Urban Area Servicing Master Plan

Client:
Town of Niagara on the Lake

Location:
St. Davids, Ontario
Canada

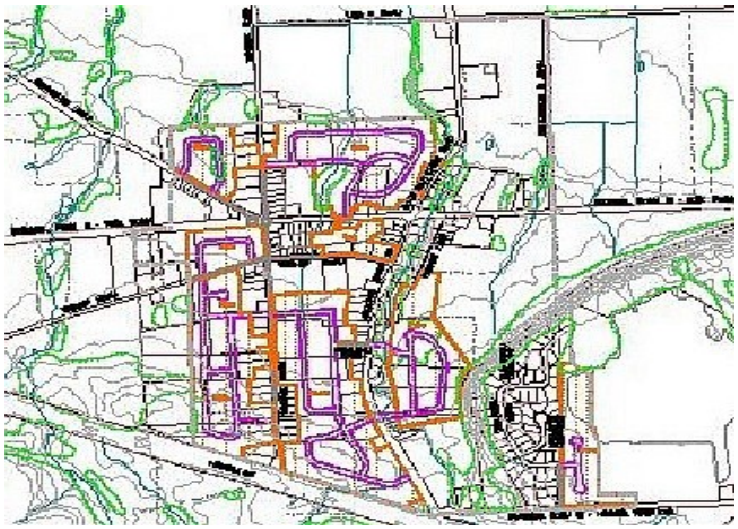
Problems:
Marked increase in development activity/interest due to installation of sanitary sewers

Challenges:
Minimize servicing costs/maximize utility of developable lands; develop consensus among public groups/agencies with diverging interests

Solutions:
Create a community development concept plan detailing servicing requirements for existing and build-out conditions

Benefits:
Town proactively positioned to direct development and address development impacts with EA approvals secured

Completion Date:
11/30/2002



Earth Tech completed a stormwater and roadway master servicing plan and class EA study for the Niagara-on-the-Lake St. Davids urban area. Due to the future installation of sanitary sewers, development activity and interest in the St. Davids urban area is expected to increase. The master servicing plan study provides the basis for the area's servicing requirements for future development associated with "build-out" to the approved limits of the St. Davids urban area boundary. The study also provides part of the technical input to the development of a community plan for St. Davids and focuses on the assessment and development of infrastructure systems for stormwater collection and management and transportation.

As consultants to the town, Earth Tech was responsible for preparing a St. Davids community concept plan (e.g., prepare general land use plan and location of servicing, +700 unit build out), which is being followed by the town/development community. EA approvals were addressed for all future stormwater, road, and water facilities with future roads and services to be developed/approved through the planning act planning process. This master servicing plan class EA planning approach was also used to complete the NOTL Virgil community plan and ultimate urban service area.

The project involved development of a concept plan that addresses servicing requirements for future development; recommended existing servicing upgrades; creation of concept development layout; identified project classes as required under the EA; preparation of documentation for public consultation as required for an EA master plan; and evaluation of construction costs for the preferred servicing strategy.

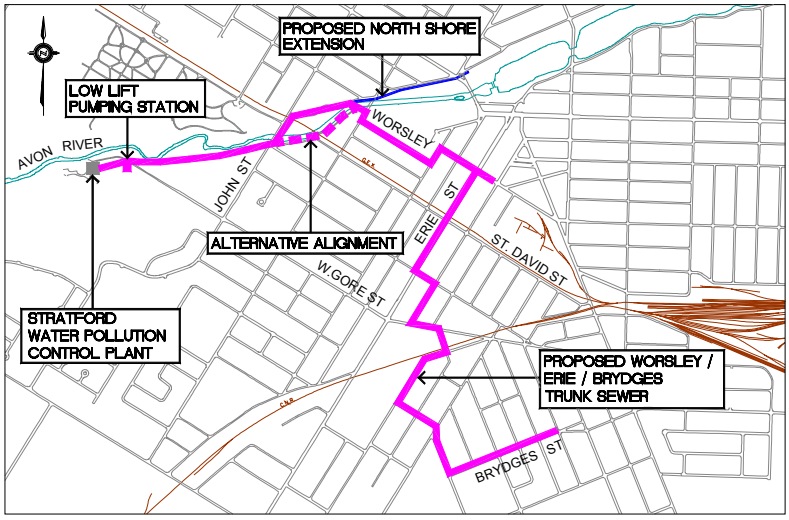
Stratford Sanitary System Master Plan Study

