Texas State University Campus Basemap Geodatabase Development Project: Phase 1

Proposal Submission to the Texas State Facilities Department

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Filed: February 24, 2026

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1. Introduction

1.1 Summary

Texas State University is a public university located in San Marcos, Texas. With enrollment surpassing 44,000 students in Fall 2025, the number of incoming students continues to grow year after year. Students new to campus currently rely on an outsourced interactive map built on third-party GIS data. This data contains obsolete attributes and shapefiles, inconsistencies in naming conventions, and topological errors.

This semester, Old Main Geospatial Solutions will initiate the first phase of transitioning to a high quality, in-house interactive map that gives the university full control of geospatial data. This first phase will involve our team cleaning and standardizing existing datasets. Data will be polished into a professional geodatabase ready for implementation in building a new interactive campus map.

1.2 Purpose

For this geodatabase to be "app-ready" and implementable in building the new interactive map, our first step is to focus on reviewing the existing data and develop a new schema that will support future map analysis and cartographic efforts. We will then begin cleaning and standardizing existing data by fixing topological errors, removing obsolete fields and attributes, and creating standardized naming conventions for the attributes of existing shapefiles. Once these tasks are complete, our team will begin developing a network dataset, converting sidewalk and road polygon layers into linear datasets. Campus buildings will be linked to this new network dataset, building a foundation for future network analysis.

1.3 Scope

This project will cover the entirety of the main campus area of Texas State University, including both city owned and university owned roads. The study area is located between Old Ranch Road 12 and Uhland Road, northwest of Interstate 35 (Fig. 1). Our team will work on this project from February 2026 to April 2026, with all deliverables executed and given to the client no later than April 24, 2026.

