Building and Site Analysis

Presented To:
Ransom District Library

January 17, 2012

RANSOM DISTRICT LIBRARY

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Table of Contents

The Ransom District Library retained C2AE and Inspecsol, Inc. to assess the structural, architectural, and site soil issues to determine the practicality and suitability of any future expansion to the current building and the extent of the poor soils that are known to exist. The north wall of the original structure has experienced severe settlement, especially the northeast corner in the Meeting Room and public restrooms. The north wall has sunk over four (4) inches and is hinged approximately ten (10) to twelve (12) feet south of the north wall. The slope to the floor at this point is very perceptible as well as uncomfortable.

C2AE investigated the buildings structural systems and discovered a number of unacceptable conditions that elicited a range of reactions of minor concern to extreme alarm, all which are reviewed in greater detail in this report. The most critical issue is the potential roof failure at the Meeting Room bay window where the bearing condition of the steel beam supporting the roof is being pulled out from under the north end of the beam from the movement of the north wall. C2AE provided the library with a temporary solution to prevent the roof from collapsing.

Inspecsol, Inc. performed the geotechnical investigation of the site to determine the extent of the poor soils that are known to be causing the settlement problems to the north portion of the library. The original proposal included three (3) soil borings, however, when this was discussed with the Building and Grounds Committee, they thought it would be prudent and wise to drill a total of ten (10) borings in various locations between the building and M-89 (East Bridge St.). The site has the distinction of being a local dump years ago where local residents disposed of their refuse, broken concrete, bricks, wood, glass, clothing, as well as large amounts of organic materials, most likely leaves and other vegetative materials. All ten (10) borings contained significant depths of organics that could be classified as peat. The deep layer of peat is very compressible and always in a constant state of decomposition, and as such, is one of the worst soil types to build structures on and to pave over. It is no wonder why the existing building has the settling problems it has, especially when it wasn't engineered for the poor soils.

The site is adjacent to the Kalamazoo River and has been flood-free over the years. The FEMA flood maps were reviewed and they also show that the entire site is above the 100 year flood plain and not in any floodways (see report). The original library structure was built on imported sand fill, elevating the floor elevation three (3) to four (4) feet above the native grades, most likely as a response to insure keeping the building dry in the event of an extreme flood event.

The building is in relatively good condition, more a testament to the excellent care and maintenance it has received over the years despite the structural issues caused by the poor soils that lie beneath. The building, however, is not an ideal structure to expand due to the structural issues, its varied structural systems, and its height above the native grades making it more expensive to save and adapt versus building a new building or repurposing a better more suitable structure. There will be ongoing structural issues within the original building due to the poor soils that will be very costly to mitigate.

Therefore, it is our professional recommendation to not expand the current facility, but to build a new library on the vacant north portion of current site (near M-89), or on another vacant site within the library district boundaries. Another option is to repurpose a vacant building that is suitable and practical to house a modern library. This option could help defray construction costs by up to twenty percent (20%).

Constructing a new library facility will offer the community not only a design that meets its specific needs, but can be a sustainable "green" building that is healthy to the user and environment, built to last generations, and economical to operate and maintain.

C2AE and Inspecsol, Inc. respectfully present our findings in this report for the Ransom District Libraries review and use.

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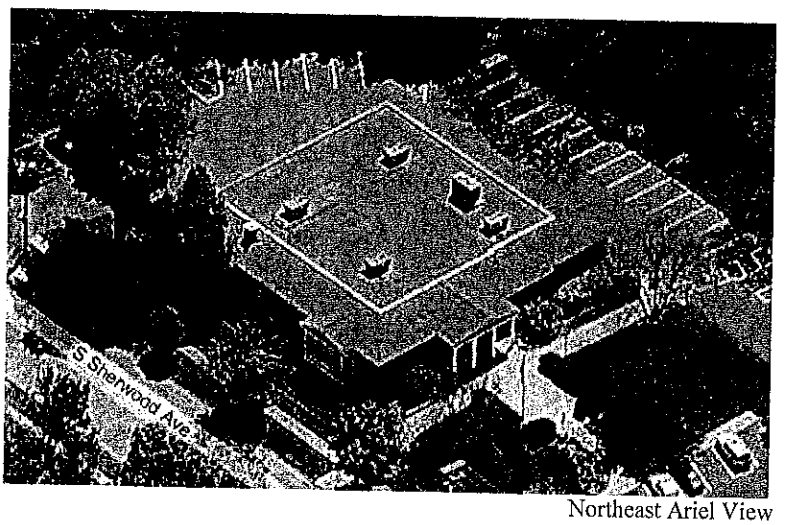
Overview

The original 6,200 sq. ft. library was built in 1973 and the subsequent 3800 sq. ft. addition in 1988. The original building has engineered wood roof trusses bearing on exterior and interior masonry block walls, while the addition has similar roof construction, but differs with load bearing 2x6 wood stud exterior walls and interior structural steel beams and columns above the finish floor level. The exterior is predominantly facebrick veneer with painted wood siding and trim details/ornamentation at the bay window projections and entry portico. The exterior windows are older wood sash units with clear non-coated insulating glass. The original building has minimal wall insulation, while the addition has 5-1/2" of fiberglass batt insulation (R-19) in the exterior stud walls. The insulation at the roof is 8" fiberglass batts (R-24) stapled to the top chord of the roof trusses over the original library and laid immediately above the suspended ceiling system in the addition. New 4" nail-base rigid insulation (R-21) was added over the entire roof in 2003. The roofing is reinforced asphalt laminated shingles on the perimeter sloped roof (5:12 pitch) and a fully adhered single ply membrane roof on the central low-slope roof with roof drains.

Interior walls are a combination of masonry block and stud construction. The interior and exterior masonry block walls are covered with drywall on wood furring in the public areas. The original fireplace was retained when the 1993 expansion occurred and is a focal point in the library, though is not used today. The suspended ceiling is 2x4 mineral fiber tiles in a painted metal grid. Two folding wall systems segregate the northwest corner from the remainder of the public areas for children's programming.



Northeast Ariel View

The building is serviced with natural gas, 208 volt 3-phase power, city water and sanitary sewer. There is no public storm water sewer system serving the immediate neighborhood.

Conditions

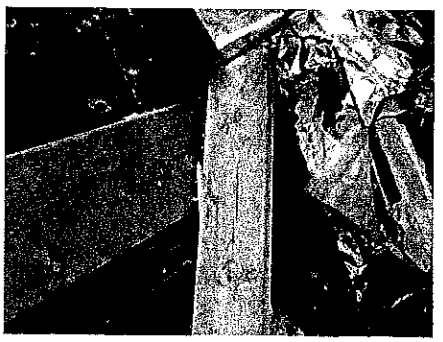
Overall, the building has been maintained very well, despite the extreme settlement issues of the north portion of the original structure and its subsequent (and ongoing) repairs. The original portion of the library is already 38 years old and was built with conventional construction techniques that were low cost for the time, but was not built with an eye for longevity despite the unknown settlement problems that would soon plague the structure. The (1988) addition is 23 years old and incorporates even less durable construction techniques from the floor level up of simple wood frame construction. However, the interface between the original and new addition structures has structural steel framing to support the roofs where the exterior walls were removed. The interior finishes are relatively new, however the trim and doors are original and showing their age. Some doors in the original building jamb, or scuff against the floor when opened, which is an indication of the building moving ever so slightly due to the uneven settlement from the compression of the bad soils it was built upon.

The settlement problem has been documented over the past ten years by Nehil-Sivak, structural engineers, through a series of studies and measurements of the north wall. They also designed corrective solutions to the exterior of the building that repaired cracked masonry, replaced the roofing and added more insulation in 2003, but did not include any corrective measures to prevent/reverse further settlement.

The north 10 ft. to 12 ft. of the original building is experiencing the most severe settlement (up to 4 inches of movement) while the remainder of the original building has seen only minor movement (less than 1 inch). However, there is a perceptible difference in floor transition between the original building and addition at the entire juncture. The most obvious floor transition issue is at the original south exit door which opens into the addition, where the bottom of the door gets wedged against the addition's floor, indicating movement (either settling or racking) of the original building. ***It is our professional opinion that without intensive corrective measures to the entire existing foundation system of the original building, the settling will continue in persist.***

Another critical issue is the pulling apart of the roof trusses along the original buildings north wall. C2AE observed that as the north wall has settled and rotated away the roof trusses have pulled away from their supporting components (walls, girder trusses, etc.). It appears that some corrective measures have been installed to prevent failure to the worst trusses, but more needs to be employed if the library decides to stay long term, or expand the current facility.

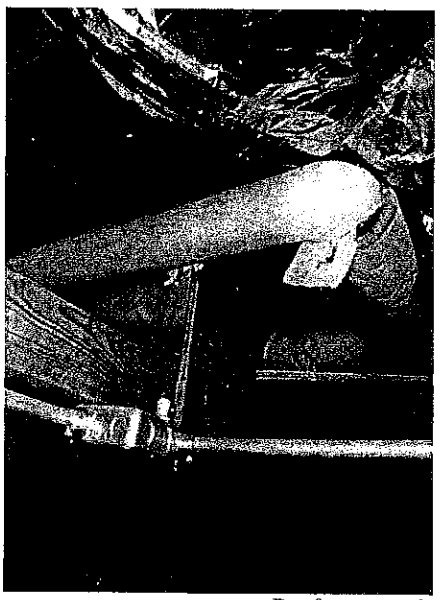
An observation while investigating the roof structure is that a fair amount of the fiberglass batt insulation has fallen out from between the top chords of the roof trusses and should be re-installed to maintain the thermal value of the roof system in order to reduce the libraries energy costs.


Roof truss movement

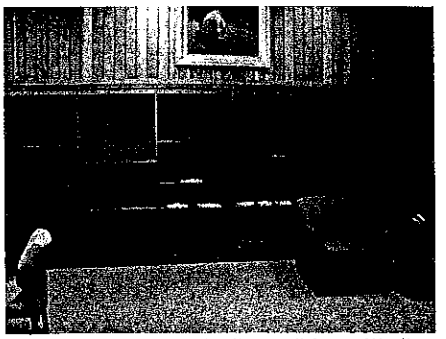
Also discovered during the investigation was the potential roof failure at the north valley of the Meeting Rooms roof over the bay window. The extreme settlement in this area has pulled most of the bearing wall away from the beam that is carrying the bay windows roof. We are concerned that a heavy wet snow fall and accumulation could cause its collapse. C2AE has issued a simple temporary solution to prevent any possible collapse of the roof and recommend its implementation before the winter season. The extreme settlement of the north wall has caused many cosmetic corrections to be implemented over the years and will continue if nothing is done to correct the problem. It is easy to visually observe the settlement when looking at the roof eave line north of the Meeting Room bay window. It slopes downward as it runs to the northeast corner.


Roof truss movement

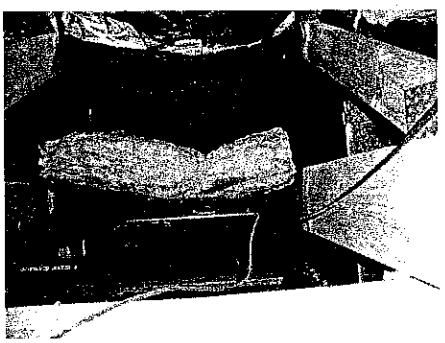
The 1993 addition has remained very stable due to the proper construction techniques for the bad soils with structural piles and grade beams rather than the conventional load bearing foundation walls and footings of the original building.


Roof truss repair

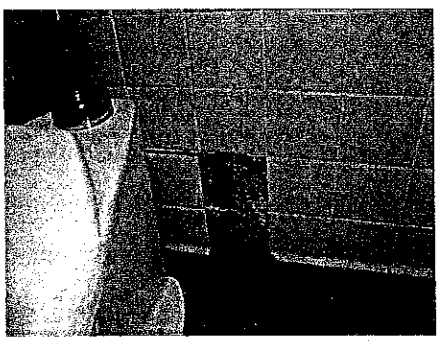
Roof truss movement



The "curve" is no illusion

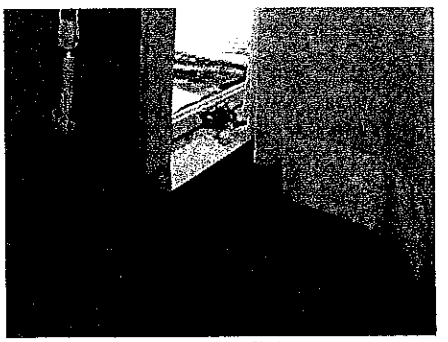


Falling roof truss



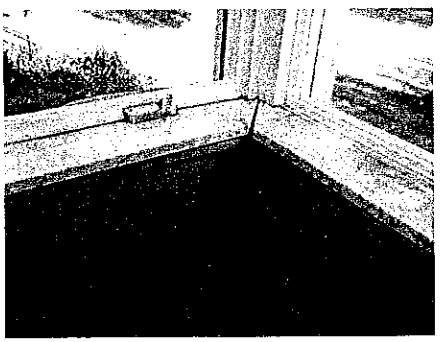
Crack in wall due to settlement

Meeting Room structural issue at bay window



Step in wall due to movement

Sagging eave line



More evidence of movement

Recommendations

It is our professional opinion that the settlement will continue to be a significant problem for the original building if nothing is ever done to correct and eliminate it. Though the most settlement has occurred along the north portion of the structure, the interior north-south running bearing wall and entire east exterior wall are carrying a lot of weight and the likelihood of further settlement, though slower, has a high probability. At the very least, the entire north 10 to 12 feet needs to be removed and rebuilt, or incorporated into any future expansion plans, and the existing interior bearing wall and east exterior wall be shored and supported for new grade beams and pilings to be installed similar to the 1988 addition. This effort would require the library (and contents) to move out for the duration of the work since it requires the concrete floor slab to be cut out, soils excavated, grade beams placed, and the pilings set, either hammer driven or augured in-place. Even with the bearing walls and structure secured, the floor slab would still be subject to continued settlement over time due to the higher floor loading imposed upon it (150 lbs/sq. ft.) since it and the compacted stabilized sand fill was placed over the poor soils. To eliminate the floor from settling a new floor system similar to the one used in the 1988 addition would need to be constructed. ***This would be a major undertaking and not without substantial cost to a building of marginal value.***

Other considerations must be made, however, that have more to do with the practicality of maintaining an older building of moderate quality and expanding/remodeling it. The floor plate is 3 feet above the surrounding parking lot and lawn areas. To make the building larger requires more parking thereby reducing the amount of green space and necessitating a barrier free ramp for building entry in a minimum of two locations. The expansion would be similar to the previous one (1988) with the addition built to the west and north, necessitating another means to support for the existing roofs, thereby creating another line of interior supports (columns and/or walls). The current wood trussed roof would need to be upgraded with fire separation and fire protection adding more unnecessary expense. It should be mentioned that buildings are designed much differently today that greatly improves their thermal efficiency and life span. The existing roof construction of the library leaves a lot to be desired and is a limiting factor when considering a major expansion. It simply wasn't designed for substantial growth and is very deep (5 feet) which limits the opportunities with ceiling design. It also should be mentioned that the roof insulation technique is contrary to today's practices which is likely the cause of the icing and water dam problems of the past. It appears the 2003 roof upgrades may have solved those problems.