Client:
City of Stratford

Location:
Stratford, Ontario
Canada

Contract Value:
Canadian $300,000

Completion Date:
03/2003



Earth Tech completed a study of the trunk sanitary system throughout the city in order to address the need for additional/upgraded trunk sanitary sewers and pumping stations as required by growth and due to historic basement flooding. The study was carried out as a Class EA. As part of the study the sources of inflow and infiltration were investigated and flow monitoring was carried out. The correlation between the monitored flows and measured rainfall was determined and used as a basis for estimating rainfall inflow/infiltration rates in different areas in the sanitary system. The operation of the trunk sanitary sewers and pumping stations was modeled using the dynamic hydraulic model XP-SWMM taking into consideration the estimated flows. The study included recommendations for additional and upgraded trunk sanitary sewers and pumping stations.

Highland Creek Watershed Digital Flooding Mapping

Client:

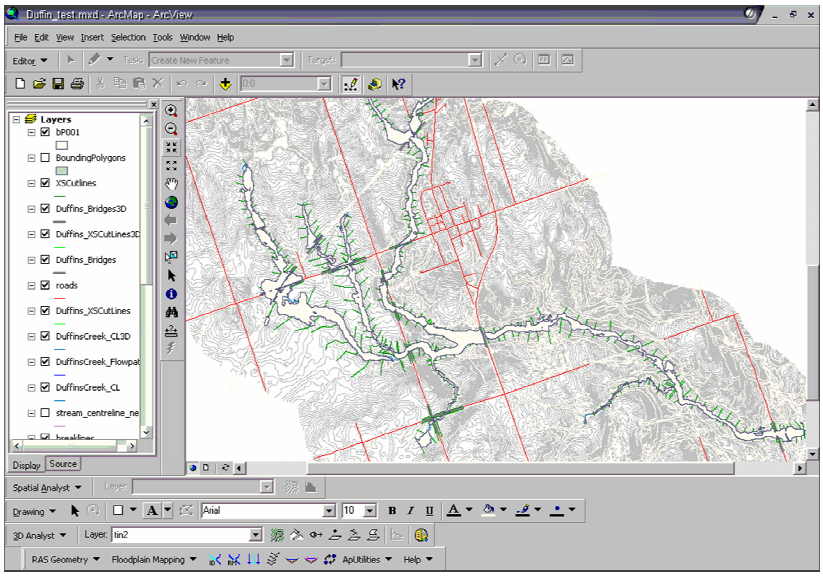
Toronto and Region
Conservation Authority

Location:

Toronto, Ontario Canada

Completion Date:

08/30/2005



The TRCA has undertaken a program to convert watershed hydraulic models from HEC-2 to HEC-RAS and move from an analog to a digital floodline mapping. Under this program, Earth Tech updated the hydraulic model and floodline mapping for the Highland Creek Watershed.

Using HEC-GeoRAS and digital topographic data, a new geo-referenced HEC-RAS model was created and digital floodlines generated. The revised model was refined with information from the previous model, such as low flow channel information and ineffective flow area, while HEC-GeoRAS was used to prepare other critical model data.

Earth Tech ensured that all stations for structures were located correctly and reviewed the adequacy and degree of completeness of the structure data with the TRCA. Floodlines were updated using the HEC-GeoRAS extension and the revised digital terrain model, and inserted into AutoCAD drawings. The updated model and digital mapping allowed effective analysis of the Highland Creek Watershed and predict flood prone areas.

