Appendix B

CMS Interim Deliverables, Agencies Comments and FMC's Responses to Comments on Tree Preservation Measures Technical Memorandum, Soil Tilling/Blending Pilot Study Report, and 2009 Arsenic Phytoremediation Pilot Study Results

Appendix B

CMS Interim Deliverables, Agencies Comments and FMC's Responses to Comments on Tree Preservation Measures Technical Memorandum, Soil Tilling/Blending Pilot Study Report, and 2009 Arsenic Phytoremediation Pilot Study Results

As specified in the CMS Work Plan, several interim deliverables reporting on evaluations or pilot studies that were undertaken as part of the CMS were prepared for purposes of soliciting early input and comments from the Agencies, the community and/or affected property owners during the development of the CMS for the Suspected Air Deposition and Culvert 105 Study Areas. FMC provided opportunities for project-specific stakeholders to discuss and comment on these documents. Copies of the interim deliverables, the Agencies' comments on the interim deliverables, FMC's responses to comments from the Agencies and community, and other applicable documents (e.g., Results of the Community Survey on Tree Preservation Measures) are included in this report as described below:

Document	**Location in Draft CMS Report**
Tree Preservation Measures	
FMC's Responses to Comments on Tree Preservation Measures Technical Memorandum	Appendix B, Table B-1
Results of the Community Survey on Tree Preservation Measures	Appendix B, Attachment B-1
Corrective Measures Study Technical Memorandum – Evaluation of Tree Preservation Measures for Suspected Air Deposition and Culvert 105 Study Areas (February 2010)	Appendix B, Attachment B-2
Agencies' letter dated April 5, 2010 with comments on FMC's Technical Memorandum on the Evaluation of Tree Preservation Measures	Appendix B, Attachment B-3
Soil Tilling/Blending Pilot Study	
FMC's Responses to Comments on CMS Soil Tilling/Blending Pilot Study Report	Appendix B, Table B-2
Corrective Measures Study Soil Tilling/Blending Pilot Study Report (March 2010)	Appendix B, Attachment B-4

Document	Location in Draft CMS Report
Agencies' letter dated May 10, 2010 with comments on FMC's CMS Soil Tilling/Blending Pilot Study Report	Appendix B, Attachment B-5
2009 Arsenic Phytoremediation Pilot Study Results	
FMC's Responses to Comments on 2009 Arsenic Phytoremediation Pilot Study Results	Appendix B, Table B-3
2009 Arsenic Phytoremediation Pilot Study Results (March 2010)	Appendix B, Attachment B-6
Agencies' letter dated June 9, 2010 with comments on FMC's 2009 Arsenic Phytoremediation Pilot Study Report	Appendix B, Attachment B-7

As indicated by the Agencies, there will be a formal public comment period for the Agencies to receive comments on the Final Draft CMS Report, with a subsequent Responsiveness Summary prepared by the Agencies.

TABLE B-1
FMC'S RESPONSES TO COMMENTS ON TREE PRESERVATION MEASURES TECHNICAL MEMORANDUM

DRAFT – MAY 2011
CMS REPORT FOR SUSPECTED AIR DEPOSITION AND CULVERT 105 STUDY AREAS
FMC CORPORATION – MIDDLEPORT, NEW YORK

Tree preservation measures were evaluated by FMC's environmental consultant (i.e., ARCADIS of New York, Inc ["ARCADIS"]) using Middleport-specific information and in consultation with AMEC Geomatrix and other qualified and experienced experts (i.e., local arborists - The Tree Doctor) (collectively referred herein as "FMC's Experts"). The results of the evaluation were presented in FMC's interim CMS-related deliverable entitled, Corrective Measures Study Technical Memorandum – Evaluation of Tree Preservation Measures for Suspected Air Deposition and Culvert 105 Study Area, dated February 2010 (referred to herein as "Technical Memorandum") and prepared by ARCADIS. The Agencies' provided comments on the Technical Memorandum by letter dated April 5, 2010. The Technical Memorandum, the Agencies April 5, 2010 letter and comments from the community (contained in the Results of the Community Survey on Tree Preservation Measures) are included in Appendix B of this CMS Report. The following presents FMC's responses to comments received from the Agencies and the community on the Technical Memorandum.

Item No.	Comment from the Agencies or the Community	FMC's Response
	Agencies' Letter to FMC Dated April 5, 2010	
1.	**Agencies' General Comment 1** <u>Measures 3a, 3b, 4a, 4b, 5a & 5b – Enhanced Best Management Practice</u> "Each of the above measures constitutes some form of contaminated soil removal method that is intended to preserve existing trees. As FMC is aware, there are presently few, and in some cases, no sample results within the root zones of trees. In many cases, the area within a root zone requiring excavation and the depth of such excavation to meet cleanup goals would be based on arsenic concentration results from 1 or 2 sample locations within or near tree root zones. In some cases, this could result in excavation of more root zone area and/or to a greater depth than necessary to meet cleanup goals. Therefore, as a best management practice, the CMS should evaluate the performance of additional soil sampling and analysis (e.g., grid sampling) within root zones during corrective measures implementation where these soil removal methods could be employed, so as to better characterize the horizontal and vertical extent of excavation needed within these root zones to achieve cleanup goals. In some	The scope of any soil remediation will be based on the corrective measures and the soil cleanup goals selected by the Agencies. Depending on the final remediation goals and property-specific soil arsenic data, only portions of a property may require remediation. The exact vertical and horizontal extent of any soil remediation required to meet the soil remediation goals on a property will be determined during the design activities of the corrective measures implementation. At that time, this information will be presented to the affected property owner, and any tree(s) within in the soil remediation area will be identified. FMC will consult with the property owner to identify trees that the owner may want preserved. If the owner wants a tree or trees preserved, then the tree(s) will be further evaluated to determine if preservation will be viable. This determination will be based on 1) the vertical and horizontal extent of soil removal required to achieve soil cleanup goals, 2) property-specific factors (i.e., soil characteristics), and 3) tree-specific factors (i.e., tree species, age, health, stability, location and condition). In addition, a qualified arborist will help evaluate the tree identified for preservation and provide

Item No.	Comment from the Agencies or the Community	FMC's Response
	situations, additional sampling results could serve to minimize the areal extent and/or depth of excavation within tree root zones, thereby minimizing root disturbance and enhancing tree survivability."	input on the viability of preservation of the tree and possible tree preservation methods based on site-specific information. After a tree is initially identified for preservation by the owner, additional soil sampling and analysis within the protected root zone of trees may be performed to refine the vertical and horizontal extent of soil removal within the protected root zone. This additional data may be used to help determine if the tree can be preserved based specifically on the soil arsenic concentrations within the protected root zone of the tree and the soil cleanup goals, and may be used to develop methods to preserve the tree(s). The property owner will have the final decision on whether their property will be remediated and on preservation of trees on their property. FMC will provide the property owner with information needed to make an informed decision concerning tree preservation and FMC's recommendation regarding the viability of preserving the tree(s) within the remediation area during the CMI design phase. Such information will also include the soil data near the tree(s) identified for preservation; vertical and horizontal extent of soil removal within the protected root zone required by the Agencies to comply with the remediation goals; information concerning the condition of the tree and any recommendation from a qualified arborist; and proposed tree preservation methods. If tree preservation is not possible based on the vertical and horizontal extent of excavation required to meet the soil cleanup goals, then the property owner will be informed of the issues related to leaving contaminant levels in soil above the soil cleanup goals.

TABLE B-1
FMC'S RESPONSES TO COMMENTS ON TREE PRESERVATION MEASURES TECHNICAL MEMORANDUM

DRAFT – MAY 2011
CMS REPORT FOR SUSPECTED AIR DEPOSITION AND CULVERT 105 STUDY AREAS
FMC CORPORATION – MIDDLEPORT, NEW YORK

Item No.	Comment from the Agencies or the Community	FMC's Response
2.	**Agencies' General Comment 2** <u>Measures 3b & 4b – Variation in the Number of Sectors & Excavation Depth</u> "These methods are intended to preserve existing trees and involve removing contaminated soils below the 6-inch depth by excavating sectors (portions) of over a number of growing seasons. With regard to the evaluation of these methods presented in Section 6 of the document, the Agencies do not consider that it properly accounts for variations in the number of sectors each root zone is divided into, and differences in required excavation depths. For instance, with regard to certain evaluation factors listed in Section 6, it can logically be assumed that excavation of 6 or more root zone sectors spread out over 6 or more growing seasons would have less of an impact than excavation of 3 sectors spread out over 3 growing seasons. Likewise, with respect to these same evaluation factors, it can logically be assumed that excavation to a depth of 9 inches would have less of an impact than excavation to 24 or more inches. Therefore, these variations should be expressed in the evaluation of Measures 3b & 4b in the CMS. To account for these variations, the Agencies consider that these measures be rated on a sliding scale for the evaluation factors listed below: - Maintenance of Character of Property = High to Moderate - Tree Structural Stability = High to Moderate - Tree Survival Probability = High to Moderate - Post-Restoration Maintenance = Moderate to Low - Short- and Long-Term Safety = High to Moderate (for 3b) - Short- and Long-Term Safety = Moderate to Low (for 4b)"	As discussed in the Technical Memorandum (Section 6.1), FMC and FMC's experts (identified above) are not aware of any documented successful application of this sector excavation approach for environmental remediation. If the Agencies can provide specific information and examples of the successful application of the sector excavation approach, FMC will consider the information. Based on information presented in Section 6 of the Technical Memorandum, consultation with FMC's experts and Middleport-specific information, FMC concluded that implementing a sector excavation approach over a six year period is not practical and likely would not improve tree survivability sufficiently to reduce the risks associated with tree damage and potential uprooting. The repeated stresses over six growing seasons without extended intervening recovery time is not expected to improve tree survivability. Therefore, FMC has rated this approach lower than tree removal and replacement in the Technical Memorandum, reflecting the comparative advantages of healthy replacement trees with six years of growth over damaged mature trees (particularly with regard to the risks associated with the latter). Although excavation to 9 inches may cause less damage than deeper excavations within the root zone, a 9-inch excavation would more likely impair the health of the tree than a 6-inch excavation by causing additional damage to the root system and creating greater instability to the structure of the tree. Therefore, in FMC's opinion, a 9-inch depth limit is not likely to substantially improve survivability compared to deeper excavations.

Item No.	Comment from the Agencies or the Community	FMC's Response
		As stated in the Technical Memorandum and above, the possibility of excavating soil to depths greater than 6-inches within the protective root zone of a tree depends on 1) the vertical and horizontal extent of soil removal required to achieve soil cleanup goals, 2) property-specific factors (i.e., soil characteristics, owner input), and 3) tree-specific factors (i.e., tree species, age, health, stability, location and condition). The advice of a qualified arborist relying on site-specific information will be considered during the design phase in the development of soil excavation methods, depths and area required to preserve a tree during the design activities if the corrective measures implementation. Based on information presented in Section 6 of the Technical Memorandum, consultation with FMC's experts and Middleport-specific information, FMC concluded that limited excavation (i.e., maximum depth of 6-inches) using mechanical methods or pneumatic pressure would present the best opportunity to preserve selected trees based on practicability of implementation, probabilities for tree survivability, tree structural concerns, and safety concerns for workers, residents and the community.
3.	**Agencies' General Comment 3** <u>Measures 2a, 2b, 3a, 3b, 4a & 4b - FMC / Property Owner Tree Responsibility</u> "Although the Technical Memorandum presents the factors that would be considered to identify trees that can be preserved in consultation with the	As discussed above in FMC's Response to Agencies' General Comment 2, based on information presented in Section 6 of the Technical Memorandum, consultation with FMC's experts and Middleport-specific information, FMC concluded that limited excavation (i.e., maximum depth

Item No.	Comment from the Agencies or the Community	FMC's Response
	property owner, it is not clear how a final decision is reached on preserving a tree and who would make the final decision. The CMS should indicate that a private property owner (or Village of Middleport for trees on Village land/right-of-ways) who wishes to preserve a tree, or trees, shall be provided with all information regarding the tree(s) and the soil contaminant levels within the root zone(s), as well as a recommendation from a FMC provided qualified arborist which has been reviewed by the Agencies. The CMS should also indicate that the property should be allowed to make the final decision regarding preservation of his/her tree(s). In cases where FMC and the Agencies agree that a tree, or trees, cannot be preserved if the excavation required to achieve cleanup goals is performed, the CMS should indicate that the property owner will be informed of the issues related to leaving contaminants in root zone soils above cleanup concentrations, so that he/she is fully aware of the potential ramifications in making his/her tree preservation decision. For preserved and replacement trees, the FMC Technical Memorandum seems to state that tree maintenance and, if necessary, removal, will become the responsibility of the property owner immediately after restoration activities are completed on the property. Since in these cases, FMC remedial activities have disturbed the root zone or caused the tree to be replaced, the CMS should indicate a reasonable amount of time that FMC will retain responsibility for tree maintenance, or removal if the tree becomes distressed, after restoration is complete."	of 6-inches) using mechanical methods or pneumatic pressure would present the best opportunity to preserve selected trees based on practicability of implementation, probabilities for tree survivability, tree structural concerns, and safety concerns for workers, residents and the community. The ability to attain the soil cleanup goals with the shallow excavation will necessarily be the determining factor in whether to consider preservation of a given tree. To this end, flexibility in the soil arsenic remediation goals (e.g., remediation to a property average target concentration) may allow shallower excavation at more locations and increase the opportunities for tree preservation. As discussed above in FMC's Response to Agencies' General Comment 1, the property owner will have the final decision on whether their property will be remediated and on preservation of trees within their property. FMC will provide the property owner with information needed to make an informed decision concerning tree preservation and FMC's recommendation regarding the viability of preserving the tree(s) within the remediation area during the CMI design phase. The long term maintenance or monitoring of preserved trees and any tree replacements will be addressed by FMC during the corrective measures implementation. In past remediation projects performed in the CMS Study Areas, FMC's landscape contractors provided warranties for the plants and trees that they planted. FMC expects to continue this policy in the future. However, FMC will provide the particular details of the tree and landscaping replacement and associated maintenance and plant warranties to affected property owners during the design activities of the corrective measures implementation. Assuming that the tree preservation

Item No.	Comment from the Agencies or the Community	FMC's Response
		method will consist of a soil removal to a maximum depth of 6 inches, FMC will retain responsibility for reasonable tree maintenance (e.g., fertilization) or removal, if required, of trees that are preserved for a reasonable time period (e.g., one year) after completion of the remedial activities at the property. However, regardless of the method of excavation depth, the responsibilities for post-remedial tree maintenance, if any, will be established between FMC and individual property owners, and included in individual property access agreements.
4.	**Agencies' General Comment 4** <u>Measures 3a, 3b, 4a & 4b - Best Management Practices</u> "These measures which are intended to preserve existing trees, involve contaminated soil removal within their root zones which will temporarily expose some roots. As stated in Section 3.3 exposed roots can become dry quickly causing root hairs to wither which in turn can detrimentally affect the roots ability to absorb water and nutrients. As a result, the CMS should evaluate a "best management practice" of applying water (and possibly nutrients), as necessary, while roots are exposed to keep them from drying out."	Procedures to address exposed roots will be developed in consultation with a qualified arborist during the design activities of the corrective measures implementation.
5.	**Agencies' General Comment 5** **Measures 3b & 4b – Recommendation for Further Evaluation** "These methods are intended to preserve existing trees and involve removing contaminated soils below the 6-inch depth by excavating sectors (portions) of over a number of growing seasons. Section 7 of the Technical Memorandum indicates that FMC does not recommend these measures for	See FMC's Response to Agencies General Comment s 1 and 2.

Item No.	Comment from the Agencies or the Community	FMC's Response
	further evaluation in the CMS. The Agencies disagree with this FMC recommendation and request that Measures 3b & 4b be carried on for further evaluation in the CMS for the following reasons: - These measures are the only methods presented which are capable of preserving existing trees in cases where excavation deeper than 6 inches is necessary to achieve cleanup goals. Without these measures, a property owner who wants to preserve tree(s) may be inappropriately limited to removing the tree(s) for deeper excavation to achieve cleanup goals or leaving soils in place below 6 inches which are above cleanup goals. - As pointed out in General Comment #2 above, dividing a tree's root zone into a larger number of sectors and excavating only one sector each growing season can logically improve a tree's survivability using these measures. While it may be true that such segmented root zone excavation deeper than 6 inches has not been performed in association with remedial projects, there are numerous examples of similar area limited excavations within tree root zones for utility installation/maintenance where trees have not been impacted. If root zones are divided into an adequate number of sectors, it would seem that these measures may be appropriate for tree preservation in some cases. - Also as pointed out in General Comment #2 above, the depth of excavation using these measures can logically impact a tree's survivability. In cases where excavation to a depth a few inches deeper than 6 inches is all that is required to meet cleanup goals, these measures may provide a viable tree preservation alternative with little additional effort. As FMC is aware, there are a number of	

Item No.	Comment from the Agencies or the Community	FMC's Response
	properties within Air Deposition Area 1 where elevated arsenic concentrations are limited to the top 12 inches of soil. - The amount of inconvenience to property owners involved in spreading out corrective measures on their property over a number of growing seasons as these measures would require, is highly dependent on individual owners. Some may not mind the longer term inconvenience needed to keep a tree they would like to see preserved."	
6.	**Agencies' General Comment 6** **Measures 3a, 3b, 4a & 4b – Seasonal Implementation** "It is mentioned in the description of these measures that the best time to remove the root zone soils would be the growing season. There could be serious effects from removing the soil and obviously many small roots during the early part of the growing season, especially if it coincided with active shoot elongation. Even if replacement with new soil was done as quickly as possible, the new shoots would be subject to wilt, and possibly die. If so, then the tree would try to refoliate (like after a mid-late May frost or early season insect defoliation). A one time refoliation for a healthy tree can usually be taken in stride. However, refoliation coupled with significant root loss would be very stressful. It would be better to time the soil removal for late summer-early fall, perhaps after the shoots have elongated, started to harden off and form terminal buds."	To the extent such excavations are conducted, the Agencies' comments concerning the root zone excavation timing will be considered during the design activities of the corrective measures implementation. The timing of an excavation within the protected root zone will be identified in the CMI Work Plan and if appropriate, FMC will review the timing of any excavation within the protected root zone again with a qualified arborist during the CMI phase.
7.	**Agencies' Specific Comment 1 (Page 4)** "The two Middleport tree inventories cited here are both limited to trees within Village street right-of-ways. It is questionable if they are inclusive of	As stated in the Technical Memorandum, the tree inventories were conducted for Village-owned trees located on the Village of Middleport street right-of-ways. The inventories did not include non-Village-owned trees on private properties. Tree inventories of the entire Village of

TABLE B-1
FMC'S RESPONSES TO COMMENTS ON TREE PRESERVATION MEASURES TECHNICAL MEMORANDUM

DRAFT – MAY 2011
CMS REPORT FOR SUSPECTED AIR DEPOSITION AND CULVERT 105 STUDY AREAS
FMC CORPORATION – MIDDLEPORT, NEW YORK

Item No.	Comment from the Agencies or the Community	FMC's Response
	all the tree types located on private property within the CMS areas. For instance, there are no pine trees in these inventories, however they exist on a number of private properties within the CMS area. The CMS should provide for an accounting of tree types commonly found on private property that do not appear in these Village inventories, along with an evaluation by type of their survivability potential."	Middleport were not known to exist. During the design activities of the corrective measures implementation, trees located within soil remediation areas will be identified and evaluated in consultation with the property owner to determine which trees can be preserved and which trees will be removed. An inventory of all trees currently located within the CMS Study Areas is not necessary for the purposes of completing the CMS. Appendix C of the Technical Memorandum identifies the relative tolerance to construction impacts on a wide variety of trees. The tolerance of any additional tree species found in the soil remediation areas will be identified during the design activities of the corrective measures implementation.
8.	**Agencies' Specific Comment 2 (Page 10)** "As a "best management practice" the CMS should indicate that a certified arborist would be utilized to make recommendations as to which preservation measure is best for each specific tree and site."	Based on information presented in Section 6 of the Technical Memorandum, consultation with FMC's experts, and Middleport-specific information, FMC concluded that limited excavation (i.e., maximum depth of 6-inches) using mechanical methods or pneumatic pressure would present the best opportunity to preserve selected trees based on practicability of implementation, probabilities for tree survivability, tree structural concerns, and safety concerns for workers, residents and the community (refer to FMC's response to Agencies' General Comment 2, above). The advice of a qualified arborist relying on site-specific information will be considered during the design phase in the development of soil excavation methods, depths and area required to preserve a tree.
9.	**Agencies' Specific Comment 3 (Page 15)** "In the case of tree replacement in the Village-owned street right-of-ways, it should be noted in the CMS that the Village tree board will be consulted in	The appropriate Village of Middleport officials will be identified and consulted during the design activities of the corrective measures implementation.

Item No.	Comment from the Agencies or the Community	FMC's Response
	the development of a list of replacement tree types."	
10.	**Agencies' Specific Comment 4 (Page 16)** "It is unclear if Measure 3b has any maximum depth limitation. This should be clarified in the CMS. This comment also applies to Measure 4b."	A maximum depth was not specified for this method, but would be determined on a case-by-case basis during the CMI phase. This determination will be based on factors including the condition, size and species of the tree, the vertical and horizontal extent of soil removal required to meet the soil cleanup goals, and the methods of excavation and backfilling methods.
11.	**Agencies' Specific Comment 5 (Page 20)** "As stated here, Measures 3a, 4a & 5a have the potential for leaving arsenic concentrations in soils deeper than 6 inches which are above cleanup goals and therefore may require post-remedial institutional and/or engineering controls. It should be noted in the CMS that in cases such as these, Measures 3a & 4a would not satisfy the Agencies' CAO of unrestricted use of residential and reasonably anticipated future residential properties."	Agreed.
12.	**Agencies' Specific Comment 6 (Page 21)** "In terms of "Effectiveness of Soil Removal" being evaluated here, Measures 3b, 4b & 5b should all be rated "High" in the CMS, since they are capable of removing all contaminated soil above cleanup goals. The reasons provided for the Moderate to Low rating given here, all appear to be related to evaluation factors other than soil removal effectiveness."	Refer to FMC's Response to Agencies' General Comment 2, above. The Technical Memorandum states that it may not be possible to leave a tree in place and remove all contaminated soils above cleanup goals without catastrophic damage to the tree due to difficulties associated with maintaining the structural integrity of the tree and difficulties in removing soil below 6 inches where the complexity of the root systems typically increase. Therefore, these alternatives were rated "Low to Moderate".

TABLE B-1
FMC'S RESPONSES TO COMMENTS ON TREE PRESERVATION MEASURES TECHNICAL MEMORANDUM

DRAFT – MAY 2011
CMS REPORT FOR SUSPECTED AIR DEPOSITION AND CULVERT 105 STUDY AREAS
FMC CORPORATION – MIDDLEPORT, NEW YORK

Item No.	Comment from the Agencies or the Community	FMC's Response
13.	**Agencies' Specific Comment 7 (Page 24)** "Since it is stated here that there may be locations where use of pneumatic excavation Measures 4a & 4b may be effective and appropriate, it would seem that a Moderate to Low rating in the CMS would be more suitable to reflect this location variability."	Agreed.
14.	**Agencies' Specific Comment 8 (Page 25)** "Given the fact that it is likely that excavation within the root zone using Measure 3a would occur simultaneously with manual/mechanical excavation beyond the root zone on the same property, it would seem that there would be little, if any additional property owner inconvenience associated with this measure. Therefore, Measure 3a should more appropriately be given a "High to Moderate" rating. The multi-year excavation associated with Measure 3b to be much of an inconvenience at all for property owners' intent on preserving their tree(s). Therefore, Measure 3b should more appropriately be given a "Moderate to Low" rating to account for this variability in property owner preference."	Refer to FMC's Response to Agencies' General Comment 2, above.
	Comments from the Community **(obtained as part of the survey on tree preservation measures)**	
15.	**Community Comment 1** "On fifty acres of land there are a large number of trees. Trees around the house and buildings should be preserved. Fruit trees around the buildings and in orchards should be preserved no matter their condition or age. Trees	Refer to FMC's Response to Agencies' General Comment 1, above. As discussed in text of the Draft CMS Report, use of a property-wide post-remediation average and maximum soil arsenic concentration goals would provide some flexibility for allowing higher single point arsenic

Item No.	Comment from the Agencies or the Community	FMC's Response
	in heavily wooded areas should be preserved to promote wildlife habitat. Most single trees in fields can be removed and there is no need for replacements. Areas where average arsenic contamination is above 60 PPM should be remediated with tree removal and no replacement necessary."	concentrations to remain in place below certain trees if remediation elsewhere on the property could attain the target property-wide average. There is precedent for this type of approach. For example, the USEPA established a soil remediation goal of 20 mg/kg for the Spring Valley site in Washington DC, but allows arsenic concentrations up to 43 mg/kg to remain in root zones of trees and/or areas where access or other construction limitations make soil removal difficult or unsafe.
16.	**Community Comment 2** "I have new, small seedling trees planted on my trailer lot and they could be easily transplanted."	Small seedling trees within soil remediation areas may be transplanted depending on property-specific and/or tree-specific factors. This will be determined on a property-by-property basis during the design activities of the corrective measures implementation.
17.	**Community Comment 3** ➢ "We just want a safe level of contamination for our children." ➢ "We want safety. We are not interested in protecting FMC. We want to be protected from what FMC created."	The overall goal of the corrective measures is the protection of human health and the environment, as required by the applicable rules and regulations and the Agencies'-established corrective action objectives. The CMS included the performance of a site-specific human health risk assessment for the arsenic concentrations in soil for current conditions and for post-remediation soil concentrations that would result from implementation of each of the CMAs. Human health risk and potential risk reduction was considered in the evaluation of the CMAs. The Draft CMS Report (Section 6 and Appendix F of the Draft CMS Report) presents the results of the human health risk assessment performed by FMC's experts.

TABLE B-1
FMC'S RESPONSES TO COMMENTS ON TREE PRESERVATION MEASURES TECHNICAL MEMORANDUM

DRAFT – MAY 2011
CMS REPORT FOR SUSPECTED AIR DEPOSITION AND CULVERT 105 STUDY AREAS
FMC CORPORATION – MIDDLEPORT, NEW YORK

Item No.	Comment from the Agencies or the Community	FMC's Response
18.	**Community Comment 4** "As much as I love all the trees and wish to not have any removed, if I have to have that done to clear the title of my property then I will work with all involved, FMC, the agencies, etc. to work out the best plan for my property. Many of the "new" trees planted at Maedl Lane are very, very nice while a lot of the other trees are strictly for "cover & privacy" which is one of the main reasons we chose to purchase that property and put apartments on it...the neighbors barely know they are there and if these trees were totally removed it would not be the same regardless of who maintains them. Personally, I feel residents who have to have any work done should have no more maintenance requirements than they had prior to the remediation."	See FMC's Response to Agencies' General Comment 3.
19.	**Community Comment 5** "Quit beating a dead horse and milking deep pockets for future paychecks. Agencies please get out of our village. Go someplace where health of people really is an issue."	This comment is directed to the Agencies.
20.	**Community Comment 6** ➢ "If and when you have to do our work in our yard there will be ground rules. There will be no rolled grass or terrible soil (clay) brought in like Vernon St. We will want a say how it is being planted. We would request grass seed and top soil even if we had to do the work ourselves. We know firsthand how it was done on Vernon and it is not acceptable in our yard."	Backfill, top soil, sod, grass seed and landscaping plants will meet accepted standards for residential properties or other property-specific use. FMC will review the scope of any soil remediation and restoration options with each property owner, prior to initiating work on their property, during the design activities of the corrective measures implementation.

Item No.	Comment from the Agencies or the Community	FMC's Response
	➢ "The agencies are ruining Middleport and taking advantage of FMC. The reason for these answers is because I do not believe remediation is in our best interest. You are going ahead without the majority of citizen's approval. So you better replace with quality nursery stock in all cases."	
21.	**Community Comment 7** ➢ "I do not feel knowledgeable to answer these questions. Some homeowners are not familiar with tree preservations measures, soil excavation, etc. I am not concerned with elevated arsenic concentrations in the amounts shown on your reports for this area. I am not in favor of the CAMU to permanently store all the excavated soil in and around Middleport. This will be a detriment to the residents of Middleport trying to sell property and for any new business trying to locate here. I feel that in the future, there could be a seepage problem from the contaminated soil storage and should not be in an area near the school." ➢ "I am comfortable with anything you must to do make my property safe. Also, not all of us are proficient in this subject. The wording of this survey made it hard to answer."	FMC held Information sessions and/or meetings concerning the Technical Memorandum and to answer questions on tree preservation on March 10, 15, 22 and 23, 2010. FMC's Community Liaison can be reached at the FMC's 15 Main Street Office at 716-735-9769 to answer any questions on tree preservation measures or FMC's environmental studies. With respect to the comment concerning the CAMU, please see FMC's Responses to Comments on the Proposed CAMU in Appendix D of the Draft CMS Report.

TABLE B-1
FMC'S RESPONSES TO COMMENTS ON TREE PRESERVATION MEASURES TECHNICAL MEMORANDUM

DRAFT – MAY 2011
CMS REPORT FOR SUSPECTED AIR DEPOSITION AND CULVERT 105 STUDY AREAS
FMC CORPORATION – MIDDLEPORT, NEW YORK

Item No.	Comment from the Agencies or the Community	FMC's Response
22.	**Community Comment 8** "We currently have no trees in our yard, but we love the look of the Village and we would love to see the trees remain, but that's not up to us because this does not apply to us."	Maintenance of the overall character of the Village of Middleport is one of the corrective action objectives established by the Agencies and was considered in the development and evaluation of corrective measure alternatives.
23.	**Community Comment 9** "Our main focus is to preserve ALL of our existing trees on our property. We are open to all soil remediation methods and durations provided they are "tree friendly" methods."	As stated in the Draft CMS Report and the Technical Memorandum, where excavation is required by the corrective measures selected by the Agencies, FMC's experts advise that some trees cannot or should not be preserved. The determination of whether a tree can or cannot be preserved is dependent on a number of property-specific or tree-specific factors. For example, an older tree with dwindling health would have a low probability of long-term survival if any soil removal was attempted within the protected root zone. As discussed in the Draft CMS Report and the Technical Memorandum, based on consultation with FMC's experts, FMC has concluded that the best method to preserve trees if soil removal is required within the tree root zone is to have a limited depth of excavation within the root zone of the tree. .
24.	**Community Comment 10** "This survey is asking about the feelings of our preservation of our trees. But we are being told if we do not want our trees cut down we will not get a letter from the Agencies saying that our property is usable for all purposes. Why don't they propose a letter that if we choose to keep the trees if they die or are cut down for whatever reason then FMC is to be notified and can come and remediate that area."	This is a comment for response by the Agencies. However, FMC would not favor a remedy that includes an open-ended requirement to remobilize and perform further excavation activities on an individual property basis multiple times in the future.

TABLE B-1
FMC'S RESPONSES TO COMMENTS ON TREE PRESERVATION MEASURES TECHNICAL MEMORANDUM

DRAFT – MAY 2011
CMS REPORT FOR SUSPECTED AIR DEPOSITION AND CULVERT 105 STUDY AREAS
FMC CORPORATION – MIDDLEPORT, NEW YORK

Item No.	Comment from the Agencies or the Community	FMC's Response
25.	**Community Comment 11** Written in response to survey Question 3(c) regarding the impacts of the character to the neighborhood of Park Avenue, immediately after the 2007 remediation: "Grass better than Vernon St. No trees were planted on one property."	See FMC's Response to Community Comment 6.
26.	**Community Comment 12** Written in response to survey Question 4(a) regarding the use of "effectiveness of soil removal" as an evaluation criteria for tree preservation methods: "If it is necessary"	Effectiveness of soil removal is one of several criteria used to identify and evaluate tree preservation measures, as discussed in the Technical Memorandum.
27.	**Community Comment 13** Written in response to survey Question 8 regarding how many trees would the owner would like to keep under any circumstances: ➢ "1 and my neighbor's Big Beautiful Trees!" ➢ "1 so long as others are replaced" ➢ "All of them!"	See FMC's Response to Community Comment 9.
28.	**Community Comment 14** Written in response to survey Question 10 regarding any trees that property owners would like to have removed: "Some need to be but not due to FMC."	Whether a tree needs to be removed to implement the selected corrective measures will be assessed during the design activities of the corrective measures implementation. See FMC's Response to the Agencies' General Comment 1.

TABLE B-1
FMC'S RESPONSES TO COMMENTS ON TREE PRESERVATION MEASURES TECHNICAL MEMORANDUM

DRAFT – MAY 2011
CMS REPORT FOR SUSPECTED AIR DEPOSITION AND CULVERT 105 STUDY AREAS
FMC CORPORATION – MIDDLEPORT, NEW YORK

Item No.	Comment from the Agencies or the Community	FMC's Response
29.	**Community Comment 15** Written in response to survey Question 12 regarding whether the property owner would decide to keep certain trees if it meant leaving some soil with elevated arsenic in the root area: "Or keeping and replanting with roots"	According to FMC's experts, transplanting mature trees after removal of contaminated soil from the root system is not practical and the transplanted tree is unlikely to survive. Survival is unlikely because transplanted trees must retain enough undisturbed root mass to replace moisture lost through the leaf structure by transpiration and the remediation goal is to remove contaminated soil that is encompassed in and is part of the root mass.
30.	**Community Comment 16** Written in response to survey Question 15 which asked if the owner would decide to keep trees if it meant that the owner would not get a letter from the Agencies saying that the property was usable for all purposes: ➢ "This is like blackmail. Shame on you." ➢ "If in the future the tree dies then FMC should be contacted."	See FMC's Response to Agencies' General Comment 3 and FMC's Response to Community Comment 10.
31.	**Community Comment 17** Written in response to survey Question 17(a) regarding the owner comfort level with no soil removal within the protected root zone as a tree preservation measure: "Best solution"	See FMC's Response to Community Comment 10.

TABLE B-1
FMC'S RESPONSES TO COMMENTS ON TREE PRESERVATION MEASURES TECHNICAL MEMORANDUM

DRAFT – MAY 2011
CMS REPORT FOR SUSPECTED AIR DEPOSITION AND CULVERT 105 STUDY AREAS
FMC CORPORATION – MIDDLEPORT, NEW YORK

Item No.	Comment from the Agencies or the Community	FMC's Response
32.	**Community Comment 18** Written in response to survey Question 17(b) regarding tree removal and replacement with nursery stock: ➢ "Trees take a long time to grow. The biggest ones possible should be planted." ➢ "Prefer done in less time"	The particulars of the site restoration will be developed during the design activities of the corrective measures implementation. At that time, FMC will provide affected property owners with the restoration information, including tree and landscaping replacement details and care and maintenance details.
33.	**Community Comment 19** Written in response to survey Question 17(d) regarding limited depth manual excavation within protected root zone: ➢ "If it dies and proper care was taken the tree should be replaced not by property owner." ➢ "Trees should be replaced if it dies by FMC."	See FMC's Response to Community Comment 18 and FMC's Response to Agencies' General Comment 3.

TABLE B-2
FMC's RESPONSES TO COMMENTS ON CMS SOIL TILLING/BLENDING PILOT STUDY REPORT

DRAFT – MAY 2011
CMS REPORT FOR SUSPECTED AIR DEPOSITION AND CULVERT 105 STUDY AREAS
FMC CORPORATION – MIDDLEPORT, NEW YORK

FMC's environmental consultant, ARCADIS of New York, Inc. ("ARCADIS"), in consultation with other qualified and experienced experts (i.e., AMEC Geomatrix, and a local construction/ soil remediation contractor, Tri-C, Inc.) (collectively referred herein as "FMC's Experts") performed a soil tilling/blending pilot study in 2009 to evaluate the effectiveness and feasibility of soil tilling/blending as a corrective measures technology to address soil in FMC study areas. The results of the pilot study were presented in FMC's interim CMS-related deliverable entitled, *Corrective Measures Study Soil Tilling/Blending Pilot Study Report,* dated March 2010 and prepared by ARCADIS (referred to herein as "Pilot Study Report"). AMEC Geomatrix reviewed the Pilot Study Report and concurred with the report findings. FMC's responses to comments received from the Agencies (by letter dated May 10, 2010) and the community on the Pilot Study Report are presented below. The Pilot Study Report and the Agencies' May 10, 2010 comment letter are included in Appendix B of this CMS Report.

Item No.	Comment from the Agencies or the Community	FMC's Response
	Agencies' Letter to FMC Dated May 10, 2010	
1.	**Agencies' Specific Comment 1** Page 4, Section 3 Acceptance and Use of Soil Tilling or Blending "While the Agencies agree that soil blending/tilling does not constitute prohibited dilution under the current federal and state regulations (as long as listed hazardous wastes are not involved), it is a long standing environmental principle that achieving remedial goals through dilution can be counter-productive in some cases where significant natural resources are needed. This concern is evident in the five (5) governmental examples of where dilution technology may be utilized, which are presented by FMC in Appendix A of the report. Each has specific limitations and do not constitute a "blanket" approval. Some are limited to construction of residential developments, some to only agricultural property, and one to where arsenic concentrations in soil are between 7.0 to 15.0 ppm. Also, it is important to note that two (2) States make a point of indicating that soil blending represents a substantial departure from their current policy and therefore its usage is limited. Therefore, based on the information presented in this report, FMC should provide additional information in the CMS which evaluates the question of dilution and potential consequential impacts on natural resources with respect to FMC's proposed usage of soil blending/tilling as corrective measures technology."	The information requested is as follows: Based on the results of the pilot study presented in the Pilot Study Report and consultation with FMC's experts, FMC concluded that the use of soil tilling/blending in the CMS Study Areas would not result in adverse impacts to natural resources, but rather would be a "green technology" that would have the following beneficial results regarding natural resources, and in particular when compared to soil excavation and replacement with clean backfill: ➢ Soil tilling/blending would only rely on the homogenization of higher and lower concentrations of arsenic already present in the soil within the property, with no addition of off-site soils or amendments to reduce the arsenic concentrations; ➢ Soil tilling/blending would decrease the amount of clean backfill soil (a significant natural resource) that would need to be imported from a borrow source; ➢ Soil tilling/blending would decrease the amount of arsenic-containing soil that would need to be placed either in the CAMU or in an off-site landfill (thereby decreasing the use of valuable land disposal space); and ➢ Soil tilling/blending would decrease the amount of fuel that would be consumed, the resulting exhaust emissions and the traffic on Village roads needed to transport excavated soil and backfill.