These challenges compromise good library space planning and design by having to incorporate 10,000 sq. ft. of older construction of moderate quality of different construction techniques. The current library structure is designed for a 30 to 40 year life span and is typical of what we are replacing today with new construction. It is our opinion that it would be better dollars spent to tear the current building down and build a new facility, either on the north end of the current site, at a new location elsewhere, or re-purpose another building that is more suitable of supporting modern library functions.

Overview

The Ransom District Library is a one story building that was constructed in two phases, an original building which takes up the northeast corner and an addition which wraps the west and south sides of the original building. The original building was constructed of wood roof trusses at 24"o.c. bearing on masonry exterior and interior walls. The addition roof is constructed of wood trusses that bear on an exterior bearing masonry wall and interior steel beams that were uses to replace the original masonry bearing walls on the west and south side of the original building. The original building's foundation is exterior perimeter concrete foundation walls and a slab on grade constructed over imported sand fill. The addition's foundation is wooden piles and concrete pile caps that support the steel floor beams and joists over a crawl space, as well as perimeter concrete grade beams.

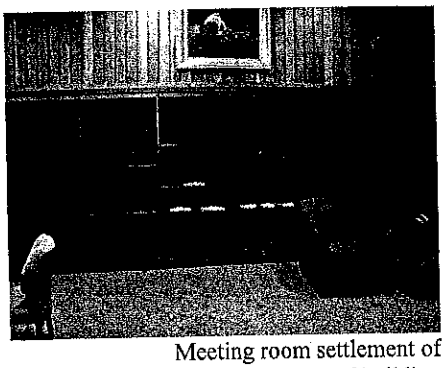
Conditions

While overall the building is not in bad structural condition, there are some areas of significant structural concern. The north wall following around the east corner of the building has experienced, and is experiencing significant movement. Some repairs to the masonry were made in the past, but new cracking has appeared and the movement has not ceased. The movement and cracking is most apparent in the front Meeting Room where there is significant gaps in the trim and the entire north side of the room is very visibly out of level (sinking). There is also significant cracking in the floor and tile of the men's and women's bathrooms and the area near the children's stack mural is visibly out of level also. Our inspection of the roof structure in these areas indicates significant structural distress. Many of the roof trusses are twisting and/or pulling apart from the masonry support wall. In the east wall of the meeting room adjacent to the bay there is a sizable gap in the masonry wall which we believe is due to the movement of the building. The damage to the roof structure will need to be addressed.

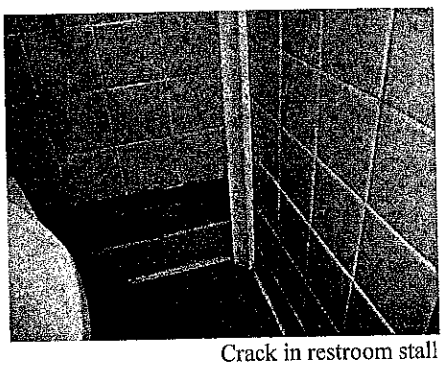
Cracking in foundation wall due to settlement

Previous crack repair

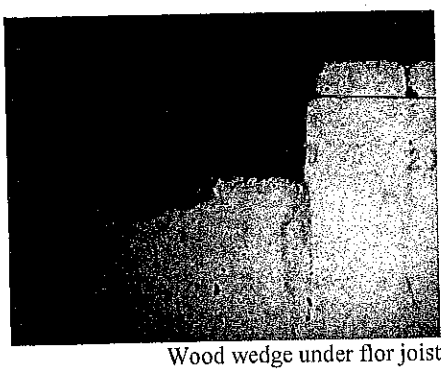
The addition is in significantly better condition except for two items that need to be remedied. At the stoop in the south wall there has been water infiltration. This infiltration has led to corrosion of the steel deck that is under the concrete crawl space slab. In an area that spans approximately six foot in each direction from the stoop the deck is corroded to the point of non existence. While the slab is retaining its structural integrity, the corrosion should be addressed. The other deficiency is along the east wall of the addition. The joists along that foundation wall are not bearing on a steel bearing plate but instead have a wood wedge under their bearing surface. These wood wedges are unacceptable for long term bearing. The plastic moisture barrier membrane that lies on top of the crawl space pea gravel has been pushed back in many areas allowing ground source moisture from the soils to enter. The membrane should be pulled back to cover the pea gravel.



Meeting room settlement of north 12' of building



Crack in restroom stall



Wood wedge under flor joist

Recommendations

If the library chooses to remain in this building the following structural repairs should be made regardless of whether an addition is planned or not:

1. The north wall extending around the east corner to the bay should be removed including the foundation and it should be replaced with a new bearing wall resting on either piles or helical piers.
2. The roofing and sheathing in this area should be taken off and any damaged roof trusses should be repaired or replaced.
3. The wood wedges under the joists in the crawl space should be removed and the joists should bear on either steel shims or solid grout.
4. The corroded form-deck around the stoop in the crawl spaces should be wire brushed to remove all corrosion and new deck support should be installed.

We also recommend that while decision regarding the future of the library are considered, that monitoring of the north and east wall be instituted. Ideally, this monitoring would be fairly precise, i.e. not done with bubble levels and tape measures, but with precision survey instruments. It should be repeated on at least a quarterly basis to allow for early warning of any major movement.

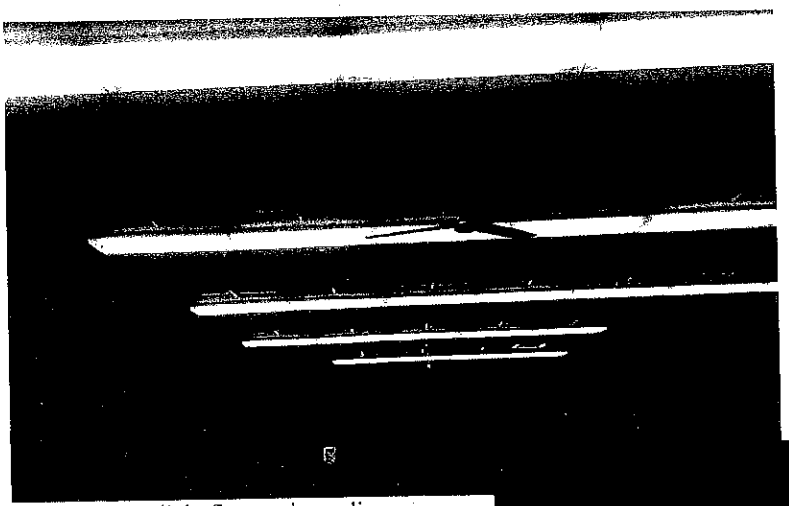
A quick inspection of the mechanical and electrical systems was done to assess there general condition and to identify any observable problems.

The heating, ventilation, and air conditioning (HVAC) system consists of four (4) roof top units that have gas fired heat exchangers and high efficiency cooling. They were installed in 2008 and appear to be operating properly. These units replace the original roof top equipment installed in 1994 during a total HVAC 'makeover' to the facility and are much more efficient, but utilize the existing ductwork located entirely above the ceilings. This system design, while very cost effective, has very poor air distribution in the heating cycle due to the high ceilings (10' to 12') creating a "hot head/cold feet" environment from heated air not able to be 'pushed' to the floor. However, it is very effective for the air delivery in the cooling cycle since cool air sinks naturally. The current HVAC system is in good shape and performs as designed, but has its inherent cost vs. benefit compromises.

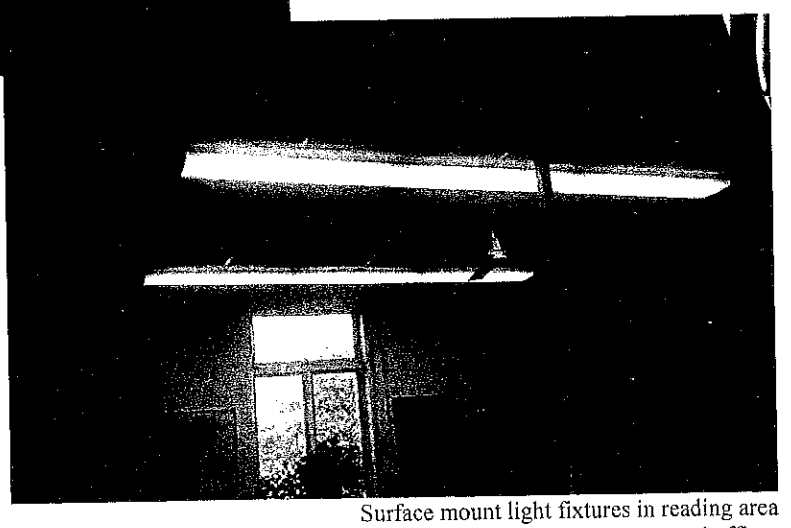
The plumbing is original as are the plumbing fixtures (circa 1973) and appear to be in good condition. However, all the restrooms do not meet current ADA and Michigan Barrier Free accessibility requirements. The public restrooms are located along the north wall of the original building where the extreme settlement problems are occurring. There is the concern of possible problems with the sanitary drains from the toilets crushing, breaking or changing slope direction due to the settlement causing sewage back-ups. There is no fire protection (sprinkler) system in the building, except for one sprinkler head in the former boiler room. The incorporation of modern plumbing fixtures and devices could save on water consumption.

The electrical service consists of a total of 580 amps, 208 volt 3-phase power that is split between two (2) 200 amp panels, a 150 amp panel (serving the panel by fireplace), and a 30 amp panel located in the former boiler room in the original building on the east wall. The service grew over the years as the building expanded and air conditioning was added. Though adequate for a 10,000 sq. ft. building, there are minimal available breaker spaces in the panels for any future need. ***It appears from the drawings that the main feed wire between the meter and the panels has not been upgraded (increased in size), and if that is the case, could potentially overheat during a high load time (very hot summer day) and burn. This needs to be verified, however, it is possible that it was upgraded when the new transformer was installed.***

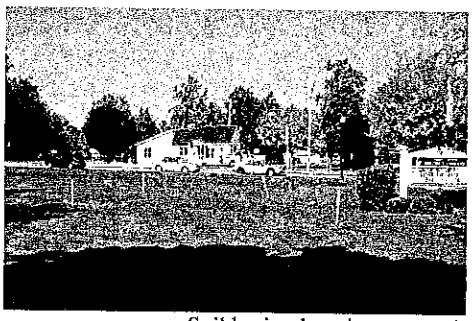
The lighting system consists of older fluorescent recessed troffer and surface mount T-12 light fixtures. Though fairly efficient compared to incandescent lighting, more efficiency can be had by replacing the current lighting fixtures with new T-8, or T-5 HO high performance lighting fixtures.



