APPENDIX C: RMT, INC. TECHNICAL MEMORANDUM

Technical Memorandum

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Project No.: 7334.01

Subject: Summary of Environmental Information for the Kalamazoo Harbor Master Plan, Saugatuck, Michigan

This Technical Memorandum summarizes the environmental information that RMT has prepared and analyzed on issues related to the buildup of sediment in Lake Kalamazoo and Douglas Harbor, near Saugatuck, Michigan. This Technical Memorandum provides information on several aspects of the project, including (1) a summary of the physical and chemical characteristics of the sediment in these areas, and implications for dredging and disposal; (2) a brief overview of past dredging practices and funding mechanisms; (3) site selection criteria and the identification of potential disposal sites; (4) potential costs for sediment management; and (5) identification of potential future funding mechanisms.

1. Sediment Characteristics and Implications for Management

An approximately 80-mile–long stretch of the Kalamazoo River, from Morrow Lake to Lake Michigan, is part of the Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund site. Lake Kalamazoo and Douglas Harbor are located on this stretch of the Kalamazoo River and are part of the Superfund site (see figure in Attachment 1). The river was designated a Superfund site in 1990, after studies showed that polychlorinated biphenyls (PCBs) were present in the river sediment. Many sediment evaluations have been performed on the Kalamazoo River, beginning in the 1970s. Most of the sediment testing has been focused on areas substantially upstream from Lake Kalamazoo and Douglas Harbor, particularly in the areas upstream of the Lake Allegan Dam, which is located approximately 25 miles upstream from Saugatuck.

The data for the upstream reaches of the river were summarized in Remedial Investigation reports by Blasland, Bouck, and Lee (BBL, 2000a; BBL, 2000b). These reports indicate that the highest concentration of PCBs in the Kalamazoo River sediment (*i.e.*, 160 mg/kg) was found in the fine-grained silty sediment of the former Otsego Impoundment. The greatest volume of PCB-impacted sediment is located in Lake Allegan, where fine-grained sediment was found to contain up to 73 mg/kg PCBs. Course-grained sandy sediment contained lower concentrations of PCBs than fine-grained sediment.

The BBL reports indicate that data for the furthest downstream stretch of the Kalamazoo River (*i.e.*, the 28-mile stretch between the Lake Allegan Dam and Lake Michigan, which includes Lake Kalamazoo and Douglas Harbor) would be included in a subsequent remedial investigation. However, if such a report was prepared, it is not available to the public. Therefore, RMT has used data from various sources to summarize what is currently known about the sediment characteristics in Lake Kalamazoo and Douglas Harbor.

Chemical Characteristics

The most comprehensive chemical data currently available for sediment in Lake Kalamazoo and Douglas Harbor appear to be from testing performed by Camp Dresser & McKee in March 2000 (CDM, 2000). These data are summarized on the attached figures (Attachment 2) and include PCB concentrations at five sampling intervals in the uppermost 3 feet of sediment (*i.e.*, 0 to 2 inches, 2 to 6 inches, 6 to 12 inches, 12 to 24 inches, and 24 to 36 inches). PCB concentrations were generally higher in Kalamazoo Lake sediment than in Douglas Harbor sediment. The data show that the highest concentrations of PCBs in the sampled intervals were in the range of 5 to 20 mg/kg. The highest concentrations of PCBs were generally found between 0.5 and 2 feet below the sediment surface, with PCB concentrations generally lower in the 2- to 3-foot sampling interval. This trend of decreasing PCB concentrations with sediment depth is similar to the trend observed in Lake Allegan (BBL, 2000b), where PCB concentrations were nondetectable in two thirds of the sediment samples collected at 2 to 3 feet below the sediment surface. RMT was not able to locate chemical data for in-place sediment located more than 3 feet below the sediment surface.

Two other sources of PCB data include data collected by Dell Engineering in 1999 near the northernmost edge of Kalamazoo Lake (Dell, 1999) and data collected by CDM in 2001 in a dredge disposal area utilized by Tower Marine, located adjacent to Kalamazoo Lake (CDM, 2001). No PCBs were detected in the samples collected by Dell Engineering, and PCB concentrations in the Tower Marine dredge disposal area ranged from nondetectable to 2.6 mg/kg (see Attachment 3).

