A BASE LINE SURVEY AND MODIFIED EUTROPHICATION INDEX FOR 8 PONDS IN PLYMOUTH, MASS.

BEAVER DAM POND
BLACK JIMMY POND
CLAM PUDDING POND
DEER POND
LOUT POND
RABBIT POND
SHALLOW POND
WARNER POND

BY

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Included in this report is the limnological listing of 50 ponds in Plymouth, Mass. This listing is the result of previous studies conducted by Lyons - Skwarto Associates.

BEAVER DAM POND

Beaver Dam Pond ranks 27 using a modified trophic index.

This is an artificial, non-stratified, warm water, clear body of water that has a maximum depth of 12 feet. This impoundment is aquifer feed.

The Secchi Disc reading was 9.

The macrophyte readings were classified as sparse to medium with growth out to the 9 foot contour line. The 3 main species present were Bladderwort, Milfoil and Coontail.

There were a few floating species in the coves.

The phosphate readings were critical whereas the nitrate readings were permissible.

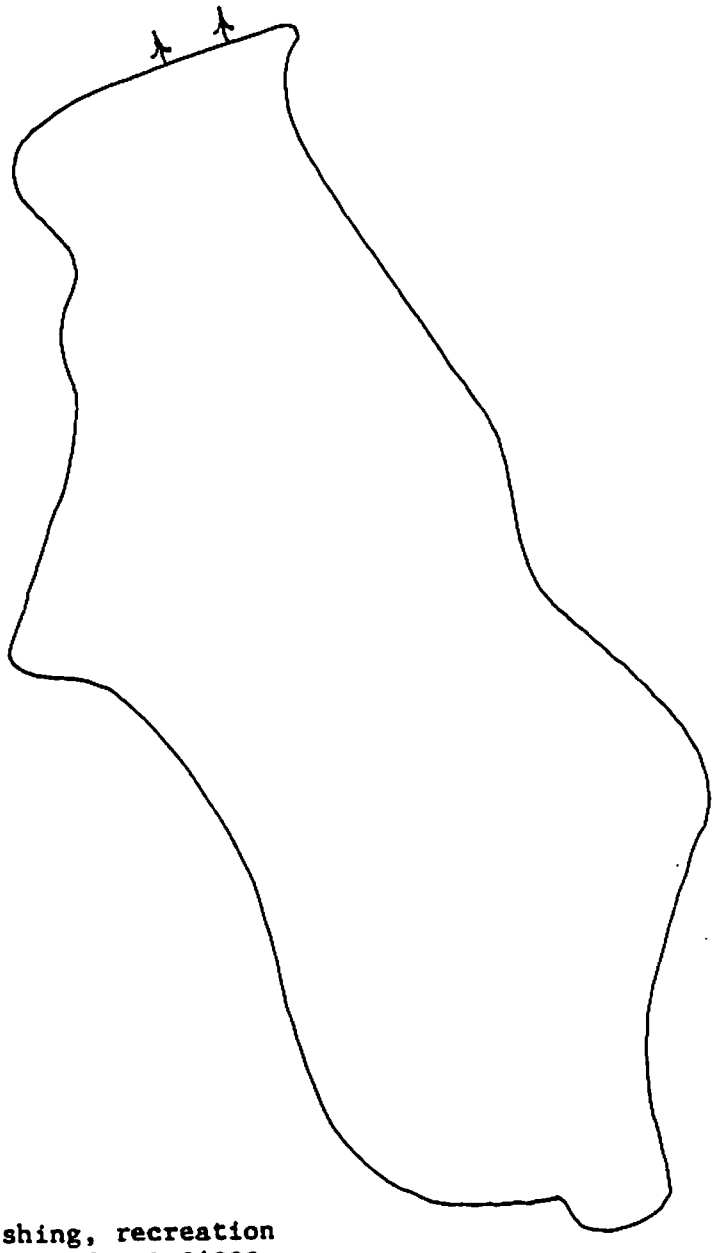
The pond was rated as eutrophic.

The pond is used for bog flooding.

There are no houses on down slopes.

BEAVER DAM POND

Planimetric Map



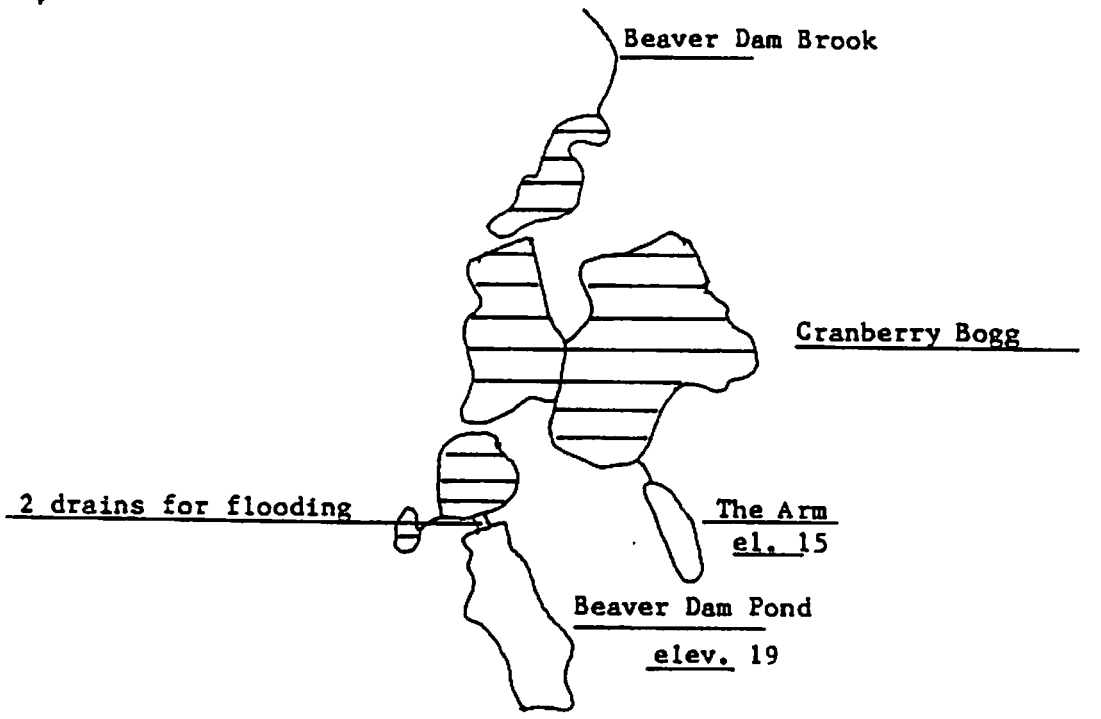
Beaver Dam Pond

Plymouth, Mass.
Watershed: coastal
Acres: 30 A 12.15
Altitude: 19' 5.79M
Water type: warm
Pond type: artificial
Transparency 9 2.74 H
Watercolor: clear
Pond use: irrigation, fishing, recreation
Topo sheet USGS M Manomet 1962 1.24000
Position topo sheet up 4.3 R. 7.5
Stratified: no
Reclaimed: no
Stocked: no
Shoreline distance 5300 1615.4 M
Bottom type-organic covering sand & gravel base
Shoreline high 10% intermediate 70% low 20%

Scale 1:317

BEAVER DAM POND

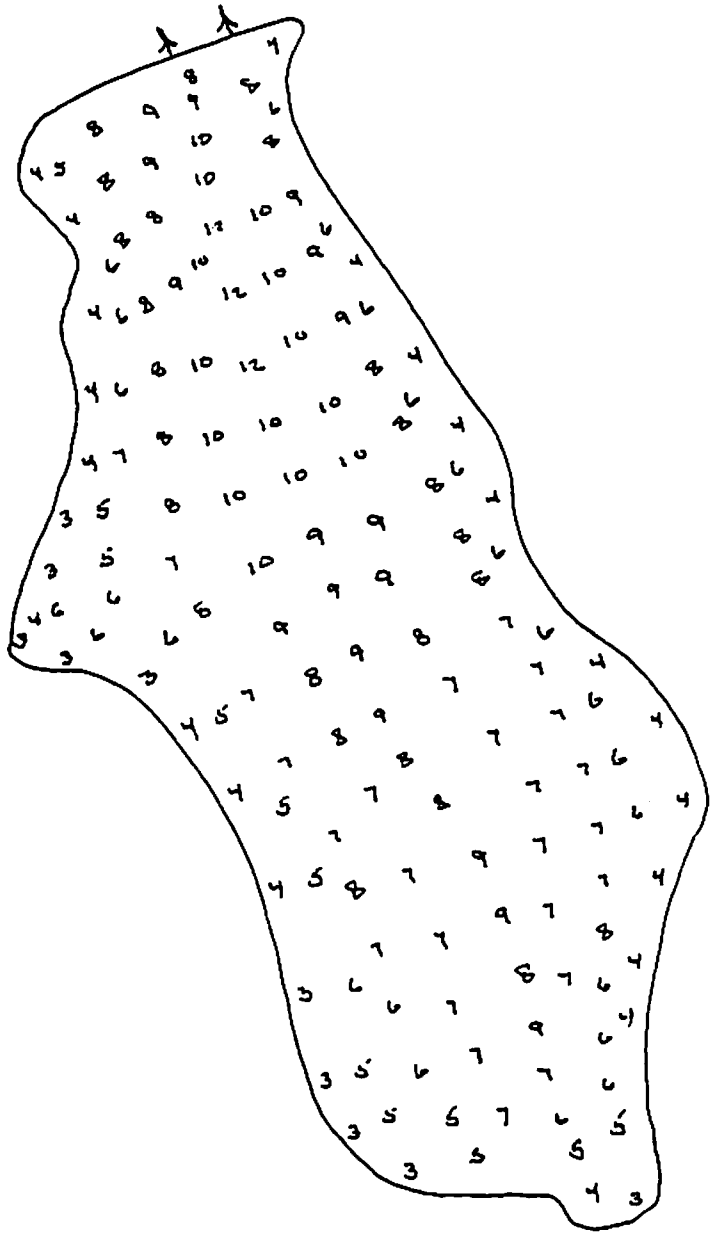
Impoundment Map



Scale 1:2000

BEAVER DAM POND

Bathymetric Map

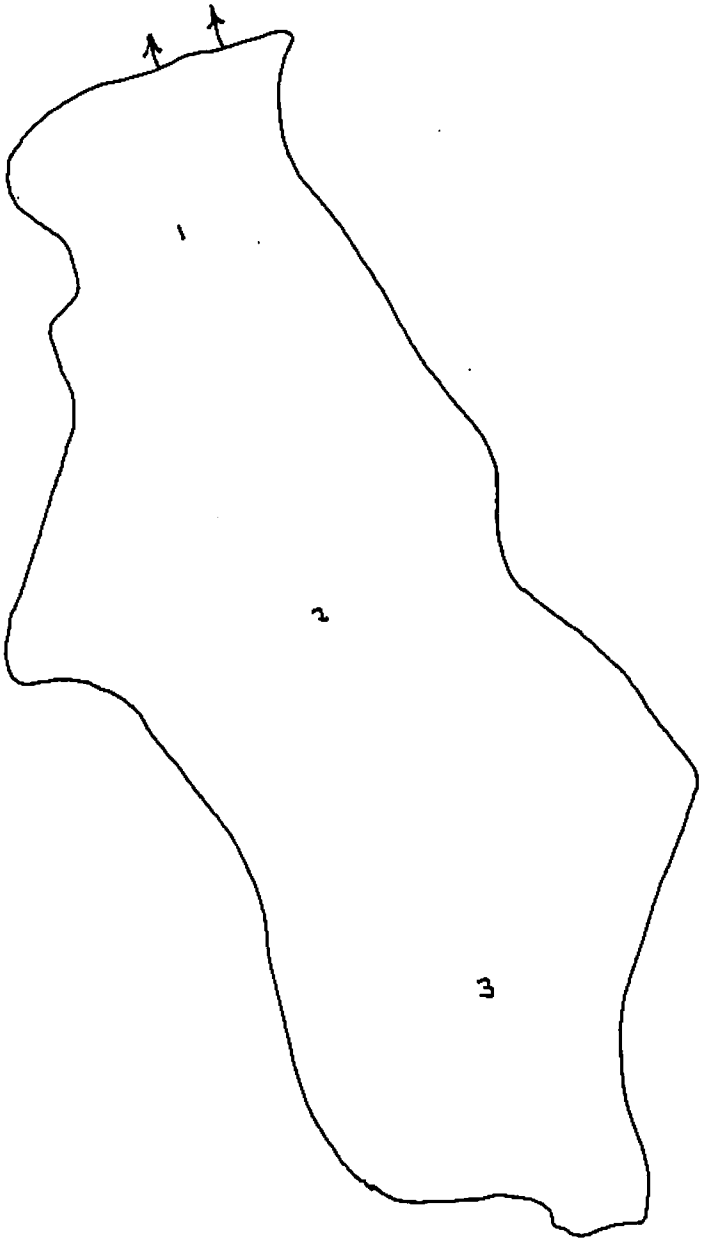


Maximum depth 12 3.66 M
Mean depth 8 2.44 M
Surface area 30A 12.15 H
Total acre feet 240 AF
Total Gallons 78,198,960

Scale 1:317

BEAVER DAM POND

Chemical Sample Stations

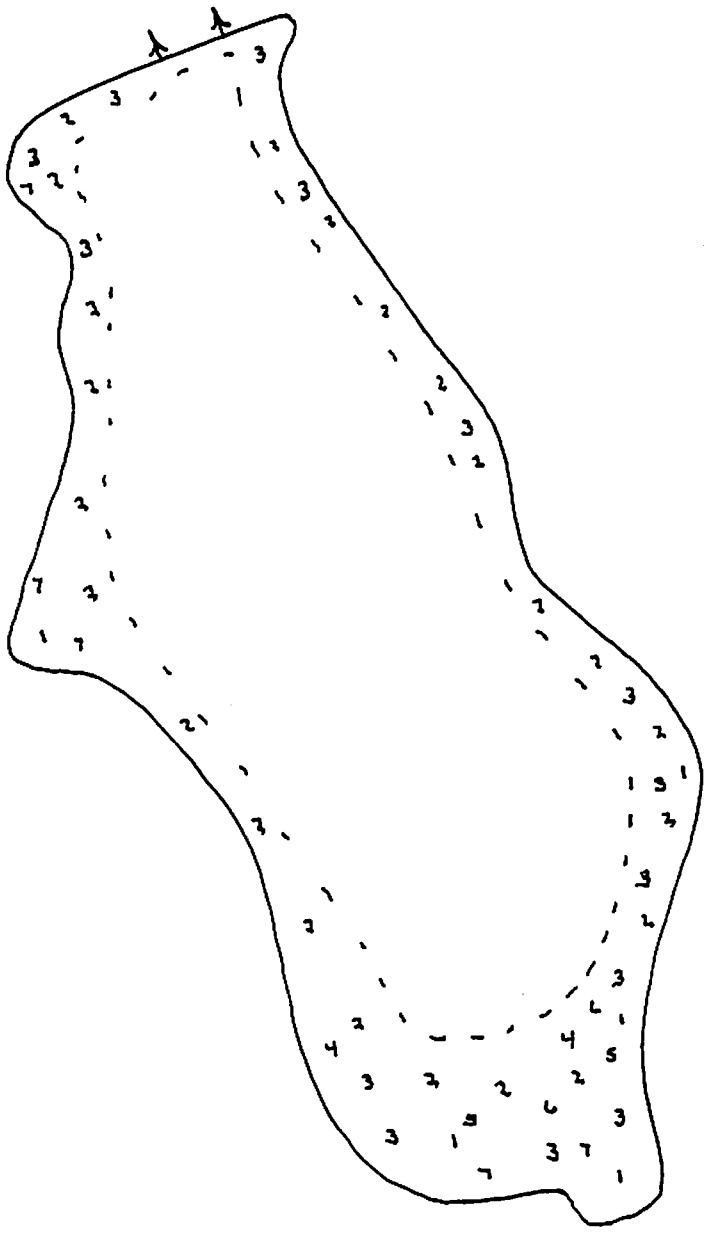


Benthic Station Number 2

Scale 1:317

BEAVER DAM POND

Submersed Aquatic Plant Map with Key



Submersed aquatic population was classified as medium out to 8 foot depth line. Dotted line 8 foot depth line.

Scale 1 : 317

SUBMERSED AQUATIC PLANTS

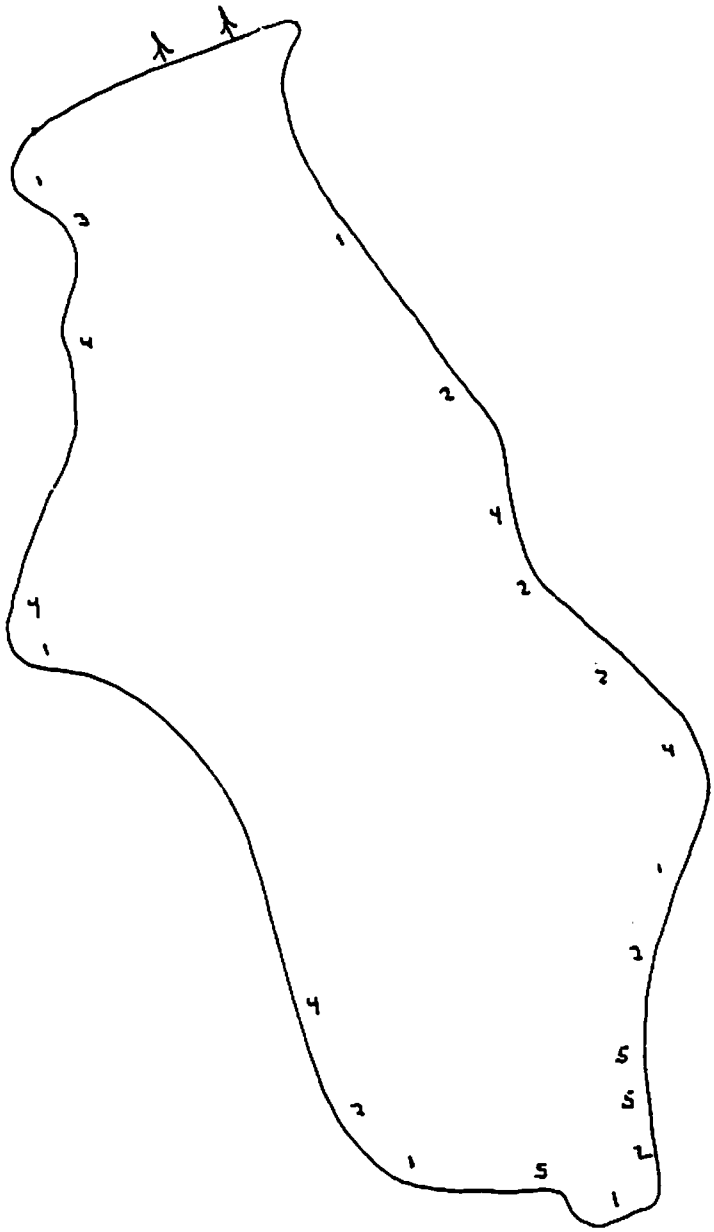
LATIN	COMMON	MAP NUMBER
Potamogeton	Pondweed	
Potamogeton Americanus		
Potamogeton Ampl. Folius	Large Leaf Pondweed	
Potamogeton Crispus	Curly Leaf Pondweed	
Potamogeton Diversifolius	Waterthread Pondweed	6
Potamogeton Filiformus		
Potamogeton Filiosus	Leafy Pondweed	5
Potamogeton Gramineus	Variable Pondweed	
Potamogeton Natans	Floating Brown Leaf	7
Potamogeton Nodosus	American Pondweed	
Potamogeton Pectinatus	Sago Pondweed	
Potamogeton Praelongus	White Stem Pondweed	
Potamogeton Richardsonii	Richardson Pondweed	
Potamogeton Robinsii		
Potamogeton Vaginatus	Giant Pondweed	
Najas	Bushy Pondweed	4
Zannichellia	Horned Pondweed	
Elodea	Waterweed	
Ranunculus	Water Buttercup	
Ceratophyllum D.	Coontail	1
Myriophyllum	Water Milfoil	2
Alisma	Waterplantain	
Heteranthera D.	Water Star Grass; Mud Plantain	
Nasturtium	Water, Cress	
Utricularia	Bladderwort	3
Vallisneria	Wild Celery	

Addenda

	Algae
Chlorophyceae	Green Algae
Unicellular	
Filamentous	
Cyanophyceae	Blue Green Algae
Unicellular	
Filamentous	

BEAVER DAM POND

Emersed Aquatic Plant Map with Key



Emersed aquatic plant population was classified as sparse.

Scale 1:317

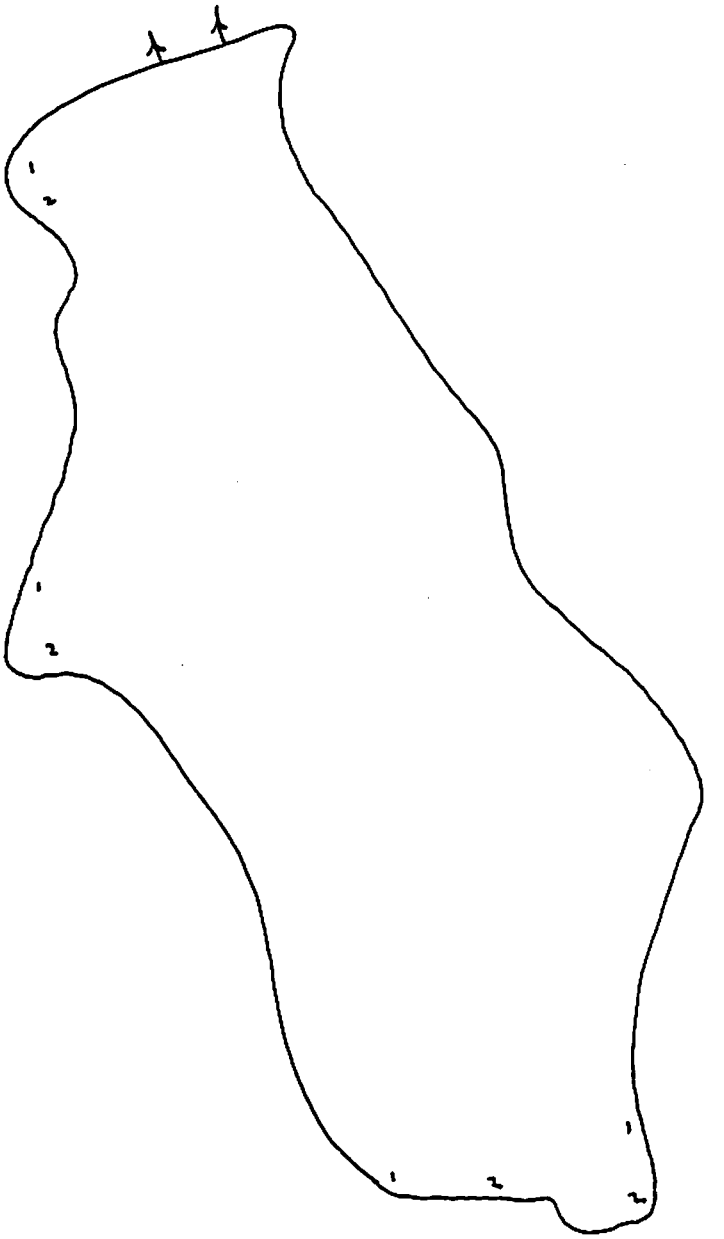
EMERSED AQUATIC PLANTS

LATIN	COMMON	MAP NUMBER
Peltandra	Arrow Arum	1
Pontederia	Pickerel Weed	
Sagittaria	Arrowhead; Duck Potatoe	
Polygonum	Watersmart Weed	2
Typha	Cattail	3
Eleocharis	Spike Rush Sedge	4
Scirpus	Bulrush Sedge	5
Juncaceae	Juncus Rush	6

Addenda

BEAVER DAM POND

Floating Aquatic Plant Map with Key



Floating aquatic plant population was classified as sparse.

scale 1:317

FLOATING AQUATIC PLANTS ATTACHED

LATIN	COMMON	MAP NUMBER
Nuphar	Cow Lily, Yellow Water Lily, Spatterdock	
Nymphaea	Water Lily, White Water Lily	1
Brasenia	Watershield	2

Addenda

FLOATING AQUATIC PLANTS - UNATTACHED

LATIN	COMMON	MAP NUMBER
Lemna	Duckweed	
Spirodelia	Big Duckweed	
Wolffia	Watermeal	

Addenda

BEAVER DAM

	IN LAKE STATION 1	2	3	OUTFALL 1	2	3	SOURCES 1	2	3
Total P	.13	.12	.12						
Nitrate (N)	.07	.09	.09						
Free Acid	0	0	0						
Total Acidity	0	0	0						
Alkalinity	0	0	0						
DO	12	12	13						
Total Hardness	17	13	18						
CO_2	14	14	15						
Ph	7.0	7.0	6.9						
Temp (C+F) 1' Levels	48	49	49						
Secchi	10'	11'	11'						

Heavy Metals

Zn	.011
CD	ND
Sn	ND
Au	.030
Fe	.053
Po	
AL	.133
Cu	.041
Ni	.232
AG	

Benthos

Total P	8.1 mg/Kg	Dry
Total Nitrogen	9.2 mg/Kg	Dry
Total Volatile Solids (%)	1.6	
Percent Solids	63.1	
Total Kjeldahl Nitrogen (mg/kg)	11.5 mg/Kg	Dry

All figures in mg/L unless otherwise noted.

BLACK JIMMY POND

Using a modified trophic index, Black Jimmy Pond ranks 12.

Black Jimmy is a warm water, spring fed, non-stratified kettlehole with a maximum depth of 27 feet.

The submersed macrophyte population was of medium density out to the 8 foot contour line with the predominant species being Bladderwort.

The emergent macrophyte population was classfied as sparse with Pickerel Weed being the dominant species.

The Secchi Disc reading was 12'.

The phosphate reading was high and the nitrate reading was acceptable.

Number of homes affecting impoundment - 2.

Cranberry bogs affecting pond - none.