TABLE B-2
FMC's RESPONSES TO COMMENTS ON CMS SOIL TILLING/BLENDING PILOT STUDY REPORT

DRAFT – MAY 2011
CMS REPORT FOR SUSPECTED AIR DEPOSITION AND CULVERT 105 STUDY AREAS
FMC CORPORATION – MIDDLEPORT, NEW YORK

Item No.	Comment from the Agencies or the Community	FMC's Response
		Based on the results of the pilot study presented in the Pilot Study Report and consultation with FMC's experts, FMC concluded that soil tilling/blending is appropriate for inclusion in the CMAs, to be used in conjunction with or in place of soil excavation under limited situations (based on specific property characteristics, soil arsenic concentrations and the soil remediation goals of the corrective measures selected by the Agencies), for the following reasons: ➢ The Pilot Study demonstrated that soil arsenic concentrations could be effectively reduced through soil tilling/blending to meet soil arsenic remediation goals and/or soil arsenic background concentrations; ➢ Soil tilling/blending is protective of human health and the environment since it would reduce exposures to soil concentrations that exceed the remediation goals; ➢ The Pilot Study demonstrated that soil tilling/blending can be effectively implemented with existing equipment and methods; ➢ The Pilot Study demonstrated that the level of effort and time required for performing soil tilling/blending is similar to soil excavation; and ➢ Soil tilling/blending technology aligns with current Agencies' initiatives related to promoting "green" technologies and practices (e.g., USEPA Green Remediation Best Management Practices and NYSDEC's DER-31/Green Remediation policy) and meets the Agencies' Corrective Action Objective for using green remediation concepts. For example, tilling/blending is less disruptive to the environment since off-site backfill soil is not needed, and would not generate any wastes that require off-site disposal. Soil and landfill space is conserved by tilling/blending as opposed by soil excavation and off-site disposal. The applicability of soil tilling/blending would be based on factors specific to the property and/or area identified for remediation. These factors include 1) physical characteristics of the area to be remediated (e.g., proximity to structures, location of underground features, location of any overhead

Item No.	Comment from the Agencies or the Community	FMC's Response
		utilities/obstruction, proximity to trees, etc.), 2) the soil arsenic concentrations in the remediation area are sufficiently low enough to achieve the soil arsenic remediation goals, 3) the distribution of arsenic in the soil remediation area (e.g., surface soil arsenic concentrations are higher at the surface and lower in the subsurface), and 4) the estimated vertical and horizontal extent of soil that would be required to be tilled/blended to achieve the soil arsenic remediation goals for the corrective measures selected by the Agencies. The soil tilling/mixing technology would be further considered based on property-specific criteria, and identified for use, if appropriate, during the design phase of the final Corrective Measures Implementation (CMI). Any proposed use of soil tilling/mixing to achieve remediation goals would be subject to review and approval of the Agencies.
2.	**Agencies' Specific Comment 2** Page 9, Section 5.2.1 Study Objectives Questions 1 & 5 – Arsenic Concentration Distribution "Based on the comparison of the "pre" and "post" mix arsenic data at each sample location, the Agencies have made the following observations that should be presented in the CMS: • At Plot AD1, where "pre mix" maximum arsenic concentrations were either within or marginally above site-specific background (20 ppm), the reductions from mixing were generally between 2.0 & 9.0 ppm. This resulted in "post mix" arsenic concentrations which were marginally lower than "pre mix" concentrations, but which were all within the site-specific background range. • At Plot AF (R1a), where "pre mix" maximum arsenic concentrations were in the 50.0 to 60.0 ppm range, the reductions from mixing were generally between 15.0 & 30.0 ppm. This resulted in "post mix" arsenic concentrations which	The pilot study was designed to evaluate a range of pre-mix soil arsenic concentrations. As discussed in Section 5.2.1 of the Pilot Study Report, soil tilling/blending resulted in a decrease ranging from 21% to 42% in the maximum soil arsenic concentration of each study plot and a decrease ranging from 41% to 55% in the average soil arsenic concentration of each study plot. Depending on the remediation goal selected, the post-mixing soil arsenic concentrations in the study plots may be adequate with no further action or may require additional mixing efforts. As discussed in Section 5.2 of the Draft CMS Report, soil excavation could potentially be supplemented and/or replaced with soil tilling/blending where the soil arsenic concentrations are sufficiently low enough to achieve the CMA-specific soil arsenic remediation goal. As discussed on FMC's Response to Agencies' Specific Comment 1, the applicability of soil tilling/blending for a particular property or area identified for remediation will be determined during the design phase of the CMI and will be based on property/area specific factors and on the actual remediation goal of the corrective measures selected

Item No.	Comment from the Agencies or the Community	FMC's Response
	were significantly lower than "pre mix" concentrations, but none were within the site-specific background range. In order to adequately evaluate the feasibility and possible usage limitations of soil blending/tilling as a corrective measures technology, the arsenic results from this pilot study should be compared in the CMS to the arsenic cleanup goal(s) associated with each Corrective Measures Alternative (CMA), so as to evaluate the effectiveness of soil blending/tilling in achieving such goals."	by the Agencies. Therefore, a detailed evaluation of the feasibility of soil tilling/blending will be performed during the design phase of the CMI instead of the CMS.
3.	**Agencies' Specific Comment 3** <u>Page 10, Section 5.2.2 Study Objectives Questions 2, 3 & 4 – Mechanical Equipment</u> "The report indicates that the blending depths were designed to be set at 18 to 36 inches. The CMS should indicate how these designed depths were confirmed during the actual performance of the pilot study. The report does not present a comparison of the level of mechanical effort in terms of the number of equipment passes. Based on the Agencies evaluation of the arsenic data after two & four equipment passes, there does not seem to be any significant additional reduction in arsenic concentrations achieved by doing four passes instead of two. The CMS should indicate the number of equipment passes necessary for blending/tilling to be most effective based on the arsenic data from this pilot study. The report indicates that the two pieces of equipment used were approximately equal in terms of the time involved in completing each pass. However, it should be pointed out in the CMS, that although the mixing time for each pass was the same for both pieces of equipment, the tiller was about 20 inches wider than the blender unit allowing it to process about one-third more area and soil volume with each pass.	The objective of the soil tilling/blending pilot study was to evaluate the effectiveness and feasibility of soil tilling/blending as a corrective measures technology. Similar to soil excavation, there is a variety of viable techniques available to achieve soil tilling/blending. The specific equipment to be used will be evaluated during the design phase of the CMI, and may vary based on the depth of soil to be mixed, access limitations, and other factors. The effectiveness of the specific equipment will be evaluated during implementation based on achieving the remediation goals. For the blending method (with soil mixing head), the depth of mixing (18 or 36 inches) was measured during the pilot study by observing the penetration of the mixing head below surface grade compared to a marked reference point on the mixing head. For the tilling method (with a roto-tiller and excavator), the depth of mixing (18 inches) was measured after stripping soil across the width of the plot with the dozer, compared to a surveyed control point. During implementation, the depth of mixing could be monitored by conventional survey methods. During the pilot study, four passes of mixing were attempted with the blending method, and two passes of mixing were attempted with the tilling method. With respect to the blending method, nearly all of the mixing was achieved after two passes with the mixing head. As discussed in Section 5.2.2 of the

Item No.	Comment from the Agencies or the Community	FMC's Response
	Therefore, at the 18-inch depth setting, the tiller would appear to be somewhat more productive in terms of area mixed over time."	Pilot Study Report, two passes with both the tilling method and the blending method resulted in similar post-mix soil arsenic concentrations when applied to study plots with similar pre-mix soil arsenic concentrations. The comparison of mechanical effort expended by the mixing equipment to complete a mixing pass provided in Section 5.2.2 of the Pilot Study Report was provided in units of time per volume of soil mixed, and not total time, for the equipment that was used. Therefore, the comparison as provided in the Report is appropriate, as well as the conclusion specified in the report that the "amount of mechanical effort expended, as measured by equipment operation time per volume of soil to complete a mixing pass with the equipment, was approximately the same (50 minutes for on pass through 100 cubic yards of soil) for both methods."
4.	**Agencies' Specific Comment 4** Page 11, Section 5.2.3 Study Objectives Question 6 – Site Conditions "This section discusses the use of tilling or blending in a residential setting and near structures. Since this pilot study was not conducted in a residential area or near any structures, the CMS should avoid using the results from this study to draw conclusions about the feasibility of its use in such situations. Although fugitive dust generation and noise are discussed, it is premature to conclude that fugitive dust and noise will not be of a concern in a residential area based on a short duration study conducted in a non-residential area during wet conditions. Also, the study does not address other concerns common to residential operation such as potential effects on structures near mixing operations and on underground utilities. In addition, the CMS should avoid drawing conclusions from this study regarding the feasibility of using an off-site mixing process or smaller tilling equipment, since these options were not evaluated in the study."	Section 5 of the Draft CMS Report states that, where appropriate, excavation could be supplemented with and/or replaced with in-place soil tilling/blending. For example, soil tilling/blending may be appropriate for areas that are: 1) relatively flat, open, and undeveloped; 2) the soil arsenic concentrations are sufficiently low enough to achieve the alternative specific soil arsenic remediation concentrations; 3) soil arsenic concentrations are higher at the surface and lower in the shallow subsurface; and 4) there are no subsurface features that would preclude the use of the machinery needed to perform the soil tilling/blending. The use of soil tilling/blending would be considered during the design phase of the CMI. Soil tilling/blending may be evaluated for implementation at a residential property during the design phase of the CMI. Such an evaluation will consider potential fugitive dust mitigation procedures and other factors specific to the property/area identified for remediation as discussed on FMC's Response to Agencies' Specific Comment 1.

TABLE B-2
FMC's RESPONSES TO COMMENTS ON CMS SOIL TILLING/BLENDING PILOT STUDY REPORT

DRAFT – MAY 2011
CMS REPORT FOR SUSPECTED AIR DEPOSITION AND CULVERT 105 STUDY AREAS
FMC CORPORATION – MIDDLEPORT, NEW YORK

Item No.	Comment from the Agencies or the Community	FMC's Response
5.	**Agencies' Specific Comment 5** Page 12, Section 5.2.4 Study Objectives Question 7 – Effects on Soil Characteristics "The results from this study suggest that there is a window of soil moisture contents outside of which tilling/blending is less effective or ineffective. As stated in this section of the report, high moisture causes the soil to clump together reducing the effectiveness of the mixing process, and extremely high moisture creates soil instability which poses safety concerns. Conversely, soil with a low moisture content (i.e., dry soil), may be very dense, making mixing difficult and/or creating an unacceptable amount of fugitive dust from the mixing process. Using the data on soil moisture content presumably generated in association with the study's soil sampling activities, the CMS should present a more detailed evaluation of the effects of soil moisture on tilling/blending and attempt to establish a general range of soil moisture contents over which tilling/blending appears to be the most effective. Also, using the data on soil type presumably generated in association with the study's soil sampling activities, the CMS should present an evaluation of what effect, if any, different soil types (e.g., clay, silt, sand, etc.) might have on the effectiveness of the mixing process. The report indicates that an excavator was needed to "pre-loosen" dense soils below 18 inches on Plot AF before blending could be performed. As a result, the CMS should consider this additional step when evaluating the effectiveness of blending in dense soils."	No information was collected during the Pilot Study to suggest that there is a low moisture content threshold that would prevent or limit the use of soil tilling/blending. As discussed in Section 4.3.1 of the pilot study report, if dense soil is encountered, then it can be effectively pre-loosened with an excavator prior to the first pass with the tilling/blending equipment. If the tilling/blending process begins to generate fugitive dust, then wetting of the soil can be implemented. Wetting of soil was identified as a contingency in the Pilot Study Work Plan, but was not needed. With respect to the saturated soil conditions encountered during implementation of the pilot study, such conditions would have also resulted in the suspension of soil excavation and backfilling activities, because approximately 1 inch of rain fell in a 24-hour period during the pilot study. During the pilot study, dense clayey soil was encountered at depth in Plot AF-1. Once this soil was pre-loosened with an excavator, it was effectively blended with the mixing head. With respect to the need to pre-loosen soil prior to mixing, this step was considered in the evaluation of the equipment operation time needed. As discussed on FMC's Response to Agencies' Specific Comment 1, the applicability of soil tilling/blending for a particular property or area identified for remediation will be determined during the design phase of the CMI and will be based on property/area specific factors and on the actual remediation goal of the corrective measures selected by the Agencies. Therefore, the detailed evaluations regarding soil moisture and type requested by the Agencies are not necessary for the purposes of the CMS.
6.	**Agencies' Specific Comment 6** Page 13, Section 5.3 Recommendation "FMC's recommendation states that "soil tilling or blending is a viable corrective measures technology for reducing arsenic concentrations in soil" and that it "warrants further evaluation in the CMS." While the	Although the maximum mixing depth evaluated during the pilot test was 36 inches, the soil mixing head and methods utilized during the pilot test would be able to mix soil to greater depths. The anticipated soil mixing depths would be determined during the design phase of the CMI, based on the pre-mix soil

Item No.	Comment from the Agencies or the Community	FMC's Response
	Agencies agree that the study does show varying reductions in arsenic concentrations in shallow soils and that this corrective measures technology deserves further evaluation in the CMS, we would also point out that there appear to be a number of limitations on the utilization of this technology. Below are what the Agencies consider to be some of the possible limitations of this technology based on the information resulting from the pilot study: • Evaluated arsenic concentrations above the cleanup goal which extend below 18 inches, may render this technology ineffective since the study's maximum mixing depth of 36 inches may not provide a enough of a volume of deeper in-situ soil of sufficiently lower arsenic concentrations to achieve the cleanup goal throughout the entire depth of the soil column. • The study results suggest that there is an upper limit arsenic concentration in shallow soils above which this technology would be ineffective in achieving cleanup goals. For instance, since the results at each sample point show an arsenic concentration reduction generally between 20 & 50%, use of this blending technology in areas where the arsenic concentrations in shallow soils are substantially above the cleanup goal, would likely be ineffective (See previous Comment 2). • The study suggests this technology is likely to be ineffective on soils which are above or below a specific window of moisture contents. • Use of this technology in a residential setting was not evaluated in this study, however, there are a number of factors which would likely substantially limit or preclude its use in a residential setting.	arsenic concentrations and the soil arsenic remediation goals specific to the area to be remediated. The maximum soil concentrations that may limit the applicability of the technology would be based on: 1) the pre-mix soil arsenic concentrations, 2) the vertical distribution of soil arsenic, and 3) the soil arsenic remediation goals specific to the property/area identified for remediation. FMC recognizes soil tilling/blending may be conducted in concert with soil excavation of the highest concentrations. Specific design details associated with the use of soil tilling/blending would be determined during the design phase of the CMI. With respect to soil moisture content, see FMC's Response above for Comment 5. With respect to use in a residential setting, see FMC's Response above for Comment 4. As discussed on FMC's Response to Agencies' Specific Comment 1, the applicability of soil tilling/blending for a particular property or area identified for remediation will be determined during the design phase of the CMI and will be based on property/area specific factors and on the actual remediation goal of the corrective measures selected by the Agencies. Therefore, further evaluation of the possible limitations suggested by the Agencies is not necessary for the purposes of the CMS.

TABLE B-2
FMC's RESPONSES TO COMMENTS ON CMS SOIL TILLING/BLENDING PILOT STUDY REPORT

DRAFT – MAY 2011
CMS REPORT FOR SUSPECTED AIR DEPOSITION AND CULVERT 105 STUDY AREAS
FMC CORPORATION – MIDDLEPORT, NEW YORK

Item No.	Comment from the Agencies or the Community	FMC's Response
	In evaluating the soil blending/tilling technology in the CMS, FMC should fully explore these and other potential limitations on the use of this technology."	
	Community Comments Received During Information Sessions/Meetings	
7.	Potential effects of soil tilling/blending on drainage if clayey soil from depth is brought to the surface.	This potential will be considered in the design phase of the CMI. Regardless of whether soil tilling/blending or excavation and backfilling is used, FMC will strive to restore the pre-remediation drainage conditions.

TABLE B-3
FMC's RESPONSES TO COMMENTS ON 2009 PHYTOREMEDIATION PILOT STUDY RESULTS

DRAFT – MAY 2011
CMS REPORT FOR SUSPECTED AIR DEPOSITION AND CULVERT 105 STUDY AREAS
FMC CORPORATION – MIDDLEPORT, NEW YORK

FMC's environmental consultants (AMEC Geomatrix and ARCADIS of New York, Inc ["ARCADIS"]) performed a site-specific arsenic phytoremediation pilot study in 2008-2009 to evaluate the effectiveness and feasibility of using phytoremediation to remove arsenic from soils in various off-site FMC study areas. The 2008 pilot study results were presented in a report entitled *Arsenic Phytoremediation Pilot Study Report,* dated July 2009 and prepared by AMEC Geomatrix. As directed by the Agencies in comments on the 2008 study, FMC implemented additional pilot study activities concerning one of the plant species in the study, the Brake Fern, in 2009. The results of the 2009 study activities were presented in a report entitled *2009 Arsenic Phytoremediation Pilot Study Results,* dated March 2010 and prepared by AMEC Geomatrix. The Agencies provided comments on the March 2010 report by letter dated June 9, 2010. The 2009 pilot study report and the Agencies' June 9, 2010 comment letter are included in Appendix B of this CMS Report. FMC's responses to comments received from the Agencies on the 2009 Arsenic Phytoremediation Pilot Study Report are presented below. No written comments were received from the community on the reports regarding the 2008 or 2009 studies.

Item No.	Comment from the Agencies or the Community	FMC's Response
	Agencies' Letter to FMC Dated June 9, 2010	
1.	**Agencies' General Comment** "As a result of our review of FMC's CMS Arsenic Phytoremediation Pilot Study Report, the Agencies believe the following observations can be made: – Both species of Brake Fern (Pteris Vittata & Pteris Nervosa) are capable of taking up arsenic from Middleport soil based on the biomass data; – Both Brake Fern species appear to accumulate substantially more arsenic in above ground biomass than in their roots; – Pteris Vittata appears to accumulate more arsenic in its above ground biomass than does Pteris Nervosa; – Planting Brake Ferns at a 6 inch spacing appears to promote significantly more above ground biomass growth to accumulate arsenic than planting at a 12 inch spacing; – Pteris Nervosa may be perennially sustainable in a Middleport climate if properly insulated over the winter periods; – In general, arsenic soil data do not indicate a discernable reduction in arsenic concentrations over the two year period of the study. Any reduction due to bio uptake appears to be completely masked by the inherent variability of the soil sampling results.	Based on the results of the pilot studies performed in 2008 and 2009 and in consultation with its experts and environmental consultant (Paul Deutsch, Principal Soil Scientist and Wai Chin Lachell, Senior Engineer of AMEC Geomatrix), FMC is in general agreement with the Agencies' six observations made based on the 2008 and 2009 pilot study results. However, it should be noted that despite the ability of ferns to uptake arsenic from Middleport soils, both the biomass of the ferns and the amount of arsenic uptake are significantly lower than documented in other published studies (Salido et al., 2003 and Kertulis-Tartar et al., 2006), as referenced in the 2009 Arsenic Phytoremediation Pilot Study Results (AMEC Geomatrix, March 2010). These published studies conducted greenhouse and field studies to evaluate the performance of the Brake Fern in the removal of arsenic in contaminated soils and had arsenic uptake concentrations 4 to 10 times higher than the highest uptake concentration observed in the 2009 pilot study. The Agencies' observations were considered by FMC and its experts during the CMS.

TABLE B-3
FMC's RESPONSES TO COMMENTS ON 2009 PHYTOREMEDIATION PILOT STUDY RESULTS

DRAFT – MAY 2011
CMS REPORT FOR SUSPECTED AIR DEPOSITION AND CULVERT 105 STUDY AREAS
FMC CORPORATION – MIDDLEPORT, NEW YORK

Item No.	Comment from the Agencies or the Community	FMC's Response
	The above observations and the enclosed comments on the 2009 Report should be considered by FMC during the implementation of this CMS."	
2.	**Agencies' Specific Comment 1** Page 4, Section 2.6 **Growth Monitoring and Reporting Activities** "The date range in the last sentence on this page is apparently incorrect since it goes up through the future date of October 22, 2010."	The end date of October 22, 2010 should be October 22, 2009.
3.	**Agencies' Specific Comment 2** Page 9, Section 4.1 **Soil Analysis Data** "The last sentence in this section states that the post-harvest arsenic concentrations in soil samples are likely attributed to variability and not plant uptake. However, since the biomass data indicate that some arsenic was taken up by the plants, the Agencies would consider it more correct to say that any reduction in soil arsenic concentration due to plant uptake was likely masked by the inherent variability of the soil sampling data."	Based on consultation with its experts and environmental consultant, as identified in the Response to the General Comment, FMC agrees with the Agencies' comment concerning the last sentence of Section 4.1.
4.	**Agencies' Specific Comment 3** Page 12, Section 4.3 **Arsenic Uptake Evaluation** Comment #2 above also applies to Item 2 on this page."	Based on consultation with its experts and environmental consultant, as identified in the Response to the General Comment, FMC agrees with the Agencies' comment concerning Item 2 on page 12.
5.	**Agencies' Specific Comment 4** Page 14, Section 4.3 **Arsenic Uptake Evaluation** "Items 8 – 10 on this page present time estimates for the reduction of arsenic in Middleport soils by certain specific amounts based on Brake Fern uptake data. Since there are only 2 years of biomass data and uptake rates appear highly variable, the Agencies consider that making any specific time estimates should be avoided. However, we would agree that the data suggest any substantial	Using the highest arsenic uptake rate (162 mg/kg) in the ferns sampled in the 2008 pilot study, FMC's experts estimated that it would take approximately 187 years to reduce the average soil arsenic concentration by 5 mg/kg. Similarly, using the highest arsenic uptake rate (380 mg/kg) in the ferns sampled in 2009, it was estimated that it would take approximately 37 years to reduce the average soil arsenic concentration by 5 mg/kg. The estimated times required for the ferns to reduce soil arsenic are sufficient for the

Item No.	Comment from the Agencies or the Community	FMC's Response
	reductions in soil arsenic concentration would take a significant number of years to be accomplished by Brake Ferns grown in the Middleport climate."	CMS evaluation of the feasibility of the technology based on site-specific data.
6.	**Agencies' Specific Comment 5** Page 16, Section 6.0 **Conclusion** "Comment #4 above applies to this section. Also, the Agencies request that FMC evaluate any and all available research regarding arsenic phytoremediation by plants in the CMS and document it in the Draft CMS Report. In particular, any available information about ongoing research to enhance the arsenic uptake rate of specific plant species should be presented in the report."	See FMC's Response to Agencies' Specific Comment 4. With respect to the Agencies' request for additional information concerning arsenic phytoremediation, FMC and its experts completed research regarding arsenic phytoremediation by plants, as documented in the Arsenic Phytoremediation Pilot Study Work Plan (AMEC Geomatrix, June 2008). As part of that research conducted, various plant species and amendments were evaluated and selected for the 2008 pilot studies. In addition, Cornell University (Cornell) was contracted to perform a bench top study using Middleport soil that evaluated various combinations of plants and competitive ions to determine the most effective combinations to support field implementation of the 2008 phytoremediation pilot study activities. Based on the research conducted by FMC's experts and experts at Cornell, plants and amendments were selected for evaluation in the 2008 field study. The 2008 study results are presented in the Arsenic Phytoremediaiton Pilot Study Report (AMEC Geomatrix, July 2009), and in FMC's view, based on evaluation by its experts, demonstrated that the plant species tested, except for the Brake Fern, have very low arsenic uptakes, are not viable for phytoremediation of Middleport soils, and do not warrant further study. The 2009 pilot study further evaluated the performance of the Brake Fern for removal of arsenic in Middleport soil and to obtain site-specific information on this technology. The 2009 pilot study results demonstrated that arsenic uptake concentrations were well below published studies and that the sub-tropical ferns do not produce sufficient biomass in the Middleport area (due to colder climate and shorter growing season) to effectively remove arsenic from soils in a timely manner.

TABLE B-3
FMC's RESPONSES TO COMMENTS ON 2009 PHYTOREMEDIATION PILOT STUDY RESULTS

DRAFT – MAY 2011
CMS REPORT FOR SUSPECTED AIR DEPOSITION AND CULVERT 105 STUDY AREAS
FMC CORPORATION – MIDDLEPORT, NEW YORK

Item No.	Comment from the Agencies or the Community	FMC's Response
		The Agencies' Corrective Action Objectives specify the use of site-specific data and information in the CMS. Accordingly, based on the pilot study results presented in the July 2009 and March 2010 reports and on consultation with its experts and environmental consultant, as identified in the Response to the General Comment, FMC concluded that the site-specific information and data obtained during the 2008 and 2009 pilot studies are sufficient to evaluate the feasibility of phytoremediation in this CMS. Therefore, further evaluation of phytoremediation and review of any ongoing research concerning arsenic phytoremediation is not warranted for the purposes of this CMS.
	Community Comments	
7.	No community comments received.	

Attachment B-1

Results of Community Survey on
Tree Preservation Measures

Attachment B-1

Results of Community Survey on Tree Preservation Measures

Information sessions and/or meetings concerning the *Corrective Measures Study Technical Memorandum – Evaluation of Tree Preservation Measures for Suspected Air Deposition and Culvert 105 Study Areas* were held by FMC on March 10, 15, 22 and 23, 2010. A survey questionnaire concerning the tree preservation measures was prepared by FMC and distributed to the owners of properties within the CMS Study Areas (a copy of the questionnaire is attached). FMC requested that responses to the questionnaire be provided either by hard copy to FMC's Neighborhood House or by using an on-line program provided by Google (also made available during the information sessions/meetings on March 22 and 23). Responses received by hard copy were entered into the on-line program, which produced a summary of all of the results received. Twenty-seven (27) responses were received (not every respondent answered every question).

A copy of the 14-page survey results summary is attached (previously provided to the Agencies by FMC email dated May 18, 2010), with no formatting beyond the output produced by the on-line program. Many of the questions (28 of 39) asked respondents to rate their response on a scale of 1 to 5, with the numbers corresponding to the indicated response (e.g., 1 = negative, 5 = positive and 2, 3 and 4 falling in between). For these questions, the results are provided in the attached results summary on the right side of the page as both the number and percentage of respondents choosing that answer, and are also visualized as a bar graph on the left side of the page. Six questions asked for a "yes" or "no" response, and these results are also provided as both the number and percentage of respondents choosing that answer, and are visualized as a pie chart. Comments received from the community as part of the survey are provided at the end of the survey results summary (page 14 of the survey summary). In addition to the ratings and survey comments provided by respondents, some respondents also wrote in comments when responding to specific survey questions. A summary list of these "write-in" comments (listed by survey question number) is appended to the end of the survey results.

FMC's responses to the community comments received as part of the survey results are provided in Table B-1 of this Appendix.

Evaluation of Potential Tree Preservation Measures Survey

1. In your view, how important are mature trees in the Village to the overall character of the Village of Middleport? Please rate your responses to the following questions on a scale of 1 to 5. *(Circle the number)*

Very Important				**Not Important**
1	2	3	4	5

Tree Removal/Replacement Scenarios

2. How do you rate the impact on the character of the Village of Middleport in the following situations associated with the removal of large mature trees and replacement with small nursery stock trees? *(Circle the number)*

	Negative				**Positive**
a. All trees in a neighborhood	1	2	3	4	5
b. 75% of trees in a neighborhood	1	2	3	4	5
c. 50% of trees in a neighborhood	1	2	3	4	5
d. 25% or less of trees in a neighborhood	1	2	3	4	5

Neighborhood Impact

3. If you know or are familiar with the respective situations, how do you rate the impact on the character of the neighborhood after completion of the environmental remediation activities? *(Circle the number)*

a. Vernon Street, immediately after the 2003 remediation

Negative				**Positive**
1	2	3	4	5

b. Vernon Street, now (6 years later)

Negative				**Positive**
1	2	3	4	5

c. Park Avenue, immediately after the 2007 remediation

Negative				**Positive**
1	2	3	4	5

c. Park Avenue, now (2 years later)

Negative				**Positive**
1	2	3	4	5

Evaluation Criteria

4. FMC has proposed the following criteria to evaluate measures that might be used to preserve trees. Please indicate your view as to which of these criteria are most and least important, ranking them from 1 to 5, with 1 being the least important and 5 the most important. *(Circle the number)*

a. Effectiveness of soil removal

Least Important				**Most Important**
1	2	3	4	5

b. Maintenance of character of property and neighborhood

Least Important				**Most Important**
1	2	3	4	5

c. Relative ease of implementation

Least Important **Most Important**
1 2 3 4 5

d. Minimizing inconvenience to property owner (e.g., noise and length of construction)

Least Important **Most Important**
1 2 3 4 5

e. Tree structural stability (tree will remain upright and not be uprooted)

Least Important **Most Important**
1 2 3 4 5

f. Tree survival probability

Least Important **Most Important**
1 2 3 4 5

g. Post-restoration maintenance

Least Important **Most Important**
1 2 3 4 5

h. Short and long-term safety

Least Important **Most Important**
1 2 3 4 5

i. Cost effectiveness

Least Important **Most Important**
1 2 3 4 5

Property Specific Questions

5. What is your street address? (including house number) _____

6. How many trees do you have on your property? _____

7. Are there trees you would like to keep under any circumstances? ____ Yes ____ No

8. If yes, how many? _____

9. If known, what types of trees are they?
___ Maple ___Oak ___Spruce ___Linden ___Locust ___Ash ___Chestnut ___Other

10. Are there trees on your property that you would like to have removed at this time or in the near future?
____ Yes ____ No

11. If yes, how many? ____

12. Of the tree(s) you indicated you would like to keep on your property, would you decide to keep them if it meant leaving some soil with elevated arsenic concentrations in the root area? (Above 20 ppm)
____ Yes ____ No

Tree Preservation Considerations

13. The following questions ask how comfortable you are with leaving arsenic soil concentrations under a tree that you want to preserve on your property, assuming that typical area background soils have arsenic concentrations from 2-21 ppm.

a. less or equal to 20 ppm (the remaining arsenic levels under a preserved tree)

	1	2	3	4	5	
Very Comfortable	○	○	○	○	○	Not Comfortable

b. 21 - 30 ppm (the remaining arsenic levels under a preserved tree)

	1	2	3	4	5	
Very Comfortable	○	○	○	○	○	Not Comfortable

c. 31 - 40 ppm (the remaining arsenic levels under a preserved tree)

	1	2	3	4	5	
Very Comfortable	○	○	○	○	○	Not Comfortable

d. 41 - 50 ppm (the remaining arsenic levels under a preserved tree)

	1	2	3	4	5	
Very Comfortable	○	○	○	○	○	Not Comfortable

e. 51 ppm and higher (the remaining arsenic levels under a preserved tree)

	1	2	3	4	5	
Very Comfortable	○	○	○	○	○	Not Comfortable

14. Would you be willing to have some restrictions imposed on the use of the areas beneath such trees and on the disturbance of soil that is in the root area?

___ Yes ___ No

15. If you want to try to save trees on your property, would you decide to keep the trees if it meant that you will NOT get a letter from the Agencies saying that your property was usable for all purposes?

____Yes ____ No

16. Is it acceptable to you if a procedure to save a tree possibly took a period of up to three years to complete? This would mean FMC's contractors would come back to a property to remove soil under or around the tree for up to three years in a row.

____ Yes ____ No

Tree Preservation Measures

17. How comfortable are you with the following measures relative to tree preservation, as recommended in the Corrective Measures Study Technical Memorandum - Evaluation of Tree Preservation Measures for Suspected Air Deposition and Culvert 105 Study?

a. No Soil Removal within the Protected Root Zone

	1	2	3	4	5	
Very Comfortable	○	○	○	○	○	Not Comfortable

b. Tree Removal and Replacement With Nursery Stock Tree.(The tree would be removed by FMC contractors and replaced with a 1 ½ -2 inch caliper tree from a nursery.)

	1	2	3	4	5	
Very Comfortable	○	○	○	○	○	Not Comfortable

c. Phased (Extended Time) Tree Removal and Replacement with Nursery Stock Trees. (This is a phased approach that would require completion of the soil removal activities over many 3+ years and would extend the time required to complete the remediation activities.)

	1	2	3	4	5	
Very Comfortable	○	○	○	○	○	Not Comfortable

d. Limited Depth (maximum 6-inches) Manual Excavation within the Protected Root Zone. (Manual removal and replacement of the top 6 inches of soil from the protected root zone of a tree. After remedial work has been completed on a property, the property owner would be responsible for maintenance of the tree (watering, pruning and fertilizing) and/or replacement if the tree were to die.)

	1	2	3	4	5	
Very Comfortable	○	○	○	○	○	Not Comfortable

e. Limited Depth (maximum 6-inches) Pneumatic Excavation within the Protected Root Zone. (Removal of the top 6 inches of soil from the protected root zone of a tree with an air spade, which uses compressed air. After remedial work has been completed on a property, the property owner would be responsible for maintenance of the tree (watering, pruning and fertilizing) and/or replacement if the tree were to die.

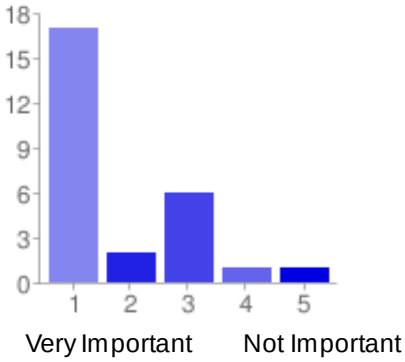
	1	2	3	4	5	
Very Comfortable	○	○	○	○	○	Not Comfortable

Other comments:

27 responses

Summary See complete responses

1. In your view, how important are mature trees in the Village to the overall character of the Village of Middleport?

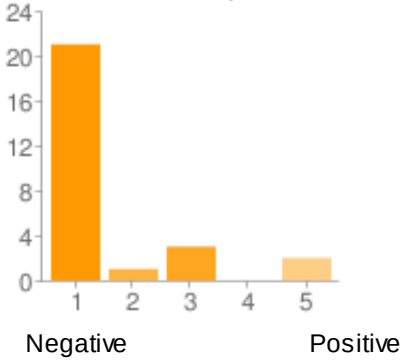


1 - Very Important	**17**	63%
2	**2**	7%
3	**6**	22%
4	**1**	4%
5 - Not Important	**1**	4%

Tree Removal/Replacement Scenarios

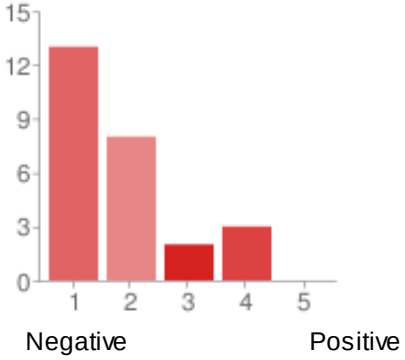
2. How do you rate the impact on the character of the Village of Middleport in the following situations associated with the removal of large mature trees and replacement with small nursery stock trees?

a. All trees in a neighborhood



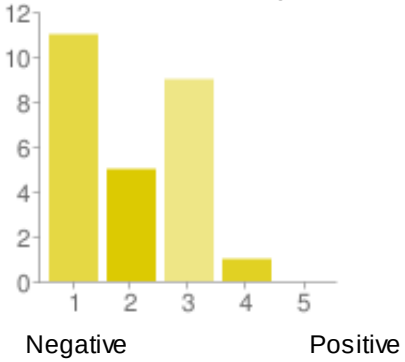
1 -	Negative	**21**	78%
2		**1**	4%
3		**3**	11%
4		**0**	0%
5 -	Positive	**2**	7%

b. 75% of trees in a neighborhood



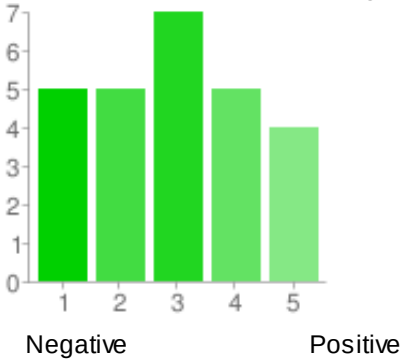
1 -	Negative	**13**	50%
2		**8**	31%
3		**2**	8%
4		**3**	12%
5 -	Positive	**0**	0%

c. 50% of trees in a neighborhood



1 -	Negative	**11**	42%
2		**5**	19%
3		**9**	35%
4		**1**	4%
5 -	Positive	**0**	0%

d. 25% or less of trees in a neighborhood

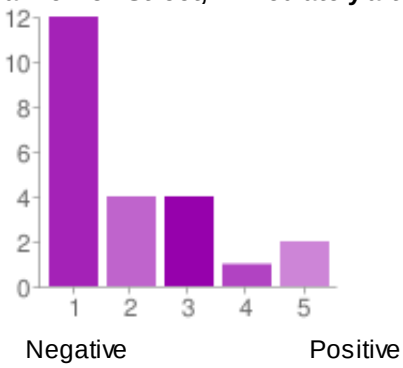


1 -	Negative	**5**	19%
2		**5**	19%
3		**7**	27%
4		**5**	19%
5 -	Positive	**4**	15%

Neighborhood Impact

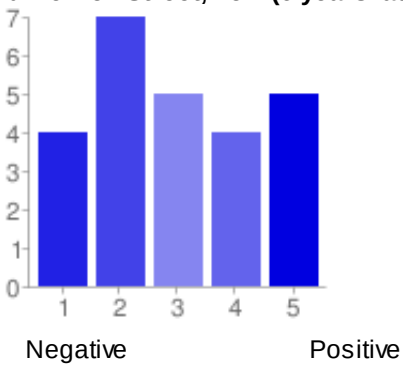
3. If you know or are familiar with the respective situations, how do you rate the impact on the character of the neighborhood after completion of the environmental remediation activities?

a. Vernon Street, immediately after the 2003 remediation



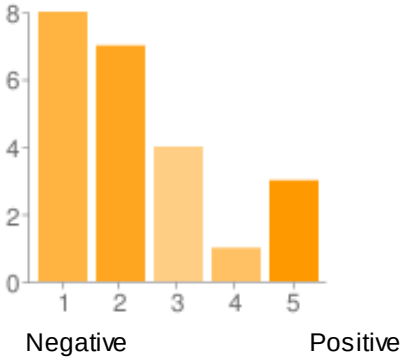
1 -	Negative	**12**	52%
2		**4**	17%
3		**4**	17%
4		**1**	4%
5 -	Positive	**2**	9%

b. Vernon Street, now (6 years later)



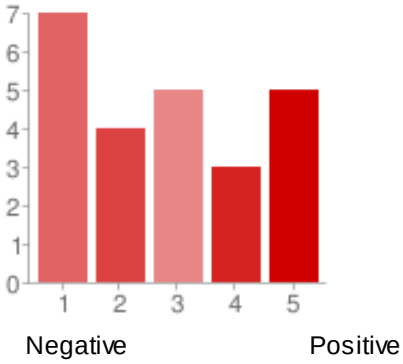
1 -	Negative	**4**	16%
2		**7**	28%
3		**5**	20%
4		**4**	16%
5 -	Positive	**5**	20%

c. Park Avenue, immediately after the 2007 remediation



1 -	Negative	**8**	35%
2		**7**	30%
3		**4**	17%
4		**1**	4%
5 -	Positive	**3**	13%

d. Park Avenue, now (2 years later)

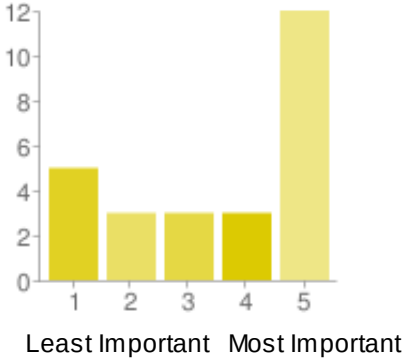


1 -	Negative	**7**	29%
2		**4**	17%
3		**5**	21%
4		**3**	13%
5 -	Positive	**5**	21%

Evaluation Criteria

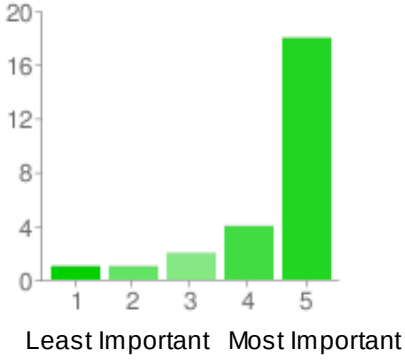
4. FMC has proposed the following criteria to evaluate measures that might be used to preserve trees. Please indicate your view as to which of these criteria are most and least important, ranking them from 1 to 5, with 1 being the least important and 5 the most important. Include any other criteria that you believe should be considered.

a. Effectiveness of soil removal



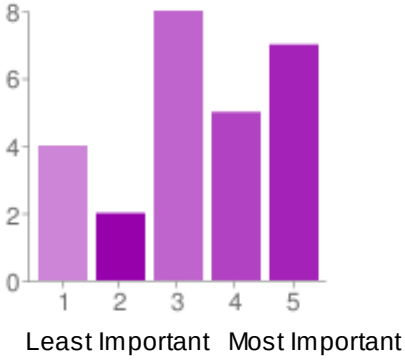
1 -Least Important		**5**	19%
2		**3**	12%
3		**3**	12%
4		**3**	12%
5 -Most Important		**12**	46%

b. Maintenance of character of property and neighborhood



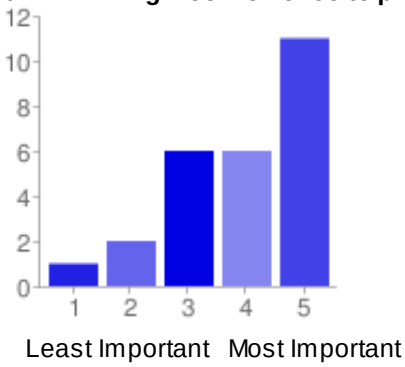
1 -Least Important		**1**	4%
2		**1**	4%
3		**2**	8%
4		**4**	15%
5 -Most Important		**18**	69%

c. Relative ease of implementation



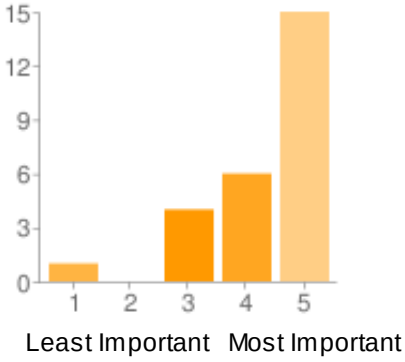
1 -Least Important	**4**	15%
2	**2**	8%
3	**8**	31%
4	**5**	19%
5 -Most Important	**7**	27%

d. Minimizing inconvenience to property owner (e.g., noise and length of construction)



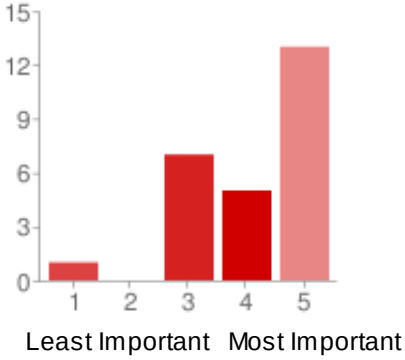
1 -Least Important	**1**	4%
2	**2**	8%
3	**6**	23%
4	**6**	23%
5 -Most Important	**11**	42%

e. Tree structural stability (tree will remain upright and not be uprooted)



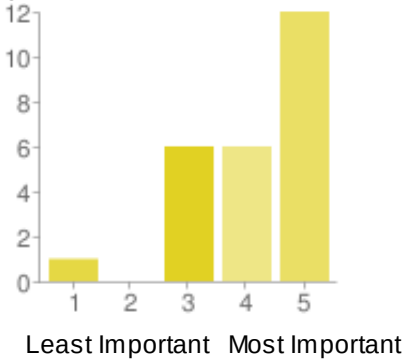
1 -Least Important	**1**	4%
2	**0**	0%
3	**4**	15%
4	**6**	23%
5 -Most Important	**15**	58%

f. Tree survival probability



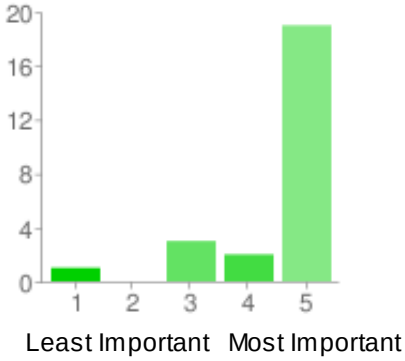
1 -Least Important	**1**	4%
2	**0**	0%
3	**7**	27%
4	**5**	19%
5 -Most Important	**13**	50%

g. Post-restoration maintenance



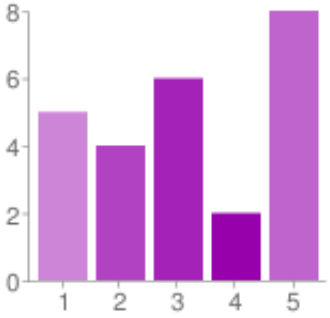
1 -Least Important	**1**	4%
2	**0**	0%
3	**6**	24%
4	**6**	24%
5 -Most Important	**12**	48%

h. Short and long-term safety



1 -Least Important	**1**	4%
2	**0**	0%
3	**3**	12%
4	**2**	8%
5 -Most Important	**19**	76%

i. Cost effectiveness



1 - Least Important	**5**	20%
2	**4**	16%
3	**6**	24%
4	**2**	8%
5 - Most Important	**8**	32%

Property Specific Questions

Please provide your street address (house number and street name) to answer the following questions.