CDM and Dell also analyzed the soil samples collected in the Tower Marine dredge disposal area and the northernmost edge of Kalamazoo Lake for metals. The sample results from the Tower Marine disposal area showed that arsenic concentrations in the more near-surface samples (*i.e.*, 2 to 4.5 feet below ground surface), which consisted of silty sediment, were generally slightly above the Michigan Cleanup Criterion for residential sites (*i.e.*, up to 12 mg/kg, as compared to the criterion of 7.6 mg/kg). Arsenic concentrations were generally below this criterion in the deeper samples, which were collected in sandy sediment. The sample results from the northernmost edge of Kalamazoo Lake showed that arsenic concentrations in clay sediment ranged from 9.3 to 9.9 mg/kg. RMT recommends establishing background arsenic levels for comparison of these data. Data from both studies are summarized in Attachment 3.

In addition, a plume of trichloroethene (TCE)–impacted groundwater has been discovered just southwest of Kalamazoo Lake in the Village of Douglas. An informational bulletin from the Michigan Department of Environmental Quality (MDEQ) indicates that TCE impacts are present in groundwater in the vicinity of Wick's Creek, which discharges to Kalamazoo Lake. The potential for TCE impacts to be present in Kalamazoo Lake sediment or surface water in this area should be taken into consideration as the Kalamazoo Harbor project proceeds.

Physical Characteristics

A limited amount of information on the physical characteristics of sediment in the vicinity of Kalamazoo Lake was contained in the two reports referenced above (Dell, 1999; and CDM, 2001). The Dell report indicates that two sediment samples collected in the top 0.5 foot of sediment along the bank of the Kalamazoo River, just north of Kalamazoo Lake, were primarily sand, while four samples collected in the top 1.5 feet of sediment at the northernmost edge of Kalamazoo Lake consisted of organic clay. The samples collected by CDM in the Tower Marine dredge disposal area consisted of both black silty clay and sandy sediment (CDM, 2001). Additional physical data may have been recorded during the chemical sediment sampling activities performed by CDM (CDM, 2000; Attachment 2). However, since a final report has not been issued, RMT has not been able to gain access to this information.

On the basis of the available physical information, the apparent declining trend of PCB concentrations with sediment depth, the typical geology in this area of southwestern Michigan, and the reduction in river velocity that would be associated with the expanded width of the river at Kalamazoo Lake and Douglas Harbor, it is likely that the physical characteristics include finer grained sediment near the sediment surface, particularly in areas located outside of the main river channel, where water velocities would be lower.

Implications for Sediment Management

There are several implications related to the chemical and physical characteristics of the sediment dredged from Kalamazoo Lake and Douglas Harbor, including dredging methods, regulatory testing requirements, disposal requirements, and project costs.

- **Dredging methods** – Sediment can typically be dredged using either mechanical or hydraulic means. Mechanical dredging is typically used when debris is present and to minimize water management costs. Hydraulic methods are often employed for maintenance dredging due to higher production rates, but significantly more water is generated which must be managed in an appropriate manner. For environmental dredging of contaminated sediment, typically more engineering controls (*i.e.*, silt curtains) are required to control the migration of suspended sediment from the dredging area (*i.e.*, to limit downstream transport). In addition, water management and solids management costs are higher due to contaminants and regulatory requirements.
- **Regulatory and testing requirements for sediment** – Current Michigan regulations and guidelines must be considered as part of the planning for future dredging activities. In August 2006, the MDEQ issued a memorandum that details sampling requirements for sediment investigations and remediation, including site characterization and verification sampling for remediation projects (MDEQ, 2006).