Groundwater Systems Upgrades

Client:
Regional Municipality of Peel

Location:
Caledon, Ontario Canada

Problems:
Ensure water quality regulatory compliance

Challenges:
Evaluate existing systems and cost-effective expansion alternatives; existing system to remain in service during construction

Solutions:
Detailed comparative evaluation of treatment trains to meet quality goals

Benefits:
Cost effective design in compliance with water quality regulations

Completion Date:
12/31/2005

Earth Tech provided engineering services for the environmental assessment, preliminary design, detailed design, and services during construction for upgrades to the Palgrave and Caledon east well sites located in the town of Caledon. Upgrades to the existing well sites are in accordance with requirements of the Ministry of Environment new Drinking Water Regulations, and include iron and manganese treatment systems, chlorine contact facilities, ultraviolet disinfection systems, and water main connections to consolidate sites.

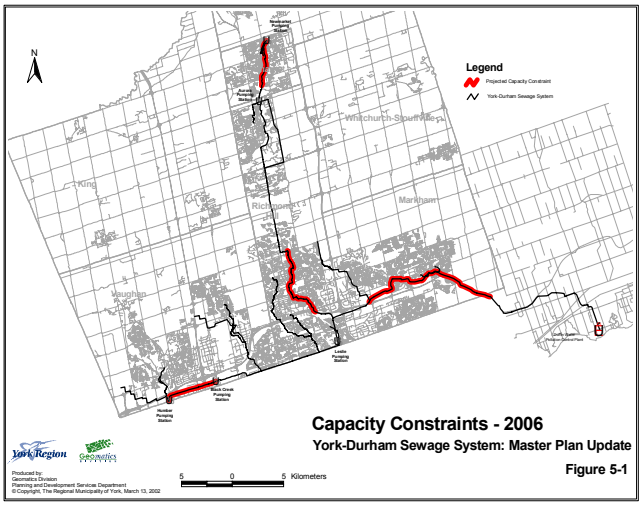
Detailed design activities are currently in progress with construction expected to commence in April 2005.

York-Durham Trunk Sewer System Master Plan Update

Client:
Regional Municipality of York

Location:
York, Ontario

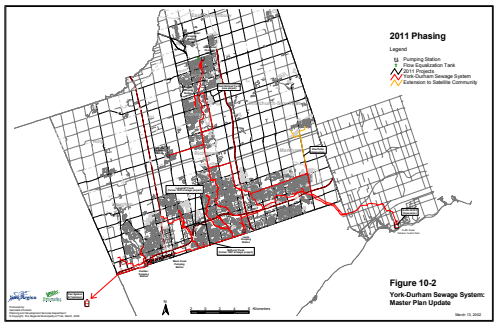
Problems:
Wastewater demands on the YDSS have continued to grow in proportion to the population. Portions of the YDSS are quickly reaching capacity



Challenges:
Develop more updated capital and operating cost commitments over the next 30 year period to monitor the level of service and address growth

Solutions:
Prepare an update to the Plan to ensure that decision making on this important infrastructure is made based on current information

Benefits:
A proactive and detailed plan which will provide a rational basis for sewage servicing in York over the next 30 years



The primary objective of the YDSS Master Plan Update was to identify the impact of the change in ownership from local municipalities to the Region of 18-inch pipes and new sewers servicing more than one community. The update also addressed revised population projections/planning period and infrastructure required to accommodate projected servicing needs for the existing service area to the year 2036. A secondary objective was to determine the feasibility and impacts of extending the YDSS to four other identified communities (King City, Stouffville, Queensville and Holland Landing) not currently served by the YDSS. A comprehensive stakeholder consultation program was also developed and implemented in order to explain the planning process followed and address concerns from a wide range of stakeholders and interest groups.