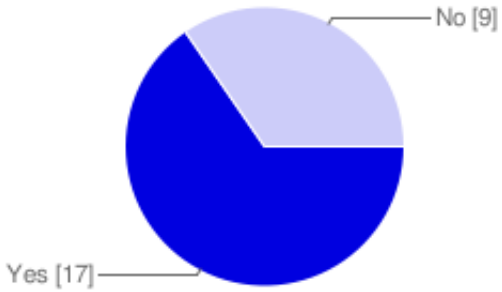
5. What is your street address?

Test address 97 South Main Street 51 state street 59 State Street 44 State Street 10160 State Rd 1 Sherman Road Lot 21 47 state street 2, 4 & 5 Maedl Lane village 10 Alfred St. 2403 hosm,er 13 maple ave 11 Alfre ...

6. How many trees do you have on your property?

26 3 1 mature 5 too many to count 5 4 or 5 hundreds 7 3 1 6 1 26 7 3 0 4 3 8 100 8 1 0

7. Are there trees you would like to keep under any circumstances?

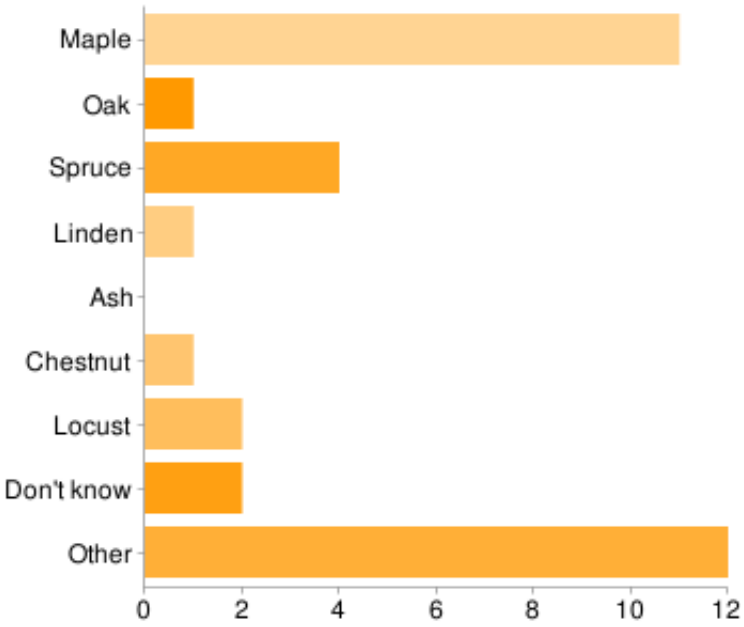


Yes	**17**	65%
No	**9**	35%

8. If yes, how many?

All 1 1 Quite a number 2 as many as possible for natural barrier between lots plus ones that were planted around the apartment buildings. It would certainly depend on what the agencies come up with as r ...

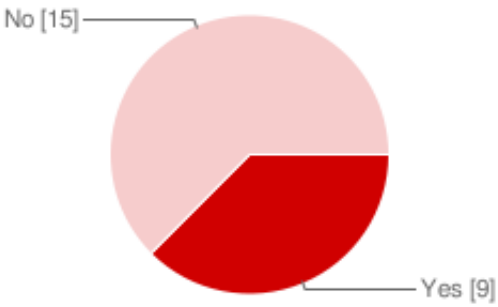
9. If known, what types of trees are they?



Maple	**11**	52%
Oak	**1**	5%
Spruce	**4**	19%
Linden	**1**	5%
Ash	**0**	0%
Chestnut	**1**	5%
Locust	**2**	10%
Don't know	**2**	10%
Other	**12**	57%

People may select more than one checkbox, so percentages may add up to more than 100%.

10. Are there trees on your property that you would like to have removed at this time or in the near future?

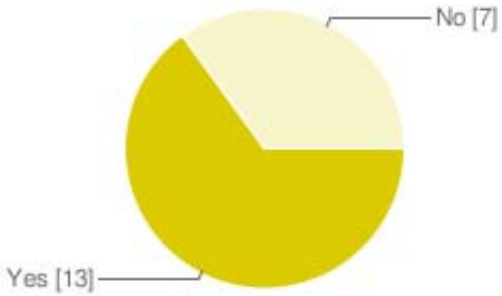


Yes	**9**	38%
No	**15**	63%

11. If yes, how many?

1 3 Quite a number are don't care 1 2 1 2 2 2

12. Of the tree(s) you indicated you would like to keep on your property, would you decide to keep them if it meant leaving some soil with elevated arsenic concentrations in the root area? (Above 20 ppm)

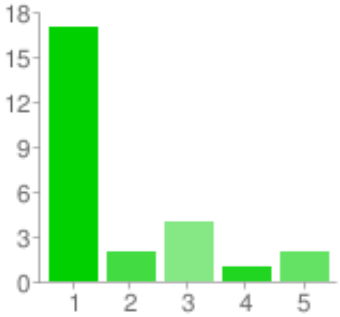


Yes	**13**	65%
No	**7**	35%

Tree Preservation Considerations

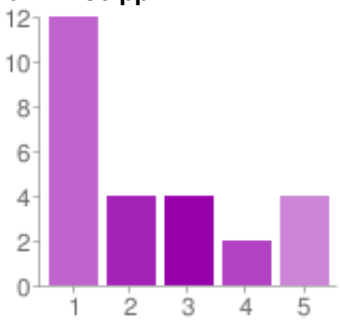
13. The following questions ask how comfortable you are with leaving arsenic soil concentrations under a tree that you want to preserve on your property, assuming that typical area background soils have arsenic concentrations from 2-21 ppm.

a. less or equal to 20 ppm



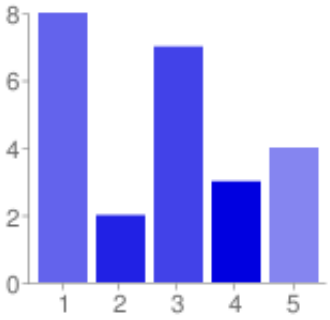
1 -Very Comfortable	**17**	65%
2	**2**	8%
3	**4**	15%
4	**1**	4%
5 -Not Comfortable	**2**	8%

b. 21 - 30 ppm



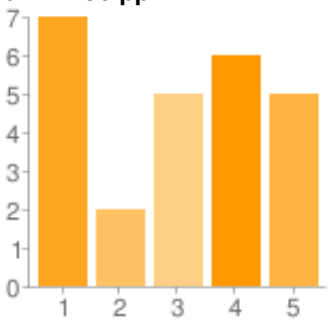
1 -Very Comfortable	**12**	46%
2	**4**	15%
3	**4**	15%
4	**2**	8%
5 -Not Comfortable	**4**	15%

c. 31 - 40 ppm



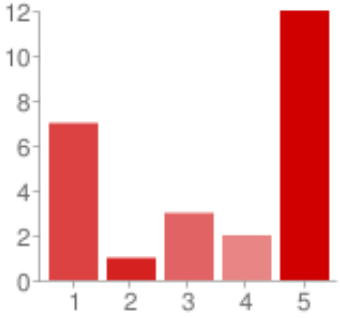
1 -Very Comfortable	**8**	33%
2	**2**	8%
3	**7**	29%
4	**3**	13%
5 -Not Comfortable	**4**	17%

d. 41 - 50 ppm



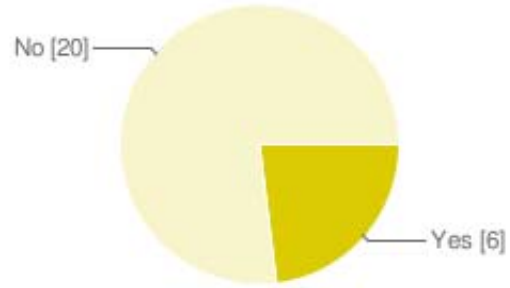
1 -Very Comfortable	**7**	28%
2	**2**	8%
3	**5**	20%
4	**6**	24%
5 -Not Comfortable	**5**	20%

e. 51 ppm and higher



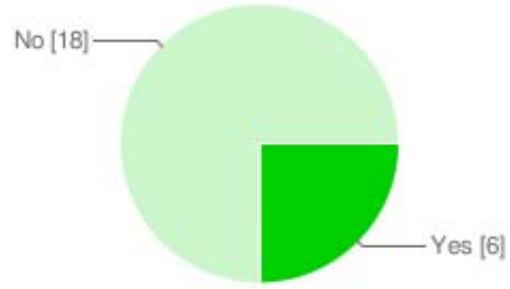
1 -Very Comfortable	**7**	28%
2	**1**	4%
3	**3**	12%
4	**2**	8%
5 -Not Comfortable	**12**	48%

14. Would you be willing to have some restrictions imposed on the use of the areas beneath such trees and on the disturbance of soil that is in the root area?



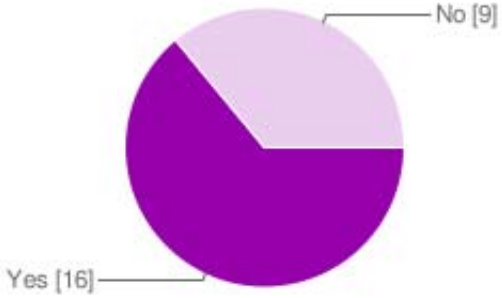
Yes	**6**	23%
No	**20**	77%

15. If you want to try to save trees on your property, would you decide to keep the trees if it meant that you will NOT get a letter from the Agencies saying that your property was usable for all purposes



Yes	**6**	25%
No	**18**	75%

16. Is it acceptable to you if a procedure to save a tree possibly took a period of up to three years to complete?

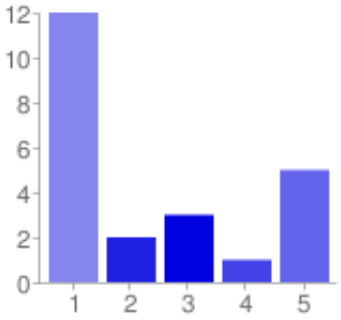


Yes	**16**	64%
No	**9**	36%

Tree Preservation Measures

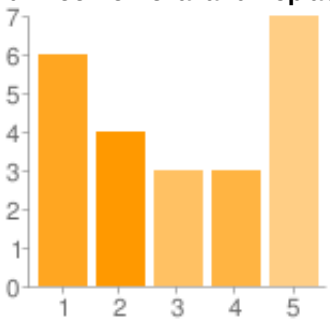
17. How comfortable are you with the following measures relative to tree preservation, as recommended in the Corrective Measures Study Technical Memorandum - Evaluation of Tree Preservation Measures for Suspected Air Deposition and Culvert 105 Study?

a. No Soil Removal within the Protected Root Zone



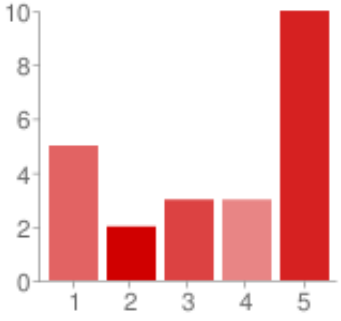
1 -Very Comfortable	**12**	52%
2	**2**	9%
3	**3**	13%
4	**1**	4%
5 -Not Comfortable	**5**	22%

b. Tree Removal and Replacement With Nursery Stock Tree.



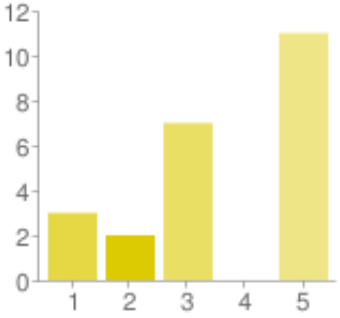
1 -Very Comfortable	**6**	26%
2	**4**	17%
3	**3**	13%
4	**3**	13%
5 -Not Comfortable	**7**	30%

c. Phased (Extended Time) Tree Removal and Replacement with Nursery Stock Trees.



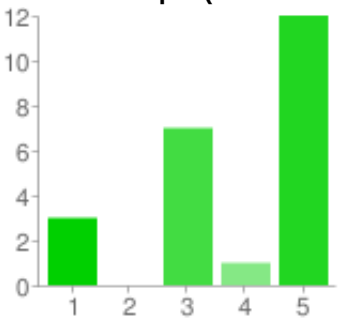
1 -Very Comfortable	**5**	22%
2	**2**	9%
3	**3**	13%
4	**3**	13%
5 -Not Comfortable	**10**	43%

d. Limited Depth (maximum 6-inches) Manual Excavation within the Protected Root Zone.



1 -Very Comfortable	**3**	13%
2	**2**	9%
3	**7**	30%
4	**0**	0%
5 -Not Comfortable	**11**	48%

e. Limited Depth (maximum 6-inches) Pneumatic Excavation within the Protected Root Zone.

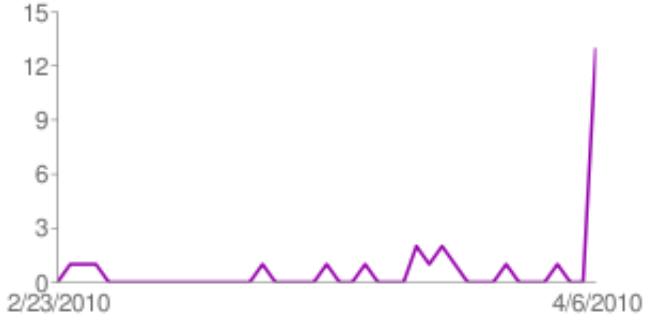


1 -Very Comfortable	**3**	13%
2	**0**	0%
3	**7**	30%
4	**1**	4%
5 -Not Comfortable	**12**	52%

General Comments

On fifty acres of land there are a large number of trees. Trees around the house and buildings should be preserved. Fruit trees around the buildings and in orchards should be preserved no matter their condition or age. Trees in heavily wooded areas should be preserved to promote wildlife habitat. Most single trees in fields can be removed and there is no need for replacements. Areas where average arsenic contamination is above 60 PPM should be remediated with tree removal and no replacement necessary. I have new, small seedling trees planted on my trailer lot and they could be easily transpla ...

Number of daily responses



GENERAL COMMENTS

On fifty acres of land there are a large number of trees. Trees around the house and buildings should be preserved. Fruit trees around the buildings and in orchards should be preserved no matter their condition or age. Trees in heavily wooded areas should be preserved to promote wildlife habitat. Most single trees in fields can be removed and there is no need for replacements. Areas where average arsenic contamination is above 60 PPM should be remediated with tree removal and no replacement necessary.

I have new, small seedling trees planted on my trailer lot and they could be easily transplanted.

We want safety. We are not interested in protecting FMC. We want to be protected from what FMC created.

As much as I love all the trees and wish to not have any removed, if I have to have that done to clear the title of my property then I will work with all involved, FMC, the agencies, etc. to work out the best plan for my property. Many of the "new" trees planted at Maedl Lane are very, very nice while a lot of the other trees are strictly for "cover & privacy" which is one of the main reasons we chose to purchase that property and put apartments on it...the neighbors barely know they are there and if these trees were totally removed it would not be the same regardless of who maintains them. Personally, I feel residents who have to have any work done should have no more maintenance requirements than they had prior to the remediation.

Quit beating a dead horse and milking deep pockets for future paychecks. Agencies please get out of our village. Go someplace where health of people really is an issue.

if and when you have to do our work in our yard there will be ground rules. There will be no rolled grass or terrible soil (clay) brought in like Vernon St. We will want a say how it is being planted. We would request grass seed and top soil even if we had to do the work ourselves. We know first hand how it was done on Vernon and it is not acceptable in our yard. The Conleys

We just want a safe level of contamination for our children.

I do not feel knowledgeable to answer these questions. Some homeowners are not familiar with tree preservations measures, soil excavation, etc. I am not concerned with elevated arsenic concentrations in the amounts shown on your reports for this area. I am not in favor of the CAMU to permanently store all the excavated soil in and around Middleport. This will be a detriment to the residents of Middleport trying to sell property and for any new business trying to locate here. I feel that in the future, there could be a seepage problem from the contaminated soil storage and should not be in an area near the school.

We currently have no trees in our yard, but we love the look of the Village and we would love to see the trees remain, but that's not up to us because this does not apply to us.
I am comfortable with anything you must to do make my property safe. Also, not all of us are proficient in this subject. The wording of this survey made it hard to answer.

Our main focus is to preserve ALL of our existing trees on our property. We are open to all soil remediation methods and durations provided they are "tree friendly" methods.

This survey is asking about the feelings of our preservation of our trees. But we are being told if we do not want our trees cut down we will not get a letter from the Agencies saying that our property is usable for all purposes. Why don't they propose a letter that if we choose to keep the trees if they die or are cut down for whatever reason then FMC is to be notified and can come and remediate that area.

The agencies are ruining Middleport and taking advantage of FMC. The reason for these answers is because I do not believe remediation is in our best interest. You are going ahead without the majority of citizen's approval. So you better replace with quality nursery stock in all cases.

Question 3 c. – Park Avenue, immediately after the 2007 remediation

- Grass better than Vernon St. No trees were planted on one property.

Question 4 a. – Effectiveness of soil removal (Evaluation Criteria)

- If it is necessary

Question 8 If yes, how many? (trees would you like to keep under any circumstances)

- 1 and my neighbor's Big Beautiful Trees!
- 1 so long as others are replaced
- All of them!

Question 10 – **Are there trees on your property that you would like to have removed at this time or in the near future?**

- Some need to be but not due to FMC.

Question 12 – Of the trees you indicated you would like to keep on your property, would you decide to keep them if it meant leaving some soil with elevated arsenic in the root area?

- Or keeping and replanting with roots

Question 15 – If you want to try to save trees on your property, would you decide to keep the trees if it meant that you will NOT get a letter from the Agencies saying that your property was usable for all purposes?

- This is like blackmail. Shame on you.
- If in the future the tree dies then FMC should be contacted.

Question 17 a. - No Soil Removal within the Protected Root Zone

- Best solution

Question 17 b. – Tree Removal and Replacement With Nursery Stock

- Trees take a long time to grow. The biggest ones possible should be planted.

Question 17 c. – Phased Tree Removal and Replacement With Nursery Stock

- Prefer done in less time

Question 17 d. – Limited Depth Manual Excavation within Protected Root Zone

- If it dies and proper care was taken the tree should be replaced not by property owner.
- Trees should be replaced if it dies by FMC

Attachments B-2 through B-7

Attachment B-2 - Corrective Measures Study Technical Memorandum – Evaluation of Tree Preservation Measures for Suspected Air Deposition and Culvert 105 Study Areas (February 2010)

Attachment B-3 - Agencies' letter dated April 5, 2010 with comments on FMC's Technical Memorandum on the Evaluation of Tree Preservation Measures

Attachment B-4 - Corrective Measures Study Soil Tilling/Blending Pilot Study Report (March 2010)

Attachment B-5 - Agencies' letter dated May 10, 2010 with comments on FMC's CMS Soil Tilling/Blending Pilot Study Report

Attachment B-6 - 2009 Arsenic Phytoremediation Pilot Study Results (March 2010)

Attachment B-7 - Agencies' letter dated June 9, 2010 with comments on FMC's 2009 Arsenic Phytoremediation Pilot Study Report

FMC Corporation

FMC Corporation
1735 Market Street
Philadelphia PA 19103

215.299.6000 phone
215.299.6947 fax

www.fmc.com

February 9, 2010

Via E-Mail and Overnight Mail

Mr. Matt Mortefolio, P.E.
NYSDEC Project Coordinator
Bureau of Solid Waste & Corrective Action
Division of Solid and Hazardous Waste Materials
NEW YORK STATE DEPARTMENT OF
ENVIRONMENTAL CONSERVATION
625 Broadway, 9th Floor
Albany, NY 12233-7255

Mr. Michael Infurna
USEPA Project Coordinator
Environmental Planning and Protection Division
UNITED STATES ENVIRONMENTAL
PROTECTION AGENCY, Region II
290 Broadway – 20th Floor
New York, NY 10007-1866

Re: RCRA Section 3008(h) Administrative Order on Consent (AOC)
Docket No. II-RCRA-90-3008(h)-0209
FMC Corporation, Middleport, NY Facility
EPA I.D. No. NYD002126845
Submittal of Corrective Measures Study Technical Memorandum -
Evaluation of Tree Preservation Measures for Suspected Air Deposition
and Culvert 105 Study Areas

Dear Messrs. Mortefolio and Infurna:

In accordance with the above-referenced Administrative Order on Consent (AOC), FMC Corporation (FMC) is currently implementing the "Corrective Measures Study Work Plan for Suspected Air Deposition and Culvert 105 Study Areas" (August 2009, AMEC Geomatrix) (CMS Work Plan). The CMS Work Plan was approved by the New York State Department of Environmental Conservation (NYSDEC) and the United States Environmental Protection Agency (USEPA) (collectively, "the Agencies"), in consultation with the New York State Department of Health (NYSDOH). As described in the approved CMS Work Plan, the enclosed document entitled "Corrective Measures Study Technical Memorandum - Evaluation of Tree Preservation Measures for Suspected Air Deposition and Culvert 105 Study Areas" (February 2010, ARCADIS) has been prepared to identify and evaluate the effectiveness and ability to implement potential tree preservation measures in the course of remediation of potentially FMC-related constituents (predominantly arsenic) in soil in off-site properties in these study areas.

Hard copies of this letter and the enclosure will be placed in the document repository at the Middleport Library and at FMC's Neighborhood House at 17 Vernon Street in Middleport, New York and made available for community review. The enclosed document will also be available at the following website:

- http://www.middleportny.com/library/

FMC

FMC will hold public information sessions tentatively scheduled for March 10, 15, 22 and 23, 2010 to present the information contained in the enclosure, to answer questions, and to solicit input from the community and stakeholders. A notice identifying the dates, times and place of the information session, information sheets and/or a survey form relative to the enclosure, and comment forms will also be mailed or distributed in late February 2010 or early March 2010 to property owners within the Suspected Air Deposition and Culvert 105 CMS Study Areas and to Village of Middleport officials.

In addition, FMC's representatives will be attending and will provide information on the enclosure during the February 11, 2010 Middleport Community Input Group meeting.

In order to meet the schedule for performance of the CMS, FMC requests that the Agencies and community members provide any comments on the enclosed document by April 2, 2010.

If there are any questions or if additional information is needed at this time, please contact me at (215) 299-6047 or at the above address.

Sincerely,

Brian M. McGinnis

Brian M. McGinnis
Remediation Project Manager

Enclosure

pc: Without enclosure
W. Mugdan, USEPA, NYC
B. Finazzo, USEPA, NYC
E. Dassatti, NYSDEC, Albany
R. Phaneuf, NYSDEC, Albany
G. Litwin, NYSDOH, Troy
R. Fedigan, NYSDOH, Troy
D. King, NYSDEC, Buffalo
G. Sutton, NYSDEC, Buffalo
Senator George Maziarz, Wheatfield
Assemblywoman Jane Corwin, Clarence
Congressman Chris Lee, Williamsville

With enclosure
J. Ridenour, NYSDOH, Troy
Mayor Julie Maedl, Village of Middleport
Daniel E. Seaman, Esq., Village of Middleport Attorney, Lockport office
Dan Watts, MRAG/MCIG Technical Advisor
Bill Arnold, Middleport Community Input Group (MCIG)
Pat Cousins, Middleport Remedial Action Group (MRAG)
M. Hinton, NYSDEC, Buffalo
N. Freeman, NYSDOH, Troy
Middleport Library/Document Repository
FMC Neighborhood House

ARCADIS
Infrastructure, environment, buildings

Imagine the result

FMC

FMC Corporation
Middleport, New York

Corrective Measures Study Technical Memorandum

Evaluation of Tree Preservation Measures for Suspected Air Deposition and Culvert 105 Study Areas

February 2010

ARCADIS

Corrective Measures Study Technical Memorandum

Evaluation of Tree Preservation Measures for Suspected Air Deposition and Culvert 105 Study Areas

Prepared for:
FMC Corporation

Prepared by:
ARCADIS of New York, Inc.
6723 Towpath Road
P.O. Box 66
Syracuse
New York 13214-0066
Tel 315.446.9120
Fax 315.449.0017

Our Ref.:
B0037736

Date:
February 2010

Acronyms

AOC	Administrative Order on Consent
CAOs	Corrective Action Objectives
CMS	Corrective Measures Study
DBH	Diameter at breast height
FMC	FMC Corporation
ICM	Interim corrective measure
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
RCRA	Resource Conservation and Recovery Act
USEPA	United States Environmental Protection Agency

Executive Summary

FMC Corporation (FMC) has completed an evaluation of potential tree preservation measures that might be employed in the course of remediation of potential FMC-related constituents (primarily arsenic) in soil located within the protected root zones of trees found within the off-site Suspected Air Deposition and Culvert 105 Study Areas (Study Areas) in Middleport, New York. This evaluation was implemented consistent with the *Corrective Measures Study Work Plan for Suspected Air Deposition and Culvert 105 Study Areas* dated August 2009 (CMS Work Plan) (AMEC Geomatrix 2009), which was approved by the New York State Department of Environmental Conservation (NYSDEC) and the United States Environmental Protection Agency (USEPA) (the latter two entities are referred to together as "the Agencies"), in consultation with the New York State Department of Health (NYSDOH). This evaluation is also consistent with the Agencies' Final Corrective Action Objectives Applicable to Off-Site Soil and Sediment ("CAOs"), which specifically state that one of the goals of corrective measures is to "[m]inimize disturbance and disruption of the community so that the character of the neighborhoods can be maintained." The preservation of trees is understood to be an important element in maintaining the character of the Middleport community and/or an affected property, and therefore a study of potential tree preservation measures was included as a task in the CMS Work Plan. The conclusions of this evaluation will be considered in the development and analysis of corrective measure alternatives in the Corrective Measures Study (CMS).

The feasibility of tree preservation during implementation of corrective measures (e.g., soil removal, soil tilling or blending) within the protected root zones of trees is dependent on a variety of factors, including distribution of FMC-related constituents; tree species; tree age, health and condition; and soil type. Due to the wide range of factors that must be considered, no single measure will apply to all situations within the Study Areas. This study provides an evaluation of nine identified potential tree preservation measures based on the following factors: the effectiveness of soil removal; maintenance of aesthetic character of the property or neighborhood; relative ease of implementation; minimizing inconvenience to property owners (i.e., noise and length of construction); tree structural stability; tree survival probability ; post-remediation maintenance requirements; short- and long-term safety of workers, property owners and the community; and cost effectiveness.

The evaluation concludes as follows:

- Any disturbance (e.g., soil removal, soil tilling, soil compaction) within the protected root zone could jeopardize the health or stability of an otherwise healthy tree. Measures implemented to attempt to preserve a tree offer varying likelihoods for success. For this reason, the most common approach in soil remediation projects is to remove the tree and replant with a new tree.

- Removal of larger trees and replanting with smaller trees would have an effect on the aesthetic character of an affected property and neighborhood. Based upon two recent inventories of trees located in right-of-ways in the Village of Middleport, approximately 80% of the trees have a trunk diameter (measured at breast height) of greater than 10 inches. The information from these inventories provides an indication of tree species and tree sizes found in a portion of the Study Area. Decades of growth time would likely be needed to fully replace the size of these trees.

- Not all trees can or should be preserved. The determination of whether a tree can or cannot be preserved is dependent on a number of property-specific or tree-specific factors. For example, an older tree with dwindling health would have a low probability of long-term survival if any soil removal was attempted within the protected root zone.

- No single tree preservation measure will apply to all situations within the Study Area. A final remedial design plan would likely include removal of numerous trees (e.g., those that are unhealthy, have been pruned, are over-mature, are poorly located, etc.) and preservation of other trees using selected measures identified in this Technical Memorandum.

- If a tree is to be preserved, limited depth excavation, using either mechanical or pneumatic pressure, would appear to present the best opportunity to preserve the tree and warrants further consideration as part of the CMS. The depth of excavation would be limited to approximately 6 inches below the soil surface, and would be completed in one continuous effort. Precedent was identified for limited depth manual excavation at four similar remediation projects within residential neighborhoods.

- Other identified measures to excavate soils within the protected root zones of trees were not recommended for further evaluation based upon practicability of implementation, lower probabilities for tree survivability, tree structural stability concerns, and safety concerns for workers, residents, and the community.

- Long term maintenance or monitoring of the preserved tree (i.e., watering, fertilizing) and/or subsequent removal of the tree would be the responsibility of the property owner.

1. Introduction

This *Corrective Measures Study Technical Memorandum – Evaluation of Tree Preservation Measures for Suspected Air Deposition and Culvert 105 Study Areas* ("Technical Memorandum") has been prepared by ARCADIS on behalf of FMC Corporation (FMC) for off-site properties in Middleport, New York. This Technical Memorandum identifies and evaluates the effectiveness and ability to implement potential tree preservation measures in the course of remediation of potentially FMC-related constituents (predominantly arsenic) in soil in off-site properties. The evaluation of tree preservation measures is being performed because corrective measures alternatives that include tree preservation measures will be evaluated in the Corrective Measures Study (CMS) for the Suspected Air Deposition and Culvert 105 Study Areas (collectively referenced hereinafter as "Study Area") (properties shaded green on Figure 1-1). FMC is performing the CMS in accordance with the terms and conditions of an Administrative Order on Consent (AOC), Docket No. II RCRA-90-3008(h)-0209, entered into by FMC and by the New York State Department of Environmental Conservation (NYSDEC) and the United States Environmental Protection Agency (USEPA) (the latter two entities are referred to jointly as "the Agencies").

1.1 Background

FMC is currently implementing tasks described in the *Corrective Measures Study Work Plan for Suspected Air Deposition and Culvert 105 Study Areas* dated August 2009 (CMS Work Plan) (AMEC Geomatrix 2009), which was approved by the Agencies in consultation with the New York State Department of Health (NYSDOH). One of the tasks detailed in the CMS Work Plan is the identification and evaluation of tree preservation measures. This task is consistent with the Agencies' Final Corrective Action Objectives Applicable to Off-Site Soil and Sediment (dated March 26, 2009 and included in Appendix A of the CMS Work Plan) ("CAOs"), which specifically states that one of the goals of corrective measures is to "[m]inimize disturbance and disruption of the community so that the character of the neighborhoods can be maintained."

The Study Area consists of approximately 230 off-site properties that are not owned by FMC. Most of the properties, which are located in the Village of Middleport, are occupied by single and multi-family homes (approximately 200 properties). The other properties within the Study Area consist of commercial businesses, agricultural or undeveloped land, Village of Middleport land (e.g., right-of-ways), and the Royalton-Hartland Central School District property. Interim corrective measures (ICMs) conducted previously at 26 residential properties in the Study Area south of the Erie Canal (i.e., at residential properties in the Suspected Air Deposition Area) have required removal of nearly all trees within the remediated areas to effectively remove soil with elevated arsenic levels. Based on observations and experience from the ICMs, the Middleport residents are cognizant of the potential impact remediation and

removal of trees can have on the aesthetic character of the Middleport neighborhoods. Concerns raised by the community about the potential loss of more trees due to remediation has led to this evaluation of potential preservation measures for trees in the Study Area as part of the CMS process.

1.2 Objectives

The primary objectives of this Technical Memorandum are to identify potential tree preservation measures and evaluate the relative effectiveness and ability to implement these measures. The evaluation included the following considerations as identified in the Agency approved CMS Work Plan (AMEC Geomatrix 2009):

- Ability to perform the work without causing permanent damage to the tree.
- The level of effort and type of equipment required.
- The safety of workers, residents and neighbors during implementation.
- The potential for the tree to fall down or die during or after completion of the work.
- The degree to which the soil removal and replacement can be accomplished.
- The effectiveness of the method to reduce soil arsenic levels and/or human health risk levels associated with remaining soil arsenic concentrations.
- Costs for performance of the work and potential future costs/liabilities.
- The time of year during which soil removal in the root zone will have the least effect on the tree.
- The ability of partial soil removal within the root zone over multiple years to avoid damaging an otherwise healthy tree.
- The soil replacement type and any additives that may serve to enhance tree preservation.
- How far into the tree root zone (typically approximated by the tree's drip line) can excavation be performed without expected damage to an otherwise healthy tree?
- How deep can soil be removed within the root zone without expected damage an otherwise healthy tree?

Site-specific information and data on tree abundance, species diversity, and tree health are presented in subsequent sections of this Technical Memorandum, along with information on factors that may result in tree damage and steps that can be taken to minimize or prevent damage to trees that are impacted by remediation activities (referred to herein as "Best Management Practices") (Sections 2 through 4).

Discussions on the identification and evaluation of potential tree preservation measures are provided in Sections 5 and 6, respectively. Conclusions and recommendations relative to particular tree preservation measures that would be evaluated in the CMS are presented in Section 7. Reference materials are listed in Section 8.

2. Tree Abundance, Diversity and Conditions in Middleport

Although a comprehensive inventory of the abundance, diversity and size of trees within the Study Area does not exist, two recent inventories of trees located in right-of-ways in the Village of Middleport are available. The inventories were commissioned by the Village of Middleport and were conducted by Micha Tree and Landscape Consultants in 2003 and Cutting Edge Tree Service and Consulting in 2007. Results of these inventories are included as Appendix A. The information from these inventories will be used herein to provide an overall indication of tree species and tree sizes (based on diameter at breast height [DBH]) found in a portion of the Study Area. Only trees with a DBH greater than 2 inches were inventoried. DBH is a commonly used measure or convention for rapidly describing the size of a tree. However, a similar DBH can reflect very different tree sizes (i.e., heights) between individual trees or across different species of trees due to different growth habits between species, or the potential effects of site specific conditions (i.e., water and nutrient availability) on a tree's development.