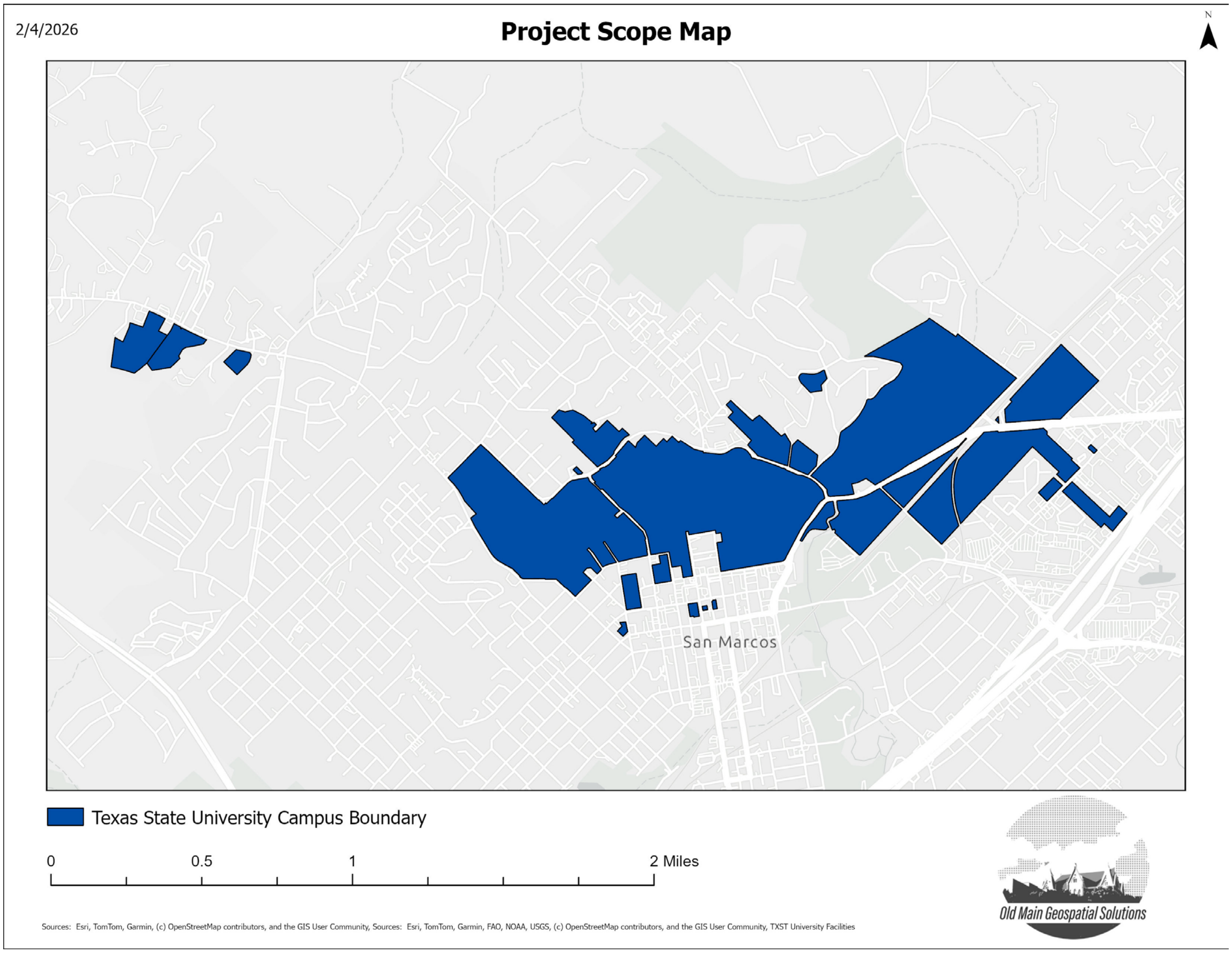

Figure 1: Study area scope for the first phase of the interactive campus map of Texas State University.

2. Literature Review

2.1 Geodatabase Design and Data Standardization

A robust and well-organized geodatabase that uses foundational vector data model concepts and uniform data standardization is the first major building block of geospatial analysis. Time spent on geodatabase construction and data standardization are crucial for success in using GIS for analysis (Cao et al. 2024). A geodatabase must be structured into categories such that the GIS program can recognize different attributes of the data and use techniques within the software to recognize patterns between data points.

In *Database Construction of GIS-Based Hydropower Station Safety Monitoring Platform*, Cao et al. brings attention to the spatial data model. The model draws relationships between groups of vector data points, and lines and polygons, and lines and polygons (along with their respective attributes) as the central database construction model upon which geospatial analysis rests ng with their respective attributes, as the centra and lines and polygons (along with their respective attributes) as the central database construction model upon which geospatial analysis rests abase construction model upon which geospatial analysis resides. Each data point is categorized into classes based on its relationship, then further categorized into smaller classes called topology. This structure allows for correct analysis between objects in the GIS software and sets the stage for further analysis. Analysis applications include navigational analysis, using topology, to find optimal driving paths for delivery vehicles (Hsu et al 2024).

2.2 Foundational GIS Data for Campus Map Wayfinding

Currently, existing research on university campus wayfinding suggests that existing signage and included information is not sufficient for proper wayfinding. Additional information such as elevation gain, surface changes, and improved visual signage is missing when it comes to the use of wayfinding applications (Chen 2024, p.334). Third-party applications such as Google Maps and Maze Maps take advantage of this supplemental information when building their wayfinding networks. Our team aims to utilize additional attributes for wayfinding on the new campus interactive map.

One crucial additional attribute is ADA-compliant entrances to buildings and/or facilities. Accounting for people with mobility disabilities is a priority for our wayfinding efforts as it is fundamental to accessibility. For many, being able to effectively find a destination gives a sense of independence, as some may need assistance if certain precautions are not considered. What may be a mundane task for some may be a challenge for those with certain disabilities, and leveling the playing field for these people is vital when it comes to providing equitable accessibility (Chen 2024, p.331).

Additionally, it is important to consider why students take the routes they take when commuting through campus. Research has shown that students often take less optimized routes because they are unfamiliar with their surroundings or simply don't know a better route. Since they lack spatial familiarity, it suppresses the ability to gain spatial knowledge, while also hindering their ability to develop a sense of space (Chan 2024, p. 9). Sense of place is defined as "a composite of conscious and subconscious perceptions, emotions and attachments to a location —on daily route decisions" (Chan 2024, p. 1). When considering attributes to add or emphasize the purpose of wayfinding, we should consider places that give students that sense of place. These areas are often associated with increased socialization on campus, such as libraries, cafes, and study areas (Chan 2024, p.9). Additionally, areas with high quality walking environments that shelter students from inclement weather, or wider pathways to allow for more foot traffic are strong examples.

