Chickawaukie Lake Restoration Project

Final Report

EPA Section 314 Grant # S001225-01-0

Maine Dept. of Environmental Protection

November 20, 1994

Chickawaukie Lake Restoration

This represents the final progress report to EPA for the Chickawaukie Lake project which was begun in September of 1990. In addition to material summarized here, several prior reports contain detailed accounts of various project activities (Jan. 1, 1992, March 31, 1993, November 1, 1993, as well as the original Diagnostic-Feasibility Study of Feb. 1, 1990). A summary of water quality data and non-point source abatement projects is also included. In 1994, the Chickawaukie Lake Project has concentrated on addressing all identified non-point source sites feasible. We have also monitored the lake from mid-May to late September for basic water quality parameters.

1994 Water Quality Summary

Stratification was quite well established by late June at 6-7 meters and persisted until mid-August, a period of about 60 days, although the thermocline had been depressed to 8 meters by late July (Figure 1). The metalimnion-hypolimnion generally covered about 50-60% of the bottom sediment area and about 20% of the total lake volume. High sediment oxygen demand was manifested, as anoxic water (DO generally < 1 ppm) covered 26% (July 14) to 39 % (July 27) of the sediment area. This declined markedly as thermocline erosion progressed after late July. Total anoxic sediment contact time was 24.4 Km^2-days which produced a rather high anoxic factor of 16.5 (lake surface area/total anoxic sediment area contact time). This is in contrast to the somewhat more severe anoxia in 1993 (Anoxic factor=23) and the relative lack of anoxic conditions in 1991-92.

Average epilimnetic phosphorus in May was 10 ppm, and peaked in late June at 15.5 ppb (Figure 2). Epilimnetic and whole-lake Total P dropped off to about 10 ppb in July and rebounded to 13-14 by mid-August. Sedimentation of particulate P may have been significant between June 22 and July 14, as TP mass declined from 150.5 kg to 95.6 kg. However, during the period immediately following this, the mass increased to 131 kg (Sept. 7). Peak hypolimnetic concentrations were 23 ppb in August but mixing thereafter distributed phosphorus throughout the water column.

Secchi transparency averaged 3.7 m during the open water season, with minimum values of 3 m in May and 2.3 m in early September (Figure 3). Chlorophyll-a tracked transparency closely. The increase in phosphorus values in late summer

stimulated substantial algal growth, although significant surface accumulations of algal material did not occur.

Overall Water Quality

Table 1

Chickawaukie Lake 1987-94

Water Quality Data

Year	Transparency (m)			Chl-a (ppb)			Total P (ppb)		
	Min.	Mean	Max.	Min.	Mean	Max.	Min.	Mean	Max.
1987	1.2	3.0	4.5	4.6	10.2	24.7	12.0	19.0	25.8
1988	1.2	3.0	5.5	4.0	9.8	19.0	14.9	17.5	23.2
1989	1.2	2.4	4.3	3.2	5.5	143.0	14.0	19.4	28.0
1990	1.7	2.9	3.7	N/A			22.1	29.0	40.8
1991	1.0	2.6	4.9	5.9	19.6	45.4	19.6	22.5	26.3
1992	3.9	6.2	9.4	0.7	3.4	5.5	5.1	10.0	18.1
1993	3.5	4.5	6	1.8	5.8	7.9	8.0	10.7	15.0
1994	2.3	3.7	4.6	4.5	5.8	9.3	10	12.4	16.0

General water quality data for 1987-94 are summarized in Table 1. The overall peak phosphorus concentrations have been held to as little as 40-50% levels experienced before the aluminum treatment in 1992. Total phosphorus levels in 1994 are somewhat higher than expected. With a 37% increase (36 kg TP) in the whole lake phosphorus content between July 14 and Sept. 7, there is an indication that significant internal recycling may be re-developing. 1993, by contrast, had more anoxic conditions but smaller apparent internal recycling. As was suggested in other reports on the China Lake and Threemile Projects (EPA Reports, March 1, 1994 and Jan. 30, 1993 respectively), it seems that lakes with significant circulation, ephemeral stratification and high oxygen demand in their sediments may be prone to recycling of phosphorus even though standard monitoring does not reveal substantial anoxia. The observed lack of clear correlation between calculated net P internal load and anoxia (Km^2-days of sediments < 1 ppm DO) suggests sediments may release substantial P when only marginally anoxic conditions exist in the water column. This is an area of research which has not been sufficiently pursued and the uncertainty surrounding this was one of the reasons for

Maine canceling the proposed China Lake aluminum treatment in 1993.

Secchi transparency has been substantially improved over the 1-1.7 m minima seen pre-treatment. We have some concern over the early season (3m) and late season (2.3) minima in 1994. Higher than expected chlorophyll-a levels also suggest that an increase in productivity is occurring. We are hopeful that, while these transparency minima are below what we had hoped to achieve (>3-4 m), continued decline in transparency and increase in algal production will not occur. It is certainly too soon after treatment to establish if the lake has attained a new equilibrium or whether a general trend is occurring.

Aluminum Treatment

In June of 1992, 248 acres (100.4 ha) of sediment surface below 12-15 feet were treated with aluminum. The dosage of 29.8 g Al/m^2 was applied by subsurface injection of aluminum sulfate and sodium aluminate. This dosage was about 20-28% higher than previous treatments of Threemile Pond and Cochnewagon Lake in Maine. The aluminum treatment produced relatively little adjustment in lake aluminum levels, pH, or alkalinity with the exception of transient events during application due to equipment malfunction. During some of these episodic events, fish mortality was evident and careful monitoring of the application control rates was needed to minimize this. Full details of the preparations and treatment process are incorporated in the progress reports of Jan. 1, 1992 and March 31, 1993.

Mesotrophic productivity levels were attained within several months without apparent fishery disruption. Samples analyzed for dissolved (0.1 micron) aluminum were low, with core samples at 7 ppb (5/24) and 4 ppb (7/6). This indicates that the predicted insolubility of aluminum in this treatment has been borne out as it has in the previous aluminum applications to Maine lakes

Watershed Projects: NPS Abatement

Most efforts in the Chickawaukie Lake project focused on NPS remediation of previously identified priority sources. In addition to those reported earlier, several projects were completed in 1994. These usually employed cost-share, with federal funds generally supporting 50% or less of the cost and landowners (or the Town and State in two projects) absorbing the remainder. Some of these projects have been done with the cooperation of engineers from our Non-point Source Program. A synopsis of the major projects is given below and locations are noted on Figure 4:

Barter Road: The Barter Road project included reditching, reculverting, and paving over 2100 feet of road which is steep in sections and which exhibited substantial erosion problems and unsafe conditions. In 1993, final grading, ditching and pavement was completed on the 1800 foot upper road which had been one of the highest priority sources. The remainder was finished in 1994. Landowner and Lake Association funds augmented the federal share to complete this permanent reduction in a chronic source of sediment and phosphorus to the lake. This project could not have been done without a remarkable amount of work by one of the residents, who had to overcome substantial difficulties in getting numerous road abutters to agree to changes and to fund the improvements. He succeeded in getting a road association formed which should make future maintenance possible. At the request of the residents, the City of Rockland has taken over the upper 1800 feet of road as a municipal way, which will go even further toward ensuring long term maintenance of the road.

Barter Road ("Spur"): The Rockport branch of the Barter road was historically a very significant problem. Steep in sections and draining almost directly into the lake, this gravel road was not being adequately maintained by the owners. Because of the lack of a road organization and the multiple parties involved, it was not feasible to accomplish the substantial reconstruction on the 1120 feet of high priority roadway in 1993 as proposed.

This year, 920 feet of the road was permanently closed, with the surface shaped, planted to grass, and drainage-relief swales (cross-drains) placed at approximately 75 foot intervals. Boulders were placed at either end to discourage vehicular traffic. The properties involved are now accessed via a short section (about 150 feet) of new gravel road which comes of a paved subdivision road (Rockport Meadows) recently taken over by the Town of Rockport. The connector section has a low gradient, a new stream crossing culvert, and sufficient width to pass emergency vehicles. As such, it will not only be more easily and cheaply maintained, but the residents will be able to access properties more safely. An overall reduction in road length and use of the paved subdivision road for most of the access will substantially reduce the NPS contribution of the Spur Road. This project required substantial legal arrangements for closing of the old road (extinguishing easements) and establishing permanent rights of way over the new road.

Randall Road: In 1992-93 the section of the Randall Road which parallels the shoreline ("Chickawaukie Road") was substantially upgraded over 1760 feet of it's length. This included better base material, ditching and rip-rap on a critical section, and replacement of several culverts.

The new subdivision road mentioned above has also been tied into the Chickawaukie Road by the addition of 100 feet of connector. This connector has been paved so that the grade will be more easily maintained and easier to travel in winter. Ditching improvements along this short stretch are intended to stabilize the roadway and provide an emergency outlet from the phosphorus control ponds at Rockport Meadows subdivision during low-frequency events. One such event (12 inches of rainfall in 24 hours) apparently caused the ditch to fail, and the Town of Rockport has contacted the owner to re-build this section before winter freezup this year.

Elimination of the Randall Road: The road usually used to access the Chickawaukie Road is still in service, although the owner has plans to discontinue the road and re-vegetate the surface. Since residents can now access their properties via the Rockport Meadows road, this proposal would result in the elimination of about 2000 feet of old, substandard gravel road in the watershed.

New Development The Rockport Meadows Subdivision is the first in the watershed designed to meet the new Phosphorus Control standards adopted by the Town of Rockport. Despite designs to reduce phosphorus export by use of drainage control and phosphorus retention ponds, problems occurred with the construction sequencing which left several substantial erosion sources unstabilized late in 1993. This included roadside erosion and complete failure of two of the berms on the phosphorus control ponds which were constructed very late in 1993. Though some of these deficiencies were repaired in 1994, several conditions of this site remained improperly stabilized until this November. Additional new construction in the subdivision has prompted a review by the Town of compliance with Rockport's requirements under its Land Use Ordinance. Further development on the remainder of the adjacent parcel will likely require review for consistency with the State's standards under the Site Location of Development Statute.

Drainage stabilization: One landowner on the east side of the lake requested help in stabilizing an eroding drainage ditch. This ditch runs down a steep slope and would not support adequate vegetation despite the fact that it rarely flows except during snow melt. About 300 feet was re-shaped and stone lined in 1993. The extreme rainfall event noted above (exceeding a 100 year event) displaced some of the stone lining. Part of this was due to the very large volume of water involved and also because of somewhat undersized stone being applied. However, despite this event, the drainageway (which has a steep pitch over much of its length) remained relatively undamaged.

Old County Road: The Maine DOT agreed to divert all flow in the project area out of the watershed into an old quarry . This will reduce the amount of road runoff reaching Chickawaukie Lake and avoid additional flow to the Lakeview Drive area which has some substandard ditch sections. The restoration project reimbursed DOT for costs associated with the additional culverts and ditching which was not included in their original budget. In addition, in 1994, the Camden-Rockland Water Co. and the City of Rockland both contributed along with DOT and project funds to complete additional drainage improvements. These were made necessary by a re-construction of the Water Company's reservoir facility, and problem drainage which frequently resulted in frozen culverts, increased flow onto Lakeview Terrace and hazardous driving conditions.

Porter Street: In 1993 the Town of Rockport re-built a section of Porter St., a steep paved road in the northeast sector of the watershed. The original Town appropriation for the road was not sufficient to fully stone line a significant section of the steepest ditches. After consultation with the Town Public Works Director, it was decided that about 800 total feet of critical ditching needed riprap. The Town agreed to provide the stone from material already purchased for other projects if the Restoration Project would pay for the additional expenses. Follow-up work on this section was done this year, and additional unstable section of ditch on the lower end of the road was stabilized, primarily at Town expense.

Conclusion

The restoration of Chickawaukie Lake has illustrated our reliance on support from a variety of financial, technical and administrative sources. In addition to the DEP management of this project, it is clear that one of the critical ingredients was support from the City of Rockland and the Town of Rockport. In addition to funding, both municipalities contributed substantial time from their code officers, not just in enforcement of local ordinances which specifically protect the lake, but in landowner contacts and in the development of the phosphorus control guidelines. The municipalities also contributed the efforts of their public works directors on several projects.

The financial administration of project funds by the Town of Rockport has greatly facilitated our non-point source reduction efforts. It has reduced overhead and ensured prompt payment of cost-share which was critical in securing the cooperation of contractors and landowners who otherwise might have been hesitant to deal with State bureaucracy. We

owe thanks Rockport Selectpersons for their support and willingness to allow town staff to participate.

As usual in a project such as this, a lake association played a pivotal role. Though small in numbers, the Chickawaukie Lake Association offered continued support, especially in public relations and meetings, serving on the project steering committee, encouraging the towns to participate, and raising substantial funds to support all phases of the project.

The Camden and Rockland Water Co. staff provided a great many hours and substantial expertise. This began long before this project began. It was their detailed water quality monitoring which made the original series of diagnostic studies possible. Their careful watershed stewardship and participation allowed us to evaluate the watershed for non-point sources, the potential for new development, draft phosphorus control guidelines, and to prioritize our NPS projects for maximum effect. In addition, the company devoted substantial funds to the project. Despite the fact that Chickawaukie is unlikely to be used as an alternate drinking water supply in the near future (due in part to provisions of the Safe Drinking Water Act), protection of this water supply should remain a commitment for the company and the municipalities involved.

