COMMENTS

to the

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

by

ALLIEDSIGNAL INC.

concerning

ONONDAGA LAKE NATURAL RESOURCE DAMAGE ASSESSMENT PLAN

May 15, 1996

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EXECUTIVE SUMMARY

AlliedSignal believes that the New York State Department of Environmental Conservation's (DEC) Draft "Onondaga Lake Natural Resource Damage Assessment Plan" (Draft Plan) is seriously flawed and should be withdrawn. On matters of law and science the Draft Plan is simply wrong. For example, the Draft Plan fails to take into account the:

1. Differences between pre- and post-CERCLA releases;
2. Distinctions between hazardous and non-hazardous substances;
3. An appropriate methodology to establish baseline conditions for measuring what natural resource damages (NRD), if any, have occurred, and;
4. The enormous body of scientific data about the Lake's condition today and what it was at various past points in time.

This last point is particularly important because the data clearly demonstrate a pattern of natural recovery in Onondaga Lake. Results from sediment cores collected from recent studies of the Lake document that mercury concentrations began a dramatic decline some 26 years ago, when discharges of mercury were reduced substantially. Pre-1970 mercury concentrations were subsequently buried with cleaner sediments and, by 1980, mercury concentrations approximated pre-1940s conditions. Results from fillets of fish collected from Onondaga Lake document that tissue concentrations of mercury also declined after the early 1970s and generally reached current, near background levels by 1980. Recent studies have also detected a near doubling in size of desirable aquatic vegetation within the Lake and a fish species diversity comparable to several other nearby lakes. Thus, significant recovery to many of the baseline conditions expected for an urban lake has occurred and is occurring in Onondaga Lake, a success story that is largely ignored by the Draft Plan.

This recovery pattern is not unexpected in light of similar occurrences at other urban lakes throughout this country and the world. Onondaga Lake is at the center of the largest urban center in upstate New York. As such, for more than two centuries, unlike a pristine remote mountain lake, it has been impacted by agricultural, industrial and municipal discharges. But like other urban lakes, natural restoration can occur rapidly when discharges are either significantly altered or ended altogether.

Briefly stated, the other major flaws in the Draft Plan may be summarized as follows:

- Data, Data and More Data Onondaga Lake is commonly referred to as "the most studied lake in the country." The more than 60,000 data points generated by the current Onondaga Lake studies being performed by AlliedSignal, as well as a significant body of extant scientific literature about virtually every facet of the Lake, would seemingly provide an ample data base upon which any NRD plan could proceed without the need for still more studies. But that is precisely what the Plan proposes—more studies, costing well in excess of $1 million. Until *all* currently available data have been reviewed by DEC and fully analyzed, including data developed by ongoing work, further studies of the type proffered by the Draft Plan are bound to be premature, duplicative and cost-ineffective.
- Synchronization With Ongoing Lake Studies And Remedial Decisions Natural resource damages are theoretically supposed to reflect the magnitude of degradation of a given resource below baseline conditions over time. In the case of the Onondaga Lake site, where studies currently being performed by AlliedSignal will eventually lead to decisions concerning *remediation* for the Lake, it will always be conceptually impossible to estimate any increment of NRD *before* the remedy is actually selected. For until a remedy is selected and the time to implement the

remedy is determined, neither the damage nor the length of time that the damage is incurred will be known. In light of the pending RI/FS studies and the remedial options to be selected, the Draft Plan is premature as applied to the Onondaga Lake study area and wholly inconsistent with the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), the U.S. Department of the Interior's (DOI's) NRDA regulations and even the State's complaint against AlliedSignal.

- Determination of Appropriate Baseline Conditions To determine the natural resource injuries, if any, to Onondaga Lake resulting from a release of hazardous substances by AlliedSignal, a "baseline" set of conditions that would be found in Onondaga Lake *but for* the presence of AlliedSignal's release of hazardous substances must be established. Baseline conditions for Onondaga Lake must necessarily reflect an urban, heavily modified lake that has certain unique natural characteristics and has received non-AlliedSignal industrial and municipal discharges since at least the mid-1800's. In its proposed methodology for establishing baseline conditions, the Draft Plan fails to make this distinction and to limit the assessment of damages to those "resulting from" the releases of hazardous substances by AlliedSignal, which is not consistent with the three sources of authority mentioned above. As a result, the Draft Plan is legally flawed.

  Pre-CERCLA Releases Because Onondaga Lake has been substantially influenced by anthropogenic activities since at least the early 1800s, virtually all of the injuries to natural resources of the Lake, including those alleged to have been caused by releases from AlliedSignal, occurred prior to 1980--the date CERCLA was enacted. Under CERCLA, NRD may not be recovered where a release and any injury resulting from the release occurred wholly before the enactment of CERCLA. Therefore, to establish appropriate baseline conditions of the natural resources to be assessed under the Plan, DEC must determine the releases and injuries as of the

enactment of CERCLA and separately determine the incremental injury and resulting damages, if any, occurring from that date forward.

- Federally Permitted Releases CERCLA also prohibits the recovery of natural resource damages resulting from a release of a hazardous substance which is federally permitted. Beginning in 1970, mercury loading in effluent from AlliedSignal was governed by a series of federal authorizations to discharge. The Draft Plan fails, however, to fully consider these federally permitted releases and any effect they may have had on resources in the Lake and its environs.
- Improper Consideration of Non-hazardous Substances Although the Draft Plan repeatedly concedes that damages for natural resource injuries related to *non-hazardous substances* are not recoverable under CERCLA, much of the Plan is devoted to the consideration of certain non-hazardous, "ionic wastes" (i.e., most notably calcium and chloride, two ubiquitous naturally occurring substances). Such damages are similarly unavailable under New York's common law of public nuisance and, therefore, should be excluded from consideration by the Draft Plan.

Unsupported Scientific Assertions Finally, the Draft Plan contains several serious scientific errors. First, it asserts that the oncolites found in Onondaga Lake are attributable to AlliedSignal. This assertion is incorrect because oncolites occurred naturally in Onondaga Lake and, indeed, throughout the world in marl lakes like Onondaga Lake. Second, the Plan asserts that oncolites provide poor substrate for macrophytes in the Lake, thereby impeding macrophyte growth. This assertion is fallacious because recent studies show that oncolites do provide an adequate substrate for macrophyte growth. Third, the Plan asserts that ionic stratification causes low dissolved oxygen levels in the Lake. This assertion is erroneous because *thermal* stratification, in combination with eutrophication, jointly cause low oxygen levels in the Lake.

For all of these reasons, the State must rescind the Draft Plan and refrain from proceeding with an assessment of NRD in Onondaga Lake at this time.

I. SIGNIFICANT NATURAL RECOVERY TO MANY OF THE BASELINE CONDITIONS EXPECTED FOR AN URBAN LAKE HAS OCCURRED AND IS OCCURRING IN ONONDAGA LAKE

Onondaga Lake has long been—and always will be—an urban lake, surrounded by over 600,000 people residing and working in Syracuse and its suburbs, the largest metropolitan and industrial center in central New York State. For well over 175 years, the Lake has been modified by a wide variety of human activities, including discharges of many kinds of agricultural, municipal and industrial discharges not related to AlliedSignal. Onondaga Lake is not—and never will be—a remote or rural lake.

Yet conditions in Onondaga Lake have improved considerably in the past 26 years as discharges of various substances to the Lake have been dramatically curtailed. By 1980, for example, metals concentrations in sediments had declined to approach baseline conditions expected for an urban lake such as Onondaga Lake. The degree to which mercury concentrations in Onondaga Lake sediments have declined in recent years is illustrated in Figure 1, and is based on a sediment core collected in 1992 from the southern basin of the Lake during the Onondaga Lake RI/FS. As shown in Figure 2, concentrations of mercury and six other metals were substantially elevated at a core depth of approximately 25 cm, which corresponds to the surface conditions present in the late 1960s (assuming a deposition rate of 0.9 cm/yr). As more specifically shown in Figure 3, concentrations of mercury declined dramatically in response to the substantial reductions in discharges of mercury that were achieved beginning in 1970 (see discussion in Section IV, below). Concentrations of the other six metals shown in Figure 2 declined dramatically after 1979 (represented by a core depth of 14 cm), in response to the upgrading of Metro to secondary treatment in 1978.

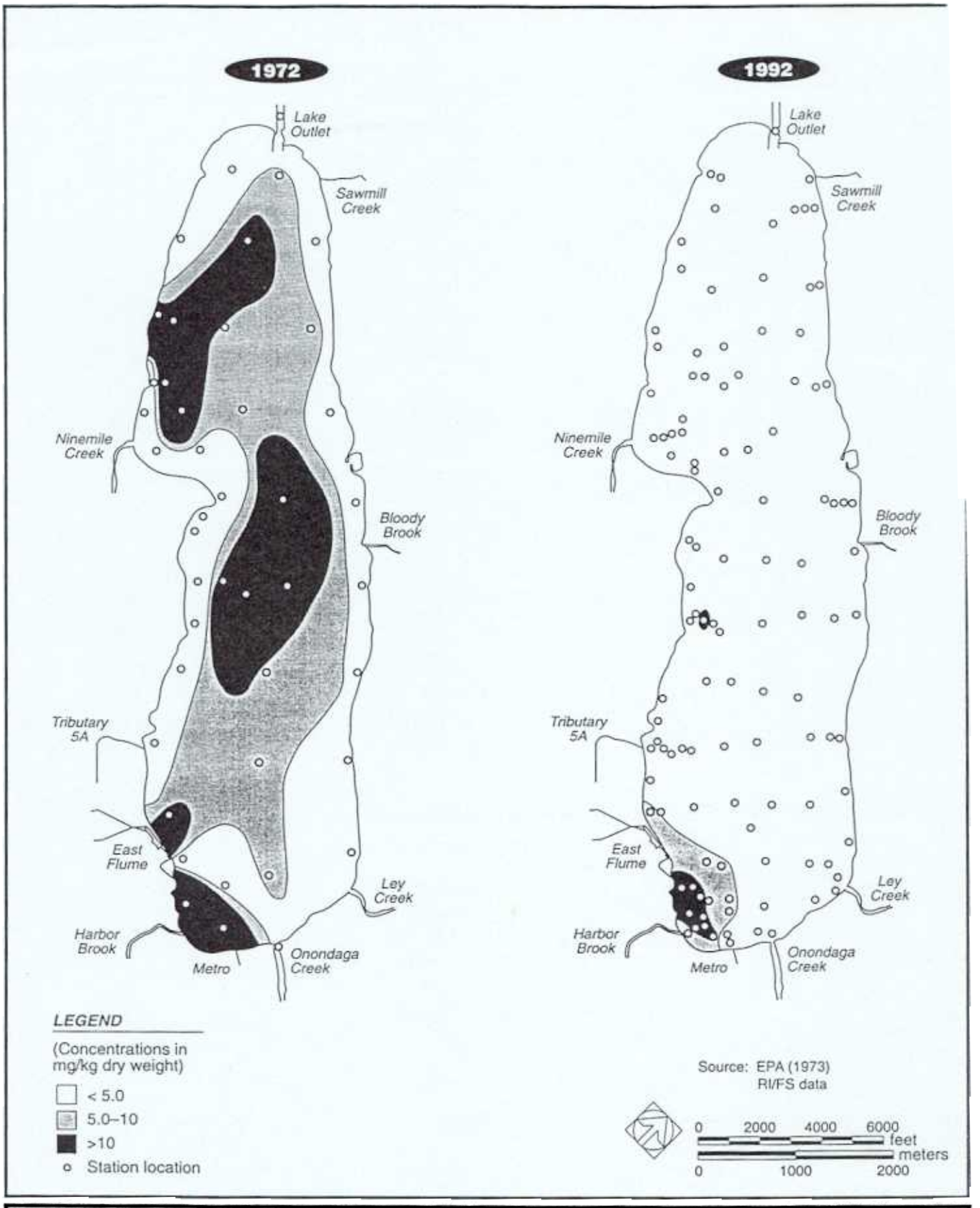

Figure 1. Distribution of mercury in surface sediments of Onondaga Lake in 1972 and 1992.

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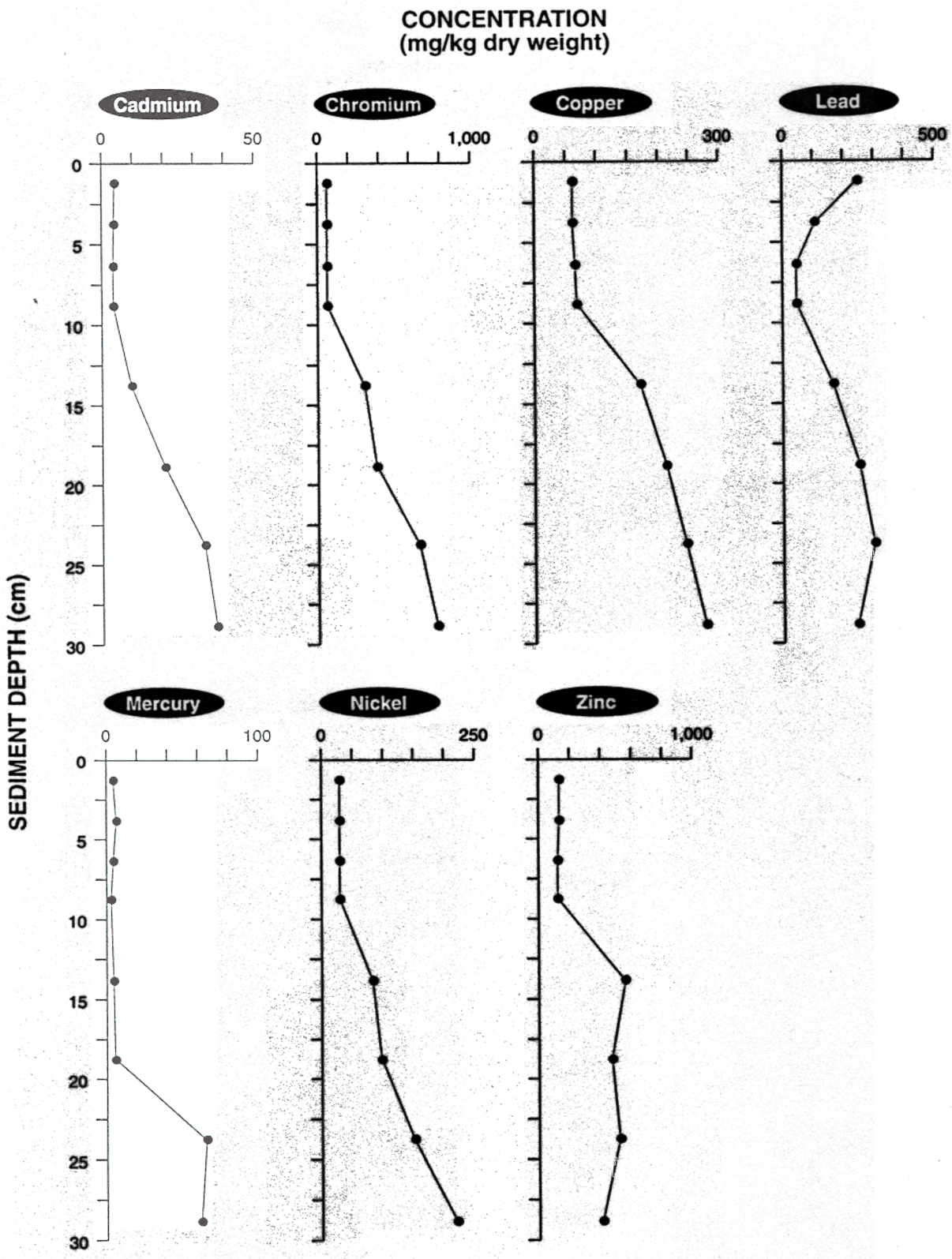

Source: RI/FS data

Figure 2. Vertical distribution of metals concentrations in sediments from the southern basin of Onondaga Lake.

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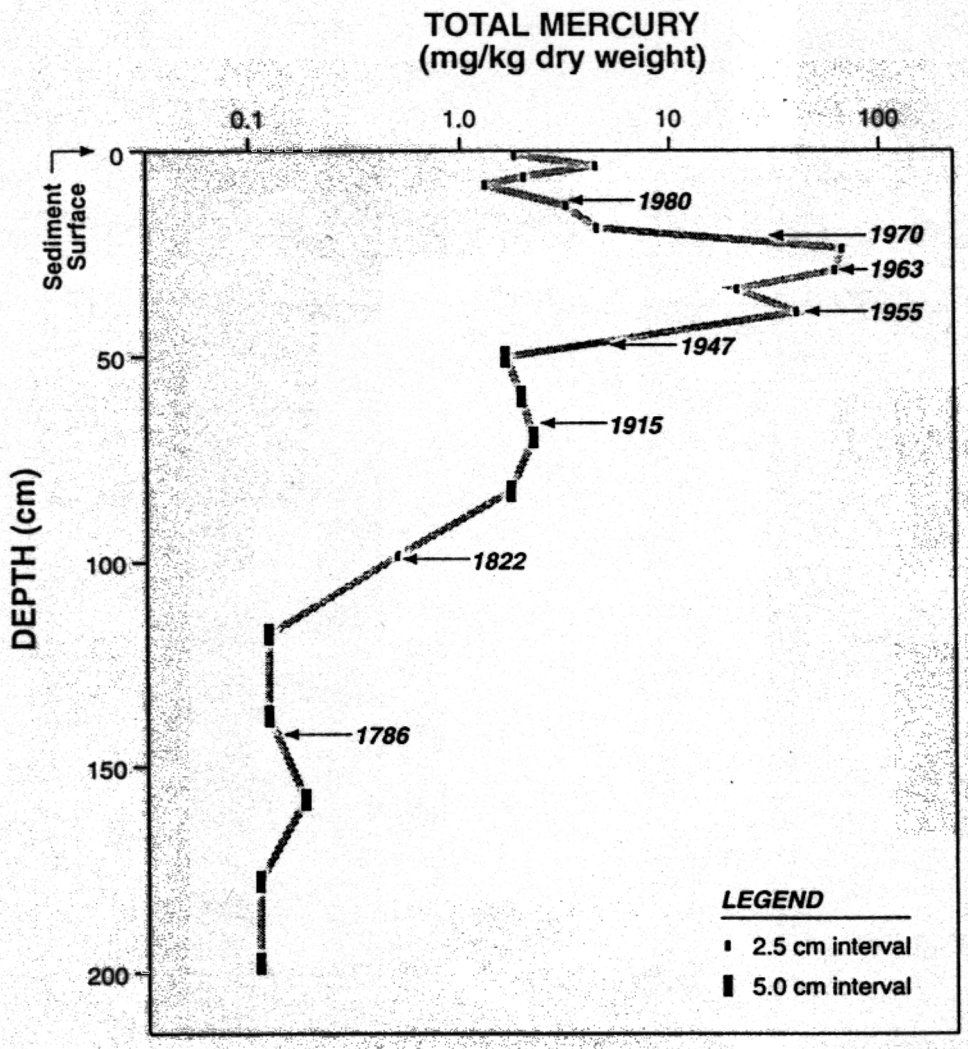

Source: RI/FS data

Figure 3. Vertical distribution of mercury concentrations in sediments from the southern basin of Onondaga Lake.