Both inventories provide information on the types of trees present in the Study Area (see a complete listing of trees in Table 2-1, attached). The 2007 inventory identified 664 trees across 25 species within Village street right-of-ways. Approximately 80% of the trees identified in the 2007 inventory were silver maple (*Acer saccharinum*), Norway maple (*Acer platinoides*), or sugar maple (*Acer saccharum*). Table 2-2 provides a summary of the range of sizes of the seven most common trees (comprising 91% of trees) identified in the 2007 inventory. Of these most common tree species, 80% of the identified trees had a DBH greater than or equal to 10 inches.

The 2007 tree inventory, and a one-day site reconnaissance conducted by ARCADIS in the fall of 2009, identified a range of conditions in the trees throughout the Study Area. Tree conditions ranged from "good" to "fair-poor" condition. In 2009, it was observed that most of the right-of-way trees have been significantly pruned due to their proximity to overhead utility lines. This observation is noteworthy because stresses on a tree caused by past pruning could exacerbate the adverse effects on a tree if soil excavation is attempted within its protected root zone. The health/condition of a tree has direct implications on the uses of and/or applicability of tree preservation measures (as discussed in Section 3). Appendix B includes photographs of some of the trees in the Study Area (including some of the pruned trees) that were observed during the 2009 site reconnaissance.

Table 2-2. Common Tree Species Identified in 2007 Inventory

Species Name (Common)	Percentage of Trees in Study Area Right-of-Ways	Summary Statistics of Tree Sizes (DBH in Inches)		Number of Trees By Size Class (DBH in Inches)			
		Range	Mean	2 – 5	5 – 10	10 – 15	> 15
Silver maple	36.6	2.5 to 42	20	8	13	2	216
Norway maple	35.7	2.5 to 22	12.5	13	51	114	55
Sugar maple	7.2	12 to 28	20	0	0	5	43
Locust	4.5	12 to 20	18	0	0	3	26
Spruce	2.6	~8	8	0	17	0	0
Littleleaf linden tree	2.4	2.5 to 16	10	3	7	4	2
Oak	2.0	6 to 14	10	0	7	6	0
Summary (total)[1]	91.0	-	-	24	95	134	342

[1] The total number of trees only reflects a subset (or most common) tree species identified in the tree inventories. A complete listing of identified trees is included in Table 2-1.

3. Impacts of Tree Health and Condition on Tree Preservation

The identification of trees potentially suitable for tree preservation and the identification and evaluation of appropriate tree preservation methods must take into consideration the overall health and condition of a tree. A tree's health is dependent upon the proper functioning of foundational physiological processes.[2] This section reviews the functions of the tree structure and factors, including physiological processes, potentially affecting tree health/survival, while the next section (Section 4) discusses Best Management Practices for tree preservation during construction activities.

3.1 Tree Structure and Function

A critical part of a tree's health is one that cannot be seen - the roots. Approximately 90 to 95% of the roots of trees present in the northeast U.S. are found within 36 inches below ground surface, with more than 50% within 12 inches of grade (Shigo 1989; Miller et al. 1993; Fite and Smiley 2008). The larger perennial roots of a tree and their primary branches characteristically grow horizontally between 6 to 24 inches below the soil surface. The finer roots (which average only 1/16 inch in diameter) which grow outward and upward from the larger woody roots are predominantly found within the top 6 inches of soil. The lateral extent of the roots typically includes at least the area within the "drip line" of the leaves as discussed further in Section 4.3. The roots of the tree provide three critical functions:

- Provide Structural Support: The roots provide the structural support of a tree. Literature suggests that the principal structural support of a tree is provided by the larger, coarse roots close to the base of the tree (Roberts et al. 2006), and that very little structural support is offered by the deeper roots or those further laterally from the base of the tree (Mattheck and Breloer 1994). These larger roots are believed to be long-lived (i.e., entire life of the tree), in contrast to the short-lived, fine roots.

[2] Photosynthesis allows a tree to capture energy from sunlight and convert it into chemical forms of energy that are used to support biological systems within the tree. The photosynthetic process begins with sun light striking chlorophyll within a tree's leaf. Through a series of reactions the energy in sunlight is converted into carbohydrates. Carbohydrates are then used by a tree to fuel all biological activities which include leaf development, growth, defense, and reproduction. Water and nutrient uptake occurs in the fine roots and epidermal cells of larger roots. Trees absorb water within their roots by osmosis, a process where water with a low concentration of minerals and nutrients passes through the root membrane towards an area that has a higher concentration of mineral and nutrients. Water is then transported from the roots to the leaves. This process is facilitated by water being lost within the leaves of a tree during transpiration (a process which supplies photosynthesis with carbon dioxide), and this loss of pressure within the leaves allows the tree to draw water and nutrients from its roots.

- Collect/Absorb Water and Nutrients: The major function of the fine roots is to absorb water and nutrients from the surrounding soil. The fine roots constitute a major portion of the total surface area of the root system, and grow outward and upward from the larger woody roots near the soil surface (i.e., top 6 inches of soil), where nutrients, water, and oxygen are characteristically available and abundant. They are commonly short-lived so that a tree is able to continually seek out un-tapped sources of water and nutrients within the soil.

- Store Water, Energy and Nutrients: The larger roots of trees conduct and store water, energy and nutrients essential to the survival of a tree. A tree characteristically stores excess energy produced during the growing season to support growth following dormancy. Existing stresses within an individual tree, whether they are caused by health, disease, or past management, cause a deficit of stored resources necessary to survival and increases the susceptibility of a tree to disease, pests, and/or general decline in health.

3.2 Factors Limiting Work in the Protected Root Zone

Disruptions within the protected root zone of a tree should be controlled and evaluated on a tree-by-tree basis. The likelihood that a tree will survive disruptions to the root system is dependent on a number of factors, as listed below.

- Tree Species: The ability of a tree to tolerate construction-related disturbance or damage is known to vary greatly by tree species (Matheny and Clark 1998). Different species have varying levels of tolerance to root severance, soil compaction and other common construction impacts. For example, silver maples have a poor-to-moderate tolerance in comparison to Norway maples, which have a moderate-to-good tolerance. Appendix C lists the relative tolerance of common tree species to the region. In addition, different species have varying susceptibilities to disease or pests. Thus, the species of a tree will have implications on the methods potentially appropriate to address soil within its protected root zone.

- Age and Health/Condition: The response of a tree to construction-related disturbance or damage, and its probability of survival, will vary greatly based upon its age and health/condition. For instance, an older tree with dwindling health will be less likely to survive potential stresses caused by the excavation/disturbance of soil from around the roots than a healthy younger tree. More specifically, a deficit of stored energy and/or nutrients can have amplified adverse consequences to a tree.

- Soil Type: The soil type within the protected root zone of a tree will directly affect the effectiveness and feasibility of any tree preservation measure that includes

excavation. For example, a sandy soil can more easily be excavated than a compacted silty clay soil. Based on soil boring logs conducted in the Study Area, the soil types predominantly consist of silty loams, but are greatly variable due to the development that has occurred over the past 100 plus years. Hence, the soil type that exists around a specific tree will vary on a case-by-case basis.

- Climate/Weather: The local climate will have implications on the implementation of remediation affecting the protected root zones of trees and tree preservation measures. In the Middleport area, such work will likely be implemented within the regional growing season, to avoid excavating in frozen soils and to prevent exposure of exposed roots to freezing conditions. It is estimated that frozen ground days occur from mid-December through early March. In addition, remedial design will also need to account for other climate factors. For example, a severe storm during or subsequent to excavation within the protected root zone of a tree could potentially threaten the structural stability of that tree or amplify existing stresses caused by the excavation.

3.3 Physiological Concerns for Excavation within the Protected Root Zone

Even with the implementation of precautions, any disruption to the root system decreases the probability of the long-term survival of the tree (Pirone et al. 1988; Urban 2008). Therefore, when evaluating whether soil excavation in the protected root zone is feasible for a particular tree, the following considerations should be evaluated with respect to the three principal functions of the roots:

- Structural Stability Considerations: Complete removal of soil within the protected root zone (e.g., to a depth of approximately 24 inches) would likely cause significant structural weaknesses, if not complete failure (i.e., tree falling down), of the root system of the tree. Application of structural supports would be extremely difficult or infeasible for a tree within an existing excavation area. ARCADIS is not aware of and did not identify any precedent for such an application.

  ARCADIS researched previously approved and implemented approaches of shallow soil remediation projects in residential neighborhoods where soil excavation was necessary around trees. The most common approach was removal of the tree. However, a few examples of mechanical or hand removal of soil within the protected root zone of a healthy tree are available. Those projects that did excavate soil within the protected root zone of a tree only did so to an approximate depth of 6 inches below the soil surface and were based upon field direction provided by a certified arborist (USEPA 2008, 2009; CH2M Hill 2009; ARCADIS pers. comm. 2009). These projects included (1) Myers Property Superfund Site, Franklin Township, Hunterdon County, New Jersey; (2) South Minneapolis Residential Soil Contamination Site, Minneapolis, Minnesota; and

(3) two projects completed by ARCADIS for confidential clients in South Carolina and Indiana.

Urban (2008) suggests that phased excavation by removing soil in small sections (zones or area sectors) at a time is possible when using pneumatic pressure (such as the Air Spade®) or potentially hydraulic pressure. The protected root zone could be divided into a minimum of two to three zones or area sectors and phasing excavation at a rate of one zone per year. This could maintain the structural stability as well as minimize adverse affects to the tree's health and/or condition of a tree while attempting complete replacement of soil within the protected root zone. However, no examples involving a phased excavation approach were found relative to a soil remediation project within residential neighborhoods.

- Water / Nutrient Uptake Considerations: Any selected soil excavation method will likely cause a physical disturbance of the fine root biomass and the ability of the tree to uptake water and nutrients. If the roots become too dry, then root hairs wither and the tree is no longer able to absorb water and nutrients. Root hairs dry out quickly when exposed to situations where there is no moisture. Conversely, if the soil is too wet or compacted, roots suffocate and lose their absorbing capacity. If the soil around a tree is compacted or permanently wet, then air is unable to penetrate the soil and the root system can suffocate.

  The few identified cases of implementation of shallow soil remediation projects in residential neighborhoods only attempted manual (i.e., by hand) excavation to depths up to approximately 6-inches within the protected root zone. Manual excavation was selected due to the difficulties of implementation and inconvenience to residents associated with other methods, such as pneumatic excavation. Tree survival rate after one year is high (i.e., approximately 90%) and commonly shows a direct correlation to the health of the tree prior to excavation.

- Energy / Nutrient Storage Considerations: The stress to a tree caused by excavating soil from within the protected root zone will adversely affect the storage and distribution of energy and nutrients, and hence, will decrease the ability of the tree to defend against pests and/or diseases. For example, bark boring beetles are known to be attracted to weakened and/or dying trees (Sinclair and Lyon 2005). Another example is that many fungi normally do little damage to trees growing under proper conditions, but can readily destroy trees when growing under adverse conditions (Pirone et al. 1988).

4. Best Management Practices for Tree Preservation

Considerable information and technical guidance are available on protecting, preserving, maintaining and/or removing trees within or near a construction site. While the Best Management Practices from the various information sources do not describe the selection of a remedial strategy and are not specific to environmental remediation projects, they provide the basis for planning a remediation/construction project with emphasis on tree preservation. Best Management Practices would be implemented, as appropriate, along with each tree preservation measure identified in Section 5. The framework for Best Management Practices includes the following activities:

- Coordination of tree preservation activities before/during/after construction
- Identification of trees to be preserved during construction
- Establishment of protected root zones
- Avoidance of unacceptable soil compaction
- Appropriate soil replacement

4.1 Coordination of Tree Preservation Activities before/during/after Construction

*Best Management Practices: Managing Trees During Construction (*Fite and Smiley 2008) recommends dividing a construction project into five phases, noting that the fate of a tree can be affected during each of these phases. The five recommended phases of tree preservation activities are as follows:

- Planning: The planning phase includes a full inventory of trees within a project site. The trees are characterized in terms of maturity, size, condition and other factors that determine whether the tree could/should be preserved.
- Design: During the design phase, trees are identified either for preservation or removal, based on the site-specific conditions, remediation needs, susceptibility to construction damage and/or the location within a project site. This phase includes developing design drawings and associated construction details and specifications for recommended Best Management Practices.
- Pre-Construction: During the pre-construction phase, Best Management Practices are selected for those trees identified for preservation (e.g., delineating the protected root zone of a tree). This phase also includes removing those trees not selected for preservation.

- Construction: The goal of the construction phase is to maintain the integrity of the protected root zone, while being consistent with the design drawings and maintaining effective communication within the project team to allow for adaptive management if necessary.
- Post-Construction: The post-construction phase would involve monitoring the health/condition of the tree following construction activities. The landowner would be responsible for this phase of the project, which would primarily focus on appropriate watering and fertilizing of a tree.

4.2 Identification of Trees to be Preserved During Construction

The planning and design phases of the project will evaluate the inventory of trees within the project site, and in cooperation with the landowner(s), make the critical decision of which trees to preserve. It must be recognized that some trees cannot be preserved regardless of the preservation measures that might be implemented. Trees in poor health/condition, structurally unstable or otherwise determined to be unable to survive excavation/disturbance of soil within the protected root zone should not be selected for preservation. As noted in Section 3, the probability of survival of older, unhealthy trees significantly decreases when attempting excavation within the protected root zone. Any subsequent need to remove a tree after completion of the remedial activities by FMC would not be within the scope of FMC's corrective measures. Therefore, identification of trees that will be preserved within the Study Area should be conducted in consultation with the property owner based on 1) owners desire to preserve a tree; 2) physiological considerations of the tree(s); 3) consideration of the aesthetic effect of the tree(s) on a property and/or neighborhood; and 4) the extent of soil removal/disturbance required for completion of the corrective measure.

Factors limiting the effectiveness of work within the protected root zone of a tree include tree species, location, structural stability, health/condition and age, soil characteristics within the protected root zone, as well as weather conditions during the construction activities, as discussed in Section 3.2. The ability of a tree to tolerate construction-related disturbance or damage is known to vary greatly by tree species. While construction tolerance is an important trait in the evaluation of whether to preserve an individual tree, the response of a particular tree also depends upon a tree's age, health, previous injuries, soil conditions, susceptibility to pests, and the time of year of proposed construction.

The aesthetics of a tree or trees on a property and/or neighborhood will also be considered in the design phase. Some trees provide greater aesthetic benefits (e.g., shade, property character) than others. While evaluating aesthetic benefits is often subjective, this will be included in the planning and design phases of the project.

The extent of soil removal/disturbance required for completion of the corrective measure also needs to be considered when identifying which trees to preserve. This would be likely based on levels of constituents found in the soil within the protected root zone of the tree and the actual excavation depths required for the Agencies to determine that FMC has completed the corrective measures for the affected area/property.

4.3 Establishment of Protected Root Zones

One of the most effective Best Management Practices to preserve a tree is to delineate and protect (from construction activities) the protected root zone of a tree. As Urban (2008) notes, "[w]henever natural soil is disturbed, it loses some of its ability to support plant life by losing its structure."

There are several methods used by arborists to identify the protected root zone. One of the most common methods of such identification is based on the "drip line" of a tree. The "drip line" is defined as all areas directly below the branches of a tree. However, varying site or environmental conditions can lead to the "drip line" not including a sufficient area of the critical root zone for successful preservation. For example, trees growing in close proximity to existing structures or other trees may have a narrow growth habit. In these circumstances, the protected root zone may be calculated by an arborist based upon the diameter of the tree and the species' tolerance to construction damage. The DBH (in inches) of the tree is multiplied by a factor ranging from 6 to 18, depending upon the tolerance factor of the tree species (Appendix C) to obtain the radius of the protected root zone (in feet). Table 4-1 (attached) provides guidelines that are used by arborists for determining the protected root zone of healthy, structurally sound trees. Figure 4-1 illustrates the potential difference of delineating the protected root zone based upon the "drip line" method in comparison to the tree diameter method.

Construction planning should also involve an arborist to evaluate the chance of survival of a given tree if soils need to be removed from within the protected root zone of a tree. A publication entitled *Preserving Trees in Construction Sites* (Dicke and Raymond 2004) notes that the reduction of the protected area around a tree significantly reduces the likelihood of survival and recommends protecting a minimum of 70% of the protected root zone from construction activities. The publication qualifies this recommendation by excluding unhealthy trees or species susceptible to damage from construction.

4.4 Avoidance of Unacceptable Soil Compaction

Soil compaction is often the greatest threat to an individual tree within a typical construction site (Fite and Smiley 2008; Miller et al. 1993; Dicke and Raymond 2004).

Stockpiling of building materials, heavy machinery traffic, and even excessive foot traffic can all result in soil compaction and damage to soil structure. The compaction of soils reduces pore space, and thus can lead to lack of aeration, lack of water penetration below ground surface, lack of root growth and root suffocation and thus a disruption in basic physiological processes (i.e., photosynthesis, transpiration) critical to tree survival. Best Management Practices must ensure that any traffic or activities that result in compaction be avoided in the protected root zone. Further, any backfilled material within the protected root zone should not be compacted to an extent that prevents aeration and adversely affects the ability of the tree to uptake water and nutrients. Best Management Practices may include prohibiting or minimizing access to certain areas, using equipment with proper flotation to minimize compaction, and/or temporarily mulching the protected root zone with wood chips or gravel.

4.5 Appropriate Soil Replacement

Any excavation within the protected root zone of a tree would require the replacement of the contaminated soil that was removed. A soil replacement plan would be developed to identify the proper soil characteristics for backfill and topsoil and to identify the soil compaction necessary to ensure structural stability of the tree, while not compacting to an extent that would adversely impact the soil aeration around the existing roots. The method for soil replacement would depend upon the depth of excavation. Shallow excavation (e.g., depths up to 6 inches) would be addressed by filling with compaction-resistant soils and then light compaction with water and/or low impact tools. A deeper excavation would likely require multiple phases of compaction to maintain structural stability of the tree while not deterring future root growth within the disturbed areas.

In addition, the soil replacement plan would evaluate any potential soil amendments required to promote the long-term survival of the affected tree. For example, many trees rely on a fungus called mycorrhizae to maximize their mineral absorption capacities. These microrrhizae colonize the roots of a host plant and are able to establish a symbiotic (commonly mutualistic) association where the fungus receives carbohydrates in return for water and minerals. Excavation of soil from within the protected root zone could adversely affect these fungi, and have detrimental impacts on a tree's water and nutrient uptake capacities. The soil replacement plan should evaluate the need for including microrrhizae amendments or inoculations based upon the species of tree.

5. Identification of Potential Tree Preservation Measures

Table 5-1 (below) lists the potential tree preservation measures that have been identified to address impacted soil within the protected root zone of trees identified for preservation, as discussed in Section 4.2. Included in this list are two measures (i.e., Measures 2a and 2b) which would remove trees and replace them with nursery stock trees. While these measures are not specifically tree preservation measures, they have been included as part of this evaluation because (1) a tree removal and replacement plan was previously approved and implemented for ICMs within the Study Area, and/or (2) in at least the long term, replacement would contribute to maintenance of the aesthetic character of a property and neighborhood. All identified measures would be implemented along with the various Best Management Practices identified in Section 4.

Table 5-1 - Identification of Potential Tree Preservation Measures

Measure Number	Description
1	No Soil Removal within the Protected Root Zone
2a	Tree Removal and Replacement with Nursery Stock Trees
2b	Phased (Extended Time) Tree Removal and Replacement With Nursery Stock Trees
3a	Limited Depth Manual Excavation within the Protected Root Zone
3b	Phased Sector Manual Excavation within the Protected Root Zone
4a	Limited Depth Pneumatic Excavation within the Protected Root Zone
4b	Phased Sector Pneumatic Excavation within the Protected Root Zone
5a	Limited Depth Hydraulic Excavation within the Protected Root Zone
5b	Phased Sector Hydraulic Excavation within the Protected Root Zone

A description of each potential measure is provided below. A summary of the evaluation of these measures is provided in Section 6. It is important to note that no single tree preservation measure will apply to all situations within the Study Area. Each property will have to be evaluated on an individual and neighborhood-wide basis. Remedial design will require planning to evaluate the potential to maintain the existing aesthetic character of an individual property and neighborhood while also attempting to

minimize potential exposure to impacted soils within the protected root zones of these trees.

5.1 Measure 1: No Soil Removal within the Protected Root Zone

This measure would involve no excavation within the protected root zones of trees in the Study Area. This approach relies on the presence of the tree and tree roots to serve as a binding mechanism to limit exposure and mitigate contaminant migration via soil erosion and leaching. This measure could allow higher soil arsenic concentrations within the protected root zone of a tree in comparison to the remaining portions of a property. Implementation of this measure may require risk evaluation and/or establishment of institutional controls or management practices to minimize potential human exposures to unacceptable levels of constituents in soil located within the protected root zones of these trees.

5.2 Measure 2: Tree Removal and Replacement

The removal and replacement measures would consist of the complete removal of trees to facilitate soil removal within the protected root zones and replacement with nursery stock trees. For the purposes of this Technical Memorandum, standard nursery stock trees are assumed to be equal to or less than 2-inch DBH and in the first third of their characteristic life span. Use of nursery stock trees as a restoration measure is consistent with the previously approved and implemented ICMs within the Study Area. For this evaluation, two potential approaches for excavation and replacement of trees are identified and are discussed below.

- **Measure 2a – Tree Removal and Replacement with Nursery Stock Trees:** This measure would include the removal of trees to facilitate soil excavation and restoration with standard nursery stock trees. This approach provides flexibility to the property owner in deciding type, placement and timing for trees planted on their property. Although this approach would effectively remove all impacted soil, it has the potential to impact the aesthetic character of a property and neighborhood. Trees can take many years to mature and develop the canopy characteristics that bring much of the existing character to the affected neighborhood and properties. A conceptual illustration of the potential growth of a planted nursery stock sugar maple over an interval of 40 years is provided as Figure 5-1.

- **Measure 2b – Phased (Extended Time) Tree Removal and Replacement with Nursery Stock Trees:** This approach consists of the completion of remedial activities within the Study Area phased over time to maintain the current aesthetic character of Middleport to the extent practicable. For example, remediation activities within the active right-of-ways could be delayed for a pre-determined time period to maintain some of the character of Middleport while the small replacement

trees on adjoining properties are provided time to mature. This approach would require completion of the soil removal activities over many years and would significantly extend the time required to complete the corrective measures for the Study Area. The interval of time between phases could depend upon anticipated growth rates of planted nursery stock trees (as illustrated in Figure 5-1), which characteristically take many years to mature and develop the canopy characteristics that bring much of the existing character to the affected neighborhood and properties.

5.3 Measure 3: Manual Excavation within the Protected Root Zone

Manual excavation is the most common method used when remediating soils within the protected root zones of trees at other sites around the United States (USEPA 2008 and 2009; CH2M Hill 2009; ARCADIS pers. comm. 2009). Previous projects which have attempted manual excavation used shovels, trowels, picks, and "micro-excavators," depending on the specific conditions of the tree being preserved. This measure was evaluated based on using a limited depth approach and a phased sector approach, as described below.

- **Measure 3a – Limited Depth Manual Excavation (for soil removal depths up to 6 inches):** This measure would consist of manually excavating soil within the protected root zone to a maximum depth of 6 inches below ground surface in one continuous effort. A maximum of six inches below ground surface was selected based upon (1) precedent established at four other identified similar remedial projects within the U.S. (USEPA 2008, 2009; CH2M Hill 2009; ARCADIS pers. comm. 2009); and (2) the larger perennial roots of a tree characteristically grow horizontally at depths from approximately 6 to 24 inches below the soil surface.

  Following removal of this surface soil, the excavation would be backfilled with clean compaction-resistant soil. If impacted soil remains at depth, this backfill would serve as a soil cover and would prevent exposure. Appropriate Best Management Practices and/or institutional controls would be applied to minimize potential exposure to impacted soils remaining beneath a depth of six inches. Long term maintenance or monitoring of the preserved tree (i.e., watering, fertilizing) and/or subsequent removal of the tree would be the responsibility of the property owner.

- **Measure 3b – Phased Sector Manual Excavation (for soil removal depths greater than 6 inches):** This measure would involve manually excavating soil within the protected root zone using a phased sector approach. This approach would divide the protected root zone into a minimum of three area sectors, with excavation spanning over a minimum of three years (i.e., one zone per year). This would enable excavation deeper than 6 inches below ground surface in a manner

that attempts to maintain the structural stability of a tree while limiting adverse effects on the health or condition of a tree.

This measure would allow removal of soil containing unacceptable levels of potential FMC-related constituents within the protected root zone to depths greater than 6 inches below the soil surface. Long term maintenance or monitoring of the preserved tree (i.e., watering, fertilizing) and/or subsequent removal of the tree would be the responsibility of the property owner.

5.4 Measure 4: Pneumatic Excavation within the Protected Root Zone

Pneumatic excavation involves the use of high pressure air to excavate soils within the protected root zone of a tree. Common arborist tools, such as the Air Spade®, focus compressed air into a high speed jet stream of air, which is able to dislodge and break apart soils from around tree roots without unduly damaging the roots. After loosening, the dislodged soil can be removed by a commercial vacuum truck. Based upon factory specifications, the Air Spade® can excavate several feet in depth in medium to stiff soil at a rate of about 1 to 2 inches per second.

Utilizing pneumatic pressure can potentially minimize impacts to roots, reduce the time necessary to excavate a large area within the protected root zone, and minimize impacts to surrounding infrastructure. By minimizing the impacts to fine root biomass, this measure would aid in recovery time by providing greater levels of water and nutrient uptake immediately after excavation. In addition, the reduced time needed for excavation decreases the time that roots are exposed and helps prevent them from drying out. Both a phased area sector approach and a limited depth approach identified in this measure are described below.

- **Measure 4a – Limited Depth Pneumatic Excavation:** This measure is the same as Measure 3a, except that the soil would be removed by using compressed air (i.e., Air Spade®).

- **Measure 4b –Phased Sector Pneumatic Excavation:** This measure is the same as Measure 3b, except that the soil would be removed by using compressed air (i.e., Air Spade®).

5.5 Measure 5: Hydraulic Excavation within the Protected Root Zone

Hydraulic excavation involves the use of water pressure to excavate soil from within the protected root zone of a tree. Similar to pneumatic excavation, hydraulic power can be used to free compacted and immobilized soil from within roots. Excavated soil would be removed from the work area in the form of a slurry (i.e., a thick suspension of solids in a liquid), which would be pumped to a truck and subsequently dewatered for

proper disposal. Both a phased area sector approach and a limited depth approach were identified for this measure, as described below.

- **Measure 5a – Limited Depth Hydraulic Excavation:** This measure is the same as Measure 3a, except that the soil would be removed by using high pressure water.

- **Measure 5b – Phased Sector Hydraulic Excavation:** This measure is the same as Measure 3b, except that the soil would be removed by using high pressure water.

6. Evaluation of Potential Tree Preservation Measures for Middleport

The potential tree preservation measures identified in Section 5 are assessed based on nine factors listed below. These nine factors were selected to best represent the evaluation criteria identified in the CMS Work Plan (AMEC Geomatrix 2009) and the objectives set forth in Section 1.2 of this report. The first two factors specifically address the effectiveness of the potential measure, while the remaining seven factors address various aspects of the implementability of the potential measure.

- Effectiveness of soil removal
- Maintenance of character of property and neighborhood
- Relative ease of implementation
- Minimizing inconvenience to property owners (i.e., noise and length of construction)
- Tree structural stability
- Tree survival probability
- Post-restoration maintenance
- Short- and long-term safety
- Cost effectiveness

The evaluation of tree preservation measures was performed based upon a review of published literature, a review of similar soil remediation projects within other residential neighborhoods, consultations with local arborists and regional tree specialists, and best professional judgment. Results of the evaluation are provided below, organized according to each evaluation factor, and summarized in Table 6-1.

As noted in Section 5, no single tree preservation measure would apply to all situations within the Study Area. However, to evaluate the effectiveness of each measure, it is assumed below that each measure would be applied across an entire affected property.

6.1 Effectiveness of Soil Removal

The potential measures were evaluated relative to the degree to which soils containing unacceptable levels of FMC-related constituents (i.e., arsenic) within the protected root zone of trees would be removed. This evaluation assumes that construction would be completed during the growing season of the tree as discussed in Section 3.2. A low rating for this factor means the measure would provide a low level of effectiveness

relative to soil removal within the protected root zone of a tree, while a high rating means this measure would be very effective.

- **Measure 1 – Not Applicable**. This measure is not applicable, as no excavation would occur within the protected root zone of identified trees.

- **Measures 2a and 2b – High**. The two tree removal and replacement measures scored a high rating as these approaches provide an effective and practicable approach to soil removal by removing trees from within the Study Area. This approach is the one most commonly implemented in soil remediation projects across the U.S., and Measure 2a has been previously implemented successfully during the ICMs that have been conducted in Middleport (e.g., for the Western Residential Properties and the 2007 Early Action work).

- **Measures 3a, 4a, and 5a – Low-to-High.** The limited depth excavation measures scored a rating of low-to-high for effectiveness of soil removal, depending on the extent of impacted soils left below 6 inches of the ground surface and the identified soil textures (to be determined during the planning phase of this project) within the protected root zone. Using any of the three excavation methods, soil could likely be effectively removed to 6 inches below ground surface across the entire protected root zone of a tree in one phase of excavation. Presence of heavily compacted or clayey soils within the protected root zone could affect the time requirements and/or effectiveness of soil excavation.

  Impacted areas would be replaced with clean soil cover, which would reduce the potential for direct human exposure to deeper soils. This approach has been implemented using manual excavation (Measure 3a) in similar residential remedial projects (USEPA 2008, 2009; CH2M Hill 2009; ARCADIS pers. comm. 2009), and could be completed within a single mobilization and construction season.

  These measures would potentially leave soil containing higher levels of arsenic within protected root zones of trees below 6 inches. However, removal of the surface soil containing unacceptable levels of arsenic and replacement with clean soil containing lower arsenic concentrations would reduce human health risks and would reduce the overall average soil arsenic level of the soil within the protected root zone. If the Agencies determine that the remaining soil arsenic levels beneath the 6-inch thick clean surface soil require further controls, these might take the form of institutional controls and/or management practices to minimize potential future human exposures.

  Under these measures, individual property owners would be responsible for each tree preserved on their property. In addition, each individual property owner would be responsible for maintaining (or even monitoring) the soil cover and preventing

erosion around the base of the tree or preventing the digging to a depth greater than 6 inches that may result in human exposure of unexcavated subsurface soil within the protected root zone.

- **Measures 3b, 4b, and 5b – Low-to-Moderate**. The phased zone excavation measures scored a low-to-moderate rating for effectiveness of soil removal. First, ARCADIS was unable to identify any precedent for a phased excavation deeper than approximately 6 inches within the protected root zone in similar residential remediation projects. Second, such excavation presents significant issues, including (1) difficulties in maintaining the structural integrity of the tree when excavating around structurally important roots, and (2) difficulties removing soil below 6 inches where the complexity of root systems typically increase. Due to the latter, some soil may not be accessible or may need to remain to preserve the long-term health of the tree as well as maintain structural integrity of the tree during excavation. However, this approach would reduce the average soil arsenic levels within the protected root zone and provide cover with clean soil, thereby reducing human health risks associated with impacted soils within the protected root zone. Potential differences between the excavation methods (e.g., pneumatic, hydraulic) are not significant enough to warrant different ratings for this factor.

6.2 Maintenance of Character of Property and Neighborhood

The evaluation of this factor addresses the ability of a measure to maintain the aesthetic character and other benefits to the property owner (such as shade) that are provided by existing trees. The planning and design phase will evaluate which trees are suitable for preservation in attempt to maintain the aesthetic character of a property, as well as the expanded effects across the community. To effectively evaluate the difference between each measure relative to this criterion, it is assumed that each measure is applied across an entire affected property. This approach differentiates which measures have a positive effect on maintenance of the aesthetic character of a property and those which will have a negative effect. A low rating indicates that the measure would result in removal of mature trees and replacement with typical nursery stock trees (equal to or less than 2-inch DBH). A high rating indicates that implementation of the measure would maintain mature, healthy trees within the Study Area to the extent that the aesthetic character of the property is not significantly changed.

- **Measure 1 – High.** This measure would involve no tree removal. Therefore, this measure was assessed a high rating.

- **Measure 2a – Low.** This measure was given a low rating as it would involve the removal of trees to facilitate the remedial process. The planting of nursery stock trees to replace the removed larger trees would have a negative effect, at least in the short term, on the aesthetic character of an affected property and

neighborhood. As discussed in Section 2, approximately 80% of the trees within Village right-of-ways have a DBH greater than 10 inches. Replacement with nursery stock trees of the same species would require decades of growth to replace the size of these trees.

- **Measure 2b – Low-to-Moderate.** This measure was given a low-to-moderate rating as it would include multiple phases of remedial excavation to allow a greater number of existing mature trees to remain in a property and neighborhood for a longer period of time in order to maintain the aesthetic character of the affected property and neighborhood. This measure could include delaying remediation activities within the Village right-of-ways for a pre-determined period to maintain some of the aesthetic character while the smaller replacement trees on adjoining properties are provided time to grow. In theory, this measure allows planted trees a period of several years to develop aesthetic characteristics important to a property and neighborhood. However, given the years of growth required, and the species of trees that grow in this climate, there may be little advantage to including multiple phases of remedial excavation over an interval of several years (e.g., less than five years). It should also be noted that many of the trees within Village right-of-ways have been significantly affected by pruning due to their proximity to aboveground utility lines. Therefore, delaying the remediation/removal of trees from the right-of-ways may not significantly improve the post-remediation aesthetic character of some neighborhoods.

- **Measures 3a, 4a, and 5a– High**. A high rating was given to the three limited depth excavation measures, as they would attempt to preserve mature, healthy trees within the Study Area by excavating impacted soils within the protected root zone. If successful, implementation of any of these three approaches would avoid or minimize direct effects to the aesthetic character of a property and neighborhood.

  As noted in Section 4.2, certain mature trees may not be able to be saved using these measures based on various tree- and site-specific factors (i.e.; size, location, age, health and condition of the tree). The planning and design phases of this project would identify and exclude such trees from preservation measures as appropriate.

- **Measures 3b, and 4b – Moderate.** A moderate rating was given to the manual and pneumatic phased sector excavation measures, as the probability of long-term tree survival is less than a limited depth excavation approach. A lower survival rate would have an adverse affect on the aesthetic character of a property and neighborhood.

- **Measures 5b – Low.** A low rating was given to the hydraulic phased sector excavation measure due to the very low probability for long-term tree survival. This

approach significantly increases the risk to the tree's roots as hydraulic pressure can sever and/or injure both fine and coarse roots.

6.3 Relative Ease of Implementation

This factor considered the ease of implementing each measure from a construction perspective. A low rating indicates that implementation of the measure would be difficult, while a high rating means the measure could be readily implemented.

- **Measure 1 – High**. The ease and practicability of implementing Measure 1 was assessed as high because it would not involve implementation of any further remedial actions within the protected root zone of a tree within the Study Area.
- **Measure 2a – High**. The ease and practicability of implementing Measure 2a was also assessed as high because this approach was previously implemented during earlier phases of this project. It is the most commonly used remedial approach across the U.S.
- **Measure 2b – Moderate**. The ease and practicability of implementing Measure 2b is similar to that of Measure 2a, except that additional time and mobilizations are needed to complete the corrective measures. Therefore, Measure 2b was given a moderate rating.

- **Measure 3a – Moderate**. A moderate rating was given to the limited depth manual excavation measure (Measure 3a). Similar remedial projects have demonstrated that a limited depth manual excavation to approximately 6 inches below ground surface can be successfully implemented. This measure attempts to maintain the structural integrity of the tree while also avoiding detrimental impacts by confining excavation within the top 6 inches from the ground surface to avoid excavation around and disturbance of structurally important perennial roots. However, excavation within the protected root zone using any method will always increase the complexity and difficulty of implementation in comparison to the tree removal and soil excavation measures (Measures 2a and 2b). Previous projects which have attempted manual excavation used shovels, trowels, picks, and "micro-excavators," depending on the specific conditions of the tree being preserved. This measure would require full-time construction oversight by a professional arborist to address any issues that may arise and to monitor potential exposure of the tree's roots to ensure that appropriate moisture levels are maintained.

- **Measure 3b – Low.** A low rating was given to the phased sector manual excavation measure (Measure 3b). Excavation within the protected root zone using this method increases the complexity and difficulty of implementation with (1) an increasing depth from the ground surface, and (2) possibly extending multiple phases of excavation over several years (i.e., minimum of 2 to 3 years).

Implementation of this measure would require full-time construction oversight by a professional arborist to address issues as they arise and to monitor the tree roots so they maintain appropriate moisture levels.

- **Measures 4a and 4b - Low**. A low rating was given to both pneumatic excavation measures. The implementation of pneumatic excavation would be subject to several challenges, including difficulty in controlling fugitive dust and frequent clogging and repair of the vacuum line. ARCADIS has conducted a number of pilot studies on similar residential soil remediation sites to evaluate the effectiveness and efficiency of using pneumatic pressure to excavate soils from within the protected root zone of a tree. These pilot studies demonstrated that the potential advantages of this approach (i.e., time of excavation, minimized impacts to tree roots) do not outweigh the disadvantages (i.e., repair of equipment/unclogging of vacuum lines, noise and dust associated with excavation). In fact, ARCADIS has found better results with implementing manual excavation and incorporating full-time construction oversight by a licensed arborist. However, there may be locations within the Study Area where strategic excavations with pneumatic pressure may be effective and more appropriate than manual excavation.

- **Measures 5a and 5b – Low.** A low rating was given to the two hydraulic excavation measures. Implementing a hydraulic excavation approach would present many disadvantages such as increased safety concerns (discussed in Section 6.8), increased risk of damaging infrastructure (such as severing plastic pipes or cables), and increased risk to the tree's roots as hydraulic pressure can sever and/or injure both fine and coarse roots.

  In addition, controlling the excavation and containing impacted soils within the project site would be difficult as mud would quickly form within the work site and the depth of excavation would become uncontrollable. Removal of excavated soil in the form of a slurry would then require pumping from the work site and subsequent dewatering to facilitate appropriate disposal of excavated soils.

6.4 Minimizing Inconvenience to Property Owners

This factor focused on the degree to which each measure would impact the daily lives of the property owners. Primary considerations would be the amount of noise generated during remediation and the time/duration of construction activities. A low rating indicates a higher degree of inconvenience to the property owners. For example, multiple excavations spanning over multiple years with a high level of noise associated with the remediation activities would rate low. A high rating means property owners would experience little or no additional inconvenience due to factors such as brief construction intervals and minimal to no associated noise.

- **Measure 1 – High**. A high rating was given as it would not involve active remediation within the protected root zones of trees within the Study Area; therefore, the property owners and residents would not be inconvenienced as a result of measures to preserve trees within the Study Area.

- **Measure 2a – Moderate**. A moderate rating was given as this is a proven measure that can be implemented quickly (i.e., one phase), but would entail some level of additional inconvenience to the property owners.