This project has illustrated the difficulty in restoring even a small lake and watershed such as Chickawaukie. We have succeeded in lowering the trophic state of the lake to an acceptable mesotrphic condition and reducing many of the high priority non-point sources of phosphorus to the lake. The longevity of these improvements rests in part on the long-term performance of the aluminum treatment. Of more importance, however, is the willingness of Rockland and Rockport to protect this valuable resource.

Figure 1

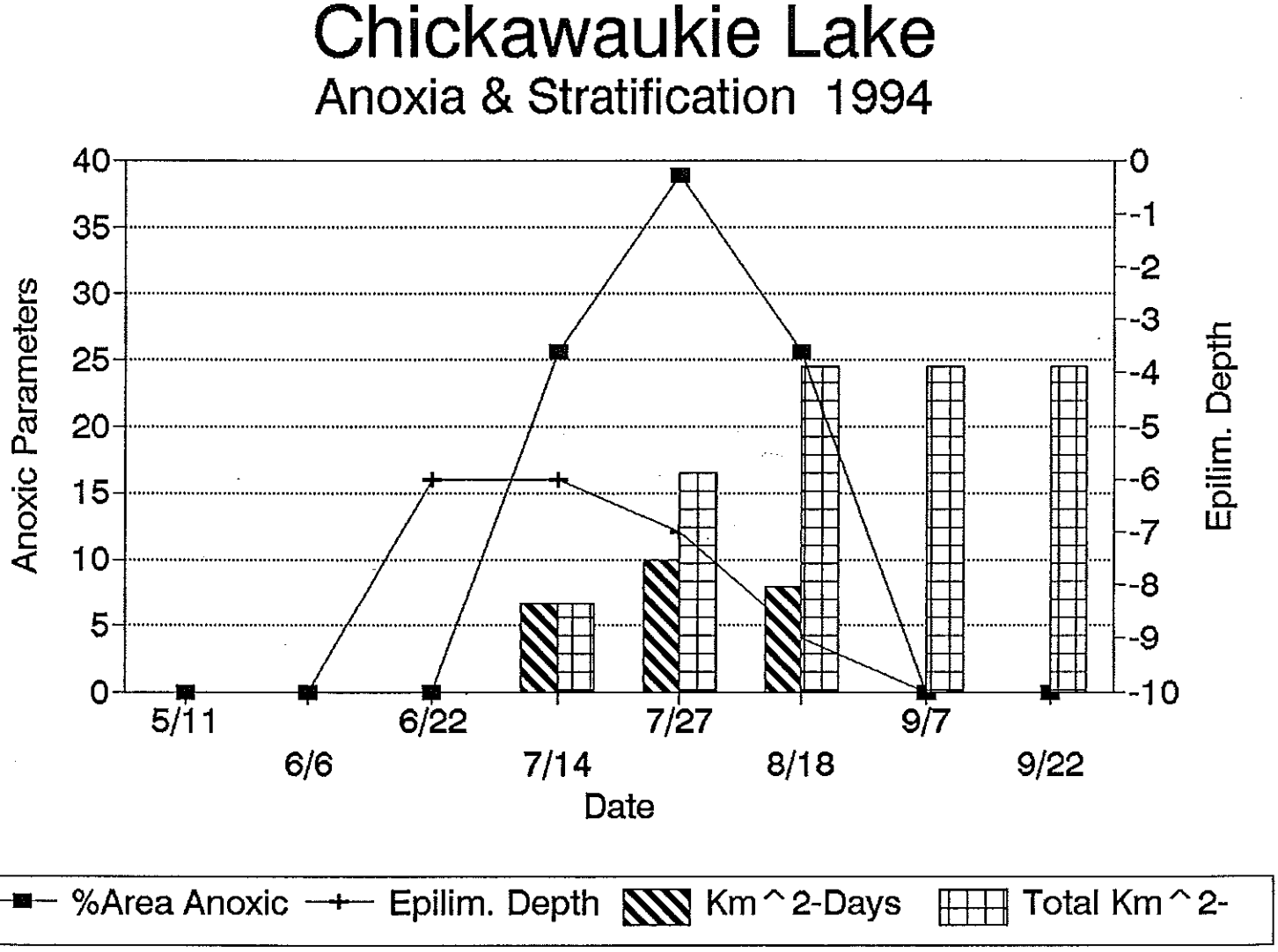

Chickawaukie Lake
Anoxia & Stratification 1994
Anoxic Parameters
Epilim. Depth
40
35
30
25
20
15
10
5
0
0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
5/11
6/6
6/22
7/14
7/27
8/18
9/7
9/22
Date
%Area Anoxic
Epilim. Depth
Km^2-Days
Total Km^2-

Figure 2

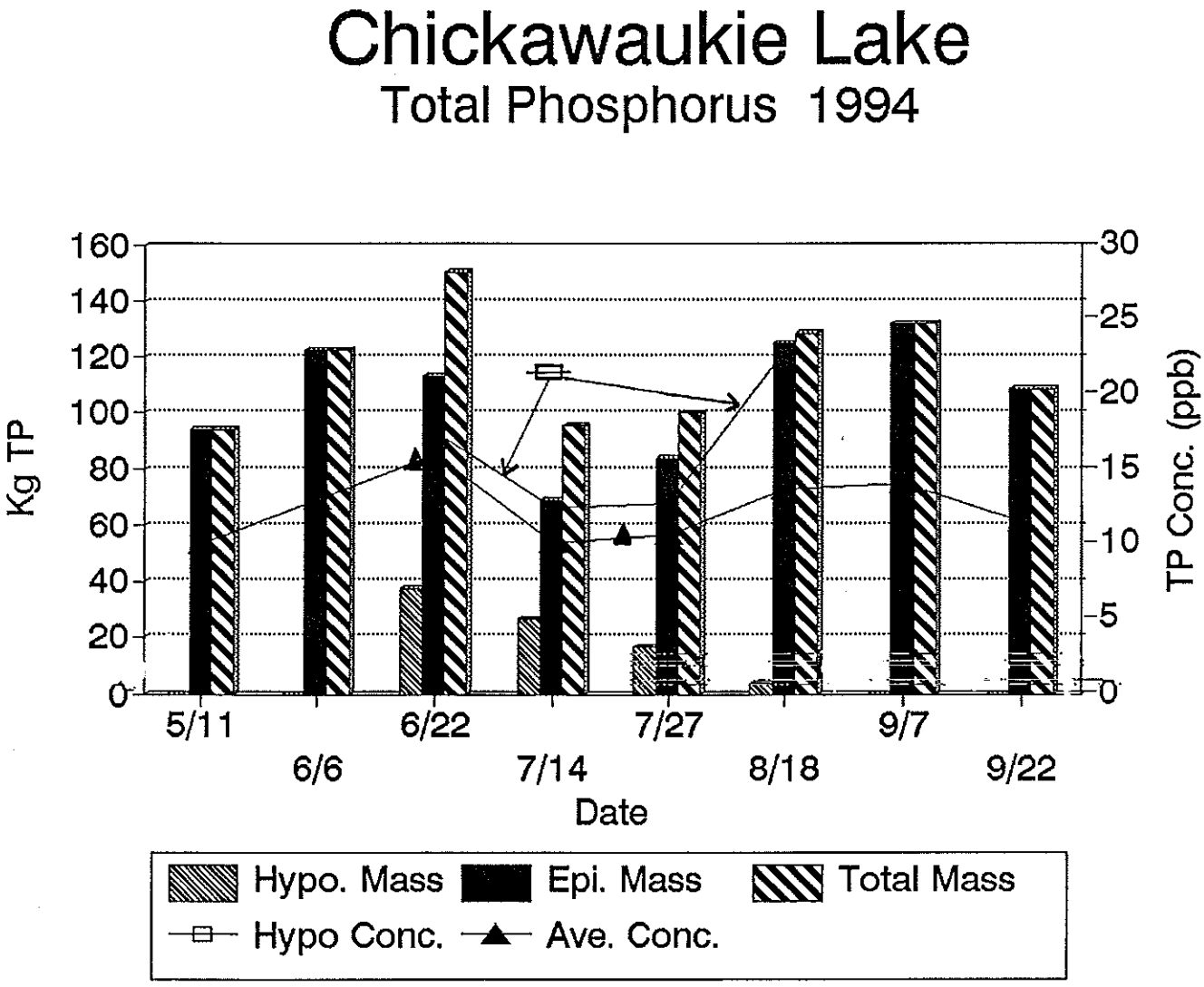

Chickawaukie Lake
Total Phosphorus 1994
Kg TP
TP Conc. (ppb)
160
140
120
100
80
60
40
20
0
30
25
20
15
10
5
0
5/11
6/6
6/22
7/14
7/27
8/18
9/7
9/22
Date
Hypo. Mass
Epi. Mass
Total Mass
Hypo Conc.
Ave. Conc.

Figure 3

Chickawaukie Lake Transparency & Chl-a

1994

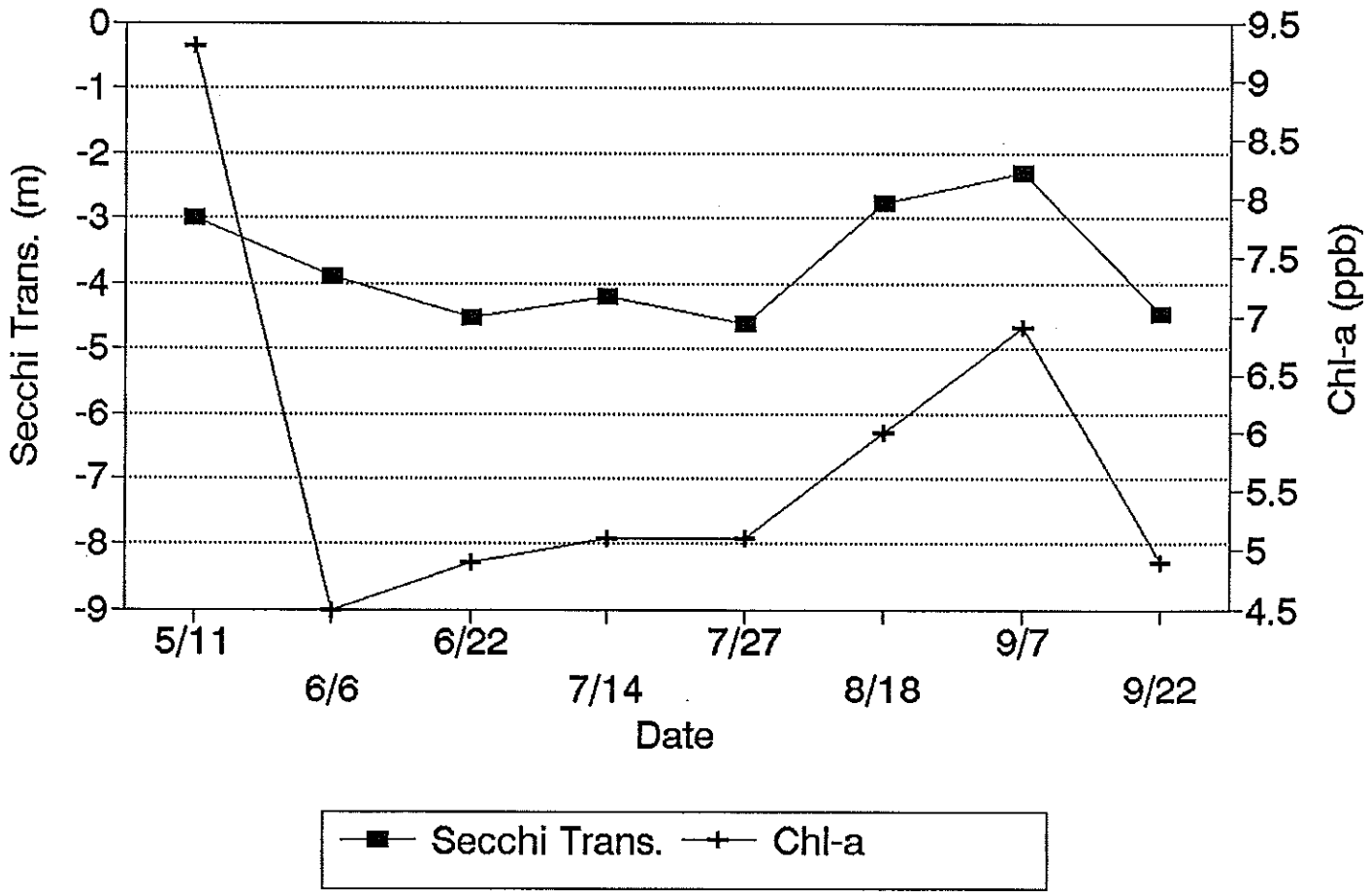
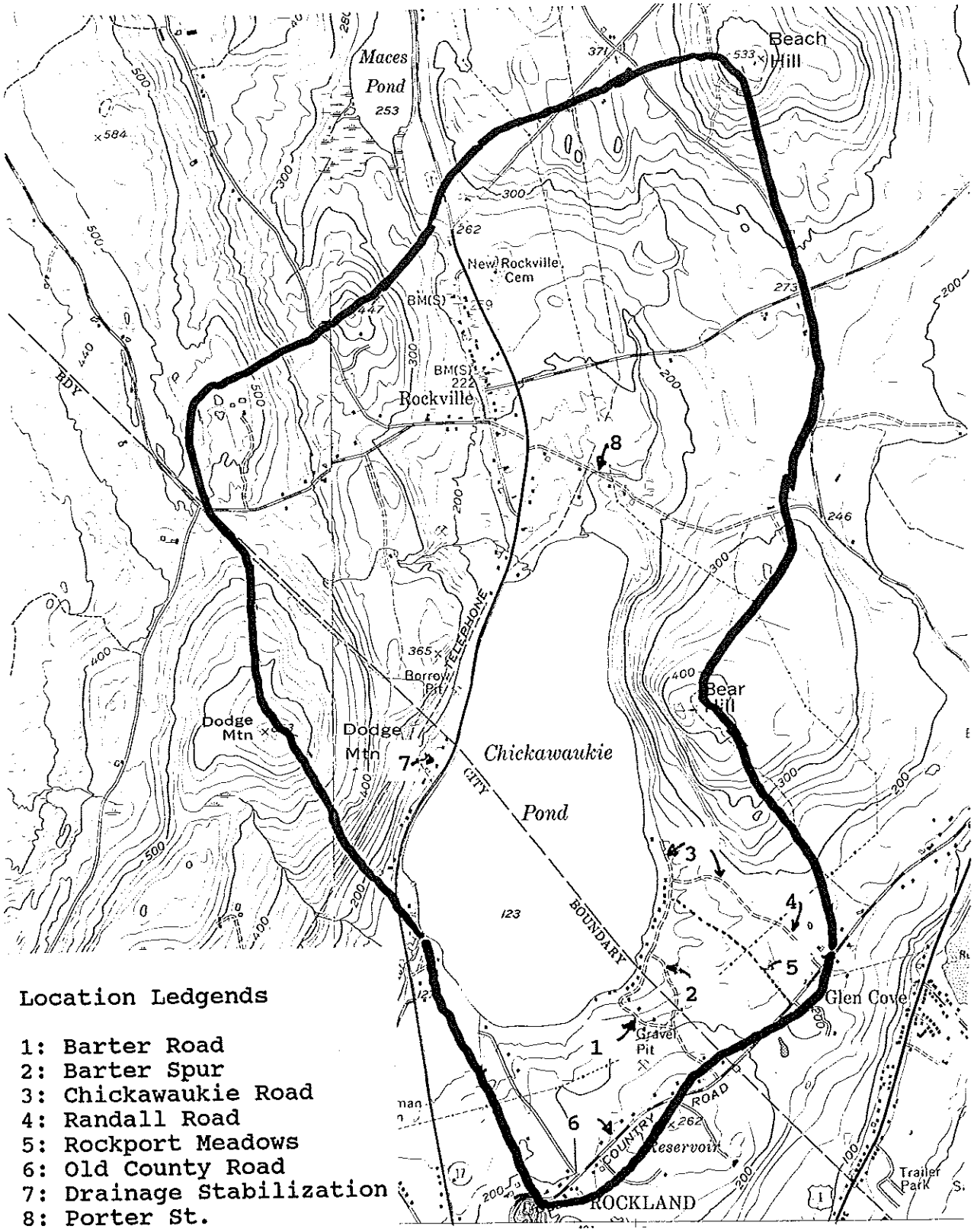