Surface mount light fixtures in reading area and offices

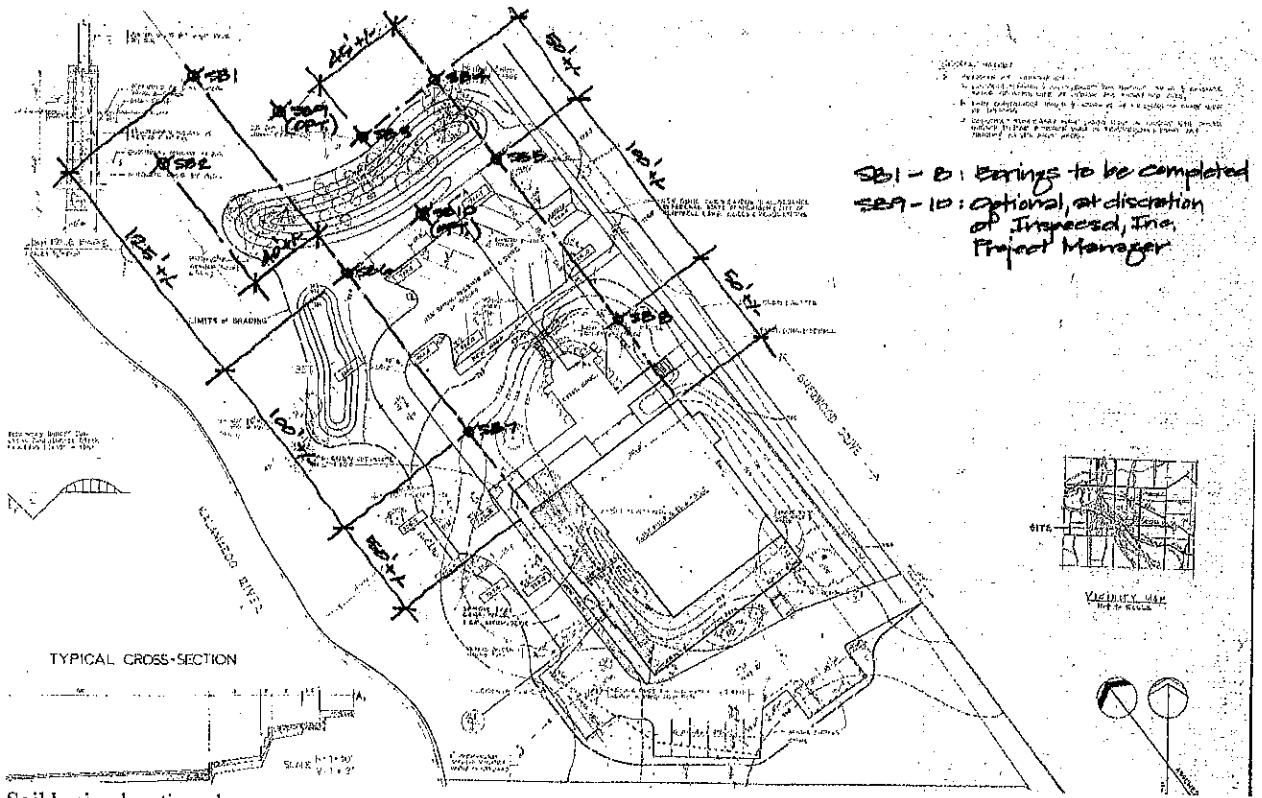


Surface mount light fixtures in reading area and offices



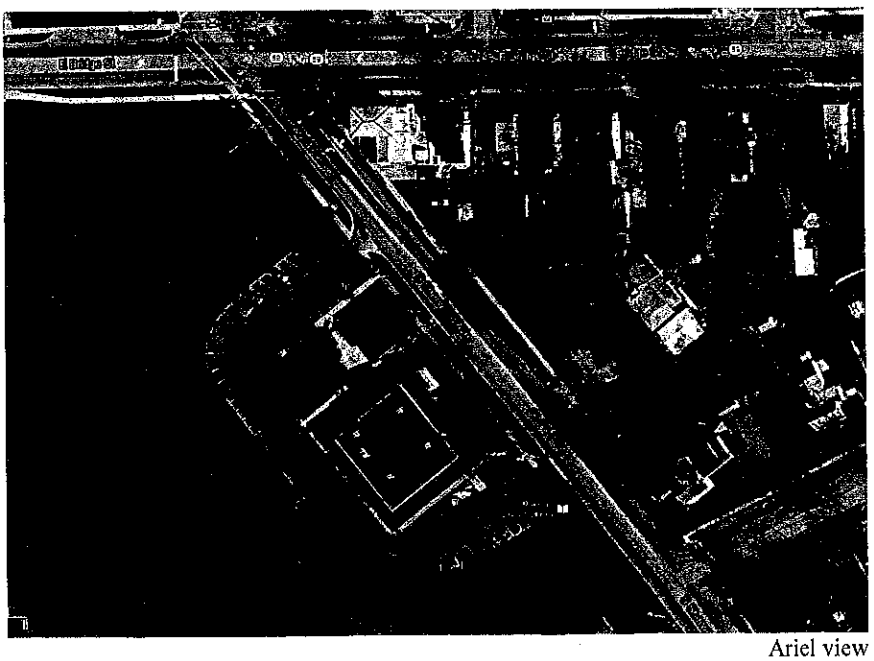
Soil boring locations at north portion of site

The soil borings and geotechnical report confirm that the entire site contains anywhere from 3 feet to 11 feet of poor soils, or a 6.5 foot average depth from the data. The soils contain a combination of dumped fill material (glass, wood, metals, bricks, concrete, paper, etc.) and peat (low strength/highly compressible) materials. The water table is anywhere from 6.2 to 10.5 feet below ground level, which is not unusual with the proximity along the Kalamazoo River. ***We feel the ten (10) soil borings give us conclusive evidence of the sites former status as a local dump and the soil structure not being conducive to standard construction techniques.*** The geotechnical report contains more detailed information regarding construction recommendations of any future buildings on the site, as well as corrective measures to be employed to the current library building.



Soil boring location plan

The library site has approximately 115,300 sq. ft., or 2.65 acres, and is a parallelogram in shape, thus making the acute (less than 90 degrees) corners difficult to plan and design with. This adjusts the usable property size down to 2 acres roughly. The site size is large enough, however, to support a 20,000 sq. ft. building and 80 to 90 cars of parking. The site is served by all public utilities except the storm water control, which surface drains to the river. It is anticipated that the current practice of surface drainage of the storm water directly to the river will not be allowed when major changes occur and a system of storm water capture, pre-filtering and controlled release would be required, as is typical of community planning today for a project adjacent to a river.

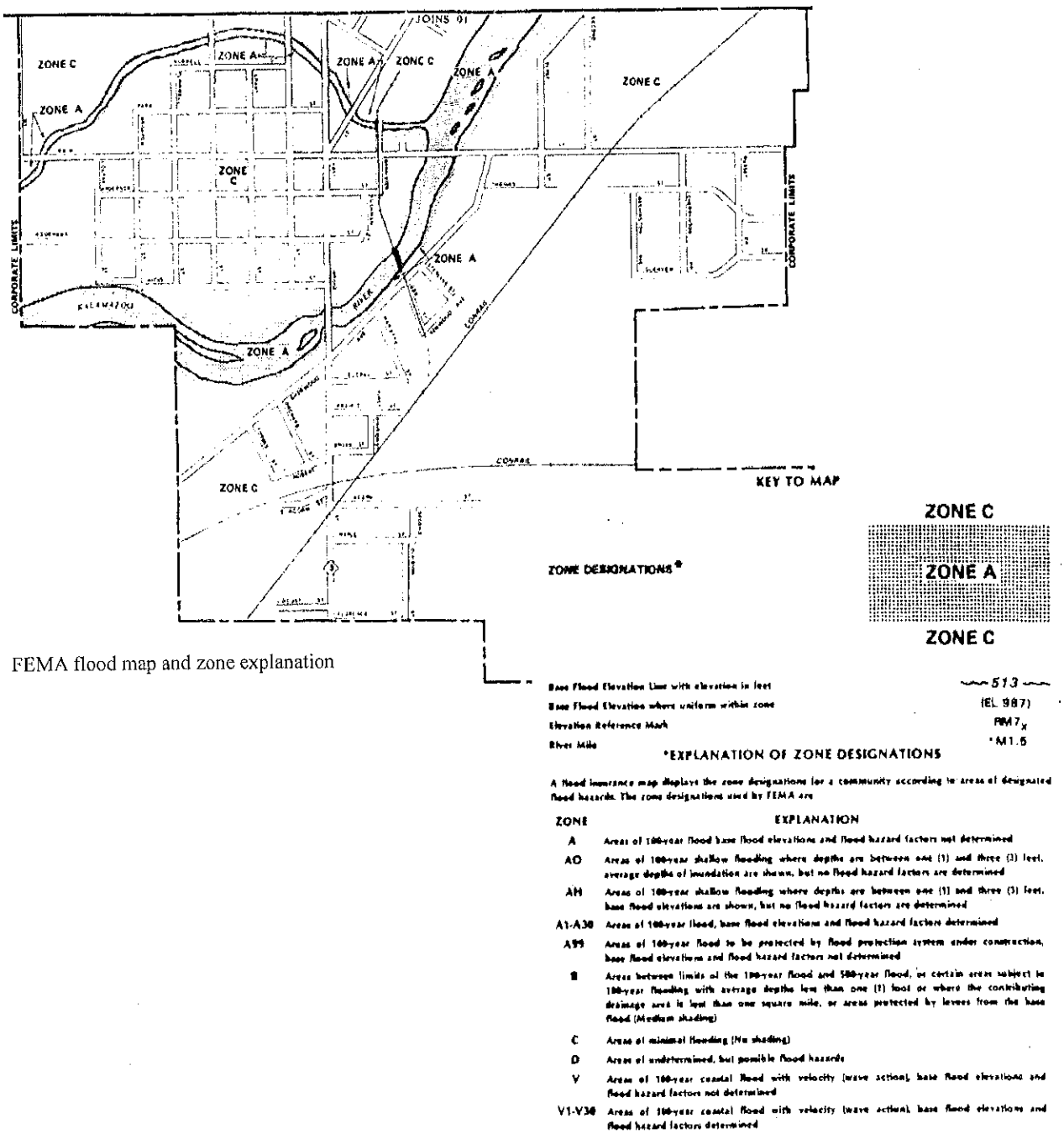


Ariel view

The entire site appears to be free of river flooding, any 100 year rain events, and, surprisingly, is not on the FEMA flood insurance maps. Discussion with the city also confirms the above information. Though the site hasn't flooded in recent times and memory, it would be prudent to plan for a future occurrence should the library stay and build new on the north portion. This would involve placing the new buildings floor level somewhere between the current grade and the existing buildings floor level. The grade does gradually rise as you approach M-89 and the bridge, so any new structure would be higher as well.

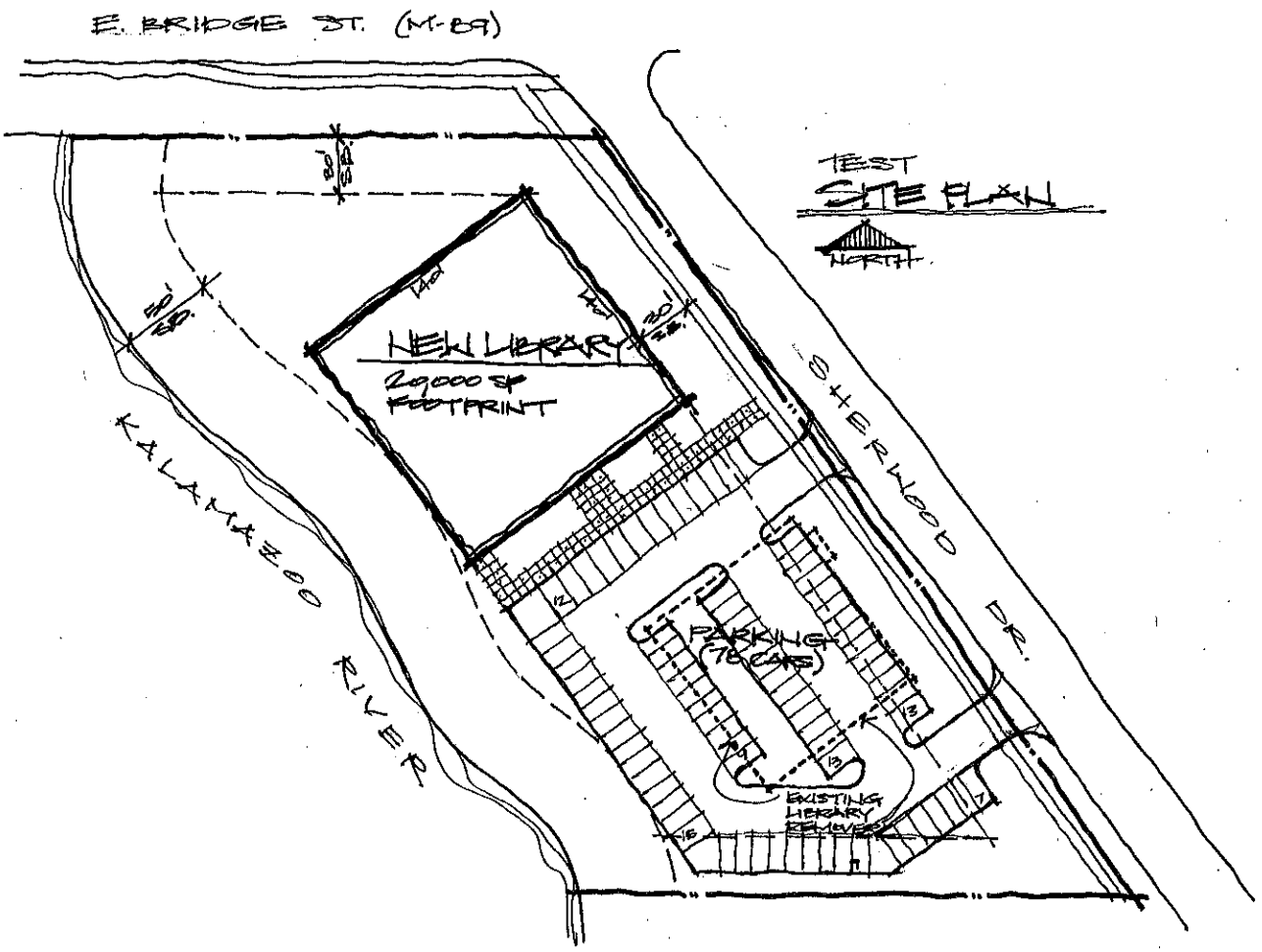
The site has a wonderful view and proximity to the river and can offer library patrons opportunities that could be exploited positively with any future expansion, or new construction, despite the poor soils. It will be difficult to convince the community of a move from this site that offers river adjacency and is nestled in a quiet residential neighborhood. Change is hard dynamic to overcome when an institution, such as the library has been in a familiar and "comfortable" location for almost 40 years.

A new building at the north portion of the site would provide a significant physical presence and visibility for the library along M-89. The parking would be behind (south) the building, thus screened from view. However, staying on the current site does come with a price tag to design with the bad soils, and depending on the arrangement with the donor family, the property may revert back over to them if you move. This would need to be confirmed. Other benefits are the ability to stay in the current building during the construction of the new facility and the purchase of new property isn't required.

