February 28, 2017
GEI Project No. 1602860

Mr. Tim Bagstad, PE
Saint Paul Regional Water Services
1900 Rice Street
Saint Paul, Minnesota 55113
tim.bagstad@ci.stpaul.mn.us

Consulting
Engineers and
Scientists

RE: Change Order Request No. 1, Structural Assessment of the McCarrons Water Treatment Plant, Saint Paul, Minnesota

Dear Mr. Bagstad:

GEI Consultants, Inc. (GEI) is pleased to assist the Saint Paul Regional Water Services (SPRWS) with the assessment of the McCarrons Water Treatment Plant. This Change Order request describes the background and original scope of the project, scope of supplementary services, proposed project schedule, and additional project costs.

Project Background and Purpose

GEI has performed two visual inspections of the plant and on our second trip to the site, we performed exploratory test pits to inspect easily accessible timber piles supporting the plant's foundation. Two test pits were successfully conducted, exposing three (3) timber piles. The successful test pits were conducted in an original portion (circa. 1921) of the plant, denoted as the "head house" on the original drawings provided by SPRWS. This area is located below the current mechanic's shop. This location was chosen for its relatively easy access to the timber piles because a concrete floor slab was never constructed in this location. The three exposed timber piles were observed to be deteriorated around the circumference of the piles immediately below the concrete pile cap foundations, extending up into the concrete foundation. Two of the three piles had deterioration extending approximately 3-4 inches into the original pile surface. The deteriorated rings were extremely soft and removable by hand.

Three (3) samples from small diameter core borings from each pile and one (1) bulk sample of deteriorated pile were shipped to a wood scientist for microscopic analysis. Two of the three samples were confirmed to be red pine and the third sample was likely red pine. A brown rot decay was positively identified in the bulk sample from Pile No. 1 and the same condition was observed on the outside of Pile No. 2 and, to a lesser extent, on the outside of Pile No. 3. The presence of the brown rot decay fungi indicates that there were likely fluctuations in the water table below the groundwater elevations that are currently being observed. This is not a favorable indication as to the potential condition of other existing red pine piles that may have also experienced a fluctuating water table.

Currently, GEI only inspected timber piles in one location of the plant as described above. In a conference call with SPRWS on November 15, 2016, the desire to complete additional test pit locations was discussed. Based on this conference call and subsequent conversations with you, it is our understanding that SPRWS would like to further explore the possibility of performing additional test pits to inspect timber piles in other locations. This change order request letter has

been prepared to discuss the additional services required to perform additional test pits and to perform field inspections and laboratory services associated with the test pits.

Scope of Supplementary Services

Before excavating the additional proposed test pits, GEI anticipates providing drawing details and notes to shore and safely access the test pits. Currently, the three (3) locations being considered for additional test pits include:

- The large vacant room just south of the Figure 8 structure.
  - This location would require cutting and the removal of a portion of the reinforced concrete floor slab near a support column.
- Original Test Pit No. 3 location between the 1921 and 1937 clear wells.
  - This location would likely require the removal of concrete and the temporary support of a large diameter clearwell outlet pipe.
- External test pit(s) located on the west side of the boiler building.
  - This location would require a sloped excavation, dewatering, and careful hand excavation near underground utilities.
  - A second location could be conducted alongside the former chimney stack foundation, although this location risks encountering debris from the demolition of the chimney.

GEI proposes to develop conceptual sketches of each option above for cost estimation and final selection discussions with SPRWS. Once the final test pit location(s) is chosen, GEI will develop detailed sketches and specifications to support the test pit excavation. If an interior test pit is selected, these details will include a reinforced concrete repair detail to restore the floor slab and suggested internally braced excavation support. If an exterior test pit is selected, GEI will review the soil borings in that location and provide recommendations to perform an open cut excavation meeting Occupational Safety and Health Administration (OSHA) requirements. At this time, GEI assumes that a sloped open cut excavation will be sufficient for reaching the timber piles without the need for a braced excavation. If an external test pit is conducted, GEI proposes to be present onsite during the excavation to limit the duration the excavation shall remain open.

Once the timber piles are exposed within the test pit(s), GEI anticipates performing one site visit to perform inspections of additional timber piles. Similar to the first timber pile inspection, GEI proposes to conduct the following field measurements and tests for each exposed pile.