Figure 4

Location of Major NPS Projects



Location Ledgends

1: Barter Road
2: Barter Spur
3: Chickawaukie Road
4: Randall Road
5: Rockport Meadows
6: Old County Road
7: Drainage Stabilization
8: Porter St.

PROGRESS REPORT

Chickawaukie Lake
Restoration Project
(EPA Grant # S001225-01-0)

Maine Department of Environmental Protection
August 1, 1990 to January 1, 1992

Chickawaukie Lake Project
Progress Report

Introduction

This report is intended to detail progess made on this water quality restoration project during the period of May, 1990 to January 1, 1992. During this time, the DEP and local sponsors have concentrated on developing a list of specific sites contributing to the non-point source pollution of Chickawaukie Lake and to preparations for an application of aluminum salts in June 1992.

Water Quality Sampling

During the 1990 open water season, bi-weekly water quality sampling was conducted by staff of the Camden-Rockland Water Co., as has been done in previous years. Arrangements were made with the Chickawaukie Lake Association for a volunteer to conduct water sampling in 1991 at the same frequency. After initial sampling was conducted in May, the volunteer was unable to continue sampling and a gap appears in the data set before DEP staff were able to resume sampling regime on June 30. Data are presented below in summarized form.

Chlorophyll-a & Transparency

Transparency data for 1990-91 are presented in figures 1 and 2. Bloom conditions accurred in both years although algal productivity was substantially more pronounced in 1991 than 1990 and was similar to 1988-89.

The 1991 minimum transparency occurred in July with a slight improvement thereafter. Bloom condtions persisted for two months until early October.

1990 blomm conditions were shorter in duration and intensity than 1991 (minimum 1.7 m, bloom duration approximately 20 days). Inadequate chorophyll data was collected to charaterize that parameter.

Chlorophyll-a reached very high levels (45 & ppb), the highest levels recorded since 1982.

Dissolved Oxygen/Temperature

1990

Initial stratification began before the July 6 sampling and was fairly strong between 5-7 meters. The metalimnion was depressed slightly toward mid-August (6-7 meters) with overturn occuring in mid-September. This resulted in approximately 90 days of quite stable stratification.

Rapid oxygen depletion occurred soon after stratification. The deep waters went from >10 ppm on June 6 to 0.2-0.3 ppm in a few weeks. By late July, all water below 7-8 meters (18% of lake volume) was < 1 ppm.

1991

Stratification began in early July at 5-8 meters and was more pronounced by early August. High winds associated with Hurricane Bob (8/19-20) depressed the metalimnion to 7-9 meters and greatly weakened it. Full turnover accurred early (<9/4) resulting in only 35-45 days of stratification.

Dissolved oxygen depeletion was evident by early July when all water below 8 meters was anoxic. By August 5, all strata below 5 meters (> 55% lake volume) as at or below 0.3 ppm. Partial mixis reduced by the hurricane resulted in hypolimnetic D.O. concentrations > 2.0 ppm.

Total Phosphorus

1990

Early season TP was high, with volume - weighted concentrations for the whole lake approaching 27 ppb. The seasonal peak was reached in mid August (42 ppb) when total P mass reached almost 390 Kg. This is higher than any recent year but was largely due to the very high concentrations in the deepest strata (~190 ppb).

Epilimnetic concentrations were in the 19-23 ppm range however, not unlike previous years. On the basis of whole-lake mass increases, interanl recycling in 1990 is estimated at about 110-140 Kg. P, higher than 1988-89 but comparable to 1986.

1991

Early season TP concentrations were lower than in 1990 but rapidly approached the same levels seen in July of that year(~22-26 ppb). Hypolimnetic concentrations began to increase significantly by early August but the early breakdown in stratification precluded very high levels being attained. Total P stocks persisted at or near 200 Kg. until as least mid October. Wind mixing may have reduced the net settling rate of particulate P and algal production (chl-a) remained high.

Internal recycling for the season is estimated at ~60 Kg., the lowest on record. High algal productivity was apparently maintained by efficient water column recycling even though high P mass accumulations were not achieved.

FIGURE 1

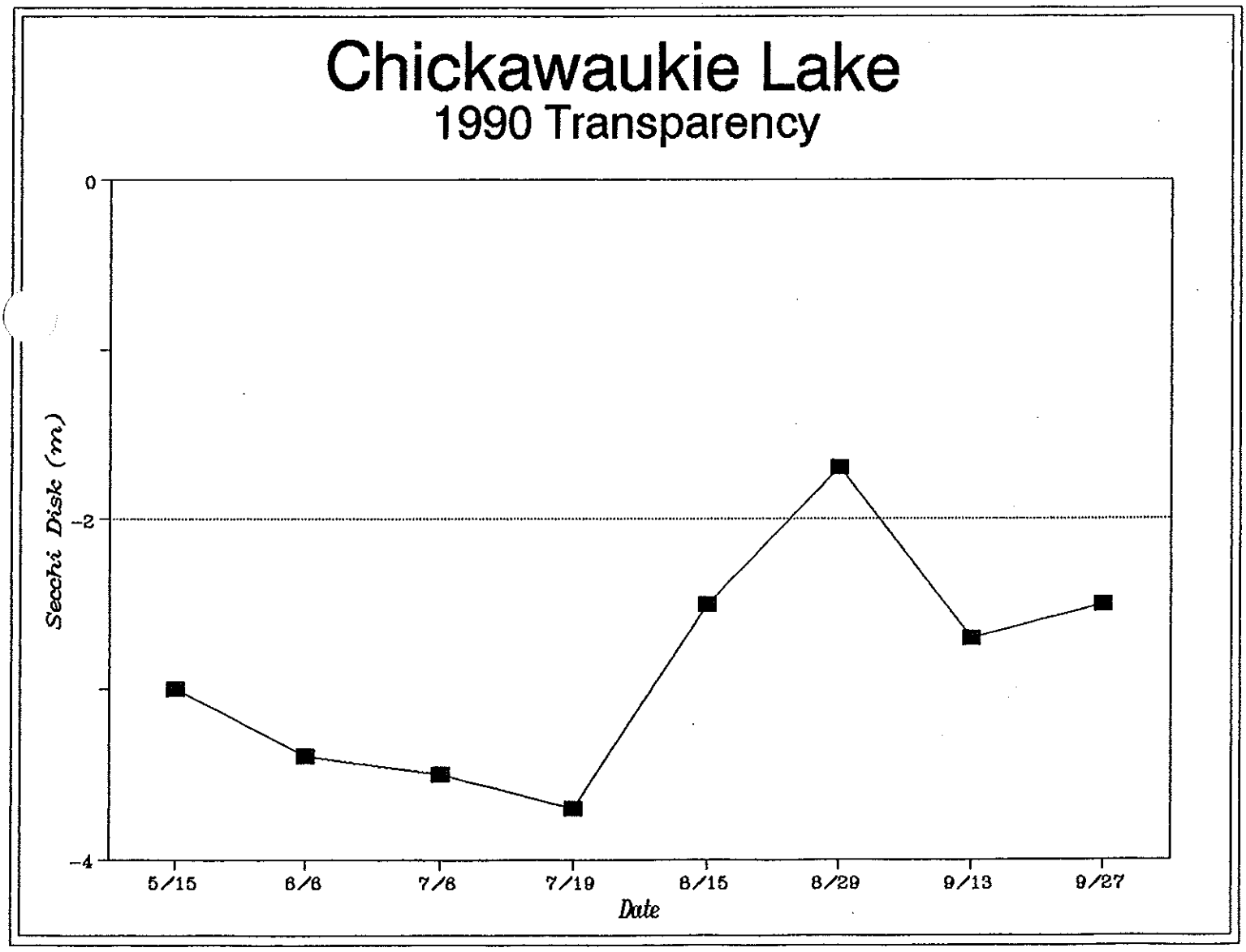

Chickawaukie Lake
1990 Transparency
0
-2
-4
Secchi Disk (m)
5/15
6/6
7/6
7/19
8/15
8/29
9/13
9/27
Date

FIGURE 3

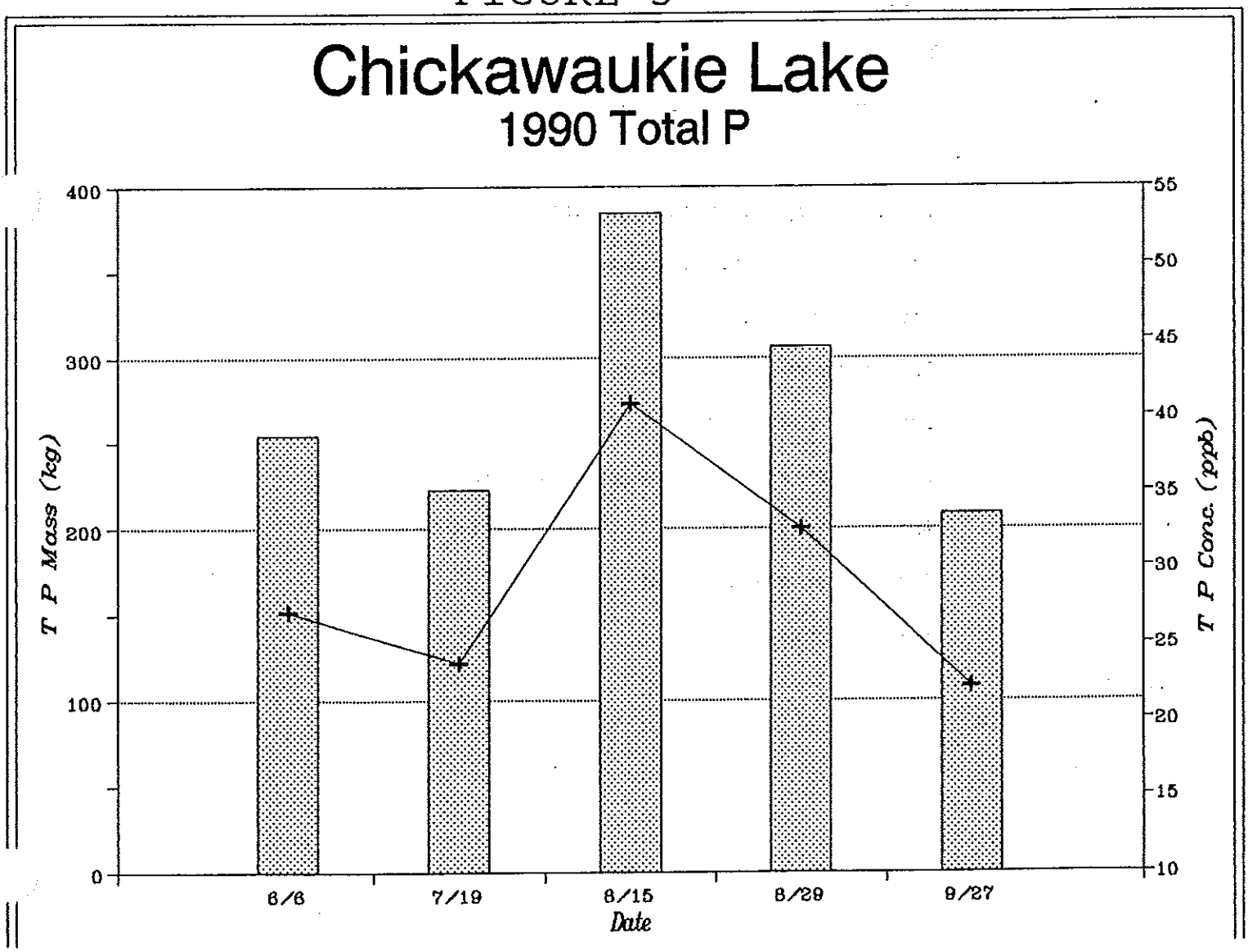

Chickawaukie Lake
1990 Total P
T P Mass (kg)
T P Conc. (ppb)
Date
0
100
200
300
400
10
15
20
25
30
35
40
45
50
55
6/6
7/19
8/15
8/29
9/27