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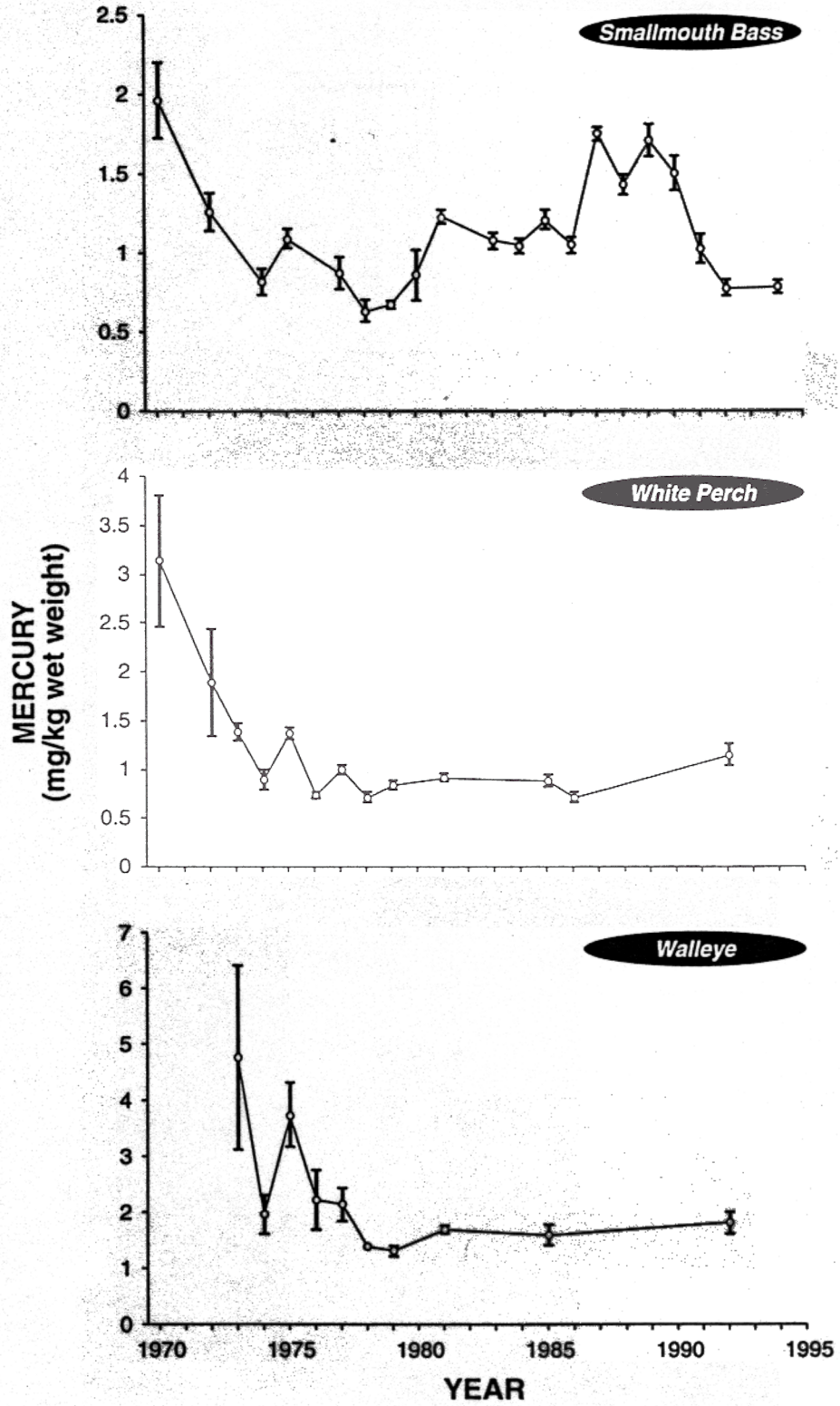
concentrations of all of these metals in surficial sediments except lead remained relatively constant after discharges were substantially reduced.

Similarly, tissue concentrations of mercury in fishes from Onondaga Lake have declined markedly since the early 1970s, as illustrated in Figure 4. In addition, Figure 5 presents a comparison of the tissue concentrations found in Onondaga Lake in 1992 with tissue concentrations found in other water bodies of New York State between 1987 and 1992. The information presented in the figure is based on data collected during the RI/FS and data collected by DEC. For all six fish species represented in Figure 5, tissue concentrations of mercury found in 1992 were substantially lower than the values found in the early 1970s. In addition, the concentrations found in most species from Onondaga Lake in 1992 were somewhat above but in the general range of levels found in other New York water bodies.

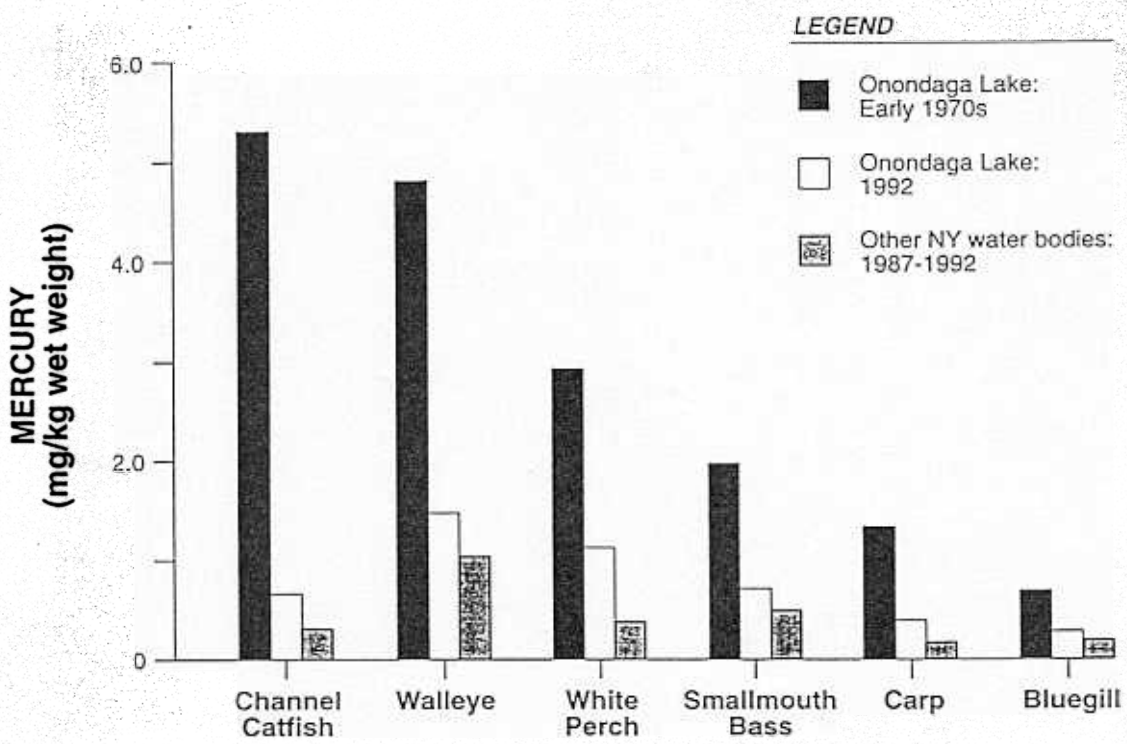
More recent examples of natural recovery in Onondaga Lake include the distribution of macrophyte assemblages and the composition of fish assemblages. The continued natural recovery of macrophyte assemblages in Onondaga Lake is illustrated in Figure 6. In the relatively short period of time between 1992 and 1995, the spatial extent of macrophyte beds in the littoral zone of the Lake approximately doubled in size, and an additional species (*Elodea canadensis*) colonized the Lake. In 1995, few suitable areas of the littoral zone of the lake were found to be devoid of macrophytes. The speed of this recovery is impressive, given the fact that it is occurring in the absence of any kind of deliberate efforts to vegetate these areas. This pattern suggests that macrophyte assemblages in the Lake are in the recovery process.

Ringler et al. (1996) and Gandino (1996) have documented the natural recovery of fish assemblages in Onondaga Lake. Between 1989 and 1993, 48



Source: RI/FS data
NYSDEC monitoring data

Figure 4. Mean concentrations (±SE) of mercury in fillets of three fish species from Onondaga Lake.



Source: RI/FS data
NYSDEC monitoring data

Figure 5. Mean concentrations of mercury in fillets of fishes from Onondaga Lake and other New York water bodies.

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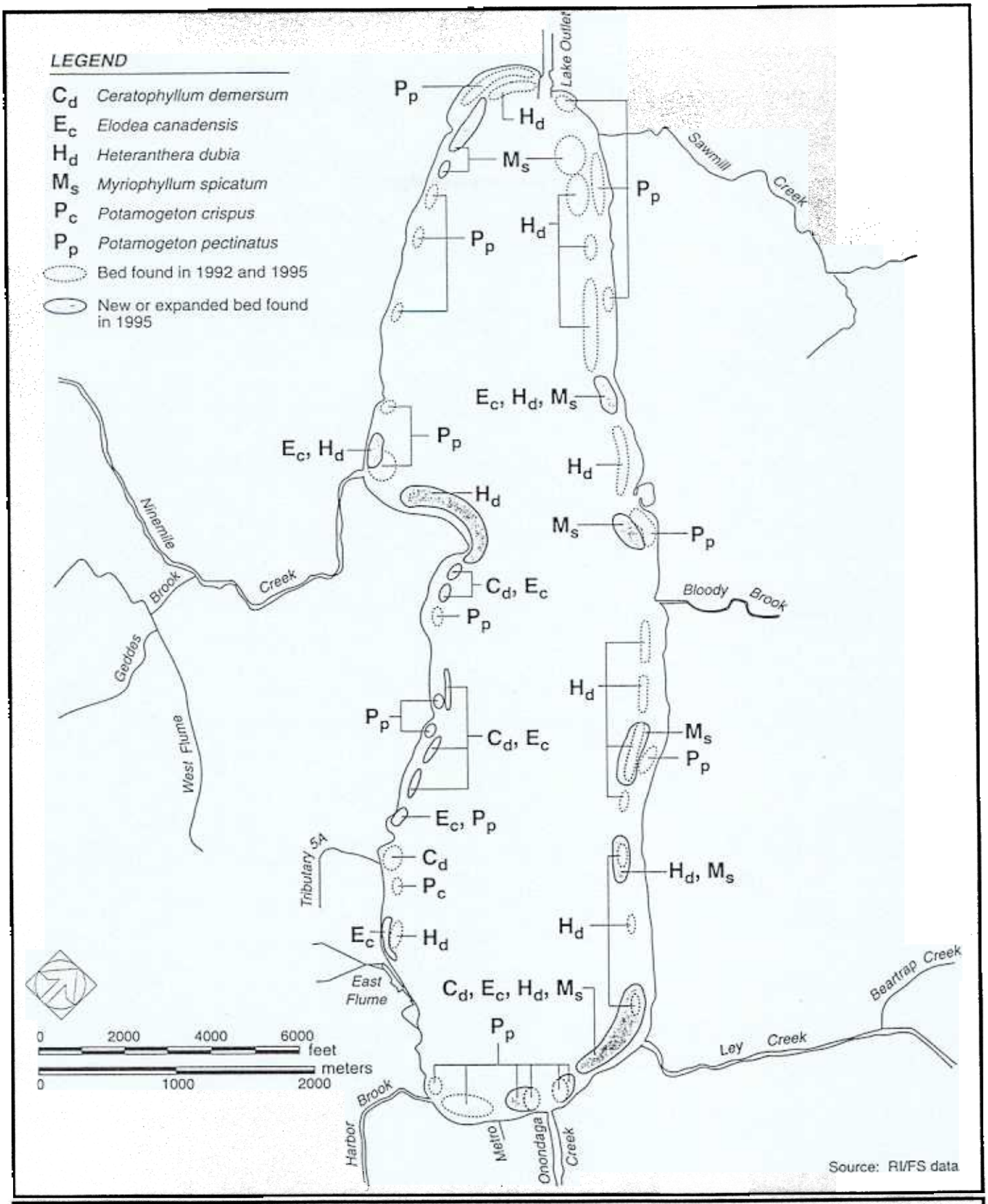

Figure 6. Distribution of major macrophyte beds in Onondaga Lake in 1992 and 1995.

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species were captured in the Lake. The diversity of fish assemblages in Onondaga Lake and growth rates, age distributions, and mortality rates of several key species in the Lake were found to be similar to the values found for assemblages in several northeastern lakes. Gandino (1996) concluded that the structure of fish assemblages in Onondaga Lake was similar to the structure of assemblages in nearby Cross Lake, which is a hypereutrophic marl lake located upstream from Onondaga Lake. The findings described above indicate that fish assemblages in Onondaga Lake have recovered substantially in recent years and are similar to the baseline conditions expected for a hypereutrophic urban lake such as Onondaga

All in all, the baseline conditions expected of an urban lake such as Onondaga Lake have been or are being met by natural recovery subsequent to significant controls of discharges into the Lake. Rather than extol these important developments, the Draft Plan gives them short shrift, Draft Plan at 112-113, choosing instead to unfairly and unrealistically contrast conditions in Onondaga Lake with the rural and remote lakes it can never become.

II. THE DRAFT PLAN IGNORES A VAST AMOUNT OF AVAILABLE DATA, REVIEW OF WHICH MUST BE FULLY PERFORMED BEFORE STUDIES PROPOSED TO COLLECT STILL MORE DATA CAN BE SERIOUSLY CONSIDERED

In preparing the Draft Plan, the extensive amount of information collected during the Onondaga Lake RI/FS was apparently not considered in more than a cursory manner. Over ***60,000*** data points have been collected by AlliedSignal as part of the Onondaga Lake RI/FS, representing water chemistry, sediment chemistry, sediment toxicity, benthic macroinvertebrate assemblages, macrophyte assemblages, and bioaccumulation in plankton, benthic macroinvertebrates, and

fishes. Given the direct relevance of the RI/FS data to understanding natural resource issues in Onondaga Lake, it is inappropriate to recommend any additional data collection until the RI/FS data have been fully evaluated.

The manner in which injuries to sediments are determined in the Draft Plan provides a clear example of the necessity of analyzing the RI/FS data before any injuries can be identified and the collection of any additional data can be recommended. In the Draft Plan, injuries to sediments are identified by simple comparisons of observed sediment chemical concentrations to screening criteria. This procedure is flatly contrary to the manner in which DEC (1993) states that the sediment criteria should be used. According to DEC (1993), "once a sediment has been identified as contaminated, a site-specific evaluation procedure must be employed to quantify the level of risk." The use of screening criteria to identify injury ignores site specific mitigating factors and other ecologically important variables. This approach is invalid. By contrast, the RI/FS was designed specifically to evaluate site-specific sediment toxicity throughout Onondaga Lake. Included in the RI/FS database are results for key biological indicators such as sediment toxicity tests (i.e., the amphipod test using *Hyalella azteca* and the chironomid test using *Chironomus tentans)* and benthic macroinvertebrate assemblages. Key factors that are known to modify the toxicity of various chemicals (*e.g.*, total organic carbon and acid-volatile sulfides) are also included in the RI/FS database. These kinds of biological and chemical information should be used to identify the presence of any actual risks or injuries in the Lake under site-specific conditions, as specified by DEC (1993).

Onondaga Lake has been referred to correctly as "the most studied lake in the country." To propose to perform additional studies costing well in excess of $1 million, as the Draft Plan does, is difficult to comprehend, not only in light of the exhaustive studies already performed by AlliedSignal but also in light of a

significant body of scientific literature devoted to virtually every facet of the Lake. Until all of these data are more fully evaluated, any proposal to perform additional studies is premature and bound to be cost-*in*effective.

III. IMPLEMENTATION OF ANY NRDA AT THIS TIME IS PREMATURE

The Draft Plan itself and any assessment of NRD for Onondaga Lake are premature, both legally and factually. Theoretically, natural resource damages reflect the magnitude of degradation of the resource below baseline conditions over a temporal axis. For a site such as the Onondaga Lake site, where an RI/FS in progress since 1992 will eventually lead to a Record of Decision concerning possible remediation for the Lake, it will always be conceptually impossible to estimate the increment of natural resource damages *before* the remedy is actually selected because the time required to fully return all of the resource to baseline cannot be ascertained until a remedial determination has been made. Indeed, any "remediation" on the cleanup side of the case should be closely coordinated with the "restoration" on the NRD side of the case. Otherwise, the two actions may be at odds, with the remedy potentially exacerbating natural resource damages.

Statutory authority supporting the orderly sequencing of remedial and restoration analysis can be found in CERCLA § 113(g)(1), which reflects the assumption that the determination of an appropriate remedy for a site on the National Priorities List, such as the Onondaga Lake site, should precede an assessment of NRD at the site. And, under DOI's regulations, at least the identification of appropriate remedial activities (as opposed to their actual implementation) is a prerequisite to performance of an NRDA. *E.g.*, 43 C.F.R. § 11.14(*ll*) (referring in definition of "restoration" to "response actions completed or anticipated"), *id.* § 1.64(a)(2)

(directing trustees to consider "information from response actions relating to the discharge or release"). In light of these requirements, *any* NRDA plan proposed for implementation before decisions are reached with respect to possible remediation of Onondaga Lake is inadequate as a matter of law.

CERCLA and the National Contingency Plan (NCP) further require coordination between the selection of a response action and an assessment of NRD to avoid exacerbating injury during implementation of the response. *See* CERCLA § 122(j)(1). At least eight sections of the NCP require such coordination. *E.g.*, 40 C.F.R. §§ 300.135(j)(2) (requiring coordination generally), 300.160(a)(3) (requiring information sharing), 300.305(e) (requiring coordination during removal action), 300.615(c)(3)(iii) (trustee obligation to consult and coordinate assessment and other investigation with remedial project manager). Premature assessment of purported damages to the Lake defeats the purpose of coordination because such an assessment overlooks the effects of a possible remedy that has not yet been chosen or implemented.

Apparently unaware of the preceding requirements, the Draft Plan concedes that the "plan is being prepared prior to completion of the response actions under CERCLA" and that "the future extent of remediation under CERCLA is not known with certainty." Draft Plan at 22. After then further conceding that "[t]he extent of restoration to be completed through the site remediation efforts is largely unknown at this time," Draft Plan at 98, the Plan simply assumes a series of speculative Lake remedial actions that have not even been the subject of the Feasibility Study required under CERCLA. Draft Plan at 98-100.

A factually and legally defensible NRDA plan cannot be developed in derogation of the several actions designed to address remediation under CERCLA, particularly when AlliedSignal has spent millions of dollars to fund the systematic

implementation of an exhaustive and DEC approved RI/FS whose ultimate objective is the identification and analysis of a recommended set of actions. Until an appropriate remedy for the Lake is actually selected on the basis of this analysis, the results of which can be considered in assessing NRD, any plan to conduct an NRD assessment will be premature and erroneously premised upon speculation and supposition, rather than fact.

IV. THE DRAFT PLAN'S PROPOSED ESTABLISHMENT OF BASELINE CONDITIONS IN AND AROUND ONONDAGA LAKE IS CONCEPTUALLY AND LEGALLY FLAWED

A. Baseline Conditions in Onondaga Lake Must Reflect Those That Would Be Expected To Occur Absent Releases Of CERCLA "Hazardous Substances" By AlliedSignal

The Draft Plan proposes an assessment of "baseline" conditions in Onondaga Lake that is inappropriate under CERCLA, the DOI regulations, and even the State's complaint against AlliedSignal. Baseline conditions are those to which the injured resource must be restored, either by resource restoration, by compensation in damages, or by a combination of the two. These conditions must isolate the damage caused by one release from that caused by all other natural or human causes.