- **Measure 2b – Low**. A low rating was given as remedial activities would take place over an interval of many years and would take multiple mobilization efforts to complete the work. Property owners and residents would be inconvenienced over several years and multiple mobilization efforts to complete the excavation. In addition, this approach would extend the overall restoration process and the time interval necessary to restore affected properties.

- **Measure 3a – Moderate and Measure 3b – Low**. A moderate rating was assigned for Measure 3a, while Measure 3b was given a low rating. There is limited noise associated with manual excavation (in comparison to the other identified excavation measures), and the limited depth approach (3a) allows all excavation to be completed in one phase. The phased manual excavation (3b) approach increases the time required for excavation (could extend up to a minimum of three years), and therefore as described with respect to Measure 2b, above, scored lower.

- **Measures 4a, 4b, 5a and 5b – Low**. A low rating was given to the two pneumatic and the two hydraulic measures. Property owners would be inconvenienced by the noise generated by the equipment, duration of construction activities, and, with Measures 4b and 5b, multiple mobilizations over a number of years and the increased truck traffic on Middleport streets. ARCADIS has found on similar residential remediation sites that communities were in favor of a manual excavation due to the noise level and duration associated with pneumatic (or comparably loud hydraulic) excavation.

6.5 Tree Structural Stability

This factor pertains to the ability of a measure to maintain and protect the structural stability of trees. A low rating indicates that the measure would be less effective in protecting the tree's structural stability, while a high rating means the measure would be more effective.

- **Measure 1 – High.** A high rating was given as no active soil removal activities would be performed within the protected root zone of a tree in the Study Area.

- **Measures 2a and 2b – Not Applicable**. The two tree removal and replacement measures do not attempt to preserve a tree. Therefore, this factor was judged to be not applicable for these measures.

- **Measures 3a and 4a – High**. A high rating was given to the manual and pneumatic limited depth excavation measures. As noted in Section 3.1, depending on the species of tree, the larger structurally important roots of a tree occur 6 to 24 inches below ground surface. By limiting the depth of excavation, and with full-time construction oversight by an arborist, these measures would not affect the structural stability of a tree and therefore mitigate any risks of a windfall during or after excavation.

- **Measures 3b and 4b – Moderate**. A moderate rating was given to the manual and pneumatic phased sector excavation measures. While a phased sector approach is specifically designed to address the structural stability of a tree, any excavating around the larger structurally important roots increases the risk that some potential damage may occur to the roots which are critical to a tree's structural stability.

- **Measures 5a and 5b – Low**. A low rating was given to both hydraulic measures based on the difficulty to control depth of excavation and the high risk for severing or injuring structurally important roots when using hydraulic pressure.

6.6 Tree Survival Probability

This factor assessed the probability of a tree's survival after implementing a particular measure. Measures were given a low rating if the likelihood of a tree's survival after implementation was judged to be low. A high rating was given to measures where the probability of tree survival would not be affected.

It is important to note that tree injuries and their effects may not be evident until after the completion of construction activities. Any subsequent need for long term maintenance or monitoring of a preserved tree (i.e., watering or fertilizing) and/or subsequent removal of the tree after completion of the corrective measures activities by FMC would not be within the scope of FMC's corrective measures.

- **Measure 1 – High**. A high rating was given as no active soil removal activities would be performed within the protected root zone of a tree in the Study Area.

- **Measures 2a and 2b – Not applicable**. The two tree removal and replacement measures do not attempt to preserve a tree. Therefore, this factor was judged to be not applicable for these measures.

- **Measure 3a – High and Measure 3b – Moderate**. A high rating was given to Measure 3a as manual excavation allows careful consideration of roots and root structures, and could be applied in a variety of soil types. With full-time construction oversight by a professional arborist, previously implemented ARCADIS remedial projects have documented high (i.e., approximately 90% or greater) survival rates of trees when excavation depths within the protected root zones are limited to approximately 6 inches below ground surface.

  Measure 3b received a moderate rating due to the complexity of roots below 6 inches of the ground surface and the increased likelihood for cutting, tearing, and abrasions to the coarse tree roots. Injuries to coarse roots could amplify the effects of the removal of a portion of fine root biomass, and a tree's overall ability to uptake water and nutrients and distribute throughout the tree. Adaptive management below 6 inches becomes more difficult for the arborist to effectively address damages (i.e., provide preventative care) caused to coarse tree roots.

- **Measure 4a – High and Measure 4b – Moderate**. A high rating was given to Measure 4a and a moderate rating was given to Measure 4b. An assessment of both pneumatic excavation measures reflect those of the manual excavation measures discussed above for Measures 3a and 3b. It was judged that the long-term benefits of using the Air-Spade® instead of manual excavation are comparable in terms of the probability of a tree's long-term survival.

- **Measures 5a and 5b – Low**. A low rating was given to both hydraulic measures as it is difficult to control the depth of hydraulic excavation which increases the risk of cutting or tearing both coarse and fine roots.

6.7 Post-Restoration Maintenance

This evaluation factor considered the need for tree maintenance activities after a measure is implemented. The level of required "after care" or post-restoration maintenance normally will be minimal and could be easily accomplished by the property owner. The primary maintenance activities to support an affected tree will focus on watering and potentially fertilizing over time. A low rating for this factor indicates a higher level of required maintenance activities. A high rating indicates minimal or no maintenance activities would be needed.

- **Measure 1 – Not Applicable**. This factor is not applicable for Measure 1 because no active soil removal activities would be performed within the protected root zone of a tree in the Study Area. Therefore, no trees would be affected and post-restoration maintenance would not be required.

- **Measures 2a and 2b – High**. Measures including tree removal and subsequent planting of nursery stock trees were both given a high rating relative to the level of required post-restoration maintenance. Smaller nursery stock trees often have high growth rates, higher survival rates, and are less susceptible to initial decline of health/condition (in comparison to larger transplanted trees). This is primarily the result of a smaller percentage of roots being removed during transplanting, in comparison to larger transplanted trees. The level of maintenance following planting would include watering and fertilizing.

- **Measures 3a and 4a – Moderate**. A moderate rating was given to both the manual and pneumatic limited depth excavation measures. While shallow excavation increases the probability for long-term survival of a tree, any excavation within the protected root zone causes a threat to a tree's health. Post-restoration maintenance for these two measures would include watering and fertilizing, but could also include monitoring for general decline of health/condition in the tree due to possible damage during excavation. As noted above, tree injuries and their effects may not be evident until after the completion of construction activities.

- **Measures 3b and 4b – Low.** A low rating was given to both the manual and pneumatic phased excavation measures. Excavation within the protected root zone at depths greater than 6 inches increases the likelihood for cutting, tearing, and abrasions to the coarse tree roots. The presence of a full-time arborist during construction would allow issues to be immediately addressed as they arise. Post-restoration maintenance for these two measures would include watering and fertilizing. Additional maintenance activities may include monitoring for general decline of health/condition of the tree due to the lower survival probabilities when excavating below 6 inches of the soils surface.

- **Measures 5a and 5b- Low.** A low rating was given to both hydraulic excavation measures as it is difficult to control the depth of hydraulic excavation, as well as the increased likelihood for cutting or tearing both coarse and fine roots. A higher level of post-restoration maintenance (i.e., monitoring of health/condition of tree) would likely be required due to the high likelihood for injuries to both coarse and fine roots which increases the susceptibility to disease or pest infestations.

6.8 Short- and Long-Term Safety

Both the short-term safety implications to workers, residents and the community during (or immediately after) implementation of the measure, and the long-term safety implications after construction to residents, their homes and other buildings (i.e., commercial or industrial), infrastructure (i.e., utility lines, sidewalks), and nearby trees, shrubs, or other landscaping were evaluated. Both considerations focus on the potential for the structural failure of a tree, either during construction or thereafter.

Among other conditions, a severe rainstorm possibly with accompanying high winds during or subsequent to excavation within the protected root zone of a tree could threaten the structural stability of a tree.

A low rating for this factor means implementation of the measure would pose a high level of safety risk. A high rating means little or no risk would be incurred during or after the measure's implementation.

- **Measure 1 – High**. A high rating was given as no active soil removal activities would be performed within the protected root zone of a tree within the Study Area. As no trees would be affected, there would be no additional risk during implementation.

- **Measures 2a and 2b – Moderate**. A moderate rating was given to both tree removal and replacement measures as safety concerns are greater than those compared to the no action alternative. While certain safety risks exist when removing a tree or remediating contaminated soils, these risks would be managed using appropriate health and safety practices.

- **Measure 3a – High.** A high rating was given as it specifically addresses structural stability of a tree (i.e., decreases likelihood for a windfall), while allowing time to carefully remove soil from around a tree's fine roots within the top six inches of soil.

- **Measure 3b – Moderate**. A moderate rating was given as it increases the safety concerns due to excavation deeper than 6 inches below ground surface, and around structurally important coarse roots. Excavating deeper than 6 inches below ground surface increases the risk that some potential damage may occur to the roots and adversely affect a tree's structural stability during or after the excavation. Also, excavating around roots deeper than 6 inches below ground surface increases the difficulty of excavation, and therefore increases risk to workers performing the excavation.

- **Measure 4a – Moderate and Measure 4b – Low**. A moderate rating was given to Measure 4a as the safety concerns (in comparison to manual excavation) increase due to the difficulty in controlling fugitive dust; frequent clogging/repair of the vacuum line; and increased noise associated with the excavating and vacuum equipment. These factors pose risks to workers performing the excavation and fugitive dust poses a risk to surrounding residents.

  A low rating was given to Measure 4b based on the complexity of excavation around structurally important coarse roots deeper than 6 inches below ground surface as well as the increased difficulties associated with implementing a pneumatic excavation approach within a residential neighborhood.

- **Measures 5a and 5b – Low**. A low rating was given to both hydraulic excavation methods. Hydraulic excavation increases the risk of damage to a tree's roots which would adversely affect the tree's structural stability during or after the excavation. In addition, hydraulic pressure poses an increased risk to the workers performing the excavation as it can cut clothes or work boots, and sever underground pipes and cables. Control of mud and/or slurry would be more difficult than manual or pneumatic excavation approaches. While these safety concerns can be addressed by incorporating health and safety practices, the relative safety concerns would be significantly higher in comparison to other measures.

6.9 Cost Effectiveness

The cost of each potential tree preservation measure was also evaluated. For this factor, a high rating equates to a low cost, a moderate rating means a moderate cost, and a low rating means a high cost as compared to the other approaches.

- **Measure 1 – Moderate to high.** A moderate to high rating was given as there would be a need to implement Best Management Practices to preserve trees and protect the protected root zones, dependent upon site-specific conditions.

- **Measure 2a – Moderate**. A moderate rating was given as this measure could be implemented efficiently and effectively with relatively low overall cost.

- **Measures 2b – Moderate to low.** A moderate to low rating was given as the cost increases with multiple phases of remediation activities over multiple years.

- **Measure 3a – Moderate**. A moderate rating was given as work would be completed in one phase and would entail excavation of surface soils to about six inches, above the roots. This approach would likely include full-time construction oversight by an arborist.

- **Measure 3b – Low**. This approach would entail high costs, primarily due to the time required for mechanical excavation within the protected root zone, care required between phases and the likely requirement of multiple phases spanning years to complete the excavation. This approach would include full time construction oversight by an arborist.

- **Measures 4a, 4b, 5a and 5b – Low**. A low rating was given for the four pneumatic and hydraulic excavation measures as these measures are difficult to implement and entail increased costs. Past experience using a pneumatic approach has proven difficult due to frequent clogging of the vacuum line and frequent equipment repairs. The hydraulic approach would include similar concerns along with the necessity for management of the resulting slurry. This slurry would be of a

significantly greater volume and weight than excavated soil, would require a dewatering step, and therefore incur higher costs.

7. Conclusions and Recommendations

This evaluation provides a basis for identifying measures for further evaluation in the CMS that could be implemented within the Study Area to address human health risk while maintaining the aesthetic character of Middleport and/or affected property. Table 7-1 is included as a summary of the evaluation for each tree preservation measure. Best Management Practices, including coordinating tree preservation activities, properly identifying the trees to be preserved, establishing protected root zones to promote the survivability of affected trees, avoiding unacceptable soil compaction during construction activities, and protecting trees from grade changes are recommended as part of any tree preservation measure, except Measures 1, 2a or 2b.

The following five measures for removing soil containing unacceptable levels of FMC-related constituents within the protected root zone of a tree are recommended to be further considered as part of the CMS based upon the evaluation of nine factors identified in Section 6. The five measures include:

- Measure 1. No Soil Removal within the Protected Root Zone
- Measure 2a. Tree Removal and Replacement with Nursery Stock Trees
- Measure 2b. Phased (Extended Time) Tree Removal and Replacement With Nursery Stock Trees
- Measure 3a. Limited Depth Manual Excavation within the Protected Root Zone
- Measure 4a. Limited Depth Pneumatic Excavation within the Protected Root Zone

The evaluation concludes as follows:

- Any disturbance (e.g., soil removal, soil tilling, soil compaction) within the protected root zone could jeopardize the health or stability of an otherwise healthy tree. Measures implemented to attempt to preserve a tree offer varying likelihoods for success. For this reason, the most common approach in soil remediation projects is to remove the tree and replant with a new tree.

- Removal of larger trees and replanting with smaller trees would have an effect on the aesthetic character of an affected property and neighborhood. Based upon two recent inventories of trees located in right-of-ways in the Village of Middleport, approximately 80% of the trees have a trunk diameter (measured at breast height) of greater than 10 inches. The information from these inventories provides an indication of tree species and tree sizes found in a portion of the Study Area. Decades of growth time would likely be needed to fully replace the size of these trees.

- Not all trees can or should be preserved. The determination of whether a tree can or cannot be preserved is dependent on a number of property-specific or

tree-specific factors. For example, an older tree with dwindling health would have a low probability of long-term survival if any soil removal was attempted within the protected root zone.

- No single tree preservation measure will apply to all situations within the Study Area. A final remedial design plan would likely include removal of numerous trees (e.g., those that are unhealthy, have been pruned, are over-mature, are poorly located, etc.) and preservation of other trees using selected measures identified in this Technical Memorandum.

- If a tree is to be preserved, limited depth excavation, using either mechanical or pneumatic pressure, would appear to present the best opportunity to preserve the tree and warrants further consideration as part of the CMS. The depth of excavation would be limited to approximately 6 inches below the soil surface, and would be completed in one continuous effort. Precedent was identified for limited depth manual excavation at four similar remediation projects within residential neighborhoods.

- Other identified measures to excavate soils within the protected root zones of trees were not recommended for further evaluation based upon practicability of implementation, lower probabilities for tree survivability, tree structural stability concerns, and safety concerns for workers, residents, and the community.

- Long term maintenance or monitoring of the preserved tree (i.e., watering, fertilizing) and/or subsequent removal of the tree would be the responsibility of the property owner.

8. References

Agencies. 2009. Letter to Brian McGinnis of FMC from Matthew Mortefolio of the NYSDEC and Michael Infurna of the USEPA, providing final Corrective Action Objectives (CAOs) for the Off-Site Soil and Sediment Corrective Measure Studies. March 26. Included as appendix to CMS Work Plan.

AMEC Geomatrix. 2009. *Corrective Measures Study Work Plan for Suspected Air Deposition and Culvert 105 Study Areas*. Prepared for FMC Corporation, Middleport, NY. August.

ARCADIS. 2009. Personal communication between D.J. Partridge and ARCADIS colleagues regarding similar excavation projects in the United States. November 2009.

British Standards Institute. 2005. *British Standard – Trees in Relation to Construction – Recommendations.* Third Edition. BS 5837:2005. BSI, London, UK.

CH2M Hill. 2009. *Final Basis of Design Report: Remedial Design South Minneapolis Residential Soil Contamination Site, Minneapolis, Minnesota.*

Cutting Edge Tree Service and Consulting. 2007. *Storm Damage Evaluation Report/Tree Inventory.* Prepared for Village of Middleport, NY.

Dicke, S.G. and M.S. Raymond. 2004. *Preserving Trees in Construction Sites.* Mississippi State University, MS.

Fite, K. and E.T. Smiley. 2008. *Best Management Practices: Managing Trees During Construction.* International Society of Arboriculture, Champaign, IL.

Luzadis, V.A. and E.R. Gossett. 1996. Sugar Maple. Pages 157-166. *Forest Trees of the Northeast*, edited by James P. Lassoie, Valerie A. Luzadis, and Deborah W. Grover. Cooperative Extension Bulletin 235.

Matheny, N.P. and J.R. Clark. 1998. *Trees and Development: A Technical Guide to Preservation of Trees During Land Development*. International Society of Arboriculture, Champaign, IL.

Mattheck, C. and H. Breloer. 1994. *The Body Language of Trees: A handbook for failure analysis.* The Stationery Office, London, UK.

Micah Tree and Landscape Consultants. 2003. *Street Tree Survey and Individual Examination*. Prepared for Village of Middleport, NY. July 18.

Miller, N.L., D.M. Rathke, and G.R. Johnson, 1993. *Protecting Trees From Construction Damage: A Homeowners Guide.* NR-FO-6135-S. Minnesota Extension Service, St. Paul, MN.

Pirone, P.P., T.P. Pirone, J.R. Hartman, and M.A. Sall. 1988. *Tree Maintenance,* Sixth Edition. Oxford University Press, USA. November.

Roberts, J., N. Jackson, and M. Smith. 2006. *Tree Roots in the Built Environment*. The Stationary Office, London, UK.

Shigo, A.L. 1989. *A New Tree Biology: Facts, Photos, and Philosophies on Trees and Their Problems and Proper Care*, Second Edition. June.

Sinclair, W.A. and H.H. Lyon. 2005. *Diseases of Trees and Shrubs*. Second Edition. Cornell University Press, Ithaca, NY.

USEPA. 2008. *Five Year Review Report for the Myers Property Superfund Site, Franklin Township, Hunterdon County, New Jersey*. May.

USEPA. 2009. *Ecological Revitalization: Turning Contaminated Properties into Community Assets*. EPA 542-R-08-003. Prepared by Office of Solid Waste and Emergency Response. February.

Urban, J. 2008. *Up By the Roots--Healthy Soils and Trees in the Built Environment.* International Society of Arboriculture. Champaign, IL.

ARCADIS

Tables

Table 2-1 - Tree Species Identified in Surveys Conducted for the Village of Middleport within Right-of-Ways

CMS Technical Memorandum - Evaluation of Tree Preservation Measures
FMC Corporation, Middleport, New York

Tree Species		Year of Observation	
Scientific Name	**Common Name**	**2003 (X = Present)**	**2007 (% of total)**
Acer negundo	Box Elder	X	0.2
Acer platanoides	Norway Maple	X	35.7
Acer platanoides var Schwedleri	Schwedler Maple	X	
Acer platanoides var Crimson King	Crimson King Maple	X	
Acer psuedoplatanus	Wine Leafed Sycamore - Maple	X	
Acer rubrum	Red Maple	X	0.6
Acer saccharinum	Silver Maple	X	36.6
Acer saccharum	Sugar Maple	X	7.2
Acer saccharum	Hard Maple	X	
Aesculus hippocastanum	Horse Chestnut	X	1.1
Catalpa speciosa	Northern Catalpa	X	0.2
Crataegus laevigata	Paul's Scarlet Hawthorne	X	0.2
Forsythia spp.	Forsythia	X	
Fraxinus americana	White Ash	X	1.4
Fraxinus pennsylvanica	Green Ash	X	
Ginkgo biloba	Ginkgo	X	
Gleditsia spp.	Locust		4.5
Gleditsia triacanthos	Honey Locust (Morraine, Imperial)	X	
Hibiscus syriacus	Rose of Sharon	X	
Juglans nigra	Black Walnut	X	0.5
Juglans regia	English Walnut	X	0.2
Laburnum anagyroides	Golden Chain	X	
Malus spp.	Crab Apple		1.1
Malus spp.	Flowering Crabapple	X	
Picea glauca	White Spruce		0.2
Picea spp.	Spruce		2.6
Platanus occidentalis	American Sycamore	X	
Platanus spp.	Sycamore		0.2
Populus spp.	Cottonwood		0.5
Prunus spp.	Cherry		0.2
Pseudotsuga menziesii	Douglas Fir		0.2
Quercus palustris	Pin Oak	X	0.2
Quercus rubra	Red Oak	X	1.8
Quercus velutina	Black Oak	X	
Salix spp.	Willow	X	
Sorbus aucuparia	European Mountain Ash	X	0.2
Syringa reticulata	Japanese Tree Lilac	X	
Syringa spp.	Lilac		2.6
Syringa vulgaris	Common Lilac	X	
Tilia cordata	Little leaf Linden (Greenspire)		2.4
Tilia spp.	Basswood	X	
Ulmus americana	American Elm		0.2
Ulmus americana	Hybrid American Elm	X	
Ulmus spp.	Elm	X	
Ulmus spp.	Liberty Elm	X	

Notes:
* Tolerance from Matheny and Clark (1998) - P = poor, M = moderate, G = good
N/A - tolerance for species not available from Appendix A
2007 percentages do not sum to exactly 100% due to rounding to one decimal place

Table 4-1 - Guidelines for Determining Protected Root Zones of Healthy, Structurally Sound Trees

CMS Technical Memorandum - Evaluation of Tree Preservation Measures[1]
FMC Corporation, Middleport, New York

Tolerance to Construction Damage	Tree Age[4]	Distance from Tree Trunk to PRZ Boundary[2,3]	
		Distance in Multiples of Tree Trunk Diameter	Distance in Feet per Inch of Trunk Diameter
High	Young	6	0.50
	Mature	8	0.75
	Over Mature	12	1.00
Medium	Young	8	0.75
	Mature	12	1.00
	Over Mature	15	1.25
Low	Young	12	1.00
	Mature	15	1.25
	Over Mature	18	1.50

Notes:

1. Table adapted from Matheny and Clark (1998) and the British Standards Institute (2005).
2. PRZ = Protected Root Zone (see explanation of PRZ in Section 5)
3. Trunk diameter measured at "breast height," or approximately 4.5 feet above grade.
4. Maturity of tree species must be determined by a certified professional arborist. An "over mature tree" is defined by Fite and Smiley (2008) as being in the later one-third of its normal life expectancy, in comparison to a "young" tree, which is in the first one-third of its normal expectancy.

Table 6-1 - Evaluation of the Effectiveness and Implementability of Tree Preservation Measures

CMS Technical Memorandum - Evaluation of Tree Preservation Measures
FMC Corporation, Middleport, New York

Potential Tree Preservation Measure [1]	Evaluation Criteria								
	Effectiveness		Implementability						
	Effectiveness of Soil Removal	Maintenance of Aesthetic Character of Property and Neighborhood	Relative Ease of Implementation	Minimizing Inconvenience to Property Owners (i.e., noise and length of construction)	Tree Structural Stability	Tree Survival Probability	Post-Restoration Maintenance Requirements	Short- and Long-term Safety of Workers, Residents, and the Community	Cost Effectiveness
1. No Soil Removal within the Protected Root Zone	Not applicable	●	●	●	●	●	Not applicable	●	◪ to ●
2a. Tree Removal and Replacement with Nursery Stock Trees	●	○	●	◪	Not applicable	Not applicable	●	◪	◪
2b. Phased (Extended Time) Tree Removal and Replacement with Nursery Stock Trees	●	○ to ◪	◪	○	Not applicable	Not applicable	●	◪	○ to ◪
3a. Limited Depth Manual Excavation within the Protected Root Zone	○ to ●*	●	◪	◪	●	●	◪	●	◪
3b. Phased Sector Manual Excavation within the Protected Root Zone	○ to ◪	◪	○	○	◪	◪	○	◪	○
4a. Limited Depth Pneumatic Excavation within the Protected Root Zone	○ to ●*	●	○	○	●	●	◪	◪	○
4b. Phased Sector Pneumatic Excavation within the Protected Root Zone	○ to ◪	◪	○	○	◪	◪	○	○	○
5a. Limited Depth Hydraulic Excavation within the Protected Root Zone	○ to ●*	●	○	○	○	○	○	○	○
5b. Phased Sector Hydraulic Excavation within the Protected Root Zone	○ to ◪	○	○	○	○	○	○	○	○

Notes:

1. All measures will be implemented in conjunction with a selected set of Best Management Practices; the selection of these practices will vary on a case-by-case basis.
2. * = Depends upon extent of impacted soils below 6 inches (i.e., maximum depth of excavation)
3. Symbols:
   - ● = High (most desired outcome)
   - ◪ = Moderate
   - ○ = Low (least desired outcome)

Table 7-1 - Recommendations and Basis for Recommendation of Potential Tree Preservation Measures

CMS Technical Memorandum - Evaluation of Tree Preservation Measures
FMC Corporation, Middleport, New York

Potential Tree Preservation Measure		Recommended for Further Consideration in CMS Report?	Basis for Recommendation
1	No Soil Removal from the Protected Root Zone	**Yes**	• This approach relies on the presence of the tree roots to serve as a binding mechanism to limit exposure and prevent contaminant migration via soil erosion and leaching, and would involve no excavation of soils within the protected root zone. • This measure would allow for higher soil arsenic levels within the protected root zone of a tree in comparison to the remaining portions of a property. • Implementation of this measure may require further risk evaluation, establishment of institutional controls or management practices to minimize potential human exposures to constituents in soil located within the protected root zones of these trees. • Recommended for further consideration in the CMS because there may be situations where this approach would be suitable for tree preservation.
2a	Tree Removal and Replacement with Nursery Stock Trees	**Yes**	• This measure, which was implemented successfully during the Interim Corrective Measures in the Study Area, would involve the removal of select trees to facilitate soil excavation and restoration with standard nursery stock trees. • While this approach would effectively remove all impacted soil and could be easily implemented, it has the potential to impact the aesthetic character of a property and the surrounding neighborhood. Trees can take many years to mature and develop the canopy characteristics that bring much of the existing character to the affected properties and neighborhoods. • This approach provides flexibility to the property owner in deciding replacement tree species, location and timing. • Recommended for further consideration in the CMS based on precedence and flexibility.
2b	Phased (Extended Time) Tree Removal and Replacement with Nursery Stock Trees	**Yes**	• This approach would phase remedial activities within the Study Area to maintain some of the current aesthetic character of impacted properties and neighborhoods. • This approach would require completion of the soil removal activities over several years and would significantly extend the time required to complete the corrective measures for the Study Area. • Due to this extended time frame, this measure has a higher level of inconvenience to property owners and is more expensive to implement. Regardless, there may be little advantage to including multiple phases of remedial excavation over an interval of several years (i.e., less than 5 years) due to the slow growth rates of common tree species found in Middleport. • Many of the trees within Village right-of-ways have been significantly affected by pruning due to their proximity to aboveground utility lines. Therefore, delaying the remediation/removal of trees from the Village right-of-ways may not significantly improve the post-remediation aesthetic character of some neighborhoods. • Recommended for further consideration in the CMS because there may be locations within the Study Area where strategic phased excavations may be an effective approach to maintaining the aesthetic character of a property or neighborhood depending on the final remedial strategy.
3a	Limited Depth Manual Excavation within the Protected Root Zone	**Yes**	• This measure would limit the depth of excavation within the protected root zone to a maximum depth of 6 inches below ground surface independent of the soil concentrations below this depth, and could be completed in one excavation phase. • This approach has been successfully implemented at other similar residential remediation projects throughout North America (USEPA 2008, 2009; CH2M Hill 2009; ARCADIS pers. comm. 2009) with minimal relative inconvenience to property owners, and has maintained the aesthetic character of affected neighborhoods. • Previously implemented ARCADIS remedial projects have documented high (i.e., approximately 90% or greater) survival rates of trees when excavation depths within the protected root zones are limited to approximately 6 inches below ground surface of healthy trees. • Removal of the surface soil containing unacceptable levels of arsenic and replacement with clean soil containing lower arsenic concentrations would reduce human health risks and would reduce the overall average soil arsenic level of the soil within the protected root zone. If the Agencies determine that the remaining soil arsenic levels beneath the 6-inch thick clean surface soil require further controls, these may take the form of institutional controls or management practices to minimize potential future human exposures. • Recommended for further consideration in the CMS based on successful prior applications in other projects.
3b	Phased Manual Excavation within the Protected Root Zone	**No**	• This approach would potentially allow excavation deeper than 6 inches below ground surface by separating the necessary excavation within the protected root zone into a minimum of 3 excavation zones, with excavation spanning over a minimum of three years (i.e., one zone per year). • This phasing over an extended period of time decreases the effectiveness of remediation, while increasing the difficulty to implement and inconvenience to land owner as well as overall costs. • Given the lack of precedent for this approach, the identified disadvantages of this approach (i.e., inconvenience to land owner, ease of implementation) outweigh the potentially questionable advantages (i.e., effectiveness to remove soil). • Not recommended for further consideration in the CMS based on the above findings.

Table 7-1 - Recommendations and Basis for Recommendation of Potential Tree Preservation Measures

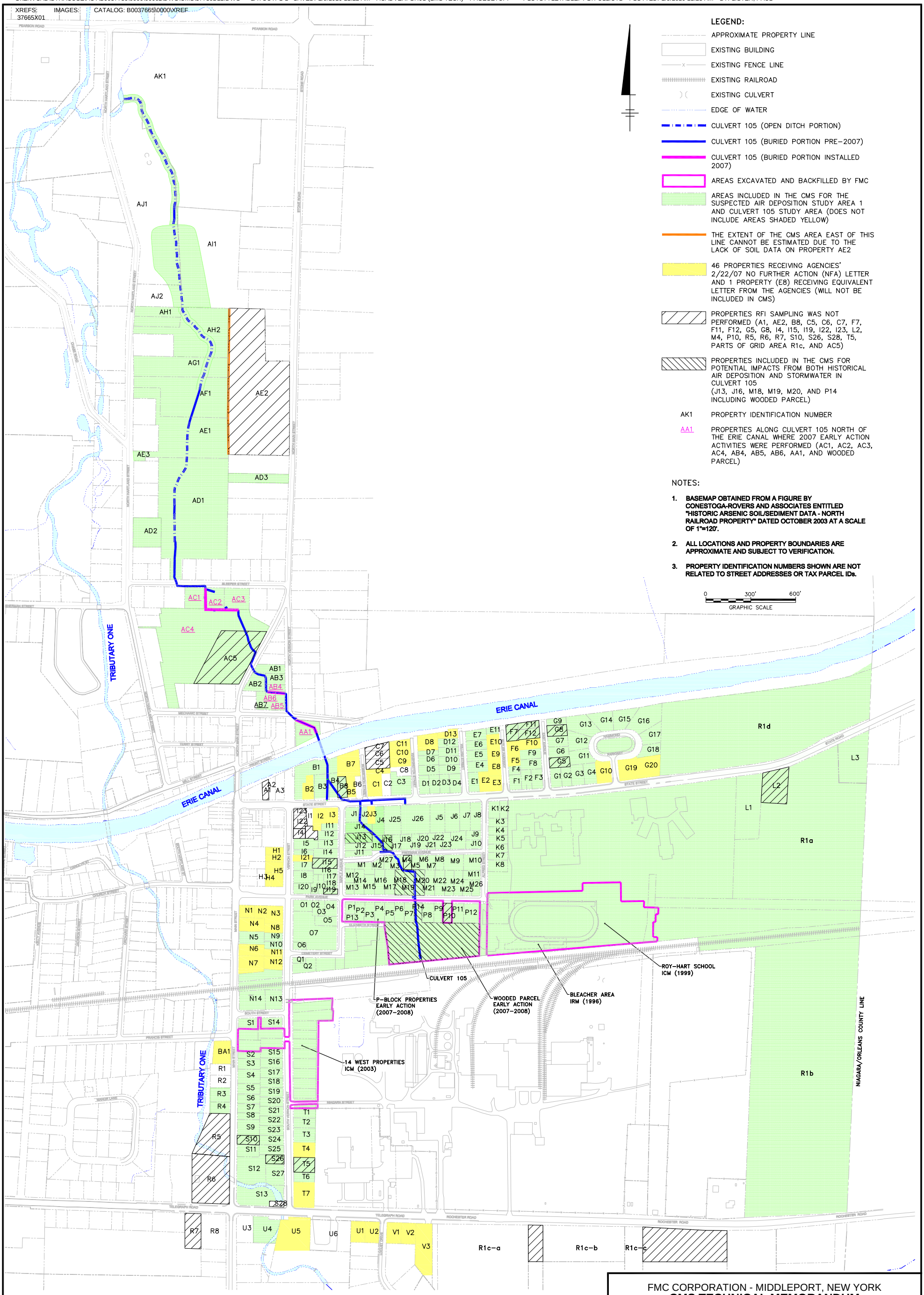
CMS Technical Memorandum - Evaluation of Tree Preservation Measures
FMC Corporation, Middleport, New York

Potential Tree Preservation Measure		Recommended for Further Consideration in CMS Report?	Basis for Recommendation
4a	Limited Depth Pneumatic Excavation within the Protected Root Zone	**Yes**	• This approach would utilize common arborist tools such as the Air Spade® to potentially minimize impacts to roots, reduce the time necessary to excavate a large area within the protected root zone and minimize impacts to surrounding infrastructure such as pipes or cables. • Based on professional experience, ARCADIS has found the implementation of pneumatic excavation would be subject to several challenges, such as: difficulty in controlling fugitive dust; frequent clogging of the vacuum line and need for repair; and increased noise associated with the excavating and vacuum equipment. • Pilot studies conducted by ARCADIS on similar projects have demonstrated that the potential advantages of this approach (i.e., time of excavation, minimized impacts to tree roots) do not outweigh the disadvantages (i.e., repair of equipment, unclogging of vacuum lines, noise associated with excavation). • ARCADIS has found better results with implementing manual excavation and incorporating full-time construction oversight by a licensed arborist. • Recommended for further consideration in the CMS because there may be locations within the Study Area where strategic excavations with pneumatic pressure may be effective and more appropriate than manual excavation.
4b	Phased Pneumatic Excavation within the Protected Root Zone	**No**	• Similar to the discussion for Measure 3b, the phasing over an extended period of time decreases the effectiveness of remediation, while increasing the difficulty to implement and inconvenience to the land owner. • Given the lack of precedent for this approach, the identified disadvantages of this approach (i.e., inconvenience to land owner, ease of implementation) outweigh the potentially questionable advantages (i.e., effectiveness to remove soil). • Not recommended for further consideration in the CMS based on the above findings.
5a	Limited Depth Hydraulic Excavation within the Protected Root Zone	**No**	• There are few advantages when comparing hydraulic excavation to manual or pneumatic methods. • Implementing a hydraulic excavation approach would present many disadvantages such as increased safety concerns, increased risk of damaging infrastructure (such as severing plastic pipes or cables), and increased risk to the tree's roots as hydraulic pressure can sever both fine and coarse roots. In addition, controlling the excavation and containing impacted soils would be difficult as mud would quickly form within the work site and the depth of excavation would become uncontrollable. • Removal of excavated soil in the form of a slurry would then require pumping from the work site and subsequent dewatering to facilitate appropriate disposal of excavated soils. • Not recommended for further consideration in the CMS based on the above findings.
5b	Phased Hydraulic Excavation within the Protected Root Zone	**No**	• Not recommended for further consideration in the CMS based on a similar basis for recommendation that was provided above for Measure 4b and Measure 5a.

ARCADIS

Figures

CITY: SYRACUSE , NY GROUP: ENVCAD DB: P. LISTER LD: P. LISTER PM: D. WRIGHT LYR: ON=*;OFF=REF, (FRZ)
G:\ENVCAD\SYRACUSE\ACT\B0037736\0000\00002\DWG\CMS\37736B11.DWG LAYOUT: 1-1 SAVED: 2/9/2010 11:22 AM ACADVER: 17.0S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: PLTFULL.CTB PLOTTED: 2/9/2010 11:23 AM BY: LISTER, PAUL
XREFS: IMAGES: CATALOG: B0037665\0000\XREF
37665X01



LEGEND:

- APPROXIMATE PROPERTY LINE
- EXISTING BUILDING
- EXISTING FENCE LINE
- EXISTING RAILROAD
- EXISTING CULVERT
- EDGE OF WATER
- CULVERT 105 (OPEN DITCH PORTION)
- CULVERT 105 (BURIED PORTION PRE–2007)
- CULVERT 105 (BURIED PORTION INSTALLED 2007)
- AREAS EXCAVATED AND BACKFILLED BY FMC
- AREAS INCLUDED IN THE CMS FOR THE SUSPECTED AIR DEPOSITION STUDY AREA 1 AND CULVERT 105 STUDY AREA (DOES NOT INCLUDE AREAS SHADED YELLOW)
- THE EXTENT OF THE CMS AREA EAST OF THIS LINE CANNOT BE ESTIMATED DUE TO THE LACK OF SOIL DATA ON PROPERTY AE2
- 46 PROPERTIES RECEIVING AGENCIES' 2/22/07 NO FURTHER ACTION (NFA) LETTER AND 1 PROPERTY (E8) RECEIVING EQUIVALENT LETTER FROM THE AGENCIES (WILL NOT BE INCLUDED IN CMS)
- PROPERTIES RFI SAMPLING WAS NOT PERFORMED (A1, AE2, B8, C5, C6, C7, F7, F11, F12, G5, G8, I4, I15, I19, I22, I23, L2, M4, P10, R5, R6, R7, S10, S26, S28, T5, PARTS OF GRID AREA R1c, AND AC5)
- PROPERTIES INCLUDED IN THE CMS FOR POTENTIAL IMPACTS FROM BOTH HISTORICAL AIR DEPOSITION AND STORMWATER IN CULVERT 105 (J13, J16, M18, M19, M20, AND P14 INCLUDING WOODED PARCEL)
- AK1 PROPERTY IDENTIFICATION NUMBER
- AA1 PROPERTIES ALONG CULVERT 105 NORTH OF THE ERIE CANAL WHERE 2007 EARLY ACTION ACTIVITIES WERE PERFORMED (AC1, AC2, AC3, AC4, AB4, AB5, AB6, AA1, AND WOODED PARCEL)

NOTES:

1. BASEMAP OBTAINED FROM A FIGURE BY CONESTOGA-ROVERS AND ASSOCIATES ENTITLED "HISTORIC ARSENIC SOIL/SEDIMENT DATA - NORTH RAILROAD PROPERTY" DATED OCTOBER 2003 AT A SCALE OF 1"=120'.
2. ALL LOCATIONS AND PROPERTY BOUNDARIES ARE APPROXIMATE AND SUBJECT TO VERIFICATION.
3. PROPERTY IDENTIFICATION NUMBERS SHOWN ARE NOT RELATED TO STREET ADDRESSES OR TAX PARCEL IDs.