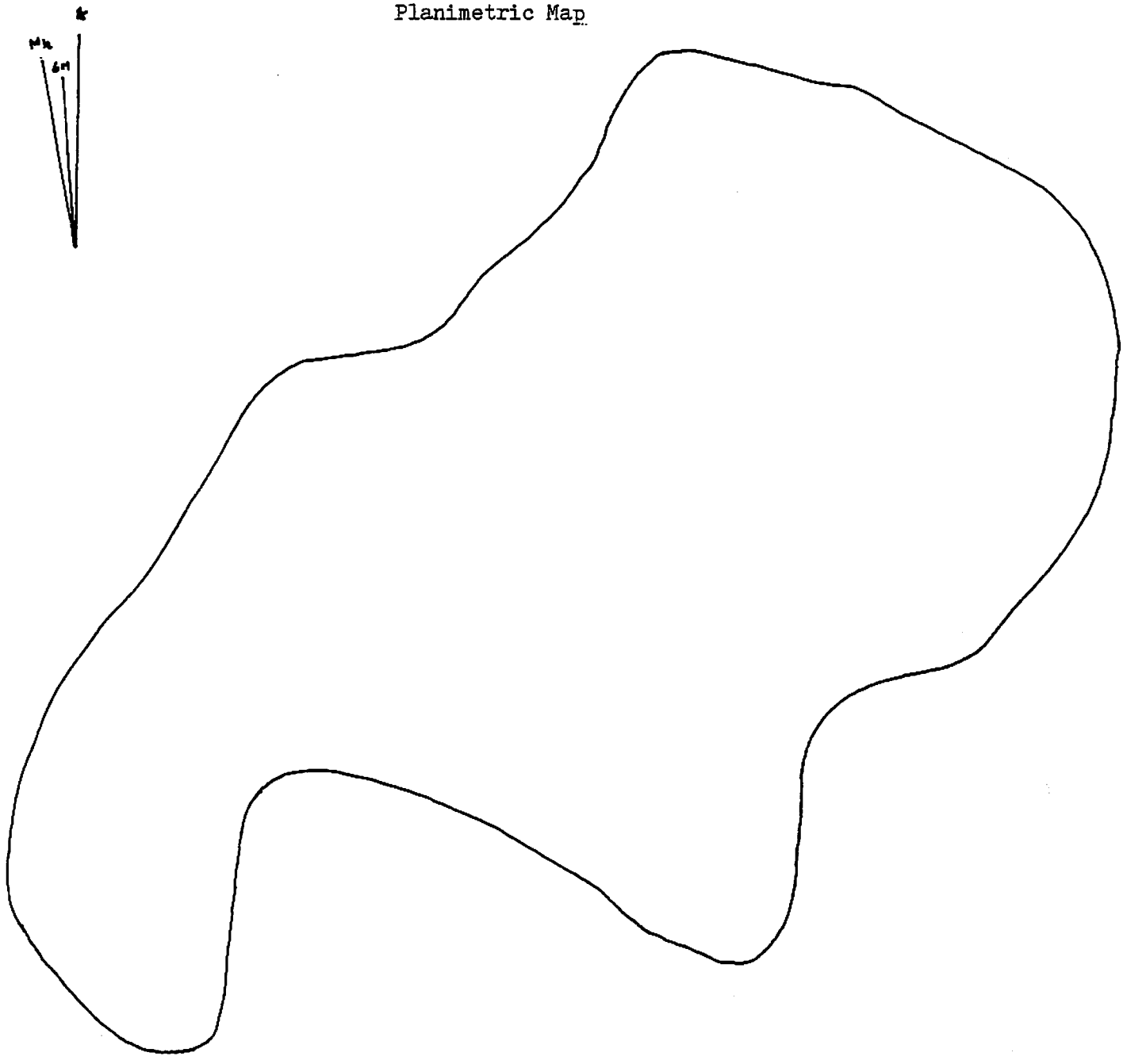
Pond is rated as mesotrophic.

Problems: Camp Clark, a "Y" camp, is located on the North shore. With the steep banks of this impoundment and lack of sewage lines, the nutrient loading seems most likely to be at this location. The soil series coupled with the steep banks certainly contributes to the cultural impact.

This trophic state indicates the presence of nutrient enrichment of the pond.

BLACK JIMMY POND

Planimetric Map



Black Jimmy Pond

Plymouth, Mass.
Watershed: coastal
Acres 11 - 4.46 H.
Altitude: 36' - 10.9M
Water type: warm - cold
Pond type: kettlehole
Transparency 12' 3.66M.
Water color: clear
Pond use: Recreational; aesthetic

Topo sheet Sagamore
USGS map 1:24000 1964

Position Topo Map
up 14.5 R .6

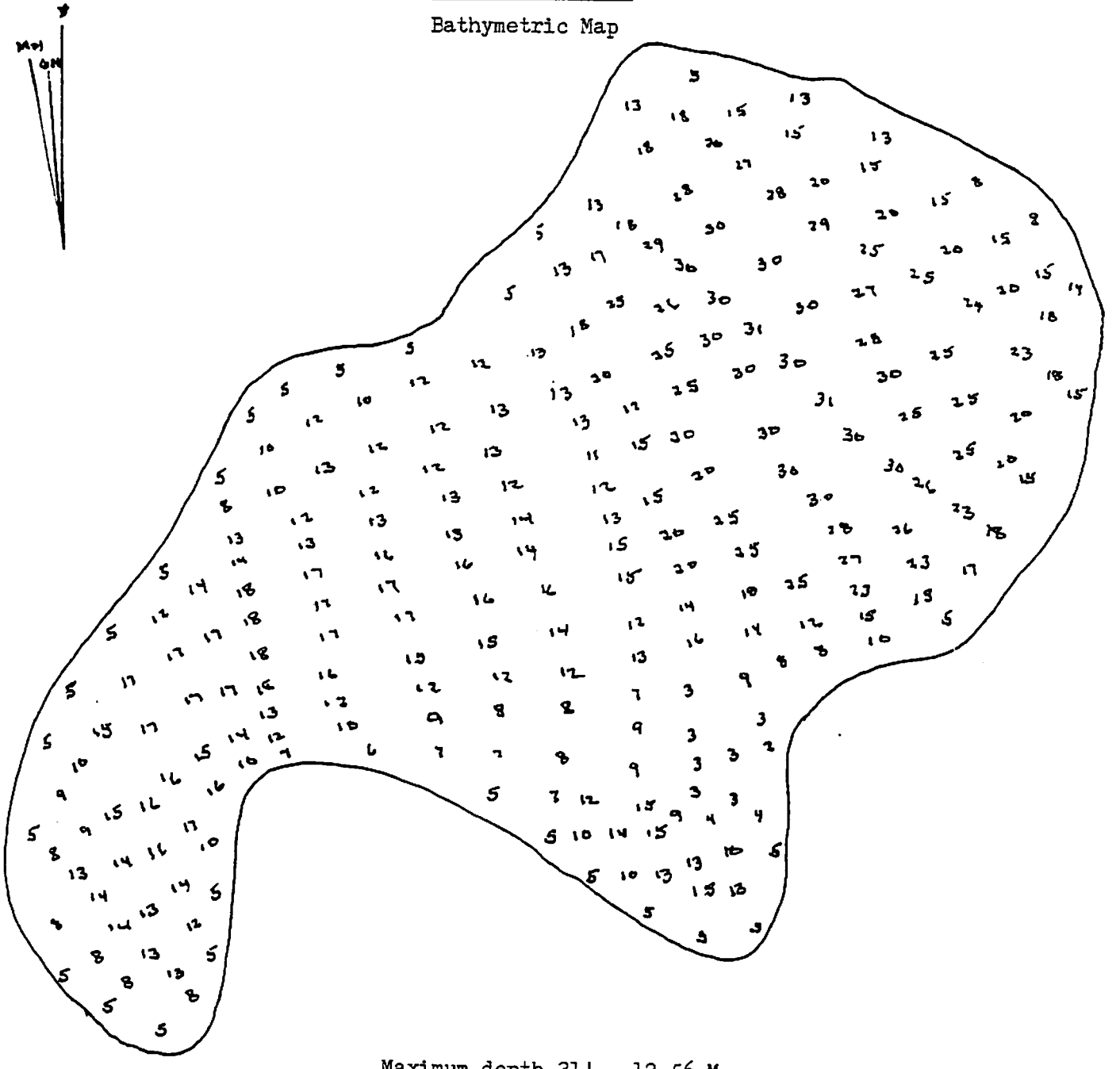
Shoreline distance 2640' - 804.7 M.
Bottom type - sand,gravel covered with organic layer
Shoreline 90% high 10% intermediate

Stratified - no

Scale 1:130

BLACK JIMMY POND

Bathymetric Map

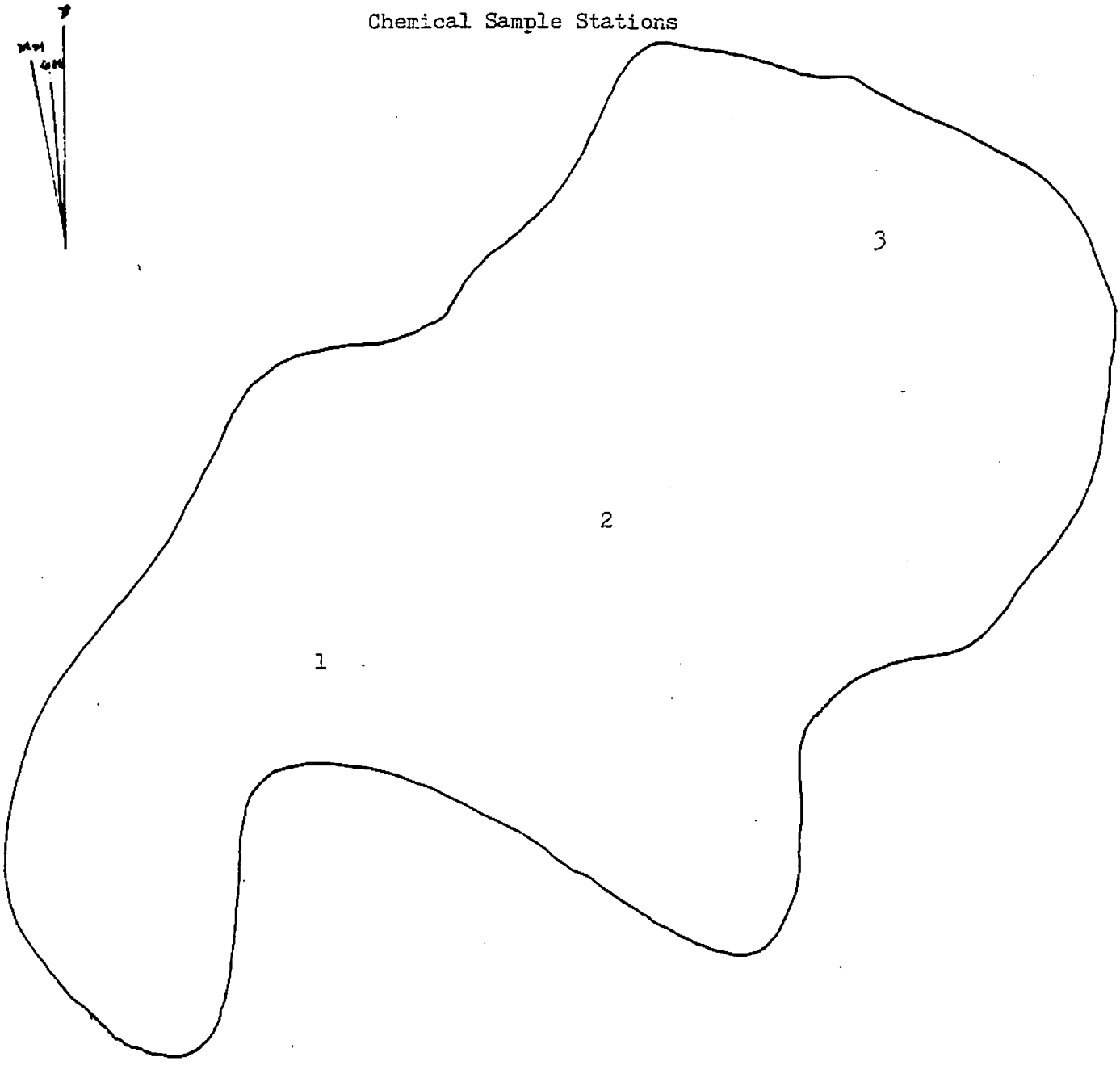


Maximum depth 31' - 12.56 M
Mean depth 17' 6.89 M
Surface area 11 A 4.46 H.
Total acre feet 187
Total gallons 60,930,023

Scale 1 : 130

BLACK JIMMY POND

Chemical Sample Stations

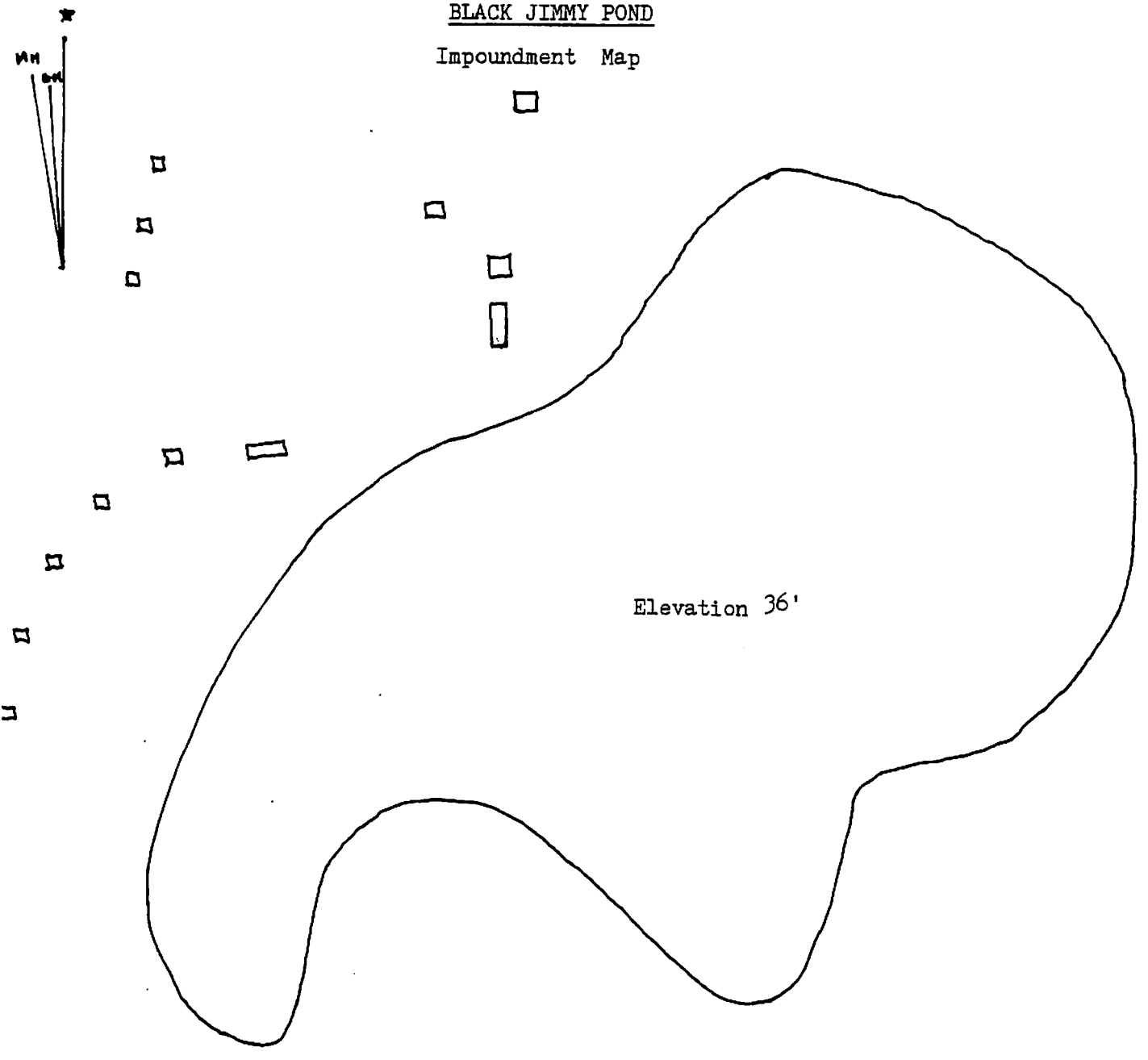


Benthic Station number 2

Scale: 1:130

BLACK JIMMY POND

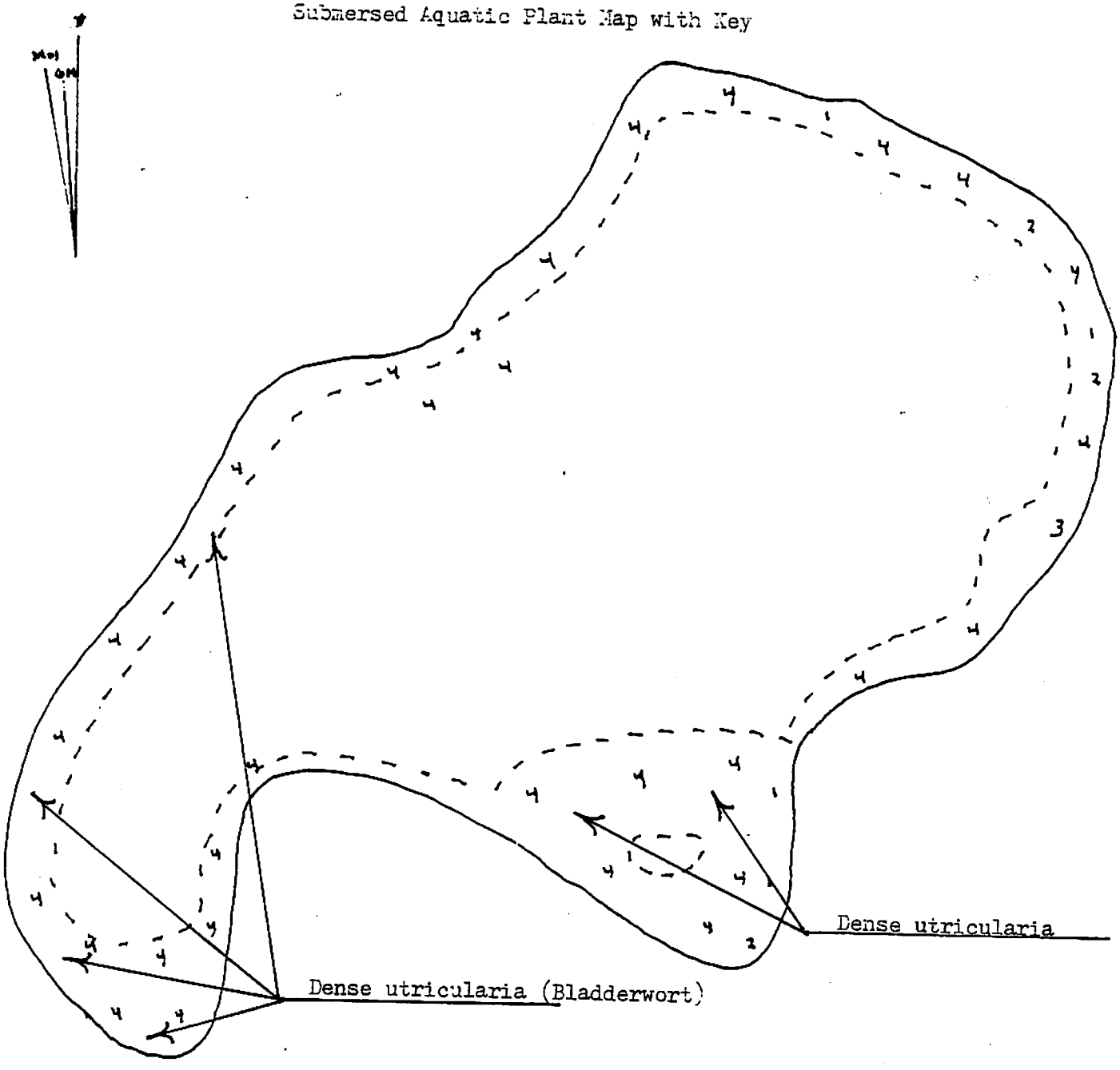
Impoundment Map



Pond type: kettlehole
Tributary: none
Outfall: none
Overland flow: none
Groundwater and underground aquifers - primary source
Rainfall secondary "
Surface run-off secondary "
Agricultural practices directly affecting impoundment - none
Industrial Sources " " " - none known
Possible sources of nutrient influx
YMCA camp location of buildings shown
Shoreline = 90% high
elevation 36

BLACK JIMMY POND

Submersed Aquatic Plant Map with Key



Dense uticularia out to 10 foot contour line ----------

Scale 1 : 130

SUBMERSED AQUATIC PLANTS

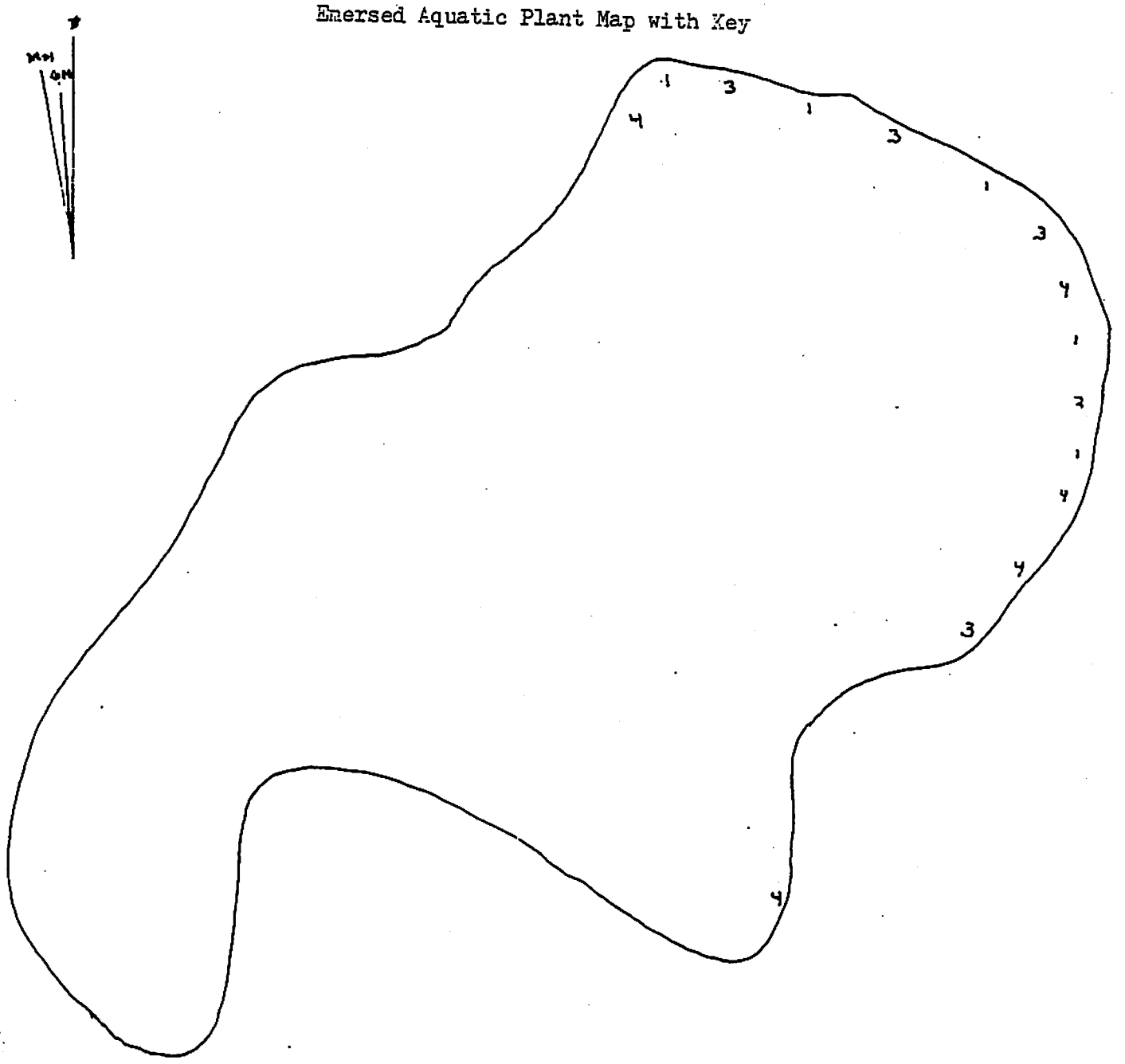
LATIN	COMMON	MAP NUMBER
Potamogeton	Pondweed	
Potamogeton Americanus		
Potamogeton Ampl. Folius	Large Leaf Pondweed	
Potamogeton Crispus	Curly Leaf Pondweed	
Potamogeton Diversifolius	Waterthread Pondweed	1
Potamogeton Filiformus		
Potamogeton Filiosus	Leafy Pondweed	
Potamogeton Gramineus	Variable Pondweed	
Potamogeton Natans	Floating Brown Leaf	2
Potamogeton Nodosus	American Pondweed	
Potamogeton Pectinatus	Sago Pondweed	3
Potamogeton Praelongus	White Stem Pondweed	
Potamogeton Richardsonii	Richardson Pondweed	
Potamogeton Robinsii		
Potamogeton Vaginatus	Giant Pondweed	
Najas	Bushy Pondweed	
Zannichellia	Horned Pondweed	
Elodea	Waterweed	
Ranunculus	Water Buttercup	
Ceratophyllum D.	Coontail	
Myriophyllum	Water Milfoil	
Alisma	Waterplantain	
Heteranthera D.	Water Star Grass; Mud Plantain	
Nasturtium	Water, Cress	
Utricularia	Bladderwort	4
Vallisneria	Wild Celery	

Addenda

	Algae
Chlorophyceae	Green Algae
Unicellular	
Filamentous	
Cyanophyceae	Blue Green Algae
Unicellular	
Filamentous	

BLACK JIMMY POND

Emersed Aquatic Plant Map with Key



Emersed plant population was classified as sparse.

Scale 1 : 130

EMERSED AQUATIC PLANTS

LATIN	COMMON	MAP NUMBER
Peltandra	Arrow Arum	
Pontederia	Pickerel Weed ----------	1
Sagittaria	Arrowhead; Duck Potatoe	
Polygonum	Watersmart Weed	
Typha	Cattail ----------	2
Eleocharis	Spike Rush Sedge ----------	3
Scirpus	Bulrush Sedge ----------	4
Juncaceae	Juncus Rush	

Addenda

CLAM PUDDING

Using a modified trophic level, Clam Pudding ranks 11.

Clam Pudding Pond is a kettlehole, warm water, spring fed, non-stratified pond, with maximum depth of 18 feet.

The macrophyte population was sparse with quillworts being the dominant species.

The microphyte population was rated as sparse with filamantous green algae the dominent species.

The Secchi Disc reading was 14'.

The phosphate reading was over the critical quantity of .045 ppm.

The pond was rated as mesotrophic. This tropic state indicates the presence of nutrient enrichment of the pond.

The pond is under lock and key surrounded by a chain link fence .

Homes - 3,000' to nearest house.

