description
This activity may include determining a livestock quarantine area in an emergency for which approximate locations of livestock operations are valuable. Orthoimagery provides a visual reference.

Initial Recommendation
This is a GIS activity, not requiring a PLS.

Summary of Key Discussion Items
There was full agreement with minimal discussion.

Final Recommendation
This is a GIS activity if it is for an inventory purpose.

Conditional Elements
None.

Reference

Geographic Information Coordinating Council, NC Statewide Global Navigation Satellite System (GNSS) Data Collection and Documentation Standards (Part 6); NCEES Model Rules (210.25, Sec B.2 and B.6)

UC-23: Create an Inventory of Buildings Located Within Flood Hazard Areas

Description
The NC Floodplain Mapping Program seals Digital Flood Insurance Rate Maps (DFIRM). These maps may be used as a source in combination with geospatial representations of building locations to create a GIS inventory of buildings and flood risk. Building locations may be created with reference to orthoimagery or LiDAR. A property owner may engage a surveyor to appeal a determination that a property is in a flood hazard area.

Initial Recommendation
This is a GIS activity, not requiring a PLS.

Summary of Key Discussion Items
The group discussed and agreed that a conceptual look at this data and creation of a map is a GIS activity, but a surveyor is needed to generate a product to be used in a legal proceeding.

Final Recommendation
This is a GIS activity if it is for an inventory purpose.

Conditional Elements
None.

Reference
Geographic Information Coordinating Council, NC Statewide Global Navigation Satellite System (GNSS) Data Collection and Documentation Standards (Part 6); NCEES Model Rules (210.25, Sec B.2 and B.6)

Disclaimer

This [map] [report] was prepared for the purpose of [(inventory of real property); (initial project planning); etc.] and should not be used for any other purpose. The information contained herein was compiled from previously georeferenced data and/or public records, and these primary sources must be consulted for verification of the information contained in this [map] [report]. This [map] [report] is not intended to indicate the authoritative location of property boundaries, shape or contour of the earth, or fixed works. This [map] [report] is not a survey and does not meet the minimum accuracy standards of a Land Information System/Geographic Information System Survey in North Carolina (21 NCAC 56.1608).