FIGURE 2

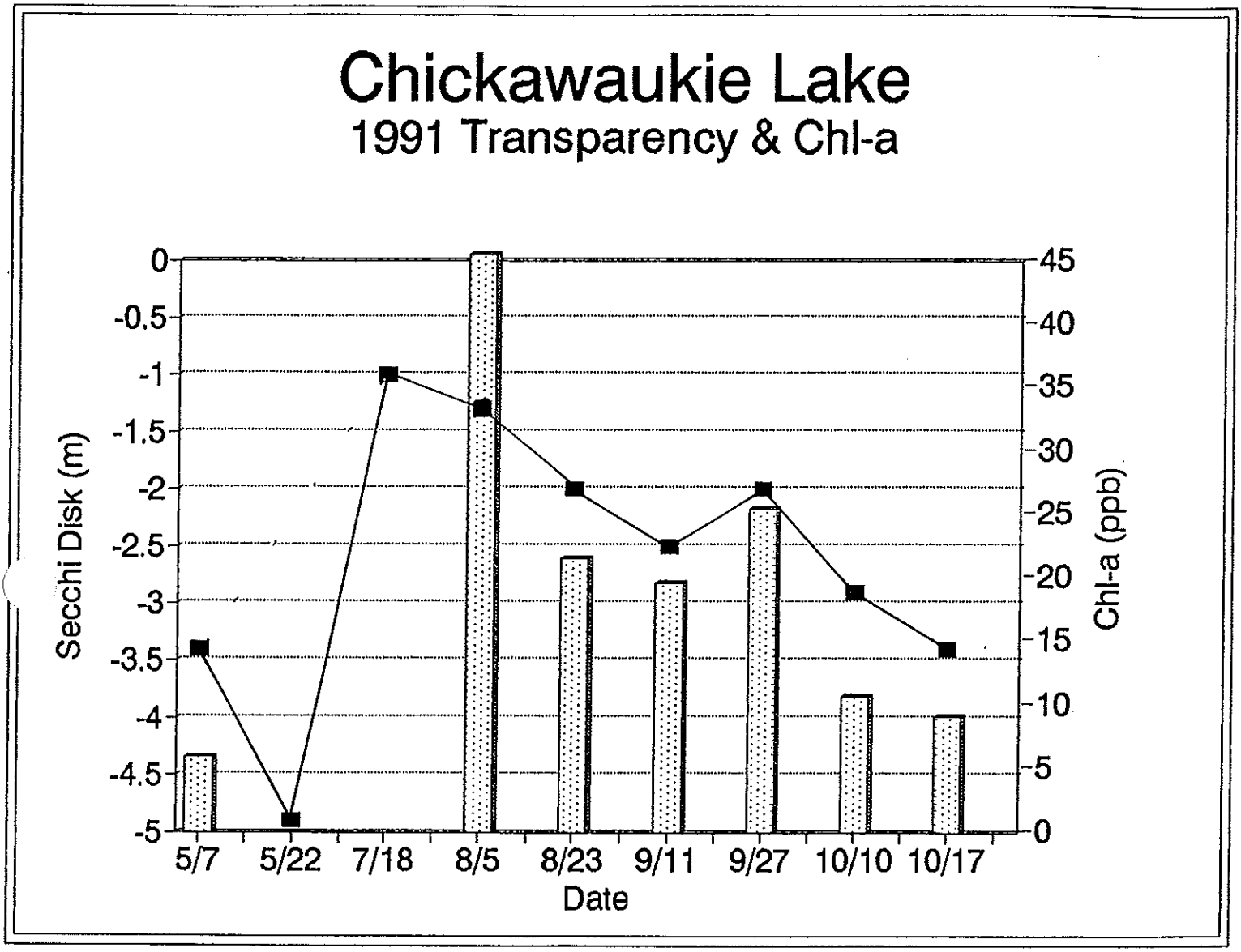
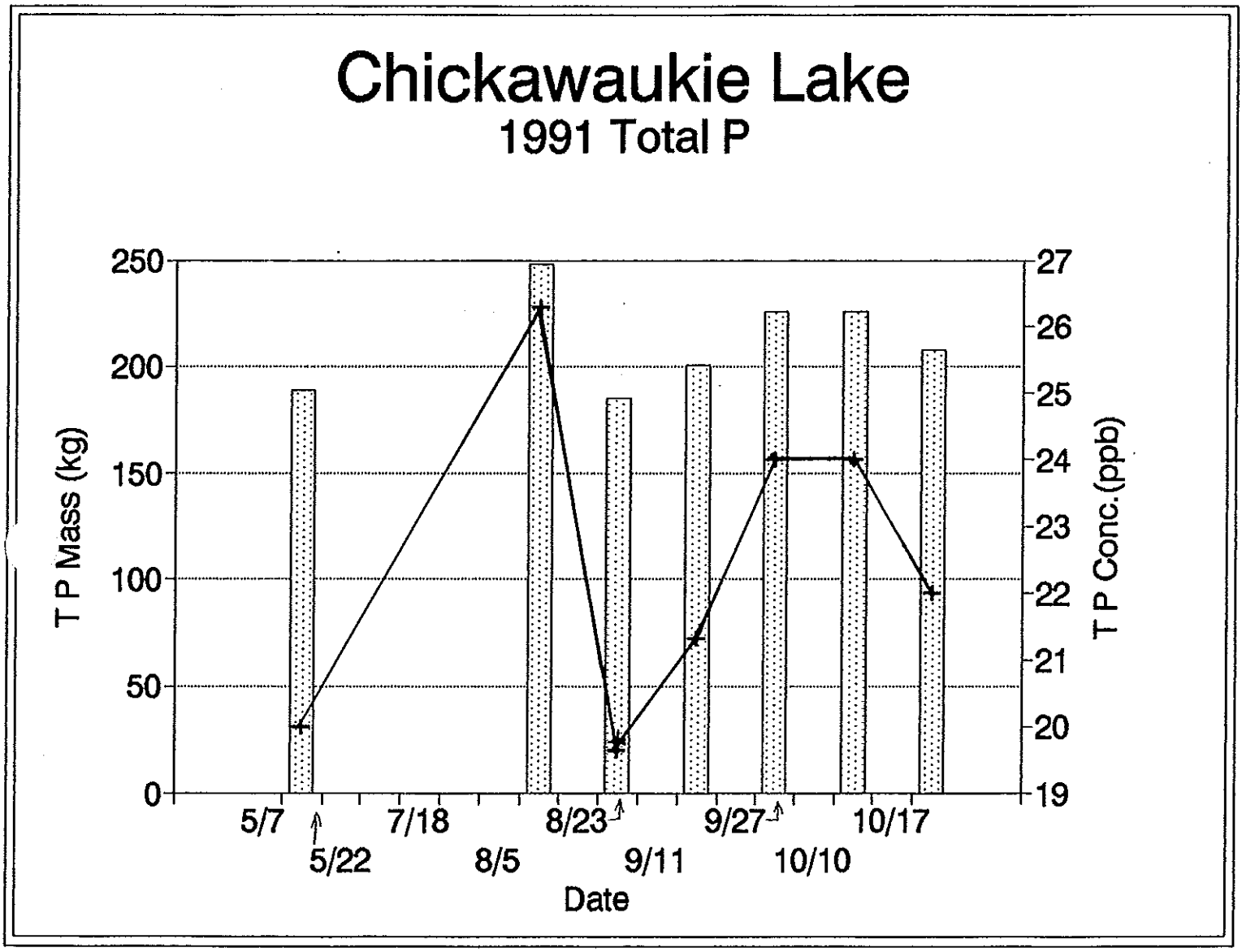

Chickawaukie Lake
1991 Transparency & Chl-a
Secchi Disk (m)
0
-0.5
-1
-1.5
-2
-2.5
-3
-3.5
-4
-4.5
-5
Chl-a (ppb)
45
40
35
30
25
20
15
10
5
0
5/7
5/22
7/18
8/5
8/23
9/11
9/27
10/10
10/17
Date

FIGURE 4


Chickawaukie Lake
1991 Total P
T P Mass (kg)
250
200
150
100
50
0
T P Conc.(ppb)
27
26
25
24
23
22
21
20
19
5/7
5/22
7/18
8/5
8/23
9/11
9/27
10/10
10/17
Date

As indicated above, water quality continued to be severely impaired during both years. In addition to monitoring information, members of the public continued to complain of summer algal blooms. It was also reported that several fishermen stopped ice fishing during the winter of 1990-91 due to obnoxious "green slime" accumulating under the ice. Chickawaukie is exposed to high winds in the winter, and the same conditions which make it popular for iceboating (lack of snow cover) also contribute to high light conditions under the ice and rapid algal growth. Late winter sampling, scheduled for mid-March 1991 could not be accomplished due to unsafe ice conditions. A winter season sampling is scheduled for mid-February in 1992.

Aluminum

Table 1 includes data on water column concentrations for total and soluble aluminum. These data, along with samples taken in Spring 1992 and thereafter, will allow us to detect any major alterations to lake aluminum levels as a result of the aluminum treatment.

On only two occasions, dissovled P was below Total AL levels. All samples were taken in early or late season. As noted in the Diagnostic-Feasibility Study (DEP Feb. 1990), these levels are comparable to other Maine lakes sampled recently, even though these are in somewhat different geologic formations. Since May 1991 we have also begun to more carefully acid wash the filters before use, which may have previously contributed somewhat to the concentation of dissolved aluminum in the samples analyzed.

Dissolved AL levels in the early 1991 samples were around 9 ppb. Improved sample preparation methods, including use of fine (0.1 micron filters) will result in better distinction between fine colloidal AL and true "dissolved" forms before and during the treatment.

Table 1 - Aluminum Concentrations

AL(ppb)

Date	Basin	Total	Dissolved	Acid Soluble	Core Depth (m)
9/23/88	1 (central)	16	18		5
	1	15	12		5
	2 (south)	23	12		5
	2	15	12		5
	3 (north)	16	12		5
	3	12	12		5
5/13/89	1	30	20		6
	2	30	15		6
	3	43	35		6
10/23/89	1	35	10		8
	2	38	8		8
	3	30	33		8
5/15/90	1	69	20		9
5/6/91	1	53	*9	24	9
Mean		30.4	16.3	24	
SD(N-1)		16.5	8.4	N/A	

*0.1 Micron Filter used

Non-point Source Control

In order to direct our efforts at reducing non-point phosphorus delivery to the lake and to direct our contacts with landowers, a five person committee was appointed to represent Rockland, Rockport, the Camden-Rockland Water Company, Chickawaukie Lake Association and the DEP. This committee sent out a request for proposals designed to aid in selection of a contractor to survey the watershed, prioritize pollution sources and recommend a course of action for remediation. In addition, the contractor's duties included contacting landowners to provide technical assistance and to coordiante a cost-share program similar to that used in the China Lake and Threemile Pond Restoration projects. Selection of a contractor took place in March, 1991. Arrangements were made for local funding of the contract through project funds from the City of Rockland and administered through the Town of Rockport and the Lake Association.

Arrangements for cost-share funds were made using Maine Lake Restoration and Protection Funds granted to the Town of Rockport under a Letter of Agreement (Appendix I). These funds were intended to be used to cost-share up to 50% of landowners' expenses for work recommended by the survey contractors, Community Planning Consultants Inc. of West Rockport, Me. ("CPC") and approved by the Committee.

Landowners were notified by mail and in the newspapers of the survey purposes before the survey began. In addition, all landowners with identified problem sites were notified by mail and telephone calls. CPC identified the individual contacts for each of the high-priority roads as well. Follow-up site visits, usually with the landowners, were done on at least 40 sites.