The existing and proposed sewer system was modeled previously in detail using an Excel spreadsheet and XP-SWMM. These models were updated with recent infrastructure changes, planning data, communities to be connected and system criteria from the Technical Assessment. Modeling scenarios for 2001, 2006, 2011, 2016, 2026, and 2036 were developed to confirm infrastructure requirements, capital costs and system phasing. Impacts of four additional communities on the YDSS were assessed and documented.

Based on the system modeling, a summary of the required capital

infrastructure was prepared and compared to the initial Master Plan. Cost estimates of the capital infrastructure were prepared. The proposed system expansion was compared to plans for rehabilitation and replacement and the recommendations of the YDSS odour control and overflow security studies to identify opportunities for common benefit and infrastructure phasing.

System Phasing plans were prepared based on five year increments from 2001 to 2036. The phasing of the components is based on the impact of increased development on the existing YDSS combined with the logical progression of implementing the components. This approach identified the Priority (needed by 2006) and Strategic Projects (needed by 2011) that need to proceed quickly to avoid capacity problems in the system before 2006. The phasing plan also determines the capital dollars to be expended in each time period.

Period	Capital Expenditure
2001 to 2006	$ 348.6 Million
2007 to 2011	$ 164.7 to $ 177.8 Million
2012 to 2016	$ 65.3 to $ 92.7 Million
2017 to 2026	$ 106.4 to $ 149.8 Million
2026 to 2036	$ 59.8 to $ 77.0 Million

Wastewater Treatment Master Plan

Client:
Region of Waterloo

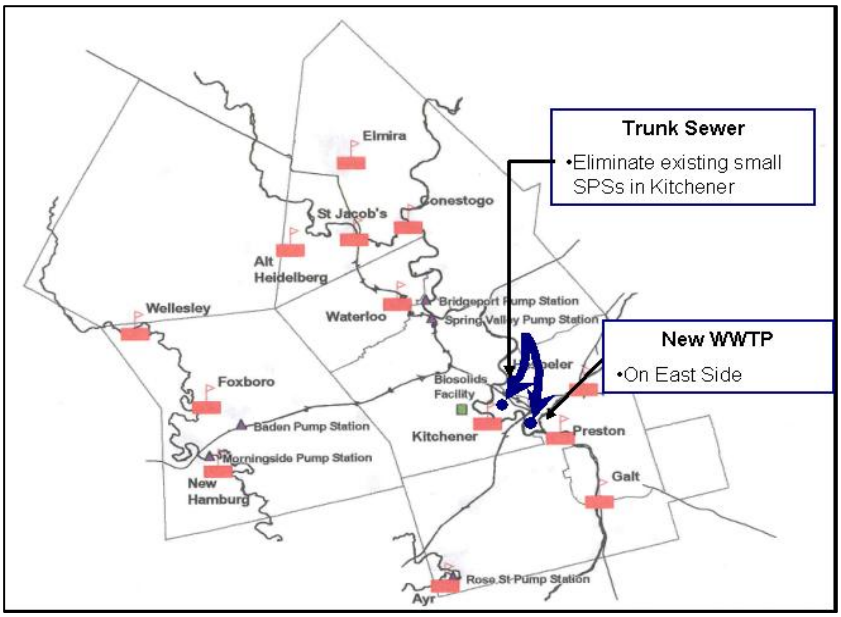
Location:
Region of Waterloo, Ontario

Problems:
RGMS recommended Wastewater Master Plan be updated provide adequate wastewater treatment to support planned population and employment increases.

Challenges:
Predict future conditions in the Grand River, identify anticipated federal/provincial legislation/ regulations for effluent quality/discharge rates.

Solutions:
Develop Master Plan to support/define wastewater infrastructure requirements and provide guidance for implementation of preferred servicing strategy.

Benefits:
The Region will be well prepared to meet wastewater servicing demands into the long-term (2045).