This conclusion is initially compelled by CERCLA itself, which authorizes the recovery of only those damages for injury "resulting from" a release of hazardous substances. CERCLA § 107(a)(4)(C). Unlike a suit to recover response costs, a claim for NRD requires a showing that a release "caused" injury giving rise to recoverable damages. *Colorado v. Department of Interior*, 880 F.2d 481 (D.C. Cir. 1989). The logical application of this statutory limitation is expressly reflected in the NRDA regulations defining "baseline'

> Baseline data should reflect conditions that would have been expected at the assessment area had the . . . release of hazardous substances not occurred, taking into account both natural processes and those that are the result of human activities.

43 C.F.R. § 11.72(b)(1). This conclusion is confirmed in other sections of the DOI regulations. For instance, the regulations define "injury" to a natural resource as a "measurable adverse change . . . in the chemical or physical quality or the viability of a natural resource resulting either directly or indirectly from exposure to a discharge of oil or release of a hazardous substance. . . ." *Id.* § 11.14(v). With respect to injuries to specific media or types of natural resources, the regulations also specifically refer to the statutory causation requirement. *E.g.*, *id.* § 11.62(b)(1) (criteria to define when "[a]n injury to a surface water resource has resulted from the discharge of oil or release of a hazardous substance").

Furthermore, the State's June 1989 complaint against AlliedSignal seeking response costs, damages and injunctive relief also contemplates recovery of NRD for only those injuries caused by releases from AlliedSignal facilities. Paragraph 50 of the complaint provides:

> 50. The release [by AlliedSignal] of hazardous substances into the environment has caused injury to, destruction of and/or loss of the natural resources of the State of New York within the meaning of Sections 101(16) and 107(a) of CERCLA, 42 U.S.C. §§ 9601(16) and 9607(a).

The State alleges further in paragraph 52 that, as a consequence of such injury caused by its releases, AlliedSignal is liable "for all damages to the State's natural resources as provided by Section 107(a)(C) of CERCLA, 42 U.S.C. § 9607(a)(C). . . ."

The limits on AlliedSignal's alleged liability are recognized further in the March 1992 Consent Decree with the State. While that Decree governs AlliedSignal's performance of an RI/FS for Onondaga Lake (and, therefore, does not control proceedings concerning the State's NRD claim), the Decree, in recognizing the NRD claim, explicitly states that AlliedSignal's liability is limited to those damages resulting from its releases. Paragraph 21 of the Decree bounds the RI/FS itself by focusing on "Allied's waste substances":

> 21. The RI/FS shall address contamination and the threat of further contamination of the Onondaga Lake System . . . resulting from Allied's waste substances and the degradation products of such substances. . . . To the extent necessary to accurately determine the impact on the [Onondaga Lake System] of Allied's waste substances, the RI shall evaluate other [*i.e.*, non-Allied] hazardous substances and contaminants. The FS shall also address contamination resulting from the presence of substances that were generated or disposed of by entities other than Allied to the extent necessary for the purposes of evaluating and developing a remedial program with respect to Allied's waste substances.

Thus, under the Consent Decree, the focus of the entire RI/FS process is on the development of an appropriate remedy to address "*Allied's* waste substances." Presumably, the State intends thereafter to pursue other parties to undertake response actions with respect to waste substances released by persons other than AlliedSignal. This limitation on the scope of the RI/FS applies at least equally—if not with more force—to the State's NRD claim. The RI/FS considers releases by others, but only to the extent necessary to determine an appropriate remedy for AlliedSignal releases. So, too, must an assessment of NRD at the Lake attributable to AlliedSignal consider not only its releases, but also the contribution of other parties to injuries to natural

resources, so that the State can determine an appropriate NRD claim for AlliedSignal releases exclusive of such other contributions.

Under CERCLA, the DOI regulations and the State's complaint, the State may recover from AlliedSignal only those NRD for injuries that result from releases of hazardous substances by AlliedSignal. The State may not recover from AlliedSignal NRD for injury caused by any other anthropogenic sources or non-anthropogenic sources. To assess damages attributable to AlliedSignal, therefore, the State's determination of "baseline" conditions in the Lake must account for injury resulting from all of these other sources and for natural conditions. In essence, as the DOI regulations expressly state, "baseline" should reflect the condition of Onondaga Lake absent releases of hazardous substances by AlliedSignal. As explained more fully below, the Draft Plan wholly fails to meet this central requirement.

1. Injuries Attributable To Anthropogenic Sources Other Than AlliedSignal Must Be Fully Accounted For In The Establishment Of Baseline Conditions For Onondaga Lake

Any baseline established for Onondaga Lake must reflect the full range of non-AlliedSignal anthropogenic influences on the Lake, which date back to at least 1822, when the Lake was first connected to the Erie Canal System. According to Effler and Harnett (1996), the first major alteration to the morphology of Onondaga Lake occurred when the Lake was made part of the canal system. A channel was cut in the northern part of the Lake so that the Lake level would drop 2 feet to the level of the Seneca River. As a result, the surface area of the Lake was reduced by 20 percent and the volume of the Lake was reduced by approximately 6 percent. The Lake level was subsequently regulated as part of the Canal System. The connection with the Canal System, the resulting drop in Lake level, and the subsequent regulation of the Lake level resulted in

numerous injuries to the natural resources of Onondaga Lake. Some of the major injuries included: 1) drainage and destruction of numerous wetlands along the lake shoreline; 2) exposure and destruction of much of the original littoral zone; 3) invasions by non-native nuisance fishes such as the alewife, gizzard shad, and white perch; and 4) destruction of nearshore macrophyte beds by lowering the Lake level during canal management activities.

The destruction of wetlands along the shoreline of Onondaga Lake eliminated unique and critical habitats for a variety of mammals, birds, fishes and other organisms. Because the littoral zone is one of the most productive and important areas in lakes (Wetzel 1983), its destruction also eliminated important habitats for the aquatic organisms of Onondaga Lake. Invasions by non-native nuisance fishes resulted in major alterations of the biota of Onondaga Lake. For example, Siegfried et al. (1996) concluded that the presence of large numbers of the planktivorous alewife substantially altered the zooplankton assemblages in the lake. The altered zooplankton assemblages likely resulted in altered fish assemblages (i.e., the predators of zooplankton) and altered phytoplankton assemblages (i.e., the prey of zooplankton). In addition, Gandino (1996) concluded that the large populations of white perch and gizzard shad in Onondaga Lake may be depressing populations of more desirable species through competition for food.

The lowering of the level of Onondaga Lake as part of canal management activities likely reduced the success of macrophytes in shallow areas, by increasing their exposure to disturbance by ice and wind waves. For example, Madsen et al. (1996) concluded that the absence of floating-leaved and emergent macrophytes in Onondaga Lake may be related to water level changes and that the magnitude of annual water level variation observed for the Lake (i.e., approximately 1 m) may have a significant effect on the littoral zone vegetation.

Madsen et al. (1996) also observed that the impacts of wave action and ice scour are amplified by water level fluctuations.

Following the connection of the Lake to the Erie Canal System, the natural resources of Onondaga Lake were further degraded by the releases of large amounts of non-AlliedSignal industrial and municipal wastes that began no later than the mid-1800s. The early effects of these releases were summarized by Effler and Harnett (1996), who concluded that "by the turn of the century, sewage and industrial pollution had already had a profound impact on Onondaga Lake." Indeed, by 1901, ice harvesting from the Lake had been banned, a reflection of the significant water pollution at that time. From the early to middle 1900s, numerous industries expanded rapidly in the Onondaga Lake drainage basin, including those related to the manufacturing of steel, pottery, pharmaceuticals, air conditioning equipment, general appliances, and electrical equipment (Effler and Harnett 1996). In addition, the population in the drainage basin more than doubled during that period and continued to expand rapidly until the 1970s. However, the development of effective sewage treatment facilities lagged far behind the growing population, resulting in large amounts of raw or partially treated sewage being released to the Lake well into this century. Metro was not completed until 1960 and was not upgraded to secondary treatment until 1978 and to tertiary treatment until 1982. In addition, despite the upgrading of Metro, large amounts of untreated sewage continue to be released to Onondaga Lake through the 66 combined sewer overflows that discharge to tributaries of the lake during rainstorms approximately 50 times per year (Effler and Harnett 1996).

The non-AlliedSignal industries have released large amounts of hazardous substances to the Lake, including numerous kinds of heavy metals and organic compounds that are well-documented in the sediment cores collected from the lake during the RI/FS. Concentrations of many of these substances are

substantially higher than the levels known to be toxic to aquatic organisms. In addition, high concentrations of PCBs in lake fishes were found as early as 1975 (Armstrong and Sloan 1980) and continue to be found today, as documented by the RI/FS data. Other non-AlliedSignal substances found in Onondaga Lake fishes include the pesticides chlordane and dieldrin (Ringler et al. 1996). In addition to these industrial releases, large amounts of ammonia and nitrite have been released to the Lake as a result of treated and untreated sewage discharges. Both of these substances are toxic to fishes at relatively low concentrations, and both substances routinely exceed DEC's water quality standards for the Lake (Brooks and Effler 1996). After analyzing long-term data for Onondaga Lake, Brooks and Effler (1996) concluded that "ammonia and nitrite problems have prevailed in the upper waters of the lake for many years."

In addition to non-AlliedSignal hazardous substances, baseline conditions in Onondaga Lake have been dramatically altered by releases of nutrients (nitrogen and phosphorus), which have caused the Lake to become hypereutrophic. This nutrient enrichment has resulted in dramatic alterations of many of the physical, chemical, and biological characteristics of the lake. Some of the major effects of eutrophication on the natural resources of Onondaga Lake are as follows:

- Reduced dissolved oxygen concentrations in the hypolimnion to stressful levels during the period of stratification

  Excluded biota during the period of stratification
- Increased turbidity

  Limited macrophyte populations

  Reduced the feeding success of fishes that use visual cues

  Caused swimming to be prohibited

- Increased concentrations of ammonia and nitrite in the water column to toxic levels
- Altered phytoplankton assemblages

  Caused assemblages to be dominated by nuisance forms that create blooms, such as small green algae and blue-green algae
- Altered benthic macroinvertebrate assemblages

  Caused assemblages to be dominated by pollution-tolerant chironomids and oligochaetes
- Altered fish assemblages

  Caused assemblages to be dominated by nuisance species such as alewife, gizzard shad, white perch, and carp
- Eliminated the coldwater fishery

Despite 175 years of these documented impacts to Onondaga Lake, the nexus to the Lake of these various non-AlliedSignal anthropogenic influences is virtually ignored by the Draft Plan's discussion of baseline conditions for the Lake. *See* Draft Plan at 88-89. Until such time as these other influences are properly accounted for, an assessment of the impacts attributable solely to AlliedSignal- -and the directly related development of a proper baseline for the Lake—can never be accomplished in the manner required by CERCLA and the implementing DOI regulations.

2. *Natural Processes Must Be Accounted For In The Establishment Of Baseline Conditions For Onondaga Lake*

As required by the DOI regulations, the establishment of baseline for Onondaga Lake must reflect the condition of the Lake with respect to naturally

occurring substances such as calcite (calcium carbonate) and salinity. Because of the characteristics of the drainage basin of Onondaga Lake, the Lake is naturally enriched with both substances.

With respect to calcite, Onondaga Lake is a natural marl lake because most of its drainage basin is located in the Limestone Belt of New York State, a physiographic region in which soils are unusually enriched in calcium (Berg 1963). Because Onondaga Lake is a natural marl lake, sediments have a high calcium content and calcite precipitation from the water column is a common event. Other nearby lakes exhibit similar characteristics. For example, the sediments of Cross Lake, a nearby marl lake located upstream from Onondaga Lake, have calcium carbonate concentrations similar to those found in Onondaga Lake. In addition, nearby Cross, Otisco, and Owasco Lakes all exhibit "whiting events," during which calcite precipitation is so great that the water column turns white (Effler and Johnson 1987) (Effler, *et al* 1987, 1989a and 1989b).

As discussed more fully in Section XI, the oncolites found in many parts of the nearshore zone of Onondaga Lake are also a natural occurrence, as are the calcareous structures found in nearby Fayetteville Green Lake and Tully Green Lake. In fact, Eggleston and Dean (1989) concluded that the different forms of the calcareous structures found in those three lakes were primarily the result of the different physiographic conditions (lake size, depth, and slopes) in the three lakes. This implies that oncolites would most likely have formed naturally in Fayetteville Green Lake and Tully Green Lake if the physiographic conditions in those lakes were similar to those of Onondaga Lake.

With respect to salinity, historical information on Onondaga Lake indicates that it has always been a naturally saline lake. Numerous salt springs were found near the Lake as early as the mid-1600s, and, according to Effler and

Harnett (1996), "the major impetus to the development around Onondaga Lake was the salt industry." Historical accounts indicate that some of the salt springs were in direct communication with Onondaga Lake and would therefore serve as a source of saline water to the Lake. Effler and Harnett (1996) concluded that "it is likely that the lake was somewhat enriched in certain ions compared to most other local hard water lakes." Results of the Onondaga Lake RI/FS geophysical survey documented the presence of numerous depressions in the lake bottom in the northwest and southeast parts of the lake. Some of these depressions appeared to be venting fluids. It was also discovered that approximately 20 percent of the chloride loading to the Lake comes from seeps in the bottom of Onondaga Creek near its mouth, where numerous salt wells were located in the past.

The Draft Plan fails to acknowledge the naturally occurring levels of substances such as calcite and salinity and their effects upon the Lake environment. As a consequence, the Draft Plan cannot identify an appropriate, defensible baseline.

B. Use Of Reference (Or Control) Lakes Is Inappropriate To Establish Baseline Conditions In Onondaga Lake

1. *In Light Of The Data Already Available For Onondaga Lake, The Draft Plan's Preference For A Reference Lake to Establish Baseline Is Premature And Unjustified Under DOI's Regulations*

To establish baseline conditions, DOI's regulations expressly set forth a preference for the use of available and applicable historical data. 40 C.F.R. § 11.72(c). Baseline data should only be collected from control areas "[w]here historical data are not available for the assessment area or injured resource." *Id.* §

11.72(d). Rather than acknowledge this express regulatory preference and fully avail itself of the broad range of historical data sources allowed for under § 11.72 (c), the Draft Plan concludes—virtually without explanation—that "there are few historical data to make a baseline assessment" and that "these data alone are not sufficient to meet the quantification needs of an NRDA." Draft Plan at 88.

As evidenced by the discussion set forth above in these comments, however, such data are both available and adequate for establishing baseline conditions in the Lake. Yet the Draft Plan proposes to make minimal use of such data and to rely, instead, on the establishment of baseline conditions through the use of a reference lake approach. Until all of the historical data available for the Lake, including the Onondaga Lake RI/FS, have been more fully examined and afforded the treatment they deserve, any decision to rely on a reference lake system would be premature under and prohibited by DOI's regulations.

2. *The Only True "Reference Lake" For Onondaga Lake Is a Hypothetical Onondaga Lake Without Releases of Hazardous Substances From AlliedSignal*

Onondaga Lake is a limnologically complex system with extensive natural influences and a centuries long history of anthropogenic modifications in a heavily populated, urban setting. In other words, Onondaga Lake is unique. To the extent that a full analysis of the historical data for Onondaga Lake is properly performed and that this analysis concludes that an evaluation of a reference lake system is somehow warranted, such an evaluation must conclude that a *true* reference lake—i.e., a lake other than Onondaga Lake that is nearby, naturally similar to Onondaga Lake and capable of distinguishing between those injuries in Onondaga Lake resulting from Allied's releases of hazardous substances and those injuries resulting from all other anthropogenic sources—does not exist. In fact, the only true reference lake that could ever meet these requirements *is* Onondaga Lake as it

would hypothetically exist without any alleged impacts of hazardous substances from AlliedSignal—i.e., a marl, hypereutrophic, urban lake without AlliedSignal releases of hazardous substances.

Almost by definition, any other lake near Onondaga Lake will fail to meet the general control area requirements of 40 C.F.R. § 11.72(d) and the specific control lake requirements of 40 C.F.R § 11.72(g)(3)(ii). The former requirements mandate the selection of such an area based upon its "similarity to the assessment area and lack of exposure to the discharge or release," while the latter provide that a control lake for NRD baseline purposes must be "such that the sediment characteristics and inflow-outflow characteristics of the control area are similar to the injured resource and the water and sediments of the control area, because of location, have not been exposed to the discharge or release." Applying these criteria to a number of nearby lakes demonstrates the futility of searching for a reference lake that could conceivably reflect the long history of non-AlliedSignal influences.

Cross Lake, a marl lake located near and upstream of Onondaga Lake, is hypereutrophic and exhibits many of the characteristics of Onondaga Lake, including high turbidity, an anoxic hypolimnion, limited macrophyte distributions, and altered benthic macroinvertebrate and fish assemblages. But Cross Lake has been relatively unimpacted by the broad array of anthropogenic influences found in Onondaga Lake. Fayetteville Green Lake and Tully Green Lake contain calcite deposits related to oncolites, and Otisco and Owasco Lakes exhibit calcite precipitation in the water column, but none of these lakes are eutrophic and urban impacted like Onondaga Lake. Many of the Finger Lakes exhibit the naturally occurring thermal stratification found in Onondaga Lake (*see* Section XI, below), but none of the Finger Lakes is a eutrophic, urban impacted lake like Onondaga Lake.

In sum, DEC must abandon the search for a non-Onondaga reference lake and refocus its efforts to develop a baseline for Onondaga Lake by fully identifying

and analyzing the full array of available historical data. Only through such a review and analysis can a true NRD baseline—i.e., a hypothetical Onondaga Lake *without* releases of hazardous substances from AlliedSignal—ever be developed for Onondaga Lake.

C. The Draft Plan's Proposed Use Of Various Standards And Criteria To Establish Baseline Conditions In And Around The Lake Is Legally Insupportable, Analytically Confused And Otherwise Inappropriate

1. *The Concept Of "ARARs" Applies Exclusively To Remedy Determinations, Not NRDA*

The Draft Plan proposes to identify "injury" in the Lake and its environs through the comparison of data for various media with various standards and criteria, referred to in the Draft Plan as "ARARs." AlliedSignal objects to the use of "ARARs" in the injury determination phase of an NRDA for several reasons.

First, the concept of ARARs is both appropriate and legally required in the context of remedial action, but is inapposite in the context of NRDA. Section 121(d)(2) of CERCLA requires the attainment of ARARs at the completion of a remedial action undertaken under § 104 or § 106. The purpose of attaining ARARs through remedial action is to "assure protection of human health and the environment." CERCLA § 121(d)(1). The purpose of an NRD action, on the other hand, is to ensure the restoration, replacement or acquisition of a natural resource that has suffered injury due to a release of a hazardous substance. *Id.* § 107(f)(1). "Restoration" under the DOI's regulations consists of "actions undertaken to return an injured resource to its baseline condition . . ." 43 C.F.R. § 11.14(*ll*). "Baseline" is the condition of the natural resource had a release of a hazardous substance not occurred. *Id.* § 11.14(e).

The use of various standards and criteria, whether ARARs for the purposes of remediation or not, may or may not accurately reflect baseline for a particular natural resource. Determining baseline requires a site-specific inquiry into the resource's condition before a release. *E.g., id.* § .62(b), (c) (defining injury with reference to conditions before a discharge or release). The DOI regulations give explicit direction on how to determine baseline and to measure injury resulting from a release. ARARs play no part in such determinations. Their use is not sanctioned in the DOI regulations, and they are not an appropriate means for determining baseline conditions for Onondaga Lake.