A public meeting was held on June 17, 1991 to discuss the findings of the survey and to explain the aims of this section of the project. The discussion included a description of the sources and causes of the lake's water quality problems and notice that cost-share funds would be available.

With the exception of significant code violations, an effort is being made to solicit voluntary correction of problems before code enforcement proceedings are used. This was deemed in keeping with the intent of the project. A case review in December of 1991 resulted in referral of a several cases for direct CEO action, primarily septic systems which apparently fail to meet the State/Local Plumbing Code.

Table 2 below summarizes NPS sources by type, priority and status as of this report. Although CPC inspected all of the recorded properties in the watershed, we note that construction activity occurring after that time will undoubtedly add to sources in the future. It should also be emphasized that this survey was intended to identify "acute" sources of sediments and not the more chronic, but subtler sources due to urbanization of the landscape described in the original land use analysis of the Diagnostic-Feasibility study.

Table 2
Non-Point Sources Identified
as of May 22, 1991

Problem Type	Priority	# Sites
Property Erosion	High (H)	9
	Medium (M)	8
Septic Systems	H	8
	M	7
Roads	H	5
	M	7
Other (logging, Agriculture)	H	4
	M	1
Total		49

Progress on NPS sites

After identification of sites was completed in May 1991, CPC met with the oversight committee to set review the prioritization of sites. As directed in the project design, CPC did follow-up contact with land owners of at least the 26 highest priority sites. Arrangements were also made with a local landscaping firm to stock seed, lime, mulch and other supplies which could be obtained free of charge by landowners cooperating with the program. The intent is to encourage completion of small projects.

The text of CPC's final project report is included as Appendix II. This contains site descriptions, status and recommended actions for each site.

Because of the limited number of acute non-point sources identified and the complexities of correcting some of the highest priority sites, relatively modest gains have been realized in this area. In their final report, CPC identified 9 sites which had largely been corrected, although cost-share was not needed in these cases. Reinspection of 8 sites originally listed (such as suspect septic systems) indicated no priority problem exists. Six high priority sites will be followed up by CPC to get a commitment from the landowners to cooperate in reducing the impact of their properties on the lake.

Of the six initially identified septic system problems three have been verified by follow-up evaluation as malfunctioning. The CEO of Rockport will attempt to get these corrected in 1992 under requirements of the Maine Plumbing Code. In addition, the Board of Selectmen will apply to the D.E.P. for a grant under the Small Communities Grants Program for 50 to 90% cost share in the design and replacement of these systems. This grant program has been used in a number of previous lakes projects (e.g. China Lake) to help correct high priority septic problems.

As noted above, two private road systems are among the most obvious sources of sediments and nutrients to the lake. One of these had been the subject of a cooperative project with the Lake Association in 1988 which resulted in the partial rebuild of one section. However, correction of the majority of the long-term defects was beyond the scope of the available resources.

Problem roads illustrate the great difficulty we experience, not only in this watershed but in others where we are active, in retrofitting properties such as these. In the case of each of these roads, a dozen or more owners share a right-of-way and title is not always clear. A meeting in Dec. 1991 focused on ways to permanently alter these roads and reduce the problem, including the potential for the Town to assume ownership after substantial re-build was done.

For both financial and technical reasons, it is unlikely that the roads can, even with the full cooperation of the owners, be brought up to Town standards for acceptance. It is also unlikely that the Town, already strapped with a large road budget and the current uncertain economy, can be induced into taking long-term reponsibility for these roads. The oversight committee also felt reluctant to invest large sums of restoration project funds needed for a rebuild of these roads if reliance would be needed on the individual owners themselves for maintenance.

The committee has asked our consultants for an ammendment to their proposal to analyze the options availble, including likely costs and the possibility of a limited Town involvement in the ongoing maintenance of the roads. Resolution of this issue is expected in the summer of 1992.

Wet Pond Installation

In the summer of 1991, two sites were screened for potential installation of wet ponds to treat runoff from established subdivisions. One site was eliminated due to wetlands in the vicinity of the only practicable site. The second site is on land owned by the Camden-Rockland Water Co. and a request is pending for permission to construct a pond there. A preliminary evaluation by an engineer contracted by Maine's 319 program indicated the site had good potential for pond construction and should meet the financial capabilies of the project. The system would serve a subdivision of approximately 11 acres which currently has 16 developed lots and a potential for as much as 5-10 more in the future.

The Knox-Lincoln Soil and Water Conservation District and the Soil Conservation Service are cooperating by producing a preliminary design for the installation. The design should be ready by late spring in order to allow for arrangements with the Water Co. and the procurement of a Natural Resources Protection Permit (Me. DEP Land Bureau) necessary for final design and installation in 1992. It is unclear at this time if arrangements can be made with the landowner for construction and maintenence and several technical and financial questions remain as well. One design consideration is the need to divert baseflow produced by springs in the upper watershed in order to assure adequate residence time for treatment of stormwater by the pond and minimal downstream thermal effects during summer.

Preparations for Aluminum Treatment

The reduction of internal loading has been identified as of absolute importance if improvements in water quality in Chickawaukie Lake are to achieved in an acceptable time frame.

Institutional & Financial Arrangements

Discussions are being conducted with the City of Rockland concerning the use of the Public Landing at Johnson Memorial Park as a staging area for the aluminum treatment. Application in early June is at a time of minimal park use and there ahould be little interference with public use of the park for boat launch, swimming or other day use activities. Arrangements will be made to reduce public risk by consultation with the City on the use of signs and posting of appropriate personnel or volunteers during the treatment which should take 7-10 days.

A draft Letter of Agreement (Appendix III) has been proposed to the Town of Rockport Board of Selectmen. A draft has also been sent to the EPA project officer for review. It should be noted that the DEP has placed a requirement for adoption of at least interim phosphorus control and development review standards by the municipalities before an aluminum treatment is authorized. This requirement is intended to be consistent for the Chickawaukie Lake and China Lake watersheds, as it is not appropriate to expend large amounts of Federal/State funds for an aluminum treatment without a commitment for long-term protection of the benefits of this restoration program.

Financial arrangements similar to those with the Town of Vassalboro during the Threemile Pond treatment in 1988 will be included, but DEP will retain overall technical direction and coordination of the application. Subsequent to the approval of the Letter of Agreement by the Town, a request for proposals will be sent out to all known vendors and advertisements will be posted with the selection of a contractor and negotiations slated for early spring 1992.

Financial arrangements include use of federal grant funds as well as funding from the Water Co., Town of Rockport, and the Lake Association. The Lake Association has not met its target of $10,000 as of this date but has made substantial progress toward it.

Laboratory Bench Tests

Jar tests were done in December 1991 to finalize dosage and ensure minimal pH shift will occur during treatment. A variety of chemical ratios and concentrations were used to fully bracket the expected target dosage of 25 g Al/m^2 lake bottom. Actual dosage to be achieved in lake was mimicked in the test jars. The tests created concentrations expected by complete instantaneous mixing of the areal dose rate of chemicals in a 1 meter deep stratum of the lake. The jar tests represent a worst-case scenario in terms of concentrations of chemicals expected at any point in the water column and the potential for pH shifts.

The test regimen was similar to that for the Threemile Pond treatment (Progress Report, Threemile Pond Project, Me. DEP, March 1991). Simultaneous injection of alum and sodium aluminate at various aluminum dosages and ratios bracketed the range of likely treatment options, both to determine the final choice and to indicate the effects of potential short-term over or under-dosing during a treatment.

Samples were withdrawn pre-treatment and at 3-5 minutes, 1 hour and 24 hours post-treatment. These were analyzed for alkalinity within 15 minutes. Readings of pH were taken in the test jars themselves. Total/residual aluminum concentrations as appropriate were obtained on samples prepared within 15-30 minutes (acidified for preservation and later analysis). Residual aluminum samples were prepared using acid washed 0.1 micron filters. Results are summarized in Table 3 below.

The target treatment regime (25 mg/l at 2:1 Alum/Aluminate) produced a slight pH shift (-0.35 at 5 minutes post-dose). This shift should produce minor effects in the lake at the time of treatment. Actual aluminum dosage was slightly below target (91%), probably due to dilution errors. Samples taken at 1 hour after dosing indicated fairly high dissolved ("RDA") concentrations of about 5-10 times background levels. Dissolved aluminum fell to 20 ppb $\pm$ within 24 hours. These concentrations are well within acceptable limits..

Actual in-lake effects should result in less RDA and pH changes, as the concentrations in the test containers after 1-24 hours exaggerate the effects to be expected on the entire water column during this period.

Municipal Planning

Over the past year, discussions have been held with the committee which is drafting revisions to Rockport's Comprehensive Plan and also with members of the Board of Selectmen and the Planning Board. Similar consultations have also been held with the Rockland Planning Commission and are scheduled with the City Council in the near future. These discussions have focused on the potential for long term protection of the water quality of Chickawaukie Lake by limiting the increase in non-point phosphorus load realized from new developement.

A three-person committee, consulting with the Code Enforcement Officers, have drafted a policy statement intended to be the basis for revisions to the Comprehensive Plans and potential local ordinances (Appendix IV) . The committee inventoried all properties in the watershed as to size and development status, and estimated the likely 50-year development scenario for the watershed.

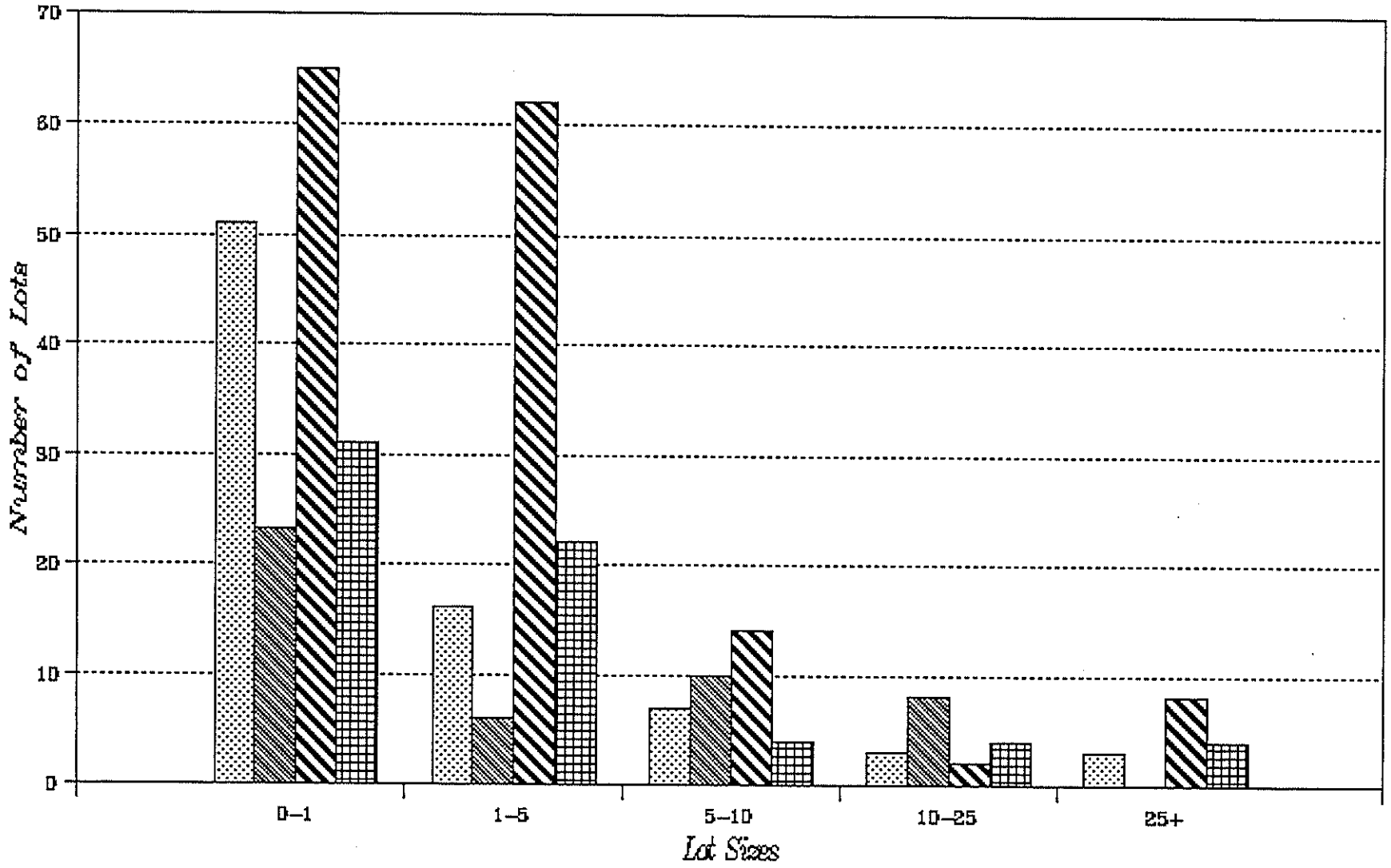
Table 3
Aluminum Dosing Jar Tests

Alum/Aluminate Ratio (volume)	Time	Al Dose 20 mg/l				Al Dose 25 mg/l				Al Dose 35 mg/l			
		pH	Alk.	RDA	TA	pH	Alk.	RDA	TA	pH	Alk.	RDA	TA
0:0 (Lake Water)	3-5 min.	7.4	10	58	41								
	1 hour												
	24 hours	7.3	10	10									
1.8:1	3-5 min.	7.3	13			7.2	12			7.1	14		
	1 hour	6.7	9			7.3	9	0.198		7.4	8		
	24 hours	7	9			7.7	8	0.042		6.7	8		
2.0:1	3-5 min.	6.8	8			6.8	12		22.7	6.8	12	0.301	31.7
	1 hour	6.8	10			6.6	8	0.12		6.9	8	0.128	
	24 hours	7.2	8			6.1	7	0.023		6.3	9	0.02	
2.2:1	3-5 min.	6.6	9			6.1	9			6.1	9		
	1 hour	6.1	6			6	6	0.147		6	6	0.094	
	24 hours	6.6	5			6.2	7	0.016		5.9	5		

FIGURE 3

Chickawaukie Lake

Developed/Undeveloped Lots



The draft standard calls for a conservative planned increase in external load to the lake resulting in phosphorus levels of 0.5 ppb above post-restoration levels. This protection level is a recommendation only and Rockland/Rockport may choose a less conservative standard (eg 1.0 ppb change).