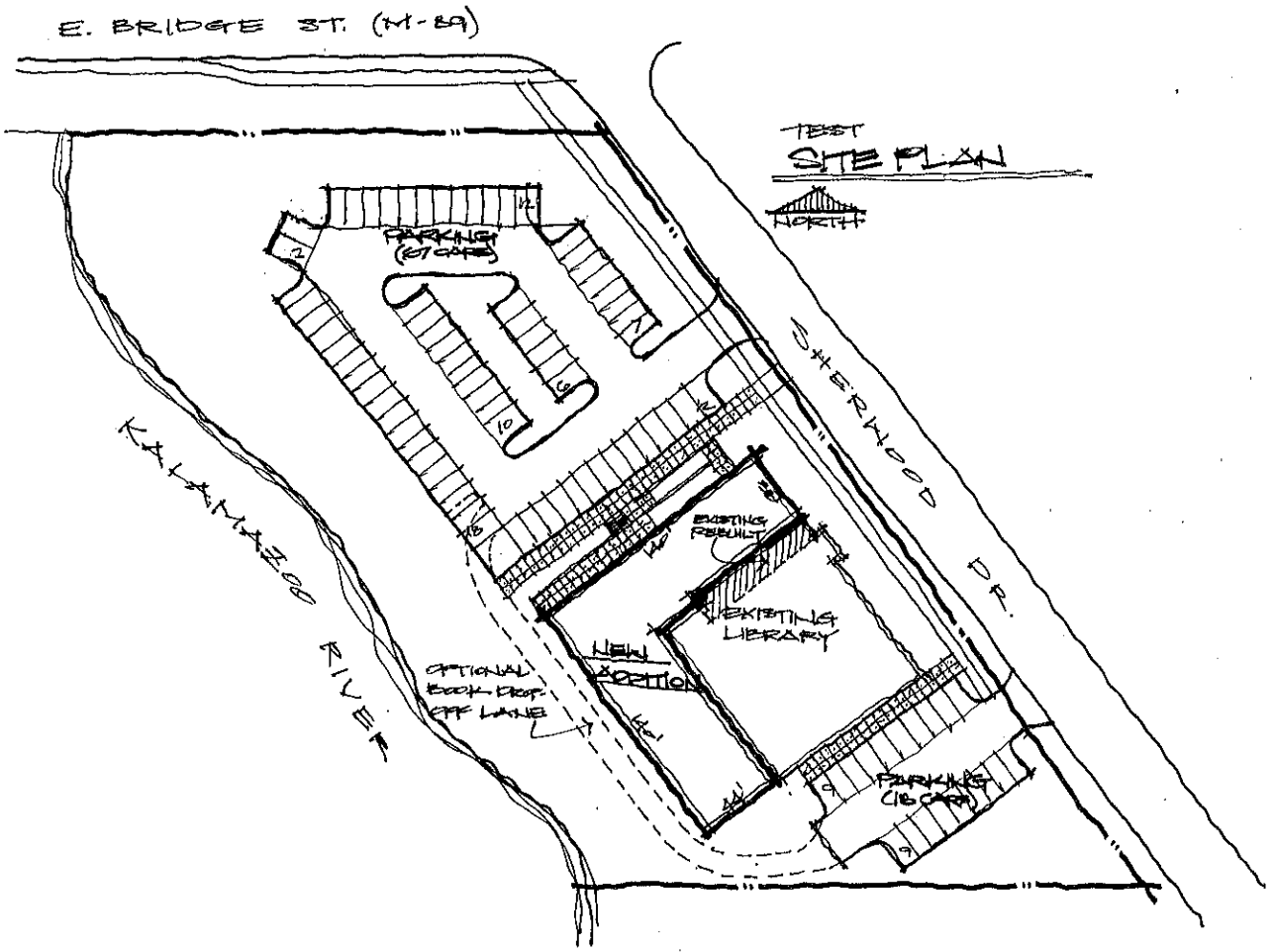


FEMA flood map and zone explanation

Site Plan Layout Concept 1



Site Plan Layout Concept 2



We believe there are five (5) viable options the library can consider:

Option 1: Make necessary repairs and not expand

Option 2: Expand current building and make limited repairs

Option 3: Expand current building and make complete repairs

Option 4: Demolish current building and construct new (on or off-site)

Option 5: Move and re-purpose an exiting suitable building

Option 1

This option only involves rebuilding the north 12 ft. of the original building (800 sq. ft.).

Lift/Level North Wall Area: 20 piles x $5,000.00 =	$ 100,000.00*
Remodel/Rebuild North Wall Area: 800 sq. ft. x $75.00 =	$ 60,000.00*
15% Contingency:	$ 24,000.00*
10% Owner Costs:	$ 16,000.00
Design Fees: $202,000.00* x 15.0% =	$ 24,000.00
Total Costs:	$ 224,000.00

Option 2

This option expands the library to 18,600 sq. ft. with a 9,600 sq. ft. addition ('L' shaped to the north and west), provides limited repairs to the existing building (replace north 12 feet of original & roof tie-in to new addition), and builds a new 80 car parking lot. This idea accepts the fact that the remaining 9000 sq. ft. of the existing building could settle since it was built over suspect soils, however, it hasn't shown any substantial movement since it was constructed. This option would require the library to move to a temporary location for the duration of the construction ($70,000.00 included in Owner Costs).

Demolish North Wall Area: 800 sq. ft. x $20.00 =	$ 16,000.00*
Remodel Existing Library: 9,000 sq. ft. x $50.00 =	$ 450,000.00*
New Addition: 9,600 sq. ft. x $175.00 =	$ 1,680,000.00*
Site Work: 80 cars x $5000.00 =	$ 400,000.00*
10% Contingency:	$ 255,000.00*
8% Owner Costs:	$ 204,000.00
FF&E: 9,600 sq. ft. x $20.00 =	$ 192,000.00*
Security & Technology: 18,600 sq. ft. x $6.00 =	$ 112,000.00*
Design Fees: $3,105,000.00* x 8.5% =	$ 264,000.00
Total Costs:	$ 3,573,000.00
	($192.10/sq. ft.)

Option 3

This option is similar to Option 2, but rebuilds the existing libraries floor to prevent any future settlement.

Demolish North Wall Area: 800 sq. ft. x $20.00 =	$ 16,000.00*
Remodel Existing Library: 9,000 sq. ft. x $50.00 =	$ 450,000.00*
Rebuild Existing Floor System: 9,000 sq. ft. x $75.00 =	$ 675,000.00*
New Addition: 9,600 sq. ft. x $175.00 =	$ 1,680,000.00*
Site Work: 80 cars x $5,000.00 =	$ 400,000.00*
10% Contingency:	$ 322,000.00*
6% Owner Costs:	$ 193,000.00
FF&E: 9,600 sq. ft. x $20.00 =	$ 192,000.00*
Security & Technology: 18,600 sq. ft. x $6.00 =	$ 112,000.00*
Design Fees: $3,847,000.00* x 8.5% =	$ 327,000.00
Total Costs:	$ 4,367,000.00
	($234.78/sq. ft.)

Option 4

This option costs the construction of a new library building on or off the current site. This would allow the library to stay in the current building and then move to the new when completed. If the new building is off-site there would be no demolition costs for removal of the existing building.

Demolition of Existing Library: 9800 sq. ft. x $10.00 =	$ 98,000.00*
New Building Construction: 18,600 sq. ft. x $165.00 =	$ 3,069,000.00*
Site Work: 80 cars x $5,000.00 =	$ 400,000.00*
7% Contingency:	$ 250,000.00*
5% Owner Costs:	$ 178,000.00
FF&E: 9,600 sq. ft. x $20.00 =	$ 192,000.00*
Security & Technology: 18,600 sq. ft. x $6.00 =	$ 112,000.00*
Design Fees: $4,121,000.00* x 8.0% =	$ 330,000.00
Total Costs:	$ 4,879,000.00
(Does not include new site purchase costs)	($262.31/sq. ft.)

Add for full (bare) Basement (on-site): 18,600 sq. ft. x $60.00 =	$ 1,116,000.00
Add for full (bare) Basement (off-site): 18,600 sq. ft. x $50.00 =	$ 930,000.00
Deduct for no Demolition of Existing Library costs:	($ 118,000.00)
Deduct for new site with good soils: 18,600 sq. ft. x $25.00 =	($ 465,000.00)

Option 5

This option re-purposes an existing building that is suitable for adaptation into a modern library. This would take a special building in terms of size, age, and construction (materials and systems), like a small grocery store. For the purposes of this cost option, it was assumed that only the shell was usable (roof, exterior walls, floor) and the site is large enough for 80 cars and needs only moderate work to be aesthetically pleasing and functional for library functions. It is also assumed that all public utilities are available and in place on-site (water, sanitary sewer, gas, power, and storm sewer).

Demolition: 18,600 sq. ft. x $3.00 =	$ 56,000.00*
Remodeling: 18,600 sq. ft. x $125.00 =	$ 2,325,000.00*
Site Work: 80 cars x $3,000.00 =	$ 240,000.00*
10% Contingency:	$ 262,000.00*
5% Owner Costs:	$ 131,000.00
FF&E: 9,600 sq. ft. x $20.00 =	$ 192,000.00*
Security & Technology: 18,600 sq. ft. x $6.00 =	$ 112,000.00*
Design Fees: $3,187,000.00* x 8.5% =	$ 271,000.00
Total Costs:	$ 3,589,000.00
(Does not include site/building purchase costs)	($192.96/sq. ft.)

C2AE ENGINEERS AND ARCHITECTS

GEOTECHNICAL EVALUATION REPORT
RANSOM DISTRICT LIBRARY
PLAINWELL, MICHIGAN

Date : **October 25, 2011**	Reference No.: **D020106**

INSPECSOL
ENGINEERING INC.
MEMBER OF THE CRA FAMILY OF COMPANIES

14496 Sheldon Rd., Suite 200, Plymouth, Michigan 48170 • Tel.: (734) 453-5123 • Fax: (734) 453-5201

Reference No. D020106

October 25, 2011

Mr. Dennis B. Jensen, AIA, ALA, MLA
Principal, Design Architect
C2AE
648 Monroe Avenue NW
Suite 210
Grand Rapids, Michigan 49503

Dear Mr. Jensen:

Re: Geotechnical Evaluation Report
Ransom District Library
Plainwell, Michigan

In accordance with your request, Inspecsol Engineering, Inc. (Inspecsol) has conducted the geotechnical evaluation of the above-mentioned site and is pleased to present the following report. The work was authorized by C2AE as outlined in our proposal dated September 22, 2011, and as amended in e-mail and telephone correspondence. Seven additional boreholes were drilled at the site as authorized by C2AE after discussions with the Library Board. This geotechnical evaluation is preliminary and is not construed to be used for any final design of building structures at the site.

We trust that this information meets with your approval. Please do not hesitate to contact us, should any questions arise.

Respectfully Submitted,

INSPECSOL ENGINEERING, INC.

J. Art Johnson, CET
Project Manager

Michael C. Gentner, PE
Vice President

REB/ma

TABLE OF CONTENTS

LIST OF FIGURES
(Following Text)

LIST OF APPENDICES

1.0 INTRODUCTION

Inspecsol Engineering, Inc. (Inspecsol) was retained by C2AE to conduct a geotechnical evaluation for a proposed expansion of the existing Ransom District Library. The site is located at 180 South Sherwood Avenue in Plainwell, Michigan. A Site Location Plan is provided as Figure 1. The library board members are considering an expansion to the facility, as current use by the library patrons indicates a larger space is needed. Options considered by the library board include adding on to the existing structure, or building a new structure on available space to the north portion of the property. C2AE has been hired by the Library to provide preliminary architectural and engineering assessments for space needs, and the condition of the existing structure.

The site is bound by M89/Bridge Street to the north, Sherwood Avenue to the east, residential property to the south, and the Kalamazoo River to the west. The current footprint of the building is approximately 10,000 square feet. The original 6,000 square feet was constructed in 1973 and is supported on shallow footings. This portion of the building has experienced excessive settlement, especially along the north and northeast building lines. An addition was completed in 1988, and was located and connected to the west and south original building lines. This portion is supported on deep foundations (driven piles). An attempt to remediate the settlement on the northern portion of the original building was completed by grouting techniques. The work completed is not well known due to lack of documentation, and based on settlement monitoring, does not appear to have been affective.

This report contains a description and findings of our geotechnical evaluation, as well as professional opinions and preliminary recommendations regarding subsurface conditions and foundation options of the proposed library expansion or new structure.

2.0 FIELD AND LABORATORY WORK PROGRAMS

The fieldwork for this geotechnical evaluation was carried out on October 7 and October 10, 2011. Ten (10) boreholes were advanced throughout the site. All of the boreholes were extended to 20 feet below the existing ground surface. Eight (8) of the boreholes were placed within the grass area north of the existing parking lot where a potential new building could be constructed. Two (2) boreholes (SB-7 and SB-8) were placed as closed as physically possible to the northeast and northwest corners of the existing building for subsurface evaluation where settlement of the structure has occurred. The borehole locations are shown on the attached Location Plan enclosed as Figure 2. The detailed results of the individual boreholes are recorded on the accompanying boring logs in Appendix A.

The number and depth of boreholes were selected by C2AE after consulting with the Library Board. The boreholes were located in the field by Inspecsol staff by pacing and/or taping off the building and other site features. Inspecsol staff arranged for underground utility locates, directed the drilling, in-situ testing and sampling operations, and logged the boreholes.