Agriculture impact - 8,000' to nearest cranberry bog - no drains.

Surrounded by wooded area - mostly comifers.

2 - 3 families use it for periodic picnicing and swimming in spite of the above; the phosphate readings were high.

The ph of 6.1 is approaching the high acid range.

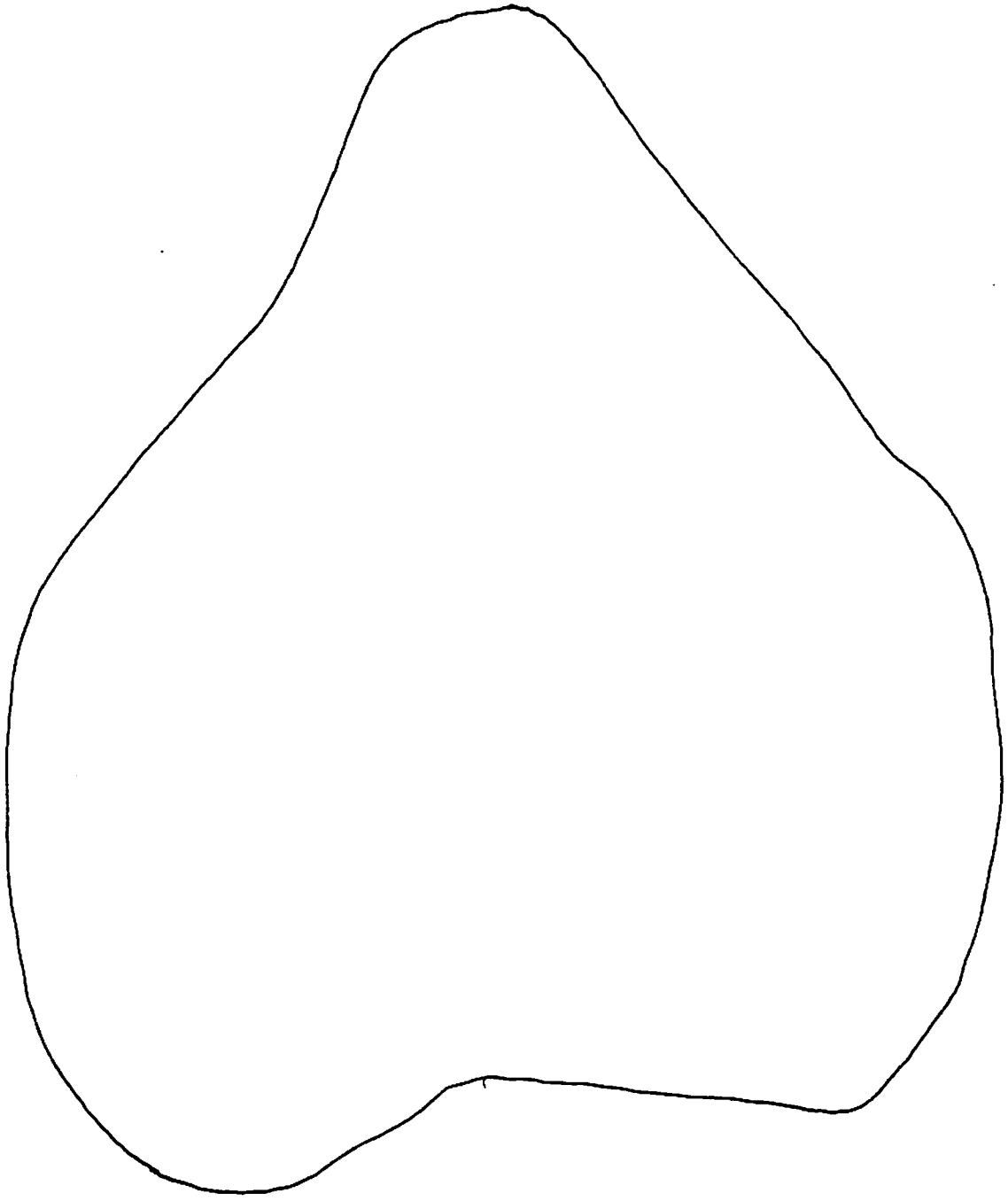
Recommendations for future testing to:

Check for phosphates periodically to record changes.

Check ph to see possible effects of acid rain.

CLAM PUDDING POND

Planimetric Map



lam Pudding

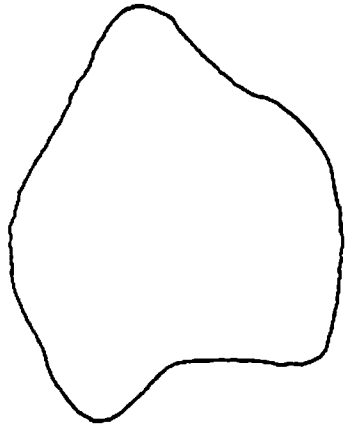
lymouth, Mass.
atershed: coastal
cres: 10 4.05 H.
ltitude: 67 20.42M.
ater type: warm - transparency 14' - 4.27 M
ond type: kettlehole
atercolor:
ond use: recreation
opo sheet USGS M Manomet 1962 1:24000
osition topo sheet - up .7 R 5.2

Stratified: no
Reclaimed: no
Stocked: no
Shoreline distance 2112 643.7 M
Bottom type
Shoreline intermediate 90% low 10%

Scale 1: 116

CLAM PUDDING POND

Impoundment Map

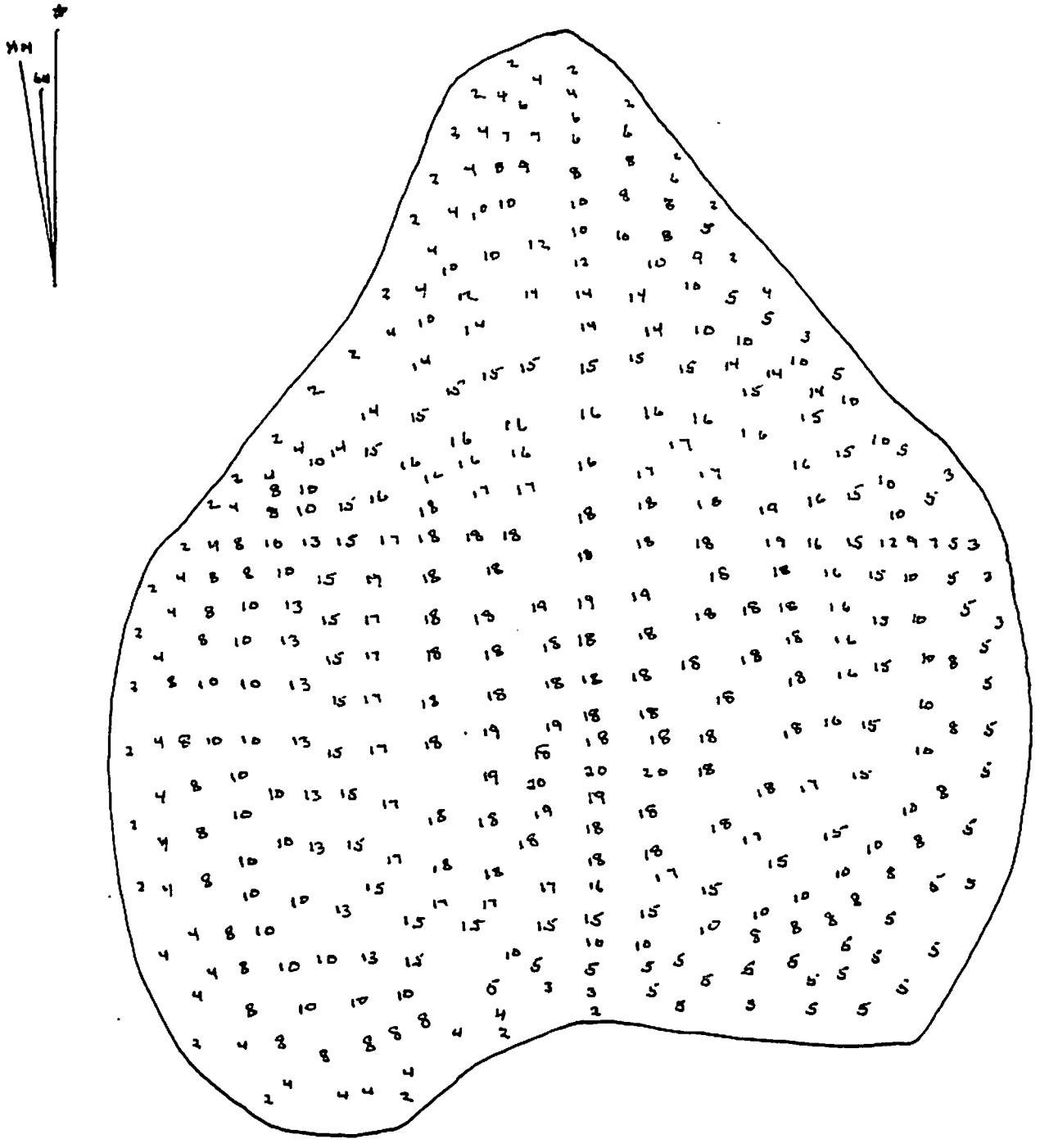


Pond type: Natural, kettlehole
Tributary: none
Outfall: none
Overland flow: none
Groundwater and underground aquifer - primary sources
Rainfall secondary
Surface runoff secondary
Agricultural practices directly affecting impoundment: none
Industrial " " " " none
Possible sources of nutrient influx - groundwater
Shoreline intermediate 90% low 10%
Altitude 67 20.42 M

Scale 1:395

CLAM PUDDING POND

Bathymetric Map

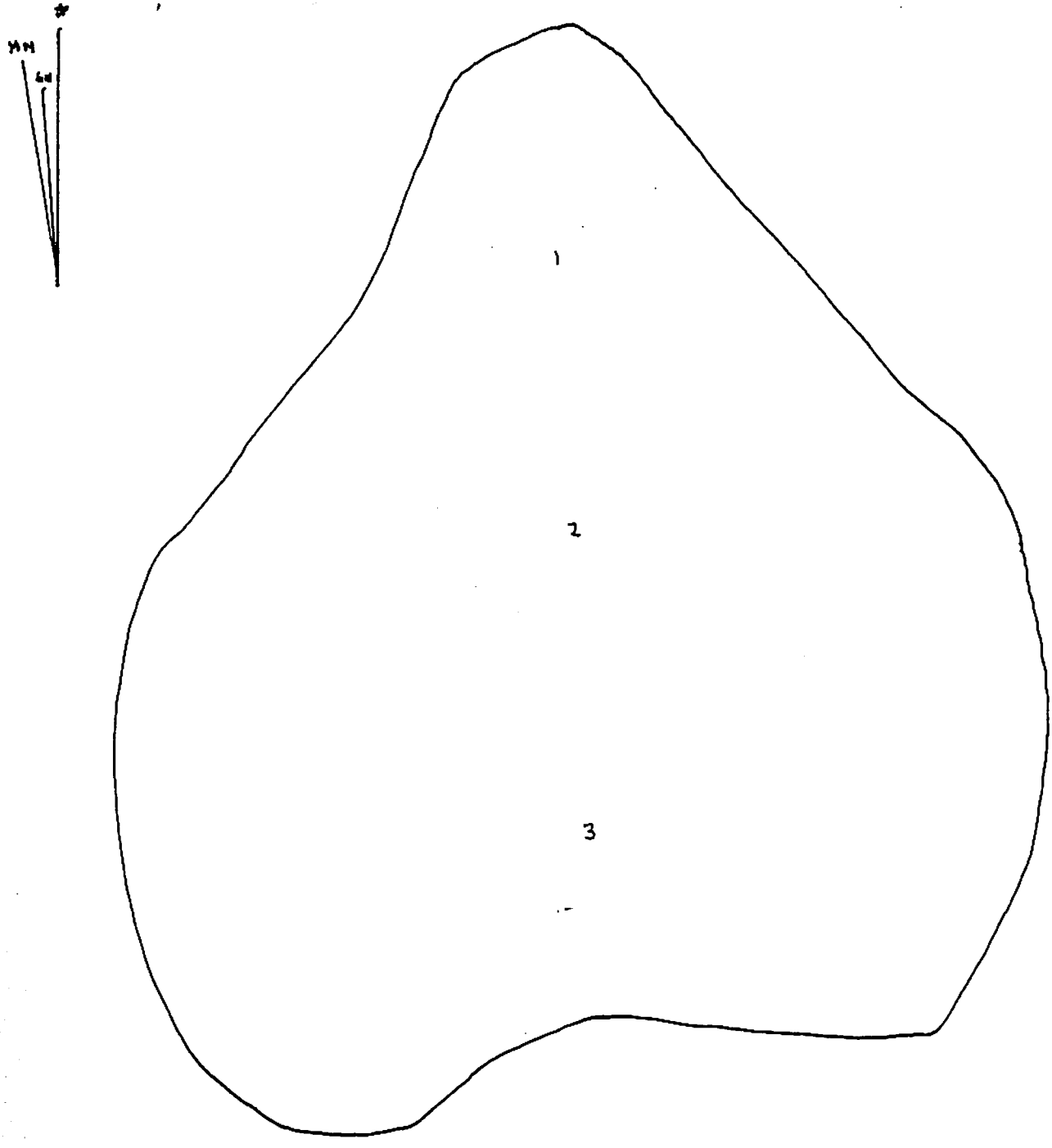


Maximum depth 20' 6.1 M
Mean depth 15' 4.6
Surface area 10 A 4.05 H
Total acre feet 150 AF
Total gallons 48,874,350

Scale 1:115

CLAM PUDDING POND

Chemical Sample Station

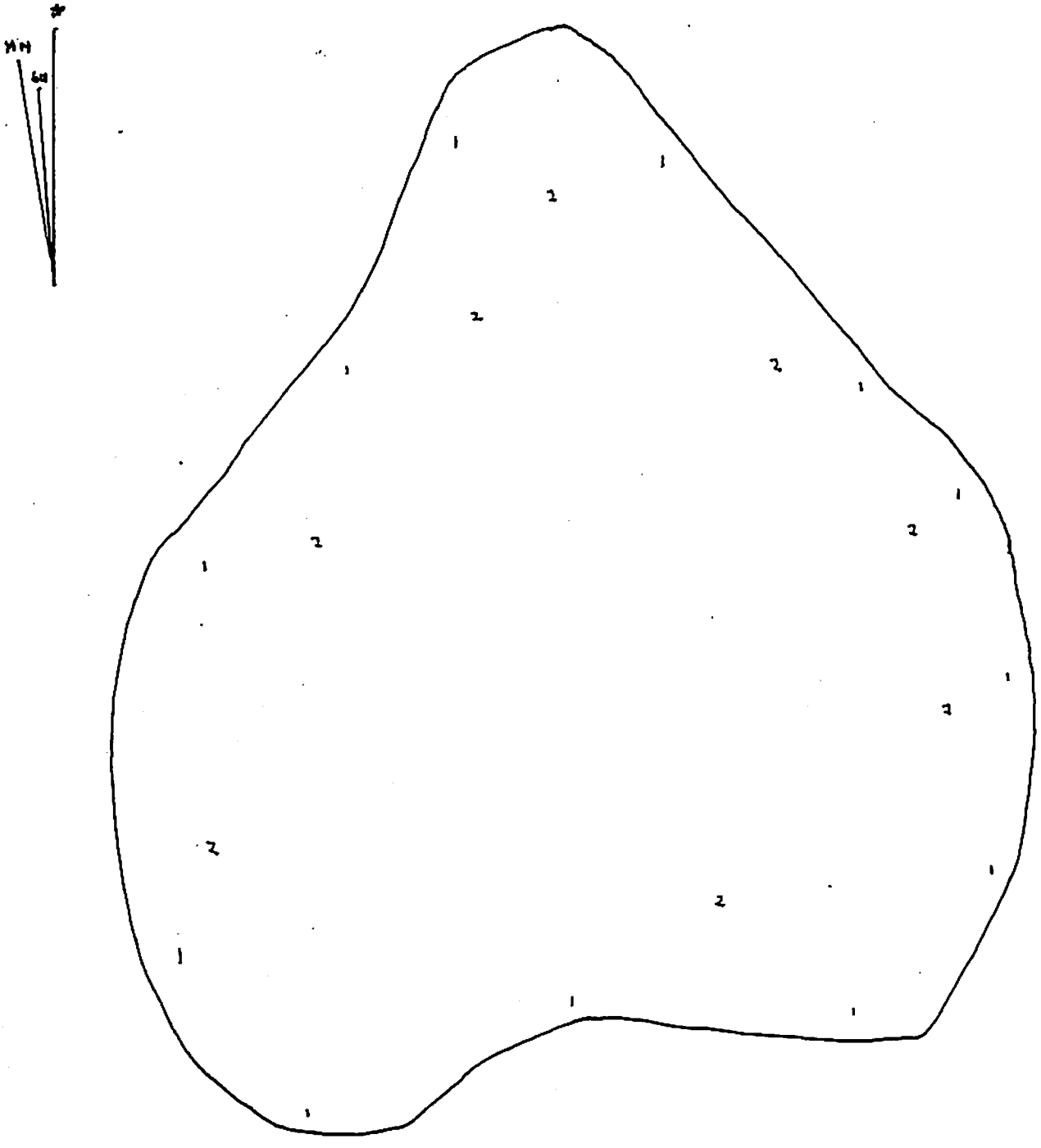


Benthic Station Number 2

Scale 1:115

CLAM PUDDING POND

Submersed Aquatic Plant Map with Key



All submersed aquatic plant population was classified as sparse.

Scale 1:115

SUBMERSED AQUATIC PLANTS

LATIN	COMMON	MAP NUMBER
Potamogeton	Pondweed	
Potamogeton Americanus		
Potamogeton Ampl. Folius	Large Leaf Pondweed	
Potamogeton Crispus	Curly Leaf Pondweed	
Potamogeton Diversifolius	Waterthread Pondweed	
Potamogeton Filiformus		
Potamogeton Filiosus	Leafy Pondweed	
Potamogeton Gramineus	Variable Pondweed	
Potamogeton Natans	Floating Brown Leaf	
Potamogeton Nodosus	American Pondweed	
Potamogeton Pectinatus	Sago Pondweed	
Potamogeton Praelongus	White Stem Pondweed	
Potamogeton Richardsonii	Richardson Pondweed	
Potamogeton Robinsii		
Potamogeton Vaginatus	Giant Pondweed	
Najas	Bushy Pondweed	
Zannichellia	Horned Pondweed	
Elodea	Waterweed	
Ranunculus	Water Buttercup	
Ceratophyllum D.	Coontail	
Myriophyllum	Water Milfoil	
Alisma	Waterplantain	
Heteranthera D.	Water Star Grass; Mud Plantain	
Nasturtium	Water, Cress	
Utricularia	Bladderwort	
Vallisneria	Wild Celery	

Addenda

	Algae	
Chlorophyceae	Green Algae	2
Unicellular		
Filamentous		
Cyanophyceae	Blue Green Algae	
Unicellular		
Filamentous		
Isoetes	quillwort	1

BLACK JIMMY

	IN LAKE STATION 1	2	3	OUTFALL 1	2	3	SOURCES 1	2	3
Total P	.09	.10	.08						
Nitrate (N)	.03	.04	.06						
Free Acid	.001	.001	.001						
Total Acidity	.001	.001	.001						
Alkalinity	0	0	0						
DO	12	12	12						
Total Hardness	18	18	18						
CO_2	10	11	10						
Ph	6.8	6.8	6.7						
Temp (C+F) 1' Levels	51(10C)	48	44						
Secchi	12'	12'	12'						

Heavy Metals

Zn	.011
CD	ND
Sn	.424
Au	.019
Fe	.025
Po	
AL	.060
Cu	.063
Ni	.030
AG	

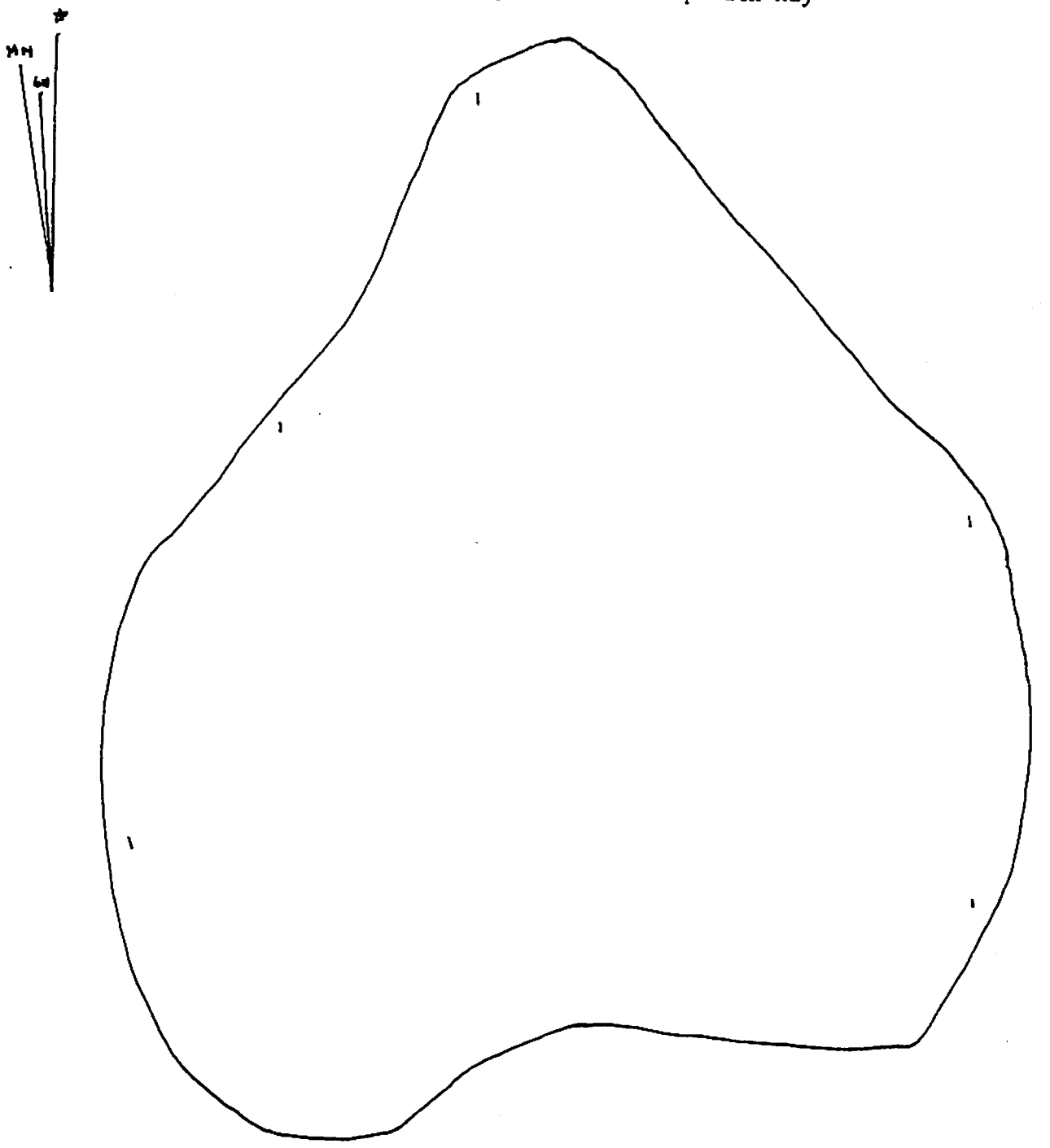
Benthos

Total P	4.3 mg/Kg Dry
Total Nitrogen	3.6 mg/Kg Dry
Total Volatile Solids (%)	.91
Percent Solids	70.6
Total Kjeldahl Nitrogen (mg/kg)	6.5

All figures in mg/L unless otherwise noted.

CLAM PUDDING POND

Emersed Aquatic Plant Map with Key



All emersed aquatic plants were classified as sparse.

Scale 1:115

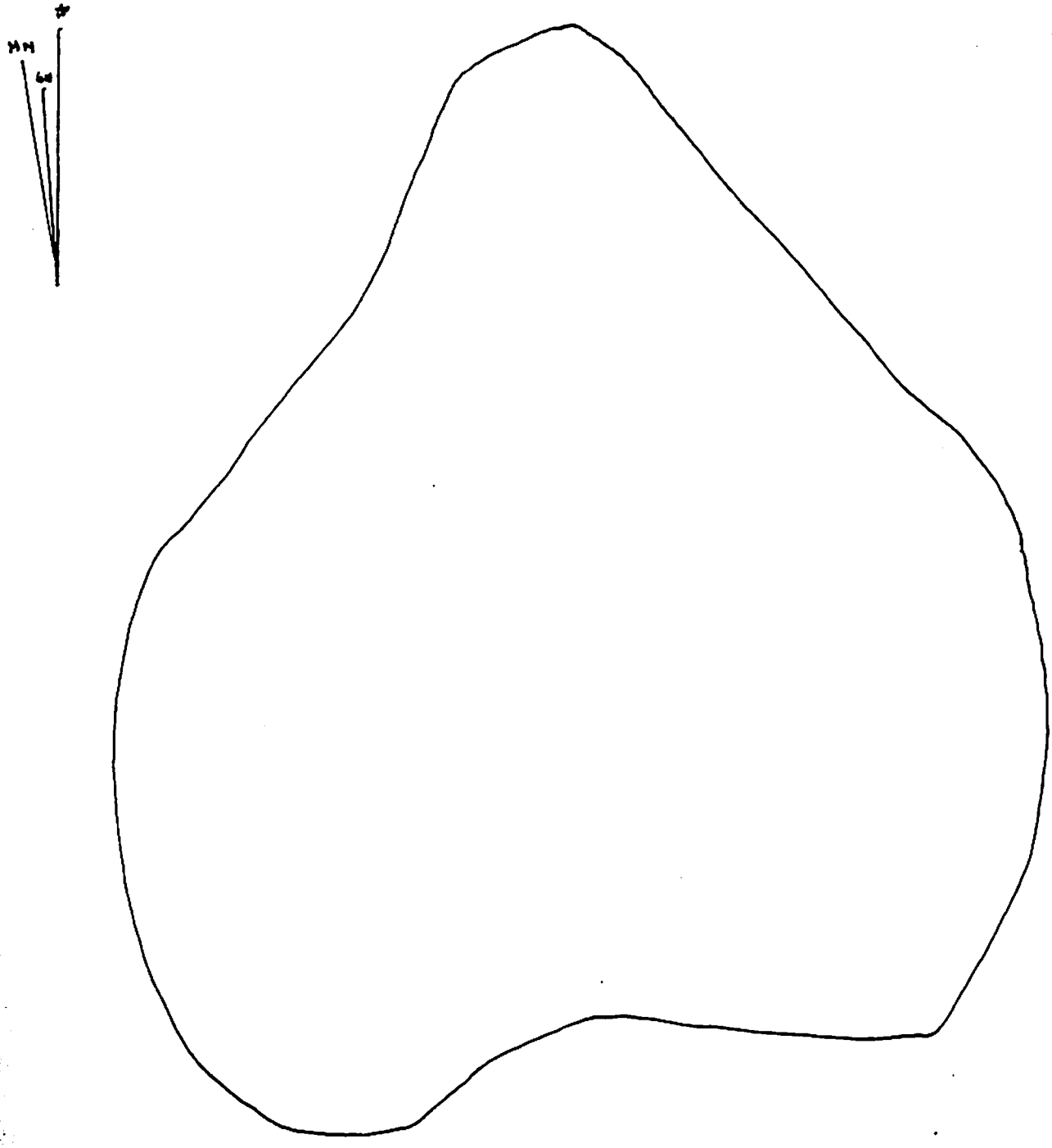
EMERSED AQUATIC PLANTS

LATIN	COMMON	MAP NUMBER
Peltandra	Arrow Arum	
Pontederia	Pickerel Weed	
Sagittaria	Arrowhead; Duck Potatoe	
Polygonum	Watersmart Weed	
Typha	Cattail	
Eleocharis	Spike Rush Sedge	1
Scirpus	Bulrush Sedge	
Juncaceae	Juncus Rush	

Addenda

CLAM PUDDING POND

Floating Aquatic Plant Map with Key



Floating aquatic plants were non-existent.