These recommendations acknowledge that some developement (80-100 housing units or more) will be likely in the watershed during the planning period and that an increase in external phosphorus load is inevitable. They also recognize that the number of small, lots available for development is large enough (Figure 3) that some alternative to minimize cummulative impact from them is essential.
This is evident from analysis of the lot sizes which would be needed in a conventional subdivision review to meet the recommended phosphorus allocation standard and the fact that most of these lots (approx. 73%) are under five acres.

For this reason, the proposed standards incorporate three ways to minimize future phosphorus impacts. The standards include use of phosphorus controls for conventional subdivions as adopted by DEP and also an alternative analysis method adapted from the Dedham Lakes Project. This latter simplifies the review and design method, especially for small subdivisions and stresses non-structural phosphorus control methods (eg. buffers and limited lot clearing). A third level of review is provided for those existing lots or newly created non-subdivision lots which are too small to meet the per-acre P control requirements (adherence to which would preclude use of a large number of existing properties by their owners in the future). This requires that the developer of the lot maximize the potential use of buffers, minimize new road construction, and maximize the benefits of diffusing and avoiding channelizing lot drainage.

While this proposal will not fully meet the goal of reducing overall phophorus load increases to the 0.5 ppb change level, it appears to be the most equitable phophorus control policy likely to gain accepance in the near future. Adoption of these guidelines as interim standards, pending completion of the rather protracted municipal ordinance adoption process, would indicate a good-faith effort by Rockland and Rockport for lake protection and allow the DEP to complete the resoration project as originally proposed.

APPENDIX I

Letter of Agreement
Cost Share for NPS Control

Letter of Agreement
between
The Maine Department of Environmental Protection
and the
Town of Rockport

The purpose of this agreement is to establish a cost-share incentive for landowners to stabilize sources of erosion and sedimentation which carry phosphorus to Chickawaukie Lake and to subsidize water quality monitoring. The parties to this agreement will be the Maine Department of Environmental Protection ("DEP") and the Town of Rockport ("Town"). This agreement will be in effect from the date signature by the parties until July 26, 1993. The Department has determined that the Town has met the requirements to 38 MRSA Section 480-N. This agreement will establish a grant to the Town of Rockport from the Maine Lake Restoration and Protection Fund to cooperatively administer lake restoration funds.

The parties agree as follows:

I a) The Town will appoint an Oversight Committee ("Committee") which will include a representative of the DEP, to set procedure and policy for evaluating and prioritizing cost-sharing with land owners for erosion and phosphorus control. In addition to cost sharing, the Committee may authorize other reasonable expenditures from these funds such as the professional fees of consulting engineers, provision of erosion control materials at or below cost to land owners, etc.

In addition, grant funds are to be used for laboratory fees associated with the restoration project. Laboratories used for services must have the approval of the DEP representative.

b) The Committee will represent the Town and will be responsible for ensuring that complete records are kept for each case concerning expenditures and measures accomplished. The Committee will authorize any expenditures by means of written notification to the Selectmen that disbursements from grant funds must be made under the terms of this Agreement.

II a) DEP may, after consultation with the Town, require changes in the process to ensure conformance to this Agreement and the requirements of the U.S. Environmental Protection Agency. DEP may require termination of this agreement after provision of at least 30 days notice if the Town fails to fulfill the provisions of this agreement. Such notice will be in writing and will detail the reasons for such termination. Upon notice of termination, the Town will cease to encumber funds and may disburse funds only to honor prior written commitments to landowners and as specifically authorized by the DEP in writing.

b) All funds granted under this agreement and incidental project revenues shall be held in a separate account, to be used only for the purposes of this agreement. The Town will return to DEP all unencumbered funds from this grant by July 26, 1993 unless this program is extended by mutual written agreement. The Town will maintain accurate and complete records of all disbursements under this program and will furnish an itemized listing to the DEP if requested. Separate records will be kept of State funds granted under this Agreement and any Federal funds subsequently granted for the Chickawaukie Lake Restoration Project.

III a) DEP will provide the Town with $20,000.00 (Twenty thousand dollars) to be used as follows:

Laboratory Expenses	6,000.00
Cost Share/Erosion Control	14,000.00

The allocations of funds between Laboratory expenses and Cost Share/Erosion Control may be altered by the Town upon written approval by the DEP Project Officer. Up to 10% divergence from/between the above categories may occur without amendment of this Agreement. Disbursements of funds to the Town are subject to availability of funds to the Department. An intial payment of $5000.00 will be provided within 30 days of final signature of Agreement. Other disbursements will be made upon request, and demonstration of need for this project, by the Town

IV The DEP will appoint agent(s) (in consultation with the Town) to perform the services below. These agent(s) will be responsible for:

1) landowner contact, site visits and consultation
2) coordination of design of erosion control practices
3) review of cost estimates for required practices
4) consultation with the Town Committee concerning setting of case priorities.
5) review of completed projects to determine their compliance with program requirements.

Dean C. Marriott

Dean C. Marriott-Commissioner
Department of Environmental Protection

12/20/90
Date

Don Willard

Rxxxxx xx x Sxlxcxtxxxx
Town of Rockport

Town Manager
On Behalf of the Rockport Board of Selectmen

12-3-90
Date

RB/sl
ROCKAGREE

APPENDIX II

NPS Survey Report & Site Status

APPENDIX III

Draft Letter of Agreement
Aluminum Treatment

LETTER OF AGREEMENT
BETWEEN THE
MAINE DEPARTMENT OF ENVIRONMENTAL PROTECTION
AND THE
TOWN OF ROCKPORT

The U. S. Environmental Protection Agency has awarded the Maine DEP a grant under Section 314 of the Clean Water Act to fund a project designed to restore the water quality of Chickawaukie Lake in the municipalities of Rockport and Rockland. The in-lake restoration project will involve the subsurface injection of liquid aluminum sulfate and sodium aluminate over the maximum area of anaerobic water to effect the immobilization of sediment derived phosphorus loading to the lake during the summer months.

The parties to this agreement shall be the Maine Department of Environmental Protection (DEP) and the Town of Rockport (Town). The term of this agreement shall be until July 1, 1993.

It is agreed that the Town, as part of its share in the restoration project, shall administer any contracts associated with the purchase and application of chemicals to the bottom sediments of Chickawaukie Lake and that the DEP will reimburse the Town for costs of obtaining qualified bids, in addition to payments to contractors for approved chemicals and their application. The estimated project cost is $120,000. This cost will be financed by a combination of funds as outlined below. This agreement will not obligate Town funds beyond those detailed in Section 4(a) unless specifically agreed in advance by the Town.

Specifically, the parties shall provide the following:

1. The DEP will provide the Town with specifications and bidding documents for the project.

2. The Town will advertise the project and obtain qualified proposals following DEP and EPA approved procedures and will draft the final contract documents.

3. The Town will enter into a contract(s) with a qualified chemical supplier and applicator selected based on the following criteria:

    a. Ability to perform application phase of project in such a way as to assure project is carried out effectively, efficiently, and within a reasonable time frame. This evaluation will consider previous lake management experience, particularly with respect to lake aluminum treatments, along with availability of an appropriate mechanical system that will comply with the application requirements of the project.

b. Ability to supply and deliver DEP approved chemicals in an efficient and timely manner.

c. Proposal price.

Contractor(s) selection will be subject to review and approval by the DEP. Final contract provisions may be subject to competitive negotiation.

4. The Town will make arrangements to :

a. Dedicate $10,000 (ten thousand dollars) of Town funds for the purpose of this project.

b. Request and administer funds for the purpose of this agreement:

1. $10,000 (ten thousand dollars) from the Camden-Rockland Water Co.

2. $10,000 (ten thousand dollars) from the Chickawaukie Lake Association.

Nothing in this agreement obligates the parties in section 4(b) 1-2 to provide the above sums to the Town. Partial payments may be accepted by the Town if agreed to by these parties.

c. Receive and administer a sum not to exceed $90,000 (Ninety thousand dollars) from DEP for the purposes of this grant. These funds may be from a combination of Federal and State funds. The final amount of funds granted by DEP will be determined by the contract price and the amount of funds received by the Town from the parties in 4(b) 1-2 above.

Funds will be provided to the Town within thirty days of scheduled commencement of contract obligations.

The total cost of bidding, chemicals, and application shall not exceed $120,000 without prior approval of DEP.

5. Notwithstanding other provisions of this agreement, DEP will not make Federal or State funds available for the aluminum treatment unless DEP determines that adequate progress has been made in Rockland and Rockport on long-term phosphorus protection policies. Evidence of such progress may include ordinance adoption or interim standards for development review as well as proposals for changes to comprehensive plans as appropriate.

6. The Town shall ensure that, in addition to any other State and Federal requirements, the following conditions will be met:

a. By signing this award document, the Town certified, to the best of its knowledge and belief, that:

1. No Federal appropriated funds have been or will be paid, by or on behalf of the recipient, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of congress in connection with the awarding of any Federal contract, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

2. If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an office or employee of an agency, a Member of congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the recipient shall complete and submit Standard Form LLL, Disclosure Form to Report Lobbying, in accordance with its instructions.

3. The Town shall require that the language of this certification be included in the award of documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representative of fact upon which reliance was placed when this transaction was made or entered into. This certification is a prerequisite for making or entering into this transaction imposed by Section 1352, Title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

7. Contracts awarded by the Town under this assistance agreement, will utilize the following affirmative steps:

a. Placing Small Business in Rural Area. (SBRAs) on solicitation lists;

b. Ensuring that SBRAs are solicited whenever they are potential sources;

c. Dividing total requirements, when economically feasible, into small tasks or quantities to permit maximum participation by SBRAs;

d. Establishing delivery schedules, when the requirements of work will permit, which would encourage participation by SBRAs;

e. Using the services of the Small Business Administration and the Minority Business Development Agency of the U.S. Department of Commerce, as appropriate; and

f. Requiring the contractor, if it awards subcontracts, to take the affirmative steps in subparagraphs a. through e. of this condition.

8. When issuing statements, press releases, requests for proposals, bid solicitations, and other documents describing projects or program funding in whole or in part with federal money, all recipients receiving federal funds, including but not limited to state and local governments, shall clearly state (1) the percentage of the total cost of the program or project which will be financed with federal money, and (2) the dollar amount of federal funds for the project or program.

9. The Town's obligation to make payments under this agreement is contingent upon the continued and timely receipt and availability of funds provided by the State under the cooperative agreement.

10. The Town shall comply with the applicable requirements of subchapter B of Title 40 of the Code of Federal Regulations, specifically 40 CFR Part 31 and 40 CFR Part 35 Subpart H.

11. The Town shall comply with regulations and guidelines for the procurement of supplies, equipment and services provided 40 CFR Part 33, Procurements Under Assistance Agreement.

12. The Town will provide all necessary administrative services to conduct the contract(s) including payment of all bills approved by the DEP. The Town agrees to comply with Federal Office of Management and Budget accounting standards contained in OMB Circular A-102, Section C, F, G, H (Quarterly Financial Status Report only), and O.

13. The Town shall identify and save harmless the United States and the State and any and all of their departments, agencies, officers, employees and agents, against any and all suits and claims of liability of every name and nature for or on account of injuries to persons or damage to property arriving out of or in consequence of the acts of the Town or its contractor in the performance of the services required by this Agreement and/or failure to comply therewith.

14. The DEP will coordinate the implementation phase of the application and will advise the Town on the progress of the contractor(s). All decisions regarding technical aspects of the project will be the responsibility of DEP staff.

Either party may terminate this Agreement for failure of the other party to adhere to the requirements herein. Termination shall be effective 30 days after provision of written notice, such notice detailing the reasons for the termination.

Termination by the Town shall include transfer to DEP all data and pertinent information collected by the Town under this project.

Upon termination of the project, the Town shall account to DEP for all funds provided to the Town in excess of those needed to adequately compensate the Town for activities performed as of the termination date. All such funds in excess of reasonable compensation to the Town for services rendered shall be returned within 30 days of termination.

CHAIRMAN, BOARD OF SELECTMAN
TOWN OF ROCKPORT, MAINE

DATE

COMMISSIONER
DEPARTMENT OF ENVIRONMENTAL PROTECTION

DATE

/RCKPRTLOA

APPENDIX IV

Draft Phosphorus Control Policy

TOWN OF ROCKPORT

Interim Policy

Development Review in Chickawaukie Lake Watershed

I. Purpose: Section VI 3(d) of the current Rockport Land Use ordinance specifies that land use practices within the Chickawaukie Lake watershed shall not degrade the water quality of the lake. Review standards are needed to evaluate the design of new subdivisions in the Chickawaukie watershed (including Mace's Pond). These standards must evaluate phosphorus export from new subdivision and set a level of protection for Chickawaukie's sensitive water quality.

