REPORT

SUDBURY WASTEWATER DISPOSAL OPTIONS
ROUTE 20 BUSINESS DISTRICTS

prepared for:
Town of Sudbury
Wastewater Disposal Options
Task Force

August 18, 1995

prepared by:

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INTRODUCTION

STUDY PURPOSE AND SCOPE

The purpose of this study is to assess the need for wastewater disposal options other than the current method of individual on-site disposal in the Route 20 business district, and (to the extent there is a need due to environmental or public health reasons) to develop and evaluate wastewater management options.

The scope of work included:

- A compilation and review of available information for the study area, such as current zoning, land use, building and parcel sizes, water use, wastewater disposal, soils data, wetlands, aquifer protection areas (Zone II).
- Review of applicable regulations and statutes.
- Review of other studies relating to the area.
- Conducting a needs assessment, based on the above review, to determine whether options to on-site disposal are warranted from the perspectives of environmental impact, public health or economic considerations.
- Preparing two technical memoranda, the first representing the data collection task, and the second representing the needs assessment task, and presenting the information to the Task Force at two meetings.
- Preparing a draft report for review by the Task force.
- Presenting the work at a public forum.
- Preparing a final report, based on input received at the public forum.

STUDY AREA

The study area consists of the Route 20 business and industrial districts, from the easterly end of Business District #1 (at the Wayland line), to the westerly end of Business District #6 (near Lafayette Drive), including Union Avenue to the railroad tracks. The districts included are:

Business District (BD) 1 through 6, 15 and 16
Limited Business District (LBD) 1 through 4, and 6
Limited Industrial District (LID) 1 and 6
Industrial District (ID) 2, 4, 8 and 12

In all, there are 98 parcels represented by the study area.

The study area has been identified to exist in large part over the Town of Sudbury aquifer for the Raymond Road wells (# 2, 4, 6, 7 & 9), which supply the Town with a significant fraction of its drinking water.

The study area is shown on Figure 1.

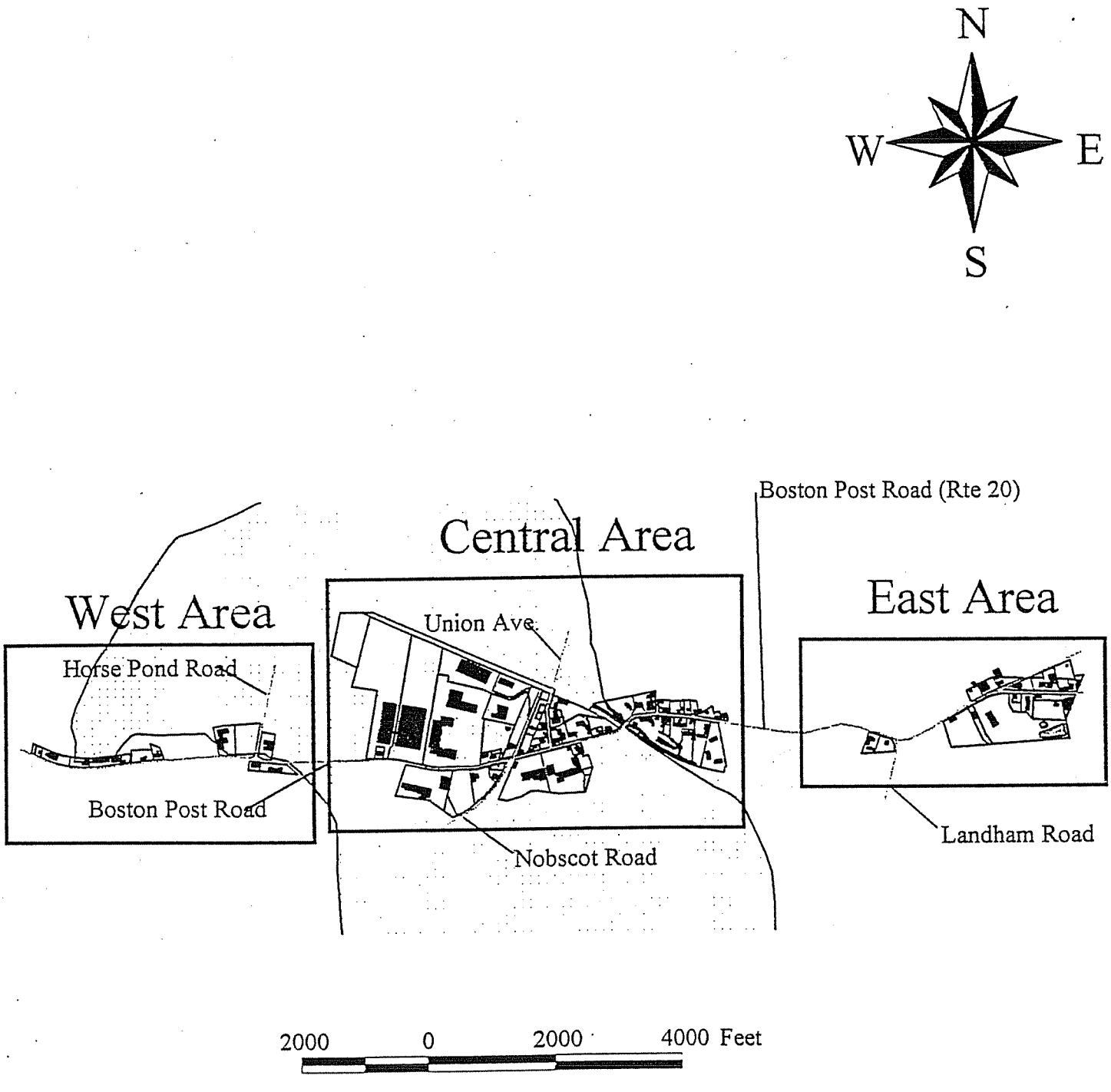

FIGURE 1
STUDY AREA

DATA COLLECTION

The following is a summary of the data collection and compilation effort. The information collected is used as the basis for assessment of wastewater disposal needs, and development of alternatives. A computer database, linked to a Geographic Information Systems (GIS) mapping software called ArcCad, was used as an analysis and presentation tool for the project.

Study Area. A composite of Assessor's Plans covering the study area, accompanied by a spreadsheet with property information (Parcel #, Assessor #, zoning designation, parcel size, building square feet and business name) was provided by the Planning Department. This spreadsheet is included as Appendix A.

Water Use. Water use by parcel was provided by the Sudbury Water District to the Planning Department, and entered onto the spreadsheet by the Planning Department. The water use data represents 1994 total water use. Data for 83 of the 98 parcels was provided.

Septic System Information. Septic system design flows were provided by the Board of Health for approximately 25% of the businesses, as well as dates (years) of construction and / or repair of systems for approximately 67% of the businesses.

Zone II /Wetlands / Surficial Geology. Digital maps were purchased from Mass GIS depicting DEP approved Zone II areas, wetlands, and surficial geology as determined by the US Geological Survey, which were incorporated into the computer database. Surficial geology provides an indication of the parent material for the soils found at or near the surface.

Soils. USDA Soils Conservation Service (SCS) maps were obtained for the study area, and digitized into the database for comparison with disposal system location. Mapping from 1964 indicated soil types generally throughout the study area which SCS classified as " unsuitable" for sanitary sewage disposal systems, due to poor drainage, wetness or poor filtering ability. Mapping from 1986 indicates that much of the area now has an overlay of "urban land", which may exhibit a variety of properties depending on the type of material brought in.

Applicable Regulations. The regulation that applies most significantly to this project is 310 CMR 15.00, the State Environmental Code, known as Title 5. Title 5 is administered by the Board of Health, and sets forth the design criteria for on-site subsurface sewage disposal systems. Factors governing design of systems include type of use, e.g., residential, retail, office, etc. (determines design wastewater flow), soil types, depth to groundwater, and siting constraints such as setbacks from buildings, lot lines, etc. Title 5 also sets forth requirements for system inspections. The most recent revision to Title 5 occurred in October 1994. Among the revisions was a recognition of several alternative technologies which can be used on sites that may be otherwise difficult to accommodate a system. Some technologies can also address the need for enhanced nitrogen removal,

which is required by Title 5 in Water Resource Protection Districts (Zone II areas) for any systems with a design flow of greater than 440 gallons per day per acre (gpd/acre).
Other regulations and bylaws that have applicability to this project include:

- Rules & Regulations Governing the Subsurface Disposal of Sewage, by the Sudbury Board of Health, latest revision March 31, 1995.
- Town of Sudbury Zoning Bylaws, Section G., "Water Resource Protection Districts", and Section N., "Wastewater Treatment Facilities", 1989.

Further discussion of these regulations and bylaws is provided in later sections of this report.

APPROACH

Our approach to this project was, using the available information described above, to answer the following questions:

1. Is the public water supply at risk of contamination because of septic systems?
2. Is public health at risk because of failing septic systems?
3. Can the use of on-site sewage disposal systems under existing use conditions continue in the study area?
4. If on-site sewage disposal systems will not meet regulations or will not function properly under existing use conditions, which wastewater management alternatives to on-site sewage disposal systems will be best for Sudbury?