Scale 1:115

CLAM PUDDING

	IN LAKE STATION 1	2	3	OUTFALL 1	2	3	SOURCES 1	2	3
Total P	.09	.08	.09						
Nitrate (N)	.05	.05	.05						
Free Acid	.005	.005	.005						
Total Acidity	.005	.005	.005						
Alkalinity	0	0	0						
DO	12	13	14						
Total Hardness	16	15	14						
CO_2	14	14	12						
Ph	6.1	6.0	6.1						
Temp (C+F) 1' Levels	48	48	46 (F)						
Secchi	14	14	14						
Heavy Metals									
Zn	ND								
CD	ND								
Sn	.012								
Au	.023								
Fe	.018								
Po									
AL	.010								
Cu	.020								
Ni	.013								
AG									
Benthos									
Total P	2.8 mg/Kg Dry								
Total Nitrogen	5.6 mg/Kg Dry								
Total Volatile Solids (%)	.58								
Percent Solids	75.6								
Total Kjeldahl Nitrogen (mg/kg)	7.1 Dry								

All figures in mg/L unless otherwise noted.

DEER POND

Using a modified trophic level index, Deer Pond ranks 34.

Deer Pond is a warm water kettlehole that is aquifer fed and non-stratified, with a maximum depth of 15'. The macrophyte readings were moderate to heavy out to the 10 foot contour line. Milfoil was the target species.

The Secchi Disc reading was 10'

The organic materials on the bottom were classified as moderate.

The phosphate readings were critical and the nitrate readings were permissible.

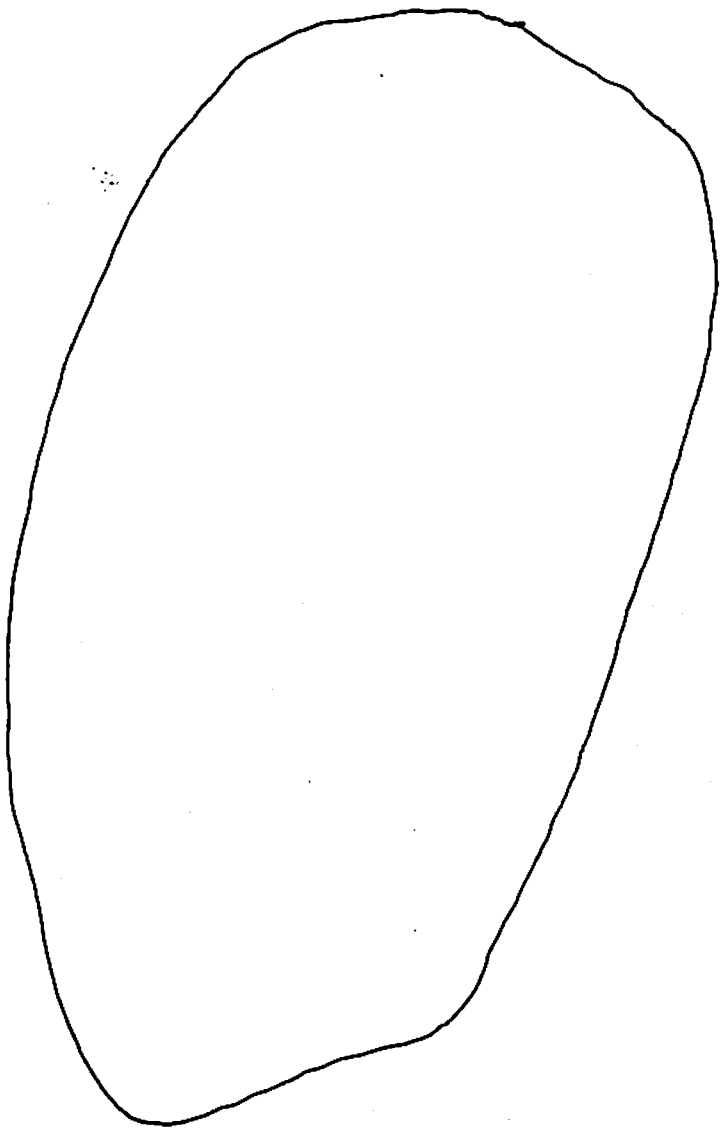
Number of homes affecting impoundment was zero.

The pond was rated as eutrophic.

The pond is used by cranberry growers for flooding and bog release.

DEER POND

Planimetric Map



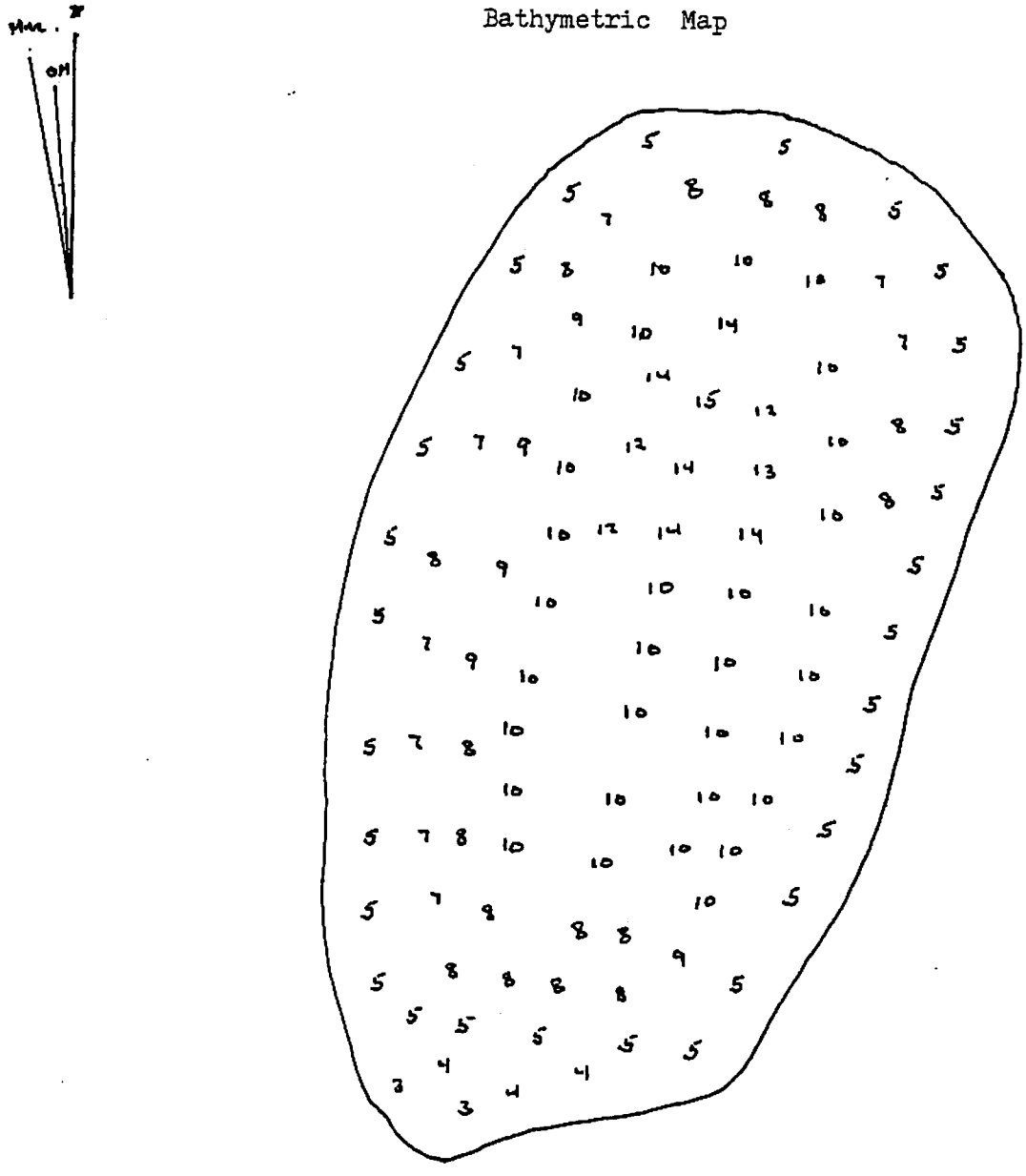
Deer Pond
Plymouth, Mass.
Watershed: Coastal
Acres 11 4.46 H
Altitude 49 14.94 M
Pond Type: Kettlehole
Water type: warm
Transparency 12' 3.66M
Water color: clear
Pond use: irrigation
Topo sheet USGSM Sagamore 1967
Wareham 1972
1:24000
Position Topo sheet up 12.8 R 16.8

Stratified - no
Reclaimed - no
Stocked - no
Shoreline distance 2112 643.7M
Bottom type - sand & gravel covered with organic material
Shoreline intermediate 100%

Scale 1:150

DEER POND

Bathymetric Map

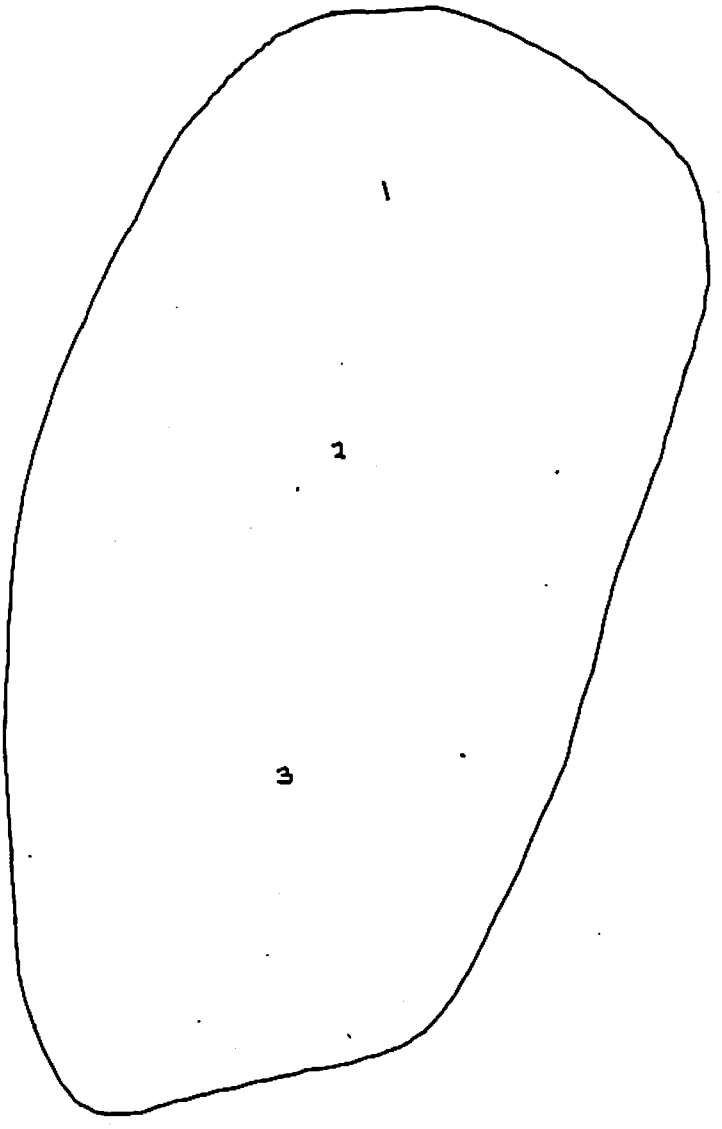


Maximum depth 15 4.57M
Mean depth 8 2.44
Surface area 11 ·4.46 H
Total acre feet 88
Total gallons 28,672,952

Scale 1:150

DEER POND

Chemical Station Map

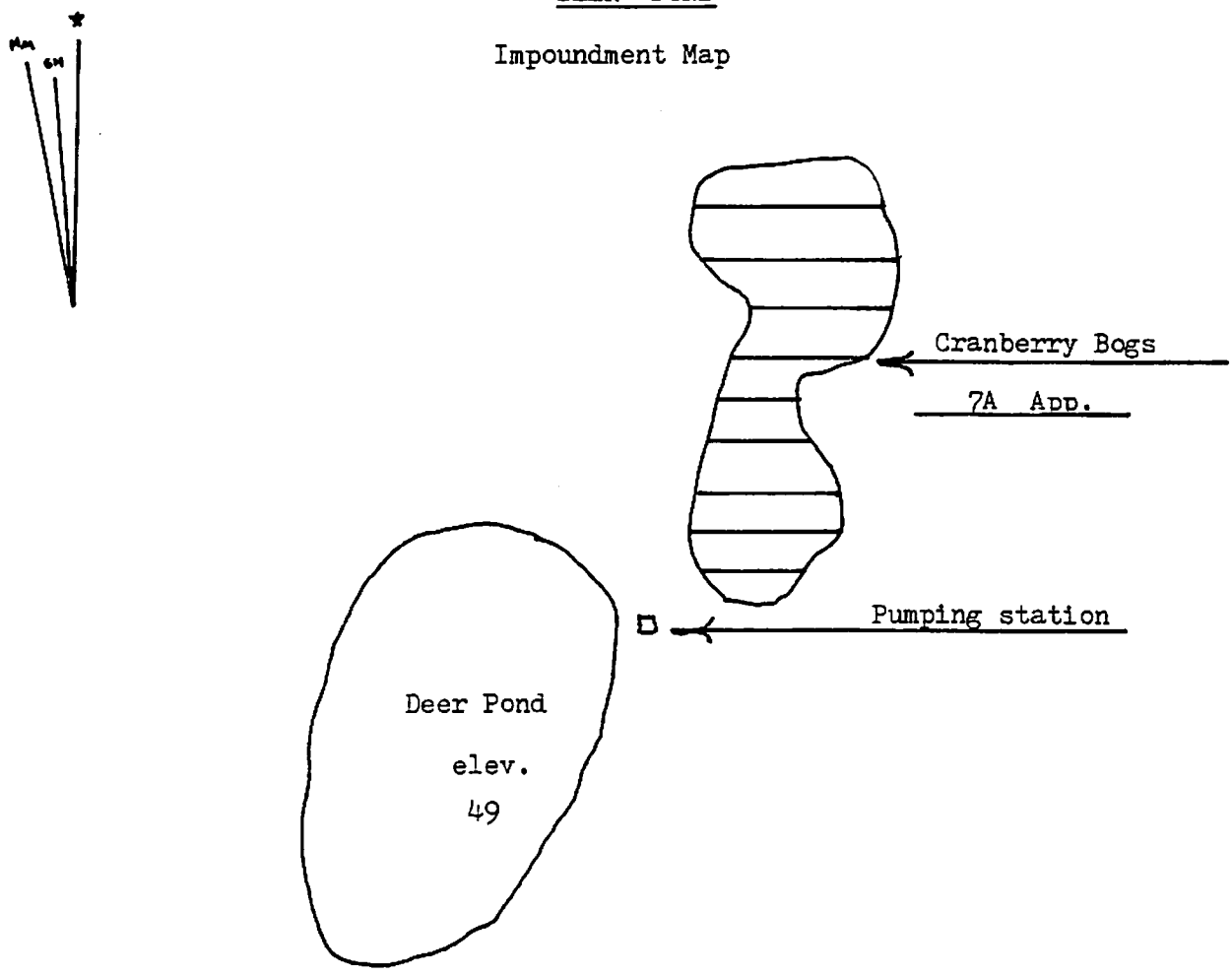


Station 2 Benthic sample station

Scale 1:150

DEER POND

Impoundment Map



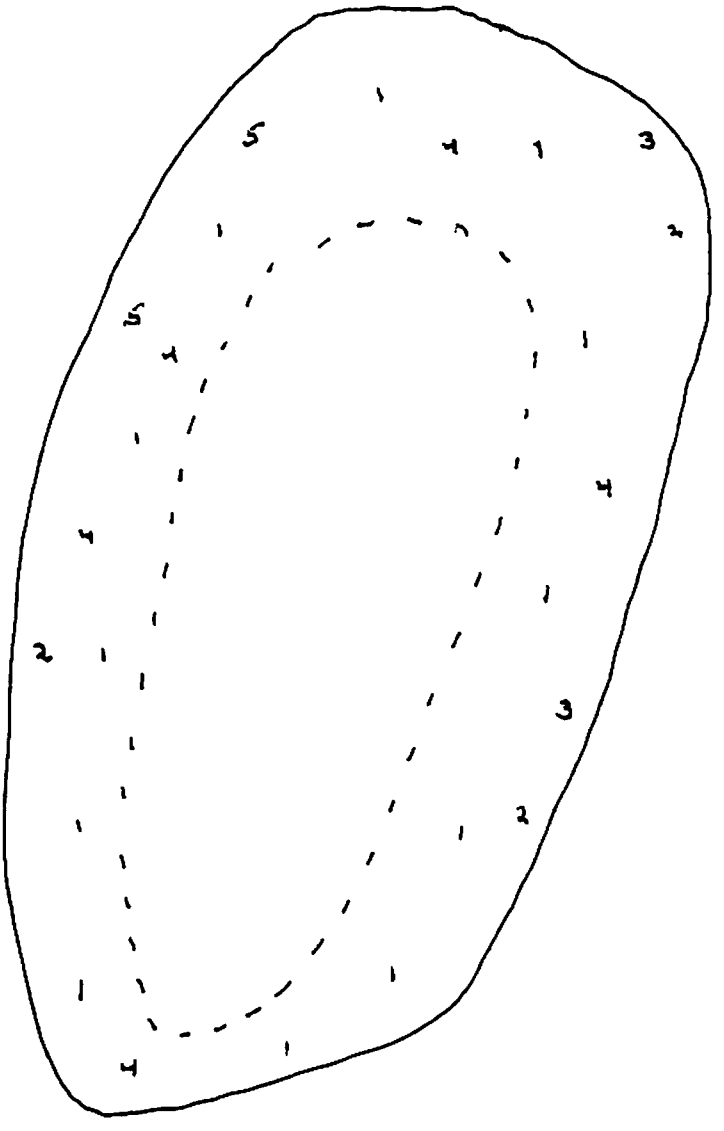
Pond type: Natural kettlehole
Tributary: None
Outfall : None
Overland Flow: Agricultural pumping
Groundwater and underground aquifer: Primary source
Rainfall: Secondary source
Surface run-off: Secondary source
Agriculture practices directly affecting impoundment: 7 A approx.
Industrial " " " " : none
Possible sources of nutrient influx: Agriculture major contributor
sewage none
underground sources - possible

Shoreline intermediate 100%
Altitude 49 14.94 M.

scale 1:300

Deer Pond

Submersed Aquatic Plant Map with Key



Milfoil - Abundant out to 8' contour line
----- = 8 foot depth line

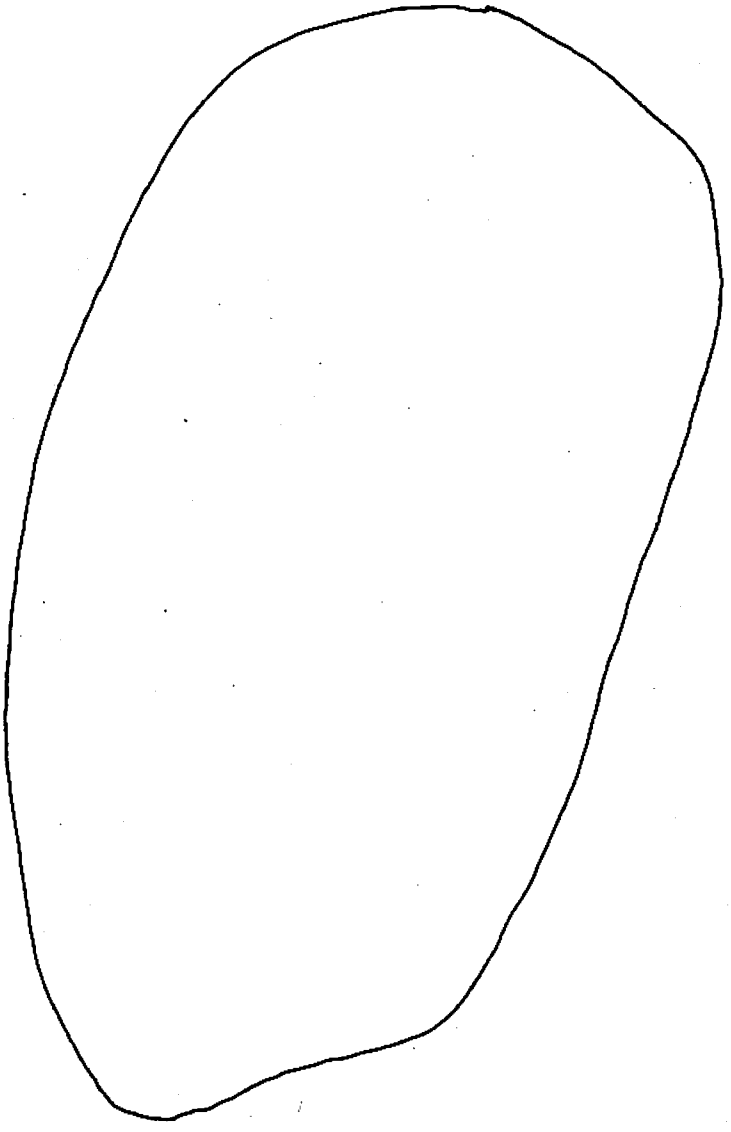
Scale 1:150

SUBMERSED AQUATIC PLANTS

LATIN	COMMON	MAP NUMBER
Potamogeton	Pondweed	
Potamogeton Americanus		
Potamogeton Ampl. Folius	Large Leaf Pondweed	
Potamogeton Crispus	Curly Leaf Pondweed	
Potamogeton Diversifolius	Waterthread Pondweed	
Potamogeton Filiformus		
Potamogeton Filiosus	Leafy Pondweed	
Potamogeton Gramineus	Variable Pondweed	
Potamogeton Natans	Floating Brown Leaf	
Potamogeton Nodosus	American Pondweed	
Potamogeton Pectinatus	Sago Pondweed ----------	2
Potamogeton Praelongus	White Stem Pondweed	
Potamogeton Richardsonii	Richardson Pondweed	
Potamogeton Robinsii		
Potamogeton Vaginatus	Giant Pondweed	
Najas	Bushy Pondweed ----------	3
Zannichellia	Horned Pondweed	
Elodea	Waterweed	
Ranunculus	Water Buttercup	
Ceratophyllum D.	Coontail	
Myriophyllum	Water Milfoil ----------	1
Alisma	Waterplantain ----------	5
Heteranthera D.	Water Star Grass; Mud Plantain	
Nasturtium	Water, Cress	
Utricularia	Bladderwort ----------	4
Vallisneria	Wild Celery	

Addenda

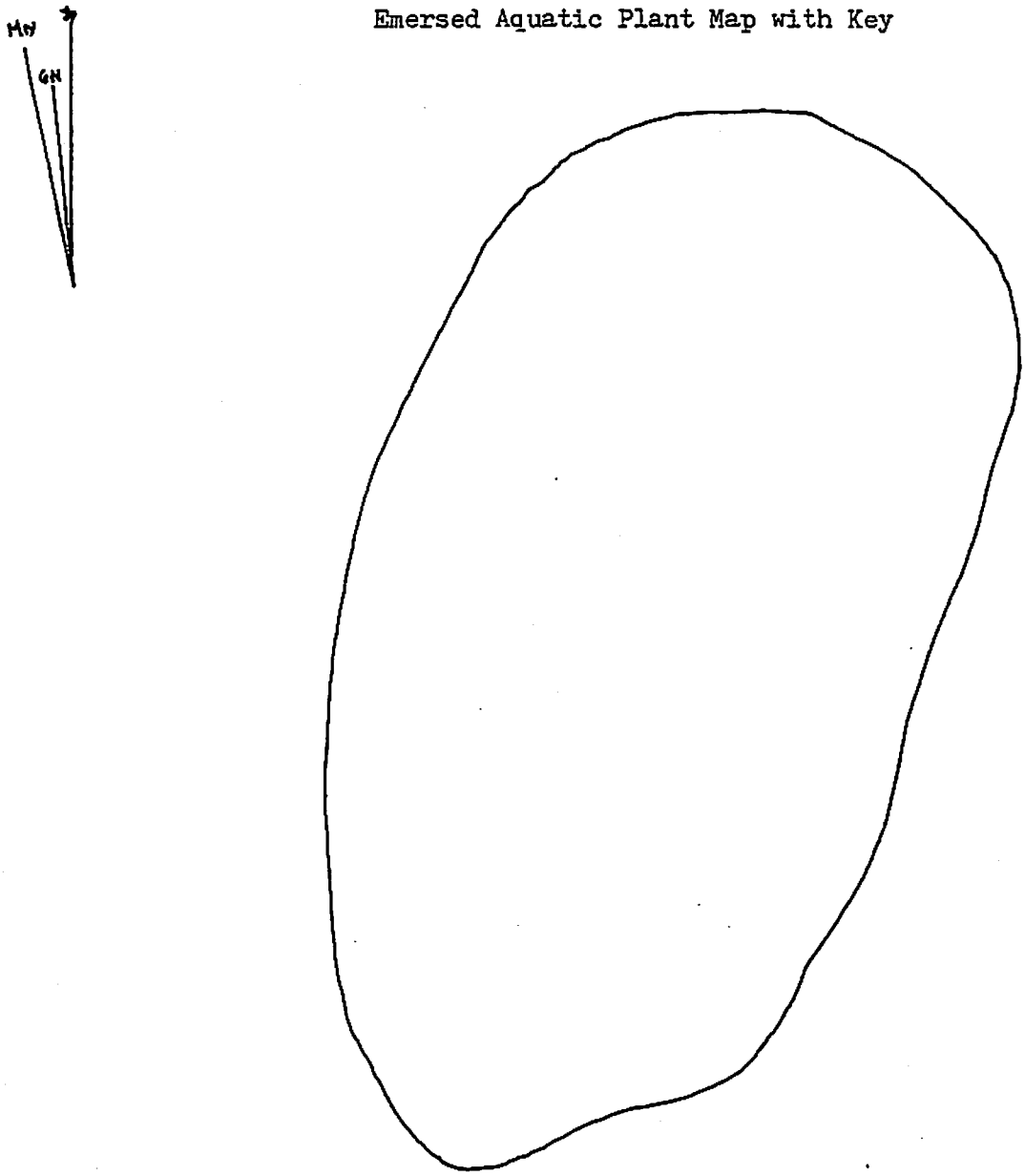
Floating Aquatic Plant Map with Key



No species present at time of survey.