Pending adoption of Comprehensive Plan revisions and subsequent ordinance revisions. The following standards will be used by the Town of Rockport to evaluate phosphorus impacts of new development.

II. Technical Basis: Review shall be consistent with either:

1. Phosphorus Control in Lake Watersheds: A Technical Guide to Evaluating New Development as published by the Maine Department of Environmental Protection, (September 1989 & Revision, Chapter 4)

2. Method 2 Optional Review standards incorporated into this policy. (Section IV).

Selection of which method is the option of the subdivider, except that the optional review standards (Section IV) may not be used if the subdivider proposes use of structural phosphorus control methods (eg. wetponds, infiltration systems etc.) or the project is not a single family residential subdivision.

III. Phosphorus Export Standards: Developments proposed in the watersheds of Chickawaukie Lake or Mace's Pond must control export of phosphorus according to the Allowable Phosphorus standard:

Lake	F Value	Protection Level	Maximum Allowable Change (50 yr)	Projected Development in 50 years	Allowable Phosphorus Export #/acre/yr.
Chickawaukie	24.95	high	0.5ppb	505 acres	0.0247
Mace's	4.36	high	1.0	150	0.029

IV. Applicability:

a) Standards in this policy will be applied to only those par: ts of subdivisions or existing and future lots located in the watersheds of Chickawaukie Lake or Mace's Pond.

b) Proposals to construct new single family or duplex dwellings and roads/driveways on existing lots shall meet the standards of this policy (Section III) if feasible.

If the proposed development cannot be designed to meet this standard, then the Code Enforcement Officer may require, to the maximum extent feasible, that the minimum standards below are met:

1) Lots clearing of trees and shrubs shall not exceed 100,000 square feet.

2) New driveway and road length shall not exceed 100 feet.

3) Buffer areas downslope of structures and roads shall be maximized but shall not be less than 50 feet.

4) Site drainage shall be develped to minimize concentrated or channelized flow from culverts and drains.

IV. Definitions:

Vegetated Buffer Strip: For the purpose of controlling storm water runoff and the export of the nutrient phosphorus, a vegetated buffer that is "wooded" is one that is in a naturally wooded state, including an undisturbed organic duff layer, and has had no more than 40% of its timber harvested within the previous 10 years. A vegetated buffer that is "nonwooded" has a dense and complete cover of vegetation, including shrubs, trees, grass, and other plants, but is not planted or maintained as a lawn and is not mowed more than once a year.

Acreage of lot not developable: All catigious areas greater than 1 acre of a lot which are > 20% sustained slope or are wetlands.

Hydrologic Soil Groups: Soils shall be deemed A, B, C, or D categories as defined in Exhibit A-1 of Urban Hydrology for Small Watersheds (TR55) of the USDA/SCS, June 1986.

VII. Submissions: In addition to requirements of Rockport's subdivision ordinance, all subdivisions reviewed under this policy must provide:

(A) information for each lot as outlined in the following table:

Lot Number (keyed to subdivision plan) or Roadway Length	Total Acreage of Lot	Acreage of Lot Not Developable	Developable Acreage of Lot
Name of lake or pond watershed			
Lot No.			
Lot No.			
Etc.			
Totals for this watershed			

B. a. a plan showing the location and dimensions of vegetative buffer strips, and classification of the buffer as wooded or non-wooded, to be designed and maintained in accordance with Section 12.4 of this ordinance;

b. a copy of all covenants and deed restrictions by which restrictions, if any, have been placed on the amount of clearing on individual lots and by which vegetated buffer strips are to be permanently maintained.

c. the amount of phosphorus projected to be exported annually from the subdivision

d. a written plan for the maintenance of vegetative buffer strips, as specified in Section 12.4 of this policy.

C. The number of acres within the proposed subdivision, location of property lines, existing buildings, water courses, vegetative cover type, and other essential physical features. The plan shall indicate the area where clearing for lawns and structures shall be permitted, and any restrictions to be placed by the applicant on clearing.

D. A copy of that portion of the county Soil Survey governing the subdivision and classification of the soils according to their Hydrologic Soil Group. When the medium intensity soil survey...indicating the suitability of soil conditions for those uses.

VII. In addition to submissions in Section VI., for major subdivisions in the direct watershed of a lake orr pond shall submit:

A. A drainage plan, consisting of a map or set of maps drawn at a scale not greater than 1 inch equals 100 feet, unless otherwise approved by the Board, showing conditions before and after development, including:

1. Contour lines with elevation intervals of 5 feet or less, with existing contours shown with dashed lines and proposed contours shown with solid lines;

2. Surface water features including perennial and intermittent water bodies or drainage ways, and wetlands, and the general direction of flow to these water bodies or drainage ways from areas to be developed;

3. Existing and proposed drainage patterns on the site, and the size of post-development drainage areas used in determining ditch and culvert sizes;

4. Drainage features, both natural and constructed and both existing and proposed, including drainage swales, diversion ditches, road ditches, road culverts, vegetated buffer strips to be maintained and their classification as wooded or non-wooded, and all other phosphorus and runoff control measures. Phosphorus control measures shall be designed in accordance with Section 12.4 of this ordinance.

5. Calculations used to determine pre- and post development flows of stormwater and the design of drainage facilities, in accordance with the latest revised edition of Technical Release 55, Urban Hydrology for Small Watersheds, published by the U.S. Soil Conservation Service. Where drainage areas extend beyond the proposed subdivision, the size, in acres, of off-site drainage areas entering the subdivision must be indicated and accounted for in the calculations and the design of facilities.

VIII. Phosphorus Export shall be calculated as per (Section II-1) or by the Optional Method below:

Note:
If the area within the proposed subdivision is greater than 20% of the total area projected to be developed in the watershed over the next 50 years, the allowable phosphorus export per acre must be adjusted using Appendix F of the Department of Environmental Protection's manual, "Phosphorus Control in Lake Watersheds: A Technical Guide for Evaluating New Development," September 1989 with revisions to Chapter 4, May 1990.

Simplified Method of Calculating Phosphorus Export from Proposed Single-Family Residential Subdivsion.

1. Lots

   a. For each lot in the proposed subdivision, identify the predominant hydrologic soil group (A, B, C, or D) of the part of the lot that will be cleared for development and converted to lawn or similar surface.

b. For each lot, determine the area of this clearing (less than 10,000 sq. ft., 10,000 to 15,000 sq. ft., or more than 15,000 sq. ft.). Unless the amount of clearing on any given lot is limited by deed restriction or a conservation easement, it shall be assumed that the amount of clearing on that lot will be greater than 15,000 square feet.

c. For each lot, determine whether the area to be cleared currently is wooded or non-wooded if it has had more than 40% of its timber volume harvested within the past 5 years.

d. Refer to Appendix I of this Ordinance. This appendix is organized into 4 sections based on the 4 possible hydrologic soil groups of the area to be cleared: A, B, C, or D. Fore each lot, select the appropriate section for the hydrologic soil group identified in paragraph a above. In turn, select the chart within this section that corresponds to the size of area to be cleared and whether the area to be cleared is wooded or non-wooded.

e. On this chart:

i. select the width of the vegetated buffer to be designed and maintained as specified in Section 12.4 of this Article;

ii. select the hydrologic soil group on which this buffer is located, and the average percent slope of this buffer; and

iii. reading down from the appropriate buffer width and across from the buffer's soil group and slope, record the indicated figure. Use the figure not in parentheses if the buffer is wooded, and the figure in parentheses if the buffer is non-wooded. This figure represents the pounds per year of phosphorus expected to be exported from the lot.

f. Add together the results for all lots in each watershed to arrive at the total amount of phosphorus projected to be exported to the respective ponds or lakes.

2. Roads

a. For purposes of this Section IV, roads include all newly constructed access and internal roads, plus that part of the length of any new driveway in excess of 150 feet. If the locations of driveways are not specified, the length shall be determined by the distance from the edge of the road surface from which a lot has its access to the midpoint of the proposed cleared area for the structure.

b. Determine the total length of roads, including the length of driveways in excess of 150 feet, within each lake or pond watershed.

c. Multiply this total length by:

i. .00280 if the width of the road surface is 20 feet; or

ii. .00304 if the width of the road surface is more than 20 feet but not more than 22 feet; or

iii. .00328 if the width of the road surface is more than 22 feet but not more than 24 feet.

iv. If the width of the road surface is less than 20 feet or more than 24 feet, complete the following formula:

[(Length of road)(width of road surface)(0.012) + .04]/100

The result is the amount of phosphorus (in pounds per year) projected to be exported from new roads serving the division in each watershed which the subdivision is located.

3. Total Projected Phosphorus Export

For each watershed in which the subdivision is located, add together the amount of phosphorus projected to be exported from lots and the amount projected to be exported from roads. The addition should be presented in the following format:

Lot Number (keyed to subdivision plan) or Roadway Length	Phosphorus Export Value (lbs./year)
Name of Lake Watershed	
Lot No.	
Lot No.	
Etc.	
TOTALS, THIS WATERSHED	
Name of Lake Watershed	
Lot No.	
Lot No.	
Etc.	
TOTALS, THIS WATERSHED	

** multiply by .5 to get available phosphorus

4. The total amount of phosphorus to be exported from the propsed subdivision within the direct watershed of a pond or lake shall not exceed the product of: the allowable phosphorus export per ace (lbs./yr.) as described in Section III for the watershed, times the number of developable acres in the subdivision within the watershed.

APPENDIX I

CHARTS TO DETERMINE AMOUNT OF PHOSPHORUS EXPORT FROM LOTS

If area to be cleared for house and lawn is predominantly Hydrologic Soil Group A . . . . . select from charts 1 - 6

If area to be cleared for house and lawn is predominantly Hydrologic Soil Group B . . . . . select from charts 7 - 12

If area to be cleared for house and lawn is predominantly Hydrologic Soil Group C . . . . . Select from charts 13 - 18

If area to be cleared for house and lawn is predominantly Hydrologic Soil Group D . . . . . select from charts 19 - 24

APPENDIX II

Phosphorus Control Design and Maintenance Standards

A. Design of Phosphorus Control Measures

1. Phosphorus control measures shall meet the design criteria contained in "Phosphorus Control in Lake Watersheds: A Technical Guide for Evaluating New Development" (Maine DEP, September 1989 with revisions to Chapter 4, May 1990). High maintenance structural measures, such as wet ponds and runoff infiltration systems, shall not be used unless:

   a. other measures, such as increasing the width of vegetated buffers, greater limits on clearing, reducing road lengths, and clustering of lots to achieve less disturbed area are clearly demonstrated to be insufficient to allow the proposed subdivision to meet the standards of this ordinance, and

   b. the Planning Board finds that the applicant has the technical and financial capabilities to properly design, construct, and provide for the long-term inspection and maintenance of the facility in accordance with the Maine DEP's manual referred to above.

2. Vegetated Buffer Strips

   a. Vegetated buffer strips shall be located downslope of areas to be developed. Runoff from developed areas must pass through the buffer strip as overland flow, not in channelized form.

   b. Only the uninterrupted width of the buffer strip may be considered in determining its ability to intercept and treat storm water runoff.

   c. Vegetated buffers may be used to intercept runoff from roadways provided that they are designed according to the specifications contained in "Phosphorus Control in Lake Watersheds: A Technical Guide for Evaluating

New Development" (Maine DEP, September 1989 with revisions to Chapter 4, May 1990).

B. Maintenance and Use Restrictions for Vegetated Buffers

1. Buffers shall be inspected annually for evidence of erosion or concentrated flows through or around the buffer. All eroded areas shall be seeded and mulched. A shallow stone trench must be installed as a level spreader to distribute flows evenly in any area showing concentrated flows.

2. All existing undergrowth, forest floor duff layer, and leaf litter must remain undisturbed and intact except that one winding walking path, no wider than 6 feet, is allowed through the buffer.

3. Pruning of live tree branches that do not exceed 12 feet in height above the ground level is permitted provided that at least the top two-thirds of the tree canopy is maintained.

4. No cutting is allowed of trees except for normal maintenance of dead, windblown, or damaged trees.

5. Buffers are not to be used for all-terrain vehicle or vehicular traffic.

6. Vegetated buffers that are non-wooded shall not be mowed more than once a year and shall not be burned.

7. Where individual lot owners are responsible for maintaining buffers, the requirements of this subsection shall be part of the lot's deed restrictions. Where a home owners' association is to be formed to maintain common lands, including buffers, the requirements of this subsection shall be incorporated into the legal documents establishing the association's responsibilities.