2. *Many Of The So-Called "ARARs" Listed In The Draft Plan Are Not Even Applicable As Such*

Many of the ARARs proposed for use in Appendix D of the Plan would not be "applicable" in the response action context and, indeed, would most likely not be "relevant or appropriate" in that context either. For instance, New York State's sediment criteria are part of a guidance document that falls into the category of a document "to be considered" under the cleanup program, but it is clearly not an ARAR. Moreover, the sediment criteria guidance document is not, by its own terms, to be used on its own to establish site specific standards. Rather, criteria in the guidance are a screening tool that may give rise to further analysis under a risk assessment or another, follow-up study. Finally, even for those rules that may be ARARs under the CERCLA cleanup program, waivers may be available by which a specific cleanup standard would not be applicable to a specific site. *See* CERCLA § 121(d)(4).

3. *Whether Properly Thought Of As ARARs Or Not, And Irrespective Of Their Applicability, The Use Of Various Standards And Criteria In The Draft Plan To Establish Baseline Is Inappropriate*

Finally, the use of ARARs and other standards and criteria in the NRDA context fails altogether to assess the contribution of other sources, including natural sources, to the injury to natural resources in the Lake and its environs. As discussed above, CERCLA, the DOI regulations and the State's complaint require that an NRDA consider the contribution of other sources to the presence of hazardous substances in the Lake. The purpose of determining such contributions is to identify an appropriate baseline, considering all non-AlliedSignal contributions, as AlliedSignal is legally responsible for only those hazardous substances that it released, and for those injuries resulting from such releases. In short, the use of ARARs or other standards or criteria to determine a baseline from which injury is measured ignores, by definition, the contribution to any injury by non-AlliedSignal sources.

For all of these reasons, ARARs are an inappropriate, inaccurate and unlawful means of identifying company specific injury to and determining baseline for the Lake.

V. THE ASSESSMENT OF RELEASES AND RESULTANT DAMAGES OCCURRING WHOLLY BEFORE DECEMBER 11, 1980 MUST BE EXCLUDED FROM THE DRAFT PLAN

Under CERCLA § 107(f)(1), the recovery of NRD is prohibited where a release and any injury resulting from the release occurred wholly before December 11, 1980. *See also* 43 C.F.R. § 11.24(b)(ii) (noting this exception to liability). At least one court has ruled that where a release and injury occur before that date, the condition of

the resource at that date is part of the degraded "baseline" to be established and considered when assessing damages. *In re Acushnet River & New Bedford Harbor Proceedings re Alleged PCB Pollution*, 716 F. Supp. 676, 684-87 (D. Mass. 1989). A trustee must therefore consider releases and injury before December 11, 1980, to assess recoverable damages because the statute prohibits the trustee from recovering damages for such injury. The State's Plan fails, however, to consider pre-CERCLA releases and injury. To establish appropriate baseline conditions of the natural resources to be assessed under the Plan, the State must include a consideration of pre-December 1980 releases and injury and determine injury and resultant damages only from that date forward.

As discussed previously, Onondaga Lake has been substantially influenced by anthropogenic activities since at least the early 1800s (Effler and Harnett 1996). Virtually all of the injuries to natural resources of the Lake originated prior to the enactment of CERCLA, including those alleged to have been caused by releases from AlliedSignal. In addition, because most conditions in Onondaga Lake had improved substantially by 1980, most of the alleged injuries to Lake resources occurred prior to 1980 and are therefore not recoverable. The historical patterns of mercury in sediments and fish tissue discussed above provide clear examples that most injuries occurred prior to 1980.

As graphically set forth above in Figure 3, results from a sediment core collected in the southern basin of Onondaga Lake during the RI/FS document the temporal pattern of mercury concentrations in the bottom sediments of the Lake. Concentrations increased after the 1940s (when the chloralkali cells were added to the AlliedSignal facilities), peaked between the mid-1950s and late 1960s, and dramatically declined after 1970, when discharges were reduced substantially in response to a consent order with the U.S. Department of Justice. The peak

The NOAA regulations contain a preference for use of HEA or a comparable procedure, collectively referred to as resource-to-resource or service-to-service approaches, instead of a monetary valuation approach. Only when HEA or a similar approach does not provide a reasonable range of alternatives may a trustee use a valuation approach such as CV. 61 *Fed. Reg.* at 453. It is inconsistent for the Draft Plan to rely on the NOAA regulations to invoke HEA and CV, without recognizing NOAA's preference for HEA to be used exclusively of CV in all appropriate circumstances. As described above, the HEA approach will adequately calculate compensation for the injuries sustained and will provide a reasonable range of alternatives from which the trustee may choose. Thus, use of the other valuation and scaling techniques proposed by the Draft Plan not only would result in double counting, but also would be inconsistent with current NRD assessment theory.

X. CONTINGENT VALUATION IS BIASED AND UNRELIABLE AND SHOULD NOT BE INCLUDED IN THE DRAFT PLAN

Regulatory agencies, the regulated community and commentators have all noted that the "CV technique is the subject of great controversy." *Id.* To address this controversy in the context of promulgating regulations under the Oil Pollution Act, NOAA appointed a "Contingent Valuation Panel" whose purposes were to assess the issue of whether CV is capable of providing reliable information about lost non-use values and to make recommendations on the use of CV. The Panel prepared a report that NOAA published in the Federal Register. 58 *Fed. Reg.* 4601. The report criticized the application of CV in most cases, finding that surveys are usually written and/or administered in a biased, indefensible manner. Nevertheless, the Panel endorsed the use of CV, but only under specific, detailed conditions that it prescribed. The number and detail of the guidelines reflect the Panel's concern that accurate, usable surveys are difficult--if not impossible--to apply.

Many scholars in the fields of both law and economics continue to criticize CV. *See* Analyzing Superfund: Economics, Science, And Law, 234-36 (Richard L. Revesz & Richard B. Stewart eds., 1995) (CV studies "have yet to meet minimum standards of reliability."); Brian R. Binger, Robert F. Copple & Elizabeth Hoffman, *The Use of Contingent Valuation Methodology in Natural Resource Damage Assessments: Legal Fact and Economic Fiction*, 89 NW. U.L. Rev. 1029 (1995) ("Without question, the [CV] method is poorly understood, based on still untested hypotheses, and subject to fatal flaws, biases, and inaccuracies in application."); Frank B. Cross, *Restoring Restoration for Natural Resource Damages*, 24 U. Tol. L. Rev. 319, 327-33 (1993) (noting that CV has serious shortcomings and summarizing its deficiencies); Note, *"Ask a Silly Question . . .": Contingent Valuation of Natural Resource Damages*, 105 Harv. L. Rev. 1981 (1992) (arguing that CV should be excluded from use in regulation and prohibited from use in court cases). The primary criticisms of CV include: (1) the highly hypothetical nature of the questioning involved, (2) embedding, (3) the survey effect, (4) faulty empirical evidence, and (5) informational weaknesses.

CV is not sufficiently developed as a valuation technique and, therefore, is not adequately vigorous for reliable use in the NRDA process. Moreover, the informational weaknesses of CV raise serious concerns regarding the validity and trustworthiness of CV-based natural resource damage valuations. Finally, no court has approved the use of CV within the context of a specific damage claim. For these reasons, the Draft Plan should not include CV as one of its damage assessment techniques.

XI. THE DRAFT PLAN CONTAINS SEVERAL SERIOUS FACTUAL ERRORS

A. Oncolites Occur Naturally And Were Not Created By AlliedSignal's Discharges

There are no conclusive data to support the numerous assertions in the Draft Plan that the formation of oncolites was the result of ionic waste discharges by AlliedSignal. Oncolites are naturally occurring calcareous nodules that are found in marl lakes throughout the world (Johnson 1974; Grove et al. 1975; Eaton and Kardos 1978; Jones and Wilkinson 1978; Schafer and Stapf 1978; Murphy and Wilkinson 1980; Dixit 1984). The primary prerequisites for oncolite formation are:

- The water column must be saturated with respect to calcium carbonate, so that conditions are favorable for calcite precipitation.
- Periphytic blue-green algae must be present to facilitate calcite precipitation. This process occurs when the algae photosynthesize and increase pH levels in the microenvironment near the oncolite surface. At least three species of periphytic blue-green algae (*Entophysalis rivularis*, *Schixothrix calcicola*, and *Calothrix parietina*) are present in nearby Fayetteville Green Lake and have resulted in the formation of extensive stromatolitic bioherms (or ledges), which are related to oncolites but require quiescent environments for formation (Eggleston and Dean 1989).
- Adequate amounts of light and dissolved oxygen must be present to allow the blue-green algae to photosynthesize and respire.

- Turbidity levels must be low enough to ensure that the blue-green algae have adequate light for photosynthesis.

- Sufficient energy in the form of waves and currents must be present to prevent oncolites from becoming cemented to hard substrates or becoming buried by sediments.

- Nuclei must be present for initial colonization by the blue-green algae. Suitable nuclei include such objects as shells and plant fragments. Fragments of *Chara* are common nuclei of oncolites in many marl lakes and *Chara* were historically abundant in Onondaga Lake.

Because all of the conditions described above likely were present in Onondaga Lake prior to the time when AlliedSignal discharges began, it is likely that oncolites were present in the Lake prior to initiation of those discharges. Furthermore, because periphytic blue-green algae are adversely affected by eutrophication (Ordonez and Garcia del Cura 1983; Wetzel 1983; Cattaneo 1987; Browder et al. 1994), it also is likely that oncolite formation declined substantially or ceased altogether when Onondaga Lake became eutrophic as a result of sewage discharges that had occurred prior to 1900. Some of the major adverse effects of eutrophication on periphytic blue-green algae include increased turbidity (which reduces light levels), reduced dissolved oxygen concentrations, and increased competition from periphytic green algae.

B. Oncolites Do Not Provide Poor Substrate For Macrophyte Growth

There are no conclusive data to support the assertion that oncolites provide poor substrate for macrophyte growth. The U.S. Army Corps of Engineers conducted greenhouse experiments to evaluate the effects of various sediment types from Onondaga Lake on macrophyte growth (Madsen *et al.* 1993,

1995). The sediment types were defined as oncolite, silt, sand, and organic. No differences were found in macrophyte growth among the various sediment types, indicating that oncolites did not adversely affect macrophyte growth. Although differences were found between growth in a reference sediment and growth in all Onondaga Lake sediments, the reference sediment was inappropriate because it was collected from a non-marl lake in Texas, had an organic content (8.6 percent) and clay content (28 percent) that were more than twice as high as the values found throughout most of Onondaga Lake, and had a calcium content (3.7 percent) that was far below the values found in Onondaga Lake and other marl lakes.

Although macrophyte densities in the nearshore zone of Onondaga Lake are relatively low in many areas where oncolites are abundant, the main reason for the scarcity of macrophytes in those areas is high levels of wave energy, which prevents macrophytes from successfully taking root. This pattern is common in marl lakes with exposed shorelines and marl benches. For example, in Lawrence Lake, Michigan (a well-studied marl lake without oncolites), researchers have found that "the broad marl bench is nearly barren of aquatic macrophytes to a depth of 1 m as a consequence of wave action" (Rich *et al.* 1971). Therefore, the co-occurrence of low macrophyte densities and high oncolite densities in Onondaga Lake is the result of wave action acting independently on both variables. If wave action were reduced, macrophytes would grow on the oncolite sediments, as was demonstrated in the greenhouse studies described above. If oncolites were not present in Onondaga Lake, however, macrophyte densities would continue to be low in high-energy areas as they are in Lawrence Lake, Michigan.

C. Thermal Stratification, In Combination With Eutrophic Conditions, Causes Low Dissolved Oxygen Concentrations In Onondaga Lake

There are numerous assertions throughout the Draft Plan that ionic stratification has played a major role in creating low dissolved oxygen concentrations in the hypolimnion of Onondaga Lake. These assertions are highly misleading because they ignore the true cause of dissolved oxygen problems in the Lake: thermal stratification combined with eutrophication. As a temperate lake, Onondaga Lake undergoes thermal stratification during the late spring, summer, and early fall as a natural process. Most of the Finger Lakes and nearby Cross Lake also undergo natural thermal stratification (Schaffner and Oglesby 1974; Effler *et al.* 1987, 1989 a,b). Once a lake is stratified, the hypolimnion is isolated from surface waters, where dissolved oxygen is produced by phytoplankton or introduced from the atmosphere. Once the hypolimnion is isolated, oxygen input from surface waters is greatly reduced or eliminated. The amount of dissolved oxygen in the hypolimnion is therefore relatively fixed at the onset of stratification and, as a result, is subject to a net reduction as organic material in the water column and sediments is decomposed by oxygen-consuming bacteria.

If the amount of hypolimnetic oxygen consumption is small relative to the volume of the hypolimnion, oxygen concentrations will not decline to stressful levels and biota can continue to inhabit the hypolimnion. This condition occurs in many of the Finger Lakes. However, if the amount of hypolimnetic oxygen consumption is large, oxygen concentrations can decline to stressful levels, resulting in the exclusion of some or all biota from the hypolimnion until fall turnover occurs. This condition occurs in Onondaga Lake and Cross Lake.

The primary mechanism by which hypolimnetic oxygen consumption reaches unacceptable levels is through nutrient enrichment and subsequent stimulation of phytoplankton populations (Wetzel 1983). When the phytoplankton die, they sink to the hypolimnion, where their decomposition results in oxygen consumption.

It is widely recognized that Onondaga Lake is hypereutrophic, which is the term reserved for the most eutrophic lakes in the world. Cross Lake is also hypereutrophic. This extreme state of eutrophy has resulted in the virtual elimination of dissolved oxygen in the hypolimnion of both lakes for most of the period of stratification. These anoxic conditions make the hypolimnion uninhabitable for most aquatic organisms. These conditions make the lakes unsuitable for coldwater fishes and result in the total elimination of the benthic macroinvertebrates that colonize the deeper parts of the lake prior to the onset of stratification.

Therefore, it is obvious that the addition of ionic stratification to Onondaga Lake would have minimal consequences with respect to natural resource injuries (i.e., no biological resources would be present in the hypolimnion that could be injured). Furthermore, it is also obvious that if Onondaga Lake was not hypereutrophic or eutrophic, there would be no widespread reductions in hypolimnetic dissolved oxygen concentrations regardless of the presence of stratification (either thermal or ionic).

XII. DETAILED COMMENTS

Page	Para.	Line	Comment
xvii	3	12	Concentrations of mercury in Onondaga Lake fishes are inaccurately described as being "well above" the FDA action level. This statement is simply unsupported by the latest data described in the text above.
xix	1	5	Macrophytes in the Lake are allegedly absent because of the presence of "flocculent...oncolite sediments." This conclusion is incompatible with the recent increase in macrophyte beds in the Lake and the roles of various influences discussed below in Comment 16-1-11
1	2	4	Ethylbenzene is not a major AlliedSignal-related substance of concern (PTI 1991).
1	2	5	Naphthalene is the only PAH compound that is a major AlliedSignal-related substance of concern (PTI 1991).
7			Table 1-1. The characterization of ammonia as an ionic waste is inaccurate and confusing. It should be listed as a separate substance, especially because its major source is sewage releases from Metro (Effler and Whitehead 1996).
7			Table 1-1. The table does not include many substances of concern or stressors of concern that may have injured natural resources in Onondaga Lake. Examples include: Ammonia, nitrite, and phosphorus from sewage releases

Page	Para.	Line	Comment
			(Effler and Whitehead 1996) Wave and ice scour resulting from lake level management (Madsen *et al.* 1996) Invasion by nuisance fishes (e.g., alewife, gizzard shad, white perch, carp) when the lake was made part of the Erie Canal System (Mills *et al.* 1983; Gandino 1996). Destruction of wetlands and littoral habitat when the lake was lowered by 2 ft during development of the Erie Canal System (Effler and Hartnett 1996).
9-10			Table 1-3 is too generic and inaccurate to be useful. For example, individual chemical *substances* other than mercury and lead are not identified. Locations of allegedly injured resources are sometimes not accurately and/or specifically identified. Injuries are sometimes not accurately identified. Finally, the footnote in Table 1-3 identifies a baseline of zero, which is below the detection limit for organic compounds in soil and groundwater. The reference to chlorinated benzene compounds at the Semet Residue Ponds is erroneous. These Ponds did not receive any chlorinated benzenes from the former Willis Avenue operation.
15	3	8	It should be noted that the open connection of the Lake to the Seneca River system allows fishes contaminated elsewhere to move into Onondaga Lake and that the effects of this potential in-migration on the patterns found in the Lake are unknown.

Page	Para.	Line	Comment
16	1	6-7	Ionic stratification is incorrectly described as "presently" extending downstream to the dam in Phoenix. See pages 67-68 of Appendix B.
16		10	The assertion regarding the "filling in" of Onondaga Lake by calcite deposition is unfounded.
16	1	11	The assertion regarding the restriction of macrophytes by oncolites and marl sediments is speculation and should be identified as such. Madsen et al. (1993) concluded that "the major factors limiting submersed species have been water transparency, water chemistry (*e.g.*, high solute concentrations), water level, and natural disturbance acting in concert, with the first two predominating."
16	2	1	Contamination of soil and groundwater in the vicinity of the waste beds is not attributable to mercury. See pages 47 and 54 of Appendix B of the Draft Plan.
17	3	12,13	The 1993 Bode conclusion of injuries to macroinvertebrates in Nine Mile Creek is overly general and contrary to the results of the 1990 CDR investigation (CDR 1991). Because there are no empirical data to indicate that mammals near the lake have been injured, the assertions regarding their injury and migration from the site are speculation and terms such as "in all likelihood" are inappropriate.
20	2	6-1	As a consequence of the U.S. Department of Justice action in 1970, each of the two chloralkali plants was allowed to discharge no more than 0.5 pounds of mercury per day. Under

Page	Para.	Line	Comment
			an NPDES permit that became effective on January 31, 1975, a mercury discharge of 0.6 pounds per day average and 1.2 pounds per day maximum from the Plant outfalls, the East and West flumes, was allowed. In 1977, AlliedSignal installed a treatment system to precipitate mercury from the Bridge Street plant's waste stream (the Willis Avenue Plant closed in 1977) prior to discharge into the main plant's waste streams. A 0.028 gross pound per day limit was established for the mercury treatment plant. Stormwater runoff into the combined East and West flumes was subject to a 0.5 pound per day average and a 1.4 pound per day maximum.
20	2	17-18	There are no data available to support the conclusion that "residual mercury in the METRO system possibly from Allied connections contribute to a large percentage of the mercury load to Onondaga Lake.
21	1	8	Historic mercury releases from the former AlliedSignal manufacturing operations have been covered by sediments and are not bioavailable. Effler (1996) reports that mobilization of sedimentary mercury is a minor contributor to the continued contamination of fish tissue in the Lake. The principal ongoing source of methyl mercury, the most bioavailable form of mercury, to Onondaga Lake is not attributable to AlliedSignal. It should also be noted that 1) the fishery in Onondaga Lake is also highly impacted by PCB contamination, 2) PCB contamination was documented as early as 1975, and 3) PCB contamination played a part in the continued closure of the lake

Page	Para.	Line	Comment
			fishery. Armstrong and Sloan (1980) made the following statement: "In the mid-1970's, Onondaga Lake fish also contained concentrations of PCB close to 5 ppm. Although there are recent indications that these levels have also declined, further PCB analyses are needed to substantiate a decision to reopen this recreational fishery." This statement in an NYSDEC technical report clearly documents that the PCB problem in Onondaga Lake was apparent in the mid-1970s and that this problem played a part in the continued closure of the recreational fishery of the lake.
22	2	5-7	Additional documents have been submitted under the Onondaga Lake RI/FS process since June 1994 and must be taken into account by the Plan.
25	2	8	This sentence erroneously implies that all substances listed in Table 1-1 are releases from AlliedSignal.
27	2	6	It is correct to recognize that chronic criteria should not be applied to acute exposures. However, this logic is ignored in the selection of numerous "ARARs." For example, all of the NOAA ERL and ERM values (from which NYSDEC sediment criteria are derived) are based on a combination of data from freshwater, estuarine, and marine environments, as well as a combination of water-column and sediment-dwelling organisms (Long and Morgan 1991). Those values are therefore inappropriate for identifying injuries to freshwater sediments. For example, Table 1 shows that 52 (71 percent) of the 73 biological indicators used to develop the ERL and ERM

TABLE 1. SUMMARY OF BIOLOGICAL INDICATORS USED TO DEVELOP ERL AND ERM VALUES FOR MERCURY BY LONG AND MORGAN (1991)

	Number of Indicators	
Biological Indicators	Freshwater	Saltwater
Acceptable Indicators		
Nematodes	--	2
Adult bivalves	--	5
Insects	1	--
Amphipods	4	14
Benthic communities	4	7
Total	9	28
Questionable Indicators		
Bacteria		
Bivalve larvae		10
Daphnia	10	
Shrimp	1	6
Fish	--	2
Total	11	19
Unspecified Indicators[1]	1	5
TOTAL INDICATORS	21	52

Note: -- indicator not used
ERL effects range low
ERM effects range median

[1] The identity of these indicators were not specified by Long and Morgan (1991).