Scale 1:150

Emersed Aquatic Plant Map with Key



No species present at time of survey.

Scale 1:150

DEER

	IN LAKE STATION 1	2	3	OUTFALL 1	2	3	SOURCES 1	2	3
Total P	.17	.19	.17						
Nitrate (N)	.07	.09	.09						
Free Acid	.005	.005	.005						
Total Acidity	.005	.005	.005						
Alkalinity	0	0	0						
DO	10	11	11						
Total Hardness	18	18	18						
CO_2	15	15	14						
Ph	6.2	6.1	6.2						
Temp (C+F) 1' Levels	44	44	44 (F)						
Secchi	10	10	10						

Heavy Metals

Zn	.008
CD	.004
Sn	.950
Au	.010
Fe	.015
Po	
AL	.144
Cu	.034
Ni	.291
AG	

Benthos

Total P	7.4 mg/Kg	Dry
Total Nitrogen	8.6 mg/Kg	Dry
Total Volatile Solids (%)	.91	
Percent Solids	70.1	
Total Kjeldahl Nitrogen (mg/kg)	12.1	Dry

All figures in mg/L unless otherwise noted.

LOUT POND

Using a modified trophic level index, Lout Pond ranks number 8.

Lout Pond is a moderately deep, cold water pond that is aquifer fed and stratified. The macrophyte readings were sparse. Microphyte readings were low, the Secchi Disc reading was 15 feet.

The phosphate readings were approaching the critical range and the nitrate readings were rated as permissible.

The organic materials on bottom were sparse.

This pond is cold water, stocked by the state.

Number of homes affecting impoundment: 3

Cranberry bogs affecting the impoundment: 3 acres

There is also one road drain from South Pond Road

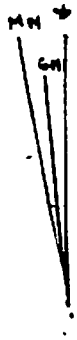
Lout Pond is rated oligotrophic because of low nutrient levels and

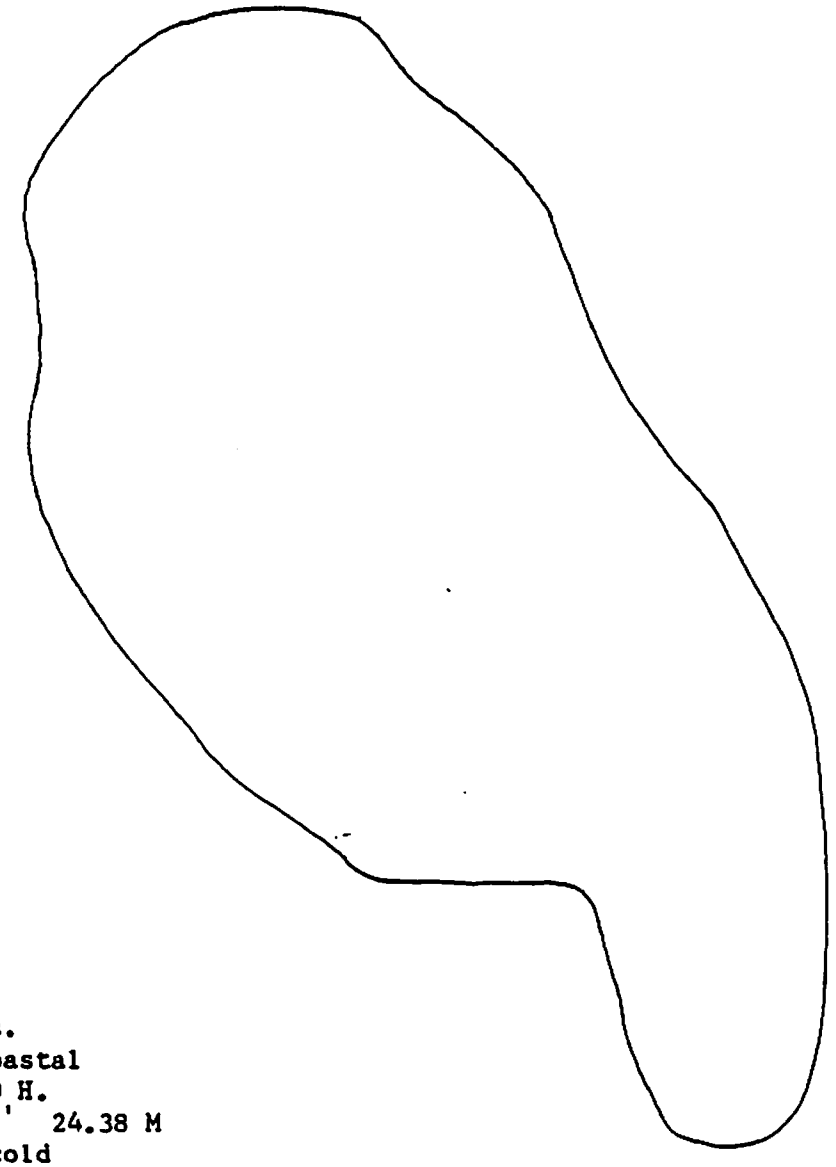
low plant biomass.

The relatively high phosphate readings indicate possible future problems and periodic testing is recommended to monitor this situation.

LOUT POND

Planimetric Map





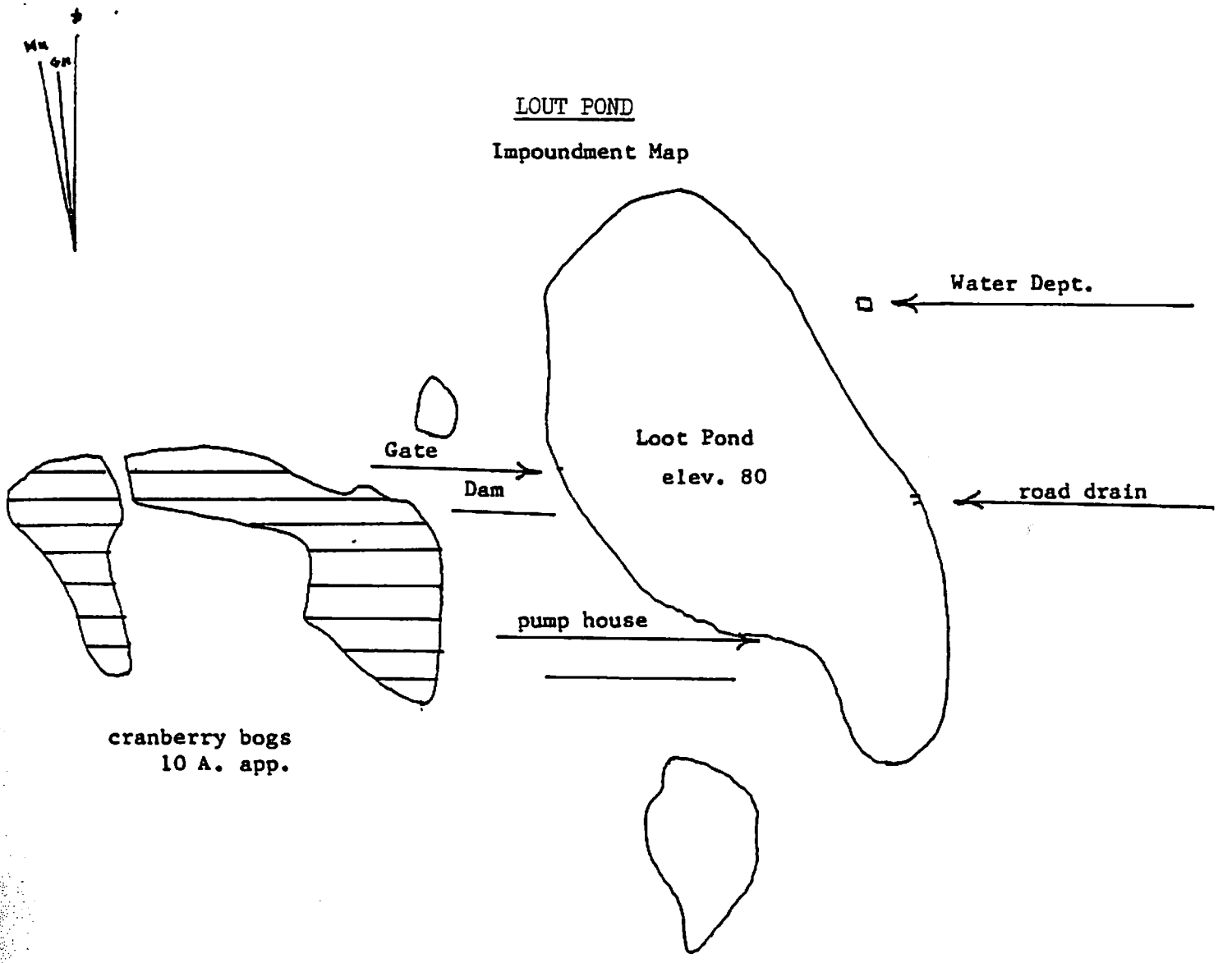
Lout Pond

Plymouth, Mass.
Watershed: coastal
Acres 18 7.29 H.
Altitude: 80' 24.38 M
Water type - cold
Transparency 15'
Water color - clear
Pond use: irrigation, recreation fishing
Topo sheet USGS Map 1962 Plymouth 1:24000
Positon topo sheet up 10.5 R 10.4
Stratified - yes
Reclaimed - yes
Stocked - cold water species
Shoreline distance 3696' 1125.5 M
Bottom type - sand & gravel
Shoreline intermediate 90% low 10%

Scale 1: 218

LOUT POND

Impoundment Map



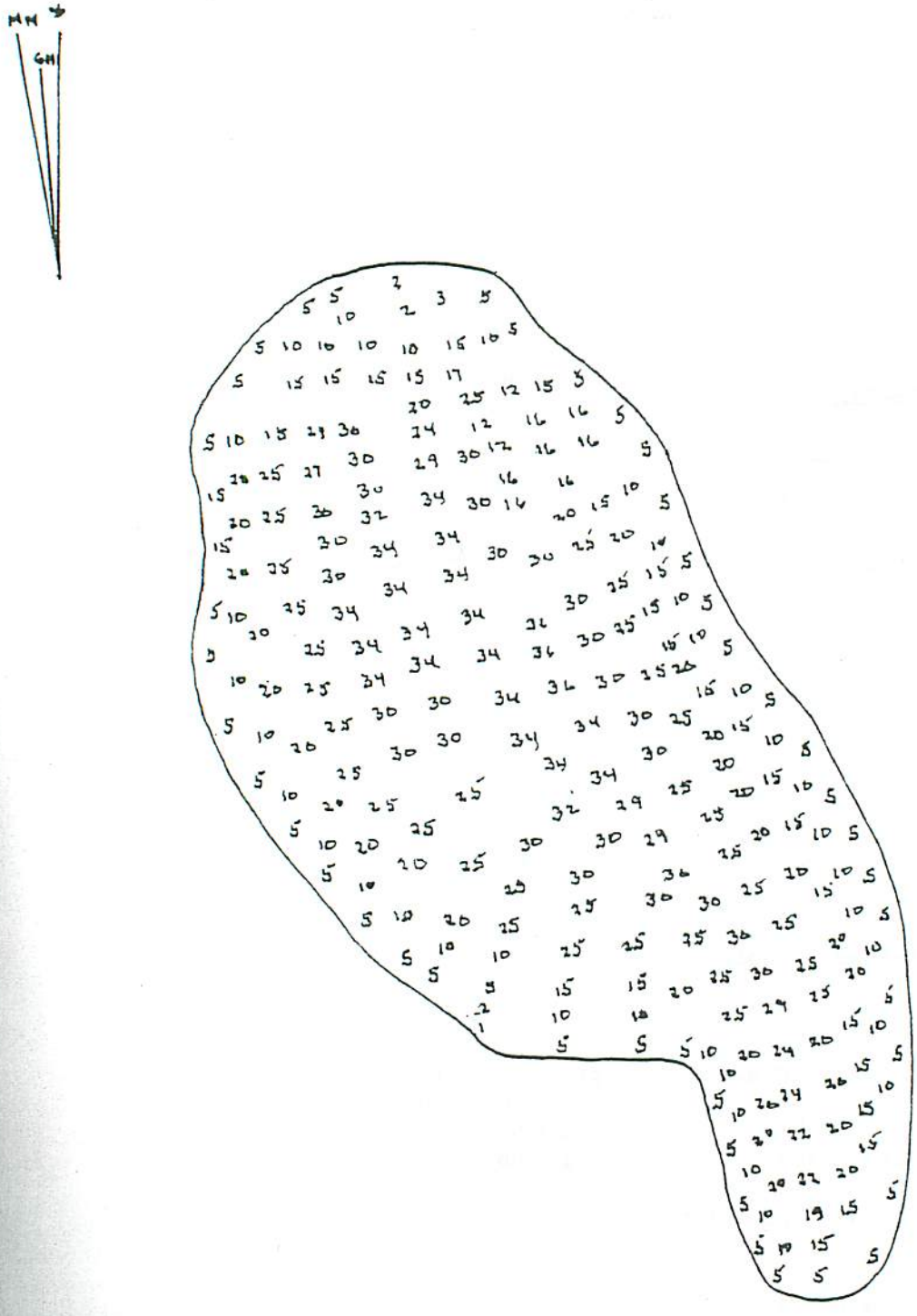
Pond type: natural kettlehole
Tributary: none
Outfall: none
Overland flow: none
Groundwater and underground aquifer - primary source
Rainfall secondary source
Surface run-off secondary source
Agriculture practices directly affecting impoundment - 10 A. App.
Industrial " " " " - none
Possible sources of nutrient influx - 10 A. of cranberry bogs
road drains
groundwater

Shoreline intermediate 90% low 10%
Altitude 80' 24.38 M

Scale 1:400

LOUT POND

Bathymetric Map

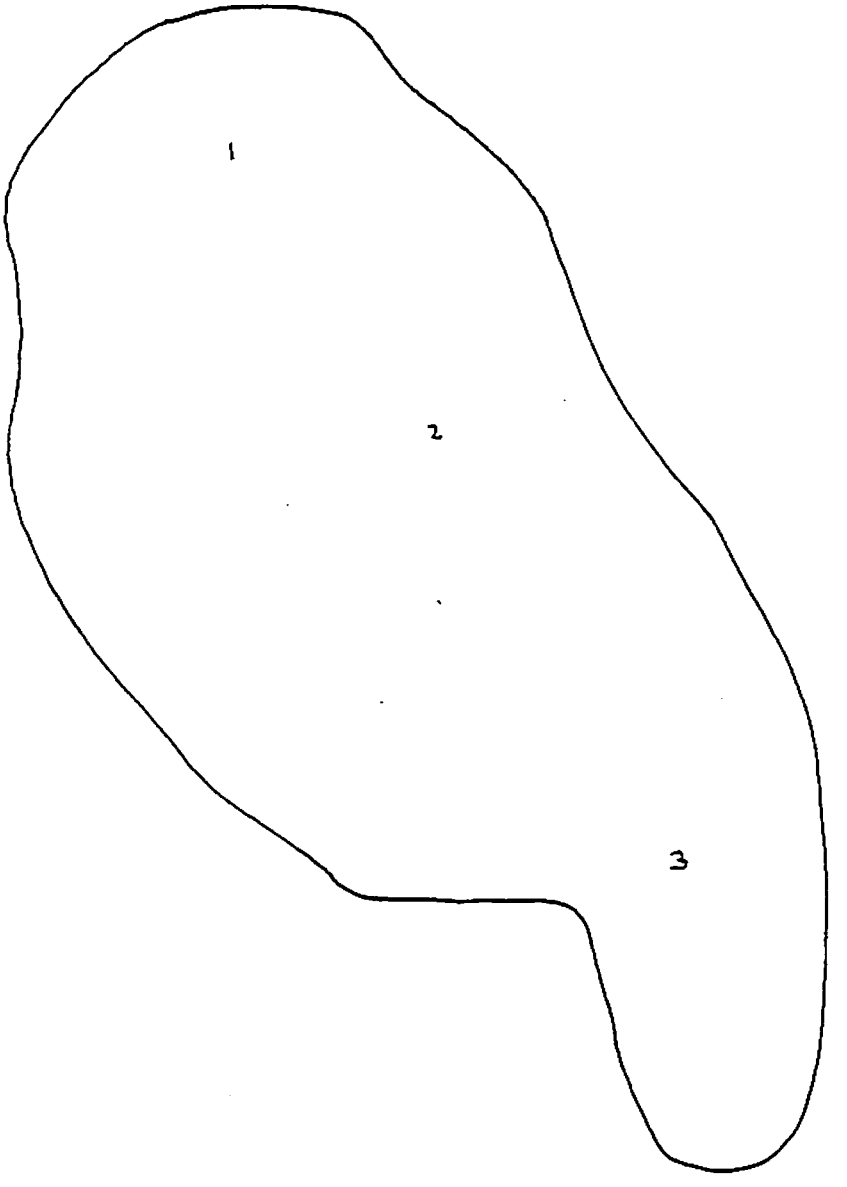


Maximum depth 36' 10.97 M
Mean depth 16' 4.88 M
Surface area 18 A 7.29 H
Total acre feet 288
Total gallons 93,838,752

Scale 1 : 218

LOUT POND

Chemical Sample Stations

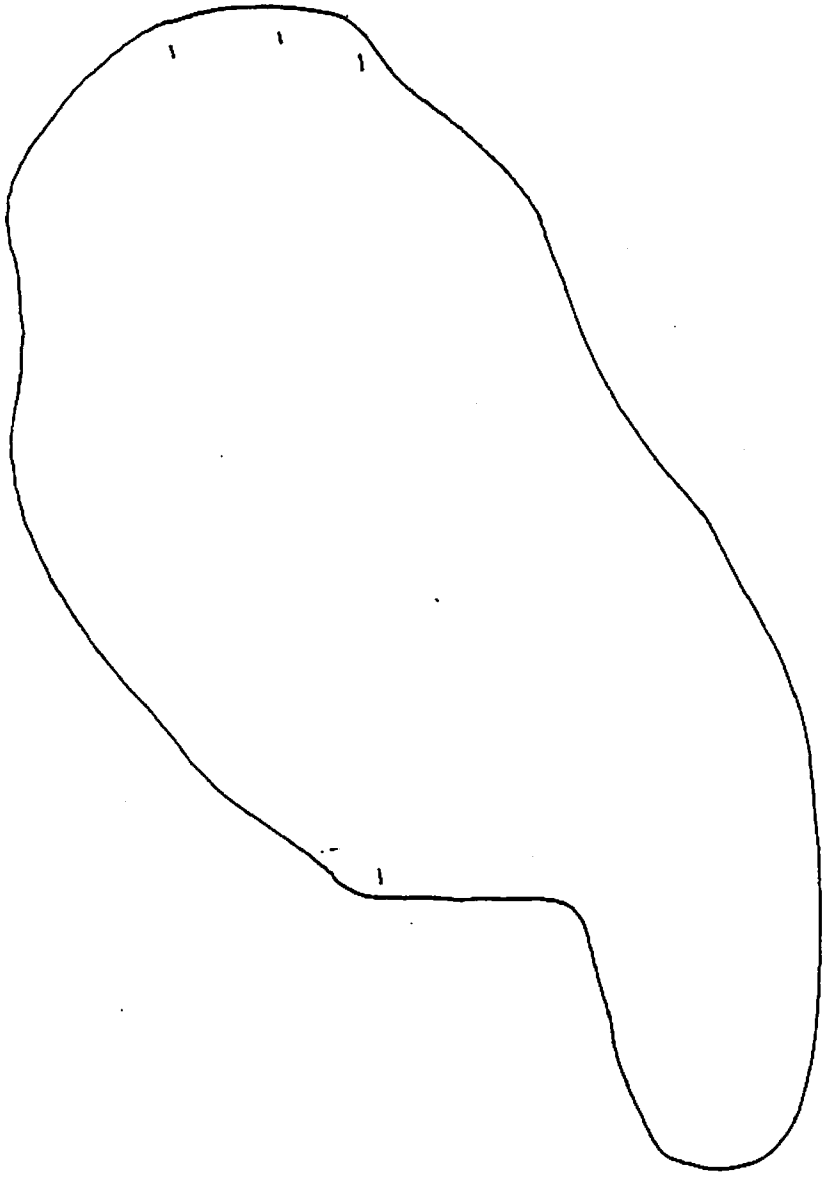


Benthic Station Number 2

Scale 1: 218

LOUT POND

Floating Aquatic Plant Map with Key



Scale 1: 218

FLOATING AQUATIC PLANTS ATTACHED

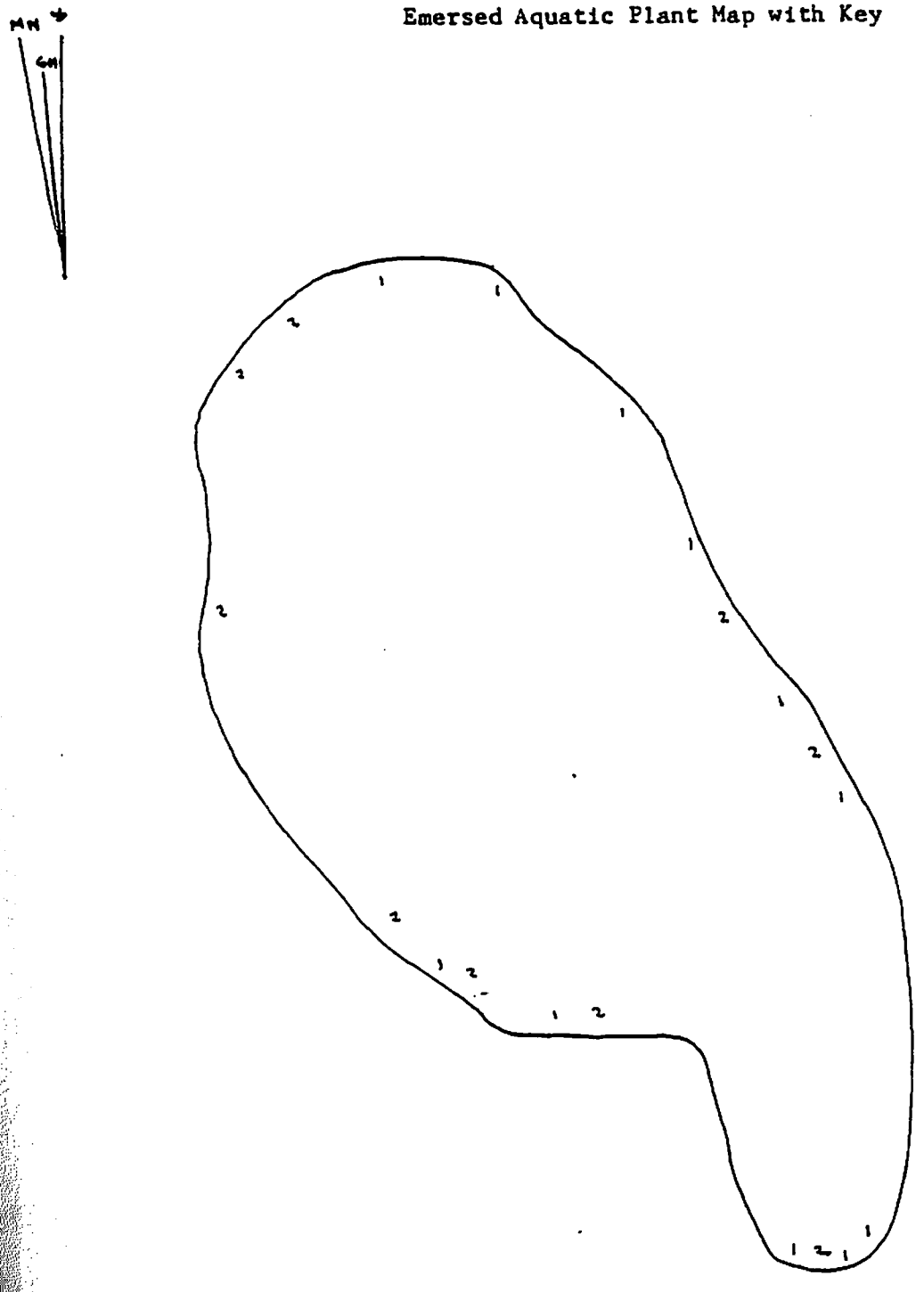
LATIN	COMMON	MAP NUMBER
Nuphar	Cow Lily, Yellow Water Lily, Spatterdock	
Nymphaea	Water Lily, White Water Lily	1
Brasenia	Watershield	
	Addenda	

FLOATING AQUATIC PLANTS - UNATTACHED

LATIN	COMMON	MAP NUMBER
Lemna	Duckweed	
Spirodelia	Big Duckweed	
Wolffia	Watermeal	
	Addenda	

LOUT POND

Emersed Aquatic Plant Map with Key



Emersed plant population was classified as sparse.