8. In addition, these requirements shall be included in a written plan submitted as part of the subdivision application.

APPENDIX V

Selected Water Quality Data

CHICKAWALKIE 4822 1 (ALL E103, HUNT,MCMACKIN,ST CLAIR)

SAMPDATE	SECCHI
05/15/90	3.0
06/06/90	3.4
07/06/90	3.5
07/19/90	3.7
08/15/90	2.5
08/29/90	1.7
09/13/90	2.7
09/27/90	2.5

	05/15/90		06/06/90		07/06/90		07/19/90		08/15/90		08/29/90		09/13/90		09/27/90	
SECCHI:	3.0		3.4		3.5		3.7		2.5		1.7		2.7		2.5	
PH	: 0.0 G	6.07	0.0 G	6.80	0.5 G	6.60	7.0 C	7.30	6.0 C	7.10	0.5 G	8.42			9.0 C	6.46
COLOR	: 0.0 G		0.0 G		0.5 G	18	7.0 C	33	6.0 C	16	0.5 G	36			9.0 C	28
COND	: 0.0 G	110	0.0 G		0.5 G	115	7.0 C	117	6.0 C	110	0.5 G	108			9.0 C	115
ALK	: 0.0 G	12.4	0.0 G	12.8	0.5 G	13.8	7.0 C	13.8	6.0 C	13.8	0.5 G	13.1			9.0 C	11.4

DEPTH/	TEMP	D.O.	TEMP	D.O.	TEMP	D.O.	TEMP	D.O.	TEMP	D.O.	TEMP	D.O.	TEMP	D.O.	TEMP	D.O.
0.0	13.5	10.8	13.5	10.8	21.5	9.1	25.2	8.4	23.0	8.7	26.0	8.2			17.0	9.7
1.0	14.0	10.8	13.4	10.8	21.5	9.1	25.1	8.4	23.1	8.5	25.5	8.2			16.9	9.6
2.0	12.2	11.0	13.3	10.8	21.5	9.1	24.8	8.4	23.1	8.5	25.0	8.2			16.2	9.2
3.0	12.0	6.2	13.2	10.8	21.3	9.1	23.8	8.4	23.1	8.4	24.8	8.2			16.2	9.0
4.0	12.0	4.6	13.2	10.7	21.0	8.8	23.5	8.3	23.1	8.4	23.2	7.1			16.2	8.8
5.0	11.8	3.7	13.2	10.7	21.0	8.7	22.5	7.9	23.0	7.1	22.8	5.4			16.2	8.8
6.0	11.5	3.2	13.2	10.6	19.3	6.8	21.0	5.8	22.0	4.4	22.2	4.4			16.2	8.8
7.0	11.5	2.6	13.2	10.6	16.8	4.0	18.2	2.4	20.1	0.5	21.0	1.5			16.0	8.2
8.0	11.2	2.2	13.2	10.6	15.2	2.2	17.0	0.7	17.0	0.1	18.2	0.2			16.0	8.2
9.0	11.2	2.1	13.2	10.6	14.2	0.3	15.0	0.2	15.0	0.1	16.8	0.1			16.0	8.1
10.0	11.0	2.0			14.1	0.2	14.5	0.1	14.9	0.1	15.8	0.1			15.8	1.5

	TP	TP	TP	TP	TP
1.0	24	18	19	14	20
3.0	27	32	13	17	26
5.0	34	17	23	15	24
7.0	25	17	14	15	19
9.0	21	34	190	140	18

DECI-DATE	DEPTH	TEMP	OXYGEN
0.48	0.0	13.5	10.8
0.48	1.0	14.0	10.8
0.48	2.0	12.2	11.0
0.48	3.0	12.0	6.2
0.48	4.0	12.0	4.6
0.48	5.0	11.8	3.7
0.48	6.0	11.5	3.2
0.48	7.0	11.5	2.6
0.48	8.0	11.2	2.2
0.48	9.0	11.2	2.1
0.48	10.0	11.0	2.0

1990

1.19	0.0	13.5	10.8
1.19	1.0	13.4	10.8
1.19	2.0	13.3	10.8
1.19	3.0	13.2	10.8
1.19	4.0	13.2	10.7
1.19	5.0	13.2	10.7
1.19	6.0	13.2	10.6
1.19	7.0	13.2	10.6
1.19	8.0	13.2	10.6
1.19	9.0	13.2	10.6
2.19	0.0	21.5	9.1
2.19	1.0	21.5	9.1
2.19	2.0	21.5	9.1
2.19	3.0	21.3	9.1
2.19	4.0	21.0	8.8
2.19	5.0	21.0	8.7
2.19	6.0	19.3	6.8
2.19	7.0	16.8	4.0
2.19	8.0	15.2	2.2
2.19	9.0	14.2	0.3
2.19	10.0	14.1	0.2
2.61	0.0	25.2	8.4
2.61	1.0	25.1	8.4
2.61	2.0	24.8	8.4
2.61	3.0	23.8	8.4
2.61	4.0	23.5	8.3
2.61	5.0	22.5	7.9
2.61	6.0	21.0	5.8
2.61	7.0	18.2	2.4
2.61	8.0	17.0	0.7
2.61	9.0	15.0	0.2
2.61	10.0	14.5	0.1
3.48	0.0	23.0	8.7
3.48	1.0	23.1	8.5
3.48	2.0	23.1	8.5
3.48	3.0	23.1	8.4
3.48	4.0	23.1	8.4
3.48	5.0	23.0	7.1
3.48	6.0	22.0	4.4
3.48	7.0	20.1	0.5
3.48	8.0	17.0	0.1
3.48	9.0	15.0	0.1
3.48	10.0	14.9	0.1
3.94	0.0	26.0	8.2
3.94	1.0	25.5	8.2
3.94	2.0	25.0	8.2
3.94	3.0	24.8	8.2
3.94	4.0	23.2	7.1
3.94	5.0	22.8	5.4
3.94	6.0	22.2	4.4
3.94	7.0	21.0	1.5
3.94	8.0	18.2	0.2
3.94	9.0	16.8	0.1
3.94	10.0	15.8	0.1
4.87	0.0	17.0	9.7

1980

4.87	1.0	16.9	9.6
4.87	2.0	16.2	9.2
4.87	3.0	16.2	9.0
4.87	4.0	16.2	8.8
4.87	5.0	16.2	8.8
4.87	6.0	16.2	8.8
4.87	7.0	16.0	8.2
4.87	8.0	16.0	8.2
4.87	9.0	16.0	8.1
4.87	10.0	15.8	1.5

DECI-DATE	DEPTH	TP
1.19	1.0	24
1.19	3.0	27
1.19	5.0	34
1.19	7.0	25
1.19	9.0	21
2.61	1.0	18
2.61	3.0	32
2.61	5.0	17
2.61	7.0	17
2.61	9.0	34
3.48	1.0	19
3.48	3.0	13
3.48	5.0	23
3.48	7.0	14
3.48	9.0	190
3.94	1.0	14
3.94	3.0	17
3.94	5.0	15
3.94	7.0	15
3.94	9.0	140
4.87	1.0	20
4.87	3.0	26
4.87	5.0	24
4.87	7.0	19
4.87	9.0	18

CHICKAWAUKIE 4822 1

	05/07/91		05/22/91		07/18/91		08/05/91		08/23/91		09/11/91		09/27/91		10/10/91		10/17/91
SECCHI:	3.4		4.9		1.0		1.4		2.0		2.5		2.0		2.9		3.4
PH:											7.44						
COLOR:											20						
ALK:											16.0						
DEPTH/	TEMP	D.O.															
0.0	11.9	10.8	17.0	10.0			22.2	8.8	21.3	8.0	20.0	8.2	16.3	8.5	14.2	8.7	
1.0	11.8	10.8	17.0	9.9	22.6	8.4	22.2	8.8	21.3	8.0	20.0	7.8	16.3	8.5	14.2	8.5	
2.0	11.2	11.1	17.0	9.9	22.0	8.0	22.2	8.7	21.3	7.7	20.0	7.6					
3.0	11.1	11.1	15.7	9.8	21.8	7.6	22.1	8.2	21.3	7.6	20.0	7.4	16.3	8.5	14.1	8.3	
4.0	11.1	11.1	15.3	9.6	21.4	7.1	22.0	7.9	21.0	7.3	20.0	7.3					
5.0	11.0	11.1	15.3	9.5	20.5	5.4	22.0	7.8	21.0	7.3	20.0	7.2	16.3	8.4	14.1	8.2	
6.0	10.9	11.1	15.2	9.5	19.5	4.1	19.8	0.3	20.9	7.3	20.0	7.2					
7.0	10.9	11.1	15.1	9.3	18.0	1.7	18.5	0.2	20.9	7.1	20.0	7.0	16.3	8.4	14.1	8.1	
8.0	10.8	10.9	14.9	9.2	17.0	0.2	17.0	0.2	19.0	2.2	20.0	7.0					
9.0	10.6	10.9	14.6	8.6	16.8	0.1	16.8	0.2	18.0	2.2	20.0	6.9	16.3	8.4	14.1	7.7	
10.0	10.4	10.4	14.2	7.6	16.2	0.1	16.1	0.1	16.9	1.9	20.0	6.8	16.3	7.0	14.1	6.5	

	TP	TP	TP	TP	TP	TP	TP	TP	TP
1.0		<20>		27	18	22			
2.0		<20>		27	21				
3.0				21	19	20			
4.0		<20>		21	17				
5.0				20	17	22			
6.0		<20>		22	18				
7.0				19	17	22			
8.0		C: 20		25	28				C: 22
9.0				74	30	21	C:24	C: 24	
10.0					24				

C: = Core (9-10 m)

DECI-DATE	DEPTH	TP
0.71	1.0	20
0.71	3.0	20
0.71	5.0	20
0.71	7.0	20
0.71	9.0	20
3.16	1.0	27
3.16	2.0	27
3.16	3.0	21
3.16	4.0	21
3.16	5.0	20
3.16	6.0	22
3.16	7.0	19
3.16	8.0	25
3.16	9.0	74
3.74	1.0	18
3.74	2.0	21
3.74	3.0	19
3.74	4.0	17
3.74	5.0	17

1991

3.74	6.0	18
3.74	7.0	17
3.74	8.0	28
3.74	9.0	30
3.74	10.0	24
4.35	1.0	22
4.35	3.0	20
4.35	5.0	22
4.35	7.0	22
4.35	9.0	21
4.87	1.0	24
4.87	3.0	24
4.87	5.0	24
4.87	7.0	24
4.87	9.0	24
5.32	1.0	24
5.32	3.0	24
5.32	5.0	24
5.32	7.0	24
5.32	9.0	24
5.55	1.0	22
5.55	3.0	22
5.55	5.0	22
5.55	7.0	22
5.55	8.0	22

DECI-DATE	DEPTH/	TEMP	D.O.
0.22	0.0	11.9	10.8
0.22	1.0	11.8	10.8
0.22	2.0	11.2	11.1
0.22	3.0	11.1	11.1
0.22	4.0	11.1	11.1
0.22	5.0	11.0	11.1
0.22	6.0	10.9	11.1
0.22	7.0	10.9	11.1
0.22	8.0	10.8	10.9
0.22	9.0	10.6	10.9
0.22	10.0	10.4	10.4
0.71	0.0	17.0	10.0
0.71	1.0	17.0	9.9
0.71	2.0	17.0	9.9
0.71	3.0	15.7	9.8
0.71	4.0	15.3	9.6
0.71	5.0	15.3	9.5
0.71	6.0	15.2	9.5
0.71	7.0	15.1	9.3
0.71	8.0	14.9	9.2
0.71	9.0	14.6	8.6
0.71	10.0	14.2	7.6
2.58	1.0	22.6	8.4
2.58	2.0	22.0	8.0
2.58	3.0	21.8	7.6
2.58	4.0	21.4	7.1

1991

2.58	5.0	20.5	5.4
2.58	6.0	19.5	4.1
2.58	7.0	18.0	1.7
2.58	8.0	17.0	0.2
2.58	9.0	16.8	0.1
2.58	10.0	16.2	0.1
3.16	0.0	22.2	8.8
3.16	1.0	22.2	8.8
3.16	2.0	22.2	8.7
3.16	3.0	22.1	8.2
3.16	4.0	22.0	7.9
3.16	5.0	22.0	7.8
3.16	6.0	19.8	0.3
3.16	7.0	18.5	0.2
3.16	8.0	17.0	0.2
3.16	9.0	16.8	0.2
3.16	10.0	16.1	0.1
3.74	0.0	21.3	8.0
3.74	1.0	21.3	8.0
3.74	2.0	21.3	7.7
3.74	3.0	21.3	7.6
3.74	4.0	21.0	7.3
3.74	5.0	21.0	7.3
3.74	6.0	20.9	7.3
3.74	7.0	20.9	7.1
3.74	8.0	19.0	2.2
3.74	9.0	18.0	2.2
3.74	10.0	16.9	1.9
4.35	0.0	20.0	8.2
4.35	1.0	20.0	7.8
4.35	2.0	20.0	7.6
4.35	3.0	20.0	7.4
4.35	4.0	20.0	7.3
4.35	5.0	20.0	7.2
4.35	6.0	20.0	7.2
4.35	7.0	20.0	7.0
4.35	8.0	20.0	7.0
4.35	9.0	20.0	6.9
4.35	10.0	20.0	6.8
4.87	0.0	16.3	8.5
4.87	1.0	16.3	8.5
4.87	3.0	16.3	8.5
4.87	5.0	16.3	8.4
4.87	7.0	16.3	8.4
4.87	9.0	16.3	8.4
4.87	10.0	16.3	7.0
5.32	0.0	14.2	8.7
5.32	1.0	14.2	8.5
5.32	3.0	14.1	8.3
5.32	5.0	14.1	8.2
5.32	7.0	14.1	8.1
5.32	9.0	14.1	7.7
5.32	10.0	14.1	6.5