METHODOLOGY

The methodology we used to conduct this study was generally as follows:

1. Review of geologic, soils, and hydrologic data to assess general conditions in the study area.
2. Develop a set of assumptions based on the data to be used for assessing the feasibility of meeting regulations for on-site sewage disposal.
3. Target specific properties in the study area which may be most likely to require upgrading or replacement of on-site sewage disposal systems, and test these against the assumptions to determine whether the properties can accommodate systems according to the regulations.
4. Using data on system ages and assumptions about average life span of a system, and replacement cost data, estimate the cost of replacement of on-site sewage disposal systems, on a present worth basis (i.e., considering operating and maintenance costs as well as capital costs). For analytical purposes, a 20 year planning period will be assumed, and a 6% interest rate will be used. The 20 year planning period is consistent with EPA wastewater facilities planning guidelines.
5. Estimate the cost for a sewering option, as an alternative to on-site systems. Estimate present worth of collection, treatment and disposal systems, including capital and operation and maintenance costs.

ASSESSMENT OF EXISTING AND FUTURE CONDITIONS

GENERAL

The data collected was compiled onto ArcCad for the purpose of analyzing the relative locations of wastewater disposal facilities with soil conditions, water resources, and other information. The study area was subdivided into East, Central and West because of non-business districts which separate them geographically. Also, because of the Water Resources Protection District (Zone II for Raymond Road aquifer) which underlies the Central Area and a portion of the West area, these areas fall under some local and DEP requirements that do not apply to the East area, which is neither in Zone II nor Zone III.

WEST AREA

Existing Conditions

The West area is comprised of districts BD6, BD15, and LBD1, located on Property Maps K05 and K06, and bounded (approximately) by Dudley Road on the east, and Lafayette Road on the west. There are 13 parcels in this area, including 11 developed and two vacant. The area is partially within the Aquifer Contribution Zone (Zone II) and completely within the Aquifer Recharge Zone (Zone III) for the Raymond Road aquifer (wells 2, 4, 6, 7 & 9). There are four restaurants, three office buildings, with the remaining uses including retail, industrial and service related businesses. Total water use for the area averages 21,518 gpd (based on 1994 water use). Total area (excluding vacant parcels) is approximately 16.7 acres, resulting in an average per acre water use of 1,289 gpd/acre. Extending this usage rate to the whole area (22.5 acres), the water use is estimated at 29,000 gpd, or a wastewater flow of 24,700 gpd (85% of water use). For planning purposes, the wastewater generation rate for this area is expected to be in the range of 25,000 to 30,000 gpd. Although not in the study area (not in a business district), Longfellow Glen Condominiums are immediately adjacent to the area, on the south side of Route 20. An additional flow of approximately 32,000 gpd from this area would need to be added if this use was to become part of the overall wastewater management strategy for the West area, bringing the total to 57,000 to 62,000 gpd.

Soils in this area are characterized by SCS as Windsor Loamy Sand, with 3-15% slopes. This soil type is rated by SCS as severe for septic systems due to poor filtering ability. Although the level of treatment is less for poor filtering soils as compared with some other soils, systems in this area would generally be expected to function normally if properly maintained, i.e., not experience sewage backups or breakouts because of the soils. Groundwater levels in the area are expected to be relatively shallow, so alternative or mounded systems may be required in some cases, to maintain the minimum depth to groundwater from the bottom of the leaching area at 4 ft.

There are no known failing septic systems in the area. Systems most likely to experience problems include food service establishments, and older systems, according to the Board of Health agent, Mr. Robert Leupold. Four of the systems were constructed prior to 1978, three between 1978 and 1995 (under Title 5), and no information on system age

was available for six parcels. None of the systems are on record as having been upgraded, repaired or replaced. Several individual parcels were reviewed with respect to Title 5 and Town of Sudbury requirements. Findings for the systems reviewed are discussed in the Needs Assessment. Constraints on changes in use depend upon actual site conditions (soil type, area available for leaching system, depth to groundwater).

Future Conditions.
Future conditions for this area are expected to be similar to existing conditions, since there are only two vacant parcels at the present time. Changes in use may occur on some properties, but the overall character of the usage is not anticipated to create any significant additional wastewater generation in the area.

The West Area is depicted on Figure 2.

CENTRAL AREA

Existing Conditions.
The Central area is comprised of districts BD2, BD3, BD4, BD5, ID2, ID8, LBD2, LBD3, LBD4, LBD6, LID1, and LID6, located on Property Maps K07, K08 and K09, and bounded by Massasoit Avenue on the east, and Raytheon Company EDL on the west. There are 55 parcels in this area, including 53 developed and two vacant (former gas station and bank). Some parcels have more than one use (e.g., retail and restaurant). The area is mostly within the Aquifer Contribution Zone (Zone II) and completely within the Aquifer Recharge Zone (Zone III) for the Raymond Road aquifer (wells 2, 4, 6, 7 & 9). There are ten restaurants, 21 office buildings, with the remaining uses including retail, industrial and service related businesses. Total water use for the area (no data for ten of the parcels, and not including Raytheon at 43,391 gpd) averages 28,305 gpd (based on 1994 water use). Area of parcels with water use data is approximately 127.3 acres, resulting in an average per acre water use of 222 gpd/acre. Extending this usage rate to the whole area (136.5 acres), the water use is estimated at 30,300 gpd, or a wastewater flow of 25,800 gpd (85% of water use).

Raytheon EDL operates a 50,000 gpd (permitted flow) secondary wastewater treatment facility with nitrogen control, and groundwater disposal via open sand beds. For purposes of this study, the Raytheon facility will be considered as having its wastewater needs met by that treatment plant.

Soils in this area as characterized by SCS are predominated by Urban Land, with some loamy sands, silt loams and muck along the Hop Brook corridor. Urban land may have high variability with regard to suitability for septic systems. Windsor loamy sands are rated by SCS as severe for septic systems, due to poor filtering ability. There are no known currently failing septic systems in the area. Systems which may experience problems include food service establishments, and older systems. Thirteen (24%) of the systems were constructed prior to 1978, twenty three (43%) were built, upgraded for

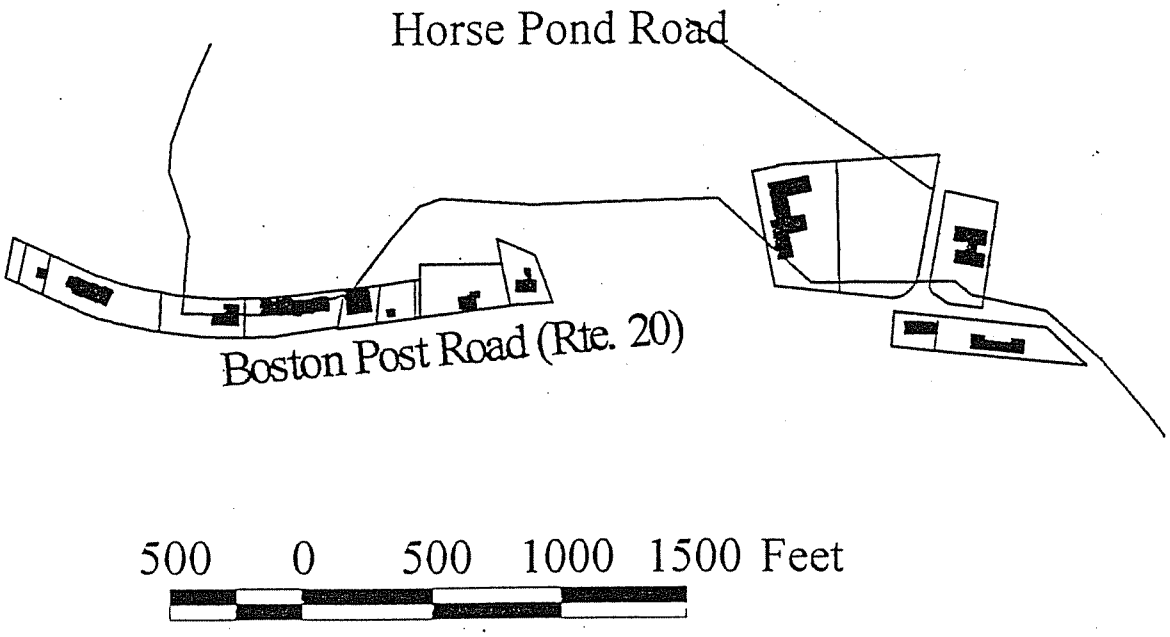

FIGURE 2
WEST AREA

change in use, or repaired / replaced between 1978 and 1995 (under Title 5), and no information on system age was available for eighteen (33%) of the parcels. Several individual parcels were reviewed with respect to Title 5 and Town of Sudbury requirements. Findings for the systems reviewed are discussed in the Needs Assessment. Constraints on changes in use depend upon actual site conditions (soil type, area available for leaching system, depth to groundwater).