2.3 Routing and Accessibility of Pedestrian Networks

With proper pedestrian infrastructure and networking in certain communities, it is far more likely for citizens, regardless of medical condition or disability, to safely commute on bike or foot to connected locations while also increasing physical health and wellness. As San Marcos and Texas State University campus continue to grow, the importance of pedestrian network analyses is being emphasized. With this increased emphasis as campus expands, it is important to maintain strict ADA compliance with the pedestrian network to ensure safety and inclusivity in movement around campus.

To develop a robust pedestrian network that is ADA compliant and ensures safety and inclusivity, it is important to include detailed data about the features of walking paths, crosswalks, curbs, hazards, etc. However, this can be hindered by pavement road networks. One of the biggest issues with pedestrian networking is lack of prioritization and recognition of certain features. For years, researchers have been using road networks as a substitute for walking paths, but roads are not interchangeable with foot-traffic paths. (E.R. Hennessy and C. Ai, 2023). Road networks typically do not account for many pedestrian walkways, nor do they account for the features of these walkways. Although road networks may often produce a framework for connectivity analysis, it does not capture enough information about pedestrian networks. (Zhang and Zhang, 2019).

In *A Comparative Analysis of Pedestrian Network Connectivity and Accessibility Using Network Approximation,* Hennesy and Ai introduced a Pedestrian Network Approximation Method, which mapped out walking routes, curb ramp locations, centerlines, and Traffic Analysis Zones. The study also examined how curb ramp data is used to measure ADA compliance build route models for those with disabilities/mobility limitations. Hennesy and Ai tested four cities: Boston, Cambridge, Seattle, and Tacoma. Due to the geographical differences of the four study locations, street designs, transportation layouts, and urban planning differed from each other, providing some variation between study areas. As a result, it was proven that Seattle and Tacoma had higher connectivity scores, as well as higher ADA compliance scores. For Boston and Cambridge, the ADA compliance scores were lower partially because of older infrastructure along the East Coast. (E.R. Hennesy and C. Ai, 2023). In addition to these studies, it was also reported that 48% of sidewalks in the United States are not ADA compliant. (Y. Eisenberg, et al, 2020).

Together, these studies have highlighted the absence of proper pedestrian networking in the United States, and gaps in ADA compliance. Lack of helpful pedestrian networking leads to increased hazards and urban immobility. It is crucial to recognize these deficiencies for the betterment of our infrastructure, and ensure we follow ADA standards, allowing us to commute safely and efficiently.

3. Data

Figure 2 below contains our master data list. All spatial attributes are accurate and were heavily referenced. The contained data requires standardization and organization. Listed attributes are not final, as unnecessary attributes will be removed, and additional entity attributes may be created if deemed helpful to the final deliverable. All data provided by Texas State

University – Facilities Management. Data is accessible and stored/manipulated via ArcGIS Pro and ArcGIS Online.

Entity	Attributes	Spatial Obje	Status	Source	Unit	Year
Satellite image of campus	N/A, image file	N/A	Available	Texas State University	N/A	2025
Building footprints	NUMBER, NAME, FINISH_FLO, CHILL_PLAN, CHILL_PIPE, CHILL_PL_1, STEAM_PLAN, STEAM_PIPE, STEAM_PI_1, Shutdown, ELECTRICAL, TYPE, BULDING_G, NAME_ABBRE, RECYCLE, DATE-DEMOL, AREA-NUMBE, PAPERSCH, ADA_YEAR, HEIGHT, CRITICAL_E, TOWER, , ZONE, GunCarry, SanS_Zone, SAAs, CAA, HistoricMa, HISTORICAL, STRUCT, Z_Min, Shape_Leng, Shape_Area, YEAR_BUILT, GlobalID, last_edite, last_edi_1,	Polygon	Available	Texas State University	US square feet	2025
Green zones	IRRIGATED,Type,Maintained,POLY_AREA,Shape_Leng,Shape_Area	Polygon	Available	Texas State University	US square feet	2025
Parking lot area	Join_Count,TARGET_,ID,LOT_,Location,CENTROID_X,CENTROID_Y,Shape_Leng,Shape_Area, ZONE,Shape_Le_1,Shape_Ar_1	Polygon	Available	Texas State University	US square feet	2025
University-owned roads	ID,NAME,PROPERTY_N,Shape_Leng,Shape_Area	Polygon	Available	Texas State University	US square feet	2025
Sidewalks	OBJECT, HAZARD, Proposed, POLY_AREA, Shape Length, Shape Area	Polygon	Available	Texas State University	US square feet	2025
Path and utilities map	Handle,EntLinetyp,Shape_Leng,Shape_Le_1	PolylineZM	Available	Texas State University	US feet	2025
Sports field markings	Entity,Handle, EntLinetyp,Shape_Leng,Shape_Length	PolylineZM	Available	Texas State University	US feet	2025
Parking stripe markings	Entity,Handle,Shape_Leng	PolylineZM	Available	Texas State University	US feet	2025
Handicap parking spots		Point	Available	Texas State University	N/A	2025
Crosswalks	ID,ASSOCIATED,LOCATION_D,GlobalID,created_us,created_da,last_edite,last_edi_1,REGION,Field	PointZM	Available	Texas State University	N/A	2025
Txst property boundary	Shape_Leng,Shape_Area,Area_Acres	N/A	Available	Texas State University	N/A	2025