0 300' 600'
GRAPHIC SCALE

FMC CORPORATION - MIDDLEPORT, NEW YORK
CMS TECHNICAL MEMORANDUM
EVALUATION OF TREE PRESERVATION MEASURES

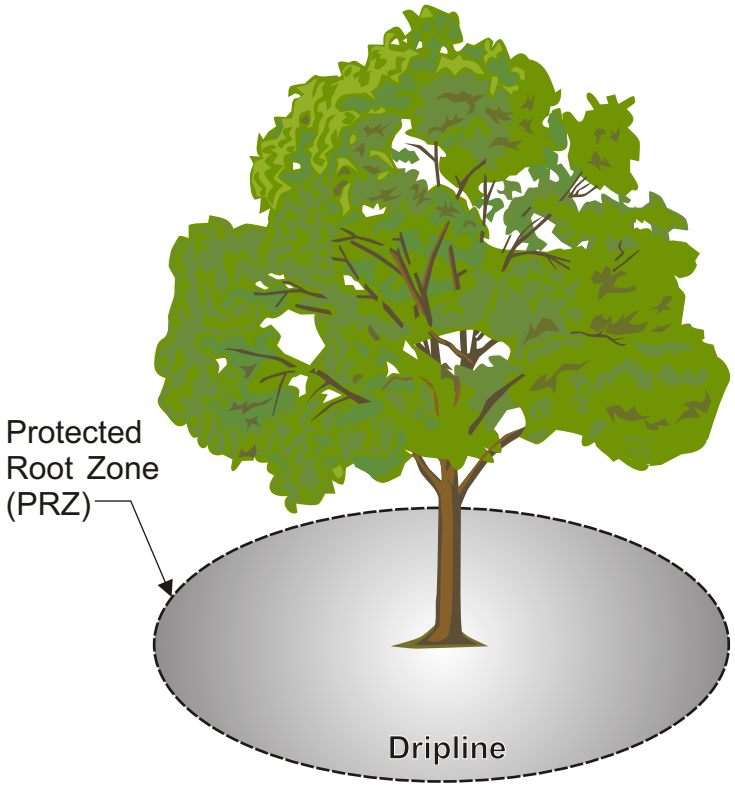
CORRECTIVE MEASURES STUDY AREA

ARCADIS

FIGURE
1-1

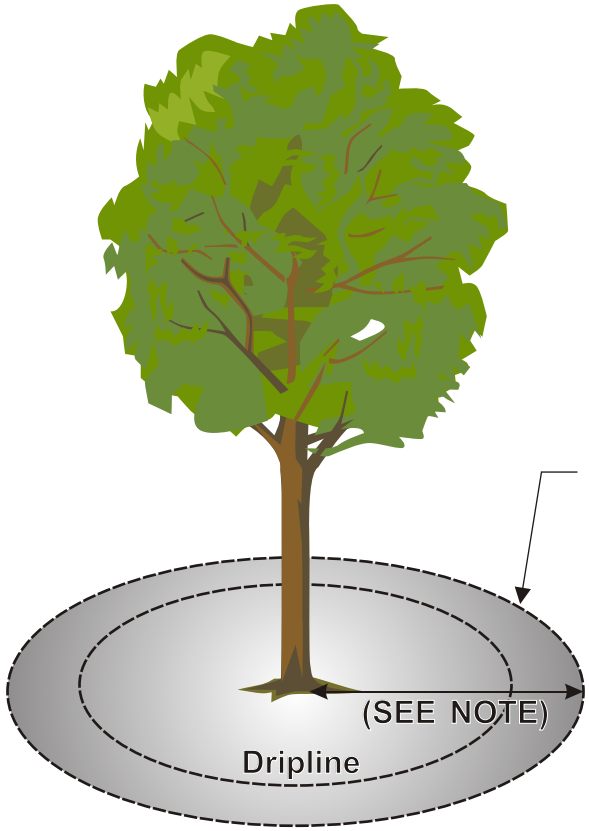
METHOD 1 - OPEN SETTING

PROTECTED ROOT ZONE DEFINED BY DRIP LINE OF TREE



METHOD 2 - CROWDED SETTING

PROTECTED ROOT ZONE DEFINED BY DIAMETER OF TREE TRUNK AND SPECIES OF TREE



Note:
The protected root zone is defined by the trees diameter (i.e., diameter at breast height) multiplied by a factor of 6 to 18. This factor is dependent upon the species of tree and its tolerance to construction impacts.

FMC CORPORATION, MIDDLEPORT, NEW YORK

CMS TECHNICAL MEMORANDUM
EVALUATION OF TREE PRESERVATION MEASURES

METHODS OF DETERMINING PROTECTED ROOT ZONE

ARCADIS

FIGURE
4-1

Notes/Assumptions:

1. DBH = diameter of the tree trunk at approximately 4.5 feet from the ground surface.
2. Assumes planting of a standard nursery stock sugar maple tree (i.e., DBH of 1 to 2 inches)
3. Assumes a growth rate of approximately 1 vertical foot per year and 1 inch DBH every 4 to 5 years under optimal conditions.
4. Minimum reproductive age (i.e., stage where tree has reached full maturity) of sugar maple is approximately 30 years (Luzadis and Gossett 1996).
5. Mature tree reaches approximate height of 50 to 80 feet with a canopy width of 35 to 50 feet.

FMC CORPORATION, MIDDLEPORT, NEW YORK

CMS TECHNICAL MEMORANDUM
EVALUATION OF TREE PRESERVATION MEASURES

CONCEPTUAL ILLUSTRATION OF THE DEVELOPMENT OF A PLANTED NURSERY STOCK TREE (SUGAR MAPLE)

ARCADIS

FIGURE
5-1

02/08/2010 SYRACUSE, NY-ENV/CAD-DJHOWES
B0037736/0000/00002/CDR/37736G04.CDR

ARCADIS

Appendices

ARCADIS

Appendix A

Historic Middleport Tree Inventories

1. 2007. Storm Damage Evaluation Report/Tree Inventory. Cutting Edge Tree Service & Consulting, Inc.

2. 2003. Micah Tree and Landscape Consultants, Inc.

Storm Damage Evaluation Report / Tree Inventory

Prepared For:

Village of Middleport

Prepared By:

Cutting Edge Tree Service & Consulting, Inc.

2007

Table of Contents

Introduction

This report has been prepared and presented to the Village of Middleport, upon their request, to evaluate all Village owned trees for storm damage and the hazards this damage presents.

Trees that are included in this report met the following qualifications for evaluation:

- Within the Village Limits
- Between the road and the sidewalk, or within 4 feet of the road where sidewalks were not present
- A Diameter at Breast Height (DBH) equal to or greater than 2 inches

Trees were evaluated along the road-side from a slow-moving vehicle. Those requiring a more detailed evaluation were inspected on foot from all angles.

Terminology

- **Marks** = Some trees were previously mark by The Village of Middleport with either an X or a Dot
- **DBH** = Diameter at Breast Height is measured 4 and a half feet above the ground on the trunk of the tree. This information give a general estimate of the size of tree, and also helps to distinguish one tree from another on a shared plot.
- *** = **Requires immediate attention**
- **1** = High Priority
- **2** = Intermediate Priority
- **3** = Low Priority
- **R** = Remove
- **P** = Prune
- **BB** = Broken Branch(es) – Branches are broken, but remains attached to the tree
- **BH** = Bee Hive
- **BS** = Bad Seam – see V-Crotch
- **CB** = Cracked Branch(es) – Branches are cracked, but remain close to their original position
- **CC** = Crown Cleaning (a.k.a. – Corrective Pruning) – Selective removal of one or more of the following items: dead, dying, diseased, weak branches, and water sprouts from the tree's crown
- **CL** = Cracked Leader – A main leader has cracked and maintains its position, but may become a hazard in the future
- **CP** = Corrective Pruning – see Crown Cleaning
- **CR** = Crown Raise – Removal of the lower branches of the crown to provide clearance
- **DL** = Dead Leader
- **DT** = Dead Top
- **DW** = Dead Wood

Terminology – continued

- **ES** = Epicormic Sprouts – Sprouts grow out of calloused/damaged tissue, shows a sign of stress
- **GR** = Girdling Root – Roots grow around trunk/other roots and slowly choke off supply of nutrients to the tree
- **H** = Hanger(s) – Branches that have been severed from the tree but remain in the tree and pose a hazard
- **HS** = Hollow Spot
- **Lightning** = A lightning strike has compromised the health of the tree
- **PI** = Poison Ivy
- **PPP** = Power Pole Problem – Presence of power pole/lines makes this tree hazardous to work on, Contact Power Authority for assistance
- **RL** = Rotten Lead
- **RR** = Root Rot
- **RT** = Rotten Top
- **Side Trim** = Selective removal of branches to increase visibility, light penetration, air movement, and reduce weight
- **SS** = Sun Scald – Like a sun burn, caused when a large object is removed during tree development, causing the tree to receive increased exposure to the sun, Sun Scald never really heals and continues to crack open as the tree grows
- **Thinned** = see Prune
- **TR** = Trunk Rot
- **Train** = Young tree needs training to insure proper growth
- **VC** = V-Crotch – An area of stress with the potential for failure
- **Wires** = Tree has grown through overhead wires and may pose a hazard (see also – PPP)

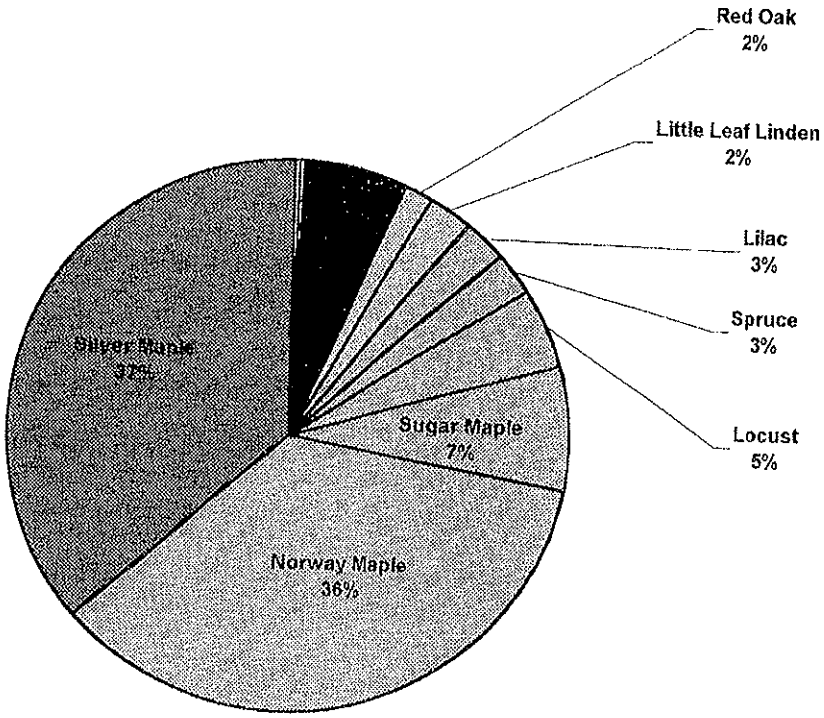
Species Composition - Table

Species	# of Trees	% of Population
Silver Maple	243	36.6%
Norway Maple	237	35.7%
Sugar Maple	48	7.2%
Locust	30	4.5%
Spruce	17	2.6%
Lilac	17	2.6%
Little Leaf Linden	16	2.4%
Red Oak	12	1.8%
White Ash	9	1.4%
Horse Chestnut	7	1.1%
Crab Apple	7	1.1%
Red Maple	4	0.6%
Cottonwood	3	0.5%
Black Walnut	3	0.5%
White Spruce	1	0.2%
Sycamore	1	0.2%
Pin Oak	1	0.2%
Ornamental Hawthorn	1	0.2%
European Mountain Ash	1	0.2%
English Walnut	1	0.2%
Douglas Fir	1	0.2%
Cherry	1	0.2%
Catulpa	1	0.2%
Box Elder	1	0.2%
American Elm	1	0.2%

Total of 664 trees inventoried/inspected

Species Composition – Chart

Diversity of Species



Marks	House Number / Location	Species	DBH (inches)	Tree Number	Priority / Action Needed	Notes	Estimated Mileage (miles) from Start Point
Kelly Avenue West Side Start at North End							
	22	Norway Maple	14"	#1	3P		0.180
	32	Norway Maple	18"	#2	2P		0.280
	32	Norway Maple	20"	#3	3R		0.290
Dot	34	Norway Maple	16"	#4	2R		0.300
	34	Norway Maple	14"	#5	2P		0.310
	34	Norway Maple	14"	#6	1R	GR	0.320
Kelly Avenue East Side Start at South End							
	35	Norway Maple	18"	#7	3P		0.050
	35	Norway Maple	12"	#8	3R		0.060
	33	Norway Maple	18"	#9	2P		0.065
	33	Norway Maple	14"	#10	2P		0.070
	33	Norway Maple	16"	#11	3P		0.080
	31	Red Oak	10"	#12	3P		0.090
	31	Little Leaf Linden	10"	#13	1R	VC	0.095
	29	Silver Maple	22"	#14	3P		0.098
	29	Silver Maple	22"	#15	3P		0.099
	25	Silver Maple	20"	#16	2P		0.100
	23	Silver Maple	18"	#17	2R		0.120
	19	Norway Maple	14"	#18	1P	CR, BB	0.140
	19	Norway Maple	14"	#19	3P		0.150
	9	Norway Maple	12"	#20	3P		0.270
	9	Silver Maple	26"	#21	1R	RR	0.275
	5	Norway Maple	8"	#22	3P		0.290
	5	Norway Maple	8"	#23	3P		0.290
	3	Silver Maple	24"	#24	2R		0.310
	1	Norway Maple	20"	#25	3P		0.320
	37	Norway Maple	16"	#26	3P		0.340
	37	Silver Maple	24"	#27	2P		0.350

Jackson Street West Side Start at North End							
	2	Locust	18"	#1	2P	DW	0.020
	2	Norway Maple	18"	#2	2P		0.050
X	4	Norway Maple	16"	#3	1R	RR	0.055
	4	Silver Maple	24"	#4	3P		0.070

Jackson Street East Side Start at South End							
X	3	Sugar Maple	18"	#5	1R	RR	0.000
	1	Sugar Maple	20"	#6	3P		0.010
	1	Little Leaf Linden	12"	#7	3P	VC	0.016
	29	Silver Maple	24"	#8	3P		0.070

Carolyn Street West Side
--No Trees On This Side--

Carolyn Street East Side Start at South End / Church Street							
	2	Silver Maple	Clump	#1	2P		0.060
	2	Silver Maple	10"	#2	3P		0.065
	2	Box Elder	10"	#3	2R		0.070
	2	Silver Maple	10"	#4	1P		0.080
	2	Silver Maple	10"	#5	1P	BB	0.085
	4	Silver Maple	8"	#6	1R		0.090
	4	White Ash	8"	#7	1R		0.100
	4	White Ash	8"	#8	3P		0.110

Orchard Street West Side Start at North End							
	2	Norway Maple	16"	#1	1P	BB	0.005
	2	Norway Maple	18"	#2	3P		0.010
	2	Norway Maple	12"	#3	2R	VC	0.020
	6	Silver Maple	32"	#4	2P		0.035
	8	Silver Maple	22"	#5	1R	RR	0.045
	8	Silver Maple	22"	#6	1P	BB	0.050
	10	Silver Maple	22"	#7	2P		0.060
	10	Silver Maple	22"	#8	1P	BB	0.065
	10	Silver Maple	24"	#9	3P		0.070
	12	Norway Maple	20"	#10	3P		0.080
	14	Silver Maple	8"	#11	3P		0.100
	16	Norway Maple	12"	#12	2P		0.110

Orchard Street West Side Continued							
	16	Norway Maple	12"	#13	3P		0.115
	18	Silver Maple	24"	#14	1R		0.125
	22	Norway Maple	18"	#15	3P		0.150
	22	Silver Maple	16"	#16	3P		0.155
	22	Silver Maple	26"	#17	2P		0.160
	22	Silver Maple	22"	#18	3P		0.165
	24	Silver Maple	28"	#19	1R		0.180

Orchard Street East Side Start at South End							
	23	Silver Maple	26"	#20	1R		0.005
	23	Norway Maple	12"	#21	1R		0.010
	23	Norway Maple	12"	#22	1P	GR	0.020
	19	Silver Maple	28"	#23	1R	RR	0.030
	19	Little Leaf Linden	8"	#24	3P		0.032
	15	Red Oak	10"	#25	3P		0.080
	15	Little Leaf Linden	14"	#26	2P	VC	0.085
	13	Silver Maple	20"	#27	3P	VC	0.095
	9	Norway Maple	14"	#28	3R		0.100
	7	Silver Maple	24"	#29	1P	BB over house	0.115
	5	Sugar Maple	28"	#30	2R	VC	0.130
	3	Norway Maple	16"	#31	2P		0.145
	1	Norway Maple	16"	#32	2P	GR	0.160

Chase Road South-West Side Start at North-West End							
	Woods	Locust			P	CR, DW	
		Cherry			R		
		Willow			R		

Chase Road North-East Side Start at South-East End / N. Hartland Street							
		Spruce	~8"	#1-#17		Side Trim	0.00-0.06

North Hartland Street West Side Start at North End / Fire Hydrant							
	Across 94	Silver Maple	24"	#1	1R		0.000
	Across 94	Silver Maple	20"	#2	1to2R		0.005
	Across 94	Silver Maple	24"	#3	3R		0.010
Dot	Across 92	Silver Maple	22"	#4	2R	lead over road	0.020
X	Across 92	Silver Maple	18"	#5	1R		0.025

North Hartland Street West Side Continued							
	Across 92	Silver Maple	18"	#6	2P		0.027
	Across 92	Silver Maple	18"	#7	1P	branch over rd	0.030
	93	Silver Maple	18"	#8	2R		0.035
	93	Silver Maple	20"	#9	3P		0.050
	93	Silver Maple	24"	#10	1R		0.052
	93	Silver Maple	18"	#11	1R		0.055
	83	Silver Maple	22"	#12	1R	NOW	0.100
	79	Silver Maple	20"	#13	3R		0.120
	79	Silver Maple	6"	#14	3P		0.130
	79	Silver Maple	22"	#15	1P	branch over house	0.140
	79	Silver Maple	24"	#16	2P	DW	0.150
	79	Norway Maple	8"	#17	3P	CR	0.160
	79	Norway Maple	16"	#18	3P	CR, VC	0.170
	Across Pole 16	Norway Maple	12"	#19	3P	CR	0.180
	Across 66	Norway Maple	14"	#20	3P		0.190
Dot	Across 66	Norway Maple	14"	#21	2R		0.195
	59	Silver Maple	18"	#22	2P		0.200
	57	Silver Maple	20"	#23	3R/P	***	0.220
	57	Norway Maple	14"	#24	2P	CR	0.240
	49	Norway Maple	14"	#25	3P		0.250
	49	Silver Maple	22"	#26	1R		0.257
Dot	49	Silver Maple	22"	#27	1R		0.260
	45	Silver Maple	24"	#28	2P		0.270
	45	Silver Maple	26"	#29	1P	DW	0.275
	45	Silver Maple	20"	#30	1R		0.280
	45	Silver Maple	24"	#31	2P		0.285
	41	Norway Maple	12"	#32	3P		0.290
	41	Silver Maple	18"	#33	2P	DW	0.300
	41	Norway Maple	10"	#34	3P		0.310
	41	Silver Maple	18"	#35	2R		0.315
--Pass Sherman Street--							
	19	Crab Apple	2.5"	#36	3P	ES	0.450
	17	Sugar Maple	16"	#37	1R		0.470
	11	Sugar Maple	18"	#38	3P		0.490
	9	Norway Maple	12"	#39	2P		0.500
	5	Silver Maple	26"	#40	2R		0.510

North Hartland Street East Side Start at South End / Mill Street							
	6	Norway Maple	20"	#41	2P		0.020
Dot	6	Norway Maple	14"	#42	1R		0.025
	16	Norway Maple	12"	#43	3P		0.050
	20	Silver Maple	24"	#44	2P	CC	0.080
	20	Silver Maple	20"	#45	2P		0.085
	20	Norway Maple	14"	#46	3P		0.100
	Across 21	Silver Maple	20"	#47	1R		0.120
	32	Silver Maple	18"	#48	3P		0.140
Dot	32	Norway Maple	20"	#49	1R		0.150
	32	Norway Maple	20"	#50	2P		0.170
	32	Silver Maple	16"	#51	2R	Rot	0.180
	36	Norway Maple	12"	#52	3P		0.185
	36	Silver Maple	20"	#53	3P		0.190
	36	Norway Maple	12"	#54	1R	RR	0.195
		Norway Maple	12"	#55	3P		0.200
		Norway Maple	12"	#56	3P		0.230
		--Pass Sleeper Street--					
Dot	48	Silver Maple	20"	#57	2to1R		0.240
	48	Norway Maple	12"	#58	2P	CR	0.270
	58	Norway Maple	12"	#59	3P		0.290
	80	Silver Maple	18"	#60	3P		0.430
	80	Silver Maple	32"	#61	2R	DW	0.440
	80	Silver Maple	18"	#62	3P		0.445
	80	Silver Maple	24"	#63	2R		0.450
	84	Locust	clump	#64	NA		0.460
	92	Black Walnut	18"	#65	1R		0.480

South Hartland Street West Side Start at North End							
	Across 8	Silver Maple	24"	#1	1P/2R	CL(back), BB, RR	0.020
	Across 8	2 Horse Chestnut	18" ea.	#2	3R/3P	RR	0.030
	5	Little Leaf Linden	14"	#3	3P	BB	0.050
	10	Sugar Maple	26"	#4	2P		0.060

South Hartland Street East Side Start at South End / Church Street							
	2	Silver Maple	32"	#5	2R	VC, BB	0.000
	2	Silver Maple	28"	#6	3R		0.010
Dot	4	Sugar Maple	28"	#7	2R/1R	RR, VCx3, DW	0.020
	Ambulance	Norway Maple	16"	#8	3P		0.060

North Main Street / South Main Street West Side Start at North End / Sleeper Street							
	37	Red Oak	14"	#1	3P	Remove Vines	0.005
	37	Sycamore	10"	#2	3P		0.010
	35	White Spruce	12"	#3		Wires	0.020
	35	Norway Maple	14"	#4	2R	GR	0.030
	15	Silver Maple	24"	#5	2P/3R		0.120
	behind Pole 11	Silver Maple	18"	#6	1P/2R	BB	0.130
	15	Norway Maple	10"	#7	3P		0.135
Dot	15	Silver Maple	28"	#8	1R		0.150
--Cross Mechanic Street--							
	11	Silver Maple	18"	#9	3P		0.160
	11	Silver Maple	20"	#10	3P		0.165
	11	Silver Maple	20"	#11	1P/2R		0.170
	11	Silver Maple	20"	#12	2P/3R		0.175
--Pass Terry Street--							
X	5	Silver Maple	26"	#13	1R/2R		0.210
--Cross Mill Street--							
--Cross Lift Bridge--							
	18	Lilac	2.5"	#14		Train	0.290
	Police Dept.	Lilac	2.5"	#15		Train	0.295
	Clerk	Lilac	2.5"	#16		Train	0.300
	26	Lilac	2.5"	#17		Train	0.305
	36	Crab Apple	6"	#18	3P		0.330
	Post Office	Norway Maple	6"	#19	3P		0.350
--Pass Church Street--							
	52	Horse Chestnut	24"	#20	2R		0.410
--Pass Rail Road Tracks--							
--No More Trees On This Side--							

South Main Street / North Main Street East Side Start at South End							
--Cross Rail Road Tracks--							
	61	Crab Apple	6"	#21	2P	ES	0.310
	41	Lilac	4"	#22		Train	0.410
	41	Norway Maple	6"	#23	3P		0.420
	41	Lilac	4"	#24		Train	0.430
	29	Lilac	2.5"	#25		Train	0.440
	29	Lilac	2.5"	#26		Train	0.450
	25	Lilac	4"	#27		Train	0.460
	25	Lilac	2.5"	#28		Train	0.470
	19	Lilac	4"	#29		Train	0.480
	17	Lilac	2.5"	#30		Train	0.490
--Cross Lift Bridge--							
	8	Silver Maple	16"	#31	2P		0.570
	16	Silver Maple	18"	#32	3P		0.600
	17	Silver Maple	22"	#33	1R	DL, RR, ***	0.610
	17	Silver Maple	24"	#34	1R	RR, DW	0.613
Dot	17	Silver Maple	22"	#35	1R	DL over sidewalk**	0.620
Dot	18	Silver Maple	22"	#36	1R	RR	0.650
	18	Silver Maple	28"	#37	1R	RR, BH, CB	0.653
	34	Norway Maple	18"	#38	3R/1P	GR, VC, DW, H	0.690
	38	Norway Maple	14"	#39	2P	BB	0.730

Freeman Road West Side Start at North End / Telegraph Road / Route 31							
	Across 103	Norway Maple	14"	#1	3P		0.000
Dot	Across 103	Silver Maple	18"	#2	1R		0.010
	Across 103	Silver Maple	24"	#3	1R	RR	0.020
	Across 103	Silver Maple	22"	#4	2R	RR	0.040

Freeman Road East Side Start at South End / Village Limit							
	107	Sugar Maple	24"	#5	2P	DW	0.020
	107	Silver Maple	22"	#6	1R	RR	0.025
	107	Silver Maple	24"	#7	1R	RR, DW	0.035
	105	Locust	16"	#8	1P	BB	0.045
	105	Locust	20"	#9	1P	DW, H, BB	0.050
Dot	103	Sugar Maple	18"	#10	2R	RR, DW	0.090

Stone Road West Side Start at North End / Village Limit
--No Trees On This Side--

Stone Road East Side Start at South End / Town Limit							
	48	Silver Maple	18"	#1	2P	DW	0.100
		Silver Maple	18"	#2	2P		0.100
	40	Norway Maple	10"	#3	3R	DT, PI	0.200
	Across 35	Norway Maple	14"	#4	3P	CR, DW	0.300

North Vernon Street West Side Start at North End							
		Silver Maple	4"	#1	3P		0.000
	16	Silver Maple	16"	#2	2P		0.030
Dot	14	Silver Maple	24"	#3	1R		0.050
	12	Silver Maple	22"	#4	1R	***	0.060
	Across 9	Norway Maple	12"	#5	3P		0.080
	Across 9	Silver Maple	18"	#6	3P		0.100

North Vernon Street East Side Start at South End / Mechanic Street							
	9	Norway Maple	12"	#7	3P	SS	0.010
	9	Norway Maple	14"	#8	1R		0.020
	11	Silver Maple	18"	#9	3P		0.040
	11	Silver Maple	18"	#10	2P		0.040
	11	Silver Maple	20"	#11	2P		0.050
	15	Silver Maple	20"	#12	3P		0.060
	17	Norway Maple	12"	#13	3P		0.070
	23	Norway Maple	14"	#14	3R	GR	0.080

South Vernon Street West Side Start at North End / State Street							
	Store	Norway Maple	6"	#1	3P/3R		0.015
	Store	Norway Maple	10"	#2	3P	DW	0.017
	10	Norway Maple	16"	#3	3P	SS	0.030
	12	Norway Maple	8"	#4	3P		0.035
	UMC	Norway Maple	8"	#5	1P/3R	DW	0.040
	UMC	Norway Maple	18"	#6	2P	CR	0.060
--Cross Park Avenue--							
	8	Silver Maple	22"	#7	1R/2R	TR throughout	0.100
Dot	8	Silver Maple	22"	#8	1R/2R	TR throughout	0.105

South Vernon Street West Side Continued							
	22	Norway Maple	12"	#9	3P		0.130
Dot	24	White Ash	24"	#10	1R	RR, GR	0.140
--Cross Rail Road Tracks--							
	30	Norway Maple	10"	#11	3P		0.175
	30	Norway Maple	22"	#12	3P	CR	0.200
--Pass South Street--							
	36	Norway Maple	2"	#13		Adjust Stakes	0.215
	36	Silver Maple	2.5"	#14	1R		0.220
	38	Norway Maple	2.5"	#15		DT	0.230
	40	Norway Maple	2.5"	#16		Train	0.240
Dot	42	Silver Maple	20"	#17	1R	RR	0.250
	42	Silver Maple	36"	#18	1R	RR	0.255
	44	White Ash	14"	#19	2P	DW	0.258
	44	White Ash	16"	#20	2P	DW, BB	0.260
	46	Norway Maple	14"	#21	3P	GR	0.300
	48	Norway Maple	14"	#22	3P		0.310
	50	Silver Maple	22"	#23	2P		0.320
	50	Silver Maple	20"	#24	1P/2R	RR, DW	0.330
	50	Silver Maple	20"	#25	2R	RR	0.335
--Pass Niagara Street--							
	54	Silver Maple	24"	#26	2P	BB, DW	0.350
	56	Silver Maple	22"	#27	2R		0.360
	56	Silver Maple	22"	#28	2R	RR, DW	0.365
	58	Norway Maple	12"	#29	3P		0.380
	60	Norway Maple	8"	#30	3P		0.385
Dot	64	Silver Maple	20"	#31	2R		0.420
	66	Red Oak	8"	#32	3P	CR	0.430
	66	Silver Maple	6"	#33	3P		0.435
	66	Silver Maple	6"	#34	1P	BB	0.440
	66	Norway Maple	12"	#35	3P	GR	0.450
Dot	Bridge	Silver Maple	22"	#36	2R	RR	0.460
	Bridge	Lilac	2.5"	#37		Train	0.465
	Bridge	Lilac	2.5"	#38		Train	0.470
	Bridge	Lilac	2.5"	#39		Train	0.475

South Vernon Street East Side Start at South End / Telegraph Road							
	65	Silver Maple	16"	#40	3R		0.010
	65	Norway Maple	16"	#41	2P	GR, DW, BB	0.020
	63	Norway Maple	16"	#42	3P		0.030
	61	Silver Maple	18"	#43	2P	DW, RR	0.040
	61	Silver Maple	18"	#44	2P/3R	DW	0.050
	59	Norway Maple	14"	#45	3P	DW	0.080
	57	Silver Maple	24"	#46	2R/1R	DW	0.090
	55	Silver Maple	24"	#47	2P	BB, DW	0.095
	53	Norway Maple	12"	#48	3P		0.100
	53	Norway Maple	8"	#49	3P		0.110
--Niagara Street--							
	49	Norway Maple	2.5"	#50		Train	0.125
	47	Norway Maple	2.5"	#51		Train	0.140
	47	Norway Maple	2.5"	#52		Train	0.141
	45	Norway Maple	2.5"	#53		DT	0.143
	45	Silver Maple	2.5"	#54		Train	0.144
	43	Norway Maple	2.5"	#55		Train	0.147
	43	Little Leaf Linden	2.5"	#56		Train	0.149
	41	Norway Maple	2.5"	#57		Train	0.151
	39	Silver Maple	2.5"	#58		Train	0.155
	39	Norway Maple	2.5"	#59		DT	0.158
	37	Silver Maple	2.5"	#60		Train	0.160
	35	Silver Maple	2.5"	#61		Train, Mulch	0.200
	33	Norway Maple	2.5"	#62		Train, SS	0.210
	31	Little Leaf Linden	2.5"	#63		Train, BB	0.220
	31	Little Leaf Linden	2.5"	#64		Train	0.222
	31	Norway Maple	2.5"	#65		Train	0.230
--Cross Rail Road Tracks--							
	25	Norway Maple	16"	#66	1P	GR, CR, BB	0.260
--Pass Maple Street--							
	21	Silver Maple	40"	#67	2R		0.300
	21	Norway Maple	12"	#68	3P		0.310
	21	Silver Maple	24"	#69	1R	RR	0.320
	RCC	Norway Maple	14"	#70	3P	GR	0.330
	RCC	Norway Maple	12"	#71	3P	GR	0.340
	17	Silver Maple	22"	#72	2R	TR, RR	0.355
	17	Norway Maple	14"	#73	2P	BB over sidewalk	0.357
--Cross Park Avenue--							

South Vernon Street East Side Continued							
	St. Steven's	Silver Maple	28"	#74	2R	RR	0.370
	13	American Elm	6"	#75	1R		0.380
	13	Norway Maple	12"	#76	3P	GR, trunk damage	0.390
	11	Norway Maple	12"	#77	3P		0.395
	Library	Little Leaf Linden	10"	#78	3P		0.400
	Library	Little Leaf Linden	6"	#79	3P	VC	0.450
Dot	7.5	Silver Maple	26"	#80	1R	RR	0.455
	7	Silver Maple	28"	#81	3R/1P	RR, BB, DW over rd	0.460

Maple Street West Side Start at North End / State Street							
		Norway Maple	18"	#1	1P	H	0.010
	4	Silver Maple	20"	#2	2P		0.020
Dot	4	Silver Maple	38"	#3	1R		0.030
	6	Norway Maple	16"	#4	3P/3R		0.040
Dot	8	Norway Maple	12"	#5	1R		0.050
	10	Norway Maple	12"	#6	3P	BB	0.060
	14	Norway Maple	12"	#7	3R		0.080
	16	Norway Maple	10"	#8	3P	VC	0.085
	18	Norway Maple	20"	#9	3R		0.090
	20	Norway Maple	18"	#10	3R		0.095
--Cross Park Avenue--							
	20	Silver Maple	22"	#11	1R	RR	0.100
	20	Norway Maple	14"	#12	3P	BB	0.110
	26	Silver Maple	28"	#13	1R	RR, CB	0.130
	Church	Norway Maple	12"	#14	2R	GR	0.140
Dot	Spc. Grinding	Silver Maple	38"	#15	2R	DW	0.150
	Spc. Grinding	Norway Maple	16"	#16	3P	CR	0.160
--Make 90° Turn--							
Dot	Across Barn	Silver Maple	22"	#17	2R		0.180
	Across Barn	Silver Maple	20"	#18	2P/3R	DT	0.190
	Across Barn	Norway Maple	18"	#19	2P/3R	GR, DW	0.195

Maple Street East Side Start at South End / South Vernon Street							
–Make 90° Turn–							
	21	Silver Maple	26"	#20	1P		0.100
–Cross Park Avenue–							
	23	Norway Maple	10"	#21	3P		0.130
	23	Sugar Maple	22"	#22	1R/2R	VC, Hollow	0.135
	13	Silver Maple	16"	#23	2R		0.145
	13	Silver Maple	22"	#24	2R		0.148
	11	Red Oak	14"	#25	3P		0.160
	9	Norway Maple	12"	#26	3P		0.175
	5	Silver Maple	36"	#27	1R	RR, BB, DW	0.190
	3	Norway Maple	12"	#28	3P		0.205
	26	Silver Maple	38"	#29	2R	RR, BB, DW	0.210
	26	Norway Maple	14"	#30	3P		0.220

Robertson Street West Side
–No Trees On This Side–

Robertson Street East Side Start at South End / State Street							
	33	Silver Maple	30"	#1	1P	DW	0.000
	33	Silver Maple	26"	#2	2P		0.005
	33	Little Leaf Linden	12"	#3	3P	VC	0.015
	33	Norway Maple	20"	#4	3P		0.025
	3	Sugar Maple	24"	#5	2R	VC, RT, BS, HS	0.030
	4	Norway Maple	18"	#6	1R	***	0.040
	5	Norway Maple	12"	#7	3P		0.060
	5	Norway Maple	10"	#8	3P		0.062

Washington Street West Side Start at North End							
	5	Norway Maple	12"	#1	3P	GR, Wires	0.030
X	37	Silver Maple	22"	#2	1R		0.050
	37	Silver Maple	22"	#3	2P		0.052
	37	Silver Maple	22"	#4	2R		0.054
	37	Sugar Maple	22"	#5	2P	DW	0.060

Washington Street East Side Start at South End / State Street							
	41	Silver Maple	32"	#6	3P		0.005
	41	Sugar Maple	22"	#7	1R	RR	0.010
	2	Sugar Maple	22"	#8	1P	DW	0.025
	4	Norway Maple	12"	#9	2P		0.035
	4	Sugar Maple	12"	#10	2R		0.037
	6	Silver Maple	20"	#11	2R	RR	0.040
	6	Sugar Maple	12"	#12	1R	RR	0.042
X	10	Sugar Maple	18"	#13	1R		0.050
	10	Locust	14"	#14	1P	H, BB	0.055

Locust Drive West Side Start at North End / Telegraph Road							
	141	Locust	18"	#1	2P	DW, CP	0.005
	141	Locust	20"	#2	2P	DW, CP	0.020
	2	Locust	20"	#3	2P	DW, CP	0.030
	4	Locust	20"	#4	2P	DW, CP	0.040
	4	Locust	20"	#5	2P	DW, CP	0.050
	6	Locust	20"	#6	2P	DW, CP	0.060
	6	Locust	18"	#7	2P	DW, CP	0.070
	8	Locust	20"	#8	3R		0.080
	8	Locust	18"	#9	2P	DW, CP	0.090
	10	Locust	18"	#10	2P	DW, CP, BB	0.095
	12	Locust	16"	#11	2P	DW, CP, BB	0.100
	12	Locust	18"	#12	2P	DW, CP	0.110

Locust Drive East Side Start at South End							
	9	Locust	16"	#13	2P	DW	0.000
	7	Locust	18"	#14	2P	DW, CP	0.010
	7	Locust	16"	#15	2P	DW, CP	0.020
	7	Locust	14"	#16	2P	DW, CP	0.030
	3	Locust	12"	#17	2P	DW, CP	0.040
	3	Locust	18"	#18	2P	DW	0.050
	3	Locust	18"	#19	2P	DW	0.060
	1	Locust	18"	#20	2P	DW, CP	0.062
	1	Locust	18"	#21	2P	DW, CP	0.070
	Apts.	Locust	20"	#22	2P	DW, CP	0.090

William Street West Side Start at North End							
	9	Red Oak	10"	#1	3P		0.020
	7	Norway Maple	16"	#2	1R		0.030
	1	Norway Maple	16"	#3	2P	DW	0.045
	1	Norway Maple	20"	#4	2P	GR	0.050
	47	Norway Maple	18"	#5	3P		0.070
	47	Silver Maple	24"	#6	3R		0.073

William Street East Side Start at South End / State Street							
	49	Silver Maple	24"	#7	2P	DW	0.005
	49	Silver Maple	28"	#8	1P	DL/RL	0.010
	49	Norway Maple	12"	#9	3P		0.015
	49	Norway Maple	10"	#10	3P		0.020
	4	Sugar Maple	16"	#11	3R/2P		0.030
	4	Sugar Maple	18"	#12	1P/2R	DW, RR	0.040
	6	Norway Maple	10"	#13	2P		0.043
Dot	6	Sugar Maple	24"	#14	1R		0.045
	8	Silver Maple	24"	#15	2P		0.050
	10	Norway Maple	12"	#16	3P		0.060
	10	Sugar Maple	22"	#17	2P		0.065

Alfred Street West Side Start at North End / State Street							
	6	Silver Maple	22"	#1	3R	VC	0.050
	6	Silver Maple	24"	#2	3R	RR	0.060
	10	Sugar Maple	12"	#3	3P		0.075
	10	Sugar Maple	16"	#4	2R	VC	0.080
Dot	10	Sugar Maple	18"	#5	1R	RR	0.085
Dot	10	Sugar Maple	18"	#6	2P		0.090
Dot	16	Sugar Maple	16"	#7	2P/3R	RR	0.095
Dot	16	Sugar Maple	16"	#8	2P/3R	RR	0.096
	16	Sugar Maple	14"	#9	1R	RR	0.097
	51	Silver Maple	36"	#10	1R		0.100

Alfred Street East Side Start at South End							
	13	Norway Maple	10"	#11	3R	GR	0.070
	13	Silver Maple	8"	#12	3P		0.075
	13	Silver Maple	20"	#13	3P		0.080
	9	Norway Maple	14"	#14	2P/3R	DW	0.090

Alfred Street East Side Continued							
	5	Norway Maple	14"	#15	3P		0.110
	3	Little Leaf Linden	16"	#16	2P	VC	0.130
	50	Norway Maple	14"	#17	3P	DW	0.140
	50	Norway Maple	12"	#18	3P	BB	0.150