Great Lakes Drilling, under the full-time supervision of Inspecsol staff, completed the boreholes. The boreholes were drilled with a truck-mounted CME-75 drill rig using 4.25" ID hollow stem augers. Representative soil samples were obtained at 2.5-foot intervals to a depth of 10 feet and at 5-foot intervals thereafter by using a 2-inch diameter split spoon barrel sampler in general accordance with ASTM D-1586. The results of these penetration tests are reported as N-values on the borehole logs at the corresponding depths. The ground surface elevation at each borehole was estimated using topographic information included on a site diagram from William C. Abbe Architect dated 4/29/88 developed during the design phase of the building expansion. We estimate the accuracy of the elevations to be +/- 2 feet, but are suffice for this geotechnical study.

Soil samples obtained from the boreholes were field classified upon retrieval for type, texture, color and moisture condition. The samples were sealed in clean, airtight, glass containers. Groundwater observations were made in the boreholes during, and upon completion, of drilling. All samples were transported to our geotechnical laboratory in Plymouth, Michigan for further examination and testing.

All samples received in the lab were visually examined by an experienced geotechnical engineer, and classified on the basis of type, texture, plasticity, color, relative density and consistency in general accordance with the Unified Soil Classification System. Moisture content determinations and organic content by loss on ignition tests were completed on select samples. Results of the moisture content are included on the individual borehole logs at their respective depths. In addition, a summary of all test results is included in Appendix B.

3.0 SITE AND SUBSURFACE CONDITIONS

Details of the subsurface conditions encountered at the site are summarized below and are also presented on the accompanying Borehole Logs in Appendix A. It should be noted that the subsurface conditions are confirmed at the borehole locations only, and may vary at other locations both horizontally and vertically. The boundaries between the various strata, as shown on the borehole logs, are based on non-continuous sampling. These boundaries represent an inferred transition between the various strata, rather than a precise plane of geological change.

3.1 Soil Conditions

Topsoil – Topsoil was encountered at all borehole locations, and ranged in thickness from 4 to 13 inches.

Sandy Fill - Below the topsoil, sandy fill with varying amounts of gravel and silt was encountered. The sandy fill also contained varying amounts of wood, glass, plastic, metal and brick debris, as well as organic material and roots. The fill extended in depths ranging from 4 to 11 feet below the existing ground surface elevations.

Standard Penetration Test (SPT) 'N' values obtained within the fill material varied between 0 to 50 blows per foot (bpf), with an average 'N' value of 12 bpf. In general, 'N' values indicate the fill consistency is very loose to compact, with higher 'N' values most likely representing areas of brick or metal debris encountered.

Moisture contents of the fill soil varied between 6 and 206 percent by weight. Higher moisture contents generally coincide with areas of higher organic content and wood debris encountered. Moisture contents are indicated at their respective depths on the individual borehole logs presented in Appendix A.

Peat – Sandy peat (PT) was encountered below the upper fill soils at boreholes SB-1, SB-2, SB-3, SB-6, SB-8, SB-9 and SB-10. The peat encountered extended in depths ranging from 7.5 to 9.5 feet below the existing ground surface elevations.

Moisture contents of the peat ranged from 54 to 123 percent by weight. Organic contents of the peat ranged from 5.3 to 16.4 percent by weight. The organic content was determined by the loss by ignition test method. Moisture contents are indicated at their respective depths on the individual borehole logs presented in Appendix A.

Sand – Below the fill at boreholes at SB-4, SB-5 and SB-7, and below the peat at the remaining boreholes, granular material (SM), (SP) and (SP-SM) was encountered, and extended to the termination depths of the boreholes. The fine to coarse sand contained varying amounts of silt and gravel.

Standard Penetration Test (SPT) 'N' values obtained within the natural sand varied between 15 to 42 blows per foot (bpf), with an average 'N' value of 27 bpf. In general, 'N' values indicate the native granular soil consistency is compact to dense. The drill crew also noted the possibility of cobbles being present within the granular soil. This was based on the occasional drill rig "chatter" from the augers as the borehole was advanced.

Moisture contents of the native granular soil varied between 4 and 41 percent by weight. Moisture contents are indicated at their respective depths on the individual borehole logs presented in Appendix A.

3.2 Groundwater Observations

The following table summarizes the depth to groundwater as encountered during and immediately after the drilling and sampling.

Boring ID	GW Depth (ft.)	GW Depth (ft.) After Drilling
SB-1	8.0	5.5
SB-2	8.0	6.8
SB-3	8.0	8.1
SB-4	6.8	6.8
SB-5	7.5	4.5
SB-6	6.2	5.9
SB-7	10.5	10.2
SB-8	8.0	8.5
SB-9	7.8	6.0
SB-10	7.2	6.6

It should be noted that groundwater levels are transient and tend to fluctuate with the seasons and periods of precipitation and temperature.

4.0 DISCUSSION AND RECOMMENDATIONS

4.1 New Construction

If the library decides to construct a new building within the Site, the most likely location would be the grass area north of the existing parking lot. Within this area, soil boreholes SB-1 through SB-6, SB-9, and SB-10 were drilled. At all locations, uncontrolled fill soil with debris (concrete, wood, plastic, etc.) was noted in the upper 5 feet. In addition, a layer of highly compressible peat was encountered from 5 to 7 feet. These conditions are not conducive to supporting structures on shallow spread footings or slab-on-grade floors. The high irregularity of the fill, in terms of both strength and compressibility, and the low strength/high compressibility of the peat layer would result in excessive settlement, both total and differential. This condition is detrimental to building structures. A few preliminary options for constructing a building at the north end of the property are discussed below. Both will add construction costs above a typical shallow footing with slab-on-grade support that would be expected for a structure type considered by the library, based on assumed loads.

One option would be to remove all fill and organics/peat below the planned building footprint, and either construct a basement, or replace the excavated material with engineered fill. A relatively light-loaded structure could then be constructed with shallow footings and slab-on-grade, or the basement supported on the underlying natural compact to dense sand. In either case, the excavated material would most likely need be disposed at a licensed Type II landfill, and confirmatory testing completed prior to disposal for landfill acceptance. This will add some environmental testing costs, and the obvious disposal costs. If a basement is constructed to offset costs for importing clean fill, there will still be cost considerations for long-term and permanent drainage. The high natural groundwater table will most likely require a under drain system of perimeter drains, lateral drains under the basement slab, and sump pumps. Waterproofing the basement walls will also be a possible requirement. Other construction related issues would be the probability of requiring temporary earth support (shoring) for excavation, and construction dewatering. These will add additional construction costs.

Another option would be to construct the building on deep foundations such as driven piles or helical piers. The deep foundation system would need to penetrate through the upper fill material and organic layer to the underlying natural sand. Because of the high water table, our preliminary assessment is that a driven system will be more cost effective than a drilled system such as drilled piers or auger-cast-in-place (ACIP) piles. The presence of rubble material and cobbles in the natural sand may cause complications for both a drilled and driven deep foundation. To prevent differential settlement between the foundations and the floor slab, it may be required to construct the floor as a structural slab. Driven piles could be comprised of either steel H-piles, steel pipe piles, or wood piles. Another option, and based on anticipated relative light loads, would be a screw-in anchor such as a helical pier. The ability of the driven pile or screw-in anchor to penetrate through the debris in the uncontrolled fill and cobbles in the natural sand will

have an impact on the final method selected. The driven pile system is more likely a better choice to compensate for this condition.

4.2 Existing Building Support

The original portion of the building, especially the north wall, has experienced excessive settlement since it was built. It is supported by shallow footings, and the effect has been consolidation/compression of the fill material and organic peat. Although it appears the settlement has subsided, or at least the rate of settlement has reduced, if the existing facility is to remain, remedial measures should be taken for foundation support. Any addition to the existing building will also need to consider design for deep foundations as discussed in Section 4.1 for foundation support.

Foundation repairs will most likely consist of a drilled or pushed piling system to penetrate the existing fill material and underlying peat. In general, the bottom of footing is exposed and a foundation pile is installed then attached to the footing so that the load us eventually transferred to the natural sand encountered in the boreholes. Possible piling systems could include helical piles, resistance (or push piles) and drilled micropiles. These can usually be installed with smaller equipment for the anticipated depths and loads required for individual piles, and with low noise and vibration effects that would be detrimental to the existing structure and minimal disturbance to patrons. A further advantage with the push piles is that they can be used to raise or jack the existing foundations to its near-original elevation to re-level the building.

As with the discussion in Section 4.1, any drilled or pushed pier used to remediate the existing footings, the presence of the debris in the fill and cobbles in the natural sand need to be considered. The refusal of piers within the debris and uncontrolled fill is more detrimental since the load carried by the pier would not transfer down to the natural soils, and if terminated in debris above the peat would result in continued settlement. A refusal due to cobbles in the natural sand would result in concerns for higher point stresses in the pier tip and damage to the pier.

Piers on the order of 15 feet in length would be capable of providing resistance loads on the order of 5 to 10 tons per pier. Typically, the piers would be spaced along a continuous footing at 4 to 6 feet, depending on required loads and the structural capacity of the existing footing for bending moments between piers. Estimated installation costs for piers of this depth and load capacity is on the order of $2,000 to $2,500 per pier.

5.0 LIMITATIONS OF THE REPORT

This report is intended solely for C2AE (Client) and other parties explicitly identified in the report and is prohibited for use by others without Inspecsol's prior written consent. This report is considered Inspecsol's professional work product and shall remain the sole property of Inspecsol. Any unauthorized reuse, redistribution of or reliance on the report shall be at the Client and recipient's sole risk, without liability to Inspecsol. Client shall defend, indemnify and hold Inspecsol harmless from any liability arising from or related to Client's unauthorized distribution of the report. No portion of this report may be used as a separate entity; it is to be read in its entirety and shall include all supporting drawings and appendices.

The recommendations made in this report are in accordance with our present understanding of the project, the current site use, ground surface elevations and conditions, and are based on the work scope approved by the Client and described in the report. The services were performed in a manner consistent with that level of care and skill ordinarily exercised by members of geotechnical engineering professions currently practicing under similar conditions in the same locality. No other representations, and no warranties or representations of any kind, either expressed or implied, are made. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties.

All details of design and construction are rarely known at the time of completion of a geotechnical study. The recommendations and comments made in the study report are based on our subsurface investigation and resulting understanding of the project, as defined at the time of the study. We should be retained to review our recommendations when the drawings and specifications are complete. Without this review, Inspecsol will not be liable for any misunderstanding of our recommendations or their application and adaptation into the final design.

By issuing this report, Inspecsol is the geotechnical engineer of record. It is recommended that Inspecsol be retained during construction of all foundations and during earthwork operations to confirm the conditions of the subsoil are actually similar to those observed during our study. The intent of this requirement is to verify that conditions encountered during construction are consistent with the findings in the report and that inherent knowledge developed as part of our study is correctly carried forward to the construction phases.

It is important to emphasize that a soil investigation is, in fact, a random sampling of a site and the comments included in this report are based on the results obtained at the test locations only (the ten [10] borehole locations). The subsurface conditions confirmed at the ten (10) test locations may vary at other locations. The subsurface conditions can also be significantly modified by the construction activities on site (e.g., excavation, dewatering and drainage, blasting, pile driving, etc.). These conditions can also be modified by exposure of soils or bedrock to humidity, dry periods or frost. Soil and groundwater conditions between and beyond the test locations may differ both

horizontally and vertically from those encountered at the test locations and conditions may become apparent during construction which could not be detected or anticipated at the time of our investigation. Should any conditions at the Site be encountered which differ from those found at the test locations, we request that we be notified immediately in order to permit a reassessment of our recommendations. If changed conditions are identified during construction, no matter how minor, the recommendations in this report shall be considered invalid until sufficient review and written assessment of said conditions by Inspecsol is completed.

We trust that this report meets with your present requirements. Please do not hesitate to contact us should any questions arise.

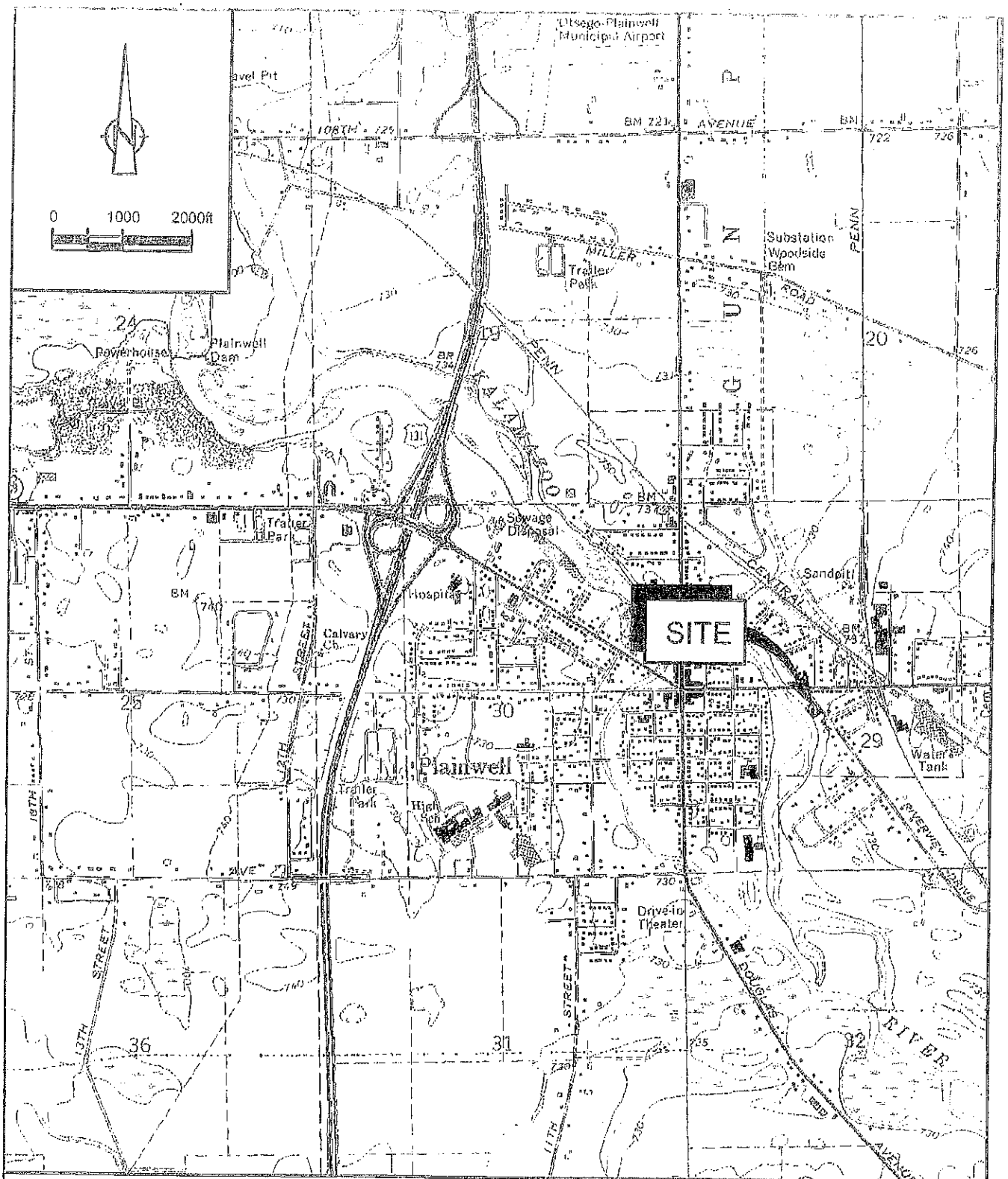
Respectfully Submitted,

INSPECSOL ENGINEERING, INC.