Figure 2: Master data list for the Campus Basemap Project, highlighting the layers and their corresponding attributes, sources, measurement units, spatial object type, and year created.

4. Methodology

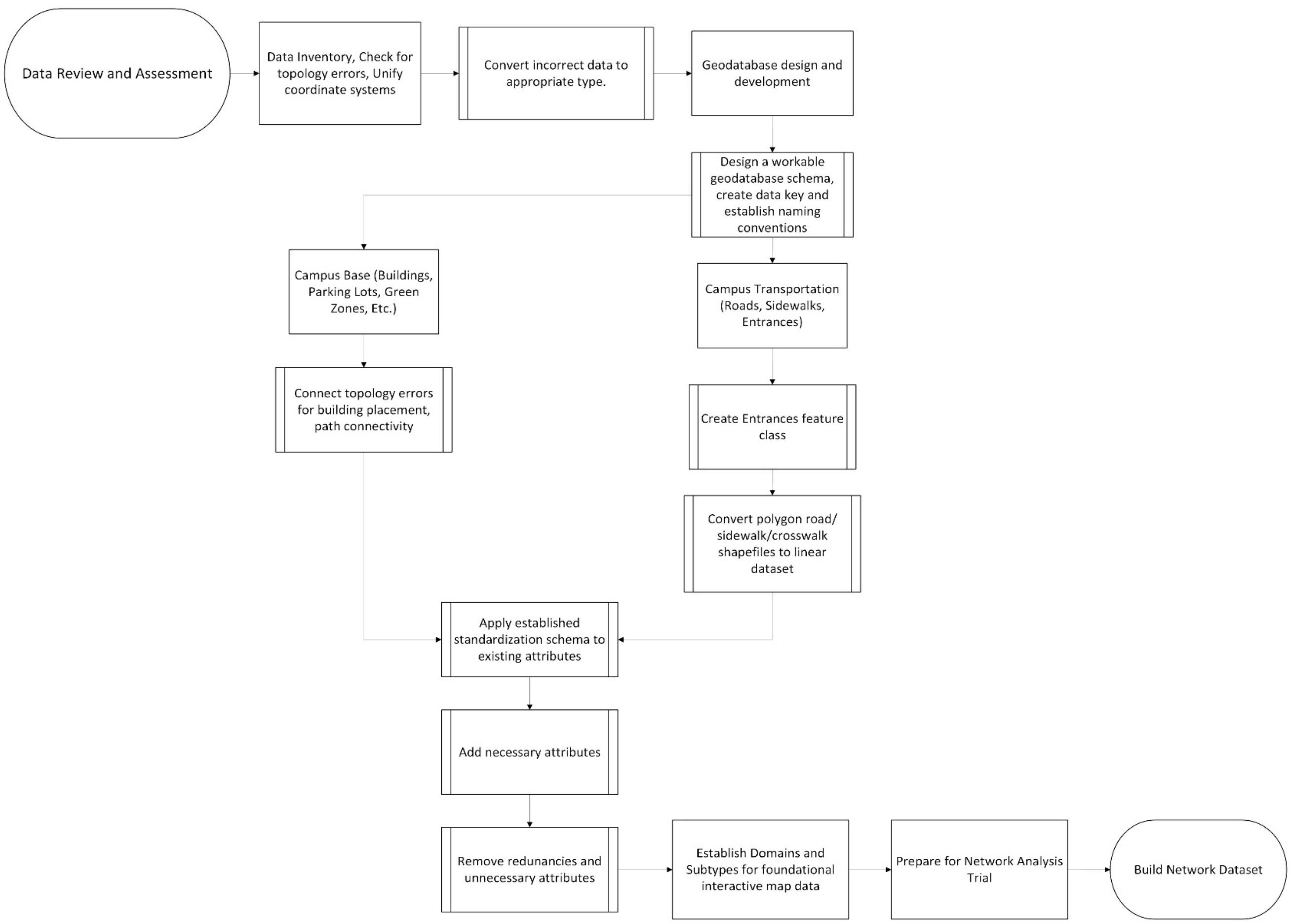

Figure 3. Flowchart detailing this project's methodology, beginning with data review and assessment and finishing with a complete network dataset.

The goal of this project is to transform a provided dataset and turn it into a standardized dataset and organized geodatabase suitable for network analysis and future GIS projects.

4.1 Data Review and Assessment

To begin with the geodatabase design, we will first take inventory of our data. As data is the backbone of this project, we will assess its integrity and ensure that each piece has a unified coordinate system (NAD 1983), the correct data type, and that there are no topological errors. The side_walks layer and roads layer are both polygon data and must be converted into line vectors with all breaks in the topology corrected using the Edit function in ArcGIS Pro. We will utilize the txst_DEM_FullExtent.tif file to reference satellite imagery for correct topology locations. We will also create a new feature class, Entrances, depicting the entrances to all campus buildings as vector point locations, using a reference image to locate them.

4.2 Geodatabase Design and Development

The geodatabase design and development phase consists of organizing our processed data into two spatially related feature datasets. The first, Campus_Base, will consist of the building_footprints polygon layer, new side_walks line layer, main_campus_property_boundary polygon layer, txst_green_zones layer and the parking_surface polygon layer. The second feature dataset, Campus_Transportation, will include the new roads line feature layer, Entrances point feature class, and side_walks layer.

4.3 Standardization of Attributes