Butler Parkway West Side Start at North End							
	7	Locust	16"	#1	3P	Wires	0.025
Dot	3	Silver Maple	20"	#2	1R	VC	0.040
	3	Silver Maple	20"	#3	2P		0.043
	53	Little Leaf Linden	16"	#4	3P	Wires	0.060

Butler Parkway East Side Start at South End / State Street							
		Red Maple	10"	#5	3P		0.020
		Norway Maple	16"	#6	3P		0.030
	8	Norway Maple	16"	#7	2R		0.040
	8	Norway Maple	16"	#8	2P		0.045
	8	Locust	20"	#9	1R	Branch over house**	0.050
	10	Norway Maple	20"	#10	2R		0.060

East Avenue West Side Start at North End							
	11	Norway Maple	12"	#1	3P		0.000
	7	Silver Maple	28"	#2	2R	VC	0.020
	5	Norway Maple	10"	#3	3R		0.040
	3	Norway Maple	14"	#4	3P		0.055
	61	Norway Maple	10"	#5	3P	GR	0.060
	61	White Ash	6"	#6	3P		0.063
	61	Silver Maple	26"	#7	2P		0.065

East Avenue East Side Start at South End / State Street							
	63	Silver Maple	20"	#8	2P		0.000
	63	Sugar Maple	20"	#9	2P		0.003
	4	Norway Maple	14"	#10	3P	Wires	0.020
	6	Norway Maple	14"	#11	3P	GR	0.030
	10	White Ash	24"	#12	1P	DW	0.050
	10	White Ash	20"	#13	1P	DW	0.053
	12	Norway Maple	12"	#14	2P	DW	0.060

Hammond Circle
--No Trees On This Road--

Telegraph Road / Route 31 South Side
--No Trees On This Side--

Telegraph Road / Route 31 North Side Start at East End / Village Limit							
	104	Norway Maple	16"	#1	2P	GR, DW	0.330

Manor Lane Outside Circle Counter-Clockwise Start at Kelly Avenue							
	40	Norway Maple	10"	#1	3P		0.040
	36	Norway Maple	12"	#2	3P		0.060
	36	Norway Maple	12"	#3	3P		0.065
	30	Norway Maple	12"	#4	3P		0.110
	30	Norway Maple	14"	#5	3P		0.120
	14	Cherry	14"	#6	2P		0.240
	4	Norway Maple	10"	#7	3P		0.300
	4	Norway Maple	10"	#8	3P		0.310
	2	Norway Maple	8"	#9	3P		0.320
	2	Norway Maple	8"	#10	3P		0.330
	31	Norway Maple	8"	#11	3P		0.360
	31	Norway Maple	8"	#12	3P		0.370

Manor Lane Inside Circle Clockwise Start at 'T'							
	13	Norway Maple	8"	#13	3P		0.150
	13	Norway Maple	12"	#14	3P		0.160
	15	Norway Maple	12"	#15	3P		0.200
	17	Red Oak	12"	#16	3P		0.240
	17	Norway Maple	10"	#17	3P		0.245
	17	Norway Maple	10"	#18	3P		0.250
	19	Norway Maple	8"	#19	3P		0.260

Francsis Street South Side Start at West End / Kelly Avenue							
Dot	35	Silver Maple	28"	#1	1R		0.000
	35	Norway Maple	12"	#2	3P		0.005
	35	Norway Maple	12"	#3	2P	CR	0.010
	33	Silver Maple	24"	#4	3P		0.015
	33	Sugar Maple	14"	#5	2R	RR	0.020
	31	Silver Maple	24"	#6	3R		0.025
	27	Silver Maple	28"	#7	3R		0.040
	25	Silver Maple	22"	#8	1P	DW	0.050
	21	Silver Maple	22"	#9	2R	VC	0.060
	19	Silver Maple	30"	#10	3R		0.070
	17	Norway Maple	6"	#11	3P		0.100
	15	Norway Maple	6"	#12	3P		0.105
	13	Horse Chestnut	20"	#13	2P		0.110
	13	Silver Maple	30"	#14	3P		0.120
	9	Silver Maple	18"	#15	2R		0.135
	5	Silver Maple	20"	#16	2R		0.150
	5	Silver Maple	6"	#17	3P		0.156
	3	Silver Maple	24"	#18	1R		0.160
	3	Silver Maple	20"	#19	3P		0.165
	3	Silver Maple	22"	#20	2P		0.170

Francis Street North Side
–No Trees On This Side–

South Street South Side Start at East End / South Vernon Street							
	36	Sugar Maple	18"	#1	3P		0.010
	36	Norway Maple	12"	#2	3R	TR	0.015
	36	Norway Maple	14"	#3	3P		0.020

South Street North Side
–No Trees On This Side–

Watson Street South Side Start at West End / Village Limit							
	11	Horse Chestnut	18"	#1	3R	Bad Crotch	0.020
	11	Horse Chestnut	18"	#2	3R		0.025
	11	Sugar Maple	20"	#3	3P		0.030
	7	Sugar Maple	24"	#4	2P	R Back Branch	0.040

Watson Street South Side Continued							
	5	Sugar Maple	26"	#5	3P		0.060
	Acrs Bskt Fctry	Sugar Maple	20"	#6	1R	RR	0.100

Watson Street North Side Start at East End / Church Street							
	8	Norway Maple	12"	#7	2P		0.040
	8	Norway Maple	12"	#8	1R		0.045
	8	Norway Maple	12"	#9	3P		0.050
	10	Silver Maple	20"	#10	2P		0.060
	12	Red Oak	12"	#11	3P		0.070
	16	White Ash	28"	#12	3P	BB	0.080
	18	Norway Maple	12"	#13	2R		0.100

Church Street South Side Start at West End / Watson Street							
	41	Catulpa	24"	#1	3P		0.000
	33	Red Oak	6"	#2	3P		0.060
X	27	Sugar Maple	16"	#3	1R		0.100
	27	Little Leaf Linden	10"	#4	1P		0.110
	25	Red Maple	4"	#5	1R		0.120
	25	Red Maple	2.5"	#6	3P		0.125
	11	Norway Maple	20"	#7	2P	over house	0.210
	5	Silver Maple	18"	#8	3P		0.250

Church Street North Side Start at East End / South Main Street							
	10	Sugar Maple	24"	#9	2R	RR	0.060
Dot?	***10***	***Ornamental Hawthorn***	***10"***	***#10***	***2P***		***0.070***
X	14	Norway Maple	8"	#11	1R		0.080
	32	European Mountain Ash	6"	#12	3P		0.170
	32	Norway Maple	10"	#13	3P		0.180

Park Avenue South Side Start at West End / South Main Street							
		Norway Maple	12"	#1	3P		0.000
		Silver Maple	30"	#2	2P		0.000
		Norway Maple	12"	#3	2R	SS, GR	0.005
		Douglas Fir	12"	#4	3P		0.006
		Silver Maple	1"	#5	Replace	DT, Exposed Roots	0.007
	6	Sugar Maple	20"	#6	1P/2R	DW, RR, VC	0.009

Park Avenue South Side Continued							
	6	Sugar Maple	22"	#7	2P/3R	TR, Cavity	0.010
	6	Crab Apple	12"	#8	3P		0.010
	8	Crab Apple	12"	#9	3P		0.015
	8	Silver Maple	22"	#10	1R	RR, DW	0.017
	8	Silver Maple	28"	#11	2R		0.020
	8	Sugar Maple	22"	#12	2P	DW	0.022
	8	Crab Apple	10"	#13	3P		0.021
	8	Crab Apple	10"	#14	3P		0.023
--Cross South Vernon Street--							
	16	Silver Maple	20"	#15	1R		0.070
	18	Silver Maple	28"	#16	2P		0.080
--Cross Maple Street--							
	22	Norway Maple	16"	#17	2P	DW, remove lite fixture	0.115
	30	Norway Maple	14"	#18	3P		0.140
	32	Silver Maple	28"	#19	1R	RR	0.150
	40	Silver Maple	22"	#20	2P	DW	0.210
	40	Silver Maple	16"	#21	3P		0.220
	42	Sugar Maple	18"	#22	1R		0.230
	44	Sugar Maple	20"	#23	3R		0.232
	48	Silver Maple	4"	#24	3P		0.260
	48	Norway Maple	14"	#25	3P		0.270

Park Avenue North Side Start at East End / Alfred Street							
	51	Silver Maple	8"	#26	3P		0.000
	51	Locust	16"	#27	3P	DW, CR, over roof	0.005
	47	Norway Maple	8"	#28	3P	GR	0.020
	43	Silver Maple	18"	#29	3P		0.040
	43	Norway Maple	14"	#30	3R		0.042
	37	Norway Maple	18"	#31	3P		0.060
	35	Norway Maple	18"	#32	1R	GR	0.070
	33	Silver Maple	18"	#33	1R	RR	0.080
	31	Silver Maple	20"	#34	1P	over house, VC	0.090
	27	Norway Maple	14"	#35	2P	BB	0.110
	23	Silver Maple	20"	#36	2R	DW	0.130
--Cross Maple Street--							
	15	Norway Maple	14"	#37	3R		0.160
--Cross South Vernon Street--							

Park Avenue North Side Continued							
	UMC	Red Oak	14"	#38	3P		0.170
	UMC	Silver Maple	4"	#39	2P	BB	0.175
	UMC	Silver Maple	8"	#40	2P	BB, CR	0.180
	7	Red Maple	2.5"	#41	3P	CR	0.185
	5	Sugar Maple	20"	#42	1R	RR, DW	0.190
	5	Sugar Maple	22"	#43	3P	TR, Watch***	0.195
	HSBC	Silver Maple	10"	#44	1P	Re-Prune	0.215

Freeman Avenue South Side
--No Trees On This Side--

Freeman Avenue North Side Start At East End / Alfred Street							
	6	Silver Maple			Tree have Issues, but they belong to the respective home-owners		
	6	Silver Maple					
	17	Silver Maple					

State Street South Side Start at West End / South Main Street							
		Lilac	2.5"	#1	1P	Bottom Sprout	0.000
	Across 13	Lilac	2.5"	#2	2P	CR	0.040
	20	Little Leaf Linden	10"	#3	2P	VC	0.090
	24	Little Leaf Linden	10"	#4	2R	VC	0.100
	Funeral Home	Norway Maple	12"	#5	3R		0.190
	42	Norway Maple	14"	#6	3P		0.240
	42	Norway Maple	12"	#7	3P		0.245
	42	Silver Maple	28"	#8	2R	RR	0.250
	44	Norway Maple	10"	#9	3P		0.255
	44	Silver Maple	6"	#10	3P		0.260
	44	Silver Maple	16"	#11	3P		0.265
	46	Norway Maple	12"	#12	2P/3R	GR	0.275
	48	Norway Maple	14"	#13	1P	BB	0.290
	50	Silver Maple	24"	#14	2R	RR	0.300
	50	Silver Maple	22"	#15	1R	DW, ***	0.310
	52	Norway Maple	8"	#16	3P		0.320

State Street North Side Start at East End / Village Limit							
	67	Norway Maple	10"	#17	3P		0.130
	63	Norway Maple	10"	#18	3P		0.135
	59	Norway Maple	8"	#19	2R		0.160
	55	Norway Maple	10"	#20	2P/3R		0.205
	51	Norway Maple	8"	#21	3P		0.240
	47	Norway Maple	12"	#22	3P	Wires	0.270
	45	Norway Maple	10"	#23	3P	GR	0.295
	43	Norway Maple	10"	#24	2P		0.300
	41	Norway Maple	12"	#25	3R		0.320
	33	Norway Maple	10"	#26	3P	GR	0.380
	33	Norway Maple	8"	#27	3R	SS	0.385
	27	Norway Maple	8"	#28	2R	GR	0.430
	27	Norway Maple	12"	#29	3P	GR	0.435

Mill Street South Side
--Canal Authority Trees--

Mill Street North Side Start at East End / North Main Street							
	8	Norway Maple	20"	#1	2R	DW	0.020
	8	Norway Maple	16"	#2	2R	Rot	0.025
	12	Silver Maple	18"	#3	3P		0.030
	12	Norway Maple	12"	#4	3P		0.035
	12	Silver Maple	20"	#5	3P		0.040
	24	Norway Maple	14"	#6	3P		0.130
X	30	English Walnut	20"	#7	1R		0.200
Dot	36	Silver Maple	24"	#8	1R		0.220
	37	Silver Maple	26"	#9	1P/2R	DW	0.230
	40	Silver Maple	30"	#10	3P		0.240
Dot	44	Silver Maple	42"	#11	1R	***	0.300
	46	Norway Maple	12"	#12	3P		0.320

Terry Street South Side Start at West End / North Hartland Street							
	11	Red Oak	12"	#1	3P		0.020
	11	Norway Maple	14"	#2	3P		0.025
	9	Norway Maple	18"	#3	1P		0.030

Terry Street North Side Start at East End / North Main Street							
	8	Silver Maple	22"	#5	2R/1P	DW	0.020
	12	Black Walnut	28"	#6	3P		0.030

Mechanic Street South Side Start at West End / North Hartland Street							
--Cross North Main Street--							
	Apt. 2	Sugar Maple	26"	#1	2R		0.250

Mechanic Street North Side Start at East End							
	Apt. 2	Horse Chestnut	24"	#2	2R	Rot/Root Damage	0.000
	Apt. 2	Horse Chestnut	20"	#3	2R	Rot/Root Damage	0.010
	31	Black Walnut	20"	#4	3P		0.040
		Silver Maple	16"	#5	3P		0.050
X		Silver Maple	20"	#6	2R-1R		0.060
		Silver Maple	22"	#7	3R		0.070
	23	Norway Maple	12"	#8	3P	VC	0.080
	21	Norway Maple	12"	#9	2P	DW	0.090
	19	Norway Maple	12"	#10	3P		0.100
	19	Norway Maple	12"	#11	3P	GR	0.110
	17	Silver Maple	24"	#12	1P		0.120
--Cross North Main Street--							
	15	Silver Maple	26"	#13	1P/2R		0.140
	13	Norway Maple	12"	#14	3P	CR	0.150
Dot	11	Norway Maple	12"	#15	3R		0.160
	11	Red Oak	6"	#16	3P		0.165
	7	Norway Maple	14"	#17	3P		0.170
	5	Silver Maple	20"	#18	3R	Leaning	0.180
	5	Norway Maple	14"	#19	3P		0.200

Sherman Street South Side
--No Trees On This Side--

Sherman Street North Side Start at East End / North Hartland Street							
	4	Cottonwood	22"	#1	3P		0.040
	4	Cottonwood	24"	#2	3P		0.045
	4	Cottonwood	26"	#3	3P		0.050
	4	Silver Maple	14"	#4	2P		0.060
X	6	Silver Maple	22"	#5	1R		0.065

Sherman Street North Side Continued							
	6	Silver Maple	20"	#6	2P		0.070
	6	Silver Maple	20"	#7	2R		0.075
	6	Silver Maple	26"	#8	3P		0.080
	Village Limit	Sugar Maple	20"	#9	1P	DB	0.140

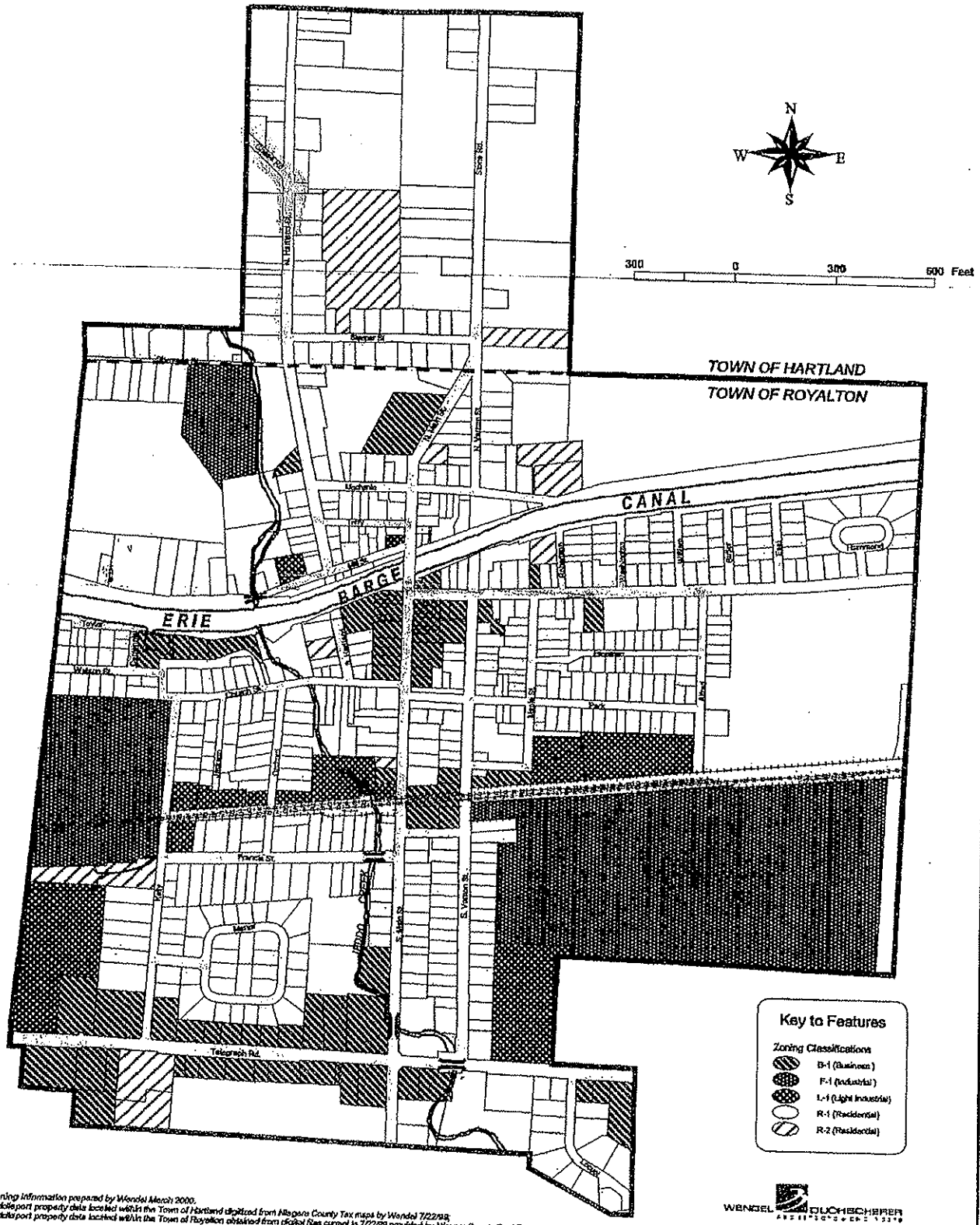
Sleeper Street South Side Start at West End / North Hartland Street							
	25	Silver Maple	20"	#1	1	Rot	0.000
	23	Norway Maple	12"	#2	P		0.010
	23	Silver Maple	24"	#3		DW, PPP Needs Attn.	0.030
	19	Silver Maple	20"	#4	3P		0.040
	19	Silver Maple	24"	#5	3P	DW	0.050
X	19	Silver Maple	20"	#6	1R		0.070
X	19	Silver Maple	20"	#7	1R		0.070
	19	Silver Maple	20"	#8	3P	DW	0.080
	Across 18	Norway Maple	18"	#9	3R	Root Issues	0.090
	11	Silver Maple	24"	#10	3P		0.095
X	11	Silver Maple	20"	#11	1to2R		0.100
	9	Silver Maple	16"	#12	3R	RR	0.110
	9	Pin Oak	8"	#13	2P	3 Bottom Branches***	0.130
	5	Silver Maple	16"	#14	3P		0.150

Sleeper Street North Side Start at East End / North Main Street							
	1	Norway Maple	2.5"	#15		Train	0.000
	8	Silver Maple	12"	#16		Thinned	0.070
Dot	8	Sugar Maple	26"	#17	2to1R		0.080
	8	Norway Maple	18"	#18		DW	0.090
	12	Silver Maple	20"	#19	2R		0.095
Dot	12	Silver Maple	18"	#20	1R	Lightning	0.096
Dot	12	Silver Maple	16"	#21	1R	RR	0.097
	18	Norway Maple	18"	#22	1P		0.098
	18	Norway Maple	10"	#23	1P		0.099
	20	Sugar Maple	20"	#24	1P	DW	0.100
X	20	Silver Maple	18"	#25	1R		0.110
		Silver Maple	34"	#26	2to3R		0.120
		Norway Maple	8"	#27		SS	0.130
	26	Silver Maple	34"	#28	2to1R		0.140
X	26	Silver Maple	36"	#29	1	Rot	0.150

Sleeper Street North Side Continued							
	26	Silver Maple	28"	#30	1	Rot	0.160
	26	Silver Maple	36"	#31	2		0.170

ZONING MAP
FOR THE VILLAGE OF MIDDLEPORT

MAP 10



Source:
Proposed Zoning information prepared by Wendel March 2000.
Village of Middleport property data located within the Town of Hartland digitized from Niagara County Tax maps by Wendel 7/22/99;
Village of Middleport property data located within the Town of Royalton obtained from digital files current to 7/22/99 provided by Niagara County Real Property Services

WENDEL DUCHSCHERER

November 2000

Map 10 - Zoning

MICHA TREE and LANDSCAPE CONSULTANTS, INC.
1590 Brick Church Road, Ontario, New York 14519-9753
315-524-8589 FAX 315-524-6456
E-mail: MichaTree@aol.com

July 18, 2003

Village of Middleport
24 Main Street
P.O. Box 186
Middleport, NY 14105-0186
Attn: Mr. James E. Mahar, DPW Supt.

Dear Mahar,

Responding to your request of June 17, 2003, we have completed a thorough street tree survey and individual examination.

Key to Abbreviations

DW	Deadwood
RW	Raised sidewalk from tree roots
LB	Raised by pruning/remove low branching
HC	Provide house or building clearance

Species Noted – Abbreviations

SM	Silver Maple
HM	Hard Maple
NM	Norway Maple
CM	Crimson Maple
H. Chest	Horse Chestnut
RM	Red Maple
L.L. Linden	Little Leaf Linden (Greenspire)
R. Oak	Red Oak
W. Ash	White Ash
E. Mount Ash	European Mountain Ash
P. Scar Haw	Pauls Scarlet Hawthorne
J.T.L.	Japanese Tree Lilac
Locust	Varieties of Honey Locust (Morraine, Imperial)
R. of Sharon	Rose of Sharon
N. Catalpa	Northern Catalpa
Schw. Maple	Schwedler Maple
Elm	A hybrid American Elm
Fl. Crab.	Flowering Crabapple
W.L.S.M.	Wine Leafed Sycamore – Maple
Forsythia	Forsythia
Lilac	Common Lilac
Black Wal.	Black Walnut
E. Walnut	English Walnut

Species Noted – Abbreviations (cont'd)

Sycamore	American Sycamore
Box Elder	Box Elder
Golden Chain	Golden Chain

Tree Survey:

Location	Species	Size	Condition
S/side S/E corn. Francis & Kelly Ave.	SM	35.4"	Fair – suckers, DW RW
W/NYT P#12 Francis	NM	15.1"	Good – raise LB, light DW
E/NTY P#12 Francis	NM	15.4"	Good – raise LB , light DW
33 Francis	SM	31.8"	Good – fair DW RW
33 Francis	HM	16.2"	Fair – DW
31 Francis	Ginko	1-1/2" Cal.	Good – new planting
31 Francis	SM	31.0"	Good – suckers
29 Francis	SM	35.1"	Poor, large limb cavity*
W/drive 27 Francis	SM	25.8"	Poor, limb cavity, stubs*
27 Francis Center	SM	37.0"	Fair – large stub DW
27 Francis East	SM	21.9"	Poor – basal cavity* RW
25 Francis West	SM	28.2"	Poor – trunk cavity* RW
25 Francis East	SM	29.5"	Fair DW – suckers
23 Francis	SM	34.0"	Poor – declining top*
21 Francis	SM	32.8"	Fair – DW low branching
19 Francis West	SM	41.4"	Fair – DW
19 Francis East	SM	28.5"	Poor – center dead, hollow limbs*
17 Francis	SM	32.1"	Stub only – used as guy*
17 Francis	NM	4.1" DBH	Raise low branching
17 Francis	NM	6.2" DBH	Raise low branching
13 Francis	H. Chest.	28.9"	Good – raise LB, DW
13 Francis	SM	27.0"	Poor – DW trunk rot*
9 Francis West	SM	39.5"	Good – DW stubs
9 Francis Center	SM	20.2"	Fair – DW
9 Francis East	SM	36.2"	Poor – trunk cor. DW, stubs*
7 Francis	SM	27.3"	Fair – stubs

* Remove tree

5 Francis	SM	5.3"	Good – low branching
3 Francis West	SM	34.3"	Fair – DW – hollow limb, suckers
3 Francis Center	SM	19.4"	Poor – trunk hollow*
3 Francis Center	RM	25.7"	DW, stubs, hanger – good
3 Francis East	SM	29.1"	Good – DW
N/#2 Jackson St.	Locust	18.2"	Good – DW, raise, remove limb over street
#2 Jackson	NM	20.7"	Good – DW, raise, H. clear
#4 Jackson	NM	16.9"	Poor, roots cut for walk in decline*
N/#4 Jackson	SM	30.4"	Good, raise L. branching DW
3 Jackson	HM	22.5"	Poor, hollow trunk & limbs*
3 Jackson	Rose of Sharon	5"-2" Cal. 1-1/2-1-1.2 Cal.	Clump adj. Old stump*
1 Jackson	HM	22.2"	Good – DW RW
1 Jackson	L.L. Linden	13.9"	Good – raise low branching
29 Church Corn. Jackson	SM	30.8"	Good – raise low branching, DW
#11 Watson	H. Chest.	22.6"	Fair – DW, suckers
#11 Watson	H. Chest.	22.0"	Good – DW, raise LB
#11 Watson	HM	25.3"	Good
#7 Watson	HM	29.0"	Fair – DW
#5 Watson	HM	30.4"	Good
4 Church Watson side	HM	26.1"	Fair – DW, raise LB
8 Watson East	NM	13.3"	Fair – DW, raise suckers
8 Watson Center	NM	13 x 3"	Good – DW – HC
8 Watson West	NM	14.4"	Good – HC
10 Watson	SM	29.9"	Good – raise, HC
12 Watson	R. Oak	7.6"	Good – light raise
16 Watson	W. Ash	33.3"	Fair – DW, stubs, suckers
18 Watson	NM	15.0"	Fair – DW, remove low limb over street
#8 Watson Centennial side	NM	17.5"	Poor – deadwood, stubs
#7 Taylor	NM	13.5"	Fair – DW, stubs
2 S. Hartland N	SM	38.5"	Fair – DW, stubs
2 S. Hartland S	SM	34.6"	Fair – DW, stubs

* Remove tree

4 S. Hartland	HM	36.3"	Fair – HC
6 S Hartland	HM	21.4"	Poor – Die back*
8 S. Hartland	SM	54.8"	Poor – trunk cav.* RW
8 S. Hartland	SM	42.6"	Fair – DW, raise
5 S. Hartland N.	SM	32.8"	Fair – DW
5 S. Hartland N.	Twin H. Chest.	21.3"/20.2"	Fair – stubs, light raise w/ trunk basal cav.
5 S. Hartland N.	H. Chest.	29"	Poor – basal & trunk cavities*
5 S. Hartland Center	C.S. Linden	12.9"	Good – light raise
10 Church S. Hartland side	HM	33.8"	Good – DW light raise
41 Church	N. Catalpa	31.5"	Fair – DW, raise LB RW
39 Church	HM	34.0"	Poor – DW, top decline, root & trunk rot* RW
33 Church	R. Oak	5.8"	Fair – light DW, chlorotic
27 Church	HM	18.6"	Poor – DW, stubs, root decline*
27 Church	L.L. Lind.	8.5"	Good – raise LB
25 Church	SM	4.3"	Good – raise LB
25 Church	Cross SM/RM	2.8"	Fair - trunk damage – mowed, Autumn Blaze
23 Church	NM	21.3"	Poor – trunk damage, DW*
11 Church	NM	25.9"	Good – DW, stubs, HC
9 Church	HM	31.1"	Fair – DW, stubs, HC (low crotched)
7 Church	SM	33.0"	Fair – DW, suckers, LB, HC
E/#5 Church	SM	20.7"	Good – raise low branching RW
20' W/NYT P #4 Church	HM	31.0"	Poor – large DW, top decline RW
8' E/NYT P #5 Church	P. Scar. Hawthorne	10"/6"	Fair – suckers, LB
14 Church	NM	9.0"	Poor – bark loss, in decline, die back*
32 Church	E. Mount Ash	3.0"	Good
32 Church	Crimson Maple	9.8"	Excellent
23 Church – Orchard side	Schw. Maple	17.5"	Good – raise LB
23 Church – Orchard side	Schw. Maple	18.1"	Good – raise LB

* Remove tree

4 Orchard	NM	12.9"	Fair – DW, bark splits, raise LB
6 Orchard	SM	37.5"	Good – suckers, raise LB
8 Orchard	SM	27.8"	Good – deadwood
8 Orchard	SM	28.8"	Fair – deadwood, hangers
10 Orchard	SM	26.6"	Fair – deadwood, raise LB
10 Orchard	SM	27.7"	Fair – deadwood
10 Orchard	SM	28.7"	Good – hangers, DW raise LB
12 Orchard	NM	22.5"	Good – DW, raise LB
14 Orchard	Elm	1.5" Cal.	Good
14 Orchard	SM	5.0"	Good – raise LB
16 Orchard	NM	11.9"	Good – raise LB
16 Orchard	NM	11.3"	Good – raise LB
18 Orchard	SM	30.0"	Fair – DW, raise LB
22 Orchard	NM	19.8"	Good – DW, raise LB
22 Orchard	SM	19.0"	Good – DW, raise LB
22 Orchard	SM	33.1"	Fair – DW
22 Orchard	SM	24.3"	Poor – center bad*
24 Francis – Orchard side	SM	29.7"	Good – DW
24 Francis – Orchard side	SM	41.9"	Good – DW, raise LB
24 Francis – Orchard side	SM	28.2"	Poor – dieback*
24 Francis – Orchard side	SM	37.0"	Fair – hollow limbs, DW
23 Francis – Orchard side	R. Maple	30.2"	Fair – large stub, DW
23 Francis – Orchard side	NM	15.1"	Fair, DW, raise LB
23 Orchard	NM	13.2"	Good – DW, raise LB
19 Orchard	SM	36.2"	Good – DW
19 Orchard	L.L. Linden	8.9"	Good – stubs, raise LB
15 Orchard	R. Oak	8.0"	Good – raise LB
15 Orchard	L.L. Linden	12.2"	Good – raise LB
13 Orchard	SM	21.9"	Good – suckers, raise LB
9 Orchard	NM	14.5"	Good – DW, raise LB
7 Orchard S.	SM	26.3"	Poor, in decline*
7 Orchard N.	SM	28.6"	Fair – DW
5 Orchard	HM	36.6"	Fair – DW, low crotched, lean
3 Orchard	NM	15.0"	Fair – DW, stubs, raise LB
1 Orchard	NM	16.2"	Good – DW, suckers HC, raise LB

* Remove tree

21 Church – Orchard side	HM	31.3"	Poor – trunk root, basal rot*
41 Main Street **	JTL	3.2" DBH	Good
Across 38 Main **	NM	6.3"	Good
Across 38 Main **	JTL	3.0"	Good
Across/Fire Station **	NM	6.5"	Good
Across/Fire Station **	JTL	2.8"	Fair
Across/Fire Station **	JTL	3.0"	Fair
Across/Fire Station **	JTL	3.2"	Fair
25 Main Street **	JTL	3.0"	Good
14 Main Street **	JTL	3.7"	Good
17 Main Street **	JTL	2.0"	Good
18 Main Street **	JTL	3.0"	Good
Village Offices **	JTL	3.2"	Good
Village Offices **	JTL	2.5"	Good
26 Main Street **	JTL	3.0"	Good
36 Main Street **	Fl. Crab.	6.5"	Good – raise, suckers
40 Main Street **	NM	6.6"	Good
52-1/2 Main Street **	H. Chest.	31.5"	Fair – DW, suckers, hollow upp. Limbs
61 Main Street **	Fl. Crab.	7.0"	Good – suckers
S/E Corn. Park & Main **	Crim. Maple	14.4"	Good (in Park Area)

** Trees are between Railroad and Canal on Main Street.

35 Kelley – R	NM	20.5"	Good, raise LB
35 Kelley – L	NM	14.5"	Fair, DW
33 Kelley - R	NM	23.1"	Good, raise LB
33 Kelley – C	NM	17.0"	Good, raise LB
33 Kelley – L	NM	19.7"	Good, raise LB
31 Kelley – R	R. Oak	6.9"	Good, raise, DW
31 Kelley – L	L.L. Linden	11.3"	Good, raise
29 Kelley – R	Silv. Maple	27.3"	Fair
29 Kelley – L	Silv. Maple	30.7"	Fair DW, raise
27 Kelley – R	H. Maple	26.4"	Poor, hollow, DW*
27 Kelley – L	Red Maple	24.2"	Fair
25 Kelley – IW	Silv. Maple	36.1"	Fair DW, HC, raise LB
Between 23 & 25 Kelley	Red Maple	19.7"	Good, DW, stubs
19 Kelley – R	NM	13.0"	Good, DW, raise LB
19 Kelley – L	NM	15.3"	Fair, DW, raise LB, HC
34 Kelley – L	NM	16.0"	Poor DW, raise LB

* Remove Tree

34 Kelley – C	NM	16.2"	Fair, raise LB
34 Kelley – R	NM	16.3"	Fair, raise LB
32 Kelley – L	NM	23.8"	Fair, raise LB, DW
32 Kelley – R	NM	19.0"	Fair, raise LB, DW
22 Kelley	NM	11.5"	Raise LB
S/E Corn Kelley/Francis on Kelley	SM	20.0"	Poor, cracked limbs, raise LB IW
S/E Corn Kelley/Francis on Kelley	SM	33.0"	Poor, hollow, DW, HC, raise LB IW
9 Kelley – R	NM	12.7"	Good
9 Kelley – L	Silv. Maple	39.3"	Good, raise LB, DW
5 Kelley – R	C. Maple	7.6"	Good, stubs
5 Kelley – L	C. Maple	9.0"	Good, stubs
3 Kelley	Red Maple	35.8"	Good, stubs, DW
Betw. #1 & #3 Kelley	NM	23.8"	Good, raise LB
37 Church, Kelley side	NM	19.8"	Good, raise LB
37 Church, Kelley side	Silv. Maple	36.3"	Good – HC
33 State	Silv. Maple	37"	Deadwood, BHL Fair
Robertson Side	Silv. Maple	31.9"	Fair
Robertson Side	Linden	12.5"	Weak crotch, fair, raise LB
Robertson Side	Norway Maple	23.8"	Deadwood, fair
3 Robertson	Sugar Maple	27.5"	Center lead – decay RW
4 Robertson	NM	19.1"	DW, BHL, Longitudinal low, split branch
5 Robertson	Crimson King Maple	12.1"	Good
5 Robertson	Crimson King Maple	8.6"	Good
41 State	Silv. Maple	34.4"	Fair
Washington Side	Sugar Maple	25.2"	Fair
Washington Side	Silv. Maple	37.4"	Stump 2 ft. high, grind
2 Washington	Sugar Maple	26"	Fair, broken walk
4 Washington	NM	14"	Fair
4 Washington	NM	12.9"	Center leader rooted
4 Washington	Silv. Maple	22.3"	Fair
6 Washington	Sugar Maple	13.2"	
10 Washington	Sugar Maple	18.8"	Trunk rot – Borers – ants
10 Washington	Honey Locust	13.7"	Declining
5 Washington	Crimson King Maple	14.0"	Fair
37 State St.	Silv. Maple	25.7"	Poor, one sided due to Power Co., decay
On Washington	Silv. Maple	24.9"	Fair
On Washington	Silv. Maple	24.5"	Fair

* Remove Tree

On Washington	Sugar Maple	25"	Fair
24 State	NM	21"	Fair
26 State on Maple	NM	16"	Fair
4 Maple	Silv. Maple	31.6"	Fair
4 Maple	Silv. Maple	41"	Poor – only ½ tree
6 Maple	NM	18.4"	Fair RW
8 Maple	NM	14.6"	Bad crotch – poor
10 Maple	NM	12.7"	Fair
12 Maple	NM	12.5"	Fair
14 Maple	NM	13"	Fair
16 Maple	NM	9.7"	Fair
18 Maple	NM	21.3"	Fair, hazardous cracked walk
20 Maple	NM	20.3"	Fair
20 Park on Maple	Silv. Maple	28.8"	Fair, DW
20 Park on Maple	NM	15.7"	Fair RW
26 Maple	Silv. Maple	37"	Poor, ant inf.*
26 Maple	Silv. Maple	42.7"	Hollow trunk, poor *
26 Maple	Silv. Maple	32.7"	DW, fair
Park Area	NM	15"	Hollow eventual removal*
Park Area	Silv. Maple	41.3"	Hole in trunk, poor
Park Area	NM	16"	Fair
Park Area	Silv. Maple	29.7"	Poor, hole in trunk
Park Area	NM	13.7"	Fair
21 Vernon St.	SM	21.8"	Fair
On Maple St. side	NM	18.7"	Fair
On Maple St. side	Red Maple	18.9"	Poor, hollow*
21 Maple	Silv. Maple	35"	Fair
23 Park	NM	10.3"	Fair
On Maple	Sugar Maple	30.7"	Fair
17 Maple	Red Maple	19.5"	Fair
17 Maple	Silv. Maple	28.7"	Fair, DW
11 Maple	Red Oak	11.5"	Fair
9 Maple	NM	16.2"	Fair
7 Maple	Crimson King Maple	16.3"	Fair
5 Maple	Silv. Maple	41.7"	Fair
5 Maple	NM	12.8"	Fair
3 Maple	Silv. Maple	39"	Fair RW
48 State St.	Silv. Maple	35"	Poor, new split*
On Alfred	Sugar Maple	28.4"	Declining*
On Alfred	Crimson King Maple	1"	Good