- Perform visual inspection of the exposed piles;
- Measure the pile perimeter or circumference;
- Perform surface probing of the timber piles using a screwdriver. The probing is proposed to be conducted at a minimum of four points around the circumference of the pile and every 6-inches vertically of the exposed pile. The probing will determine how far one can push a screwdriver into the surface of the pile, if at all.
- Obtain a minimum of one 1/8-inch diameter core from each timber pile for microscopic laboratory analysis. The core sample will be sent for microscopic analysis to help determine geometry, nature, and extent of any pile deterioration in addition to the wood species. All core holes will be plugged with treated timber plugs so that the structural

integrity of the piles is maintained.

As an additional non-destructive test method, GEI proposes to utilize a Resistograph, or resistance drill, in combination with the laboratory microbiological analysis on the core samples to quantify the level of wood decay. A Resistograph is a drill equipped with a 12-inch long needle that has a 1/8-inch diameter tip. As the drill advances through the timber pile, it will measure the resistance of the wood which can be correlated to the density of the wood. Regions of consistent relative densities are indicative of sound wood, and conversely, regions with little to no resistance are generally indicative of wood decay. The benefit of using this tool is that multiple locations can be mapped in a relatively short timeframe and the readings are calibrated to reduce human influence on the readings.

It is important to note that, while the non-destructive tests provide a qualitative assessment of the timber piles condition, the only method to quantify the pile's actual remaining structural capacity is to perform destructive compressive strength testing of the pile. Due to the advanced rates of deterioration identified in the first two test pits, GEI is proposing to conduct destructive testing of the piles at each test pit location. To perform laboratory compressive strength testing, a 12 to 24-inch long pile section is proposed to be removed. To obtain a statistically significant sample size and to account for potential variations in the wood, at least three (3) different piles per test pit location are preferred for the mechanical testing. The laboratory costs to perform the compressive strength testing are $3,500 per pile. For the purposes of this proposal, GEI has included costs to perform six compressive strength tests, assuming two test pits are excavated and three pile sections per test pit are removed. To restore the structural continuity of the removed pile sections, either cast-in-place concrete or a steel pipe section will be designed to connect the concrete foundation to the remaining pile section. GEI has designed successful repairs for damaged pile sections and pile sections removed for testing on past projects.

The laboratory testing is proposed to be conducted by Wood Advisory Services, Inc. Dr. Al De Bonis is the President of Wood Advisory Services, Inc. and has over 40 years of experience in the evaluation of wood structures. Attached to this proposal is a brief introduction to Wood Advisory Services, Inc. and a resume for Dr. De Bonis. Wood Advisory Services, Inc. performed the laboratory analysis of the first timber samples obtained in 2016.

Project Assumptions

- GEI and SPRWS will determine the test pit locations together.
- The interior and exterior test pit work will be conducted by SPRWS or a third-party Contractor hired by SPRWS.
- The entire circumference of the timber piles will be exposed for a minimum of three feet vertically below the concrete pile cap.
- GEI will not be onsite during the preparation of an interior test pit. We plan to inspect the piles in the test pits soon after they are ready.
- Sump pumps, provided by SPRWS, will be installed and operated to allow inspection and testing above ground water line.
- An external test pit can be excavated and timber piles inspected within one day. Backfill operations may be conducted the second day, without the supervision of GEI staff.
- If both external and internal test pits are conducted, GEI assumes they can both be

inspected during one mobilization to the project site.

- A total of eight (8) timber piles will be exposed for field inspection and subsequent microscopic laboratory assessment. Additional laboratory testing can be conducted as an additional service.
- The pile sections necessary for compressive strength testing will be removed by SPRWS staff or a third-party Contractor hired by SPRWS. The repair of the pile section will also be conducted by SPRWS staff or a third-party Contractor.

Project Schedule

Within two weeks of approval of this change order, GEI will provide the conceptual sketches for the test pit options discussed above. Upon selecting the proposed test pit option, with input from SPRWS, GEI will develop the final drawings and specifications for completing the test pit(s). GEI anticipates completing this work within two weeks of selecting the final test pit location. The field work is estimated to be conducted in late March or early April, depending on the availability of SPRWS staff or a third-party Contractor.