  Current Michigan regulations related to sediment disposal must also be taken into consideration. For all dredging projects greater than 1,000 cubic yards in volume, and for projects in designated USEPA Areas of Concern like the Kalamazoo River, the MDEQ requires sampling of the sediment for potential constituents of concern prior to its disposal. Michigan Solid Waste Rules (Part 115) govern waste characterization for dredge spoils, and the MDEQ has several review criteria for which the results are compared (see Attachment 4). If concentrations are below the review criteria, then the sediment can be placed on-shore in an area near the water body from which the sediment was removed. If concentrations exceed the review criteria, additional testing for the leachability of the contaminants is typically required.
- **Superfund cleanup and relationship to future dredging activities** – In discussions with the USEPA Remedial Project Manager, Sheri Kolak, RMT learned that a number of stakeholders are discussing remediation and natural resource damage issues through mediated negotiations. These negotiations will end soon (1 to 2 months), at which time the USEPA will announce the outcomes. Ms. Kolak indicated that any remediation performed will begin at the upstream end of the Superfund site. The USEPA considers the PCB levels in our study area to be "quite low" and have indicated that they are focused on addressing areas with the greatest PCB mass (*e.g.*, Lake Allegan). Ms. Kolak is aware of the Tower Marine dredging project, and encouraged us to work with the State (Mr. Mark Desharm, Ms. Wendy Fitzner) to obtain permitting for the project. She said it is unlikely that any dredging will be performed in the harbor/lake as part of the Superfund cleanup "in the foreseeable future." The Baseline Ecological Risk Assessment for the Superfund Site (CDM, 2003) identified that a PCB concentration range of 0.5 to 0.6 mg/kg in sediment was protective of environmental species.
- **Disposal requirements and costs** – Michigan Solid Waste Rules (Part 115) also govern waste characterization and disposal requirements for dredge spoils. These Rules contain a review criterion of 1 mg/kg for the disposal of dredge spoils containing PCBs, and other criteria for other potential compounds, such as metals (see Attachment 4). If concentrations of potential contaminants in the dredge spoils are below

the review criteria, the dredge spoils can be placed, without further testing, in an area located adjacent to the shore of the dredged waterway.

The MDEQ may also approve disposal of the material at a further off-site location; however, the Agency is likely to require testing to be certain that potential contaminants will not leach from the material at concentrations that may pose a risk to groundwater. If the material contains contaminants at concentrations above the review criteria, leachability testing is required, regardless of the disposal location. If the material contains PCBs at concentrations above Michigan's Cleanup Criteria for residential sites (*i.e.*, 4 mg/kg), or other compounds, such as metals, at concentrations above Michigan's Cleanup Criteria for residential sites, the MDEQ would require that the soil be covered to prevent direct contact. In addition, groundwater monitoring would likely be required, and restrictive covenants would likely be needed. If the dredge spoils are disposed at an off-site location, the concentration thresholds for cover placement and restrictive covenants are likely to be even lower (*e.g.*, 1 mg/kg for PCBs). If the dredge spoils contain PCB concentrations above 50 mg/kg, the material would need to be managed as a Toxic Substances Control Act (TSCA) waste, and disposed at a landfill approved to accept such waste.

2. Overview of Past Dredging Operations

In 1998, Tower Marine was issued a permit by the MDEQ for the dredging of 22,000 cubic yards of sediment from an area near the southern shoreline of Kalamazoo Lake. The permit allowed for the material to be placed into a contained upland area, located adjacent to the shore. These dredging activities were funded by Tower Marine. As summarized above, the dredged material was sampled by CDM in 2000, with samples analyzed for compositional PCBs and metals (CDM, 2001). All PCB results were below the Michigan Cleanup Criterion for residential sites (4 mg/kg). Tower Marine subsequently prepared a table, which reported an average PCB concentration of 0.74 mg/kg, based on the sampling performed by CDM.

Reportedly, the sediment was dredged and pumped to the adjacent upland area, and water was allowed to drain back into the lake. RMT is not aware of the ultimate fate of the dredged material that was placed in the upland area (*i.e.*, whether it was left in-place, with or without a cover; or whether it was taken to an alternative location for disposal).