Surficial geology maps[1] reveal that much of the Central business districts are underlain by lake bottom deposits from glacial Lake Sudbury, consisting of well sorted and stratified fine sand and silt. A silt/clay layer of low permeability is documented to exist in portions of this district, at a shallow depth below the surface. A shallow water table coexists with this layer as well. Evidence of this shallow water table (in some locations within two feet of ground surface) is documented in reports relating to subsurface investigations for gasoline service stations in the area, as well as direct observations by town officials during municipal construction projects. The water bearing aquifer for the Raymond Road wells lies beneath this low permeability layer. The Raymond Road wells provide approximately 80% of the water supply for the Town of Sudbury, according to the Water District Superintendent. The full extent of this layer is not known, but Well No. 2 is believed to be protected to some degree from surficial contamination by the clay layer.[2] As further evidence of the existence of the clay layer, Horsley & Witten, Inc.[3] introduce test well data from the Raytheon property (within the Central Area) which suggests that "the property is underlain at depth by fine grained glaciolacustrine deposits and there may not be a direct connection between this area and the aquifer that sustains the wells in the Raymond Road area".

Given the above conditions, several observations can be made regarding the use and impact of septic systems in this area:

1. The silt/clay layer and attendant shallow depth to groundwater may limit redevelopment or change in use if those soil types are used for design purposes, or if the water table requires mounded systems to achieve the required separation.
2. The silt/clay layer is acting as a boundary which prevents or limits the contact of surficial groundwater with aquifer groundwater. If this is the case, surficial groundwater impacted by land use in the area (e.g., nitrates from septic systems, oil from leaking underground tanks, etc.) has a lower potential for impacting the water supply aquifer, than if there were no such layer. This condition has been recognized by the Sudbury Water District as an important feature in the protection of the Raymond Road aquifer.

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[1]Surficial Geologic Map of the Framingham Quadrangle, Middlesex and Worcester Counties, Massachusetts, 1974, Arthur E. Nelson.

[2]Report on Raymond Road Aquifer Study, for Sudbury Water District, 1985, by H_2O Engineering Consulting Associates, Inc.

[3]Sudbury Nitrogen Loading Analysis, for Sudbury Water District, 1993, by Horsley & Witten for H_2O Engineering Consulting Associates, Inc.

3. Evidence of contamination reaching the #2 well suggests that the clay layer is not providing complete protection from activities in the Route 20 area. Monitoring for nitrate levels in the wells in addition to other parameters is warranted.[4]

Future Conditions.

Future conditions for this area are expected to be similar to existing conditions, due to the nearly saturated development. Horsley & Witten, Inc. predicted no change in current versus build-out commercial / industrial water use for the Raymond Road aquifer.[3] Redevelopment of some parcels for other uses may be permissible on a case by case basis, however, factors other than septic system limitations (e.g., the maximum impervious coverage of 25% in Water Resource Protection Districts, wetlands) may dictate the extent of redevelopment. Wetland areas exist throughout the Central area, as shown on Figure 3. For planning purposes, the wastewater flow for this area is estimated to be in the range of 25,000 to 30,000 gpd. The Raytheon EDL wastewater treatment facility was upgraded in 1991, and would be expected to continue in operation throughout the 20 year planning period for this study (1995 to 2015).

The Horsley & Witten report on Nitrogen Loading Analysis for Groundwater Supplies predicted nitrate-nitrogen concentrations well below EPA drinking water standard goal of 5 mg/l at build-out conditions in the Raymond Road wells based on modeling, but calibrated the results to a prediction of 2.76 mg/l which was attributed to attenuation between the bottom of the leach fields and the groundwater table. The calibration was done by reducing the input nitrate value to achieve a result which more closely resembled measured nitrate concentrations.

The Central Area is depicted on Figure 3.

EAST AREA

Existing Conditions.

The East area is comprised of districts BD1, ID4, BD16, ID11 (partial) and ID12, located on Property Maps K10 and K11, and bounded by the Wayland Town line on the east, and the Bay Path condominiums on the west. There are 22 parcels in this area, including 21 developed and one vacant (former Linde Gases of New England). The area is outside of delineated Zones II and III. There are three restaurants, five office buildings, with the remaining uses including retail, industrial and service related businesses. Total water use for the area (no data for eight of the parcels) averages 16,165 gpd (based on 1994 water use). The parcel area represented by those for which water use data was available is 20.1

[4]According to the Sudbury Water District, trace levels (well within drinking water standards) of trichloroethylene (TCE) have existed in Well No. 2 for several years. This well is the closest to Route 20. Although the exact source of this contamination is not known, it is suspected to be from a source along Route 20, suggesting that the clay layer is somewhat permeable or not continuous.

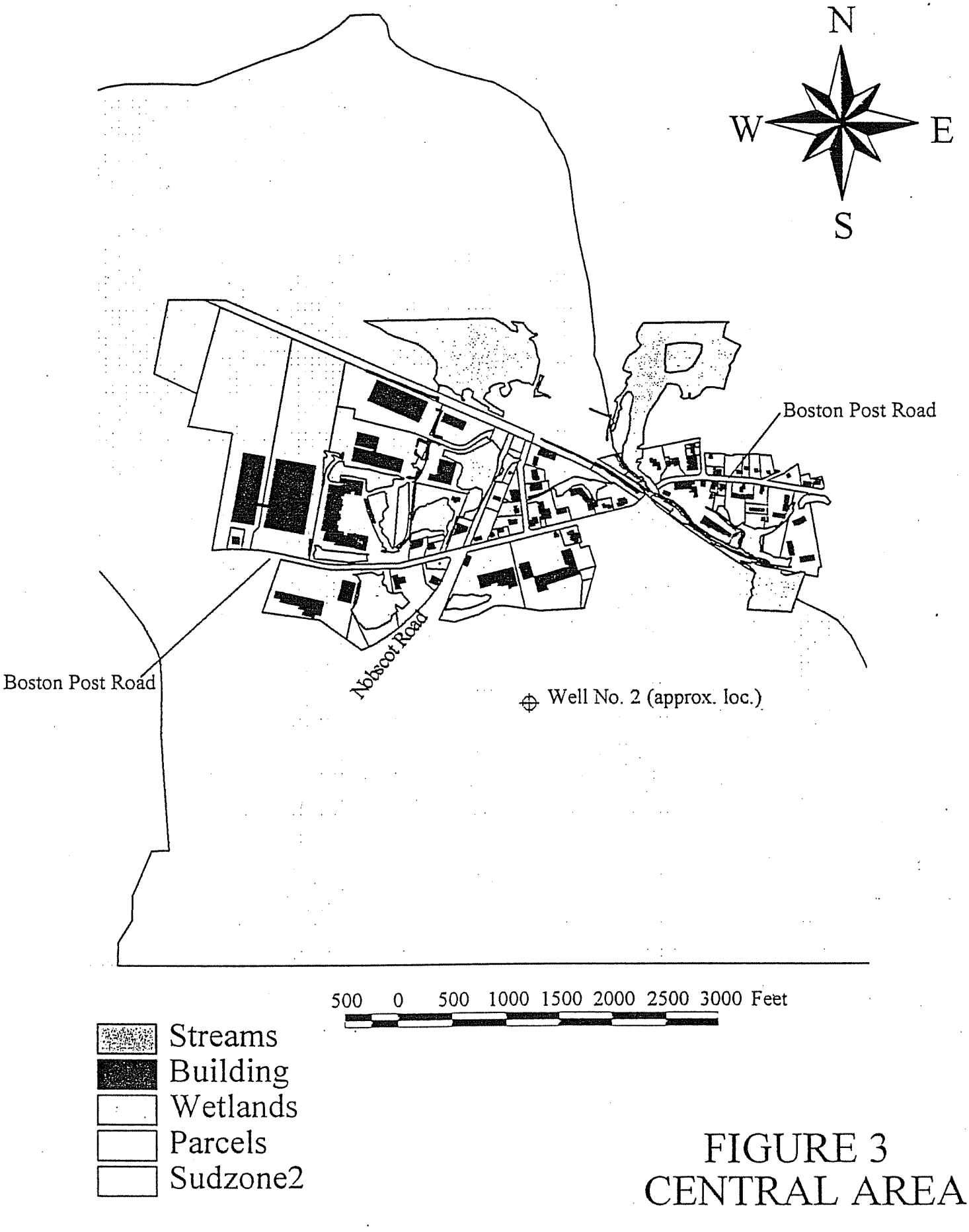


FIGURE 3
CENTRAL AREA

acres, resulting in a per acre water use of 803 gpd/acre. Using 85% as the ratio between wastewater flow and water use, the wastewater flow would be 13,740 gpd. One parcel (Wingate Nursing Home) has a septic system design flow of 14,700 gpd. The total known wastewater flow is therefore approximately 28,500 gpd. The parcels for which water use data was not given are generally considered to be low water users (typically 500 gpd or less). The total wastewater flow for planning purposes is estimated to be in the range of 32,000 gpd to 45,000 gpd.

Soils in this area are characterized by SCS as Urban Land, which may have high variability with regard to suitability for septic systems. There are no known currently failing septic systems in the area. Systems most likely to experience problems include food service establishments, and older systems, according to the Board of Health agent. Five of the systems were constructed prior to 1978, eight between 1978 and 1995 (under Title 5), and no information on system age was available for nine parcels. Several individual systems were reviewed with respect to Title 5 and Town of Sudbury requirements. Findings for the systems reviewed are discussed in the Needs Assessment. Constraints on changes in use depend upon actual site conditions (soil type, area available for leaching system, depth to groundwater).