Following the geodatabase design, we will begin standardizing attributes in the field names for each layer within the project. Each layer will need unique standardized names, and unique fields added to their attribute tables, according to the request of the client. For example, the parking_surface polygon layer will need a new field for parking space capacity and permit type associated with the parking lot. Field names must be consistent and easily identifiable. Redundancies or duplicate fields will be removed, as will any empty fields or fields containing [null] values throughout the field. All line feature layers within the Campus Transportation Feature class will be used for network analysis and therefore must include calculated fields for length that are clearly labeled as Length within the attribute field. Finally, we will ensure that each field is associated with the correct data type (float, double, integer, or text).

4.4 Establish Domains and Subtypes

To prepare for future analysis, we will assign appropriate domains and subtypes to each feature class according to the client's wishes. Building types, road ownership, parking lot permit type, and green zone type will all receive subtype classifications to organize the data. At the time of this proposal, specific domains and subtypes will not be finalized until the attributes are standardized.

4.5 Prepare for Network Analysis Setup

Finally, we will prepare to create a network dataset that will support future campus navigation network analysis. We will utilize the Create Network Dataset geoprocessing tool in ArcGIS Pro using the side_walks layer and the txst_DEM_FullExtent.tif. We will then set the network dataset properties to connect side_walks to roads, buildings, and parking lots within the project geodatabase and add costs. This will complete the viability of the dataset to support network analysis for this project's scope.

5. Budget

Data Preparation

Total Hours (5 hours/week * 4 weeks * 3 GIS Analysts). . . . . .60 hours
Hourly Pay. $31.50
Total. $1,890

Data Analysis

Total Hours (10 hours/week * 7 weeks * 3 GIS Analysts). . . . . .210 hours
PM Hours (5 hours/week * 7 weeks). . . . . 35 hours
Assistant PM Hours (7 hours/week * 7 weeks). 49 hours
Hourly Pay. $31.50
PM Hourly. $50.00
Assistant PM Hourly. $40.00
Total. $10,325

System Management

Project Manager

Total Hours. . . . . 55 hours
Hourly Pay. $50.00
PM Pay. $2,750

Assistant Project Manager

Total Hours. . . . . 33 hours
Hourly Pay. $40.00
Assistant PM Pay. $1,320.00
Total. $4,070.00