The laboratory results generally take three to four weeks to receive. GEI will include the results with the overall structural assessment report. The preliminary results from the laboratory testing will be distributed to SPRWS staff when they are received.

Project Fees

In accordance with our proposal dated December 1, 2015, GEI had only budgeted for one mobilization to perform test pit explorations and for performing microscopic laboratory testing on four (4) timber pile samples. This field work was completed in October 2016 and the lab samples were processed in December 2016. Additionally, GEI conducted a second visual structural site inspection in combination with the test pit exploration work. This second inspection for the east half of the Figure 8 structure and filters 13-23, was not included in the original proposal. However, since we did not utilize an outside excavation contractor for the test pit work and rather used additional GEI staff to hand dig the test pits, we were able to complete that scope within the original budget.

The additional scope of services outlined above will be performed on a time-and-material basis for an estimated fee of **$44,600**. The current Purchase Order No. 8-662-1 amount is $59,000 to cover the original scope of work. Therefore, we are requesting a revised total Purchase Order amount of $103,600 or a new Purchase Order for $44,600. If additional services are requested beyond those described above, you will be notified, and they will be performed on an accrued time and expense basis in accordance with the attached fee schedule. A new task will be setup within our accounting system to track these additional costs independently from the original scope and budget.

We appreciate the opportunity to continue working on this project. Should you have any questions or require additional information, please contact Kevin Roell at (906) 662-4750.

Sincerely,

GEI CONSULTANTS, INC.

Kevin Roell, PE
Project Engineer

Steven A. Elver, PE, SE
Senior Consultant

Attachments:

Estimated Cost and Schedule Table
Fee Schedule
Wood Advisory Services Company Description
Resume Al De Bonis, Ph.D.

Estimated Cost and Schedule Table

Task	Resource	Units	Rate	Estimated Hours	Cost	Milestones	Feb-27-17	Develop Conceptual Sketches	Mar-06-17	Develop Final Sketches and Specifications	Mar-13-17	Mar-20-17	Perform Timber Pile Inspections	Mar-27-17	Summarize Field Inspection Results and Ship Laboratory Samples	Apr-03-17	Apr-10-17	Apr-17-17	Evaluate Laboratory Test Results and Incorporate Findings Into Final Report	Apr-24-17	May-01-17	May-08-17
Task 5 - Supplemental Timber Pile Investigations																						
	Grade 9	hour	$ 252	3	$ 756							1									1	
	Grade 8	hour	$ 229	30	$ 6,756				1		2	2			20	0.5					4	
	Grade 7	hour	$ 157	0	$ -																	
	Grade 5	hour	$ 110	60	$ 6,600				4		4	8			32	4					8	
	Grade 2	hour	$ 85	30	$ 2,550				8		8	12				2						
	Administrative	hour	$ 62	1	$ 62											1						
	Resistograph Testing	cost	$ 2,200	1	$ 2,200																	
	Wood Laboratory Microbiology	cost	$ 2,900	1	$ 2,900																	
	Compressive Strength Testing	each	$ 3,500	6	$ 21,000																	
	Expenses	cost	$ 1,800	1	$ 1,800																	
			Subtotal =		$ 44,624																	
					Total Estimated $ 44,624																	

EXHIBIT B

FEE SCHEDULE AND PAYMENT TERMS

FEE SCHEDULE

Personnel Category	Hourly Billing Rate $ per hour
Staff Professional – Grade 1	$ 80
Staff Professional – Grade 2	$ 85
Project Professional – Grade 3	$ 93
Project Professional – Grade 4	$ 99
Senior Professional – Grade 5	$ 110
Senior Professional – Grade 6	$ 145
Senior Professional – Grade 7	$ 157
Senior Consultant – Grade 8	$ 229
Senior Consultant – Grade 9	$ 252
Senior Principal – Grade 10	$ 252
Senior CADD Drafter and Designer	$ 92
CADD Drafter and Designer	$ 76
Field Professional	$ 100
*Senior Technician	$ 72
*Technician II	$ 68
*Technician I	$ 59
Word Processor, Administrative Staff,	$ 62
Office Aide	$ 55