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			values for mercury were based on saltwater organisms. In addition, more than half of the 21 freshwater indicator organisms are considered questionable indicators of sediment quality because they are based on organisms that are not intimately associated with sediments or organisms of uncertain ecological relevance (*i.e.*, bacteria). Long and Morgan (1991) made the following statements regarding the use of these values: "Note that these ERL and ERM values are not to be construed as NOAA standards or criteria" (Page 1). "These values were not intended for use in regulatory decisions or any similar applications" (Page 2). "The present evaluation should be updated with additional data as they become available and should be supplemented with an evaluation of the chemical data normalized to TOC, AVS, and any other appropriate parameters in addition to dry weight" (Page 166). Regarding the validity of the ERL and ERM values, Long and Morgan (1991) made the following statements: "In the present effort, data from a variety of approaches and from studies performed in areas with significantly different pollution histories were evaluated, equivalent to comparing grapes and watermelons" (Page 141). "Subsequent evaluations of data such as these would be facilitated if the data were from the use of similar meth-

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			ods" (Page 166).
			"Overall, the degree of confidence in the accuracy of the ERL and ERM values should be considered as moderate for the metals group and PCBs and low for the pesticide and PAH groups. Much more data are needed to support or refute the ERL and ERM values for all groups and for individual analytes within the groups' 137).
			"Except for these latter few analytes, it is very obvious that more data are needed to reduce the uncertainty in the data" (Page 141).
			Regarding mercury in particular, Long and Morgan (1991) made the following statement:
			"For many of the analytes, e.g., mercury, there inconsistent data at concentrations above the apparent effects thresholds, i.e., data from some studies indicated no effects at relatively high concentrations of the analyte". (Page 137).
			The apparent effects threshold identified for mercury by Long and Morgan (1991) was 1.0 mg/kg, compared to the ERL and ERM values of 0.15 and 1.3 mg/kg, respectively.
			Based on the issues identified above, use of the NOAA ERL and ERM values to identify injuries to Onondaga Lake sediments is as inappropriate as it is to use chronic criteria to

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			evaluate acute exposures.
27	2	11	The assumption that all of the proposed "ARARs" are appropriate for documenting resource injuries is not valid for many of the "ARARs." For example, use of the NYSDEC sediment criteria to identify injuries is inappropriate and counter to the manner in which NYSDEC has specified that the criteria be used. NYSDEC (1993) states that the sediment criteria should be used only as screening criteria to identify contaminated sediments and that "once a sediment has been identified as contaminated, a site-specific evaluation procedure must be employed to quantify the level of risk." Because the use of screening criteria to identify injury in the Draft Plan ignores site-specific mitigating factors and other ecologically important variables, it is not a valid approach.
27	3	6	It is not surprising that Onondaga Lake does not function like a typical lake because it has been so massively altered by nutrient enrichment that it is classified as hypereutrophic (Effler *et al.* 1990), a category reserved for the most extreme state of eutrophication. This extreme state of eutrophication has dramatically altered biological assemblages, eliminated dissolved oxygen from the hypolimnion during most of the period of stratification, and caused turbidity levels to be so high that macrophytes would not be expected to survive at depths greater than several feet. A summary of some of the major adverse effects of eutrophication on lake ecosystems is presented in Figure 7.

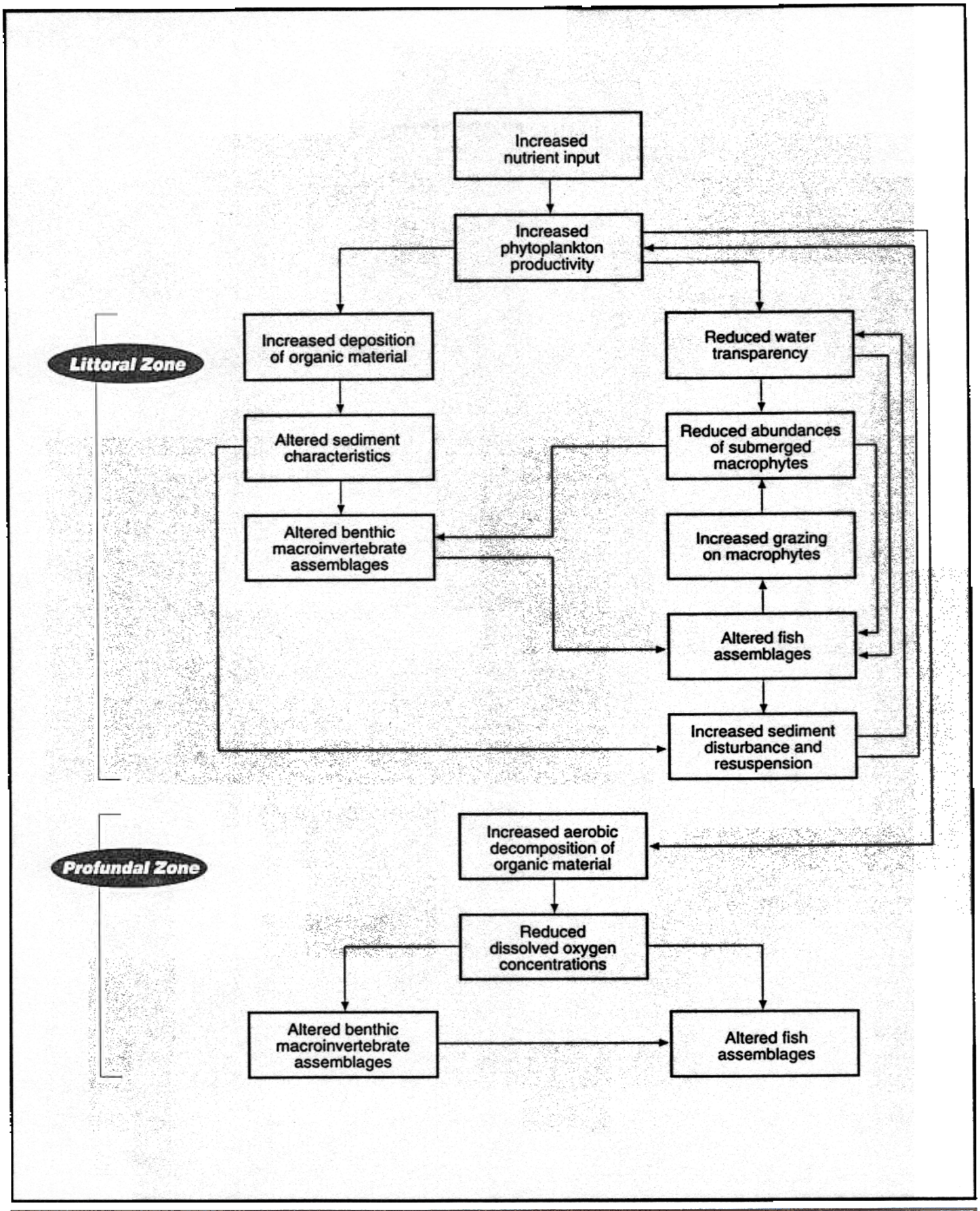

Figure 7. Summary of selected major adverse effects of eutrophication in lakes.

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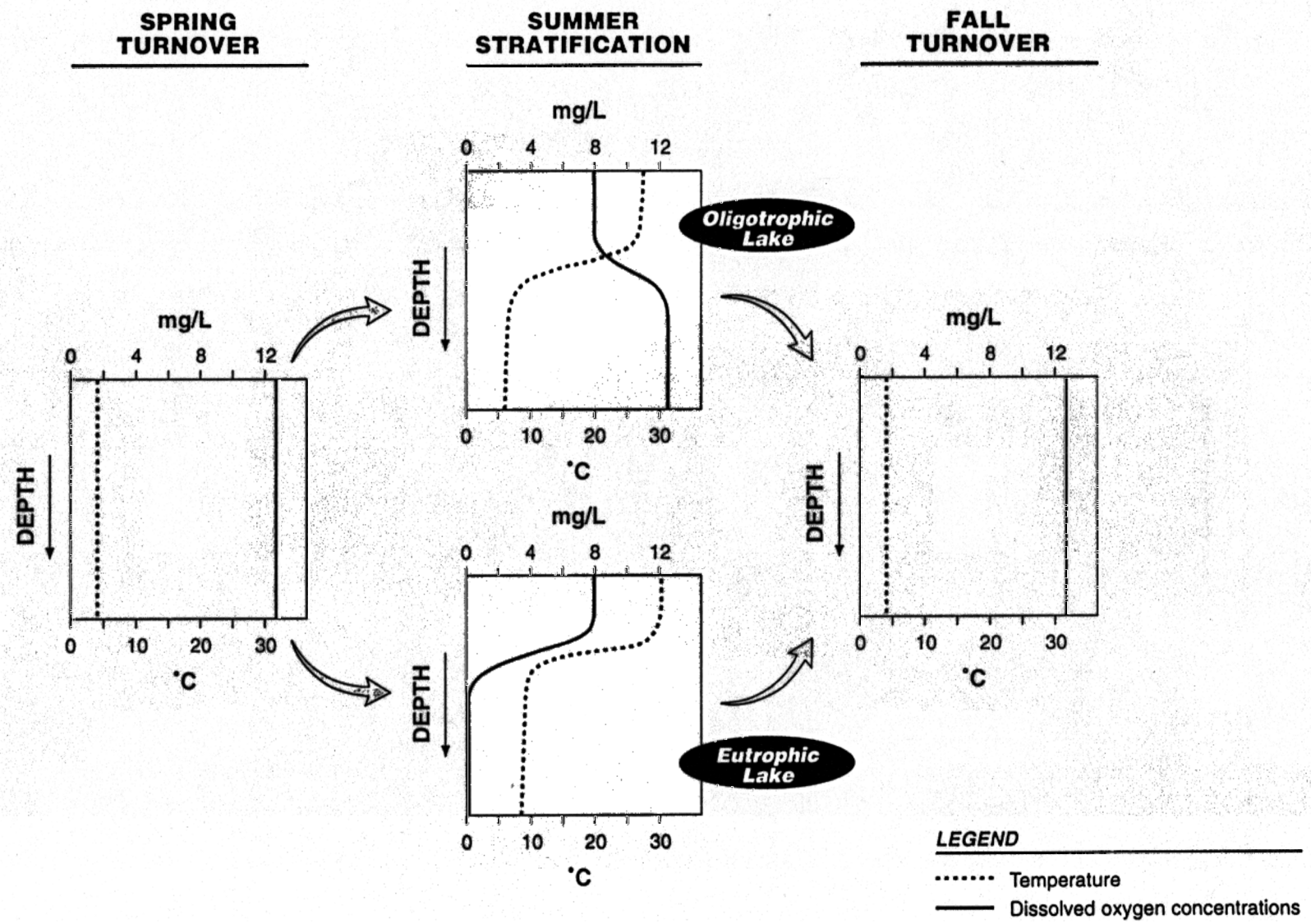
			Despite the widely acknowledged effects of eutrophication on Onondaga Lake, the NRDA plan does not consider the direct and indirect effects of the responsible nonhazardous substances (*i. e.*, nutrients) on the natural resources of the lake. It should also be noted that NYSDEC (1991) has promulgated water quality standards for nitrogen, phosphorus, ammonia, and nitrite, all of which have been exceeded in Onondaga Lake for many years and continue to be exceeded at present.
29	1	3	The dissolved oxygen problems in the Lake have little to do with ionic discharges. The primary cause of stratification in Onondaga Lake, as in most temperate lakes, is thermal stratification. The additional effects of ionic stratification are minimal at most. The true cause of dissolved oxygen problems in the Lake is nutrient enrichment, which causes phytoplankton blooms (Figure 6; Wetzel 1983). When these organisms die, they settle below the thermocline and their decomposition by aerobic bacteria consumes dissolved oxygen in the hypolimnion. If the Lake were not eutrophic, the phytoplankton populations would not be so dense, and dissolved oxygen concentrations in the hypolimnion would not decline as dramatically as they do at present, regardless of the presence of stratification. Figure 8 illustrates the differences in how the dissolved oxygen concentrations vary in oligotrophic and eutrophic lakes as a function of lake turnover and stratification during summer.
29	2	5	It is correct to evaluate sediment data using the methods



Source: Modified from Wetzel (1983)

Figure 8. Idealized seasonal vertical distribution of dissolved oxygen concentrations and temperature in oligotrophic and eutrophic lakes.

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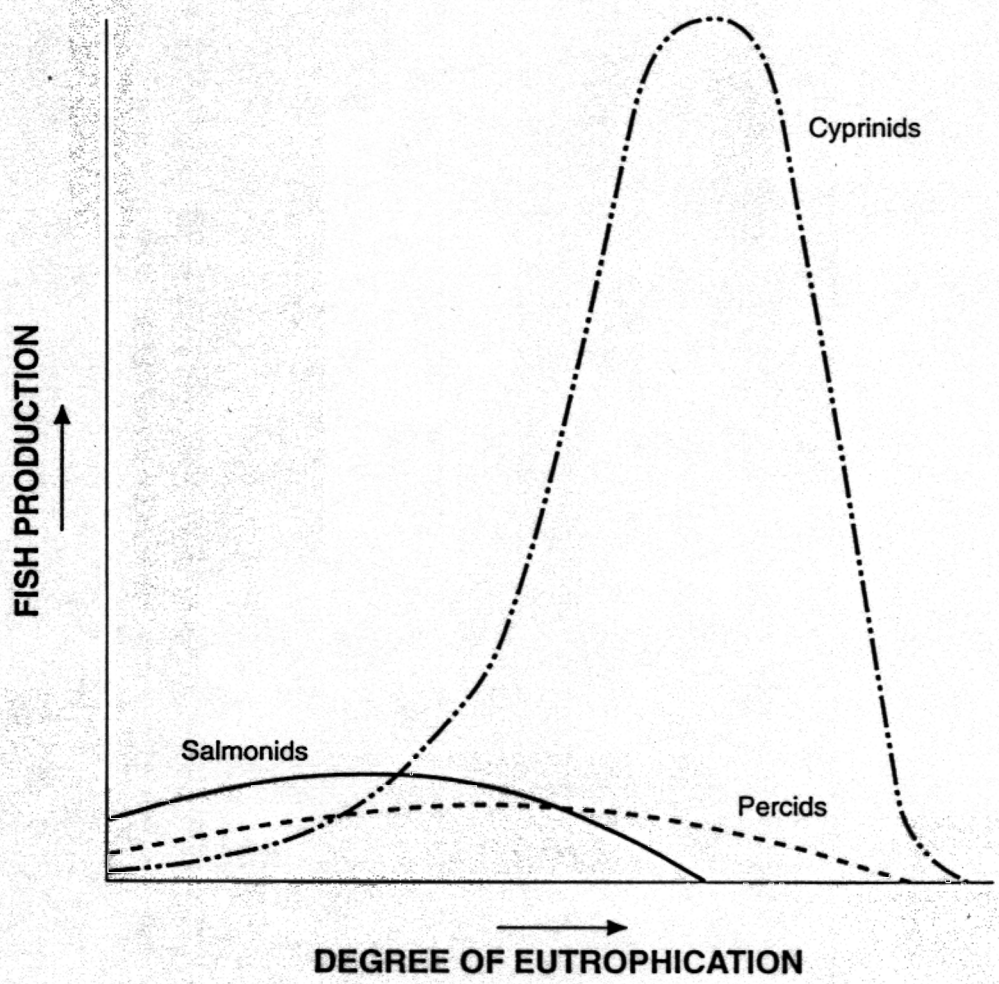
			described in NYSDEC (1993), which specifies that the numerical criteria in that document be used only for screening purposes and that actual risks be evaluated using site-specific procedures. The correct use of the criteria at this point in the Plan contrasts with the erroneous use of those criteria to evaluate site-specific injuries in other parts of the Plan. These generic criteria should not be used as "ARARs" to assess natural resource injuries in Onondaga Lake.
29	5	4	Taking into account the comments set forth above in Section IV, baseline conditions would include non-native nuisance species such as alewife, gizzard shad, white perch, and carp and would not include coldwater species such as salmonids and coregonids. For example, numerous studies of the effects of eutrophication on fish assemblages have found that as eutrophication increases, salmonids are replaced by percids, which are later replaced by cyprinids (Figure 9) (Larkin and Northcote 1969; Johansson and Persson 1986; Bergstrand 1990; Persson *et al.* 1991 It has also been suggested that the abundance of centrarchids (e.g., smallmouth bass, sunfishes) in North American lakes should increase with increasing eutrophication in the same manner that cyprinids increase (Persson *et al.* 1991).
29	6		Numbers of fish and biomass in excess of and below the PCB criterion for fish flesh contamination should also be estimated using the same methods as for mercury.
29	7	3	As noted in the earlier discussion on fish assemblages, the



Source: Modified from Leach et al. (1977)

Figure 9. Schematic of the relationship between the production of various fish families and degree of eutrophication in lakes.