Scale 1: 213

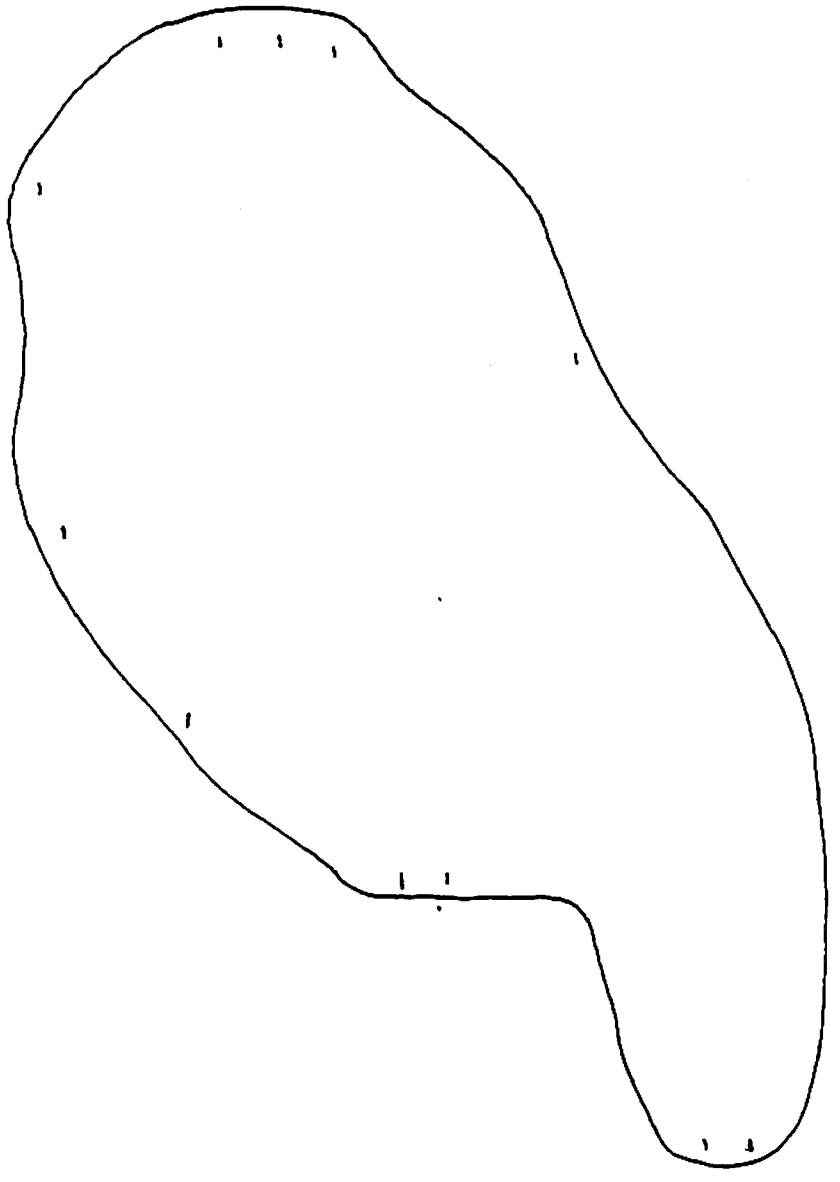
EMERSED AQUATIC PLANTS

LATIN	COMMON	MAP NUMBER
Peltandra	Arrow Arum	
Pontederia	Pickerel Weed	1
Sagittaria	Arrowhead; Duck Potatoe	
Polygonum	Watersmart Weed	
Typha	Cattail	
Eleocharis	Spike Rush Sedge	2
Scirpus	Bulrush Sedge	
Juncaceae	Juncus Rush	

Addenda

LOUT POND

Submersed Aquatic Plant Map with Key



All submersed aquatic plant population was classified as sparse in all but excepted areas.

Scale 1: 218

SUBMERSED AQUATIC PLANTS

LATIN	COMMON	MAP NUMBER
Potamogeton	Pondweed	
Potamogeton Americanus		
Potamogeton Ampl. Folius	Large Leaf Pondweed	
Potamogeton Crispus	Curly Leaf Pondweed	
Potamogeton Diversifolius	Waterthread Pondweed	
Potamogeton Filiformus		
Potamogeton Filiosus	Leafy Pondweed	
Potamogeton Gramineus	Variable Pondweed	
Potamogeton Natans	Floating Brown Leaf	1
Potamogeton Nodosus	American Pondweed	
Potamogeton Pectinatus	Sago Pondweed	
Potamogeton Praelongus	White Stem Pondweed	
Potamogeton Richardsonii	Richardson Pondweed	
Potamogeton Robinsii		
Potamogeton Vaginatus	Giant Pondweed	
Najas	Bushy Pondweed	
Zannichellia	Horned Pondweed	
Elodea	Waterweed	
Ranunculus	Water Buttercup	
Ceratophyllum D.	Coontail	
Myriophyllum	Water Milfoil	
Alisma	Waterplantain	
Heteranthera D.	Water Star Grass; Mud Plantain	
Nasturtium	Water, Cress	
Utricularia	Bladderwort	
Vallisneria	Wild Celery	

Addenda

Algae	
Chlorophyceae	Green Algae
Unicellular	
Filamentous	
Cyanophyceae	Blue Green Algae
Unicellular	
Filamentous	

LOUT

	IN LAKE STATION 1	2	3	OUTFALL 1	2	3	SOURCES 1	2	3
Total P	.04	.03	.04						
Nitrate (N)	.025	.02	.025						
Free Acid	0	0	0						
Total Acidity	0	0	0						
Alkalinity	.002	.002	.002						
DO	12	12	13						
Total Hardness	14	14	15						
CO_2	18	17	17						
Ph	7.5	7.4	7.5						
Temp (C+F) 1' Levels	64(10')	55(20')	46(30')						
Secchi	15	15	15						

Heavy Metals

Zn	.010
CD	.005
Sn	.152
Au	.018
Fe	.038
Po	
AL	.092
Cu	.037
Ni	.060
AG	

Benthos

Total P	2.1 mg/Kg	Dry
Total Nitrogen	2.1 mg/Kg	Dry
Total Volatile Solids (%)	.92	
Percent Solids	77.4	
Total Kjeldahl Nitrogen (mg/kg)	7.0	Dry

All figures in mg/L unless otherwise noted.

RABBIT POND

Rabbit Pond ranks 28 using a modified trophic index.

Rabbit Pond is a kettlehole, non-stratified, clear, aquifer-fed, warm water pond with a maximum depth of 15'.

Submersed aquatic vegetation was rated as medium to heavy out to 10' contour lines with Milfoil being the dominant species. Bladderwart was intermixed with the Milfoil.

Floating aquatic plants were prevalent in the shallow areas with yellow and white lilies being predominant.

The Secchi Disc reading was 13'.

The phosphate readings were high. The nitrate readings were permissible.

Pond was rated as eutrophic.

Number of homes affecting impoundment - 20.

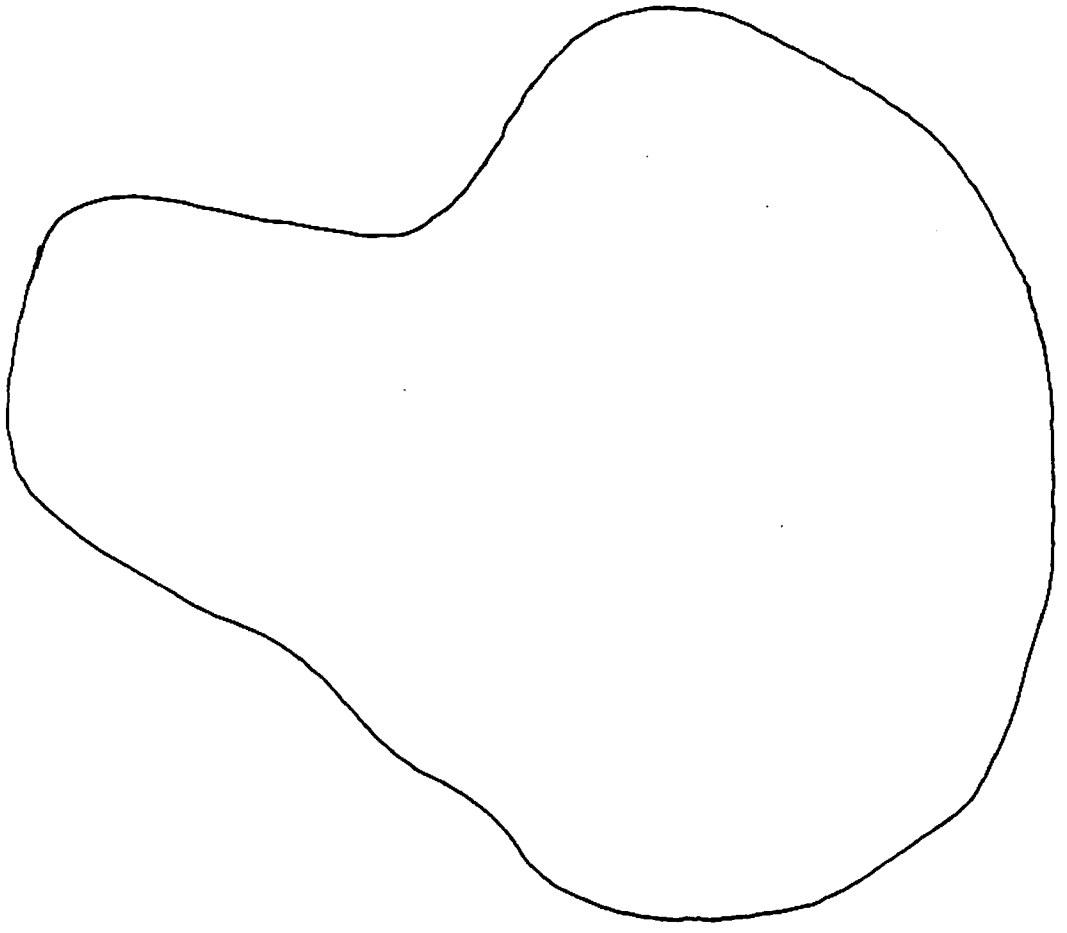
Cranberry acerage - none.

Problems: Cultural impact by the number of homes surrounding impoundment. This pond was rated as eutrophic with a good chance of accelerated eutrophication. The steep banks, coupled with the soil series are certainly contributing factors.

This is a kettlehole that can be classified as eutrophic with the obvious nutrient loading from the number of homes surrounding the impoundment.

RABBIT POND

Planimetric Map



Rabbit Pond

Plymouth, Mass.
Watershed: coastal
Acres 5 A 2.03 H.
Altitude 8'
Water type: warm
Pond type: kettlehole
Transparency 13'
Watercolor: clear
Pond use: recreational
Topo sheet USGS map Manomet
1:24000 1962

Position Topo Map
up 5.0 R 10.3

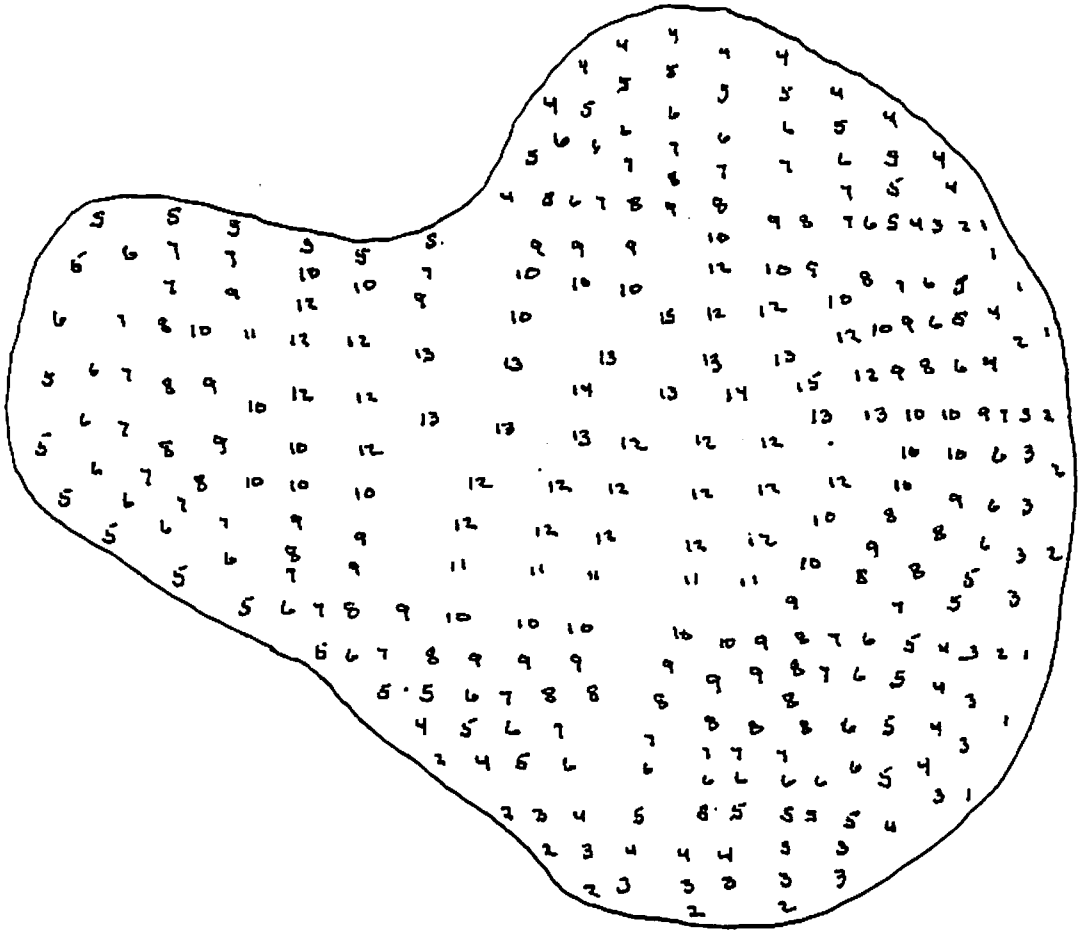
Shoreline distance 2112' 643.7 M

Bottom type - sand & gravel covered by 4 inches organic.
Shoreline 90% high 10% intermediate
Stratified - no
Reclaimed - no
Stocked - no

Scale 1:120

RABBIT POND

Bathymetric Map



Maximum Depth 15' 4.57 M

Mean Depth 10' 2.74 M

Surface Area 5 A 2.03 H.

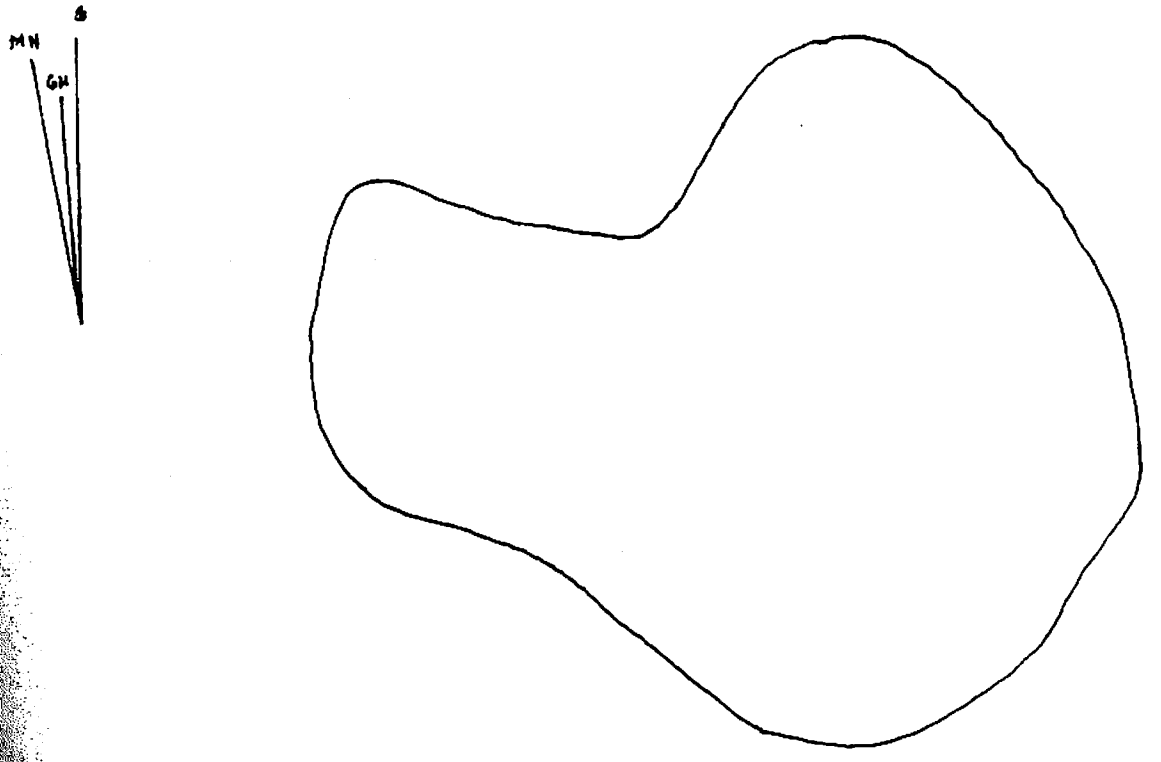
Total Acre Feet 45

Total Gallons 14,662,305

Scale 1:120

RABBIT POND

Impoundment Map

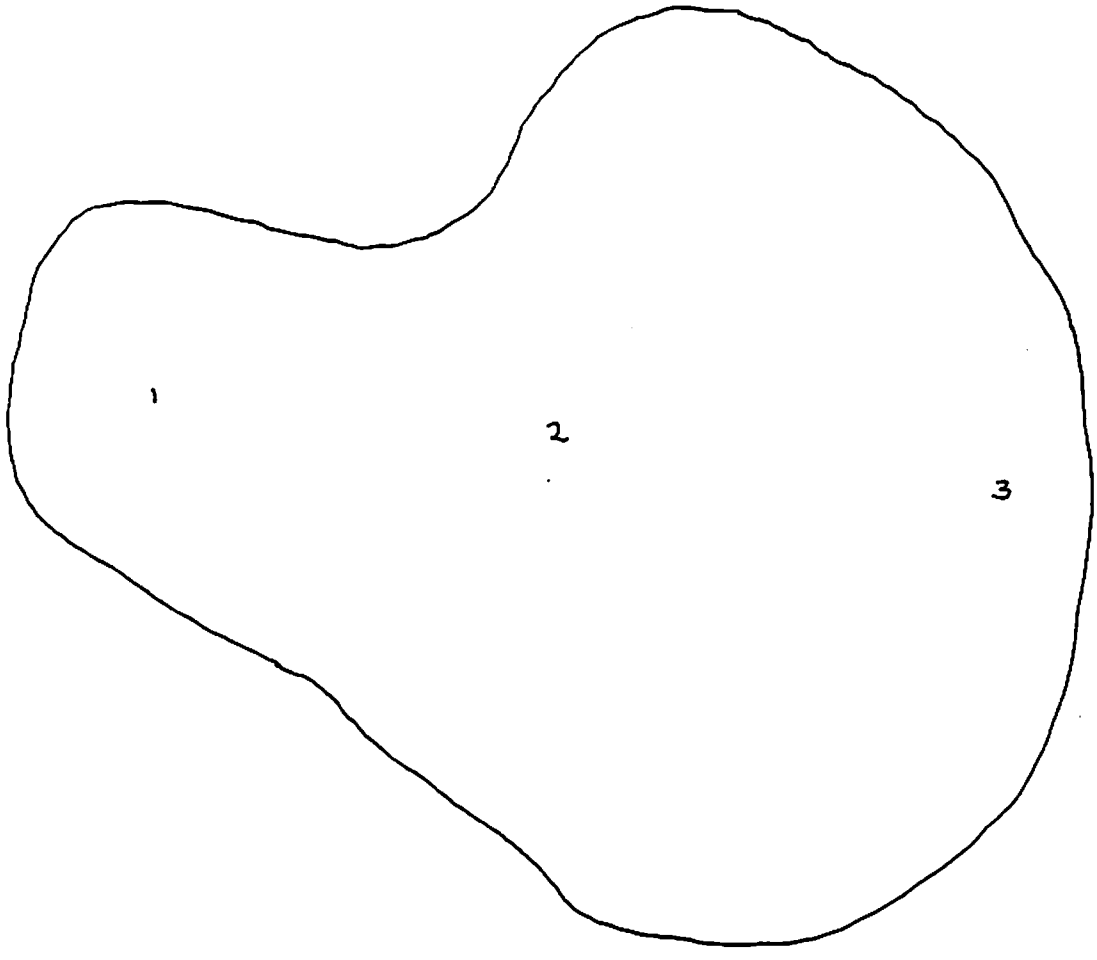


Pond type: kettlehole
Tributary: none
Outfall: none
Overland Flow: none
Groundwater & underground aquifer - primary source
Rainfall - secondary source
Surface Run-off - secondary source
Agriculture practices directly affecting impoundment - none
Industrial sources " " " - none
Possible sources of nutrient influx - 1. 10 houses around system
2. groundwater
3. road drains
Shoreline 90% high 10% intermediate
Altitude 8' 2.44 M.

Scale 1:165

RABBIT POND

Chemical Sample Stations

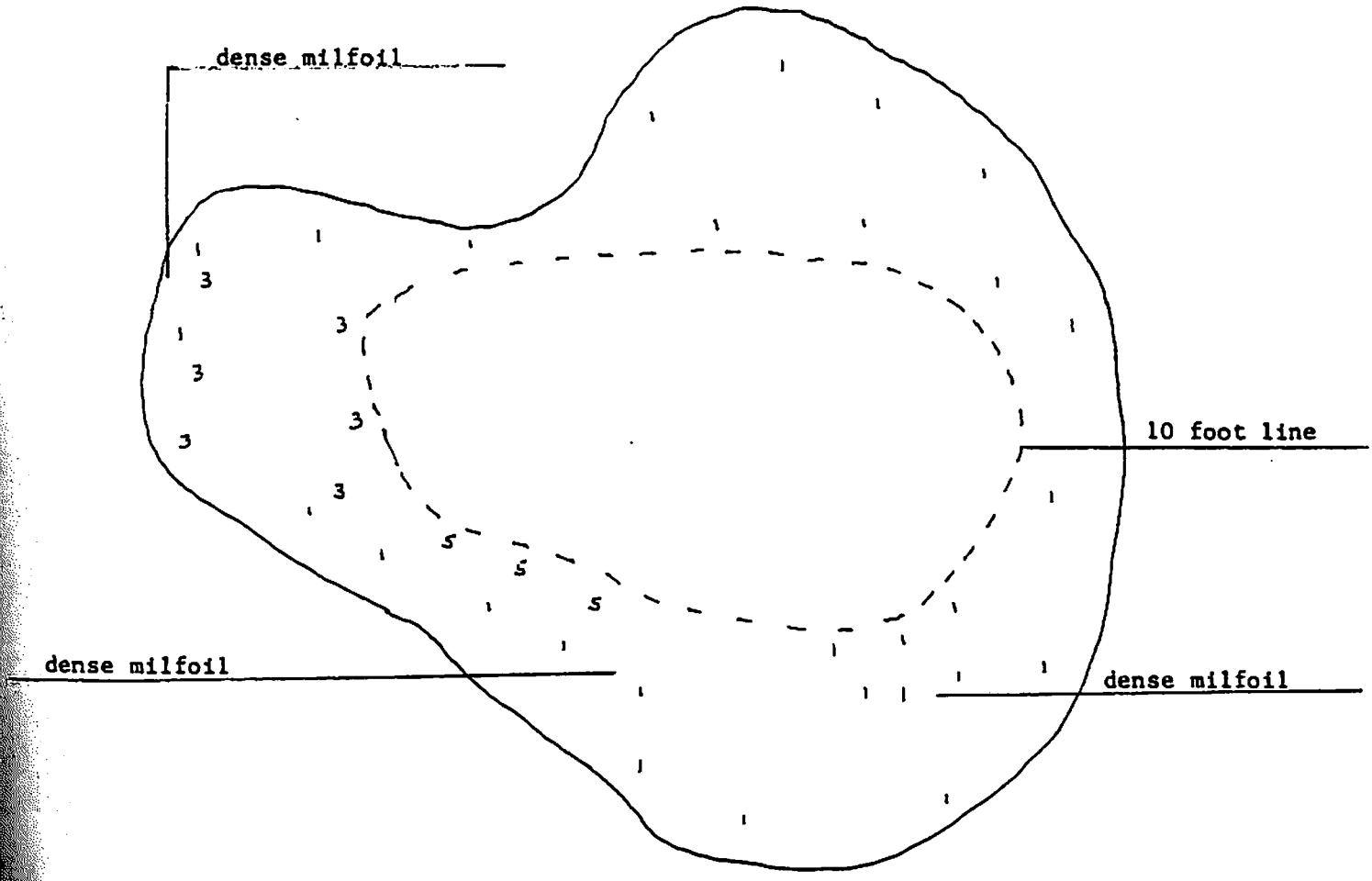


Benthic Station Number 2

Scale 1:120

RABBIT POND

Submersed Aquatic Plant Map with Key



Milfoil infestation was out to 10 foot contour line.