Future Conditions.

Future conditions for this area are expected to be similar to existing conditions, because of the nearly complete occupancy of the parcels. The one vacant parcel (former Linde Gases) is a 15 acre parcel, is undergoing bioremediation for PCB and hydrocarbon contamination. If this parcel is found to be developable, and has soils suitable for a septic system, commercial development may occur at this site. Due to the size of the parcel, a significant water user may develop the site. This eventuality is accounted for in the wastewater flow range given above.

The East Area is depicted on Figure 4.

NEEDS ASSESSMENT

SUMMARY OF STUDY AREA

The Route 20 Business Districts have been discussed by geographic area - West, Central and East. Each area has its own characteristics, in terms of subsurface conditions, Water Resource Protection Districts, and types of use. A summary of comparative information is presented in Table 1.

NEEDS ANALYSIS

Several businesses were reviewed in each of the three areas to determine the ability to meet Title 5. In selecting those to review, priority was given to those with high water

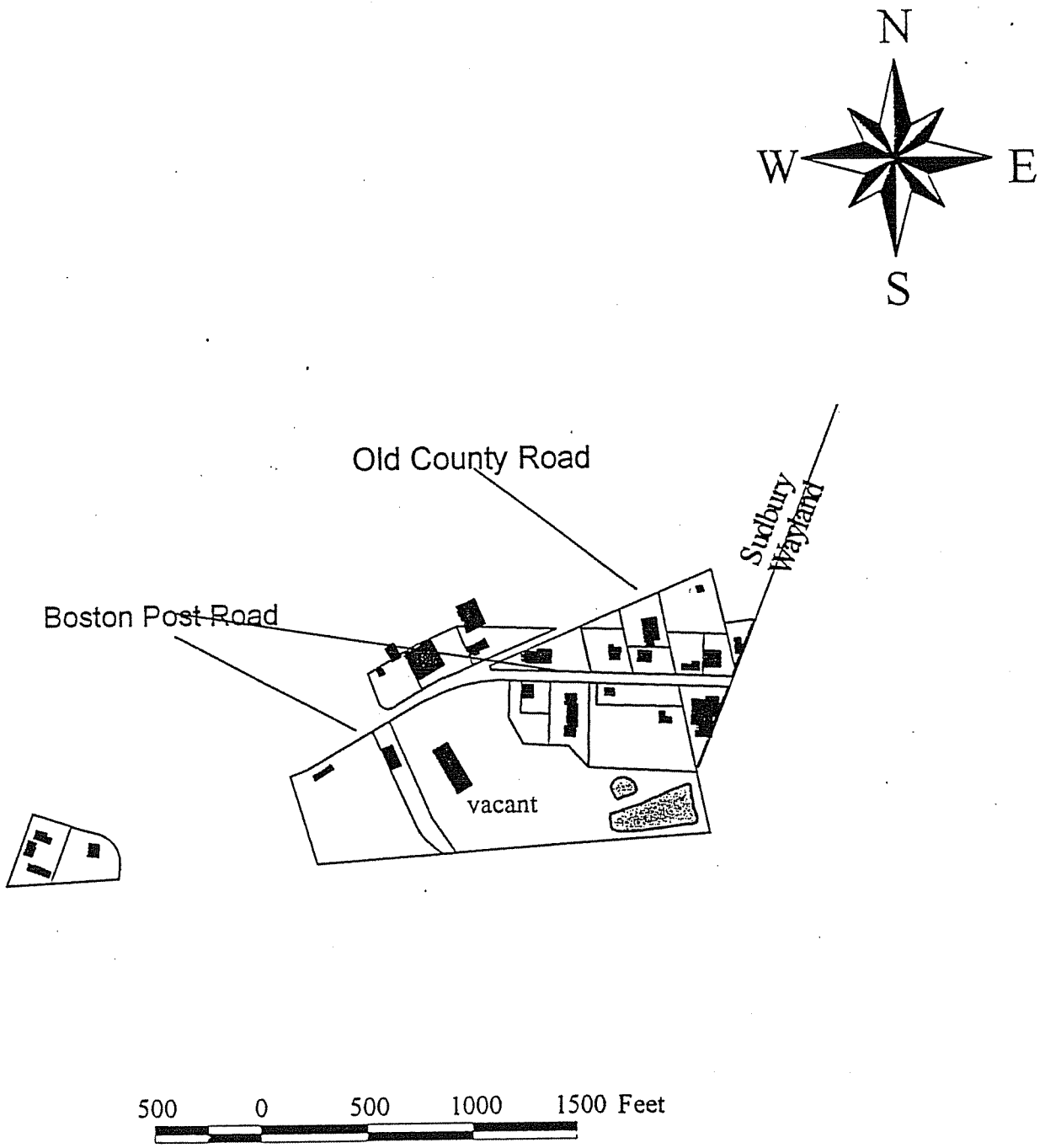


FIGURE 4
EAST AREA

use, restaurants, and small lots. Sudbury Board of Health data on the years that systems were built, upgraded or repaired /replaced indicate a median construction year of 1977 (half of the systems for which there are data were constructed before 1977, and half after). Title 5 was last revised in 1978, and was recently revised in October 1994. The average time between construction and system modification is 18.6 years, based on available board of Health data between 1974 and 1995.

TABLE 1
SUMMARY OF STUDY AREA

	West Area	Central Area(1)	East Area
Restaurants	4	10	3
Office	3	21	5
Retail/Industrial/Service	4	22	13
Vacant	2	2	1
Total Parcels	13	55	22
Total Parcel Area, acres	22.5	136.5	55
Total Water Use, gpd	21,518	28,305	16,165(2)
Parcel Area with Water Use Data, acres	16.7	126.3	20.1
Water Use per Acre, gpd	1,289	222	803
Median Parcel Size, Acres	1.7	0.75	1.3
Design Wastewater Flow, gpd	25,000 - 30,000	25,000 - 30,000	32,000 - 45,000

1. Excluding Raytheon Company
2. Not including Wingate Nursing Home (new), with 14,700 gpd design wastewater flow.

Systems have been modified either to provide for increased use, to repair a problem associated with performance, or to bring the system up to current standards. It is therefore difficult to assess average system life, because many of the modifications have been performed prior to any observed problem or "failure".

ASSUMPTIONS

Based on our review of soils maps and discussions with the Board of Health agent, the following assumptions were made in order to conduct the site by site review of systems:

- Title 5 design flows applied to building area and current use to determine site design flow.
- Soils are Class II, Sandy Loams and Loams. Some areas may have more restrictive soil conditions, which would result in more leaching area being required.

- Long Term Acceptance Rate = 0.6 gpd sq.ft. for sizing the leaching area (based on Class II soils).
- Use 2 ft. wide x 2 ft. deep trench, with effective area of 6 sq. ft. per lin. ft. of trench. Assume maximum length of single trench = 100 ft., per Title 5.
- Sufficient depth to groundwater can be obtained, either by having at least four feet of naturally occurring unsaturated soils between the bottom of the leaching system and the high water table, or by constructing a mounded system to achieve the separation.
- If soil conditions are more limiting than assumed on a case by case basis, variances from Title 5 would be necessary for some uses/lots.
- Existing uses would be accommodated by the Board of Health to the extent possible (in the event of system failure) to achieve maximum feasible compliance with Title 5.

WEST AREA

Four properties were reviewed, and all appear to have sufficient area based on current use to meet Title 5 requirements, plus Board of Health regulations for restaurants (where applicable). Site specific information, such as percolation rate and depth to groundwater would be needed to make a definitive assessment for a specific property. Costs for system upgrades would be higher if systems had to be mounded to achieve separation from groundwater.

CENTRAL AREA

Eight properties were reviewed. The results of the review range from properties which appear to have sufficient space to meet Title 5, and possibly allow for a change in use, to properties which appear to be at maximum use, and in fact may have difficulty in constructing a replacement system without significant variances necessary due to extremely shallow water table and small lots. Site specific information, such as percolation rate and depth to groundwater would be needed to make a definitive assessment for a specific property. Mounded systems with impervious retaining walls may be necessary on some small lots to achieve separation from groundwater and maintain setbacks from property lines. The extreme shallow groundwater conditions are known to exist in the area between Raymond Road and Nobscot Road, based on discussions with the Town Engineer. Additional complications may exist on properties in the Central area, due to prior uses and soil / groundwater discharges. Such properties may have to undergo site assessment and remediation, prior to construction / replacement of on-site septic systems. In the Central area, 25% impervious lot coverage limits and wetland delineations may be factors to constrain development, in addition to Title 5 requirements. Also, any new construction in Zone II areas must have design flows of less than 440 gpd per acre, or be designed with enhanced nitrogen removal, according to Title 5. Section VII of the Rules & Regulations Governing the Subsurface Disposal of Sewage, by the Sudbury Board of Health, also requires a six (6) ft separation between the

bottom of the leaching facility and the high groundwater table. Given the shallow groundwater conditions existing in this area, the result is that mounded systems would likely be required to achieve this separation.