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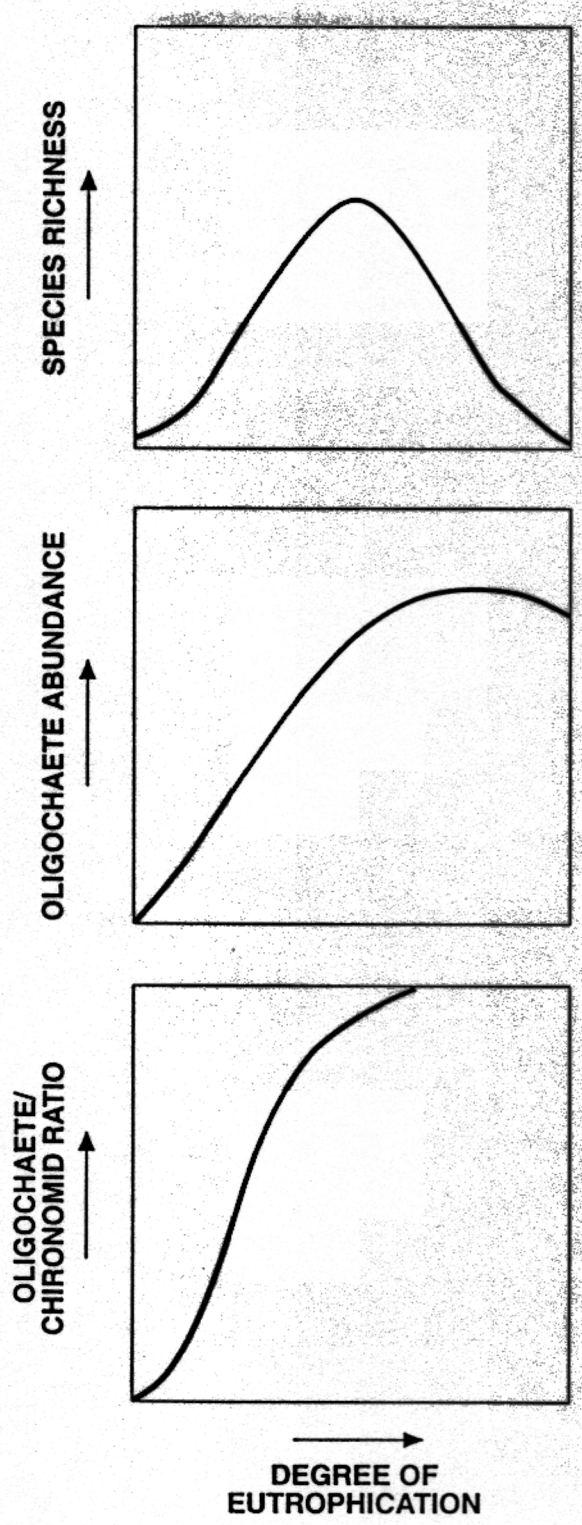
			baseline for comparison of macroinvertebrate and plankton assemblages should be a hypereutrophic marl lake because both characteristics influence the kinds of assemblages that would be expected to be found in Onondaga Lake in the absence of AlliedSignal discharges. As the result of eutrophication, the species richness and diversity of macroinvertebrate assemblages in Onondaga Lake would be expected to decline and the assemblages would become dominated by pollution-tolerant opportunistic species of chironomids and oligochaetes. For example, Wiederholm (1980) studied the effects of eutrophication in Swedish lakes and found that as eutrophication increases, species richness declines, oligochaete abundances increase, and the ratio between oligochaete and chironomid abundances increases (Figure 10). Also as a result of eutrophication, the characteristics of phytoplankton assemblages in Onondaga Lake would be expected to be dramatically altered (Wetzel 1983; Auer *et al.* 1996). Perhaps the most important direct effect of eutrophication in lakes is the stimulation of increased productivity of phytoplankton (Jonasson 1969). Based on an extensive analysis of the past and present phytoplankton assemblages in Onondaga Lake, Auer *et al.* (1996) concluded that "clearly Onondaga Lake should be considered highly eutrophic." The characteristics of zooplankton assemblages would also be expected to be dramatically altered by eutrophication in Onondaga Lake (Wetzel



Source: Modified from Wiederholm (1980)

Figure 10. Schematic of the relationship between selected characteristics of profundal benthic macroinvertebrate assemblages and degree of eutrophication in lakes.

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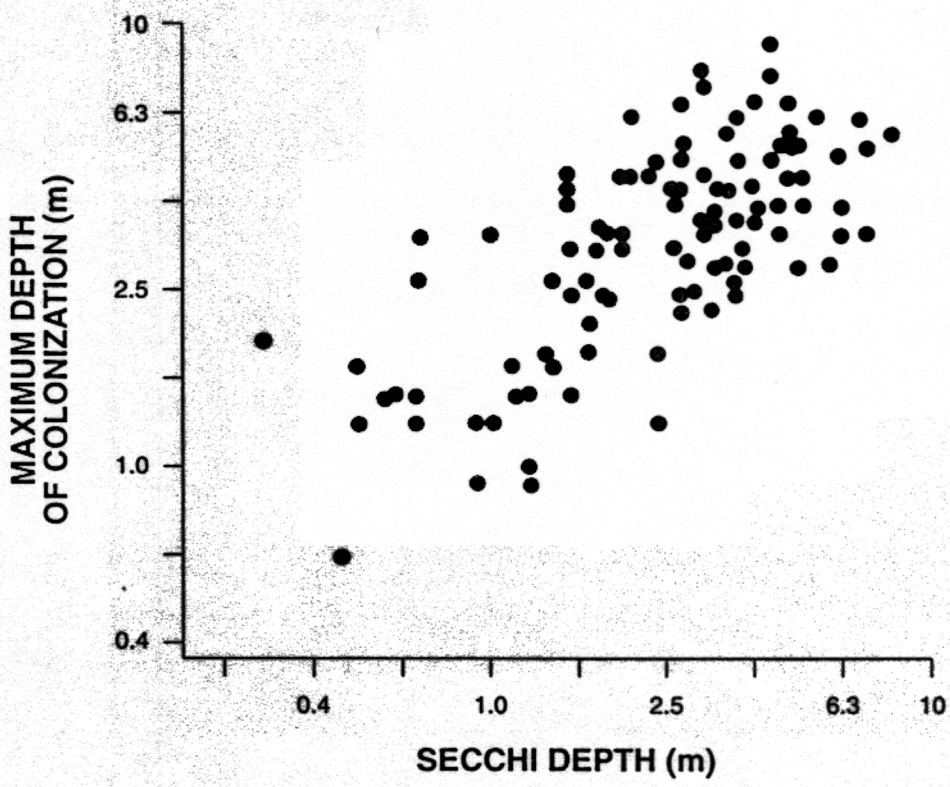
			1983).
30	1	5	As for other biological assemblages, the baseline for macrophytes should be a hypereutrophic marl lake that is connected to the Erie Canal System because all of those characteristics influence the kinds of assemblages expected to be found in Onondaga Lake in the absence of AlliedSignal discharges. The minimum depth of macrophyte colonization in the Lake would be limited by wave and ice scour on the shallow marl bench (Rich *et al.* 1971; Jupp and Spence 1977; Chambers 1987), and this limitation would be exacerbated by the lowering of the Lake level that occurs during management of the canal system (Madsen *et al.* 1993). The maximum depth of macrophyte colonization would be severely limited by the high levels of turbidity that occur in Onondaga Lake as a result of its hypereutrophic state (Canfield *et al.* 1985; Chambers and Kalff 1985). Empirical relationships between turbidity (as estimated by Secchi depth) and maximum depth of macrophyte colonization are presented in Figures 11 and 12. As a result of the effects of wave and ice scour and high levels of turbidity, the area of potential macrophyte colonization throughout most of Onondaga Lake would be limited to a relatively narrow depth range.
31	1	2	Xylene should be referred to as "xylenes" because it is a combination of three isomers.
34	5	3	No reference is provided for the statement that "[c]ontamination has been observed off-site."



Source: Modified from Canfield et al. (1985)

Figure 11. Relationship between maximum depth of macrophyte colonization and Secchi depth in lakes.

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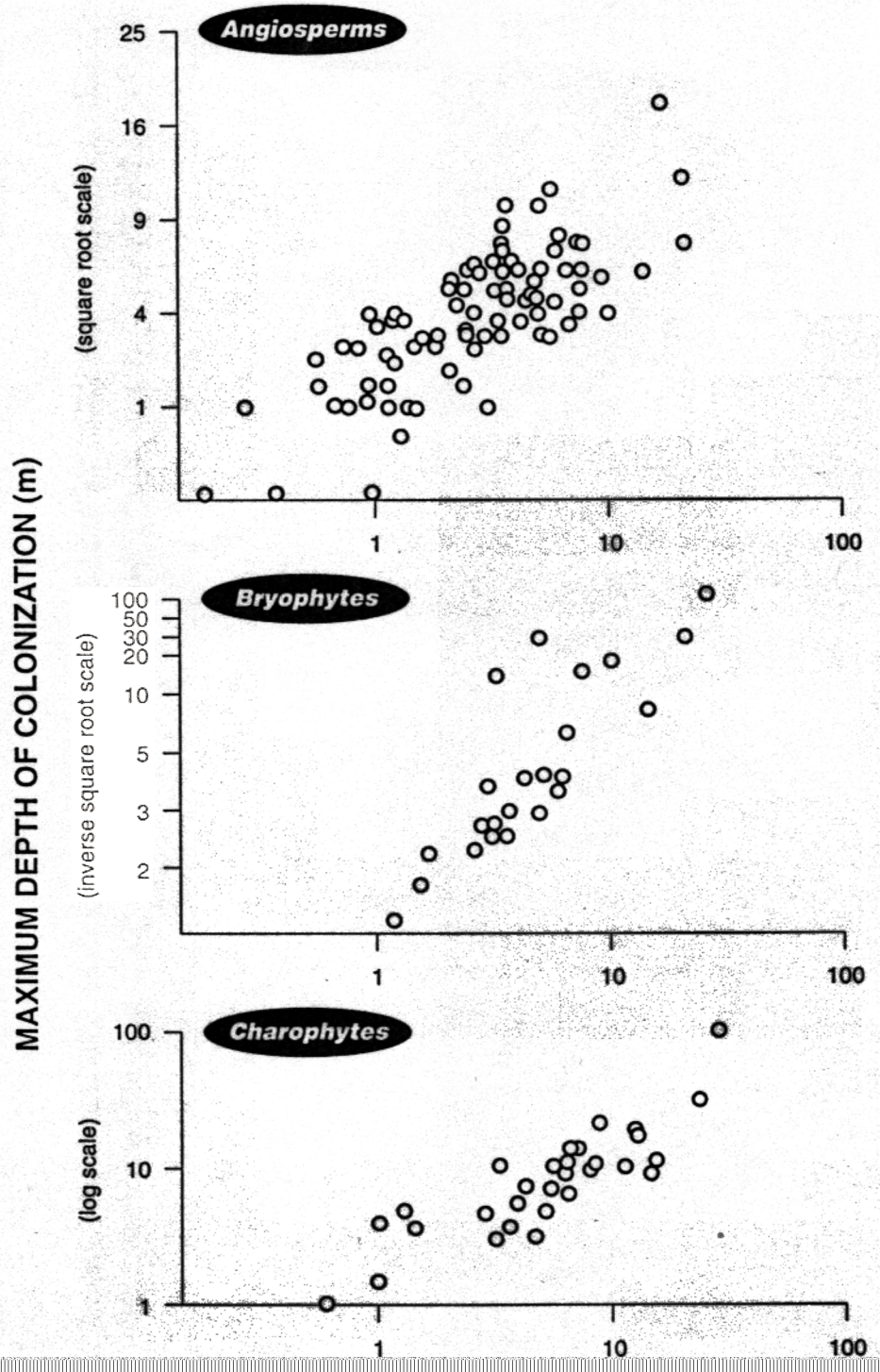

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35	2	5	A source of water to the East Flume is a non-AlliedSignal storm sewer. Benzene from automobile emissions is a frequent source of benzene in urban runoff. The inference that historical releases of BTEX compounds were much higher is speculation and should be deleted, unless supporting data are made available.
36	4	5	It is accurate that there are other documented sources of BTEX compounds to Onondaga Lake, such as a manufactured gas plant located on the southeastern shore of the Lake and several oil and gasoline storage facilities. However, the remainder of the discussion on these compounds contradicts this fact because the Draft Plan erroneously attributes all alleged injuries from these compounds to AlliedSignal.
37	2	3	The suggestion that the NYSDEC sediment criterion should be used as a cleanup level is contradictory to the manner in which NYSDEC (1993) specifies that the criteria be used. According to NYSDEC (1993), "comprehensive sediment testing and risk management are necessary to establish when remediation is appropriate and what final contaminant concentrations the sediment remediation efforts should achieve." The sentence in the Draft Plan should therefore be deleted.
39	4	1	The wastewater pipeline was from the Willis Avenue Plant, not the Benzol Plant.
40			AlliedSignal is unaware of any records that link the exact periods of waste discharge from the Willis Avenue Plant to the

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			waste beds. Similarly, AlliedSignal is unaware of any records that identify the character of this discharge. Any description of this waste in the Draft Plan is anecdotal. Finally, Waste Bed 15 did not exist until 1975, and manufacturing activities at the Willis Avenue plant were terminated in 1977, not 1979 as suggested in the Draft Plan.
44	2	2	See Comment 37-2-3.
45	2	2	It is correct to recognize that pesticides and PCBs may have injured natural resources in Onondaga Lake, even if these substances have not been related to AlliedSignal. Because those injuries would be present in the Lake in the absence of AlliedSignal discharges, they are representative of the true baseline conditions as defined in the federal regulations. This logic should be extended to other non-AlliedSignal substances that likely have injured lake resources, such as nitrogen, phosphorus, cadmium, chromium, copper, nickel, and zinc.
46	3	4-7	There are no PCB transformers present at the site as of the date of these comments.
49	4	2	AlliedSignal is a potential major source of only one PAH compound: naphthalene (PTI 1991). Contributions from AlliedSignal of all other PAH compounds are minor relative to other sources around Onondaga Lake. The patterns of PAH compounds in sediments identified by RI/FS data document that the major sources of most PAH compounds are located between Harbor Brook and Ley Creek along the southern

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			shoreline of the Lake (PTI 1993b).
52	2	5	The assumption that historical releases of PAH compounds were much higher is speculation and should be deleted, unless supporting data are made available.
53	3	13	It is accurate to acknowledge that there are other sources of PAH compounds to Onondaga Lake, such as Oil City and Metro. It would provide a more complete picture to state that the combined contribution of those sources likely dwarfs the contribution by AlliedSignal.
55	1	2	See Comment 37-2-3
55	3	2	It is accurate to identify naphthalene as the only major PAH compound related to AlliedSignal. It would be more accurate if the entire section on PAH compounds were limited to naphthalene, or to attribute other PAHs to other parties.
56	2	2	No AlliedSignal facility was involved in the production of mercury.
57	1	4	No "dumping" of the cells occurred.
57	2	4	The reference to "two production cells" should be changed to "two mercury cell-containing production facilities."
58	2	5-10	To the extent that the Draft Plan meant to infer that the Solvay Waste beds are a source of mercury to Nine Mile Creek, there are no data to support this conclusion
59	1	1	Metro has been found to be a major source of mercury to

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			Onondaga Lake. Baseline conditions must therefore account for mercury contributions by Metro, as well as other potential sources.
59		4	The assumption that historical releases of mercury were much higher is speculation and should be deleted, unless supporting data are made available.
60	3		Table 6-5 proposes for mercury in sediments an "ARAR" of .15 mg/kg, the NOAA effects range-low value. This value is inappropriate, in part, because it is more than three times lower than the "background" level identified for Onondaga Lake in the Draft Plan (Appendix B, Page 41). The proposed "ARAR" for soil is within the normal range of mercury concentrations in soil (0.1 to .5 mg/kg).
61	4	4	The term "likely" is speculative and inaccurate.
61	4	8	See Comment 61-4-4.
62	1	4	Justification should be provided for the identification of target receptors.
63	1	2	The proposed study does not indicate how it will be possible to identify fishes that are leaving the Lake, as contrasted to those entering the Lake or just displaying random movements.
63	2	4	It is correct that the toxicity of many metals is reduced with increased water hardness, which decreases the bioavailability of the metals. However, the recognition of other factors that reduce bioavailability of chemicals in the environment is lacking

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			in other parts of the Draft Plan. For example, acid-volatile sulfides reduce the bioavailability of divalent metals in sediments (DiToro *et al.* 1992) and organic carbon reduces the bioavailability of nonionic organic compounds (e.g., BTEX compounds, chlorinated benzenes, PCBs, and PAH compounds) in sediments (DiToro *et al.* 1991). The consideration of site-specific bioavailability is critical for establishing accurate baseline conditions.
64	4	1	Lead was used to anchor the graphite anodes. The lead was poured in molten form and then covered with asphalt pitch, making the prospect of lead releases to waste water discharges less likely than inferred by the Draft Plan.
65	3	1	It is correct to recognize that there are many sources of lead to Onondaga Lake, such as metal finishing facilities, automobile emissions, urban run-off, and Metro. Sediment samples taken by DEC in 1984 from that part of the West Flume upstream from the Bridge Street chloralkali Plant were found to contain 380 mg/kg of lead, and lead in Geddes Brook sediment upstream of the confluence with the West Flume was reported to be 80 mg/kg.
65	3	7	If the most likely major source of lead in Tributary 5A is upstream from the AlliedSignal facility, it is unlikely that AlliedSignal is more than a minor potential source to the stream.
67	5	3	It is correct to acknowledge that lead was released under a

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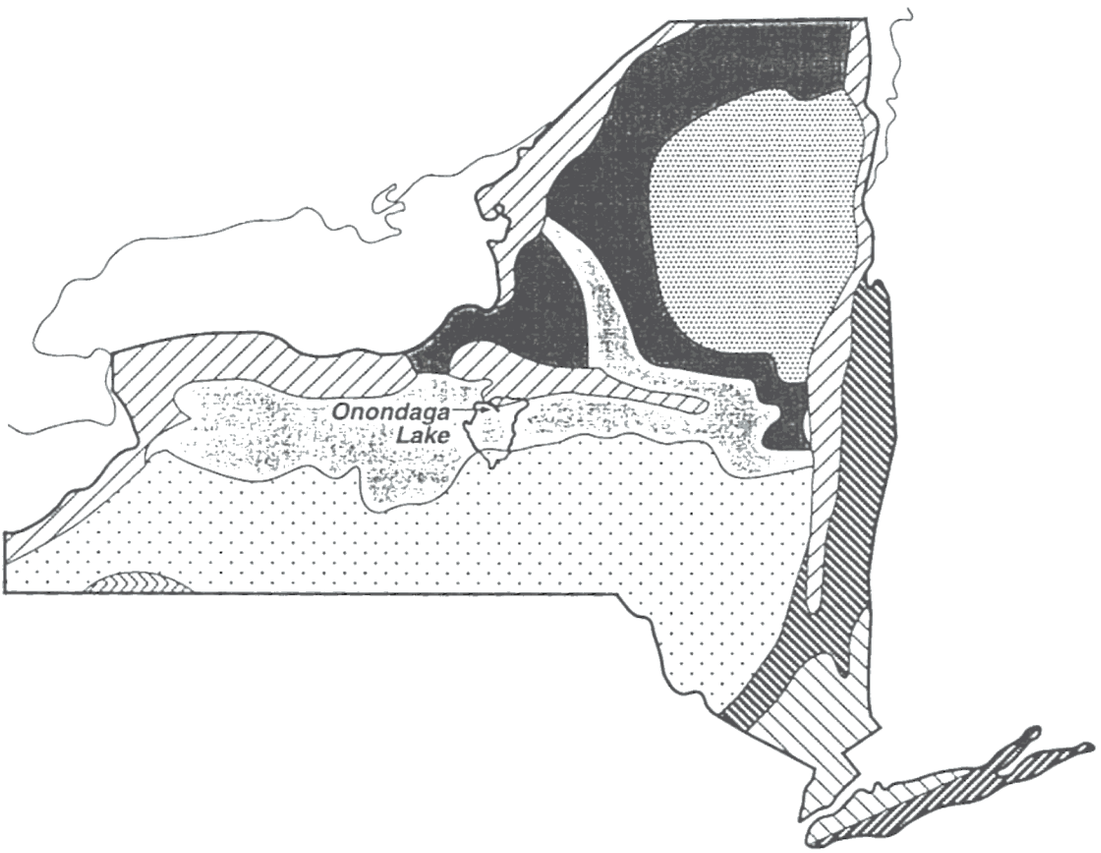
			permit and that there are numerous larger sources of lead to Onondaga Lake other than AlliedSignal.
68	2	2	Ammonia is inaccurately described as a form of nitrogen more utilized by other plants than are other forms (*e.g.*, nitrate).
68	3	5	Because Onondaga Lake is naturally a marl lake, calcite precipitation is a natural phenomenon in the Lake, as it is in other nearby lakes, such at Otisco Lake, Owasco Lake, and Cross Lake (Effler and Johnson 1987; Effler *et al.* 1987, 1989 a,b). Most of the drainage basin of Onondaga Lake is located in the Limestone Belt of New York State, a physiographic region in which soils are rich in calcium (Figure 13; Berg 1963). It is therefore not surprising that Onondaga Lake is naturally a marl lake. Based on the information presented above, it is misleading to state that calcite formed as a result of AlliedSignal discharges, because calcite precipitation would have occurred in the Lake in the absence of AlliedSignal discharges.
69	1	2	It is correct to recognize the beneficial aspects of calcium with respect to reducing metals toxicity. This benefit is particularly important in an urban lake such as Onondaga Lake, which receives metals discharges from numerous sources.
70	2	6-8	Soda ash, calcium chloride and chlorine were manufactured, not used. Sodium nitrite, not sodium nitrate, was also produced.
76	2	1	The mud boils are naturally occurring and are not related to the



LEGEND

- Adirondack Mountain Area
- Adirondack Foot Hills
- Ontario-Oneida-Champlain Lake Plain
- Limestone Belt
- Slate Belt
- New England Hill Area
- Northern Appalachian Plateau
- Allegheny Plateau
- Coastal Plain
- Onondaga Lake drainage basin

Source: Berg (1963)

Figure 13. Physiographic regions of New York State.