3. Potential Future Disposal Sites for Dredge Spoils

A number of criteria will have an impact on the ultimate selection of a dredge disposal site. These criteria include factors that affect the feasibility of using the disposal site, the overall cost, and regulatory and community acceptance. Dredge disposal sites should be compared using the following criteria:

- **Feasibility** – In order for a dredge disposal site to be feasible, there must be a feasible way to transport the dredged materials to the disposal area. The physical characteristics of the dredged material must be compatible with the selected transportation method, and the physical and chemical characteristics must be acceptable and appropriate for the disposal site.
- **Overall cost** – Costs for various disposal options could be wide-ranging, and will include both direct costs (*i.e.*, transportation and disposal costs) and indirect costs (*e.g.*, costs for permitting, testing, regulatory interaction).
- **Regulatory and community acceptance** – Regulatory and permitting requirements for different disposal options will differ, and should therefore be considered when evaluating the overall feasibility, overall costs, and the time frames for implementation. In addition, community perspectives and potential concerns need to be considered, with the intent of minimizing negative impacts.

After considering these criteria, RMT has identified three potential options for disposing of dredged sediment. As planning proceeds and more information becomes available (*e.g.*, sediment volumes and project-specific physical and chemical characteristics), these options should be evaluated using the criteria listed above.

Option 1: Upland Disposal on Available Property

This option involves final disposition of dredge spoils on upland property, assuming this is appropriate for the contaminant levels found in sediment. For example, the City owns two parcels of land, which are located approximately 4 miles northeast of Kalamazoo Lake, that may be potential disposal sites for dredged sediment (Attachment 5). Upland parcels may be feasible for sediment disposal; however, more project-specific information, including the chemical characteristics of the sediment and the physical site setting (*e.g.*, site topography, location of any wetlands on the properties, etc.) is needed in order to assess the suitability of the disposal locations. If the concentrations of PCBs and any other potential constituents of concern (e.g., metals) are below the MDEQ's review criteria (Attachment 4), or if engineering controls (*e.g.*, a cover) can be constructed to address any exceedences, **an upland property disposal option would be much less costly than the option of disposing sediment at a Subtitle D landfill facility.**

Option 2: Upland Licensed Landfills

RMT contacted a number of solid waste landfills in the area of Kalamazoo Harbor and identified two facilities that could be feasible for the disposal of dredged materials: Autumn Hills RDF in Zeeland, Michigan, and Ottawa County Farms Landfill, in Coopersville, Michigan. These facilities are located approximately 20 miles and 40 miles from Saugatuck, respectively, and are licensed to accept PCB-containing sediment. These facilities are feasible options for the disposal of sediment, if the sediment cannot be disposed on the City-owned properties.

Option 3: In-Water Confined Disposal Facility (CDF)

In-water CDFs are sometimes used for the disposal of dredged sediment. The Army Corps of Engineers (ACOE) operates or uses 47 such facilities in its Detroit District, in which Saugatuck is located. These CDFs are generally used by the ACOE for the disposal of the dredge spoils from its navigational dredging activities; however, the ACOE does accept applications from parties wishing to use its facilities. Unfortunately, there are no existing ACOE CDFs in the immediate vicinity of Saugatuck. The ACOE indicates that its nearest facility is located in Holland, which is approximately 20 miles north of Saugatuck. While it would likely be feasible to transport dredged material from Saugatuck, down the Kalamazoo River to Lake Michigan and north to Holland, the ACOE indicates that transportation and materials-handling costs would likely be very high. In addition, the CDF at Holland is nearing its capacity. The ACOE is currently encouraging the removal of the clean sediment in the Holland CDF for beneficial reuse, in order to extend its life. The next nearest disposal facility used by the ACOE is located in Grand Haven, which is approximately 40 miles north of Saugatuck on Lake Michigan. This facility is a privately-owned on-shore facility, which the ACOE contracts for use. The construction of an in-water CDF in the vicinity of the Kalamazoo Harbor project was discussed at the project meeting on December 14, but the MDEQ indicated that they would not likely approve this option.

4. Potential Costs for Sediment Management

JJR has indicated that two dredging scenarios are being evaluated for Kalamazoo Lake, including one scenario ("River Town"), which would require that approximately 360,000 cubic yards of sediment be dredged, and a second scenario ("Harbor Town"), which would require that approximately 960,000 cubic yards of sediment be dredged. RMT has developed conceptual cost ranges for each of these scenarios, assuming that the dredging

activities will be performed in an environmentally sound manner and in compliance with current state and federal regulations and requirements.