The Region of Waterloo currently owns and manages 11 wastewater treatment plants (increasing to 13 shortly), which receive a combination of domestic and industrial wastewater. The treated effluent from these plants is discharged to the Grand River or one of its tributaries. The Region is expecting an increase in population of 250,000 and an increase in employment levels of 170,000 jobs over the next 40 years. In 2003 the Region prepared a Regional Growth Management Strategy (RGMS), which recommended the Wastewater Master Plan be updated to provide technical background in support of changes that may be required to the Regional Official Policies Plan.

Earth Tech was retained by the Region to prepare the update to the Wastewater Treatment Master Plan. The purpose of the assignment is to facilitate the development of an over all plan for the provision and upgrading of facilities necessary to provide wastewater treatment services adequate for the Region's needs in accordance with the Region's Growth Management Strategy to the year 2045.

The plan developed by Earth Tech will identify the timing, financial resources, approval requirements and conceptual design details of the Regional infrastructure and programs that will need to be upgraded, expanded or provided during the planning period including wastewater treatment plants, pumping stations and trunk sanitary sewers. Development of the master plan is to take into account the characteristics of the water bodies that receive the effluent, preserving

and enhancing significant aspects of the natural environment. Public and agency involvement throughout the master planning process will be required to address the interests of the general public as well as relevant federal, provincial and municipal government agencies.

The general objectives of the Wastewater Master Plan assignment include:

- Determination of the future influent flows and loadings to the Region's WWTPs.
- Identification of future effluent requirements considering receiving water characteristics, legislative requirements, and impact of the effluent on the receiving water body, etc.
- Impacts on liquid train treatment processes by the Region's recently completed Biosolids Master Plan.
- Determination of the feasibility of upgrading or expanding the Region's WWTPs to meet the capacity and effluent requirements determined above.
- Identification and evaluation of a range of alternatives to meet the wastewater needs of the Region as well as providing wastewater servicing to the East Side area.
- Sufficient and meaningful public and agency consultation at appropriate stages of the Master Plan development to fulfill Municipal Class Environmental Assessment requirements and so that the preferred strategy can have the support of the MOE, GRCA and local municipalities.
- Determination of a preferred approach to providing wastewater treatment. Flexibility will be a desirable attribute of the preferred approach so that unforeseen future changes may be accommodated and so the plan can be supported by the Region's Planning and Works Committee and Council. The plan is to identify upgrades or expansions of existing Regional wastewater facilities and any new Regional wastewater facilities that will be required.
- Implications of recent and impending legislative changes relating to effluent toxicity.

Through the master planning process, Earth Tech will deliver a clear and concise document, which consolidates all the work completed by the Project Team and will incorporate all comments from the public, review agencies and stakeholders. The draft Master Plan working document will set out, in detail, an implementation and monitoring plan to achieve all of the Region's vision and goal statements, technical, institutional and financial objectives.

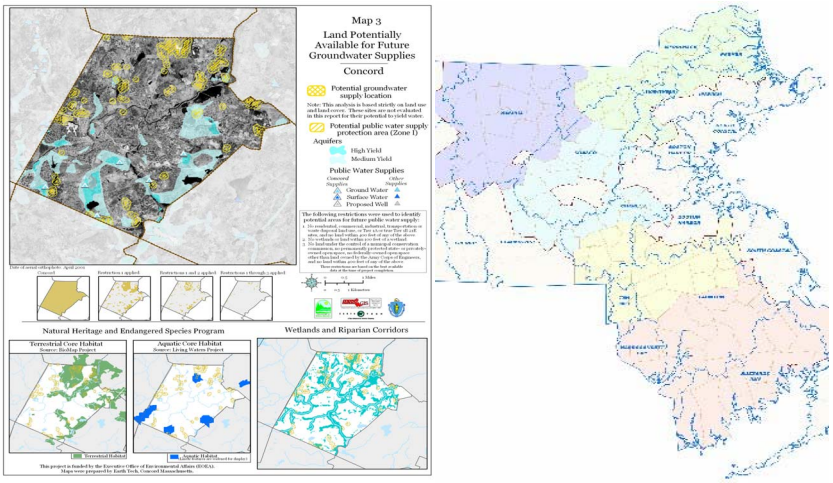
Water Assets Study

Client:

Massachusetts Executive Office of Environmental Affairs

Location:

Massachusetts, USA



The overall goal of the water assets study was to analyze the existing and potential future water supplies of 131 communities along the Interstate Route 495 belt. Under contract to the Executive Office of Environmental Affairs (EOEA), Earth Tech provided a comprehensive assessment of current and potential water supplies, and evaluated each community's ability to meet current and future water demands in an environmentally sound manner.

Many communities along Interstate Route 495 in Massachusetts are under great pressure from population growth and development, which began 30 to 40 years ago, but has accelerated in the last ten years. While this growth brings certain economic benefits to the area, it also places considerable strain on the natural resources, particularly water. Water resources include not just drinking water, but also the fresh water needed to sustain the natural, scenic, historic and aesthetic qualities of the region.

This study included 131 communities in the I-495 corridor. The range of towns and cities in this study was broad, including small towns with no public water supply, mid-size communities that rely strictly on municipal wells, to large cities that use surface water exclusively for public water supply. The study area included nearly all communities in ten eastern Massachusetts watersheds including Parker River, Merrimack River, Shawsheen River, Nashua River, SuAsCo, Charles River (Upper Charles only), Ten Mile River, Taunton River, Narragansett Bay-Mount Hope, and Buzzards Bay.

Project Approach

The project consisted of three main components:

- A series of GIS maps and analyses developed using data available

from the state GIS resources, MassGIS

- Development of a relational database to update, reconcile and query information across several Department of Environmental Protection (DEP) databases
- Individual community reports and regional summaries for each of the ten watersheds

Earth Tech worked with EOEA to introduce the project to the public water suppliers and other interested parties through five regional meetings. At these meetings, the statistical and water system information needed from the suppliers, and drafts maps provided by the study, were presented. Earth Tech then interviewed the 120 public water suppliers individually. Towns that did not have water supplies could choose to participate through their town planner or other appropriate municipal officials.

At the interviews, Earth Tech verified and corrected the public water supplier annual statistical report data gathered from DEP records. New information was gathered on water-conservation programs, water-system limitations, and planned improvements. In addition, the major infrastructure components, such as water tanks, water-supply sources (existing and proposed), service area, interconnections, major water main trunklines were mapped using GIS.

As part of this project, each community received a 30- to 50-page individualized report including a water-supply statistical analysis. The report also contained a series of maps that provide planning resources for cities and towns to allow them to consider more sustainable development practices. The report contained an analysis of each public water system and of the land that may be available for future drinking water development. The analysis was completed through database queries to summarize and analyze the numeric and geographic land use data.

GIS Analysis and Maps

Earth Tech created a series of five water assets study maps that displayed land use and zoning within existing and potential water supply protection areas (WSPAs). EOEA provided the initial map designs, however, Earth Tech adjusted designs of the maps as necessary to accommodate project modifications. The maps included existing groundwater and surface water supply protection areas, land potentially available for groundwater supply development, and land use and zoning within potential future Zone I water supply protection areas.

Using data provided by MassGIS, Earth Tech performed a series of analyses to identify land that may be available for future well supplies.

Earth Tech performed a three step “cut-away” process initially defined by EOEA and refined during the project. The resulting maps depicted areas still available for new well supplies after removing developed land uses (plus a 400-foot buffer), wetlands (plus a 100-foot buffer), and permanently protected open space (plus a 400-foot buffer). Hydrogeologic conditions were not considered. However, the land use analysis is often the first step that a public water supplier needs to take before undertaking a groundwater exploration program. Many public water suppliers do not have the GIS tools needed to do this type of analysis.