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			former AlliedSignal operations in Tully Valley.
79	3	8	More recent estimates of ammonia loading to Onondaga Lake indicate that Metro was responsible for 91 percent of the total loading (Effler and Whitehead 1996). Loadings from the wastebeds along Nine Mile Creek were estimated at only 4 percent of total loading to the lake.
80		2	Given the magnitude of Metro's ammonia loading to Onondaga Lake (91 percent), the AlliedSignal source is not critical for either salmonid or non-salmonid species.
80	3	6	Although it is correct that the sediments of Onondaga Lake are calcium-rich, this is a common and natural phenomenon in marl lakes (Wetzel 1983). For example, the calcium content of sediments in nearby Cross Lake (which is a natural marl lake located upstream from Onondaga Lake) is similar to the concentrations found in Onondaga Lake (PTI 1993b).
81	2	3	It is correct that determination and quantification of injury pursuant to the federal NRDA regulations does not apply to non-hazardous substances such as ionic wastes.
82	1	4	Although ionic stratification may have extended the period of stratification of Onondaga Lake, it is highly unlikely that this occurs at present. For example, the period of stratification in Onondaga Lake in 1988 (May to October) was the same as the periods of stratification found in nearby Cross and Otisco lakes (Figure 13; Effler *et al.* 1989 a,b), both of which thermally stratify and are not affected by ionic stratification.

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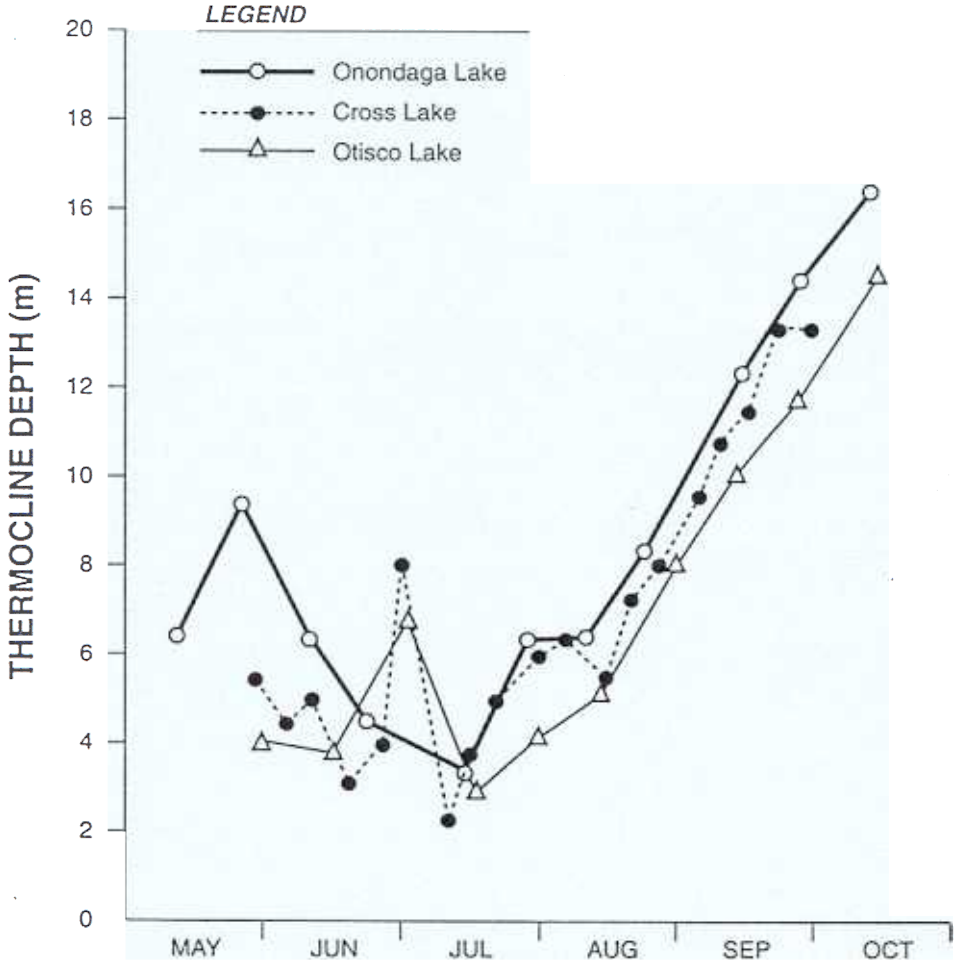
82		6	Regardless of the presence of stratification, anoxic conditions would not be a major problem in Onondaga Lake if the Lake were not hypereutrophic.
82	1	7	It is not "likely" that stratification would occur naturally in Onondaga Lake, it is "certain" that it would occur, as it does in many temperate lakes (such as the Finger Lakes and Cross Lake) as a result of thermal stratification (*e.g.* Effler *et al.* 1987, 1989 a,b; Schaffner and Oglesby 1978). Murphy (1978) described the strong thermal stratification that occurred in Onondaga Lake as long ago as 1969. Figure 14 documents the natural development of the thermocline in Onondaga, Cross, and Otisco Lakes in 1988.
83	1	1	Because oncolites and calcium-rich sediments are natural phenomena and are found in marl lakes throughout the world, their presence in Onondaga Lake should not be considered an "impact." For example, the nearshore zone of Littlefield Lake, Michigan (a well-studied pristine marl lake) is nearly identical to that of Onondaga Lake, with a narrow and shallow marl bench that is covered with oncolites (Murphy and Wilkinson 1980). Examples of other lakes throughout the world in which naturally occurring oncolites or similar structures have been described in the scientific literature include the following: Canandaigua Lake, New York (Clarke 1900; Eaton and Kardos 1978) Cedar and Ore lakes, Michigan (Davis 1900a,b; Jones



Source:
Onondaga Lake – Onondaga County (1990)
Cross Lake – Effler et al. (1989b)
Otisco Lake – Effler et al. (1989a)

Figure 14. Comparison of thermocline depths in Onondaga, Cross, and Otisco lakes in 1988.

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			and Wilkinson 1978) Lake Constance, Germany (Schafer and Stapf 1978) Lake Manyara, Tanzania (Dixit 1984) Lake Turkana, Kenya (Johnson 1974) Lake Stephanie, Ethiopia (Grove *et al.* 1975). In addition, related calcareous structures called stromatolitic bioherms (or ledges) occur naturally in Fayetteville Green Lake, New York (Brunskill and Ludlam 1969; Eggleston and Dean 1989), which is located less than 20 km from Onondaga Lake. Eggleston and Dean (1989) also found solid calcareous mounds growing upward from the outer edge of a shallow marl platform in Tully Green Lake, New York. The authors concluded that the different forms of the calcareous structures found in Onondaga Lake, Fayetteville Green Lake, and Tully Green Lake were primarily the result of the different physiographic conditions (lake size, depth, and slopes) in the three lakes. This indicates that oncolites would likely have formed naturally in Fayetteville Green Lake and Tully Green Lake if the physiographic conditions in those lakes were similar to those found in Onondaga Lake.
83	1	2	There is no evidence from sediment cores that indicates the calcite content of historical sediments differed substantially from current surface sediments.
83	1	3	The statement that calcium-rich sediments with oncolites are

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			poor substrates for macrophyte growth is incorrect. Based on laboratory studies of macrophyte growth in various types of sediments from Onondaga Lake, Madsen *et al.* (1995) concluded that "no differences between Onondaga Lake sediment types (oncolite, silt, sand or organic) were found in plant growth bioassay studies." Therefore, calcium-rich sediments with oncolites provide a substrate that is as beneficial to macrophyte growth as the other kinds of sediments found throughout the lake.
83	1	4	It is correct that the potential effect of ammonia on macrophytes has not been documented sufficiently. The remainder of the sentence is therefore speculation and should be deleted.
83	2	3	Reduced dissolved oxygen in Onondaga Lake is primarily the result of its hypereutrophic state, combined with its natural tendency to thermally stratify. The contribution of ionic wastes to this problem is negligible.
83	2	4	The most likely causes of the disappearance of the historical populations of Atlantic Salmon and cisco from Onondaga Lake are overfishing, blockage of migration routes by the canal lock system, and reduced hypolimnetic dissolved oxygen levels as a result of eutrophication. Effler and Harnett(1996) report that the Lake had lost its cold water fishery for these species no later than the 1890's. Dam construction on the Oswego River largely blocked the migration route of the Atlantic Salmon (Lipe, *et al.* 1983).

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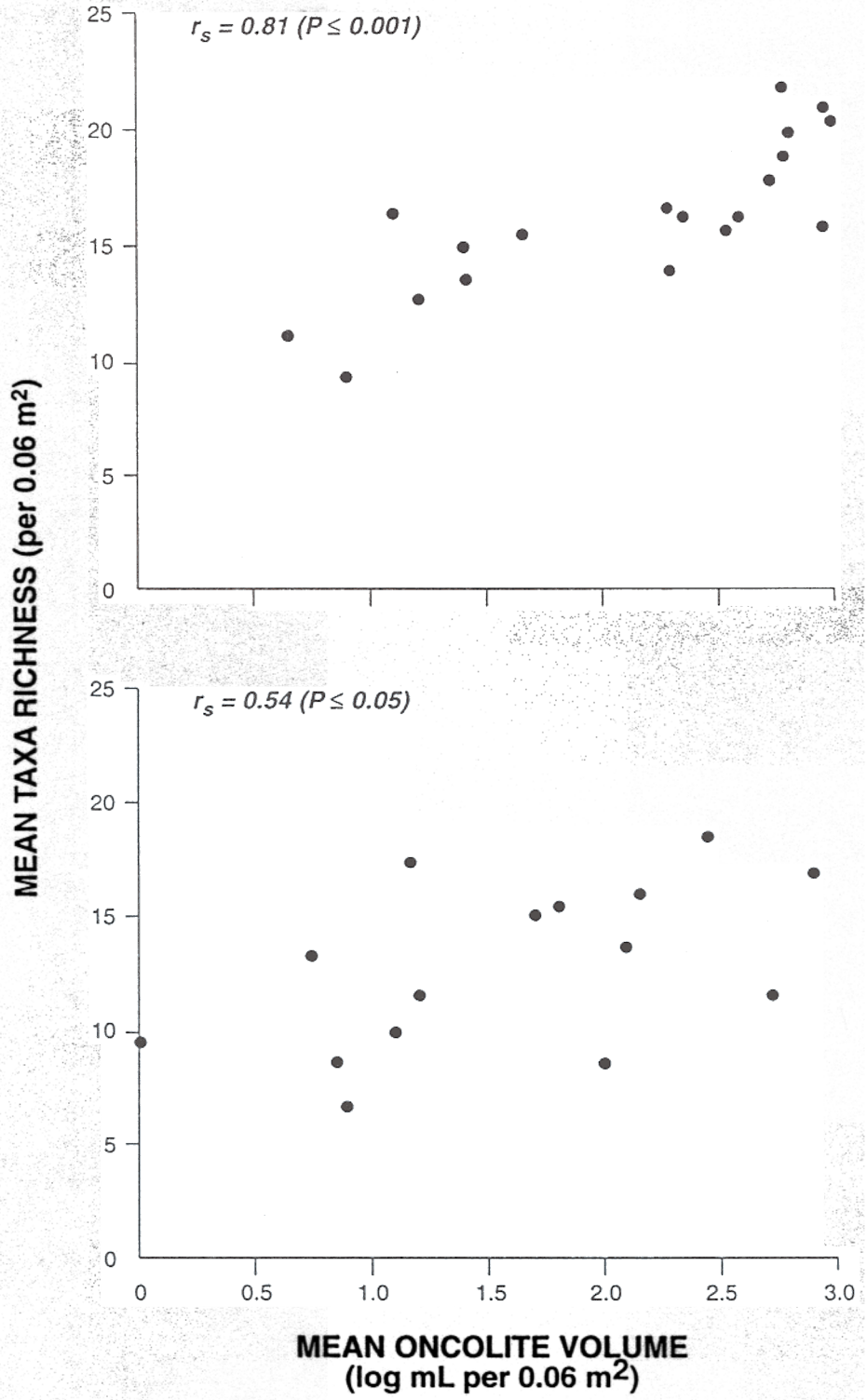
83	2	5	The dominant planktivorous fishes in Onondaga Lake (*i.e.*, alewife, gizzard shad, and white perch) are not native to the lake but were allowed to invade the Lake when it was connected to the Erie Canal System (*e.g.*, Mills et al. 1983).
83	2	6	The existing fish assemblage in Onondaga Lake is typical of the kind of assemblage expected to be found in eutrophic New York lakes and reflects the overwhelming influence that eutrophication has had on fishes and other aquatic organisms in the lake. For example, Gandino (1996) concluded that the fish assemblage in Onondaga Lake is similar to the assemblage found in nearby hypereutrophic Cross Lake.
83	2	9	Any effects of increased salinity on the ecosystem of Onondaga Lake are likely minimal, compared to the massive alterations that have occurred as a result of eutrophication (see Figure 7).
83	2	10	As explained in Comment 30-1-5, macrophyte assemblages in Onondaga Lake have been dramatically limited by Lake drawdown (during Lake level management activities) and high turbidity from eutrophication. Because oncolites occur in shallow, high-energy environments, the presence of macrophytes in association with oncolites would not be expected, because most macrophytes are generally excluded from shallow high-energy environments (Rich et al. 1971; Jupp and Spence 1977; Chambers 1987).
83	2	10	Data collected for the RI/FS refute the assertion that oncolites have reduced benthic invertebrate assemblages in the nearshore

Page	Para.	Line	Comment
			zone of Onondaga Lake. Statistically significant positive correlations were found between oncolite abundance and taxa richness and amphipod abundance (Figures 15 and 16). These results indicate that oncolites enhance benthic habitats, most likely by providing additional microhabitats, refuges from predation, and substrates for algal growth (i.e., a food source for many benthic macroinvertebrates).
83	2	12	Because the assertion regarding the effects of ammonia toxicity is acknowledged as not being well documented, it should be deleted.
85	1	2	Historical maps should also be consulted to quantify the amount of wetlands and littoral zone habitats around Onondaga Lake that were destroyed when the Lake was lowered by 2 ft to construct the Erie Canal System and when wetlands were drained for mosquito control (Effler and Harnett 1996).
86	1	10	In addition to accounting for the effects of natural lake features on macrophyte assemblages, the Draft Plan must also account for the effects of non-AlliedSignal anthropogenic factors (primarily eutrophication) must also be accounted for. The assumption that "services" provided by macrophytes in lakes to fishes, other aquatic biota, and wildlife are proportional to macrophyte abundance and composition is scientifically untenable.
88	3	4	The selection of an "unimpaired" control area is directly opposed to the specification of the federal NRDA regulations



Source: RI/FS data

Figure 15. Comparison of mean taxa richness with mean oncolite volume for water depths of 1.5 m (above) and 4.5 m (below) in Onondaga Lake.

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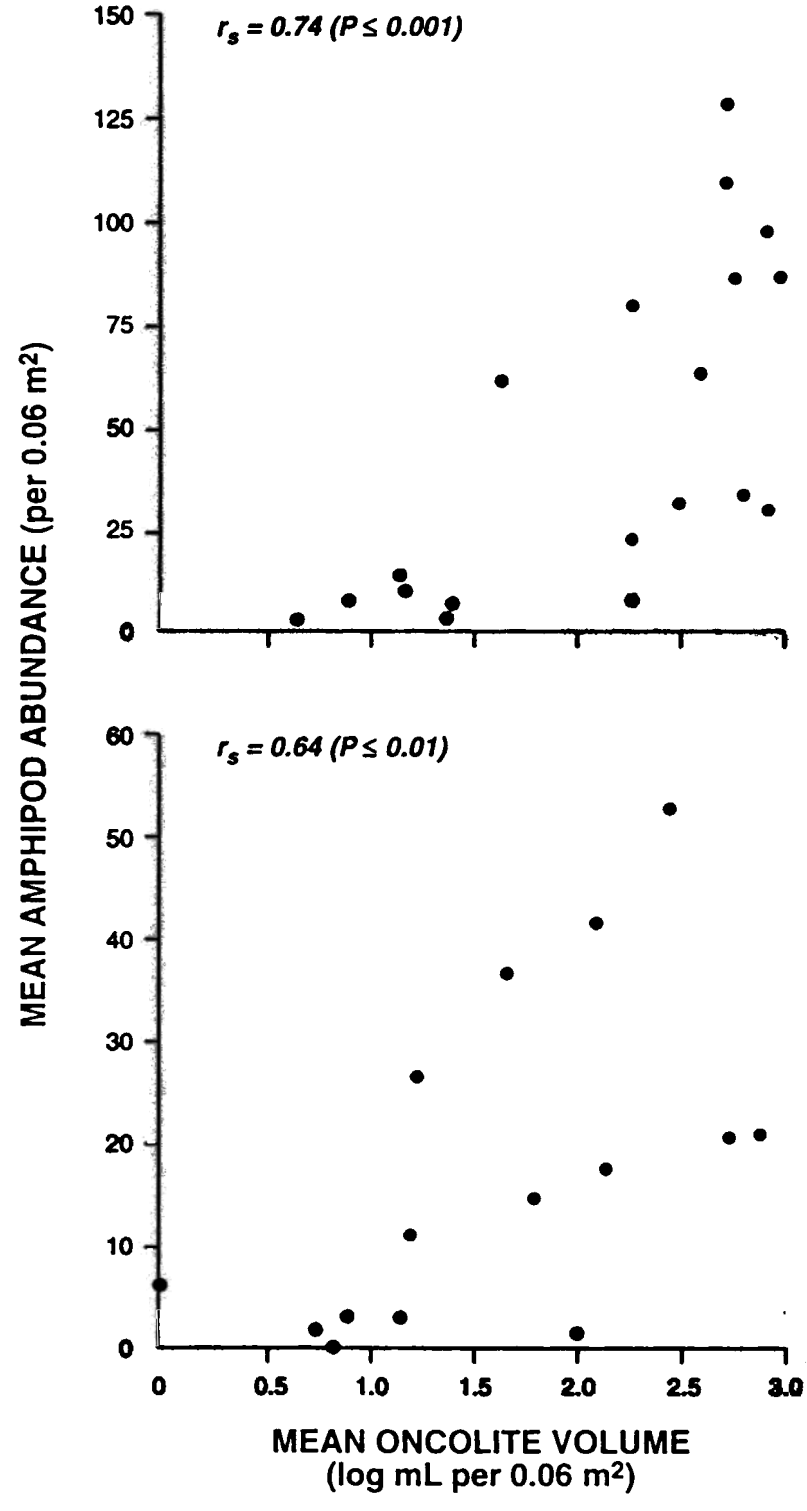

Source: RI/FS data

Figure 16. Comparison of mean amphipod abundance with mean oncolite volume for water depths of 1.5 m (above) and 4.5 m (below) in Onondaga Lake.