These costs are conceptual in nature and include a number of reasonable, yet conservative assumptions. As the dredging project moves forward, RMT would evaluate a number of cost saving ideas, such as:

- Separating or segregating fine-grained and coarse-grained sediments - PCBs and metals tend to be absorbed to organic matter and fine-grained sediment. If feasible, segregation of the physical types of deposits (fine-grained and coarse-grained) may provide cost savings for management and disposal.
- Pumping versus trucking of dredge spoils - once the sediment has been characterized, further evaluation of conveyance, dewatering, and solids management may identify more cost-effective approaches.
- Phasing the sediment dredging activities - refining the dredge plan to conduct the sediment removal in phases that allows budgeting and execution of the dredging plan over time.
- Improved dredging equipment - new dredging equipment is being pilot tested at several sites to reduce water entrainment, yet allow a flowable dredge spoil that can be pumped.
- Beneficial reuse of sediment - upon further sediment characterization, it may be possible to beneficially reuse sediments that are not impacted by PCBs or metals (at levels of concern).

Option 1: Upland Disposal on Available Property

- **Conceptual costs** – RMT estimates that this option would cost a total of approximately $35 to $40 per cubic yard, including $25 to $30 per cubic yard for dredging, dewatering, and water management; $6 per cubic yard for transportation and disposal; and $4 per cubic yard for engineering and permitting (approximately 10% of the total cost). For the "River Town" scenario (360,000 cubic yards), the total project cost may be on the order of $13 to $17 million, while the "Harbor Town" scenario (960,000 cubic yards) would be on the order of $34 to $40 million.
- **Key assumptions** – For conceptual costing purposes, RMT has assumed that hydraulic dredging would be performed, based on an assumption that the sediment is a fine to medium sand that drains well. RMT has assumed that a 40-acre staging and sediment dewatering area would be available at the edge of the harbor (within about 2,000 feet of the dredging areas). The dredged sediment would be directed into Geotubes® for dewatering, which would be staged on a stone-covered liner. The water would be directed to a catch basin and subsequently returned to the harbor/river. The sediment would be dredged at a rate of approximately 1,500 in-place cubic yards per day (or 1,950 in-place tons per day). Preparation for the upland disposal area at the City-owned property was assumed, which included the construction of haul roads, and staging area for dewatered dredge spoil disposal.

Option 2: Upland Disposal at a Licensed Landfill Facility

- **Conceptual costs** – This disposal option would add approximately $35 per cubic yard, bringing the total project cost up to approximately $75 per cubic yard. Therefore, if all of the dredged sediment needed to be disposed at a licensed landfill facility, for the "River Town" scenario, the total project cost would be on the order of $25 to $30 million, while the "Harbor Town" scenario would be on the order of $50 to $70 million.
- **Key assumptions** – The same assumptions were made for this scenario as for Option 1, except that the ultimate disposal location is a licensed landfill facility that accepts PCB-containing sediment. The weight of the disposed sediment was assumed to be 1.3 tons per cubic yard.

5. Potential Future Funding Mechanisms

RMT has researched and evaluated several potential funding options for future dredging-related activities, including grant programs administered by state and federal agencies. On the basis of RMT's research, two programs appear to be the most promising, as follows:

- **Michigan Department of Natural Resources (MDNR) Waterways Program Grants** – Grants administered by the MDNR Waterways Program are aimed at improving boating opportunities in Michigan. There are two types of grants: (1) preliminary engineering (up to $60,000), and (2) infrastructure improvements (over $60,000). Activities that may fit into the category of preliminary engineering include sediment testing, preparing plans and specifications, and completing permit applications. Dredging activities aimed at increasing water depth may fit into the second category. There is no preset total funding limit for the program. Decisions are made on a project-specific basis annually. Preliminary engineering studies are typically funded rather quickly, while funding for infrastructure improvements is subject to legislative approval. In 2006, the Program approved a total of between $1.5 to $2.0 million in grants. A large proposal (e.g., $1.0 million) would not be out of the question. The grant applicant must cover 25 to 50 percent of the total project cost, depending on how the funding will be used. Applications for MDNR Waterways Program Grants are accepted annually, with the next round of applications due on April 1, 2007.
- **Michigan Department of Environmental Quality (MDEQ) Coastal Zone Management Grants** – This is the program through which the City of Saugatuck obtained grant funding for the Kalamazoo Harbor Master Plan. The MDEQ has indicated that grant applications for activities such as engineering evaluations (*e.g.*, a disposal options analysis) or the implementation of dredging to improve spawning or other habitat, would likely be competitive proposals in this Program. Funding for dredging aimed only at improving boating, without providing any additional environmental benefit, would not likely be competitive. Total available funding in 2006 was over $1 million. The maximum grant amount for a single project is $50,000. While grants administered by this Program are smaller than those potentially available through the MDNR Waterways Program, the MDEQ has indicated that it likes to find opportunities to provide additional funding to previous recipients, in order to follow through with the project. The grant applicant must cover at least 50 percent of the total project cost. A Request for Proposals will be sent out to municipalities in January or February 2007, with applications due in April or May.

RMT also spoke with contacts at the USEPA, the U.S. Army Corps of Engineers (ACOE), and the MDEQ regarding other potential grant programs; however, based on the information we have found to date, those programs do not appear to be viable options for the Kalamazoo Harbor Project. The USEPA administers a grant program authorized by the Great Lakes Legacy Act; however, the USEPA project manager indicates that the Kalamazoo Harbor project would not be eligible because there are potentially responsible parties for the Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund site and no Record of Decision has yet been reached for the river. The ACOE periodically dredges a stretch of the Kalamazoo River located downstream from Lake Kalamazoo for navigational purposes, and the ACOE has a cost-sharing program for navigational dredging. RMT's understanding is that the dredging activities in Kalamazoo Lake and Douglas Harbor would be for commercial, as well as recreational boating purposes. However, the ACOE indicates that this project is unlikely to receive funding or other assistance. A third potential option that RMT researched, funding through the MDEQ Clean Michigan Initiative, also does not appear viable, because past funding for sediment remediation projects was for specific approved projects, and there is no additional appropriation at this time.

Summary, Conclusions, and Recommendations

The actual project cost for future dredging activities will depend upon a number of factors, including the following:

- Contaminant levels (PCBs, metals) found throughout the profile of the sediment deposit

- Physical characteristics and material handling properties of the sediment
- Volume of sediment to be dredged
- Amount of debris present in the lake/harbor
- Permitting and regulatory requirements for dredging, dewatering, and final disposition of the solids

The City-owned property is a lower cost option for final disposition of the dredge spoils, which should be explored further with MDEQ. Regardless, dredging a large volume of sediment (*e.g.*, 1 million cubic yards) will result in a multi-million dollar project cost. As such, the City may want to consider implementing a phased, or staged approach to future dredging activities, as follows:

1. **Pursue funding options through the MDNR and the MDEQ** – Engage contacts at the MDNR and the MDEQ, as well as legislative representatives on project funding mechanisms. RMT recommends that the City apply for MDNR and MDEQ grants, which are due in April 2007. These funding sources can support sediment testing, design and permitting, and a limited amount of dredging activities.
2. **Conduct sediment sampling and analysis** – RMT recommends that a focused sediment investigation be performed to characterize the key chemical and physical properties of the sediment deposits targeted for removal.
3. **Refine the dredging approach and cost estimates** – The cost estimates developed by RMT are conceptual and preliminary in nature, and reflect numerous assumptions and uncertainties. RMT recommends that a phased dredging plan be developed, focusing first on the City's primary areas of concern for sediment accumulation. A more refined dredging plan, volume estimates, and cost estimate are needed for the City's planning purposes.
4. **Obtain MDEQ input on permitting requirements for City-owned property** – Once the sediment data is available, RMT can explore the permitting requirements with the appropriate MDEQ representatives. Additional input from the MDEQ regarding the proposed dredging project and permitting requirements is needed to secure the City-owned property as a final disposition option.
5. **Discuss dredging project and federal funding needs with political representatives** – Continue to pursue federal funding sources through your local and state representatives.

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