Scale 1:120

SUBMERSED AQUATIC PLANTS

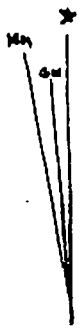
LATIN	COMMON	MAP NUMBER
Potamogeton	Pondweed	
Potamogeton Americanus		
Potamogeton Ampl. Folius	Large Leaf Pondweed	
Potamogeton Crispus	Curly Leaf Pondweed	
Potamogeton Diversifolius	Waterthread Pondweed	
Potamogeton Filiformus		
Potamogeton Filiosus	Leafy Pondweed	
Potamogeton Gramineus	Variable Pondweed	
Potamogeton Natans	Floating Brown Leaf	
Potamogeton Nodosus	American Pondweed	
Potamogeton Pectinatus	Sago Pondweed	2
Potamogeton Praelongus	White Stem Pondweed	
Potamogeton Richardsonii	Richardson Pondweed	
Potamogeton Robinsii		
Potamogeton Vaginatus	Giant Pondweed	
Najas	Bushy Pondweed	
Zannichellia	Horned Pondweed	
Elodea	Waterweed	
Ranunculus	Water Buttercup	
Ceratophyllum D.	Coontail	
Myriophyllum	Water Milfoil	1
Alisma	Waterplantain	
Heteranthera D.	Water Star Grass; Mud Plantain	
Nasturtium	Water, Cress	
Utricularia	Bladderwort	3
Vallisneria	Wild Celery	

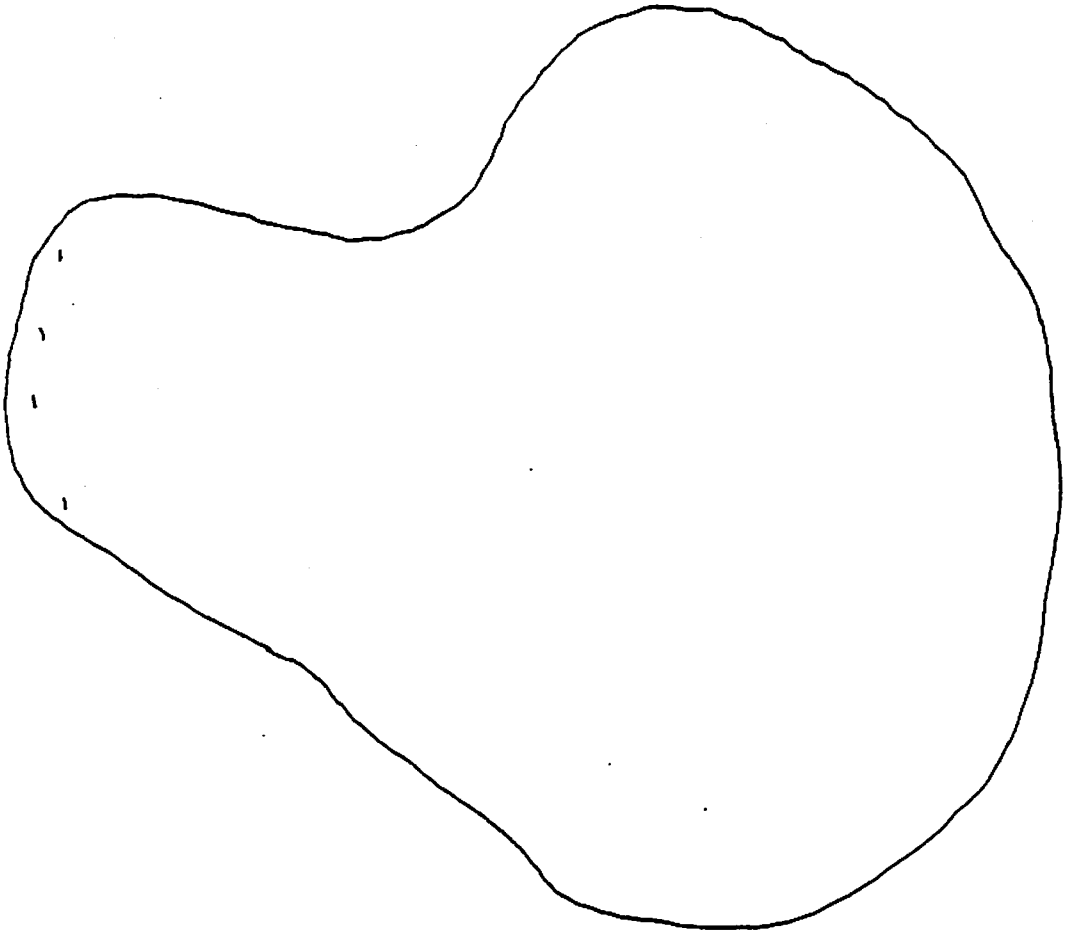
Addenda

Algae	
Chlorophyceae	Green Algae
Unicellular	
Filamentous	
Cyanophyceae	Blue Green Algae
Unicellular	
Filamentous	

RABBIT POND

Emersed Aquatic Plant Map with Key





Emersed aquatic plant population was classified as sparse.

Scale 1:120

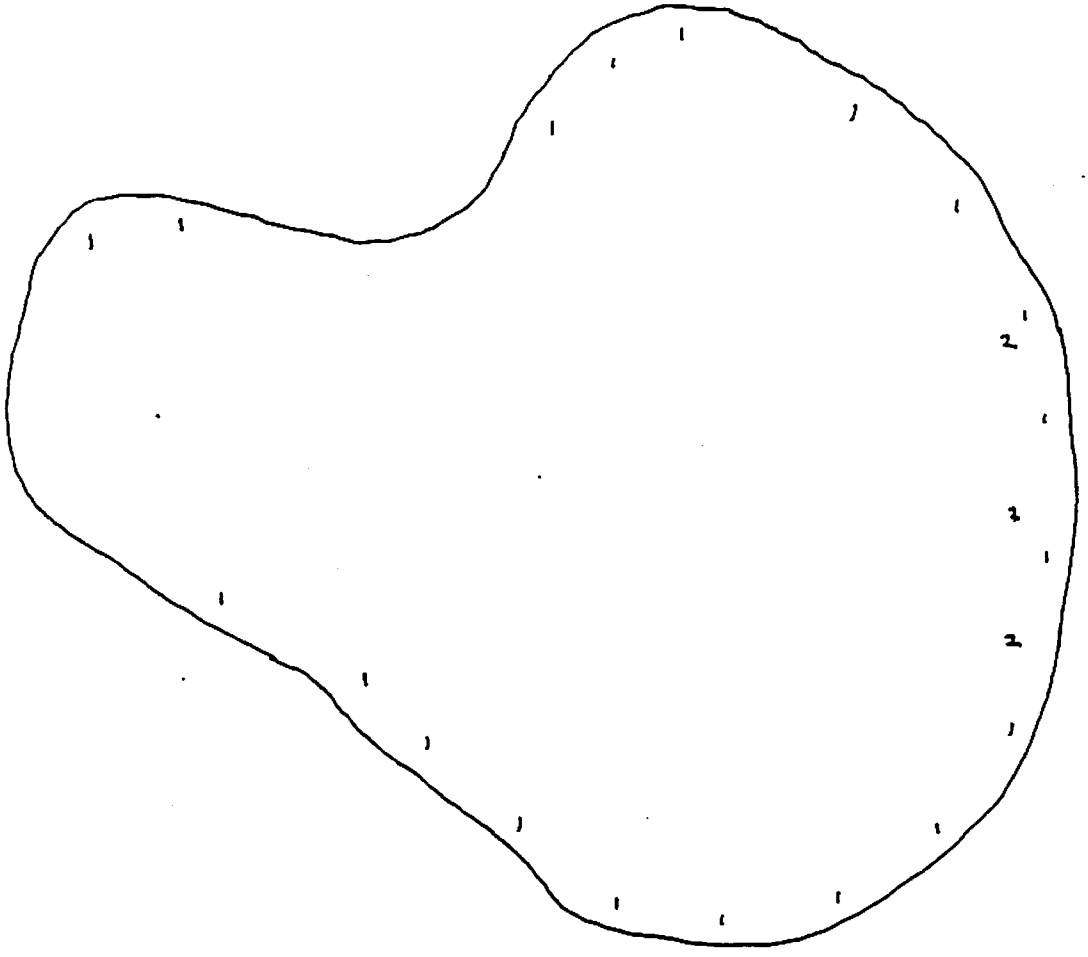
EMERSED AQUATIC PLANTS

LATIN	COMMON	MAP NUMBER
Peltandra	Arrow Arum	
Pontederia	Pickerel Weed	
Sagittaria	Arrowhead; Duck Potatoe	
Polygonum	Watersmart Weed	
Typha	Cattail	
Eleocharis	Spike Rush Sedge	1
Scirpus	Bulrush Sedge	
Juncaceae	Juncus Rush	

Addenda

RABBIT POND

Floating Aquatic Plant Map with Key



Floating plant population was classified as medium density.

Scale 1:120

FLOATING AQUATIC PLANTS ATTACHED

LATIN	COMMON	MAP NUMBER
Nuphar	Cow Lily, Yellow Water Lily, Spatterdock	2
Nymphaea	Water Lily, White Water Lily	1
Brasenia	Watershield	
	Addenda	

FLOATING AQUATIC PLANTS - UNATTACHED

LATIN	COMMON	MAP NUMBER
Lemna	Duckweed	
Spirodelia	Big Duckweed	
Wolffia	Watermeal	
	Addenda	

RABBIT

	IN LAKE STATION 1	2	3	OUTFALL 1	2	3	SOURCES 1	2	3
Total P	.07	.07	.08						
Nitrate (N)	.025	.02	.02						
Free Acid	.001	.001	.001						
Total Acidity	.001	.001	.001						
Alkalinity	0	0	0						
DO	12	11	11						
Total Hardness	18	18	17						
CO_2	12	13	13						
Ph	6.5	6.5	6.4						
Temp (C+F) 1' Levels	55	54	55 (F)						
Secchi	13	13	13						

Heavy Metals

Zn	.010
CD	ND
Sn	.090
Au	.017
Fe	.042
Po	
AL	.090
Cu	.033
Ni	.021
AG	

Benthos

Total P	9.2 mg/Kg	Dry
Total Nitrogen	6.3 mg/Kg	Dry
Total Volatile Solids (%)	1.96	
Percent Solids	70.1	
Total Kjeldahl Nitrogen (mg/kg)	9.6	Dry

All figures in mg/L unless otherwise noted.

SHALLOW POND

Shallow Pond ranks 41 using a modified trophic index level. It is natural, non-stratified, warm water pond with a maximum depth of 7 feet.

Floating aquatic plants cover more than 50% of its surface; with many emersed plants intersparsed.

The submersed vegetation covers all the bottom.

The Secchi Disc reading was 6'.

The phosphate readings were critical.

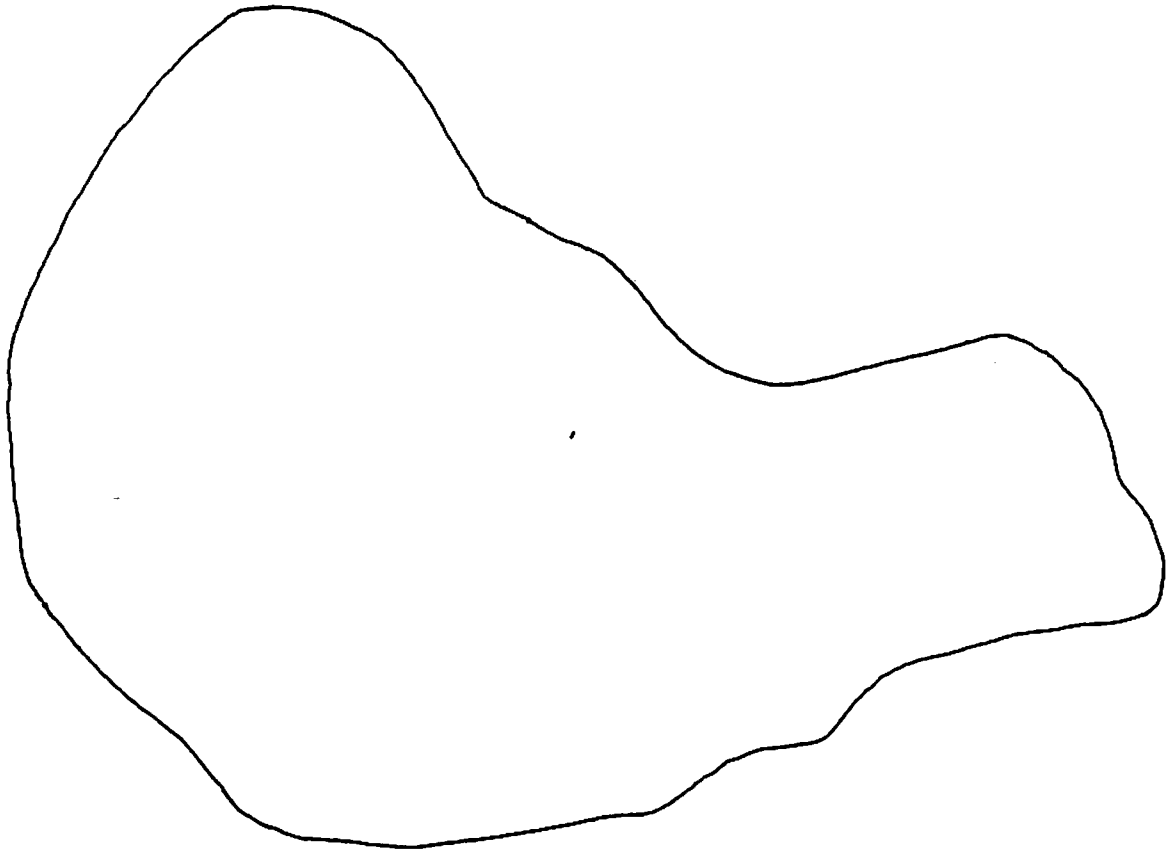
The nitrate readings were permissible (see Addenda, Macrophite Population and Nutrient Untilization).

Agriculture impact and ground water are possible sources of eutrophication. There are no homes near this impoundment.

This impoundment is fast approaching the final stages of eutrophication, it is in fact an aquatic biologists delight.

SHALLOW POND

Planimetric Map



Shallow Pond

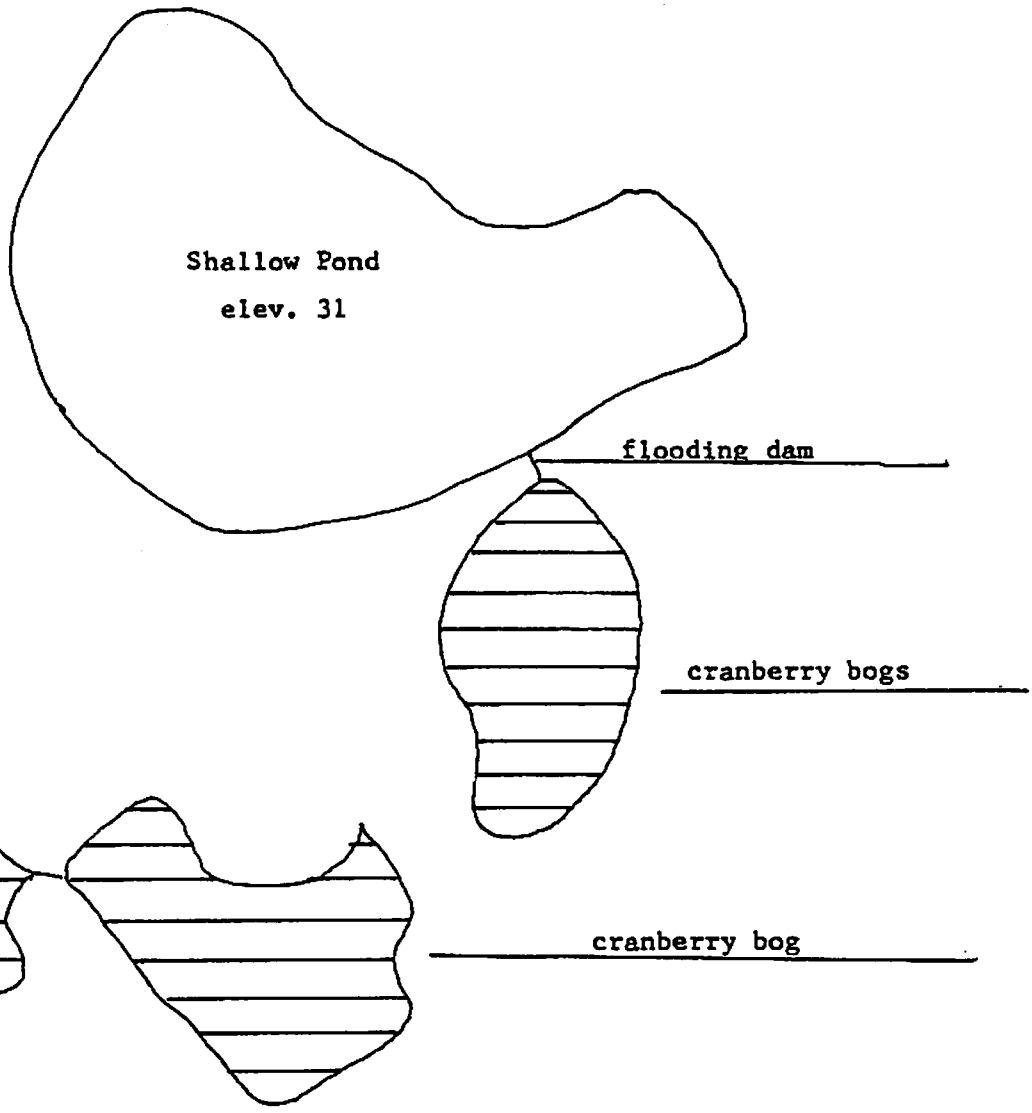
Plymouth, Mass.
Watershed: coastal
Acres 18 7.29 H
Altitude 31 9.45 M
Water type: warm
Pond type: natural
Transparency 6' 1.83 M
Watercolor: clear
Pond use: irrigation
Topo sheet USGS M Manomet 1962 1:24000
Position topo sheet up 2.5 R 9.7

Stratified: no
Reclaimed: no
Stocked: no
Shoreline distance 4224 1287.5 M
Bottom type - organic over sand & gravel
Shoreline: intermediate 90% low 10%

Scale 1:242

SHALLOW POND

Impoundment Map

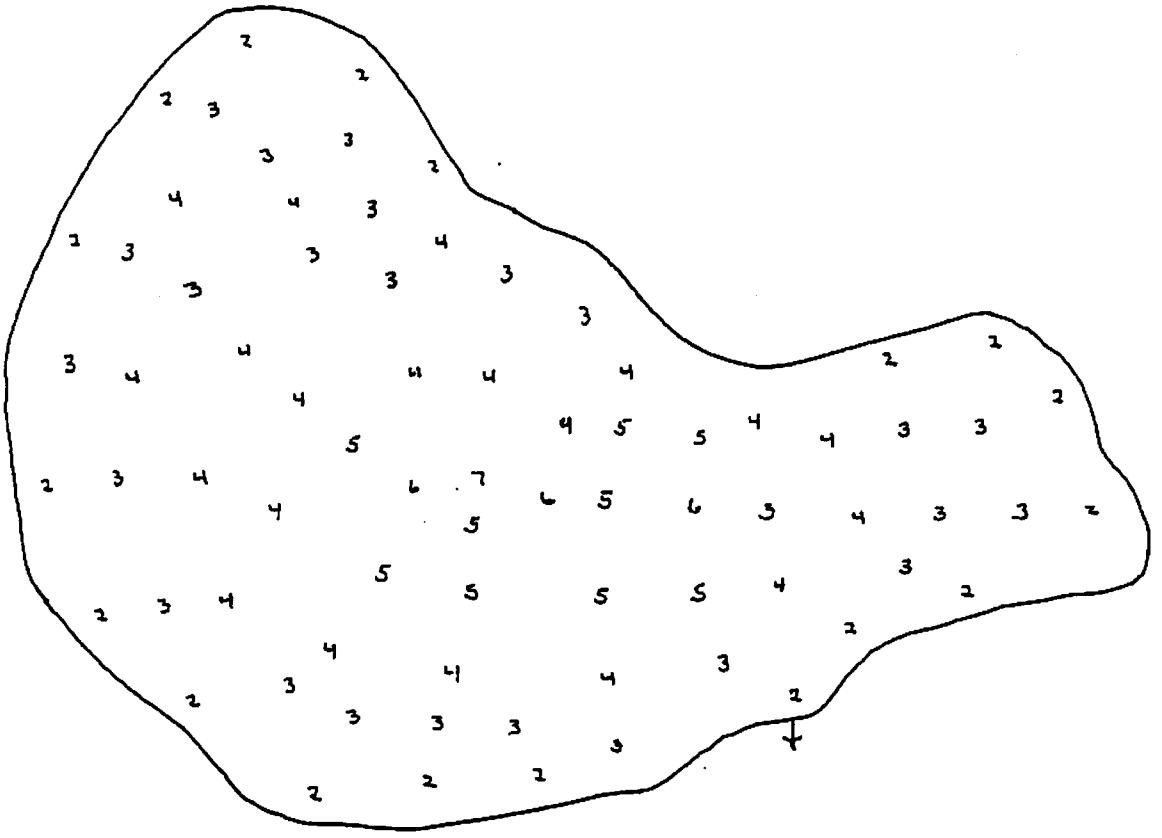


Pond type: natural
Tributary: none
Outfall: none
Overland flow: none
Groundwater & underground aquifer - Primary source
Rainfall - Secondary source
Surface run-off - Secondary source
Agriculture practices directly affecting impoundment - 15 A. app
Industrial " " " " - none
Possible sources of nutrient influx 15 A. of cranberry bogs
groundwater
houses none
Shoreline intermediate 90% low 10%
Altitude 31 9.45M

Scale 1:372

SHALLOW POND

Bathymetric Map



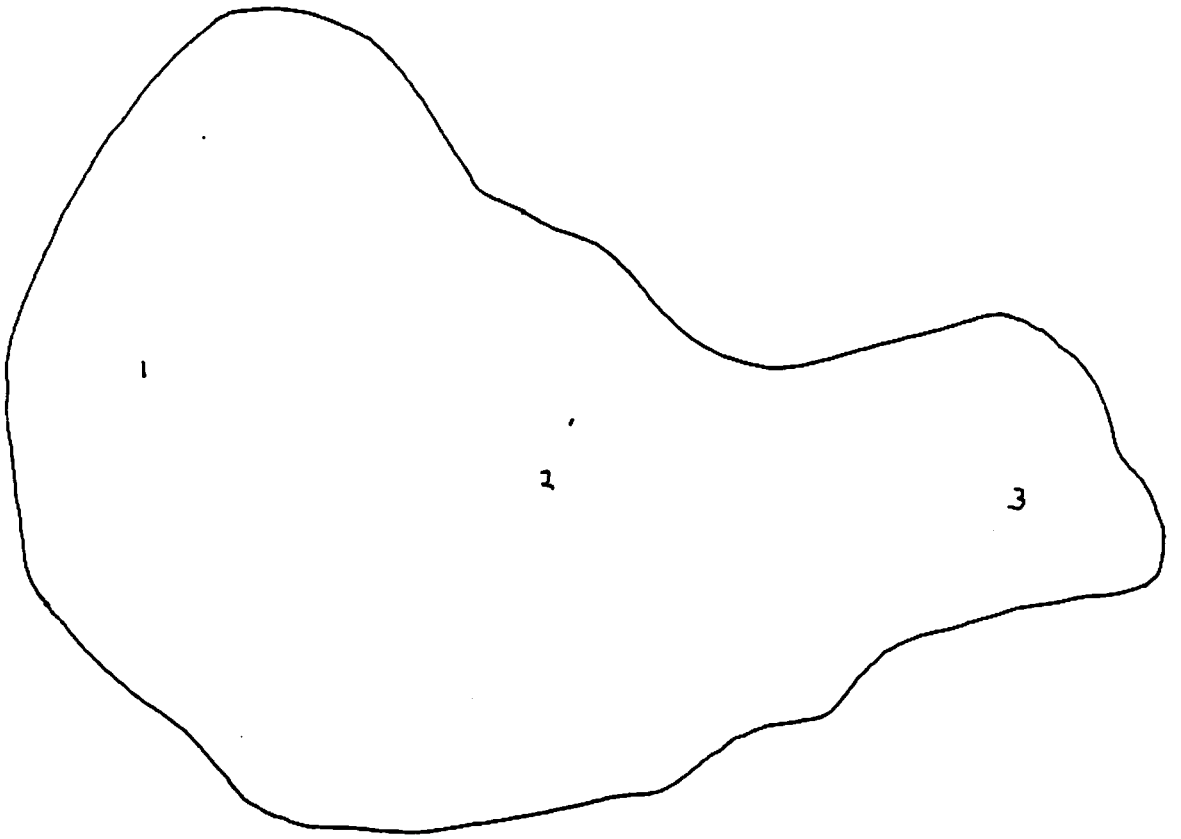
Maximum depth	7'	2.13 M
Mean depth	4'	1.22 M
Surface Area	18 A	7.29 H

Total acre feet: 72

Total gallons 23,459,688

Scale 1:242

SHALLOW POND
Chemical Sample Stations

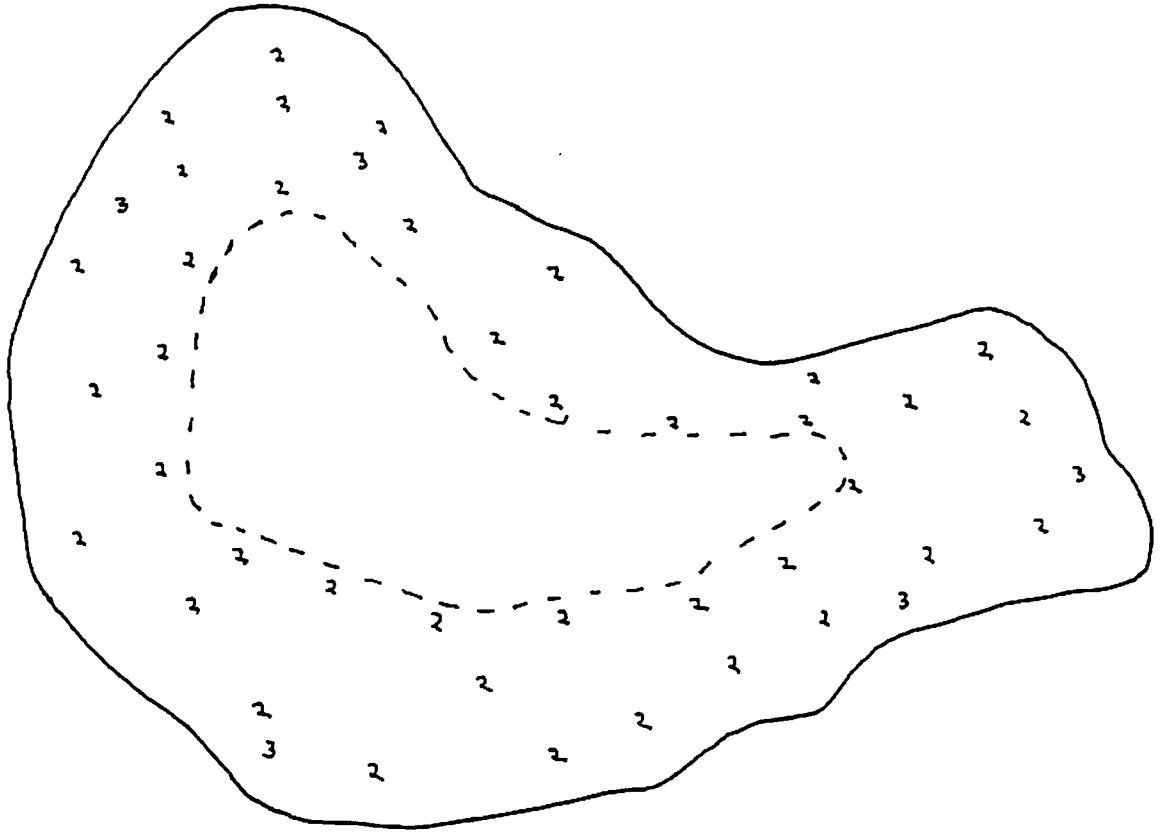


Benthic Station Number 2

Scale 1:242

SHALLOW POND

Floating Aquatic Plant Mpp with Key



All species abundant out to 4' contour line

Dotted line = 4 foot depth.