EAST AREA

Two systems were reviewed, a restaurant and an office condominium. The restaurant is estimated to be at maximum use, i.e., is not likely to be able to increase the number of seats, because the resultant increase in design wastewater flow would exceed the capacity of the parcel to accommodate the leaching area. The other site appears to have sufficient lot size to accommodate a Title 5 system, should an upgrade or replacement be proposed. Site specific information, such as percolation rate and depth to groundwater would be needed to make a definitive assessment for a specific property.

IDENTIFICATION AND EVALUATION OF WASTEWATER MANAGEMENT ALTERNATIVES

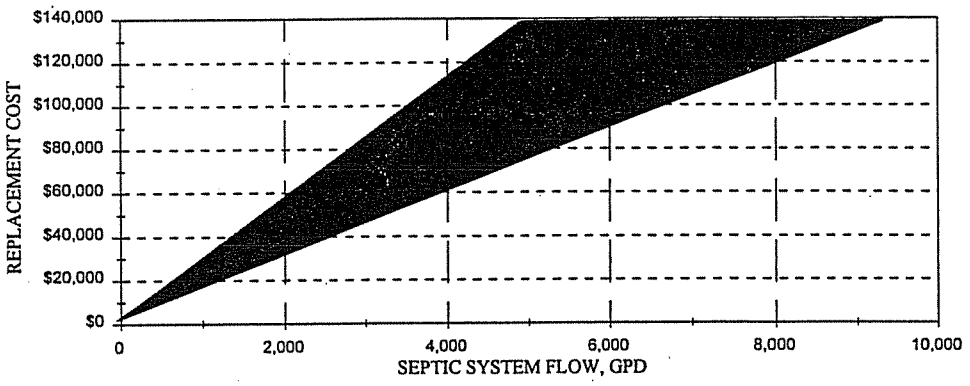
The following options will be assessed as to feasibility and cost. Cost comparisons are developed using the Present Worth method, which brings annual and future capital costs back to the present. A 20 year planning period and 6% interest rate are used to generate the factors to be used in the analysis.

REHABILITATION OF SEPTIC SYSTEMS.

Existing soils data, parcel size, system ages, and cost information were used to estimate total cost of system replacement to maintain existing uses. The service life of a septic system is estimated to exceed 30 years (with proper maintenance), and will be assumed at 30 years for planning purposes and cost comparisons. Discussions at Task Force meetings resulted in consensus on selection of the 30 year service life.

Cost data for septic system construction was obtained from other Woodard & Curran projects, Sudbury Board of Health information, and published cost data. A composite estimate of septic system replacement costs is presented in Figure 5. For example, for replacement of a 4,000 gpd system , the costs are expected to range between $60,000 and $110,000. Annual costs include pumping of septic tanks and inspection of systems. Pumping costs are based on average rates quoted by a local septage hauler, plus the treatment charge of $0.09/gallon at the Wayland/Sudbury Septage Treatment Facility.Total pumping and treatment costs are expected to be $375 per pumpout, for an average sized system. Costs are generally a function of septic tank size, and accessibility by the pumper truck. Inspection of systems must be performed at the time of sale, change in use, or any other time as required by the Board of Health. For estimating purposes, it will be assumed that inspection will occur every two years, at a cost of $500 per inspection.

FIGURE 5
SEPTIC SYSTEM COSTS



LIMITED SEWERING TO COMMUNAL SEPTIC SYSTEM / WASTEWATER TREATMENT FACILITY

For each of the three areas, we have estimated the cost for design, construction, and operation and maintenance of a sewer system (gravity or pressure to be determined based on available topography), to a treatment and disposal system located within the general area. It will be assumed that land will be available for this purpose. Undeveloped sites with sufficient land area were chosen only in order to determine the length of sewer needed to reach them. Land costs are not included in the estimate. In the Central Area, which is within a Treatment Facility Restricted Zone, treatment facilities are limited to 20,000 gpd maximum, in accordance with Sudbury Zoning Bylaws for Wastewater Treatment Facility Restricted Zones. Based on the estimated wastewater flow for this area (25,000 - 30,000 gpd excluding Raytheon), the treatment plant must be located outside of the Restricted Zone, or a Special Permit would be required. If neither of these were possible, two treatment plants would be required, with discharges situated no closer than 1/2 mile from each other, and from the Raytheon facility discharge. The West area treatment plant location is outside of the Restricted Zone and therefore would not have a limit as to size. Depending upon whether Longfellow Glen is included, the design flow would be 25,000 to 30,000 gpd (not including Longfellow Glen), or 57,000 to 62,000 gpd (including Longfellow Glen).

WEST AREA

<u>On-site Rehabilitation of Title 5 Systems</u>

Based on system age, seven of the thirteen systems would be replaced immediately (including the two vacant parcels). Three systems would be replaced in 2005 (ten years), and three in 2015 (20 years). Capital, annual, and Present Worth costs are summarized as follows (detail provided in Appendix):

Total Capital Cost	$448,000 to $560,000
Present Worth of Capital Cost	$360,300 to $450,500
Annual Cost (pumping & inspection)	$8,125
Present Worth of Annual Cost	$96,000
Total Present Worth Cost	**$456,300 - $546,500**

Limited Sewering to Communal Septic System / Wastewater Treatment Facility.

Assessor's maps were used to plan and estimate the quantities necessary to provide sewer service to the businesses in this area. A pumping station would be required to lift the wastewater to a treatment facility in the area. Land costs are not included in the estimate, and no salvage value is assigned to the equipment at the end of the planning period. Unit costs are based on actual bid prices for similar recent work, and the range reflects bid fluctuations. Capital, annual, and Present Worth costs are summarized as follows (detail provided in Appendix):

Capital Cost

Collection System Capital Cost	$576,900 to $732,200
Treatment and Disposal System Capital Cost	$625,000 to $937,500
Total Annual Cost (operation & maintenance)	$60,000 to $100,000
Present Worth of O&M	$688,200 to $1,147,000
Total Present Worth Cost	**$1,890,100 to $2,816,700**

CENTRAL AREA

On-site Rehabilitation of Title 5 Systems

Based on system age, 24 of the 54 systems would be replaced immediately (including the three vacant parcels). Seven systems would be replaced in 2005 (ten years), and 23 in 2015 (20 years). Capital, annual, and Present Worth costs are summarized as follows (detail provided in Appendix):

Total Capital Cost	$721,600 to $902,000
Present Worth of Capital Cost	$402,300 to $502,900
Total Annual Cost (pumping & inspection)	$33,750
Present Worth of Annual Cost	$387,200
Total Present Worth Cost	**$789,500 to $890,100**

Limited Sewering to Communal Septic System / Wastewater Treatment Facility.

Assessor's maps were used to plan and estimate the quantities necessary to provide sewer service to the businesses in this area. A pumping station would be required to lift the wastewater to a treatment facility in the area. Land costs are not included in the estimate, and no salvage value is assigned to the equipment at the end of the planning period. Unit

costs are based on actual bid prices for similar recent work, and the range reflects bid fluctuations. Capital, annual, and Present Worth costs are summarized as follows (detail provided in Appendix):

Capital Cost	
Collection System Capital Cost	$1,670,600 to $2,072,300
Treatment and Disposal System Capital Cost	$625,000 to $937,500
Total Annual Cost (operation & maintenance)	$60,000 to $100,000
Present Worth of O&M	$688,200 to $1,147,000
Total Present Worth Cost	**$2,983,800 to $4,156,800**

EAST AREA

On-site Rehabilitation of Title 5 Systems

Based on system age, 10 of the 22 systems would be replaced immediately (including the one vacant parcel). Two systems would be replaced in 2005 (ten years), and 10 in 2015 (20 years). Capital, annual, and Present Worth costs are summarized as follows (detail provided in Appendix):

Total Capital Cost	$596,000 to $746,000
Present Worth of Capital Cost	$398,000 to $497,500
Total Annual Cost (pumping & inspection)	$13,750
Present Worth of Annual Cost	$162,700
Total Present Worth Cost	**$560,700 to $660,200**

Limited Sewering to Communal Septic System / Wastewater Treatment Facility.

Assessor's maps were used to plan and estimate the quantities necessary to provide sewer service to the businesses in this area. A pumping station would be required to lift the wastewater to a treatment facility in the area. Land costs are not included in the estimate, and no salvage value is assigned to the equipment at the end of the planning period. Unit costs are based on actual bid prices for similar recent work, and the range reflects bid fluctuations. Capital, annual, and Present Worth costs are summarized as follows (detail provided in Appendix):

Capital Cost	
Collection System Capital Cost	$566,600 to $716,200
Treatment and Disposal System Capital Cost	$937,500 to $1,250,000
Total Annual Cost (operation & maintenance)	$75,000 to $125,000
Present Worth of O&M	$860,300 to $1,433,800
Total Present Worth Cost	**$2,364,400 to $3,400,000**

ENTIRE STUDY AREA

A sewering option involving the entire study was considered, whereby the area would be sewered to a single wastewater treatment facility located outside of Sudbury Wastewater Treatment Facility Restricted Zones. The design flow for a plant to handle the study area would be 80,000 gpd to 105,000 gpd (with no allowance for wastewater from non-business parcels along the Route 20 study area, and exclusive of the Raytheon EDL treatment facility). A secondary wastewater treatment plant of this size would be in the range of $1.5M and $2.5M. The collection system costs would be similar to those developed for the three areas separately, with a total capital cost of from $2.8M to $3.5M. Total project capital costs would be between $4.3M and $6.0M. Using an annual operation and maintenance cost of $200,000 for the treatment plant and collection system, the present worth of the annual O&M cost is $2.3M. The Total Present Worth for this alternative is the capital cost plus the present worth of the O&M cost, or $6.6M to $8.3M. The Total Present Worth of on-site rehabilitation for the entire study area is $1.8M to $2.1M.