Equipment Costs

Supplies ($600/workstation * 5 workstations) $3,000.00
Maintenance ($300/workstation * 5 workstations) $1,500.00
Total Equipment Costs. $4,500.00

Software

ESRI Software License for 11 weeks. $4,230.82

Travel Expenses

300 miles @ $0.20/mile. $60.00

TOTAL COSTS. $25,075.82

6.Timetable

This project will be completed in five phases from January 20 to April 29 when the project is due. From January 20, 2026, through February 24, the team will work on proposal preparation and data review, and assessment while compiling and organizing existing data. From February 25 through March 8, the team will divide data into equal parts and work on logical geodatabase design. March 9 through March 29, we will begin standardizing attribute names and creating logical domains and subtypes for each facet of the project's data within the geodatabase. From March 30 through April 12, the team will set up a network dataset suitable for network analysis. From April 12 until the final presentation, we have allotted two weeks to finalize products and present our final deliverables.

Project Phase Dates	
1/20/26 - 2/24/26	Proposal Preparation, Data Review and Assessment
2/25/26 - 3/8/26	Geodatabase Design
3/9/26 - 3/29/26	Standardizing Attributes and Applying Domains and/or Subtypes
3/3026- 4/12/26	Network Dataset Setup and Trial Network Analysis
4/13/26 - 4/29/26	Finalize Project Deliverables
Notable Dates	
February 25	Proposal Presentation
March 30	Progress Report Client Check-In
April 29	Final Project Presentation

7. Final Deliverables

For our final deliverables, we will create a detailed proposal, progress report, data dictionary, and final report documenting all processes and methods utilized for the project, including the results. We will also introduce a schema design with fields, domains, and types, along with the correct methodology for data cleaning and network criteria. Other deliverables include presentation slides, a poster with results, a File Geodatabase, and a network dataset. For our File Geodatabase, we will have an organized and clean file, with standardized feature classes. These feature classes include, but are not limited to: Buildings, Roads, Sidewalks, Parking, Previous surfaces, etc. These feature classes will also include domains, types, subtypes, and relationship classes. Our network dataset will include a functional geometric network derived from sidewalk data, capable of supporting basic routing or service area analysis.

8. Conclusion

As the student population at Texas State University continues to grow year after year, it's our goal at Old Main Geospatial Solutions (OMGS) to provide the foundation for a high-quality interactive campus map for users to reference when traversing campus. To get to this point, there are many steps that must be taken along the way. The first phase, data cleaning, is the foundation for transitioning away from our current third-party mapmaker. Through extensive data standardization, removal of obsolete features, and necessary additions to existing data, we will create a more accurate, reliable, and useable version of a campus basemap. Through this process we will take existing shapefiles and polygons to create a sidewalk network to allow students to navigate from building to building. When this map is completed, students will have a reputable reference to use when navigating across campus. In addition, spatial knowledge will be improved over time among students. Finally, students would be able to plan better for their commutes by using the map to see how long it will take to walk to class. Overall, OMGS will provide Texas State University with the resources to better serve its expanding population and strengthen operational efficiency for years to come.

9. References

Cao, Y., Zhang, H., Yang, Z., & Li, Y. (2024). Database Construction of GIS-Based Hydropower Station Safety Monitoring Platform. *2024 5th International Conference on Clean Energy and Electric Power Engineering (ICCEPE), Clean Energy and Electric Power Engineering (ICCEPE), 2024 5th International Conference On*, 244–248. https://doi.org/10.1109/ICCEPE62686.2024.10931763

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10. Appendix: Texas State University Campus Basemap Geodatabase Development Project: Phase 1