- Rates will increase up to 5% annually, at GEI's option, for all contracts that extend beyond twelve (12) months after the date of the contract. Rates for Deposition and Testimony are increased 1.5 times.
- *The scope of work is based on a normal work week, Monday through Friday, eight (8) hours per day. Overtime will be charged at 1.3 times the specified rate; Sunday and holiday hours will be charged at two times the personnel rate, with a minimum charge of eight (8) hours

OTHER PROJECT COSTS

Subconsultants, Subcontractors and Other Project Expenses - All costs for subconsultants, subcontractors and other project expenses will be billed at cost plus a 15% service charge. Examples of such expenses ordinarily charged to projects are subcontractors; subconsultants: chemical laboratory charges; rented or leased field and laboratory equipment; outside printing and reproduction; communications and mailing charges; reproduction expenses; shipping costs for samples and equipment; disposal of samples; rental vehicles; fares for travel on public carriers; special fees for insurance certificates, permits, licenses, etc.; fees for restoration of paving or land due to field exploration, etc.; state sales and use taxes and state taxes on GEI fees.

Field and Laboratory Equipment Billing Rates – GEI-owned field and laboratory equipment such as pumps, sampling equipment, monitoring instrumentation, field density equipment, portable gas chromatographs, etc. will be billed at a daily, weekly, or monthly rate, as needed for the project. Expendable supplies are billed at a unit rate.

Transportation and Subsistence - Automobile expenses for GEI or employee owned cars will be charged at the rate per mile set by the Internal Revenue Service for tax purposes plus tolls and parking charges, or at a day rate negotiated for each project. When required for a project, four-wheel drive vehicles owned by GEI or the employees will be billed at a daily rate appropriate for those vehicles. Per diem living costs for personnel on assignment away from their home office will be negotiated for each project.

PAYMENT TERMS

Invoices will be submitted monthly or upon completion of a specified scope of service, as described in the accompanying contract (proposal, project, or agreement document that is signed and dated by GEI and CLIENT).

Payment is due upon receipt of the invoice. Interest will accrue at the rate of 1% of the invoice amount per month, for amounts that remain unpaid more than 30 days after the invoice date. All payments will be made by either check or electronic transfer to the address specified by GEI and will include reference to GEI's invoice number.

Wood Advisory Services, Inc.

A wood science and engineering consulting company.

Since 1984, we have provided a wide range of consulting and testing services in virtually every aspect of wood science and wood construction technology across the United States and Internationally. Our services include; the standardized testing of wood and wood-based materials, assessment of existing wood structures and assemblies (i.e., visual grading, resistance drilling, and assessment of wood decay and/or insect attack), building envelope performance, indoor air quality investigations, failure analysis, forensic investigations, research and development, statistical reliability assessment, and witness testimony.

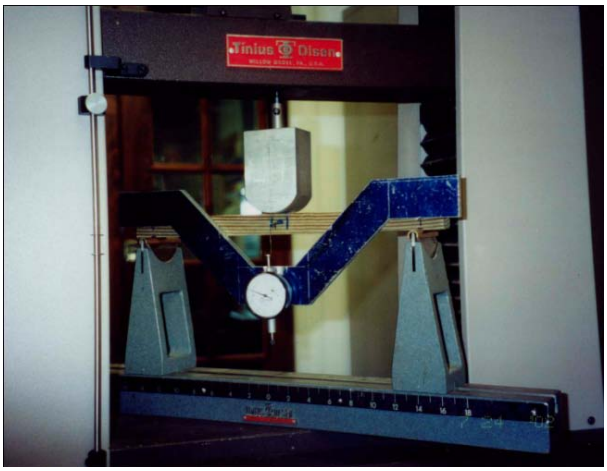
Wood Advisory Services, Inc. has served a variety of clients, including high profile engineering and architectural firms, major corporations, building contractors, trade associations, government agencies, building owners, insurance companies, home owners, and law firms.

