Municipal Wastewater Infrastructure Across Edwards Aquifer Recharge Zone

Prepared for

GEAA Greater Edwards Aquifer Alliance

Prepared by

Creative Geospatial Solutions

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Introduction

Summary

Stretching from Austin, Texas all the way down to San Antonio and west to Brackettville, the Edwards Aquifer provides water for seven counties. It serves as a principle water source for numerous populations, including large metropolitan areas such as San Antonio, Texas, the country's 7th largest city (US Census Bureau, 2010), as well as Hays County, which in 2007 was the 15th fastest growing county in the nation (The US Census Bureau, 2010). Yet the aquifer does not only fulfill human demands, it is also the main source of water for the natural environment of Central Texas.

The Edwards Aquifer is made up of karst limestone, which allows water to trickle through the ground into the aquifer. Although this characteristic helps filter the water of natural debris, it does not protect the aquifer from human-associated pollution.This process results in incredibly clean, high quality water, which supports a large number of endangered species. To name a few, there is the Golden Cheek Warbler, the Texas Blind Salamander, the San Marcos Gambusia, and the Texas Wild Rice (Texas Parks and Wildlife Development). Though these karst features provide many positive functions for the aquifer, they also contribute to a serious vulnerability to pollution. Through these features, storm water run-off, fertilizers, oil leaks, and wastewater spills can all enter this source of immaculate water, on which approximately two million people rely (The US Census Bureau, 2010). With the implementation of Geographic Information Systems (GIS), Creative Geospatial Solutions will assist the Greater Edwards Aquifer Alliance (GEAA) in mapping the location of wastewater pipelines in order to minimize potential pollution risks and to further analyze the interconnectedness between urban development and its impact on the Edwards Aquifer and its recharge zones.

Purpose

Due to the naturally porous landscape over the Edward's Aquifer, it is imperative to undergo every possible measure to reduce and prevent pollution from entering the aquifer. One current contributor of hazardous material is wastewater infrastructure. Wastewater lines are located in dense networks that rest above and within the Edwards Aquifer Recharge Zone. In areas of the recharge zone, through which water enters the aquifer, this can result in pollution from leaks directly entering the Edwards Aquifer. To understand the severity of this risk, it is important to understand the structure of wastewater lines, the majority of which are situated underground, many near rivers, creek beds, and other susceptible recharge features. This means if a break occurs, it may not be noticeable from the surface. It is common for a wastewater spill to go unnoticed for an extended period of time, pouring hazardous material into direct sources for the groundwater below it. Frequently these spills are not reported, and remediation can take weeks, if not months. Other complications within wastewater infrastructure are lift stations. This is a section of the pipeline installed to transport wastewater uphill and can often times be the cause of spills. Recently a spill occurred at a lift station where an estimated 54,000 gallons spilled into a creek located above the Edwards Aquifer Recharge Zone. Although it was corrected and remediation crews found no pollution resulting from the spill, these situations can have disastrous consequences, only further establishing the need for preventative actions. (Wastewater Spills Into Mudd Creek, 2010)