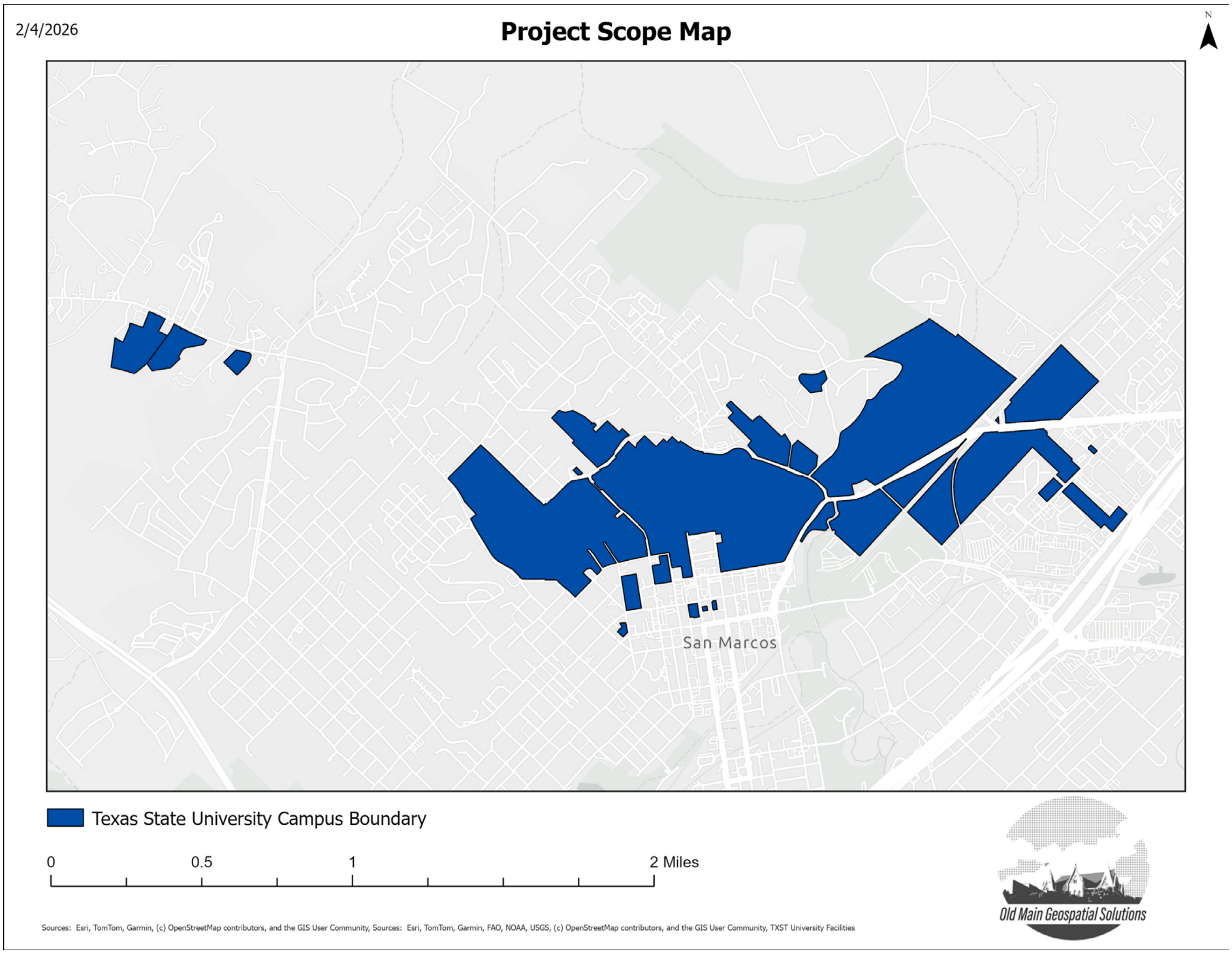

Figure 1: Study area scope for the first phase of the interactive campus map of Texas State University.