Rebecca Bentley/mw

Rebecca E. Bentley, EIT
Staff Engineer

Michael C. Gentner, PE
Vice President



SOURCE: USGS QUADRANGLE MAP;
OTSEGO, MICHIGAN
DATE: 1967, REVISED: 1973

figure 1

SITE VICINITY MAP
RANSOM DISTRICT LIBRARY
180 SOUTH SHERWOOD AVENUE
Plainwell, Michigan

INSPECSOL
ENGINEERING INC.

D020106-00(PRES001)GN-DE001 OCT 21/2011

REFERENCE No.: D020106

ENCLOSURE No.: _____

INSPECSOL ENGINEERING INC.

BOREHOLE No.: SB-1

ELEVATION: 723 +/- ft

BOREHOLE REPORT

Page: 1 of 1

CLIENT: C2AE

PROJECT: Ransom District Library

LOCATION: Plainwell, MI

DESCRIBED BY: A. Johnson

CHECKED BY: R. Bentley RBB

DATE (START): October 10, 2011

DATE (FINISH): October 10, 2011

DRILLER: Great Lakes

DRILL RIG: CME-75

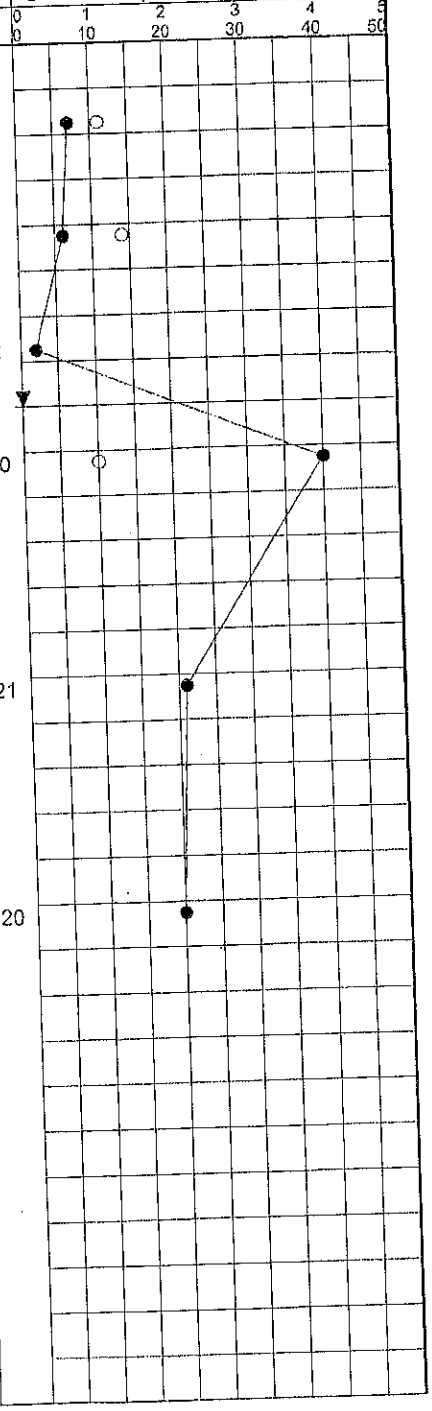
LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- RC - ROCK CORE
- ▼ - WATER LEVEL
- GS - GRAB SAMPLE

Depth	Elevation (ft)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Moisture Content	Blows per 6 in.	Penetraion Index
Feet	723 +/-		GROUND SURFACE			%			N
	0.00		0.5 (TOPSOIL) (FILL) Sand FILL with silt, trace gravel and cinders, loose, brown, moist.		S-1	100	11	3-3-4	7
	0.00		3.0 (FILL) Silty fine to coarse sand FILL, trace gravel, cinders and root hairs, loose, brown, moist.		S-2	39	14	3-2-4	6
5	0.00		6.0 (PEAT) Based on drill cuttings. No recovery		S-3	0	--	1-1-1	2
	0.00		7.5 (SP) Fine to coarse SAND with gravel, trace silt, dense to compact, brown, wet.		S-4	33	10	19-17-23	40
10									
					S-5	100	--	9-9-12	21
15									
					S-6	55	--	7-8-12	20
20	0.00		20.0 END OF BORING AT 20.0 FEET						
25			Borehole was advanced with hollow stem augers, and backfilled with soil cuttings.						

WL: 8.0 ft.
WL (AB): 5.5 ft.
CAVE IN: 6.4 ft.

Unconfined Compressive Strength (Qu) (tons/sq.ft.) △ Hand Penetrometer ☐ Torvane
○ Water content (%)
W_p W_l Atterberg limits (%)
● "N" Value (blows / 12 in.)



OIL LOG WITH GRAPH D020106 RANSOM DISTRICT LIBRARY.GPJ CRA PLYMOUTH.GDT 10/21/11

REFERENCE No.: D020106 ENCLOSURE No.:

INSPECSOL ENGINEERING INC.

BOREHOLE No.: SB-2
ELEVATION: 723 +/- ft

BOREHOLE REPORT

Page: 1 of 1

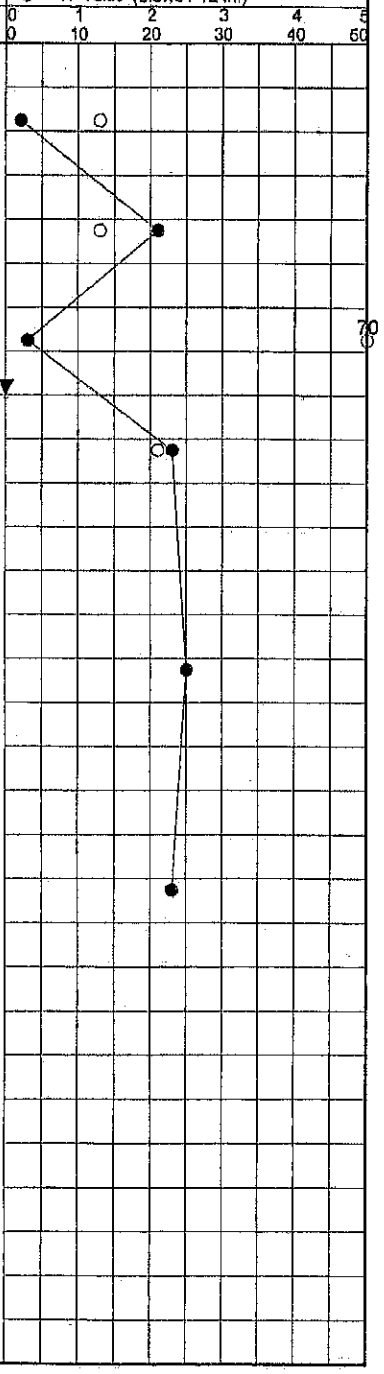
CLIENT: C2AE
PROJECT: Ransom District Library
LOCATION: Plainwell, MI
DESCRIBED BY: A. Johnson CHECKED BY: R. Bentley
DATE (START): October 7, 2011 DATE (FINISH): October 7, 2011
DRILLER: Great Lakes DRILL RIG: CME-75

LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- RC - ROCK CORE
- ▼ - WATER LEVEL
- GS - GRAB SAMPLE

Depth	Elevation (ft)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Moisture Content	Blows per 6 in.	Penetration Index
Feet	723 +/-		GROUND SURFACE			%			N
	0.00		0.5 (TOPSOIL)						
			(FILL) Fine to coarse sand FILL with silt and gravel, very loose to compact, brown, moist.		S-1	55	13	2-1-1	2
			Note: Concrete, wood and brick debris noted		S-2	44	13	5-15-6	21
5	0.00		5.5 (PEAT) Sandy PEAT with organics and roots, trace silt, very loose, black, moist.		S-3	78	70	6-2-1	3
			LOI = 10.7%						
	0.00		8.0 (SP-SM) Fine to coarse SAND with gravel and silt, compact, light brown, wet.		S-4	100	21	15-13-10	23
10			12.0						
	0.00		(SP) Fine to coarse SAND with gravel, trace silt, compact, brown, wet.		S-5	22	--	8-14-11	25
			Note: Possible cobbles noted by drilling crew						
15									
					S-6	78	--	7-6-17	23
20	0.00		20.0 END OF BORING AT 20.0 FEET						
			Borehole was advanced with hollow stem augers, and backfilled with soil cuttings.						
			LOI - Loss by ignition						
25			WL: 8.0 ft. WL (AB): 6.8 ft. CAVE IN: 8.0 ft.						

Unconfined Compressive Strength (Qu) (tons/sq.ft.) △ Hand Penetrometer ☐ Torvane
○ Water content (%)
W_p, W_l Atterberg limits (%)
● "N" Value (blows / 12 in.)



SOIL LOG WITH GRAPH D020106 RANSOM DISTRICT LIBRARY.GPJ CRA_PLYMOUTH.GDT 10/21/11

REFERENCE No.: D020106

ENCLOSURE No.: _____

INSPECSOL ENGINEERING INC.

BOREHOLE No.: SB-3

ELEVATION: 723 +/- ft

BOREHOLE REPORT

Page: 1 of 1

CLIENT: C2AE

PROJECT: Ransom District Library

LOCATION: Plainwell, MI

DESCRIBED BY: A. Johnson

CHECKED BY: R. Bentley

DATE (START): October 10, 2011

DATE (FINISH): October 10, 2011

DRILLER: Great Lakes

DRILL RIG: CME-75

LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- RC - ROCK CORE
- ▼ - WATER LEVEL
- GS - GRAB SAMPLE

Depth	Elevation (ft)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Moisture Content	Blows per 6 in.	Penetraion Index
Feet	723 +/-		GROUND SURFACE			%			N
	0.00		0.4 (TOPSOIL)						
			(FILL) Clayey sand FILL with silt and gravel, compact, brown, moist.		S-1	100	--	4-6-5	11
	0.00		3.0						
			(FILL) Sand FILL, trace gravel, compact, dark brown, moist.		S-2	72	11	10-6-5	11
5	0.00		5.0						
			(PEAT) Sandy PEAT with organics and roots, very loose, black, moist to wet.		S-3	100	123	1-1-1	2
			LOI = 16.4%						
	0.00		8.0						
			(SM) Fine to coarse silty SAND with gravel, dense, brown, wet.		S-4	44	21	12-22-20	42
10			Note: Possible cobbles noted by drilling crew						
	0.00		12.0						
			(SP-SM) Gravelly SAND with silt, compact to dense, brown, wet.		S-5	72	--	6-13-14	27
15			Note: Possible cobbles noted by drilling crew						
					S-6	50	--	8-18-14	32
20	0.00		20.0 END OF BORING AT 20.0 FEET						
			Borehole was advanced with hollow stem augers, and backfilled with soil cuttings.						
			LOI = Loss by ignition						
25			WL: 8.0 ft. WL (AB): 8.1 ft. CAVE IN: 9.3 ft.						

Unconfined Compressive Strength (Qu) (tons/sq.ft.) △ Hand Penetrometer ☐ Torvane

○ Water content (%)

W_P W_l Atterberg limits (%)

● "N" Value (blows / 12 in.)

0 1 2 3 4 5

0 10 20 30 40 50

123

SOIL LOG WITH GRAPH D020106 RANSOM DISTRICT LIBRARY.GPJ CRA PLYMOUTH.GDT 10/21/11

REFERENCE No.: D020106 ENCLOSURE No.: _____

INSPECSOL ENGINEERING INC.

