# Title: Exercise in Designing a Wastewater Object Model

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Designing a object data model for a Geodatabase requires a combination of patience and tenacity.  Patience is required to go through numerous reiterations, and tenacity is required to follow the job through.  Because  the potentials of the Geodatabase are so great, it requires customization to achieve that full potential.  Fine-tuning the object data model will mean multiple reiterations.  The final product should provide a framework not only for the existing data but for future development.

The data model developed is within the realm of  Clean Water Atlanta, a City of Atlanta agency developed to upgrade the city's wastewater system.  Within Clean Water Atlanta is the Program Management Team (PMT), operating under a contract to assist the city. This project was instituted in 1999, due to a Department of Justice's ruling that issued the city a Consent Decree to reduce the number of spills into nearby streams.  PMT is comprised of a joint venture between Montgomery Watson-Harza and Khafra, as well as other sub-contractors.  Prior to the inception of PMT and it's role in GIS, wastewater data in the city was in CADD format.  Under PMT, this data was converted into shapefiles with minimal data, save for some survey data incorporated in the beginning months of the project.  Within the scope of PMT is a Sanitary Sewer Evaluation Survey (SSES) which will provide additional data to GIS.  With receiving SSES data in mind, the need for a GIS framework that would accept massive amounts of data was needed.  This was an impetus into considering our options.

There are various means to developing a Geodatabase.  The path we took would eventually lead us optimizing CASE tools.  But first lessons would have to be learned through trial and error.  The first effort made was after realizing the GIS data, in shapefile format, was inefficient.  In addition, the GIS data would be needed to relate better in an Enterprise.  Realizing that Geodatabase would simplify our GIS data directory, the shapefiles were first converted into a Personal Geodatabase.  But after understanding the limitation of this, as well as plans to purchase an Oracle server, it was decided developing a data model was necessary.  ESRI's sample data models were examined for inspiration, in particular their Wastewater Data Model.  But through meetings with SSES, attempting to transform the data into fitting a 'cookie cutter' model would be inadvisable. It was determined that our data would need to be compliant with the Hanson work order system.  With the field definitions in hand, sewer mains & facility points (manholes) were created within ArcCatalog.  Though this appeared to be sufficient, developing a UML model became desirous. Developing the UML model involved Microsoft Visio 2000 Enterprise using CASE tools.  In order to determine the best data format, meetings with City of Atlanta staff and Engineering professionals was made.

The first interpretation we had on developing a data model was the lack of documentation. Without any training in data models and with little knowledge of UML, the hardest part was understanding the concept. Investigating a working data model was the best step. After erroneously trying to create one in an empty template, revising ESRI's sample data model for Wastewater was the best path to follow. Often was the case though, research was needed to determine how to code certain objects. Using the CASE tools in Visio Enterprise were not totally intuitive. Research was needed to understand the various field definition options. Also, a large cumbrance was the necessity of repetitive data entry. Beyond that, the other obstacle was simply determining what should be modeled. This would often result to a quagmire of indecision, debating the need to model every potential data.

The migration of the data model into a functioning Geodatabase begins with the exportation into a Microsoft Repository. This first step of the migration process is still in Visio Enterprise. More than likely, errors would exist which the software would provide a detailed log of specific instances. This became an invaluable QA/QC tool of the Geodatabase design. Once the repository is completed, which would appear as an Access database, it can be converted into a Personal Geodatabase. Then finally the Geodatabase can simply be copied into SDE using ArcCatalog. The empty data model template can now have data uploaded into it. The two methods of doing this can be done from ArcCatalog or ArcMap. ArcMap was found to have the best importing functionality, more import options and faster upload time. As for tables, they were loaded separately as it was found quicker & simpler to not model these. Subtypes & domains were modeled, but there still remained other Geodatabase customizations, which were done in ArcCatalog. The Geometric Network was the primary focus for customization, creating a simple Geometric Network between sewer mains & facility points.

The implementation of a modeled Geodatabase has improved the standardization of our GIS data. First of which, the data is now in a manageable format in a single location. Redundant data has been eliminated, now data is stored in a fewer number of files. Much of the redundant data has been converted into SDE tables based on the unique key code. Tables such as these, along with other data is now available either through relationship classes or by creating an SDE layer. Though the geometric network has not been fully developed, even a stripped down version of the network provides multiple QA/QC abilities. Now there is a direct spatial relationship between the two primary data types - sewers & manholes. The final plus of developing the object data model into a Geodatabase is implementing business rules into GIS. Data is more rational, developing a data model requires a systematic analysis of the GIS data.

Developing an object data model became a more arduous task than first suspected. Multiple attempts were made with a negative result. At the time, little documentation on object data models were available, and ESRI technical support requires developer's level support. Among the problems or misconceptions we had after upgrading to Geodatabase, was spatially viewing "live" databases. Since then, SDE layers have been created based on tables and related feature classes. Also, it became a critical case that required a qualified DBA administer SDE due to usage rights & data stability. Several Geodatabase issues, such as user privilege rights should be addressed by a DBA.

One lesson we've learned is that with a growing GIS, the Geodatabase schema is never final. Schema modification will most likely be required again. Which does present a complication when multiple users and a mapping web site is linked to SDE. Schema modification should optimally occur as few times as possible. When it does occur, be prepared to trouble shoot failing web sites & re-source ArcMap documents. In addition, we will most likely expand the scope of the data model to include more wastewater feature classes as well as stormwater feature classes. Also, there are still numerous abilities of the Geodatabase & ArcCatalog left to mine. Among those tools is to develop various rules for wastewater functionality. And, as mentioned before, the geometric network is a relatively empty shell of it's potential.

The overall process of developing a data model was a positive one. The opportunity afforded us to become more familiar with the GIS data and maximize its efficiency. Though the data model will still be modified, it's now in a format that can be easily upgraded and assist the current Enterprise GIS. Knowledge of past successes and failures will prepare future customizations of the model and design of the Geodatabase.