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			that the "results of human activities" must be accounted for in the selection of baseline conditions.
90	3	9	Because the East and West Flumes are man-made ditches with minimal flows, it is inappropriate to use natural streams with higher flows to represent baseline conditions. Also, the East and West flumes receive runoff from upstream, non-AlliedSignal sources. The suggestion that upstream Geddes Brook and upstream NineMile Creek are appropriate reference areas for the West Flume and East Flume has no scientific merit.
91	1	10	The decision to disregard upgradient reference wells in determining baseline for organic compounds in groundwater is inconsistent with the DOI regulations.
91	4	3	Salt springs were and are located in other, non-AlliedSignal areas around the Lake.
93	3	1	The MEI approach is not suited for use in Onondaga Lake. According to Ryder (1982), use of the MEI is questionable for lakes subjected to high levels of nutrient enrichment because the effects of nutrients may initially be positive but eventually become negative as nutrient levels become high enough to adversely affect fish assemblages.
93	4	3	It is correct to include "fertility" as a necessary condition for any reference lake, which must also be a hypereutrophic lake.
94	1	2	Salmonids would not be expected to be present in a hypereu-

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			trophic lake such as Onondaga Lake (see Comment 29-5-4).
95	2	1	The Finger Lakes are not hypereutrophic, which will make them inappropriate for use as reference lakes.
97	2	1	The number of submersed macrophyte species in Onondaga Lake (currently 6) is comparable to the total of 5 species found in hypereutrophic Cross Lake and the mean value of 4.4 species found for 163 eutrophic lakes throughout the world (Madsen *et al.* 1996). Most of the New York lakes with greater numbers of species are oligotrophic or mesotrophic, rather than eutrophic or hypereutrophic.
	2	7	To restore the sport fishery, PCB concentrations in fishes must also be reduced to acceptable levels. Otherwise, the fishery will remain restricted even if mercury levels are reduced to acceptable levels (see Comment 21-1-8).
101	3	10	Naturally occurring thermal stratification (in conjunction with eutrophication) has led to the anoxia problems in Onondaga Lake and represents baseline conditions. Therefore, the presence of ionic stratification is irrelevant.
	3	10	It is correct that the anoxia problems result from the combined effects of stratification and nutrient enrichment. Therefore, if nutrient enrichment had not occurred, the anoxia problems would not have occurred, regardless of the presence of stratification (either thermal or ionic).

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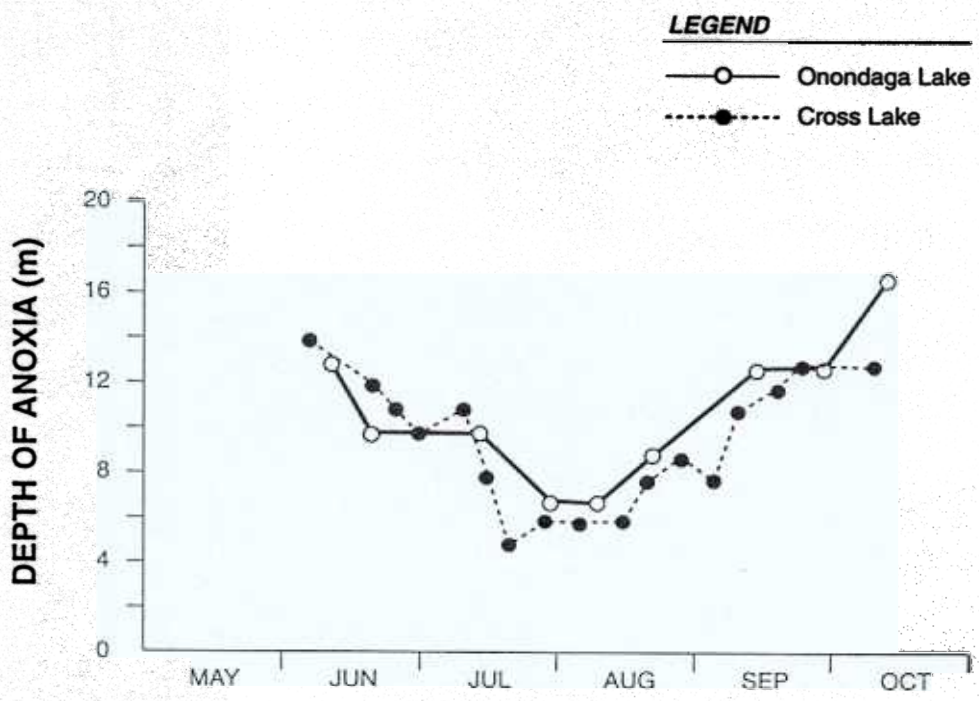
101	3	22	The elimination of ionic stratification will have no effect on restoring the coldwater habitat because naturally occurring thermal stratification will remain and, combined with continued nutrient enrichment, will cause the anoxia problems to persist, as they do in nearby hypereutrophic Cross Lake (Effler *et al.* 1989b), which is not affected by ionic stratification. Figure 17 depicts the similarities in the depths of anoxia found in Onondaga and Cross lakes in 1988.
101	4	2	The anoxia does not result from ionic discharges. It results from thermal stratification combined with nutrient enrichment. Deepwater benthic macroinvertebrates are rarely abundant in lakes. To the extent that their presence has been reduced in Onondaga Lake, it is attributable to the causes noted above.
	1	8	The importance of deepwater habitat to young fishes, zooplankton, and macroinvertebrates is grossly overstated. The impacts of any purported shifts to salt-tolerant species are likely minimal relative to the massive impacts of nutrient enrichment and their well-documented effects on all kinds of aquatic biota (see Comment 83-2-9).
	1	10	The phytoplankton and zooplankton assemblages in Onondaga Lake have been grossly altered by eutrophication and invasions by nonnative planktivores (after construction of the Erie Canal System). Any alterations resulting from salinity are likely minimal by comparison.
	2	2	It is likely that Onondaga Lake has always been supersaturated



Note: The depth of anoxia is defined as the depth at which the concentration of dissolved oxygen is less than 0.5 mg/L.

Source:
Onondaga Lake – Onondaga County (1990)
Cross Lake – Effler et al. (1989b)

Figure 17. Comparison of the depths of anoxia in Onondaga and Cross lakes in 1988.

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			with calcium, given the high calcium content of soils in its drainage basin (see Comment 68-3-5).
	2	5	There is no evidence to support the assertion that calcite precipitation caused a precipitous decline in macrophyte abundances in Onondaga Lake. The decline was likely due primarily to eutrophication and lake drawdown (see Comment 30-1-5). The assertion should therefore be deleted, unless supporting data are made available.
	2	7	There is no evidence to support the assertion that oncolites have exacerbated the decline in macrophyte abundances in Onondaga Lake by providing poor substrate (see Comment 83-1-3). The assertion should therefore be deleted, unless supporting data are made available.
	3	7	Contamination does not necessarily imply that injury has occurred. As specified by NYSDEC (1993), site-specific factors must be accounted for to determine the actual level of risk posed by any contamination.
	4	3	Reductions in wetlands around Onondaga Lake occurred when the lake level was lowered by 2 ft during construction of the Erie Canal System and when wetlands were drained or filled for mosquito control (Effler and Harnett 1996). In addition, the disposal of Solvay wastes was permitted.

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103	1	10	The statement that it is "anticipated" that injuries to wildlife will be documented is biased and inappropriate. This kind of prediction prior to data collection casts doubt on the objectivity and credibility of any future studies. Assessment of bird populations is, for all practical purposes, technically impossible.
	2		The implication that dredging may be required for the entire lake is inappropriate and fosters the misconception that dredging may be needed. The RI/FS data document conclusively that sediments do not pose a substantial risk to aquatic biota throughout most, if not all, of the Lake. A sediment capping scenario involving the establishment of a seven-foot thick cap in water that is less that 15 feet in depth is also unreasonable in that it could lead to a significant reduction in both benthic and water column habitat.
		9	The statement that oncolites are unsuitable substrate for periphyton is incorrect. In fact, oncolites are formed by periphytic blue-green algae that colonize the surfaces of the oncolites (Roddy 1915; Jones and Wilkinson 1978; Dean and Eggleston 1984; Dahanayake et al., 1985; Pentecost 1989).
	2	4	The RI/FS data document that areas of shallow, aquatic vegetation were already established in many parts of Onondaga Lake in 1992 and that those areas had expanded substantially by 1995 (Figure 6, above).

Page	Para.	Line	Comment
108	4		This discussion of habitat enhancement for the Lake is irrelevant until the eutrophic state of the Lake is improved such that dissolved oxygen concentrations in the hypolimnion do not decline to stressful levels during the period of thermal stratification.
	4	2	It is questionable whether increased public access will substantially increase the size of the recreational fishery in Onondaga Lake.
	2		The consideration of oncolites is unnecessary because the primary factor excluding macrophytes from many of the shallow areas of Onondaga Lake is wave disturbance (see Comment 30-1-5).
	4	3	It is correct to consider enhancing macrophytes primarily by protecting and stabilizing sediments because wave disturbance is probably the primary factor excluding macrophytes from many of the shallow areas of Onondaga Lake. For example, Madsen *et al.* (1995) conducted a survey of the distribution of macrophytes throughout the nearshore zone of Onondaga Lake in 1992 and reached the following conclusion: "Transects without aquatic macrophytes were largely restricted to those areas with the greatest fetch, or exposure." Madsen *et al.* (1995) also observed the following: "Sites which had significant plant growth typically were protected from wind-generated waves, which may have allowed plants to colonize undisturbed." However, wave disturbance is not related to AlliedSignal

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			operations.
	3	2	It is correct to recognize that natural recovery is occurring in Onondaga Lake and will continue to occur in the future.
	3	7	It is correct to recognize that organic substances will weather, biodegrade, and become buried with cleaner sediments as part of natural recovery.
	3	9	It is correct to recognize that mercury will become buried with cleaner sediments as part of natural recovery.
	3	14	Dissolved oxygen depletion in Onondaga Lake is the combined effect of thermal stratification and eutrophication and has little or nothing to do with ionic stratification.
	1	3	The RI/FS data show that sediments are primarily a net removal mechanism for mercury and that the diffusive flux of mercury from the sediments is relatively minor. The relationship between mercury in sediments and bioaccumulation in fishes is therefore minimal.
Appendix B			
3	2	6	The value for benzene should be based on an organic-carbon-normalized value to accommodate station-specific organic carbon contents. The use of an average organic carbon value of 2 percent for all of Onondaga Lake is inappropriate because the RI/FS data show that the organic carbon content of surface

Page	Para.	Line	Comment
			sediments at 56 (49 percent) of the 114 stations sampled exceeded 2 percent.
3	4	2	BTEX compounds in surface sediments were actually evaluated at 114 stations during the RI/FS, not 42 or 96 as stated in the Draft Plan.
15	2	4	The presence of chlorinated benzenes in sediments from most tributaries documents that there are sources of these compounds other than AlliedSignal.
26	1	5	It is correct that PAH compounds are ubiquitous throughout the Lake and its tributaries and that there are numerous sources other than AlliedSignal. However, the only major PAH compound attributable to AlliedSignal is naphthalene.
29	2	1	The NOAA guidance values are not appropriate for use as "ARARs" (see Comment 27-2-6 for the main text).
34	3	5	The designation of samples as "toxic" if mortality values exceeded 10 percent is inappropriate because the maximum acceptable control survival for the amphipod and chironomid tests are 20 and 30 percent, respectively (U.S. EPA 1994). In addition, a valid designation of toxicity requires statistical comparison with reference conditions (U.S. EPA 1994).
34	3	7	The designation of samples as "clearly toxic" if mortality values exceeded 20 percent is inappropriate. (see Comment 34-3-5).
34	4	6	The assertion that "correlations" demonstrate injury is incorrect because correlation does not equal causation (Sokal and Rohlf

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			1981). Correlation would simply indicate a positive association between a chemical and a biological effect. A second chemical or other factor that is also correlated with the first chemical and the biological effect may be the actual cause of the effect.
40	4	7	Use of the Lowest Effect Level as the ARAR for mercury is inappropriate (see Comment 27-2-6 for the main text).
41	4		The fact that "background" mercury concentrations exceeded the "ARARs" by more than a factor of 3 confirms the inappropriateness of the proposed "ARAR" for identifying injury.
43	4	9	It is correct that the burial of the highest concentrations of mercury in Onondaga Lake has reduced recycling to the water col- This process is part of the natural recovery that has been occurring throughout the Lake for decades.
48		5	The alternative "ARAR" of 0.1 mg/kg for mercury in fish tissue is inappropriate and should not be used to determine injury.
52	3	5	See Comment 34-4-6 for this appendix
55	3	6	It is correct that AlliedSignal currently is not a major source of lead.
56	3	6	The fact that the ARAR for lead is exceeded in numerous tributaries of Onondaga Lake documents the numerous sources of this metal other than AlliedSignal.
56	4	7	Use of the Lowest Effect Level as the "ARAR" for lead is inappropriate (see Comment 27-2-6 for the main text).

Page	Para.	Line	Comment
59	4	5	See Comment 34-4-6.
62	2	2	It is correct that the federal NRDA regulations do not apply to ionic wastes.
67	3	5	The effects of the increased duration of anoxia were minimal because the 5 months of anoxia attributable to thermal stratification were more than sufficient to exclude biota from the hypolimnion of Onondaga Lake.
7		15	Zooplankton in Onondaga Lake were most likely limited by intense predation by planktivorous fishes, especially the alewife. According to Siegfried et al. (1996): "[t]he pattern of zooplankton community composition changes documented for Onondaga Lake since the late 1960s appears to be related, at least in part, to changes in the abundance of alewife." The authors also noted that alewife are presently virtually absent from the Lake and the planktivorous fish that remain are unlikely to impact the zooplankton community in the same manner as the alewife. They concluded that "[t]he reappearance of daphnids in Onondaga Lake appears to have been facilitated, in part, by the absence of effective planktivorous fish."
71	2	13	Calcium carbonate is typically the single largest component of sediments in marl lakes (Wetzel 1983).
75	2	3	The suggestion that increases in zooplankton diversity are due to reductions in ionic waste discharges is misleading because according to Siegfried *et al.* (1996): "[m]uch of this increase is

Page	Para.	Line	Comment
			attributable simply to the increased collection effort. Most of the additions to the species assemblages represent detection of a rare species." Therefore most of the "apparent" increase in the number of species in the Lake is simply a sampling artifact.
75	2	4	The statement regarding increases in fish diversity is misleading for the same reason described in Comment 75-2-3. According to Ringler *et al.* (1996): "enhanced sampling effort during recent years, coupled with a lack of quantification in historical collections, makes a comparative analysis difficult." Actually, those problems are so severe that they make a comparative analysis useless.
75	2	10	See Comment 71-1-15.
76	3	10	Dean and Eggleston (1984) provide no evidence that oncolite formation in Onondaga Lake was related to AlliedSignal discharges.
76	3	16	The number of stations (4) sampled by Wagner et al. (1996) is so small that no valid conclusions can be made regarding the state of benthic macroinvertebrate assemblages throughout the Lake. Results from the 66 stations sampled during the RI/FS indicate that the littoral zone throughout most of Onondaga Lake supports abundant and diverse benthic assemblages (PTI 1993). By contrast, the deeper parts of the Lake support little benthic life due largely to the adverse effects of eutrophication coupled with thermal stratification.
78	1	3	See Comment 83-2-10 for the main text.

Page	Para.	Line	Comment
78	2	5	The ammonia loading from Ninemile Creek is insignificant compared to the massive amount (91 percent of total loading) released by Metro.
78	3	5	The assertion that ammonia may have contributed to toxicity is speculation and should be deleted, unless supporting information is made available.
Appendix C			
	2	7	It is incorrect to assume that a simple elevation above a baseline condition is indicative of injury. The key question is whether the elevation is great enough to have caused injury.
2	1	6	It is inappropriate to compare future biological data from reference areas to data collected in 1992 in Onondaga Lake if the time interval between the two data sets is large.
2	3	1	It is correct that alterations of natural communities around Onondaga Lake occurred prior to the initiation of AlliedSignal activities.
3	3	1	The assertion that wetlands have been injured by contact with groundwater and surface water containing injurious levels of ionic wastes should be deleted, unless supporting data are made available. As stated in the following paragraph: "injury to wetlands in and around Onondaga Lake from ionic wastes has not been well documented."

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6	3	1	Historical maps created in the early 1800's can also be used to quantify the amount of wetlands and nearshore areas destroyed when the level of Onondaga Lake was lowered by 2 feet during construction of the Erie Canal System.
9	1	3	Updated mapping of macrophyte beds in 1995 indicate substantial increases in macrophyte abundances, as well as colonization by an additional species (*Elodea canadensis*).
9	1	4	Floating-leaved and emergent species would not be expected to be major macrophyte species in Onondaga Lake, given the degree of exposure of most of the shoreline and the lack of protected bays
9	1	6	The "belief" that the loss of charophytes was related to the opening of AlliedSignal facilities is incorrect. Chara exhibits a well-documented negative association with phosphorus concentrations, indicating that charophyte populations most likely declined in response to increasing eutrophication of Onondaga Lake.
9	1	8	Although 16 species may have historically inhabited Onondaga Lake, the negative effects of increasing eutrophication likely excluded most of those species. The number of macrophyte species in Onondaga Lake (currently 6) is comparable to the number found in hypereutrophic Cross Lake (5) and the number found in 163 eutrophic lakes throughout the world (mean = 4.4).

Page	Para.	Line	Comment
9	1	10	Plant leaves and stems are typically covered by carbonate particles in marl lakes.
9	1	17	The "fertile reference sediments" used by Madsen et al. (1993) were inappropriate as reference sediments. They were collected from a lake in Texas, they had an organic content greater than the values typically found in Onondaga Lake, and they had a calcium content considerably lower than the values typically found in Onondaga Lake.
9	2	4	An additional major factor that must be accounted for is reduced water clarity because this factor has severely limited the maximum depth of macrophyte colonization in Onondaga Lake as a result of the hypereutrophic state of the Lake.
14	2	3	It is not clear why sediment characterization will ignore surface sediments (0-2 cm) and focus on subsurface sediments and 30-cm core intervals.
16	1	1	DEC's conclusion is inconsistent with the federal NRDA regulations, which specify that the "results of human activities" must be accounted for in the selection of baseline conditions.
16	1	6	The statement that the reference lake should not have an exposure pathway from other sources is inconsistent with the federal NRDA regulations (see Comment 16-1-1 for this appendix).
17	4	1	Bioaccumulation analyses of zooplankton should be conducted on discrete taxa that are commonly preyed on by fishes (*e.g.*, cladocerans). Results based on total net catches are difficult to

Page	Para.	Line	Comment
			interpret
18	2	3	Sample depths should correspond to those sampled during the RI/FS.
19	1	3	To be consistent with the RI/FS, adult fishes should be sampled using trap nets and gill nets, rather than by electroshocking.
19	2	4	The statement that the target species for bioaccumulation studies are presently not known is inconsistent with the statement in Section 2.2.4 of the Draft Plan that the target species are white perch, gizzard shad, bluegill, and smallmouth bass.

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