SUMMARY AND CONCLUSIONS

The Route 20 Study area consists of approximately 98 businesses in three somewhat distinct areas - West, Central and East, in that they are separated by non-business uses. The businesses are a mix of retail, office, restaurant and industrial uses. There are five vacant parcels in total. With exception of the Raytheon EDL wastewater treatment facility, the area is entirely served by on-site septic systems as the only means of wastewater disposal. Some septic systems have been in existence for over 30 years without replacement. Other systems have been repaired or upgraded due to failure or change in use. There are currently no known failing systems which are causing a public health problem. There appears be some systems which are at maximum use for the parcels they are on, due to site specific conditions (low permeability soils, shallow groundwater table, small lots). Although the Raymond Road aquifer (Zone II) resides beneath much of the Central and West areas, subsurface information suggests that a relatively impermeable layer of silt and clay exists at shallow depth below the surface. This layer appears to be protecting the aquifer from surface contamination due to septic systems, leaking oil tanks, etc.

Our conclusions from this investigation are as follows:

1. The risk of contamination of groundwater in the Raymond Road Aquifer is mitigated by the silt and clay layer which exists beneath some or all of the Route 20 business district, therefore, continued use of on-site systems in this area does not appear to pose a direct threat to the aquifer.
2. Some septic systems appear to be at maximum use, i.e., a change in use to higher wastewater discharge is not feasible, based on lot size and current use. This condition is very site specific, and a determination using on-site soil data would be required to

definitively assess whether a given site could be redeveloped or changed (e.g., from retail to office use).

3. The total present worth (20 year planning period) of rehabilitating septic systems to maximum feasible compliance with Title 5 is estimated to be in the range of $1.8M to $2.1M. These costs would be borne by the affected property owners, on a site by site basis.
4. The total present worth of a sewering option in each area, with a satellite treatment plant is estimated to be in the range of $7.2M to $10.4M. These costs could be covered by the affected property owners through the creation of a sewer district or betterment assessments, or could be borne by the entire community through property taxation.
5. The total present worth of a sewering option to a single treatment facility serving the entire Route 20 business district is estimated to be in the range of $6.6M to $8.3M. The present worth (capital cost) of the collection system alone is $2.8M to $3.5M. These costs could be covered by the affected property owners through the creation of a sewer district or betterment assessments, or could be borne by the entire community through property taxation.

RECOMMENDATIONS FOR MAINTENANCE OF ON-SITE SEWAGE DISPOSAL SYSTEMS

The following should be considered as minimum guidelines for operation and maintenance of on-site sewage disposal systems, to maximize useful life of these systems.

Septic tanks should be inspected annually, and pumped at least every other year.

Complete system inspections should be conducted every two years, including grease traps, septic tanks, distribution boxes and leaching systems where accessible.

APPENDIX A
SPREADSHEET OF PARCELS

STREET #	PARCEL #	ASSESSOR'S #	ZONING	PARCEL SIZE (sq ft)	BLDG. SQ. FT.	USE - BUSINESS NAME	1 YR WATER USAGE GALLONS	WATER USAGE GPD	WASTEWATER GPD @ 85%	BUILT	SEPTIC SYSTEM INFO. UPDATED	DESIGN FLOW, GPD
WEST AREA												
740 BP	55	K05	BD 6		2,535	Office - Want Ad	136,000	373	317	1961		
738 BP	56	K05 - 077	BD 6, A 1	90,169	26,270	Hotel - Coach House Inn	2,145,000	5,877	4,995	1985		
736 BP	57	K05 - 011	BD 6, A 1	77,101		VACANT	0	0	0			
730 BP	58	K05 - 012	BD 6, A 1	124,146	19,868	Retail - Wayside Plaza	119,000	326	277	1975		
712 BP	59	K05 - 013	BD 6, A 1	50,530	8,800	Industrial - Sudbury Rental	77,000	211	179			
708 BP	60	K05 - 015	BD 6, A 1	50,530	1,680	Office - Dentist	95,000	260	221			
694 BP	61	K05 - 017	BD 6, A 1	61,420	3,610	Restaurant - 99	1,192,000	3,266	2,776	1976		
681 BP	62	K05 - 019	BD 6, A 1	33,541	560	Auto Repair	119,000	326	277			
642 BP	63	K06 - 044	LBD 1	139,392		Nursing Home	3,378,000	9,255	7,867			
	64	K06 - 005	LBD 1	176,418		VACANT	0	0	0			
616 BP	65	K06 - 012	LBD 1	84,506	8,382	Office - Sud Medical Center	268,000	734	624	1962	1990	
621 BP	66	K06 - 028	BD 15	22,651	4,760	Retail/Restaurant - Barnstead Shops	198,000	542	461	1985		
615 BP	67	K06 - 026	BD 15	70,132	12,352	Retail - Dudley Square	127,000	348	296	1984		