Introduction

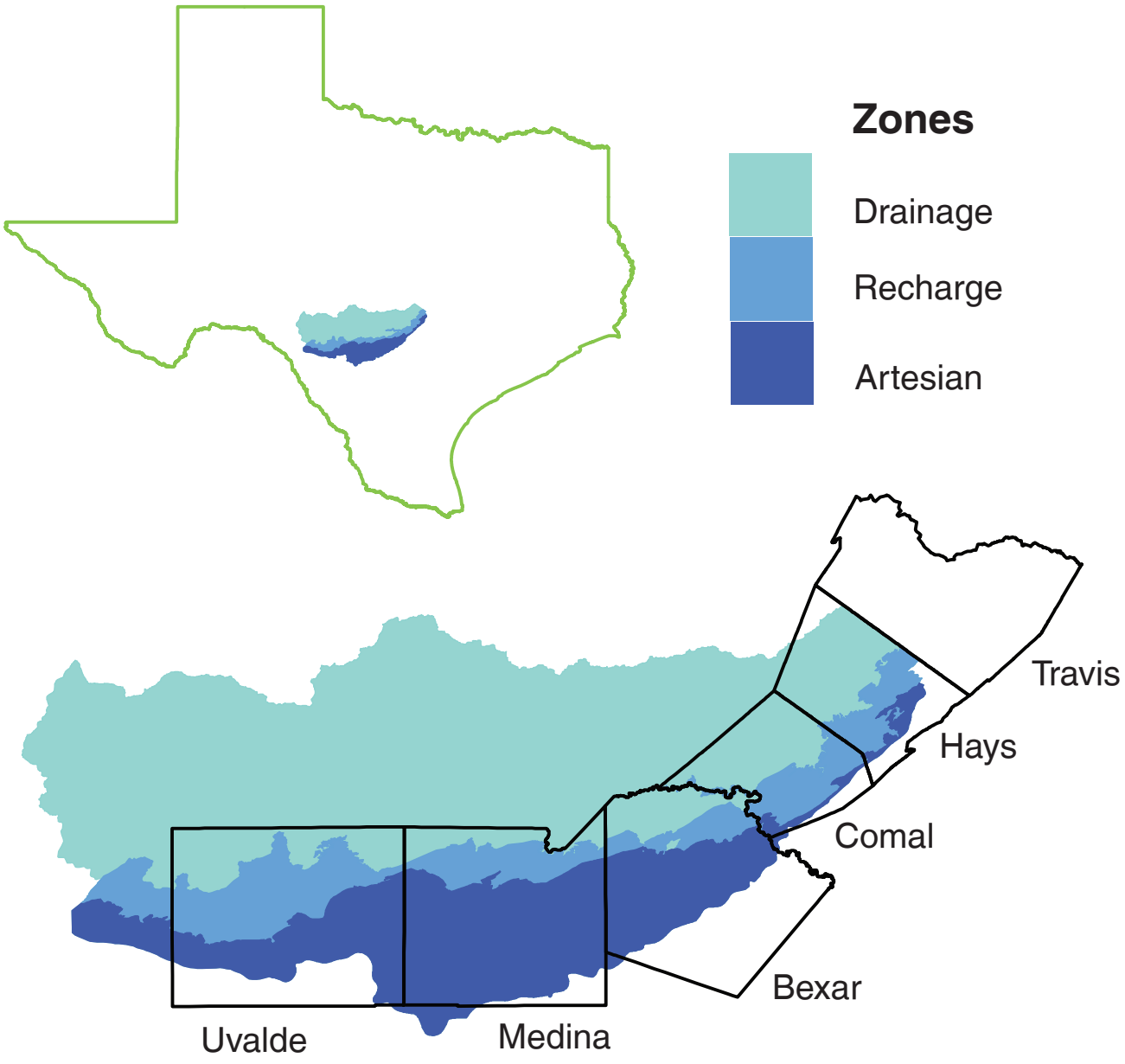
Purpose cont.

By providing a complete dataset of wastewater lines that fall within the Edward's Aquifer recharge zone, our goal is to enable more timely and efficient remediation of spills. Currently, there are dozens of wastewater utility providers within the seven counties above the aquifer, whom each have segregated wastewater pipeline location data. If a water sample proves to be polluted, it is not possible to follow the flow of wastewater lines to detect the location of the spill. Providing a comprehensive dataset of all wastewater lines will greatly reduce the amount of time an impaired wastewater line will remain a hazard.