* Remove Tree

6 Alfred	Silv. Maple	28.3"	Fair
6 Alfred	Silv. Maple	32"	Fair
10 Alfred	Sugar Maple	12"	Fair
10 Alfred	Sugar Maple	18.3"	Fair
10 Alfred	Sugar Maple	23.3"	Fair
10 Alfred	Sugar Maple	25.5"	Poor, decayed, ant infested
16 Alfred	Sugar Maple	20.1"	Borers – ants, poor
16 Alfred	Sugar Maple	19.1"	Fair
16 Alfred	Sugar Maple	17.4"	Decline, poor
51 Park Ave.	Wine leaved Syc. Maple	1"	Good
Alfred side	Sugar Maple	13.3"	Remove, ½ dead, hollow*
Alfred side	Silv. Maple	40.0"	Fair, DW, hole in trunk
Alfred side	Forsithia	6' x 6'	Good
13 Alfred	NM	12.3"	Fair
13 Alfred	Silv. Maple	8.2"	Fair
13 Alfred	Silv. Maple	26.8"	Fair, DW
11 Alfred	Silv. Maple	30"	Poor, decay several spots*
9 Alfred	NM	19.2"	Fair
5 Alfred	NM	14.5"	Fair
3 Alfred	Linden	15.1"	Fair
50 State	NM	15.9"	Fair
On Alfred	NM	12"	Fair
49 State	Silv. Maple	29.5"	Fair
William	Silv. Maple	33.9"	Fair RW
William	NM	12.6"	Fair
William	NM	9.5"	Fair
4 William St.	Sugar Maple	17.2"	Fair
4 William St.	Silv. Maple	27"	Trunk rot 12 ft., poor*
4 William St.	Sugar Maple	22.9"	Fair
6 William	NM	10.7"	Fair
6 William	Sugar Maple	29.1"	Decay trunk, poor
8 William	Silv. Maple	28.4"	Fair
10 William	Sugar Maple	16.2"	Poor, main leader dead*
10 William	NM	9.8"	Fair
10 William	Sugar Maple	25.7"	Some decay trunk, poor
9 William	Red Oak	7"	LB, Fair
7 William	NM	19.3"	Weak crotch, has been bolted, Fair
1 William	NM	16.3"	Fair
1 William	NM	20.8"	Fair RW

* Remove Tree

47 State	NM	20.1"	Fair
47 State	Silv. Maple	29.5"	Fair
55 State	Red Maple	9.7"	Fair
On Butler	NM	17.2"	Fair
8 Butler	Crimson King Maple	20.5"	Fair
8 Butler	Crimson King Maple	21.3"	Fair
8 Butler	Moraine Locust	25.5"	8" broken branch lodged in top
10 Butler	NM	23.7"	Wet wood, Fair
7 Butler	NM	18.5"	Fair
7 Butler	Moraine Locust	18.2"	Fair
3 Butler	Silv. Maple	26.5"	Hollow trunk, poor
3 Butler	Silv. Maple	24.7"	Fair
53 State on Butler	Linden	16.4"	Fair
63 State	Silv. Maple	25.1"	Fair
On East Ave.	Sugar Maple	25.8"	Fair, DW top
On East Ave.	NM	9.2"	Poor*
4 East Ave.	NM	14.7"	Fair
6 East Ave.	NM	15.4"	Fair
8 East Ave.	Silv. Maple	36.6"	Top leader dead, decay at base*
10 East Ave.	Ash	27.2"	Raised walk, severe
10 East Ave.	Ash	25.2"	Broken walk hazard
12 East Ave.	NM	14.4"	Fair
11 East Ave.	Crimson King Maple	11.3"	Good
11 East Ave.	Silv. Maple	29.1"	Fair
7 East Ave.	Silv. Maple	34.1"	Fair
7 East Ave.	Silv. Maple	31.7"	Poor, decay, eventual removal*
5 East Ave.	NM	13.4"	Fair
3 East Ave.	Crimson King Maple	15.8"	Fair
61 State	Crimson King Maple	8.8"	Fair
On East Ave.	Ash	5.4"	Fair
On East Ave.	Silv. Maple	30.7"	Fair, DW
Hammond Parkway – East Side – Inside walk within 25 ft. from Street	Sugar Maple	14.7"	Good
Hammond Parkway	Crabapple	9.2"	Fair
Hammond Parkway	Crimson King Maple	12.3"	Good
Hammond Parkway	Eng. Walnut	22.1"	35 ft. to tree, inside walk, Fair

* Remove Tree

Hammond Parkway – within Circle	Crabapple	18.2"	Fair
Hammond Parkway	Sugar Maple	24.9"	Fair
Hammond Parkway	Clump Lilac	15' x 15'	Fair
Hammond Parkway	Crabapple 4 stems	6.3" 10.3" 10.9" 8.5"	Rotted at base*
Hammond Parkway	Crabapple	17.6"	Fair
17 Vernon on Park	Silv. Maple	24.5"	Decay, leader over house*
On Park	Silv. Maple	38"	Decay at base*
On Park	Silv. Maple	24.4"	Major decay – trunk*
16 Park	Silv. Maple	25.3"	Decay main crotch*
18 Park	Silv. Maple	37.5"	Fair, hazardous walk
20 Park	Silv. Maple	28.5"	Decay main leader*
22 Park	NM	17.4"	Fair
22 Park	Silv. Maple	29"	Fair
24 Park	Silv. Maple	34.5"	Decay in trunk, eventual removal* RW
30 Park	NM	16"	Fair
32 Park	Silv. Maple	37.5"	Fair, DW
34 Park	Silv. Maple	38"	Decay*
36 Park	Sugar Maple	41.8"	Decay main crotch, split, east leader*
40 Park	Silv. Maple	29"	Fair
40 Park	Silv. Maple	17.2"	Fair
42 Park	Sugar Maple	21.4"	Decay main crotch, top dead*
44 Park	Sugar Maple	22.3"	Some decay – trunk, Fair
48 Park	Silv. Maple	4"	Good
48 Park	Crimson King Maple	14.7"	Fair
51 Park	Silv. Maple	6.8"	Fair
51 Park	Honey Locust	16.5"	Fair
47 Park	NM	11.7"	Fair
45 Park	Honey Locust	21.8"	Fair
43 Park	Silv. Maple	25"	Fair
43 Park	NM	16.7"	Fair
37 Park	NM	19.5"	Fair
35 Park	NM	22.8"	Fair
33 Park	Silv. Maple	22.6"	DW, Fair RW
33 Park	Silv. Maple	28.8"	Storm damaged*

* Remove Tree

31 Park	NM	27.6"	Fair
27 Park	NM	13"	Fair
25 Park	Sugar Maple	23.8"	Declining, decay*
23 Park	Silv. Maple	26.8"	Decay at base*
23 Park	Silv. Maple	22.7"	Poor
23 Park	Silv. Maple	28.4"	Decay*
Locust Drive No sidewalk	23 Locusts Var. 8' from edge of pavement	Ave. DBH – 20"	Fair - Need raising of low branching – DW pruning
Manor No sidewalk	22 Crimson Maples 8-9' from edge of pavement	Ave. DBH 10.5	Good – Need raising of low branching
Manor #3	Flow. Crab.	10" DBH	Fair, stubs, DW
Manor #14	Cherry	18" DBH	Fair, stubs, DW, raise low branching
Manor #17	Red Oak	10" DBH	Good, stubs, DW, raise low branching
8 Mill St.	NM	30.5"	Fair RW
8 Mill St.	NM	21.4"	Fair RW
12 Mill St.	Silv. Maple	28.2"	Fair RW
12 Mill St.	NM	15.8"	Fair RW
12 Mill St.	Silv. Maple	32.2"	Fair RW
24 Mill St.	NM	17.4"	Good
N. Hartland 2	SM	19"	Poor, top dead*
N. Hartland 2	SM	26"	Poor, definite rot*
6 N. Hartland	NM	34"	Fair RW
6 N. Hartland	NM	20"	Poor
12 N. Hartland	SM	34.1"	Poor RW
14 N. Hartland	Silv. Maple	27.4"	Poor, rot*
14 N. Hartland	Silv. Maple	34.5"	Poor, rot*
16 N. Hartland	Crim. King Maple	11"	Fair
20 N. Hartland	Silv. Maple	32.5"	Fair RW
20 N. Hartland	Silv. Maple	30.7"	Fair RW
20 N. Hartland	NM	14.1"	Fair RW
Opp. 21	Silv. Maple	31.7"	Fair RW
Vacant Lot	Silv. Maple	42.6"	½ dead* RW
	Silv. Maple	24.6"	Fair
32	Silv. Maple	27.5"	Fair, cracked RW
32	NM	35"	Fair, BHL (4" dia.) RW
32	Silv. Maple	24.7"	2/3 dead* RW
32	NM	31.5"	Poor RW
Lot between 32 & 36	Red Maple	20.5"	Fair, cracked walk
Lot between 32 & 36	NM	16.9"	Fair, cracked walk

* Remove Tree

Lot between 32 & 36	Red Maple	21.4"	2/3 dead*, cracked walk
36	Silv. Maple	38"	Rotted base*
36	Silv. Maple	32"	Fair RW
	NM	16.6"	Fair
25 Sleeper on N. Hartland	Crimson King Maple	14"	Fair
25 Sleeper on N. Hartland	Crimson King Maple	10.8"	Fair
48 N. Hartland	Silv. Maple	30.1"	Fair RW
	NM	11.5"	Fair
58 N. Hartland	NM	11.1"	Fair
Opp. 66 N. Hartland	NM	17.1"	Fair
Opp. 66 N. Hartland	NM	16.6"	Fair
Opp. 66 N. Hartland	NM	21"	Poor
Opp. 62 N. Hartland	Silv. Maple	27.1"	Fair
Opp. 57 N. Hartland	Silv. Maple	29.8"	Fair RW
Opp. 57 N. Hartland	NM	20.2"	Fair RW
Opp. 57 N. Hartland	NM	18"	Fair, cracked walk
Opp. 49 N. Hartland	Silv. Maple	31.3"	Fair RW
Opp. 49 N. Hartland	Silv. Maple	29.5"	Poor, some decay
Opp. 45 N. Hartland	Silv. Maple	29.7"	Fair
Opp. 45 N. Hartland	Silv. Maple	34.1"	Fair RW
Opp. 45 N. Hartland	Silv. Maple	25.7"	Poor, decay
Opp. 45 N. Hartland	Silv. Maple	30.3"	Fair, hazard, broken walk
Opp. 41 N. Hartland	NM	15.1"	Fair RW
Opp. 41 N. Hartland	Silv. Maple	26.4"	Fair RW
Opp. 41 N. Hartland	NM	11.1"	Fair, broken walk
Opp. 41 N. Hartland	Silv. Maple	26.2"	Fair
Opp. 19 N Hartland	Crabapple	3.2"	Fair, cracked walk
Opp. 17 N. Hartland	SM	19.5"	Poor, decay*
Opp. 13 N. Hartland	Red Maple	21.4"	Poor, decay*
Opp. 11 N. Hartland	SM	25.9"	Fair
Opp. 9 N. Hartland	NM	15.9"	Fair
Opp. 7 N. Hartland	Silv. Maple	41"	Fair, cracked walk
North Hartland	Silv. Maple	16.8"	Top gone*
Opp. 92 (lot)	Silv. Maple	19.1"	½ dead*
Opp. 92 (lot)	Silv. Maple	29"	Fair
93 N. Hartland	Silv. Maple	27"	Fair, poison ivy on trunk
93 N. Hartland	Silv. Maple	27.5"	Fair
93 N. Hartland	Silv. Maple	25.1"	Fair
93 N. Hartland	Silv. Maple	27.1"	Fair
93 N. Hartland	Silv. Maple	25.3"	Fair
93 N. Hartland	Silv. Maple	32.7"	Fair, some decay trunk
93 N. Hartland	Silv. Maple	24"	Fair

91 N. Hartland	Silv. Maple	38.1"	Poor, severe decay*
91 N. Hartland	Silv. Maple	43.5"	Fair
83 N. Hartland	Silv. Maple	30.7"	Fair RW
79 N. Hartland	Silv. Maple	31"	Fair RW
79 N. Hartland	Silv. Maple	5"	Fair
79 N. Hartland	Silv. Maple	31.1"	Fair, some decay RW
79 N. Hartland	Silv. Maple	35.6"	Fair RW
79 N. Hartland	Crimson King Maple	7.9"	Fair
79 N. Hartland	NM	25.8"	Fair, cracked walk
80 N. Hartland	Silv. Maple	24.4"	Fair, 11' to street
80 N. Hartland	Silv. Maple	44.8"	Fair, 11' to street
80 N. Hartland	Silv. Maple	24.8"	Fair, 11' to street
80 N. Hartland	Silv. Maple	36.3"	Fair, 11' to street
84 N. Hartland	Honey Locust	15.5" 22" Twin	Fair, 11' to street
84 N. Hartland	Honey Locust	14"	Fair, 11' to street
92 N. Hartland	Black Walnut	22.4"	Fair, 10' to street
11 Terry St.	Red Oak	7.5"	Fair RW
11 Terry St.	NM	18.2"	Fair RW
7 Terry St.	NM	22.3"	Fair RW
Inside walk 8 Terry St.	Silv. Maple	34.5"	Fair, tree 8'5" RW
Inside walk 12 Terry St.	Black Walnut	35"	Fair, tree 11'
15 Mechanic St.	Silv. Maple	38"	Fair RW
13 Mechanic St. W. of N. Main	Crinsom Maple	12.5"	Fair, wetwood
11 Mechanic St.	NM	12"	Poor
11 Mechanic St.	Red Oak	4.6"	Fair, cracked walk
7 Mechanic St.	NM	17.8"	Fair
5 Mechanic St.	Silv. Maple	28.7"	Fair, hole in tree
W. of 5 Mechanic St.	NM	16.8"	Fair
E. of N. Main 17 Mechanic St.	Silv. Maple	27.1"	Fair RW
19 Mechanic St.	Crimson King Maple	10.3"	Fair RW
19 Mechanic St.	Crimson King Maple	11.6"	Fair RW
21 Mechanic St.	NM	14.1"	Fair, cracked walk
23 Mechanic St.	NM	14.6"	Fair
Side of 9 N. Vernon St.	Silv. Maple	33.8"	Fair
	Silv. Maple	31.3"	Bad decay at base*
	Silv. Maple	19.6"	Faira
	Silv. Maple	35"	2/3 dead*
31 Vernon St.	Silv. Maple	38.4"	½ dead*
31 Vernon St	Black Walnut	26.5"	Fair RW

* Remove Tree

33 Vernon St.	Horse Chestnut	27.6"	Poor, hole in trunk
33 Vernon St.	Horse Chestnut	38"	Fair
36 S. Vernon, South side	HM	22.4"	Good
36 S. Vernon, South side	NM	10.5"	Poor, rotted trunk at base
36 S. Vernon, South side	NM	17.3"	Fair, stubs, DW
17 Freeman	SM	45.0"	DW, stubs, HC, Fair
10 Alfred, Freeman side	HM	18.6"	Fair, DW, stubs
10 Alfred, Freeman side	Larch	12.3"	Fair, DW
10 Alfred, Freeman side	HM	21.1"	Good, DW, stubs
2 Steeper St.	RM	23.9"	Butt rotted*
2 Steeper St.	Crim. Maple	2-1/2"	Good
4 Steeper St.	SM	31.1"	Stub with brush, root rot, trunk rot*
8 Steeper St.	SM	11.8"	Good
8 Steeper St.	HM	29.0"	Poor, top center decayed
8 Steeper St.	SM	4.0"	Trunk rot (stub)*
12 Steeper St.	NM	18.9"	DW, raise LB
12 Steeper St.	SM	30.3"	Fair, DW
12 Steeper St.	RM	21.6"	Fair, DW, trunk & limb scars, raise LB
12 Steeper St.	RM	19.0"	Poor, DW, trunk rot
18 Steeper St.	CM	18.4"	Good, raise LB
18 Steeper St.	CM	14.0"	Good, raise LB
20 Steeper St.	HM	25.1"	Good, DW RW
20 Steeper St.	RM	22.9"	Trunk rot*
22 Steeper St.	SM	42.7"	Fair, upper limb cavities
22 Steeper St.	NM	12.0"	Fair, DW
26 Steeper St.	SM	39.9"	Fair RW
26 Steeper St.	SM	42.1"	Trunk rot* RW
26 Steeper St.	SM	35.6"	Fair, DW RW
26 Steeper St.	SM	42.6"	Fair RW
25 Steeper St.	SM	28.3"	Fair
25 Steeper St.	NM	14.7"	Good
25 Steeper St.	SM	36.0"	Fair
19 Steeper St.	SM	24.1"	Good
19 Steeper St.	SM	37.5"	Fair, top decline
19 Steeper St.	SM	29.3"	Poor, large rotted stub
19 Steeper St.	SM	34.0"	Declining – P. Ivy*
19 Steeper St.	SM	28.9"	Poor, DW, P. Ivy
11 Steeper St.	NM	25.0"	Good
11 Steeper St.	RM	37.0"	Good, DW
11 Steeper St.	SM	30.1"	Poor, future removal*

* Remove Tree

9 Steeper St.	RM	23.2"	Fair, top of crown decline
9 Steeper St.	R. Oak	6.2"	Good, raise LB
5 Steeper St.	SM	41.0"	Poor, top in decline RW
5 Steeper St.	RM	18.8"	Fair, DW
Opp. #2 Steeper St.	C. Lilac	12' x 8'	
Opp. #2 Steeper St.	C. Lilac	12' x 10'	
Opp. #2 Steeper St.	C. Lilac	12' x 10'	
30 Mill St.	E. Walnut	23.2"	Fair, raise LB, center hollow
36 Mill St.	SM	36.3"	Fair, trunk rot
37 Mill St.	SM	38.1"	Fair, inside walk, prev. limb loss RW
40 Mill St.	SM	34.8"	Fair, raise LB, DW
44 Mill St.	SM	48.0"	Poor, suckers, cankers, raise LB
44 Mill St.	NM	13.8"	Fair, DW
46 Mill St.	NM	16.2"	Good, raise LB
S/E Corn. Park & Main	SM	37.8"	Good, in Monument area
S/E Corn. Park & Main	NM	13.0"	Fair, frost crack & rot
S/E Corn. Park & Main	Doug. Fir	12.1"	Good
4 Park	HM	27.6"	Fair, DW, stubs
4 Park	HM	28.0"	Fair
6 Park	Fl. Crab.	11.0"	Good
6 Park	SM	27.0"	Fair
Common Park Area	Fl. Crab.	12.0"	Good
Common Park Area	Fl. Crab.	10.8"	Good
Common Park Area	Fl. Crab.	10.9"	Good
Common Park Area	SM	39.1"	Fair
Common Park Area	HM	27.6"	Fair, DW, hangers
N/side Park off Main	R. Oak	13.0"	Good
N/side Park off Main	SM	3.0"	Good
N/side Park off Main	SM	5.0"	Good
7 Park	SM	3.0"	Good
7 Park	HM	30.3"	Fair (cabled) (2)
5 Park	HM	32.4"	Fair, upper trunk cavity, DW
On Park N/Main, W/Vol. Fire Mon.	SM	6.9"	Good
S/E Corn. Mechanic & N. Vernon	NM	13.5"	Fair, frost crack
9 N. Vernon	NM	18.6"	Fair, DW, frost crack RW

* Remove Tree

11 N. Vernon	RM	22.9"	Good
11 N. Vernon	SM	26.2"	Good
11 N. Vernon	SM	33.3"	Good
15 N. Vernon	SM	28.0"	Fair, DW
17 N. Vernon	NM	14.3"	Good
23 N. Vernon	NM	19.2"	Fair, trunk vandalized
23 N. Vernon	SM	42.6"	Poor, DW, large
16 N. Vernon	SM	24.1"	Poor, high % DW
14/16 N. Vernon	SM	32.5"	Poor, hollow at grade line, large trunk canker & burl
12 N. Vernon	SM	32.4"	Good
12 N. Vernon	JT Lilac	1-3/4" C	Good
12 N. Vernon	JT Lilac	1-1/2" C	Good
N/W Corn. N. Vernon & Mechanic on N. Vernon	NM	14"	Good, DW, raise LB
N/W Corn. N. Vernon & Mechanic on N. Vernon	SM	26.9"	Fair, DW
NYS #31-E Opp. 13 State St.	JT Lilac	2-3/4" C	Good
20 State St.	LL Linden	11.8"	Good
Opp. #23 State St.	LL Linden	10.0"	Good
30 State St.	NM	18.2"	Declining*
34 State St.	NM	14.5"	Fair, trunk damage
48 State St.	NM	14.5"	Good
46 State St.	NM	13.7"	Fair
44 State St.	SM	18.5"	Good
44 State St.	SM	4.0	Good, raise LB
44 State St.	NM	12.5"	Good
42 State St.	SM	37.7"	Fair
42 State St.	NM	14.1"	Good
42 State St.	NM	16.1"	Good
50 State St.	SLM	30.5"	Fair
50 State St.	Sil. Crim.	28.1"	Fair
52 State St.	NM	7.8"	Good
67 State St.	NM	11.2"	Good
67 State St.	NM	10"	Good
59 State St.	NM	9.5"	Fair
59 State St.	NM	8.8"	Fair
55 State St.	NM	12.4"	Fair
51 State St.	Crim. King Maple	8.5"	Good
47 State St.	NM	13.8"	Fair

* Remove Tree

45 State St.	NM	9.7"	Fair
43 State St.	NM	11.2"	Fair
41 State St.	NM	13.1"	Fair
33 State St.	NM	11.7"	Good
33 State St.	NM	11.5"	Good
25 State St.	Crim. King Maple	8.4"	Poor
25 State St.	NM	13"	Fair
8 N. Main St.	Silv. Maple	17"	Fair
10 N. Main St.	Silv. Maple	23"	Poor
17 Mechanic on N. Main	Silv. Maple	28.3"	Fair
17 Mechanic on N. Main	Silv. Maple	34.3"	Fair RW
	Silv. Maple	29.3"	Poor, carpenter ants
18 N. Main	Silv. Maple	25.4"	Poor, cavity
18 N. Main	Silv. Maple	38"	Poor, storm damaged ½ tree
34 N. Main	NM	21"	Fair, tar spot RW
36 N. Main	Silv. Maple	38.8"	Poor, rotted out, HAZARD!!
38 N. Main	NM	16.8"	Fair RW
37 N. Main	Red Oak	14"	Fair
37 N. Main	Sycamore	9.1"	Fair
15 Mechanic on N. Main	Silv. Maple	36.7"	Poor, cavity storm damaged
11 N. Main	Silv. Maple	20.7"	Fair
11 N. Main	Silv. Maple	21.8"	Fair RW
11 N. Main	Silv. Maple	27.4"	Fair
11 N. Main	Silv. Maple	25.2"	Fair RW
5 N. Main	Silv. Maple	31"	Fair
72 Main on Francis	Silv. Maple	38.5"	Poor, ½ dead*
72 Main on Francis	Silv. Maple	43.3"	Poor
6 Francis	Silv. Maple	37.5"	Fair
8 Francis	Silv. Maple	27.8"	Poor, storm damaged
8 Francis	Silv. Maple	28.3"	Fair
10 Francis	Silv. Maple	31.6"	Poor, decay
10 Francis	Silv. Maple	39.3"	Fair
14 Francis	Silv. Maple	41"	Poor, rotted at base
16 Francis	Silv. Maple	39.9"	Fair
18 Francis	NM	17.7"	Fair
24 Francis	NM	20.5"	Fair, 20.7 ft. to curb
24 Francis	Box Elder	11"	Fair, 20.7 ft. to curb
28 Francis	Silv. Maple	36.6"	Decay in South leader
Betw. 28 & 34 Francis	Silv. Maple	26"	Fair

* Remove Tree

Betw. 28 & 34 Francis	Silv. Maple	22.7"	Fair
Betw. 28 & 34 Francis	Silv. Maple	34.2"	Fair
Betw. 28 & 34 Francis	Silv. Maple	30.0"	Fair
34 Francis	Silv. Maple	52.2"	Poor, rot main crotch
34 Francis	Golden Chain	8.4"	Uprooted
34 Francis	NM	26.4"	Fair
104 Telegraph	NM	18.1"	Fair
104 Telegraph	NM	22.8"	Fair

* Remove Tree

Use of both vehicular and some foot survey carried out the attached survey of trees. No examination was made of any internal condition of roots, trunks, or limbs of any trees. Any and all deficiencies in the trees we discovered only by external signs. No internal examination for rot or other conditions can be made without further tests. We make no representations nor are we responsible for any problems arising out of internal causes of any trees or vegetation when no internal examination is made.

Thank you again for allowing Micha Tree & Landscape Consultants, Inc. to be of service to you.

Respectfully submitted,

Frederick R. Micha
Micha Tree & Landscape Consultants, Inc.
American Society of Consulting Arborists
Registered Consulting Arborist #033

Encl.
FRM:bac

#20

Location	Species	Size	Condition
S. Vernon St. Mobil Station	NM	10"	Fair to good
Mobil Station	NM	14"	Fair to good
#10 S. Vernon St.	Crimson King Maple	14"	Fair
#12 S. Vernon St.	Crimson King Maple	9"	Fair
#12 S. Vernon St.	Crimson King Maple	11"	Fair
Methodist Church	NM	18"	Fair to good
#18 S. Vernon St.	Silver Maple	26"	Poor
#18 S. Vernon St.	Silver Maple	30"	Poor, heavy upper side pruning
#20 S. Vernon St.	Silver Maple	32"	Poor, heavy upper side pruning
#20 S. Vernon St.	Silver Maple	32"	Poor*
#22 S. Vernon St.	NM	12"	Fair to good
#24 S. Vernon St.	Ash	34"	Poor, heavy side pruning
R.R. Sub-station #30 S. Vernon St.	NM	12"	Fair to good
#30 S. Vernon St.	NM	26"	Fair
#36 S. Vernon St.	Silver Maple	35"	Fair, heavy side pruning
#38 S. Vernon St.	NM	14"	Fair to good
#42 S. Vernon St.	Silver Maple	28"	Poor, heavy side pruning
#42 S. Vernon St.	Silver Maple	38"	Fair, heavy side pruning
#44 S. Vernon St.	Green Ash	12"	Fair to good, heavy side pruning
#44 S. Vernon St.	Green Ash	17"	Fair to good, heavy side pruning
#46 S. Vernon St.	NM	11"	Fair to good
#48 S. Vernon St.	NM	14"	Fair, heavy side pruning
#48 S. Vernon St.	Silver Maple	26"	Fair, heavy side pruning
#48 S. Vernon St.	Silver Maple	28"	Fair, heavy side pruning
#50 S. Vernon St.	Silver Maple	27"	Fair, heavy side pruning
#50 S. Vernon St.	Silver Maple	31"	Fair, heavy side pruning
#52 S. Vernon St.	Silver Maple	35"	Poor, stem rot*
#54 S. Vernon St.	Silver Maple	36"	Fair, heavy side pruning
#56 S. Vernon St.	Silver Maple	34"	Fair, heavy side pruning
#56 S. Vernon St.	Silver Maple	32"	Fair, heavy side pruning
#58 S. Vernon St.	Silver Maple	36"	Poor*
#58 S. Vernon St.	Silver Maple	33"	Poor*
#60 S. Vernon St.	Crimson King Maple	12"	Good
#60 S. Vernon St.	NM	7"	Good
#64 S. Vernon St.	Silver Maple	29"	Poor, stem rot

* Remove Tree

#66 S. Vernon St.	Pin Oak	7"	Good
#66 S. Vernon St.	2 Silver Maple	4"	Good
#66 S. Vernon St.	NM	12"	Good
S. of Village Property	Silver Maple	26"	Fair, DW
S. of Village Property	3 LL Linden	2-1/2"	Fair to good
#21 S. Vernon St.	Silver Maple	46"	Fair
#21 S. Vernon St.	Crimson King Maple	12"	Fair to good
#21 S. Vernon St.	Silver Maple	35"	Fair
St. Stephens Catholic Church	NM	18"	Fair to good
St. Stephens Catholic Church	Crimson King Maple	13"	Good
#17 S. Vernon St.	Silver Maple	32"	Fair, stem rot
#17 S. Vernon St.	NM	14"	Good
St. Stephens Parish Hall	Silver Maple	34"	Fair
St. Stephens Parish Hall	Silver Maple	36"	Fair
#13 S. Vernon St.	Elm Spec. Var.	1"	Good
#13 S. Vernon St.	Crimson King Maple	13"	Good
#11 S. Vernon St.	Crimson King Maple	11"	Good
Middleport Free Library	LL Linden	10"	Good
Middleport Free Library	LL Linden	13"	Good
#7-1/2 S. Vernon St.	Silver Maple	33"	Fair
#7 S. Vernon St.	Silver Maple	36"	Poor, DW, possible removal
#65 S. Vernon St.	Silver Maple	30"	Fair, DW
#65 S. Vernon St.	Silver Maple	25"	Fair to good, some base rot
#65 S. Vernon St.	NM	25"	Good
#63 S. Vernon St.	NM	23"	Fair to good
#61 S. Vernon St.	Silver Maple	25"	Fair to good
#61 S. Vernon St.	Silver Maple	25"	Fair to good
#57 S. Vernon St.	NM	13"	Good
#57 S. Vernon St.	Silver Maple	35"	Fair, DW
#55 S. Vernon St.	Silver Maple	36"	Fair
#53 S. Vernon St.	NM	12"	Fair to good
#53 S. Vernon St.	Crimson King Maple	10"	Good

* Remove Tree

Location	Species	Size	Condition	Appraised Value
#49 S. Vernon St.	NM	12"	Good	$1,016.00
#47 S. Vernon St.	Silver Maple	23"	Fair, DW, stem rot	799.00
#47 S. Vernon St.	Black Oak	3"	Fair	300.00

#45 S. Vernon St.	Silver Maple	30"	Poor, base rot	715.00
#45 S. Vernon St.	Liberty Elm	1"	Good, transport to new location	95.00
#45 S. Vernon St.	Silver Maple	32"	Fair, DW	744.00
#43 S. Vernon St.	NM	12"	Good	1,015.00
#43 S. Vernon St.	Basswood	24"	Fair to good	1,053.00
#41 S. Vernon St.	Silver Maple	38"	Fair, DW, base rot*	500.00
#39 S. Vernon St.	Silver Maple	23"	Fair to good	1,332.00
#39 S. Vernon St.	Silver Maple	30"	Poor, upper stem rot, crown decline	1,430.00
#37 S. Vernon St.	Silver Maple	34"	Fair, DW	744.00
#33 S. Vernon St.	NM	26"	Fair to good, girdling roots	2,719.00
#31 S. Vernon St.	Silver Maple	31"	Fair, stem rot	1,806.00
#38 S. Vernon St.	NM	14"	Fair to good	1,100.00

* Remove Tree

ARCADIS

Appendix B

Site Photographs (October 2009)

Appendix B – Site Photographs (October 2009)

CMS Technical Memorandum - Evaluation of Tree Preservation Measures
FMC Corporation, Middleport, New York

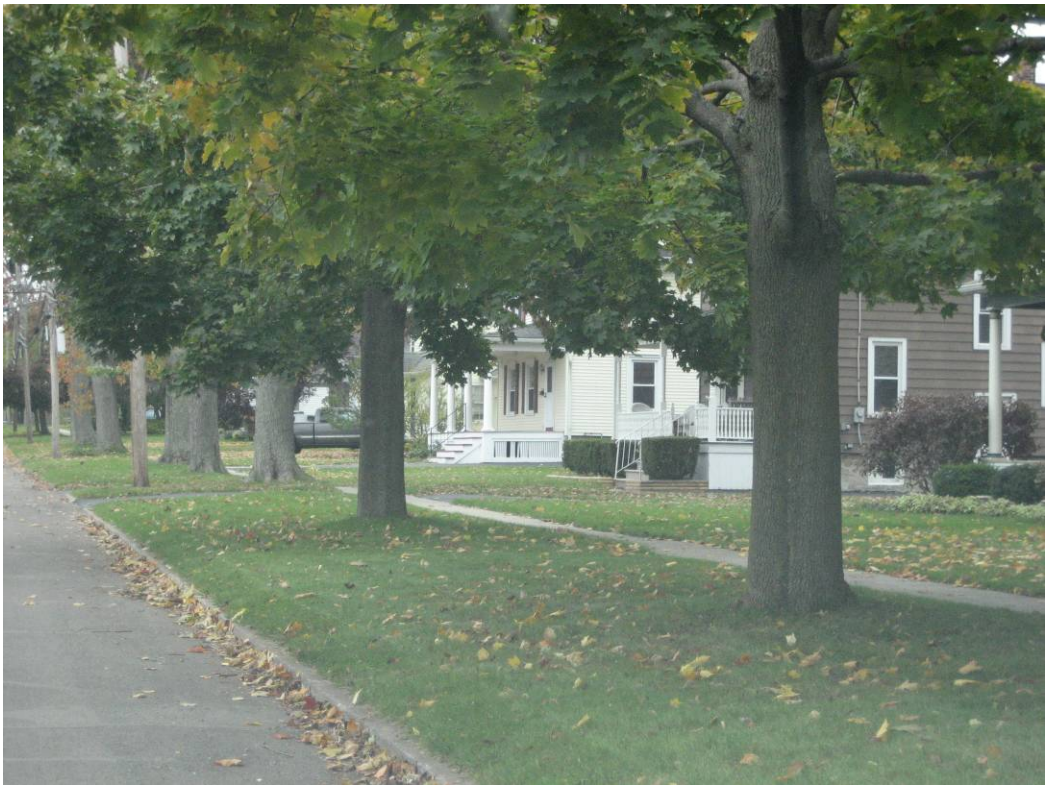
Photographs 1 and 2. Significant pruning of mature trees within existing right-of-ways and proximate to existing utility lines

Photograph 3. Significant pruning of mature trees within existing yards of single family residences

Photograph 4. Significant canopy cover from healthy mature trees in the yards of single family residences

Photographs 5 and 6. Healthy trees within an active right-of-way

Photograph 7. Significant tree canopy coverage within active right-of-ways



ARCADIS

Appendix C

Relative Tolerance of Selected Tree Species to Construction Impacts

Appendix C - Relative Tolerance of Selected Tree Species to Construction Impacts

CMS Technical Memorandum - Evaluation of Tree Preservation Measures
FMC Corporation, Middleport, New York

Tree Species		Tolerance				
Scientific Name	**Common Name**	**Good**	**Good to Moderate**	**Moderate**	**Moderate to Poor**	**Poor**
Abies spp.	Fir		X			
Acer negundo	Box elder	X				
Acer platanoides	Norway maple		X			
Acer rubrum	Red maple		X			
Acer saccharinum	Silver maple				X	
Acer saccharum	Sugar maple				X	
Aesculus x carnea	Red horse-chestnut	X				
Aesculus glabra	Ohio buckeye					X
Ailanthus altissima	Tree of heaven	X				
Alnus rubra	Red alder				X	
Amelanchier spp.	Serviceberry	X				
Aralia spinosa	Devil's walkingstick			X		
Arbutus menziesii	Madrone					X
Asimina triloba	Pawpaw	X				
Betula spp.	Birch			X		
Calocedrus decurrens	Incense cedar			X		
Carpinus caroliniana	Hornbeam; Blue beech			X		
Carya cordiformis	Bitternut hickory		X			
Carya glabra	Pignut hickory		X			
Carya illinoensis	Pecan		X			
Carya ovata	Shagbarck hickory			X		
Carya tomentosa	Mockernut hickory			X		
Catalpa spp.	Catalpa		X			
Cedrus deodara	Deodar cedar	X				
Celtis spp.	Hackberry; Sugarberry		X			
Cercidiphyllum japonicum	Katsura-tree				X	
Cercis canadensis	Redbud			X		
Cladrastis lutea	Yellowwood					X
Cornus alternifolia	Pagoda dogwood			X		
Cornus florida	Flowering dogwood				X	
Cornus nuttallii	Pacific dogwood	X				
Cornus stricta	Swamp dogwood	X				
Crataegus spp.	Hawthorn	X				
Cupressus spp.	Cypress	X				
Diospyros virginiana	Persimmon	X				
Fagus spp.	Beech					X
Fraxinus spp.	Ash		X			
Ginkgo biloba	Ginkgo	X				
Gleditsia spp.	Locust	X				
Gymnocladus dioicus	Kentucky coffee-tree	X				
Halesia spp.	Silverbell			X		
Ilex spp.	Holly	X				
Juglans spp.	Walnut					X
Juniperus virginiana	Eastern red cedar	X				
Larix laricina	Tamarack			X		
Liquidambar styraciflua	Sweetgum				X	
Liriodendron tulipifera	Tuliptree			X		
Magnolia grandiflora	Southern magnolia			X		
Malus spp.	Apple; crabapple		X			
Morus spp.	Mulberry		X			

Appendix C - Relative Tolerance of Selected Tree Species to Construction Impacts

CMS Technical Memorandum - Evaluation of Tree Preservation Measures
FMC Corporation, Middleport, New York

Tree Species		Tolerance				
Scientific Name	**Common Name**	**Good**	**Good to Moderate**	**Moderate**	**Moderate to Poor**	**Poor**
Myrica spp.	Barberry	X				
Nyssa spp.	Tupelo; Black gum		X			
Osmanthus americanus	Devilwood			X		
Ostrya virginiana	American hophornbeam			X		
Oxydendrum arboretum	Sourwood				X	
Paulownia tomentosa	Empress-tree	X				
Picea spp.	Spruce		X			
Pinus spp.	Pine		X			
Platanus x acerifolia	London plane	**varies from good to poor**				
Platanus occidentalis	Eastern sycamore		X			
Populus spp.	Poplars	X				
Populus deltoides	Eastern cottonwood		X			
Populus grandidentata	Bigtooth aspen				X	
Populus nigra 'Italica'	Lombardy poplar		X			
Populus sargentii	Plains cottonwood			X		
Populus tremuloides	Quaking aspen			X		
Populus trichocarpa	Black cottonwood					X
Prunus serotina	Black cherry				X	
Pseudotsuga menziesii	Douglas-fir	**varies from good to poor**				
Pyrus calleryana	Callery pear			X		
Quercus alba	White oak	**varies from good to poor**				
Quercus bicolor	Swamp white oak	X				
Quercus coccinea	Scarlet oak				X	
Quercus falcata	Southern red oak		X			
Quercus inbricaria	Shingle oak	X				
Quercus incana	Bluejack oak	X				
Quercus laevis	Turkey oak	X				
Quercus laurifolia	Laurel oak			X		
Quercus lobata	Valley oak			X		
Quercus lyrata	Overcup oak	X				
Quercus macrocarpa	Bur oak		X			
Quercus marilandica	Blackjack oak	X				
Quercus michauxii	Swamp chestnut oak	X				
Quercus muehlenbergii	Chinquapin oak	X				
Quercus nigra	Water oak	X				
Quercus palustris	Pin oak		X			
Quercus phellos	Willow oak		X			
Quercus prinus	Chestnut oak		X			
Quercus rubra	Northern red oak		X			
Quercus shumardii	Shumard oak	X				
Quercus stellata	Post oak	**varies from good to poor**				
Quercus velutina	Black oak		X			
Rhododendron spp.	Rhododendron			X		
Rhus spp.	Sumac		X			
Salix spp.	Willow		X			
Sassafras albidum	Sassafras					
Sorbus aucuparia	Mountain ash			X		
Stewartia spp.	Stewartia	X				
Styrax spp.	Snowbell			X		

Appendix C - Relative Tolerance of Selected Tree Species to Construction Impacts

CMS Technical Memorandum - Evaluation of Tree Preservation Measures
FMC Corporation, Middleport, New York

Tree Species		Tolerance				
Scientific Name	**Common Name**	**Good**	**Good to Moderate**	**Moderate**	**Moderate to Poor**	**Poor**
Taxodium spp.	Cypress	**X**				
Thuja occidentalis	Northern white cedar	**X**				
Tilia spp.	Linden; Basswood				**X**	
Tsuga spp.	Hemlock				**X**	
Ulmus spp.	Elm		**X**			
Viburnum spp.	Viburnum		**X**			

Source:
Table adapted from Matheny and Clark 1998.