STREET #	PARCEL #	ASSESSOR'S #	ZONING	PARCEL SIZE (sq ft)	BLDG. SQ. FT.	USE - BUSINESS NAME	1 YR WATER USAGE GALLONS	WATER USAGE GPD	WASTEWATER GPD @ 85%	BUILT	SEPTIC SYSTEM INFO. UPDATED	SEPTIC SYSTEM INFO. DESIGN FLOW, GPD
CENTRAL AREA												
528 BP	1	K07 - 011, 013	LID 1	2,158,398	374,616	R & D - Raytheon	15,834,000	43,381	36,874			50,000
490 BP	2	K07-018	LID1	1,139,000	44,985	Industrial - Chiswick Park	486,000	1,332	1,132	1988		
29U, 31U	2	K07 - 018	LID 1	p/o 490 BP	44,985	Industrial - Chiswick Park	1,078,000	2,953	2,510			
27 U	3	K08 - 056	LID 1	130,680	1,120	Saxonville Lumber	25,000	68	58	1975		800
25 U	4	K08 - 060	LID 1	217,800	33,000	Warehouse - NE Door	133,000	364	310			
460 BP	5	K08 - 062	LID 1, BD 5	204,296	3,300		118,000	323	275			
476 BP	6	K07 - 008	BD 5	26,136	6,100	Retail - Kappy's Liquors		0	0	1983		
505,507-525 BP	8	K07 - 005,006,014	LBD 2	660,805	48,438	Retail - Star Plaza	1,067,000	2,923	2,485	1966	1995	
477 BP	9	K07 - 007	ID 8	151,153	4,823	Auto Repair/Fuel Service - Sousa	22,000	60	51			
237-239 N	10	K08 - 001	ID 8	32,670	1,080	Fuel Service - Interstate Oil	40,000	110	93			
465 BP	11	K08 - 002	ID 8	21,780		Gas Station - VACANT	0	0	0			
454 BP	12	K08 - 065	BD 5, LID 1	128,938	7,050	Retail - Big & Tall	125,000	342	291	1983		
450 BP	13	K08 - 066	BD 5	46,609		Office - Bank VACANT	0	0	0			
21 U	14	K08 - 090	BD 5	66,211	2,520	Office -Veterinarian	75,000	205	175	1984		
23 U	15	K08 - 073	BD 5	18,295		Bay Bank ATM	0	0	0			
15 U	16	K08 - 071	BD 5	32,234	4,698	Retail/Office - Sud Coffee, Printer	26,000	71	61			175
1 U	17	K08 - 070	BD 5	28,750	5,412	Office	193,000	529	449			682
434 BP	18	K08 - 069	BD 5	43,560	2,160	Gas Station - Mobil		0	0			
444 BP	19	K08 - 058	BD 5	6,970	992	Retail - Westsport	7,000	19	16	1969		
440 BP	20	K08 - 067	BD 5	10,890	2,032	Office	35,000	96	82	1984		
435-457 BP	21	K08 - 003	LBD 6	352,836	40,704	Retail - Sudbury Plaza	1,892,000	5,184	4,406	1984	1995	
435-437 BP	22	K08 - 004	LBD 6	420,790	84,167	Shopping Mall		0	0	1984		4,600
415 BP	23	K08 - 006	LBD 6	27,443		Police Station	103,000	282	240			243
430 BP	24	K08 - 077	BD 5	20,909	3,950	Auto Repair - Colonial Auto	61,000	167	142	1987		
424-428 BP	25	K08 - 078,079	BD 5	49,604	10,074	Retail/Restaurant - Bed&Bath	10,000	27	23	1966	1983	
418-420 BP	25	K08-078,079	BD5	15,300	10,074	Retail/Restaurant/Office - Marronne's	188,000	515	438	1971	1983	
18 U	26	K08 - 076	BD 5	27,443	5,533	Post Office	172,000	471	401	1983		
22 U	27	K08 - 075	LID 6, BD 5	27,878	9,944	Office - Bay Bank	35,000	96	82	1972		
28 U	28	K08 - 074	LID 6, BD 5	132,858	4,402	Sudbury Lumber	246,000	674	573	1968		633
410 BP	29	K08 - 080	BD 5	99,317	26,000	Retail/Office - Rugged Bear Plaza	64,000	175	149	1984		1,740
400 BP	30	K08 - 081	BD 5	20,473	2,060	Office - Prudential Realty	52,000	142	121	1965		2,100
394 BP	31	K08 - 082	BD 5	71,874	5,562	Restaurant - Lotus Blossom	1,420,000	3,890	3,307	1985		
378 BP	32	K08 - 037	VBD 1	116,741		Restaurant - Dunkin Donuts		0	0	1995		
370 BP	33	K08 - 036	VBD 1	27,443	6,368	Office	362,000	992	843	1974	1990	
5-15,17,19 C	34	K08 - 035,085,086	VBD 1	81,457	14,138	Retail/Service - MacKinnons		0	0			1,000
361-389 BP	35	K08 - 026,029	VBD 1	285,318	54,401	Retail/Office - Mill Village	84,000	230	196	1972	1995	
357 BP	36	K09 - 050	VBD 1	28,750	2,665	Retail - Maggie Flood	10,000	27	23			
353 BP	37	K09 - 051	VBD 1	7,405	2,325	Residence	3,000	8	7	1984		
351 BP	38	K09 - 052	VBD 1	60,548	4,708	Office - NE Telephone	55,000	151	128	1973		
345 BP	39	K09 - 053	VBD 1	27,443	10,931	Office	309,000	847	720			
333 BP	40	K09 - 056	VBD 1	84,506	2,497	Retail - Choice Seating	132,000	362	307	1970		
335 BP	41	K09 - 055	VBD 1	20,038	3,135	Store Shop		0	0	1984		
339 BP	42	K09 - 054	VBD 1	26,136	7,692	Retail / Office	153,000	419	356			
327 BP	43	K09 - 057	VBD 1	139,392	7,616	Office - Mill Brook I	234,000	641	545	1982		
321-325 BP	44	K09 - 059	VBD 1	191,228	23,000	Office - Mill Brook II	380,000	1,041	885	1986		
316 BP	45	K09 - 405	VBD 1	8,712	1,695	Auto Repair	4,000	11	9			
320 BP	46	K09 - 401	VBD 1	12,632	4,584	Retail/Service - Henly Read Books	75,000	205	175	1965		
61 KP	47	K09 - 049	VBD 1	29,185	2,356	Office Building	20,000	55	47	1971		
68 KP	48	K09 - 033	VBD 1	21,780		Office Building	6,000	16	14			
344 BP	49	K09 - 032	VBD 1	32,670	1,805	Office Building	30,000	82	70	1988		
346 BP	50	K09 - 031	VBD 1	15,246	2,674	Office - Clinical Counseling	40,000	110	93	1964		
348 BP	51	K09 - 030	VBD 1	32,670	1,770	Residence -Wood Davison House		0	0	1960		
354 BP	53	K09 - 029	VBD 1	6,534	1,392	Office - Sudbury Music	34,000	93	79	1990		
33 U	2A	K07 - 017	LID 1	395,525	16,512	Industrial Warehouse - Chiswick	693,000	1,899	1,614	1973	1988	1,200
8 C, 356 BP	52,54	K09-027,028	VBD 1	24,829	2,334	Office - NB Taylor	22,000	60	51	1964		
470 BP	7A	K08 - 064	BD 5	17,424	1,440	Gas Station	14,000	38	33	1967	1983	

STREET #	PARCEL #	ASSESSOR'S #	ZONING	PARCEL SIZE (sq ft)	BLDG. SQ. FT.	USE - BUSINESS NAME	1 YR WATER USAGE GALLONS	WATER USAGE GPD	WASTEWATER GPD @ 85%	BUILT	SEPTIC SYSTEM INFO. UPDATED	SEPTIC SYSTEM INFO. DESIGN FLOW, GPD
EAST AREA	East Area	East Area	East Area									
150 BP	68	K11 - 002	BD 1	71,003	2,804	Sit & Stay Kennel	330,000	904	768			
136 BP	69	K11 - 003	BD 1	261,360	17,680	Nursing Home - Wingate		0	0	1995		
68 OC	70	K11 - 004	ID 11	264,845	46,743	Office		0	0			1,450
120 BP	71	K11 - 007	BD 1	55,757	6,642	Restaurant - Matt Garretts	1,683,000	4,611	3,919	1978		
104 BP	72	K11 - 008	BD 1	40,075	2,756	Restaurant - Papa Ginos	486,000	1,332	1,132	1983		
100 BP	73	K11 - 010	BD 1	24,394	2,922	Auto Repair - Auto Diagnostics	72,000	197	168	1970		
33 OC	74	K11 - 009	BD 1, ID 12	43,560	5,931	Store Shop		0	0			
86-92 BP	75	K11 - 011	BD 1	29,185	2,671	Retail - Antiques	85,000	233	198			
84 BP	76	K11 - 013	BD 1	27,007	4,950	Retail - Town Line Hardware		0	0			
78 BP	77	K11 - 012	BD 1, ID 12	13,504	1,416	Car Wash	630,000	1,726	1,467			
9 OC	78	K11 - 014	ID 12	82,328	1,630	Industrial - Lewis Property	214,000	586	498	1992		
83 BP	79	K11 - 015	ID 4	55,757	13,800	Office - Mariner Place	388,000	1,063	904			
103 BP	80	K11 - 016	ID 4	40,075	880	Restaurant - Herbies Ice Cream		0	0	1974		
85 BP	81	K11 - 017	ID 4	146,797		Mass. Public Works		0	0			
111 BP	82	K11 - ?	ID 4	64,904	18,191	Office - Village East	236,000	647	550	1984		
119 BP	83	K11 - 018	ID 4	18,295	1,134	Retail - Sud Auto Parts		0	0	1983		
	84	K11 - 200	ID 4	30,492	4,608	Office		0	0	1986		
141 BP	85	K11 - 019	ID 4	686,941		VACANT (Linde)	0	0	0	1973		
151 BP	86	K11 - 020	ID 4	57,499		Buddy Dog	162,000	444	377	1976		
163 BP	87	K10 - 014	ID 4	258,746		Boston Edison Substation	1,323,000	3,625	3,081			
209 BP	88	K10 - 008	BD 16	61,855		Gas Station - Sudbury Auto	50,000	137	116	1992		
215 BP	89	K10 - 007	BD 16	60,548	11,326	Office	241,000	660	561	1984		

APPENDIX B
COST CALCULATIONS

West Area Title 5 Rehabilitation Alternative

Construction	Capital	Present Worth
Initial	$272,000 - $340,000	$272,000 - $340,000
2005	$136,000 - $170,000	$75,900 - $94,900
2015	$40,000 - $50,000	$12,400 - $15,600
	Subtotal	**$360,300 - $450,500**

Annual Costs		
Pumping & Treatment	13 @ $375 = $4,875	$55,900
Inspection	7 @ $500 = $3,500	40,100
	Subtotal	**$96,000**

Total Present Worth **$456,300 - $546,500**

West Area Collection And Treatment alternative

DESCRIPTION	QUANTITY	UNIT	LOW UNIT COST	LOW TOTAL	HIGH UNIT COST	HIGH TOTAL
SEWER GRAVITY MAIN	3950	L.F.	$60	$237,000	$75	$296,250
MANHOLES	14	EA	$1,000	$14,000	$1,200	$16,800
SERVICE CONNECTIONS	1170	L.F.	$50	$58,500	$60	$70,200
PUMP STATION	1	EA	$50,000	$50,000	$75,000	$75,000
FORCE MAIN	1000	L.F.	$60	$60,000	$75	$75,000
REPAVING	10500	S.Y.	$4	$42,000	$5	$52,500
			SUBTOTAL	$461,500		$585,750
ENGINEERING (DESIGN & CONST.SERVICES)		15%		$69,225		$87,863
CONTINGENCIES		10%		$46,150		$58,575
COLLECTION SYSTEM			**TOTAL**	**$576,875**		**$732,188**

WASTEWATER TREATMENT FACILITY
DESIGN FLOW = 25,000 - 30,000 GPD
EFFLUENT LIMITS: BOD = 30 MG/L
TSS = 30 MG/L
GROUNDWATER DISPOSAL VIA OPEN SAND BEDS

	LOW	HIGH
CONSTRUCTION COST	$500,000	$750,000
ENGINEERING @15%	$75,000	$112,500
CONTINGENCIES @ 10%	$50,000	$75,000
	$625,000	$937,500
OPERATION & MAINTENANCE, $/YR	$60,000	$100,000
PRESENT WORTH FACTOR (20 YRS @ 6%)	11.47	11.47
PRESENT WORTH OF O&M	$688,200	$1,147,000
TOTAL PRESENT WORTH		
TREATMENT	$1,313,200	$2,084,500
COLLECTION	$576,875	$732,188
TOTAL PRESENT WORTH	**$1,890,075**	**$2,816,688**

Central Area

On-site Rehabilitation of Title 5 Systems

Construction	Capital	Present Worth
Initial	$236,000 - $295,000	$236,000 - $295,000
2005	$60,000 - $75,000	$33,500 - $41,900
2015	$425,600 - $532,000	$132,800 - $166,000
	Subtotal	**$402,300 - $502,900**

Annual Costs			
Pumping & Treatment	54 @ $375 = $20,250	$232,300	
Inspection	27 @ $500 = $13,500	154,900	
	Subtotal		**$387,200**

Total Present Worth **$789,500 - $890,100**

Central Area

Limited Sewering to Communal Septic System / Wastewater Treatment Facility.