BOREHOLE No.: SB-4
ELEVATION: 723 +/- ft

BOREHOLE REPORT

Page: 1 of 1

CLIENT: C2AE
PROJECT: Ransom District Library
LOCATION: Plainwell, MI
DESCRIBED BY: A. Johnson CHECKED BY: R. Bentley
DATE (START): October 10, 2011 DATE (FINISH): October 10, 2011
DRILLER: Great Lakes DRILL RIG: CME-75

LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- RC - ROCK CORE
- ▼ - WATER LEVEL
- GS - GRAB SAMPLE

Depth	Elevation (ft)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Moisture Content	Blows per 6 in.	Penetraion Index
Feet	723 +/-		GROUND SURFACE			%			N
	0.00		0.4 (TOPSOIL)						
			(FILL) Sand FILL with silt and gravel, compact, dark brown, moist.		S-1	72	6	6-13-14	27
	0.00		3.0						
			(FILL) Sand FILL with silt, peat, organics, debris, trace gravel, very loose, dark brown, moist. LOI = 6.1%		S-2	72	42	1-2-1	3
5					S-3	100	61	2-2-2	4
	0.00		8.0						
			(SP-SM) Fine SAND, trace silt, dense, brown, wet.		S-4	17	--	15-16-15	31
10	0.00		10.0						
			(SP) Gravelly SAND, trace silt, compact, brown, wet. Note: Possible cobbles noted by drilling crew		S-5	72	--	8-9-8	17
15									
					S-6	55	--	7-9-10	19
20	0.00		20.0 END OF BORING AT 20.0 FEET. Borehole was advanced with hollow stem augers, and backfilled with soil cuttings. LOI = Loss by Ignition						
25			WL: 6.8 ft. WL (AB): 6.8 ft. CAVE IN: 8.2 ft.						

Unconfined Compressive Strength (Qu) (tons/sq.ft.) △ Hand Penetrometer □ Torvane
○ Water content (%)
W_p W_l Atterberg limits (%)
● "N" Value (blows / 12 in.)

0 1 2 3 4 5
0 10 20 30 40 50

SOIL LOG WITH GRAPH D020106 RANSOM DISTRICT LIBRARY.GPJ CRA PLYMOUTH.GDT 10/21/11

REFERENCE No.: D020106

ENCLOSURE No.:

iNSPECSOL ENGINEERING INC.

BOREHOLE No.: SB-5

ELEVATION: 724 +/- ft

BOREHOLE REPORT

Page: 1 of 1

CLIENT: C2AE

PROJECT: Ransom District Library

LOCATION: Plainwell, MI

DESCRIBED BY: A. Johnson

CHECKED BY: R. Bentley

DATE (START): October 10, 2011

DATE (FINISH): October 10, 2011

DRILLER: Great Lakes

DRILL RIG: CME-75

LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- RC - ROCK CORE
- - WATER LEVEL
- GS - GRAB SAMPLE

Depth	Elevation (ft)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Moisture Content	Blows per 6 in.	Penetraion Index
Feet	724 +/-		GROUND SURFACE			%			N
	0.00		0.3 (TOPSOIL)						
			(FILL) Sand FILL with silt, trace gravel and cinders, compact to very loose, dark brown, moist.		S-1	100	9	6-7-8	15
					S-2	0	--	1-0-0	0
5	0.00		5.0 (FILL) Sand FILL with silt and wood, brick, metal debris, loose, dark brown, moist.		S-3	44	206	4-1-8	9
	0.00		8.0 (SP) Gravelly SAND, trace silt, dense, brown wet.		S-4	39	41	13-18-17	35
10			Note: Possible cobbles noted by drilling crew						
					S-5	100	4	8-11-15	26
15									
					S-6	67	--	9-14-17	31
20	0.00		20.0 END OF BORING AT 20.0 FEET						
			Borehole was advanced with hollow stem augers, and backfilled with soil cuttings.						
25			WL: 7.5 ft. WL (AB): 4.5 ft. CAVE IN: 5.5 ft.						

Unconfined Compressive Strength (Qu) (tons/sq.ft.) △ Hand Penetrometer ☐ Torvane

○ Water content (%)

W_p W_l Atterberg limits (%)

● "N" Value (blows / 12 in.)

0 1 2 3 4 5

0 10 20 30 40 50

206

SOIL LOG WITH GRAPH D020106 RANSOM DISTRICT LIBRARY.GPJ CRA.PLYMOUTH.GDT 10/21/11

REFERENCE No.: D020106 ENCLOSURE No.: _____

INSPECSOL ENGINEERING INC.

BOREHOLE No.: SB-6
ELEVATION: 724 +/- ft

BOREHOLE REPORT

Page: 1 of 1

CLIENT: C2AE
PROJECT: Ransom District Library
LOCATION: Plainwell, MI
DESCRIBED BY: A. Johnson CHECKED BY: R. Bentley RBB
DATE (START): October 7, 2011 DATE (FINISH): October 7, 2011
DRILLER: Great Lakes DRILL RIG: CME-75

LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- RC - ROCK CORE
- ▼ - WATER LEVEL
- GS - GRAB SAMPLE

Depth	Elevation (ft)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Moisture Content	Blows per 6 in.	Penetraion Index
Feet	724 +/-		GROUND SURFACE			%			N
	0.00		0.8 (TOPSOIL)						
			(FILL) Sand FILL, trace clay and wood, brick debris, loose to very loose, dark brown, moist.		S-1	100	--	2-3-4	7
					S-2	100	11	2-1-1	3
5	0.00		5.5 (PEAT) Sandy PEAT with organics, roots, very loose, black, moist to wet. LOI = 13.1%		S-3	72	65	2-2-1	3
	0.00		8.0 (SP-SM) Fine to coarse SAND with silt and gravel, dense, light brown, wet. Note: Possible cobbles noted by drilling crew		S-4	72	25	15-15-24	39
10									
	0.00		12.0 (SP) Gravelly SAND, trace silt, compact, brown, wet.		S-5	100	--	10-12-17	29
15									
					S-6	100	--	8-11-14	25
20	0.00		20.0 END OF BORING AT 20.0 FEET. Borehole was advanced with hollow stem augers, and backfilled with soil cuttings. LOI = Loss by ignition						
25			WL: 6.2 ft. WL (AB): 5.9 ft. CAVE IN: 6.3 ft.						

Unconfined Compressive Strength (Qu) (tons/sq.ft.) △ Hand Penetrometer ☐ Torvane
○ Water content (%)
Atterberg limits (%) W_p W_l
● "N" Value (blows / 12 in.)

0 1 2 3 4 5
0 10 20 30 40 50

SOIL LOG WITH GRAPH D020106 RANSOM DISTRICT LIBRARY.GPJ CRA PLYMOUTH.GDT 10/21/11

REFERENCE No.: D020106

ENCLOSURE No.:

INSPECSOL ENGINEERING INC.

BOREHOLE No.: SB-7

ELEVATION: 730 +/- ft

BOREHOLE REPORT

Page: 1 of 1

CLIENT: C2AE

PROJECT: Ransom District Library

LOCATION: Plainwell, MI

DESCRIBED BY: A. Johnson

CHECKED BY: R. Bentley RB3

DATE (START): October 7, 2011

DATE (FINISH): October 7, 2011

DRILLER: Great Lakes

DRILL RIG: CME-75

LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- RC - ROCK CORE
- ▼ - WATER LEVEL
- GS - GRAB SAMPLE

Depth	Elevation (ft)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Moisture Content	Blows per 6 in.	Penetraion Index
Feet	730 +/-		GROUND SURFACE			%			N
	0.00		0.4 (TOPSOIL)						
			(FILL) Sand FILL with silt, trace organics and glass, wood debris, very loose to loose, brown, moist.		S-1	61	--	3-3-3	6
			Note: Slight petroleum odor noted in S-4 at 8.5 to 10.0 ft. depth		S-2	55	13	1-1-19	20
5					S-3	33	10	4-50/4"	50/4"
			LOI = 5.7%		S-4	22	27	1-1-2	3
10			11.0						
	0.00		(SP) Gravelly SAND, trace silt, compact, brown, wet.		S-5	83	--	8-9-12	21
15									
			20.0		S-6	33	--	8-10-13	23
20	0.00		END OF BORING AT 20.0 FEET						
			Borehole was advanced with hollow stem augers, and backfilled with soil cuttings.						
			LOI = Loss by ignition						
25			WL: 10.5 ft. WL (AB): 10.2 ft. CAVE IN: 11.2 ft.						

Unconfined Compressive Strength (Qu) (tons/sq.ft.) △ Hand Penetrometer ☐ Torvane

○ Water content (%)

W_p W_l Atterberg limits (%)

● "N" Value (blows / 12 in.)

0 1 2 3 4 5

0 10 20 30 40 50

SOIL LOG WITH GRAPH D020106 RANSOM DISTRICT LIBRARY.GPJ CRA PLYMOUTH.GDT 10/21/11

REFERENCE No.: D020106 ENCLOSURE No.: _____

INSPECSOL ENGINEERING INC.

BOREHOLE No.: SB-8
ELEVATION: 727 +/- ft

BOREHOLE REPORT

Page: 1 of 1

CLIENT: C2AE
PROJECT: Ransom District Library
LOCATION: Plainwell, MI
DESCRIBED BY: A. Johnson CHECKED BY: R. Bentley RCB
DATE (START): October 7, 2011 DATE (FINISH): October 7, 2011
DRILLER: Great Lakes DRILL RIG: CME-75

LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- RC - ROCK CORE
- ▼ - WATER LEVEL
- GS - GRAB SAMPLE

Depth	Elevation (ft)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Moisture Content	Blows per 6 in.	Penetraion Index
Feet	727 +/-		GROUND SURFACE			%			N
	0.00		(TOPSOIL) 1.1						
			(FILL) Fine to coarse sand FILL with plastic, glass debris, compact to very loose, brown, moist.		S-1	72	--	2-8-18	26
					S-2	72	11	9-8-8	16
5					S-3	17	14	2-1-2	3
	0.00		7.5 (PEAT) Sandy PEAT with organics, roots, very loose, black, moist to wet.						
			LOI = 11.5%		S-4	100	88	1-0-4	4
10	0.00		10.0 (SP) Gravelly SAND, trace silt compact to dense, brown, wet.						
			Note: Possible cobbles noted by drilling crew						
					S-5	11	14	5-7-7	14
15									
					S-6	100	--	9-15-18	33
20	0.00		20.0 END OF BORING AT 20.0 FEET						
			Borehole was advanced with hollow stem augers, and backfilled with soil cuttings.						
			LOI = Loss by ignition						
25			WL: 8.0 ft. WL (AB): 8.5 ft. CAVE IN: 9.5 ft.						

Unconfined Compressive Strength (Qu) (tons/sq.ft.) △ Hand Penetrometer ☐ Torvane
○ Water content (%)
W_p W_l Atterberg limits (%)
● "N" Value (blows / 12 in.)

0 1 2 3 4 5
0 10 20 30 40 50

SOIL LOG WITH GRAPH_D020106 RANSOM DISTRICT LIBRARY.GPJ CRA PLYMOUTH.GDT 10/21/11

REFERENCE No.: D020106

ENCLOSURE No.: _____

INSPECSOL ENGINEERING INC.

BOREHOLE No.: SB-9

ELEVATION: 723 +/- ft

BOREHOLE REPORT

Page: 1 of 1

CLIENT: C2AE

PROJECT: Ransom District Library

LOCATION: Plainwell, MI

DESCRIBED BY: A. Johnson

CHECKED BY: R. Bentley

DATE (START): October 10, 2011

DATE (FINISH): October 10, 2011

DRILLER: Great Lakes

DRILL RIG: CME-75

LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- RC - ROCK CORE
- - WATER LEVEL
- GS - GRAB SAMPLE

Depth	Elevation (ft)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Moisture Content	Blows per 6 in.	Penetraion Index
Feet	723 +/-		GROUND SURFACE			%			N
	0.00		0.5 (TOPSOIL)						
			(FILL) Sand FILL with silt, trace gravel, compact, brown, moist.		S-1	100	--	12-11-10	23
			4.5		S-2	33	36	7-4-8	12
5	0.00		(FILL) Sand FILL with peat, organics, roots and glass, wood debris, loose to very loose, dark brown, moist.		S-3	22	46	1-3-1	4
			8.0						
	0.00		(SP) Gravelly SAND, trace silt, dense to compact, brown, wet.		S-4	61	14	14-20-17	37
10			Note: Possible cobbles noted by drilling crew						
					S-5	28	--	10-12-15	27
15									
					S-6	83	--	9-13-13	26
20	0.00		20.0 END OF BORING AT 20.0 FEET						
			Borehole was advanced with hollow stem augers, and backfilled with soil cuttings.						
25			WL: 7.8 ft. WL (AB): 6.0 ft. CAVE IN: 8.0 ft.						

Unconfined Compressive Strength (Qu) (tons/sq.ft.) △ Hand Penetrometer ☐ Torvane ○ Water content (%) W_p W_l Atterberg limits (%) ● "N" Value (blows / 12 in.)

0 1 2 3 4 5
0 10 20 30 40 50

SOIL LOG WITH GRAPH D020106 RANSOM DISTRICT LIBRARY.GPJ CRA PLYMOUTH.GDT 10/21/11

REFERENCE No.: D020106 ENCLOSURE No.: _____

INSPECSOL ENGINEERING INC.