The large quantity of GIS data for this project was managed using ESRI’s Spatial Database Engine (ArcSDE) with Microsoft SQL server database software. Map plotting was automated by customizing the ESRI developer’s sample, MapBook, to handle multiple data frames and text updates from the data attributes. MapBook was enhanced by Earth Tech to efficiently create maps from standardized templates for all 131 communities.

Database Development

Earth Tech developed the water assets database to integrate data from three separate Department of Protection (DEP) databases:

- The Water Quality Testing System (WQTS)
- Water Management Act (WMA)
- Zone II

Earth Tech’s water assets database contained data on 120 major public water suppliers within the 131 communities in the study area. Data for each public water system included how much water was consumed annually, amount of water withdrawn from individual sources, consumption by customer class (residential, industrial, commercial), as well as other related water system information.

To update, reconcile and query the information, a relational Access database with a graphical user interface was developed. Interview forms were designed and pre-populated with data from the database to assist with the data review and entry during the interviews. This greatly facilitated the interview process, allowing for quick and accurate data collection and provided the communities an opportunity to verify the data.

Regional analyses were performed for each of the watersheds in the study area. A separate Access database performed all regional queries and tables for the regional reports and formed the basis for many of the maps required for each watershed. The regional queries were linked to the master database so any changes or updates to a water supply would be automatically reflected in the regional analysis.

Municipal Wells Zone II Delineations

Client:

Massachusetts Department of Environmental Protection

Location:

Boston, Massachusetts USA

Reference Information

Mr. Joseph Cerutti
Hydrogeologist
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6th Floor
Boston, Massachusetts
02108
(617) 292-5948

Mr. Paul Blain
Hydrogeologist
Department of Environmental Protection
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Boston, Massachusetts
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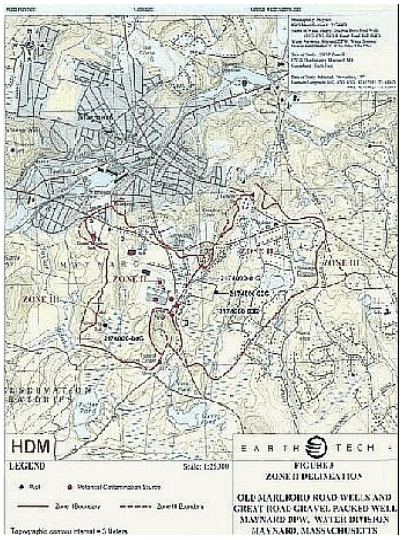

Earth Tech delineated Zone IIs for over 90 municipal water-supply wells throughout Massachusetts. The overall project goals were to map the wellhead protection area, or Zone II, for each well using scientific techniques, inventory and map threatening land uses and practices in each Zone II, and assist municipalities upgrade wellhead protection controls. Wells selected for this project were generally built before 1980, before the need for wellhead protection was widely recognized. Some of the wells date to the late 19th century. Earth Tech examined historical information, such as well logs and pumping test records, and interpreted geologic and topographic maps to create a conceptual model of the glacial, sand-and-gravel aquifer supplying each well.

Data from electronic databases was collected and field surveys conducted to identify potential sources of well contamination. In some cases, the Zone II was found to be small, especially where the well was near a large body of water. Others were large, covering many square miles, where the aquifer was broad and water bodies are insignificant in size. Some Zone IIs were largely wooded and remote from contamination sources, while others were mostly urban. Delineation of Zone II will allow each community to more effectively protect drinking water supplies.

Earth Tech worked closely with both DEP and the water suppliers through meetings and frequent correspondence to produce a high quality product. A report was prepared for each community containing color maps of the hydrogeology, potential contamination sources, and Zone II. The text was concisely written with the intent of appealing to the broadest possible audience. The quality of the technical work and the clarity of the presentation won high praise from DEP.

Earth Tech was successful over the ten competing consultants to win this project. We were selected based on our unparalleled experience with groundwater-supply and Zone II development in Massachusetts, the reputation of our staff with DEP and price.