DESCRIPTION	QUANTITY	UNIT	LOW UNIT COST	LOW TOTAL	HIGH UNIT COST	HIGH TOTAL
SEWER GRAVITY MAIN	5550	L.F.	$60	$333,000	$75	$416,250
MANHOLES	22	EA	$1,000	$22,000	$1,200	$26,400
SERVICE CONNECTIONS	9670	L.F.	$50	$483,500	$60	$580,200
PUMP STATION	1	EA	$50,000	$50,000	$75,000	$75,000
FORCE MAIN	5500	L.F.	$60	$330,000	$75	$412,500
REPAVING	29500	S.Y.	$4	$118,000	$5	$147,500
			SUBTOTAL	**$1,336,500**		**$1,657,850**
ENGINEERING (DESIGN & CONST.SERVICES) 15%				$200,475		$248,678
CONTINGENCIES 10%				$133,650		$165,785
COLLECTION SYSTEM			**TOTAL**	**$1,670,625**		**$2,072,313**

WASTEWATER TREATMENT FACILITY
DESIGN FLOW = 25,000 - 30,000 GPD
EFFLUENT LIMITS: BOD = 30 MG/L
TSS = 30 MG/L
GROUNDWATER DISPOSAL VIA OPEN SAND BEDS

	LOW	HIGH
CONSTRUCTION COST	$500,000	$750,000
ENGINEERING @15%	$75,000	$112,500
CONTINGENCIES @ 10%	$50,000	$75,000
TOTAL TREATMENT & DISPOSAL	$625,000	$937,500
OPERATION & MAINTENANCE, $/YR	$60,000	$100,000
PRESENT WORTH FACTOR (20 YRS @ 6%)	11.47	11.47
PRESENT WORTH OF O&M	$688,200	$1,147,000
TOTAL PRESENT WORTH		
TREATMENT	$1,313,200	$2,084,500
COLLECTION	$1,670,625	$2,072,313
TOTAL PRESENT WORTH	**$2,983,825**	**$4,156,813**

East Area

On-site Rehabilitation of Title 5 Systems

	Capital	Present Worth
Construction		
Initial	$299,200 - $374,000	$299,200 - $374,000
2005	$24,000 - $30,000	$13,400 - $16,800
2015	$273,600 - $342,000	$85,400 - $106,700
	Subtotal	**$398,000 - $497,500**

Annual Costs		
Pumping & Treatment	22 @ $375 = $8,250/yr or Present Worth =	$94,600
Inspection	11 @ $500 = $5,500/yr or Present Worth =	$68,100
Subtotal		**$162,700**

Total Present Worth	**$560,700 - $660,200**

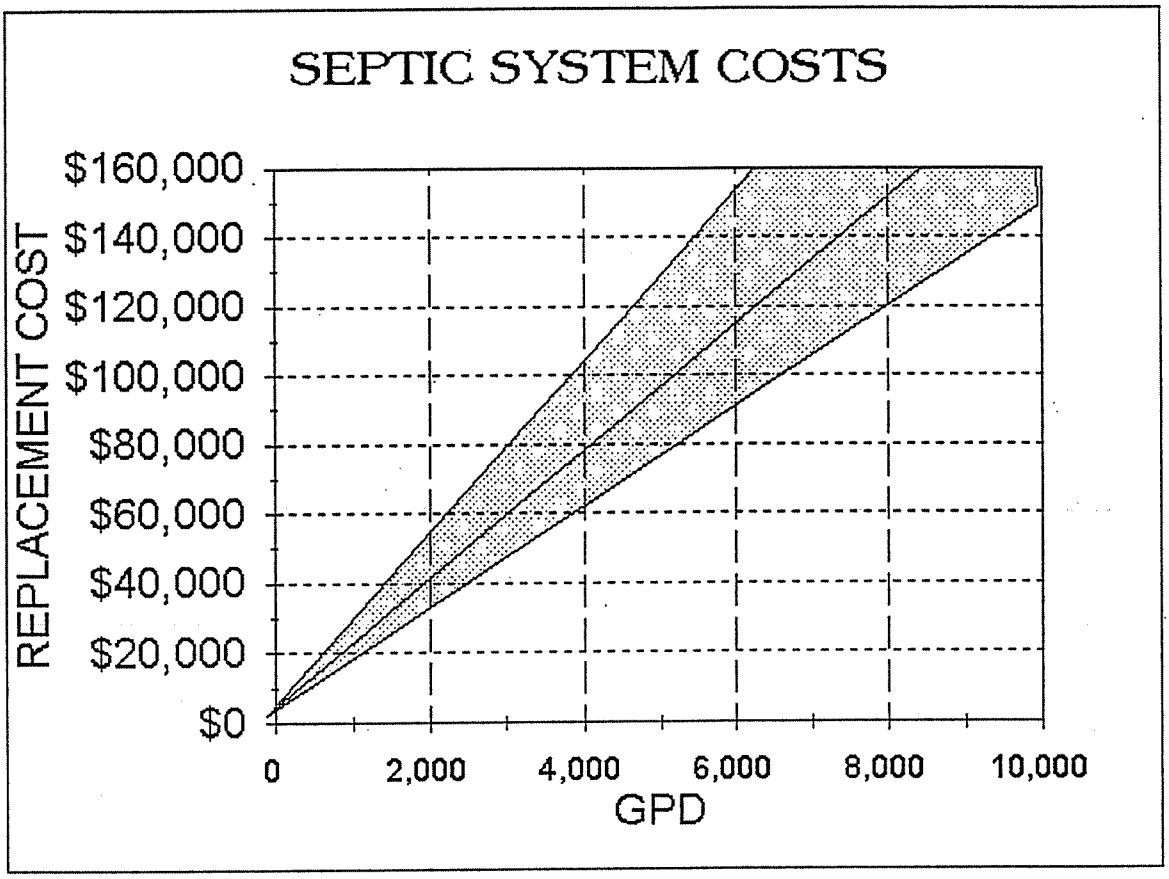
East Area

Limited Sewering to Communal Septic System / Wastewater Treatment Facility.

DESCRIPTION	QUANTITY	UNIT	LOW UNIT COST	LOW TOTAL	HIGH UNIT COST	HIGH TOTAL
SEWER GRAVITY MAIN	2690	L.F.	$60	$161,400	$75	$201,750
MANHOLES	9	EA	$1,000	$9,000	$1,200	$10,800
SERVICE CONNECTIONS	2290	L.F.	$50	$114,500	$60	$137,400
PUMP STATION	1	EA	$50,000	$50,000	$75,000	$75,000
FORCE MAIN	1600	L.F.	$60	$96,000	$75	$120,000
REPAVING	5600	S.Y.	$4	$22,400	$5	$28,000
			SUBTOTAL	$453,300		$572,950
ENGINEERING (DESIGN & CONST.SERVICES) 15%				$67,995		$85,943
CONTINGENCIES 10%				$45,330		$57,295
			TOTAL	**$566,625**		**$716,188**

WASTEWATER TREATMENT FACILITY
DESIGN FLOW = 32,000 - 45,000 GPD
EFFLUENT LIMITS: BOD = 30 MG/L
TSS = 30 MG/L
GROUNDWATER DISPOSAL VIA OPEN SAND BEDS

	LOW	HIGH
CONSTRUCTION COST	$750,000	$1,000,000
ENGINEERING @15%	$112,500	$150,000
CONTINGENCIES @ 10%	$75,000	$100,000
TOTAL	**$937,500**	**$1,250,000**
OPERATION & MAINTENANCE	$75,000	$125,000
PRESENT WORTH FACTOR (20 YRS @ 6%)	11.47	11.47
PRESENT WORTH OF O&M	**$860,300**	**$1,433,800**
TREATMENT	$1,797,800	$2,683,800
COLLECTION	$566,600	$716,200
TOTAL PRESENT WORTH	**$2,364,400**	**$3,400,000**


SEPTIC SYSTEM COSTS
REPLACEMENT COST
$160,000
$140,000
$120,000
$100,000
$80,000
$60,000
$40,000
$20,000
$0
0
2,000
4,000
6,000
8,000
10,000
GPD

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