Wood Advisory Services, Inc. is a consulting company specializing in the engineering uses of wood and wood-based products. Our company is composed of respected technical professionals in wood science and technology. Our experts are members of and have served as elected officers in several professional societies, including the *American Society for Testing and Materials*, *Forest Products Society*, the *Society of Wood Science and Technology*, the *American Wood Preserver's Association*, the *National Home Builder's Association*, the *New York State Builder's Association* and the *American Society of Civil Engineers*. Our staff members have published refereed journal articles in the *Forest Products Journal*, *Wood and Fiber Science*, *Journal of Structural Engineering*, *Transactions of the American Society of Agricultural Engineers*, *Journal of Materials Education*, *Wood Science and Technology*, and *Wood Design Focus.* We have been pioneers in the development of full-size structural lumber testing procedures, design properties, and statistical distribution and reliability simulations. This record of professional activity and research, combined with a wealth of practical consulting experience, is brought to every project.

Wood Advisory Services, Inc.
PO Box 1322
Millbrook, NY 12545
845.677.3091
www.woodadvisory.com

Standardized Testing

At WAS, Inc., we have the in house capability of performing numerous mechanical property evaluations according to the American Society of Testing and Materials (ASTM) standardized tests. Our Tinius Olsen 10,000lb bench top test machine is used for determining modulus of rupture (MOR) and modulus of elasticity (MOE), compression-parallel-to-grain, compression-perpendicular-to-grain, shear, tension-parallel-to-grain and hardness for solid wood and wood-based materials. Additionally, we have the capability of calibrating aluminum bars and proving rings used for quality control purposes.



Our in-grade full size lumber testing machine is used to evaluate lumber in bending as well as in tension. Materials from 2"x 4" x 8' up to 2"x 10"x 16' sizes can be evaluated. All data is recorded using a data acquisition system.

WAS, Inc. also has the capability of performing ASTM concentrated load testing of plywood panels, as well as ASTM adhesive bond characteristics.

In addition to standardized testing procedures, we have also developed non-standardized procedures that allow us to evaluate a wide range of properties for specific uses.

Engineering & Construction

Wood Advisory Services, Inc, has performed numerous investigations of in-situ wood structural members as well as removing large members, such as wood pile sections, for extensive mechanical and microbiological evaluations. Wood Advisory Services, Inc. provides specialized expertise in the evaluation of in-service wood piles used for foundations and marine structures.

Structural assessment and rehabilitation efforts require close examination of existing wood foundation piles. We have investigated pile condition in terrestrial, fresh water, and marine environments.

We have evaluated structural timbers, utility poles, lumber, decking, glulam, composite timbers, and structural composite panel products. Frequently, the renovation of older structures requires detailed assessment of the structural capacity of large timber beams, columns, and connections.

Failure analysis and forensic investigations of wood and wood-based products is a specialty of Wood Advisory Services, Inc. We have evaluated many types of failures such as trusses, ladders, siding, scaffolds, concrete formwork, glulam beams, heavy timbers, and a variety of built-up wooden structures. To provide the most thorough analysis for our clients, we often partner with architects, engineers, and contractors.

Building Performance

Wood Advisory Services, Inc. is frequently called upon to assess building performance problems. Many performance deficiencies in these structures are due to poor construction practices, design anomalies, moisture intrusion problems, or defective materials. These deficiencies can lead to indoor environments that promote the growth of microbiological organisms which can in turn compromise indoor air quality.

Structures & Assemblies

Wood Advisory Services, Inc. routinely evaluates performance problems in light frame wood structures. In addition to common residential and commercial light structures, we have been called upon to evaluate performance problems in very specialized applications, such as pool buildings, log homes, bowling ally's, ice-skating rinks, timber-frame structures and gymnasiums.

Research & Development

Wood Advisory Services, Inc. has worked with industry, government agencies, trade associations, and utilities in research and development projects. We have provided the following services:

- Research project development and implement-ation
- Process and product evaluation
- Statistical analysis and experimental design
- International Conference of Building Officials (ICBO) code-approval assistance

Wood and wood-based products have unique mechanical, physical, and biological properties which merit consideration during the design process. Realistic material specifications often require a specialized knowledge of the wood products industry and the performance history of its many and varied products. We frequently assist engineers and architects in the design of wood structures and specification of wood materials. In addition, we often advise contractors and material suppliers on the interpretation of wood construction specifications.