A similar project was done in Anchorage Alaska where Anchorage Water and Wastewater Utility (AWWU) updated their spatial data for water and wastewater lines and assets. The original data was digitized using hardcopy maps. The dataset has proved valuable in allowing AWWU to be "better prepared to respond in the event of an emergency line break or natural disaster." (Anchorage Water and Wastewater Utility Asset Mapping Project, 2007)

Scope

Counties within Edwards Aquifer



0 120 Miles

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Proposal

Data

- State and county boundaries (TPWD)
- Aquifer recharge zone boundaries (CAPCOG)
- Stream segments (CAPCOG)
- Wastewater spill data (EAA)
- Urban areas and population data (CENSUS)
- Locations of wastewater lines to be obtained from individual service providers
- Comprehensive list of municipal service providers generated from TCEQ
- Contact information, pipeline diameter, pipeline installation date, and additional notes to be obtained - from service providers

Abbreviations: Texas Parks and Wildlife (TPWD), Capitol Area Council of Governments (CAPCOG), Edwards Aquifer Authority (EAA), US Census Bureau (Census.gov)

Methodology

ArcGIS 9.3.1 will be the primary software used for viewing, editing, and analyzing the data. Wastewater utility lines that are received in the form of paper maps will be georeferenced and digitized using the ArcGIS editor tool. Any data provided by utility maps will be added to the associated attribute table. All wastewater pipeline location data will be collaborated to form one comprehensive dataset.

Proposal cont.

Analysis

- Change detection of urban areas to locate center of new development
- Wastewater spill relationship to new urban development
- Direction of growth in relationship to spill density
- Relationship between pipeline age and location of spill occurrences
- Relationship between location of wastewater lift stations and pollution sightings

We anticipate that newer development and higher density populations will have a positive correlation to wastewater spills. We also expect to find a positive relationship between the location of wastewater lift stations and pipeline pollution.

Implications

The comprehensive dataset can be used to identify utility providers with a history of excessive pollution problems and aid in public awareness of the general population's primary drinking water source.

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Budget

GIS Project Manager	Total Hours` Hourly Pay Total Hours	80 $46.00	$3680.00
Data Collection	Total Hours` Hourly Pay Total Hours	120 $28.00	$3360.00
Data Analysis	Total Hours` Hourly Pay Total Hours	120 $30.00	$3600.00
GIS Web Developer	Total Hours` Hourly Pay Total Hours	80 $43.00	$3440.00
Equipment Cost x !) Weeks	Supplies ($150 per workstation x 4) Mantenance ($200 per workstation x 4) Depreciation ($8000 {total value of computers} / (equip life in months) x 2.5 months (months that equipment)) will be in exclusive use for project Total equipment cost	$600.00 $800.00 $555.56 $2500.00	$1955.56
Data and Software	Purchased Licence for 10 weeks Total Data and Software Costs	$5000.00	$7500.00
Travel Expenses	125 miles at $.051 per mile		$63.75
Total Costs			$23,599.31

Timeline

February 23	Project Proposal Presentation to GEAA
February 24	Data collection & Conversion
March 22	Work on Progress Report
March 30	Present Progress Report to GEAA
March 31	Analysis and Development of Interactive Map/Web page.
April 12	Preparation of Final Report and Deliverables
May 2	Final Presentation Rehearsal
May 4	Turn in Final Report and Deliverables
May 6	Present Project to GEAA

Final Deliverables

- CD/DVD containing all data
- Metadata
- Final Report
- Poster
- Power Point Presentation
- Interactive KML files
- Website

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Conclusion

Creative Geospatial Solutions anticipates the completion of this project to result in a comprehensive dataset of wastewater lines within the Edwards Aquifer recharge zone.
This dataset will be available to the public to view and utilize as a resource in pollution prevention management and corrective actions. It will also serve as base information to be updated and maintained for continued monitoring of wastewater infrastructure.

Participation

Trey Fuller

Purpose
Data

Brittany Schamaun

Budget
PowerPoint

Corina Salmon

Summary
Logo

Phillip Julian

Timeline
Logo
Layout and Design

Collaborated Efforts

Scope
Conclusion
Implications
Final Deliverables
Analysis
Methodology

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References

Anchorage Water and Wastewater Utility Asset Mapping Project. (2007). Retrieved February 15, 2011, from ESRI: http://www.esri.com/partners/common/trimble/anchorage_water.pdf

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Texas Parks and Wildlife Development. (n.d.). Retrieved February 15, 2011, from Edwards Aquifer Species: http://www.tpwd.state.tx.us/publications/pwdpubs/media/pwd_bk_w7000_0013_edwards_aquifer_species.pdf

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