Entity	Attributes	Spatial Obje	Status	Source	Unit	Year
Satellite image of campus	N/A, image file	N/A	Available	Texas State University	N/A	2025
Building footprints	NUMBER, NAME, FINISH_FLO, CHILL_PLAN, CHILL_PIPE, CHILL_PL_1, STEAM_PLAN, STEAM_PIPE, STEAM_PI_1, Shutdown, ELECTRICAL, TYPE, BULDING_G, NAME_ABBRE, RECYCLE, DATE-DEMOL, AREA-NUMBE, PAPERSCH, ADA_YEAR, HEIGHT, CRITICAL_E, TOWER, , ZONE, GunCarry, SanS_Zone, SAAs, CAA, HistoricMa, HISTORICAL, STRUCT, Z_Min, Shape_Leng, Shape_Area, YEAR_BUILT, GlobalID, last_edite, last_edi_1,	Polygon	Available	Texas State University	US square feet	2025
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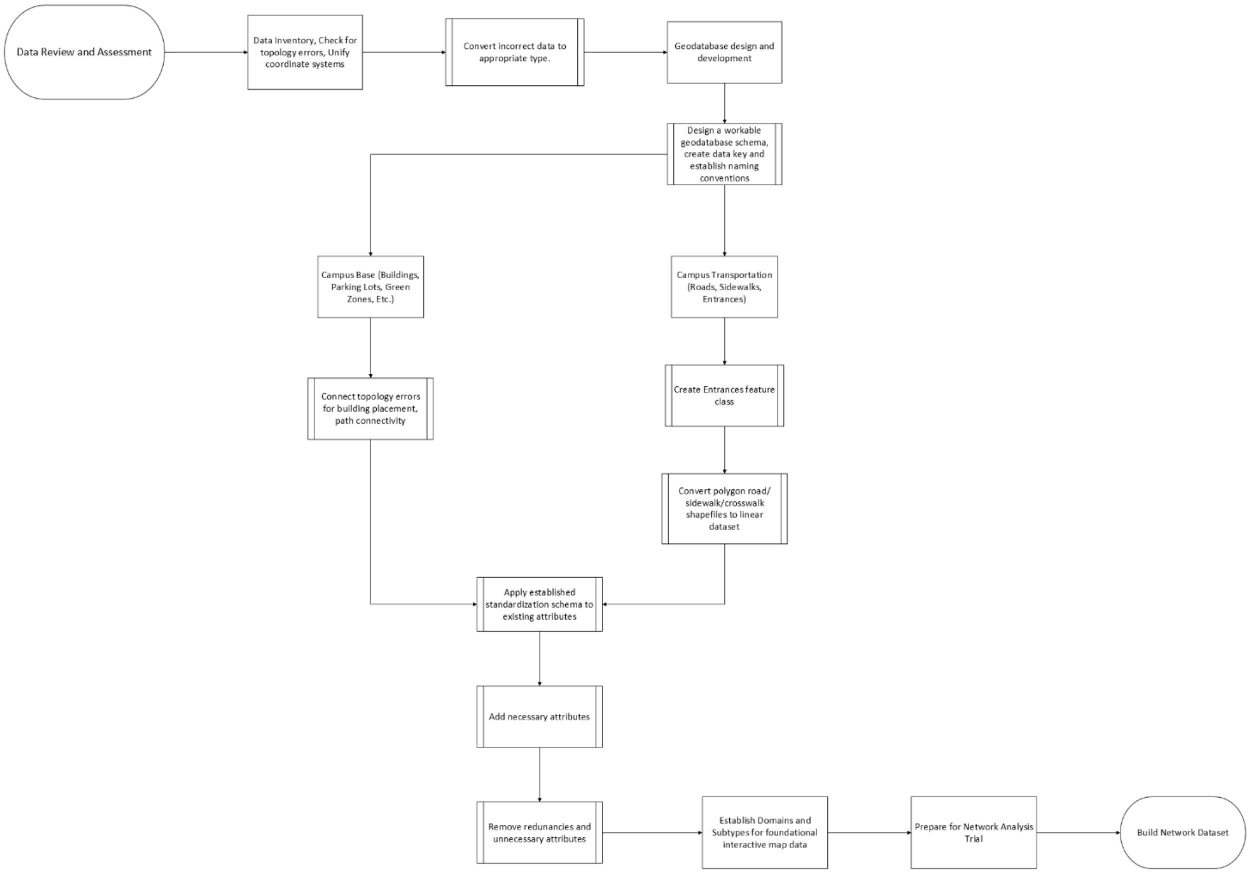

Figure 3. Flowchart detailing this project's methodology, beginning with data review and assessment and finishing with a complete network dataset.

Each section of this proposal was contributed to by each of the Old Main Geospatial Solutions team members. The team logo was created by Caitlin Powell using Adobe Illustrator. Study area map made by Jackson Otto. Dataset compiled, described, and displayed by Hugo Sifuentes. Literature review and research contributed by Caitlin Powell, Jackson Otto, and Campbell Inman. Caitlin Powell wrote and designed the methodology and timetable, and Cameron Hudgens and Hugo Sifuentes contributed to the flow chart. The budget was created by Cameron Hudgens. Campell Inman summarized the final deliverables, and Jackson Otto summarized the conclusion. Editing, proofreading and formatting was led by Cameron Hudgens with support from the team.