Expert Witness Testimony

Our technical experts have provided litigation support and expert testimony in a wide variety of legal cases. Technical rigor, objectivity, and integrity define our approach to litigation support. We have provided technical support on projects ranging from construction problems in single family dwellings to national class action product liability suits. Our experts have investigated products failures such as hardboard and other composite wood sidings, fire-retardant lumber and plywood, structural lumber, trusses, scaffold systems, ladders, partial and complete building collapses, moisture intrusion problems and a wide variety of other design and construction problems.

CURRICULUM VITAE: **ALBERT LOUIS DEBONIS**
(*abbreviated*)

ADDRESS: Wood Advisory Services, Inc.
3700 Route 44 - Suite 102
PO Box 1322
Millbrook, NY 12545

TELEPHONE: TEL: (845) 677-3091
FAX: (845) 677-6547

EDUCATION:

Ph.D., Colorado State University, 1978, Wood Science/Engineering.
M.S., Colorado State University, 1974, Wood Mechanics.
B.S., University of Massachusetts, 1972, Wood Technology.
A.A.S., Paul Smiths College, 1970, Forestry.

EMPLOYMENT HISTORY:

WOOD ADVISORY SERVICES, INC.
Millbrook, New York

June 1984 - Present — Position: President

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY
Department of Forest Products
Blacksburg, Virginia

February 1979 - June 1984 — Position: Assistant Professor

WESTERN WOOD PRODUCTS ASSOCIATION
Portland, Oregon

April 1977 - February 1979 — Position: Manager, Engineering Research & Development

COLORADO STATE UNIVERSITY
Department of Wood Science
Fort Collins, Colorado

September 1972 - March 1977 — Position: Graduate Research Assistant

PROFESSIONAL ORGANIZATIONS:

AMERICAN SOCIETY FOR TESTING & MATERIALS, former chairman & multiple committee responsibilities
FOREST PRODUCTS SOCIETY (Formerly Forest Products Research Society), multiple committee responsibilities
SOCIETY OF WOOD SCIENCE AND TECHNOLOGY, multiple committee responsibilities
AMERICAN SOCIETY OF CIVIL ENGINEERS, multiple committee responsibilities
AMERICAN NATIONAL STANDARDS INSTITUTE, member ANSI A14.1
NORTHEASTERN LUMBER MANUFACTURERS INSTITUTE, member, Board of Directors
NORTHEASTERN LUMBER MANUFACTURERS ASSOCIATION, associate member
NATIONAL ASSOCIATION OF HOME BUILDERS, member
NYS BUILDERS ASSOCIATION, member
SOUTHERN PINE INSPECTION BUREAU, MSR committee
SOUTHERN PINE INSPECTION BUREAU, technical committee
TRUSS PLATE INSTITUTE, associate member
NATIONAL FRAME BUILDIERS ASSOCIATION, member
AMERICAN WOOD COUNCIL OF THE AMERICAN FOREST & PAPER ASSOCIATION, design professional

TECHNICAL ARTICLE AND GRANT REVIEWER - PEER REVIEW PROCESS

[Solicited by the Organizations listed below]

1. Forest Products Society
2. Society of Wood Science & Technology
3. American Society for Testing and Materials
4. USDA Cooperative State Research Service
5. USDA Competitive Grants Program
6. USDA Forest Products Laboratory
7. Massachusetts Agricultural Experiment Station

HONORS AND AWARDS

AWARD OF APPRECIATION, for Outstanding Service to ASTM (1988).
GAMMA SIGMA DELTA, National Agricultural Honor Society (1984).
OUTSTANDING YOUNG MEN OF AMERICA AWARD (1980).
SIGMA XI, National Scientific Research Honor Society (1974).
ALPHA ZETA, National Agricultural Honor Society (1972).
MAGNA CUM LAUDE, University of Massachusetts (1972).
DIRECTORY OF INTERNATIONAL BIOGRAPHY: A biographical record of contemporary achievement.

PARTICIPATION IN PROFESSIONAL WORKSHOPS – (10)

PUBLICATIONS & PRESENTATIONS:

REFEREED JOURNAL ARTICLES (11)
PROFESSIONAL JOURNAL ARTICLES (NON-REFEREED) (4)
OTHER TECHNICAL ARTICLES (205)
PROFESSIONAL PRESENTATIONS (36)
CHAPTERS IN BOOKS (1)
PROCEEDINGS ARTICLES (6)