BOREHOLE No.: SB-10
ELEVATION: 724 +/- ft

BOREHOLE REPORT

Page: 1 of 1

CLIENT: C2AE
PROJECT: Ransom District Library
LOCATION: Plainwell, MI
DESCRIBED BY: A. Johnson CHECKED BY: R. Bentley BCR
DATE (START): October 10, 2011 DATE (FINISH): October 10, 2011
DRILLER: Great Lakes DRILL RIG: CME-75

LEGEND

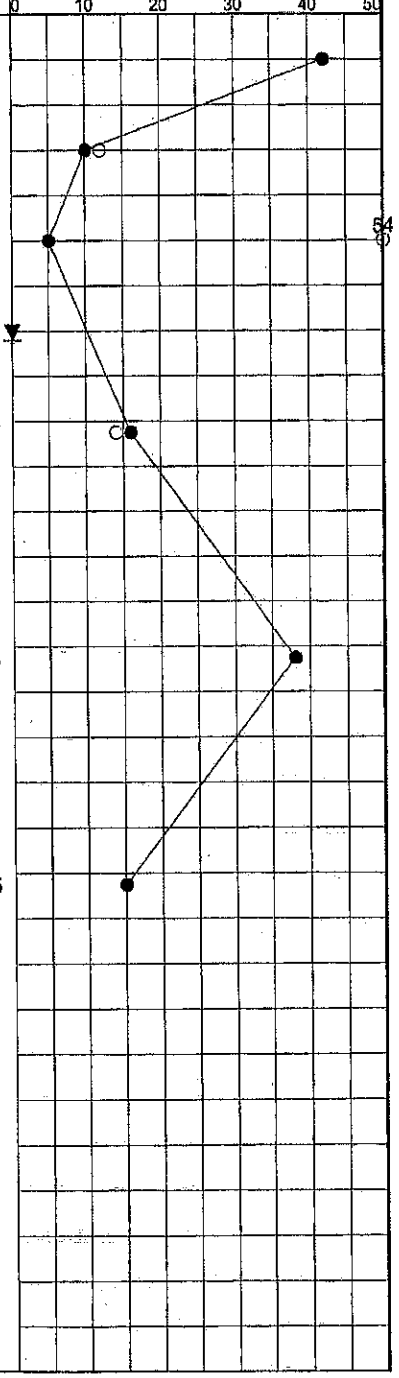
- SS - SPLIT SPOON
- ST - SHELBY TUBE
- RC - ROCK CORE
- ▼ - WATER LEVEL
- GS - GRAB SAMPLE

Depth	Elevation (ft)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Moisture Content	Blows per 6 in.	Penetraion Index
Feet	724 +/-		GROUND SURFACE			%			N
	0.00		0.4 (TOPSOIL)						
			(FILL) Sand FILL, trace organics, cinders, wood, brick debris, dense to compact, dark brown, moist.		S-1	44	--	4-12-20-22	42
					S-2	100	12	10-6-5-5	10
	0.00		4.0 (PEAT) Sandy PEAT with organics and roots, loose to compact, dark brown, wet. LOI = 5.3%		S-3	100	54	2-2-2-3	5
5									
	0.00		8.0 (SP) Gravelly SAND, trace silt, compact to dense, brown, wet.		S-4	100	14	2-5-11	16
10									
					S-5	22	--	8-8-30	38
15	0.00		15.0 (SP) Fine SAND, trace silt, compact, brown, wet.						
					S-6	17	--	8-7-8	15
20	0.00		20.0 END OF BORING AT 20.0 FEET						
			Borehole was advanced with hollow stem augers, and backfilled with soil cuttings.						
			LOI = Loss by ignition						
25									

WL: 7.2 ft.
WL (AB): 6.6 ft.
CAVE IN: 7.8 ft.

Unconfined Compressive Strength (Qu) (tons/sq.ft.) △ Hand Penetrometer □ Torvane
○ Water content (%)
Atterberg limits (%) w_p w_l
● "N" Value (blows / 12 in.)

0 1 2 3 4 5
0 10 20 30 40 50

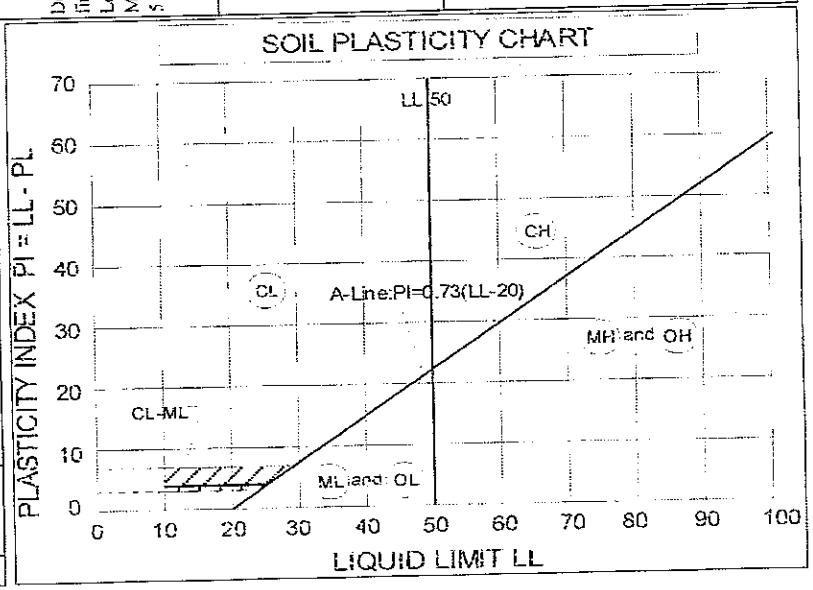


SOIL LOG WITH GRAPH D020106 RANSOM DISTRICT LIBRARY.GPJ CRA-PLYMOUTH.GDT 10/21/11

INSPECSOL ENGINEERING INC.

SOIL CLASSIFICATION SYSTEM (MODIFIED U.S.C.S.)

MAJOR DIVISIONS				GROUP SYMBOL	TYPICAL DESCRIPTION	LABORATORY CLASSIFICATION CRITERIA
COARSE-GRAINED SOILS (MORE THAN HALF BY WEIGHT LARGER THAN THE NO. 200 SIEVE SIZE)	GRAVELS (MORE THAN HALF OF COARSE FRACTION LARGER THAN NO. 4 SIEVE SIZE)	CLEAN GRAVELS		GW	WELL GRADED GRAVEL, GRAVEL-SAND MIXTURES	Determine percentages of sand and gravel from grain size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows: Less than 5 percent.....GW, GP, SW, SP; More than 12 percent.....GM, GC, SM, SC; 5 to 12 percent.....Borderline cases requiring dual symbols. $C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 & 3
				GP	POORLY GRADED GRAVELS AND GRAVEL-SAND MIXTURES	Not meeting all gradation requirements for GW
		DIRTY GRAVELS		GM	SILTY GRAVELS, GRAVE-SAND-SILT MIXTURES	Atterberg limits below "A" line or PI less than 4 / Above "A" line with PI between 4 and 7 are *borderline* cases requiring use of dual symbols
				GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES	Atterberg limits below "A" line or PI greater than 7
	SANDS (MORE THAN HALF OF COARSE FRACTION SMALLER THAN NO. 4 SIEVE SIZE)	CLEAN SANDS		SW	WELL GRADED SANDS, GRAVELLY SANDS	$C_u = \frac{D_{60}}{D_{10}}$ greater than 6; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 & 3
				SP	POORLY GRADED SANDS, OR GRAVELLY SAND	Not meeting all gradation requirements for SW
		DIRTY SANDS		SM	SILTY SANDS, SAND-SILT MIXTURES	Atterberg limits below "A" line or PI less than 4 / Limits plotting in hatched zone with PI between 4 and 7 are *borderline* cases requiring use of dual symbols
				SC	CLAYEY SANDS, SAND-CLAY MIXTURES	Atterberg limits below "A" line or PI greater than 7
FINE-GRAINED SOILS (MORE THAN HALF BY WEIGHT PASSES NO 200 SIEVE SIZE)	SILTS BELOW "A" LINE ON PLASTICITY CHART; NEGLIGIBLE ORGANIC CONTENT			ML	INORGANIC SILTS AND VERY FINE SAND, ROCK FLOUR, SILTY SANDS OF SLIGHT PLACTICITY	
				MH	INORGANIC SILTY, MICACEOUS OR DIATOMACEOUS, FINE SANDY OR SILTY SOILS	
	CLAYS ABOVE "A" LINE ON PLASTICITY CHART; NEGLIGIBLE ORGANIC CONTENT			CL	INORGANIC CLAYS OF LOW PLASTICITY, GRAVELLY, SANDY OR SILTY CLAYS, LEAN CLAYS	
				CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS	
	ORGANIC SILTS & ORGANIC CLAYS BELOW "A" LINE ON PLASTICITY CHART			OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY	
				OH	ORGANIC CLAYS OF HIGH PLASTICITY	
HIGHLY ORGANIC SOILS				PT	PEAT AND OTHER HIGHLY ORGANIC SOILS	



INSPECSOL ENGINEERING INC.
MEMBER OF THE QIA FAMILY OF COMPANIES

CONVENTIONAL SOIL DESCRIPTIONS

Gradation Description and Terminology:

Coarse grained or granular soils have more than 50% of their dry weight retained on a #200 sieve; they are described as boulders, cobbles, gravel or sand. Fine grained soils have less than 50% of their dry weight retained on a #200 sieve; they are described as clay or clayey silt if they are cohesive, and silt if they are non-cohesive. In addition to gradation, granular soils are defined on the bases of their relative in-place density and fine grained soils on the basis of their strength or consistency and their plasticity.

GRAIN SIZE CLASSIFICATION

COBBLES	Greater than 3 inches (76 mm)
GRAVEL	3 in. to No. 4 (4.76 mm)
Coarse Gravel	3 in. to 3/4 in.
Fine Gravel	3/4 in to No. 4 (4.76 mm)
SAND	No. 4 (4.76 mm) to No. 200 (.0.074 mm)
Coarse Sand	No. 4 (4.76 to No. 10 (2.0 mm)
Medium Sand	No. 10 (2.0 mm) to No. 40 (0.42 mm)
Fine Sand	No. 40 (0.42 mm) to No. 200 (0.074 mm)
SILT	No. 200 (0.074 mm) to 0.002 mm
CLAY	Less than 0.002 mm

NOTE: The "No. __" refers to the standard sieve sizes.

COMPONENT PERCENTAGE DESCRIPTORS

Noun(s) (e.g. SAND and GRAVEL)	35 to 50%
Adjective (e.g. SANDY)	20 to 35%
With	10 to 20%
Trace	< 10%

PROPERTY DESCRIPTORS

Stratified	Blocky
Laminated	Lenses/Seams
Fissured	Homogeneous

COHESIVE (CLAYEY) SOIL

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH Qu (tsf)
Very Soft	< 0.25
Soft	0.25 to 0.49
Firm	0.50 to 0.99
Stiff	1.00 to 1.99
Very Stiff	2.00 to 3.99
Hard	> 4.00

NON-COHESIVE (GRANULAR) SOIL

RELATIVE DENSITY	BLOWS PER FOOT (N-VALUE)
Very loose	< 5
Loose	5 to 9
Compact	10 to 29
Dense	30 to 50
Very Dense	> 50

APPENDIX B

LABORATORY RESULTS

Borehole	Depth ()	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	Class-ification	Water Content (%)	Dry Density (pcf)	Satur-ation (%)	Void Ratio
SB-1	1							11.2			
SB-1	3.5							14.3			
SB-1	8.5							10.5			
SB-10	2							11.9			
SB-10	4							53.6			
SB-10	6							44.8			
SB-10	8.5							14.2			
SB-2	1							13.1			
SB-2	3.5							12.6			
SB-2	6							69.6			
SB-2	8.5							20.7			
SB-3	3.5							11.1			
SB-3	6							123.5			
SB-3	8.5							21.2			
SB-4	1							6.2			
SB-4	3.5							41.6			
SB-4	6							60.8			
SB-5	1							8.8			
SB-5	6							206.3			
SB-5	8.5							41.3			
SB-5	13.5							4.1			
SB-6	3.5							11.3			
SB-6	6							64.5			
SB-6	8.5							25.1			
SB-7	3.5							13.1			
SB-7	6							9.7			
SB-7	8.5							26.9			
SB-8	3.5							11.3			
SB-8	6							14.5			
SB-8	8.5							87.8			
SB-8	13.5							13.6			
SB-9	3.5							36.1			
SB-9	6							46.1			
SB-9	8.5							13.8			

INSPECSOL ENGINEERING INC.
MEMBER OF THE CRA FAMILY OF COMPANIES

Summary of Laboratory Results

Project Name: Ransom District Library
Project Number: D020106
Client: C2AE
Location: Plainwell, MI

LOSS ON IGNITION TEST DATA

PROJECT:	RANSOM DISTRICT LIBRARY	**PROJECT NO:**	D020106
LOCATION:	PLAINWELL, MI		
CLIENT:	C2AE		
SAMPLED BY:	CRA	**SOURCE:**	INSPECSOL
DATE SAMPLED:	10/18/2011	**DATE TESTED:**	10/19/2011

Sample No.	SB- 7	SB - 4	SB - 8	
Sample Location	S4 8.5 - 10' FEET	S2 3.5' - 5' FEET	S4 8.5 - 10' FEET	
Sample & Tare Weight Before Ignition (g)	44.9	35.4	26.9	
Sample & Tare Weight After Ignition (g)	42.6	33.5	24.3	
Loss of Weight By Ignition (g)	2.3	1.9	2.6	
Weight of Tare (g)	4.3	4.2	4.2	
Initial Weight of Sample (g)	40.6	31.2	22.7	
Percent Organic (%)	5.7	6.1	11.5	

LOSS ON IGNITION TEST DATA

PROJECT:	RANSOM DISTRICT LIBRARY	**PROJECT NO:**	D020106
LOCATION:	PLAINWELL, MI		
CLIENT:	C2AE		
SAMPLED BY:	CRA	**SOURCE:**	INSPECSOL
DATE SAMPLED:	10/18/2011	**DATE TESTED:**	10/19/2011

Sample No.	SB- 6	SB - 10	SB-3	SB - 2
Sample Location	S3 6 - 7.5 ' FEET	S3 4 - 6' FEET	S3 6 - 7.5' FEET	S3 6 - 7.5' FEET
Sample & Tare Weight Before Ignition (g)	26.5	37.9	21.9	27.6
Sample & Tare Weight After Ignition (g)	23.6	36.1	19	25.1
Loss of Weight By Ignition (g)	2.9	1.8	2.9	2.5
Weight of Tare (g)	4.3	4.2	4.2	4.2
Initial Weight of Sample (g)	22.2	33.7	17.7	23.4
Percent Organic (%)	13.1	5.3	16.4	10.7