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Customized GIS Interface Development, Town Assessor's Office

Client:

Town of Brewster

Location:

Brewster, Massachusetts

USA

Reference Information

Mr. Paul Hicks

Town of Brewster

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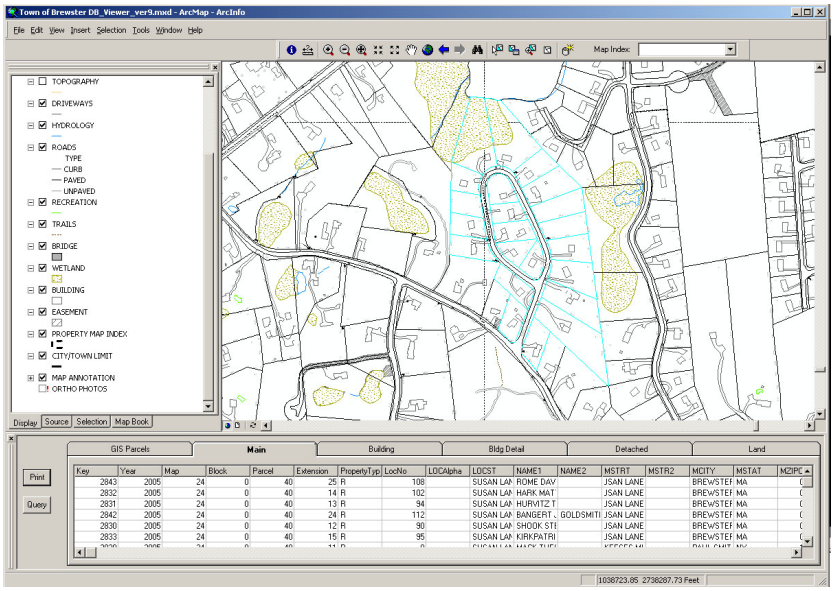

The Town of Brewster's assessing and mapping functions were historically managed using different software packages that were not integrated. To allow Brewster to view Assessor's and GIS data in the same interface, Earth Tech built a customized extension. The interface allows users with limited GIS experience to navigate through the Town's 7500+ parcels, searching by parcel number, address, owner name or map number

Benefits of Integrated Interface:

- On-the-fly query ability to find parcels, view data about the parcels and print maps.
- Data from the assessor's database is viewed in a tabbed window, each tab represents a different table from the database.
- Approximately 40 fields of data are currently accessible through the interface, including owner, structure detail, detached structures, and taxable land value.
- Information can be printed, and a map generated of the area of interest by a click of a button.
- Appearance of information in the database window is adjustable. The visible data fields can be changed and alias names can be assigned to make field names more intuitive.

Townwide GIS Implementation
Sandwich Water System

Client:
Town of Sandwich

Location:
Sandwich, Massachusetts
USA

Earth Tech is managing implementation of a town system that will serve multiple town departments in different office locations. Earth Tech obtained 100-scale planimetric data at a reduced cost through a data-sharing agreement with a local utility. Cost savings on basic base map features allowed for additional items originally considered too expensive, including two-foot topographic contours and 0.5-foot pixel resolution orthorectified aerial photographs. Earth Tech is creating water distribution, parcel, stormwater, and other GIS data layers that accurately overlay with new base map data..

Geographic Information System

Client:
Town of Wrentham

Location:
Wrentham, Massachusetts
USA

Earth Tech provided GIS services specific to the transition of the town of Wrentham assessor maps from AutoCAD to GIS format. The assessor maps were previously in an AutoCAD format, and the parcel information was maintained in a GIS format. This necessitated updating both platforms on an annual basis, which was inefficient. To complete the transition from AutoCAD drawings to GIS, text annotation from each of the 120 drawing files was converted into a GIS format. This enabled seamless viewing of the assessor data shown on the AutoCAD maps across the entire town.