Scale 1:242

FLOATING AQUATIC PLANTS ATTACHED

LATIN	COMMON	MAP NUMBER
Nuphar	Cow Lily, Yellow Water Lily, Spatterdock	1
Nymphaea	Water Lily, White Water Lily	2
Brasenia	Watershield	3

Addenda

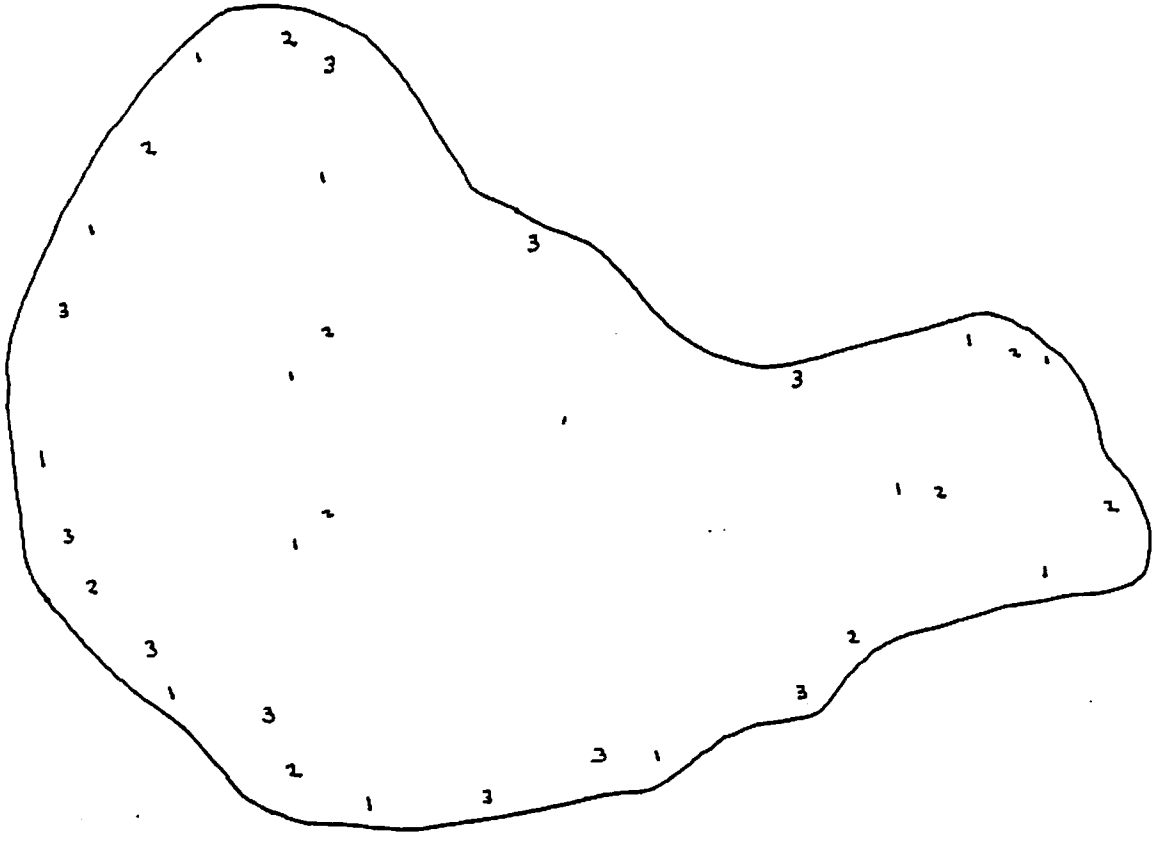
FLOATING AQUATIC PLANTS - UNATTACHED

LATIN	COMMON	MAP NUMBER
Lemna	Duckweed	
Spirodelia	Big Duckweed	
Wolffia	Watermeal	

Addenda

SHALLOW POND

Emersed Aquatic Plant Map with Key



Emersed plants abundant through all shallow areas.

Scale 1:242

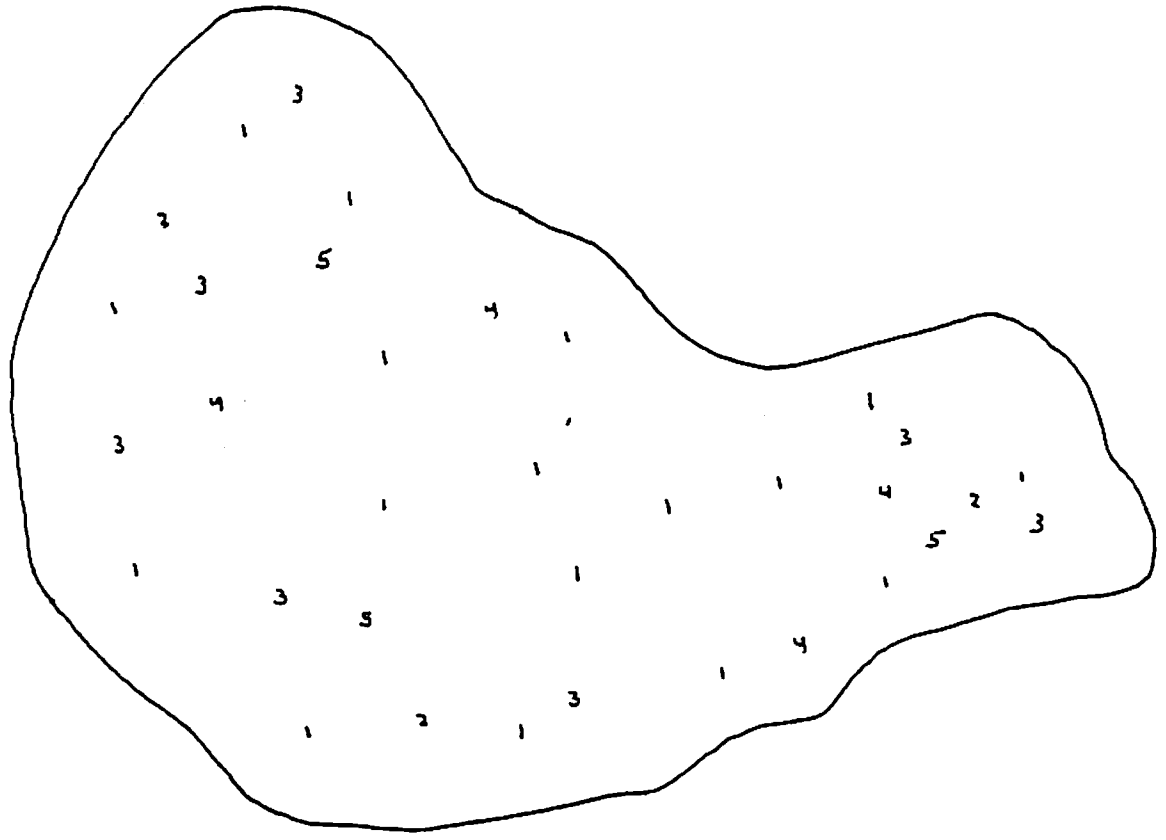
EMERSED AQUATIC PLANTS

LATIN	COMMON	MAP NUMBER
Peltandra	Arrow Arum	
Pontederia	Pickerel Weed	
Sagittaria	Arrowhead; Duck Potatoe	
Polygonum	Watersmart Weed	
Typha	Cattail	
Eleocharis	Spike Rush Sedge	1
Scirpus	Bulrush Sedge	2
Juncaceae	Juncus Rush	3

Addenda

SHALLOW POND

Submersed Aquatic Plant Map with Key



Vegetation abundant throughout whole area.

Scale 1:242

SUBMERSED AQUATIC PLANTS

LATIN	COMMON	MAP NUMBER
Potamogeton	Pondweed	
Potamogeton Americanus		
Potamogeton Ampl. Folius	Large Leaf Pondweed	
Potamogeton Crispus	Curly Leaf Pondweed	
Potamogeton Diversifolius	Waterthread Pondweed	2
Potamogeton Filiformus		
Potamogeton Filiosus	Leafy Pondweed	
Potamogeton Gramineus	Variable Pondweed	
Potamogeton Natans	Floating Brown Leaf	3
Potamogeton Nodosus	American Pondweed	
Potamogeton Pectinatus	Sago Pondweed	4
Potamogeton Praelongus	White Stem Pondweed	
Potamogeton Richardsonii	Richardson Pondweed	
Potamogeton Robinsii		
Potamogeton Vaginatus	Giant Pondweed	
Najas	Bushy Pondweed	
Zannichellia	Horned Pondweed	
Elodea	Waterweed	
Ranunculus	Water Buttercup	
Ceratophyllum D.	Coontail	
Myriophyllum	Water Milfoil	
Alisma	Waterplantain	
Heteranthera D.	Water Star Grass; Mud Plantain	5
Nasturtium	Water, Cress	
Utricularia	Bladderwort	1
Vallisneria	Wild Celery	

Addenda

	Algae
Chlorophyceae	Green Algae
Unicellular	
Filamentous	
Cyanophyceae	Blue Green Algae
Unicellular	
Filamentous	

SHALLOW

	IN LAKE STATION 1	2	3	OUTFALL 1	2	3	SOURCES 1	2	3
Total P	.12	.12	.14						
Nitrate (N)	.05	.07	.08						
Free Acid	.005	.005	.005						
Total Acidity	.005	.005	.005						
Alkalinity	0	0	0						
DO	10	11	11						
Total Hardness	16	17	15						
CO_2	19	18	18						
Ph	5.3	5.2	5.3						
Temp (C+F) 1' Levels	47	47	46 (F)						
Secchi	6'	6'	6'						

Heavy Metals

Zn	.059
CD	.002
Sn	ND
Au	.037
Fe	.236
Po	
AL	.184
Cu	.058
Ni	.080
AG	

Benthos

Total P	17.4 mg/Kg	Dry
Total Nitrogen	9.4 mg/Kg	Dry
Total Volatile Solids (%)	2.3	
Percent Solids	61.1	
Total Kjeldahl Nitrogen (mg/kg)	12.1	

All figures in mg/L unless otherwise noted.

WARNER POND

Using a modified trophic index, Warner Pond ranks 26th.

Warner Pond is a natural, warm water, non-stratified pond with a maximum depth of 14'.

The macrophyte population was classified as sparse to medium with dominant species of the floating variety.

The Secchi Disc reading was 5 with the water color being brown.

This was probably caused by large growths of spagmum moss out to the 10 foot contour line.

The phosphate reading was high. The nitrate reading was permissible.

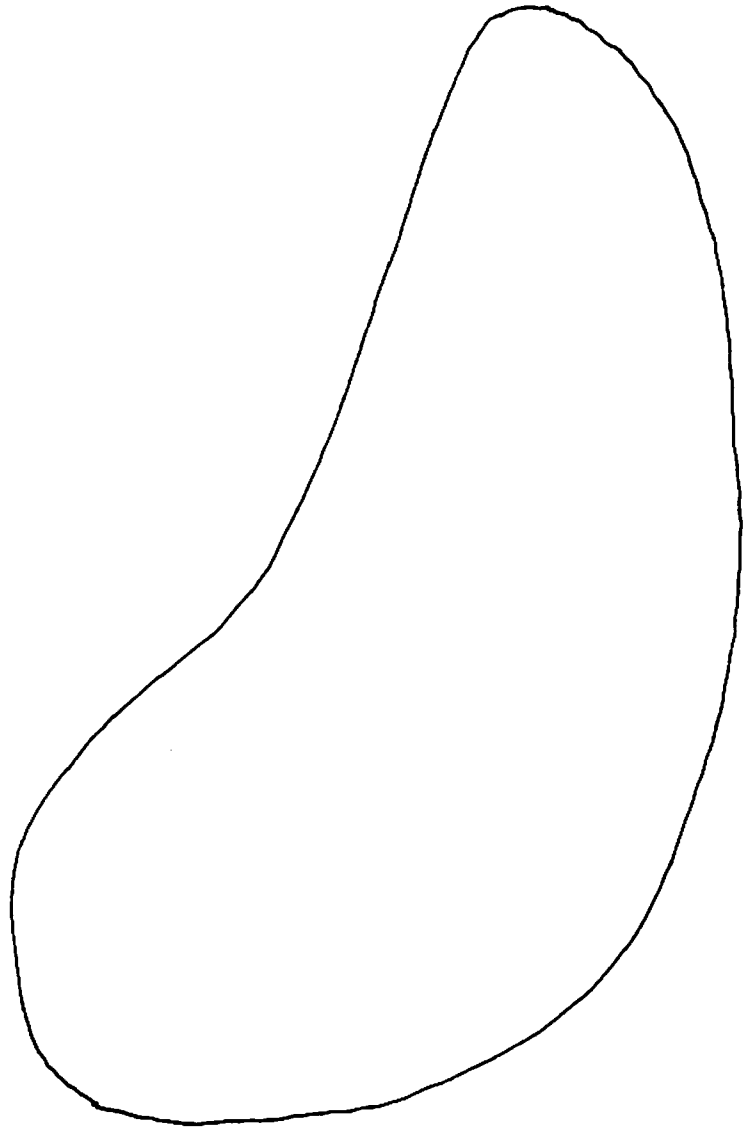
The cultural impact must be a contributing factor to cause the high phosphate reading.

The agricultural impact was considered low.

The pond was rated as eutrophic. The pond ratings from 20 to 26 (see final listing) could possibly be rated as mesotrophic, however, all are suffering from so called cultural eutrophication. That is eutrophication which is accelerated by human activities. This was the basic reason for the eutrophic rating.

WARNER POND

Planimetric Map



Warner Pond

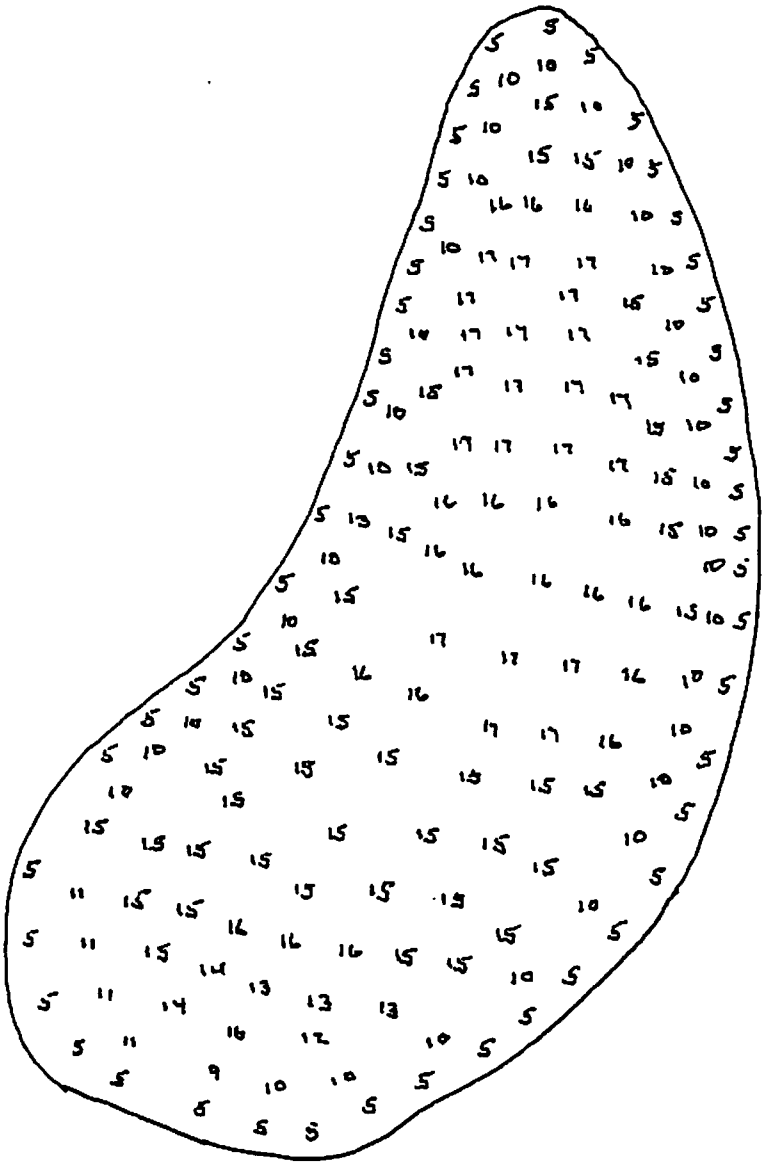
Plymouth, Mass.
Watershed - coastal
Acres: 4.5 1.82 H.
Altitude 20 6.1 M
Water type: warm
Pond type: kettlehole
Transparency 5 1.52 M
Watercolor: brown tint
Pond use: Recreational
Public water pumping station
Topo sheet USGS Map Manomet
1:24000 1962

Position Topo Map
up 6.1 R. 8.9
Shore line distance
2030 618.7 M
Bottom type--sand & gravel covered with organic layer
Shore line 65% high 35% low
Stratified - no
Stocked - no
reclaimed - no

Scale 1:127

WARNER POND

Bathymetric Map

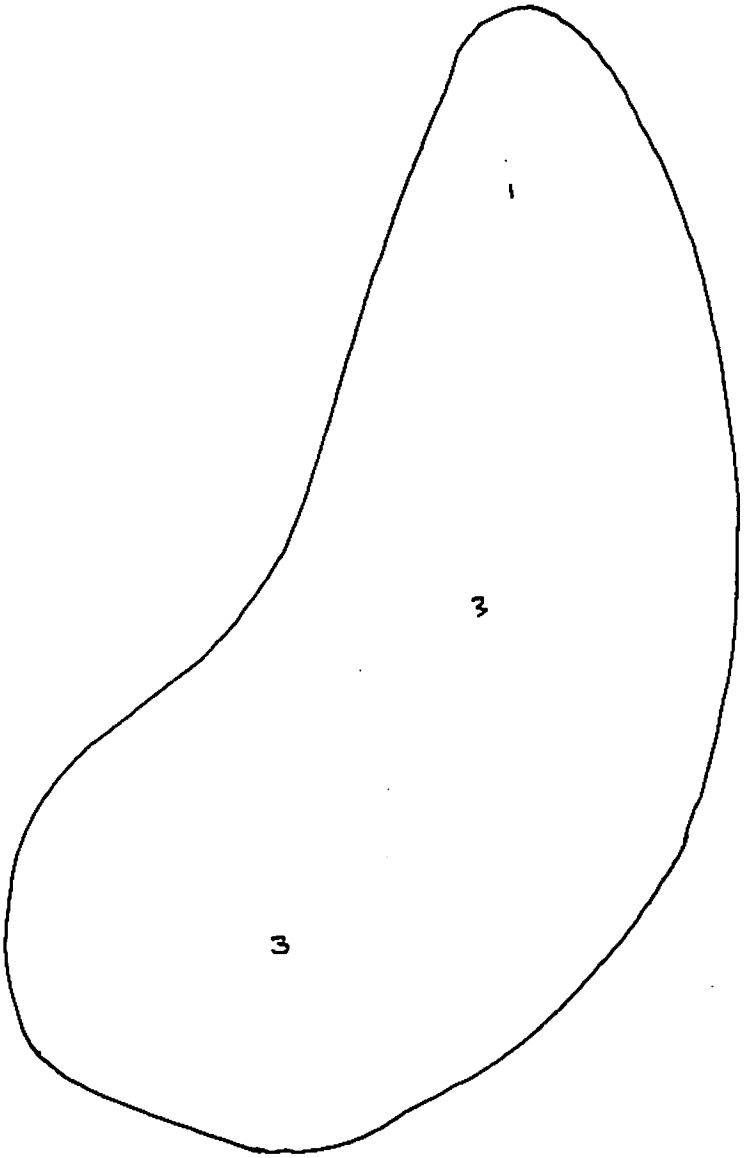


Maximum depth	17	5.18 M
Mean depth	12	3.66 M
Surface area	4.5	1.82 H.
Total acre feet	54	
Total gallons	17,594,766	

Scale 1:127

WARNER POND

Chemical Sample Stations

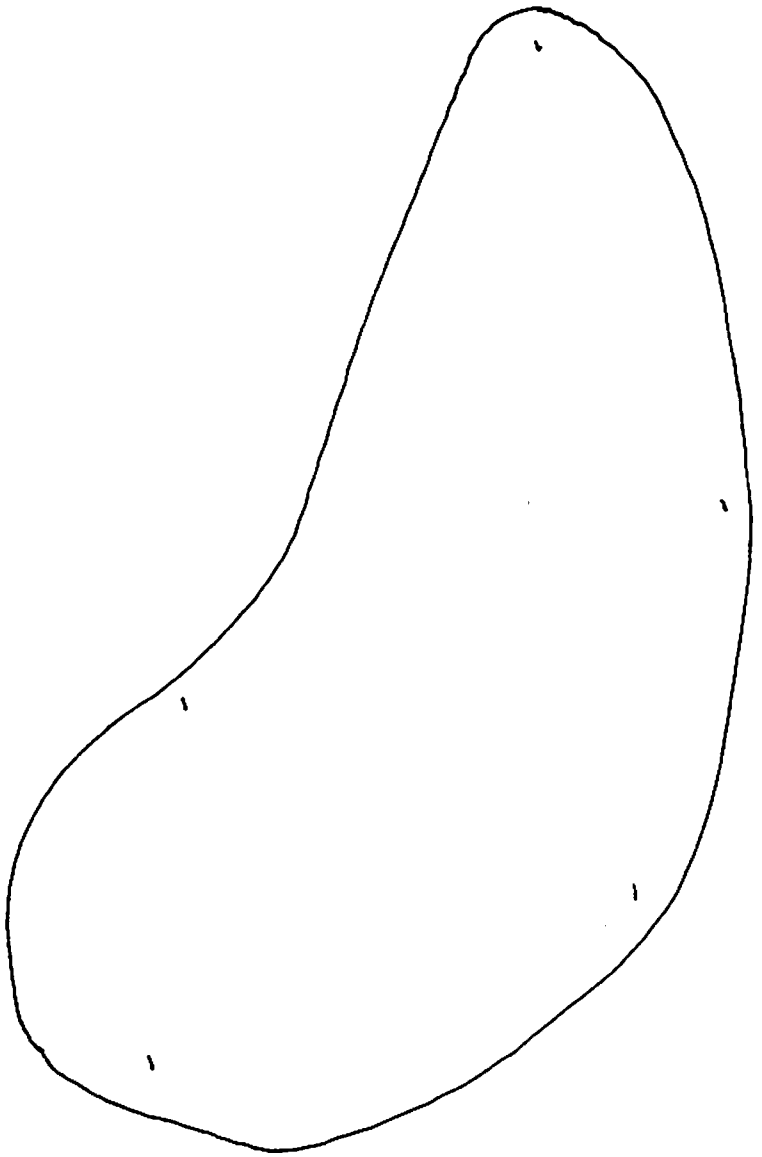


Benthic Station Number 2

Scale 1:127

WARNER POND

Submersed Aquatic Plant Map with Key



Submersed plant population was classfied as sparse.

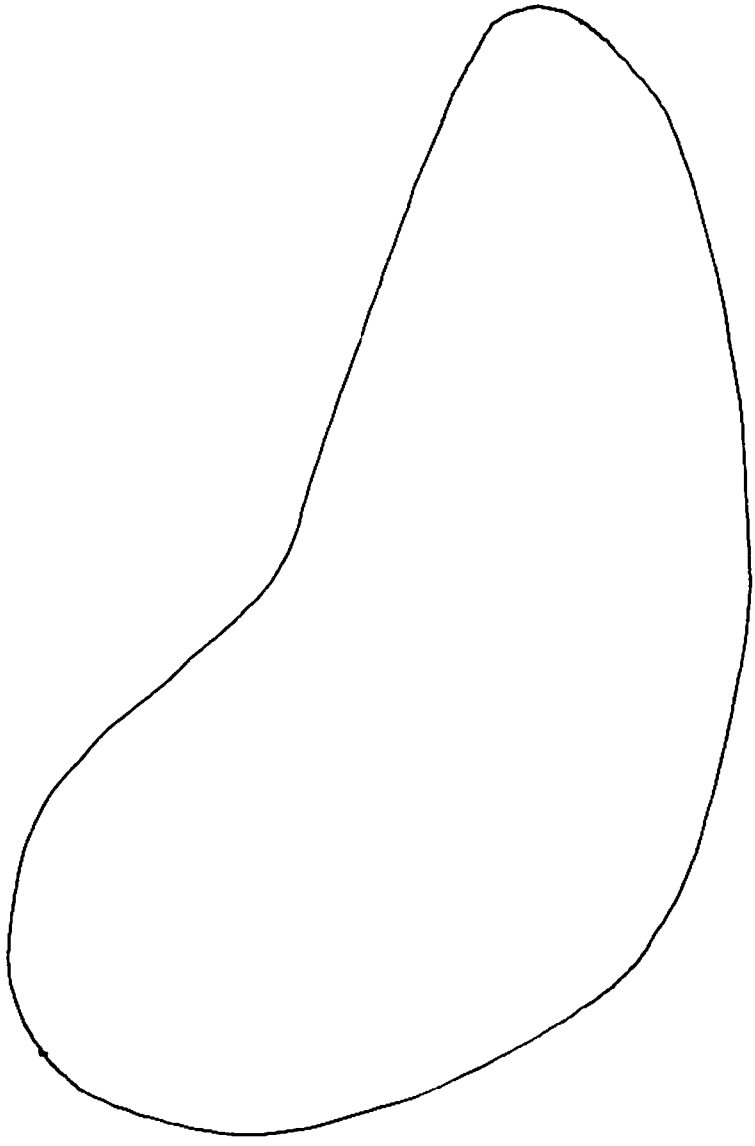
Scale 1:137

SUBMERSED AQUATIC PLANTS

LATIN	COMMON	MAP NUMBER
Potamogeton	Pondweed	
Potamogeton Americanus		
Potamogeton Ampl. Folius	Large Leaf Pondweed	
Potamogeton Crispus	Curly Leaf Pondweed	
Potamogeton Diversifolius	Waterthread Pondweed	
Potamogeton Filiformus		
Potamogeton Filiosus	Leafy Pondweed	
Potamogeton Gramineus	Variable Pondweed	
Potamogeton Natans	Floating Brown Leaf	
Potamogeton Nodosus	American Pondweed	
Potamogeton Pectinatus	Sago Pondweed	
Potamogeton Praelongus	White Stem Pondweed	
Potamogeton Richardsonii	Richardson Pondweed	
Potamogeton Robinsii		
Potamogeton Vaginatus	Giant Pondweed	
Najas	Bushy Pondweed	
Zannichellia	Horned Pondweed	
Elodea	Waterweed	
Ranunculus	Water Buttercup	
Ceratophyllum D.	Coontail	
Myriophyllum	Water Milfoil	
Alisma	Waterplantain	
Heteranthera D.	Water Star Grass; Mud Plantain	
Nasturtium	Water, Cress	
Utricularia	Bladderwort	
Vallisneria	Wild Celery	
	Addenda	
	Algae	
Chlorophyceae	Green Algae	
Unicellular		
Filamentous		
Cyanophyceae	Blue Green Algae	
Unicellular		
Filamentous		
Fontinelis	Water Moss	

WARNER POND

Emersed Aquatic Plant Map with Key

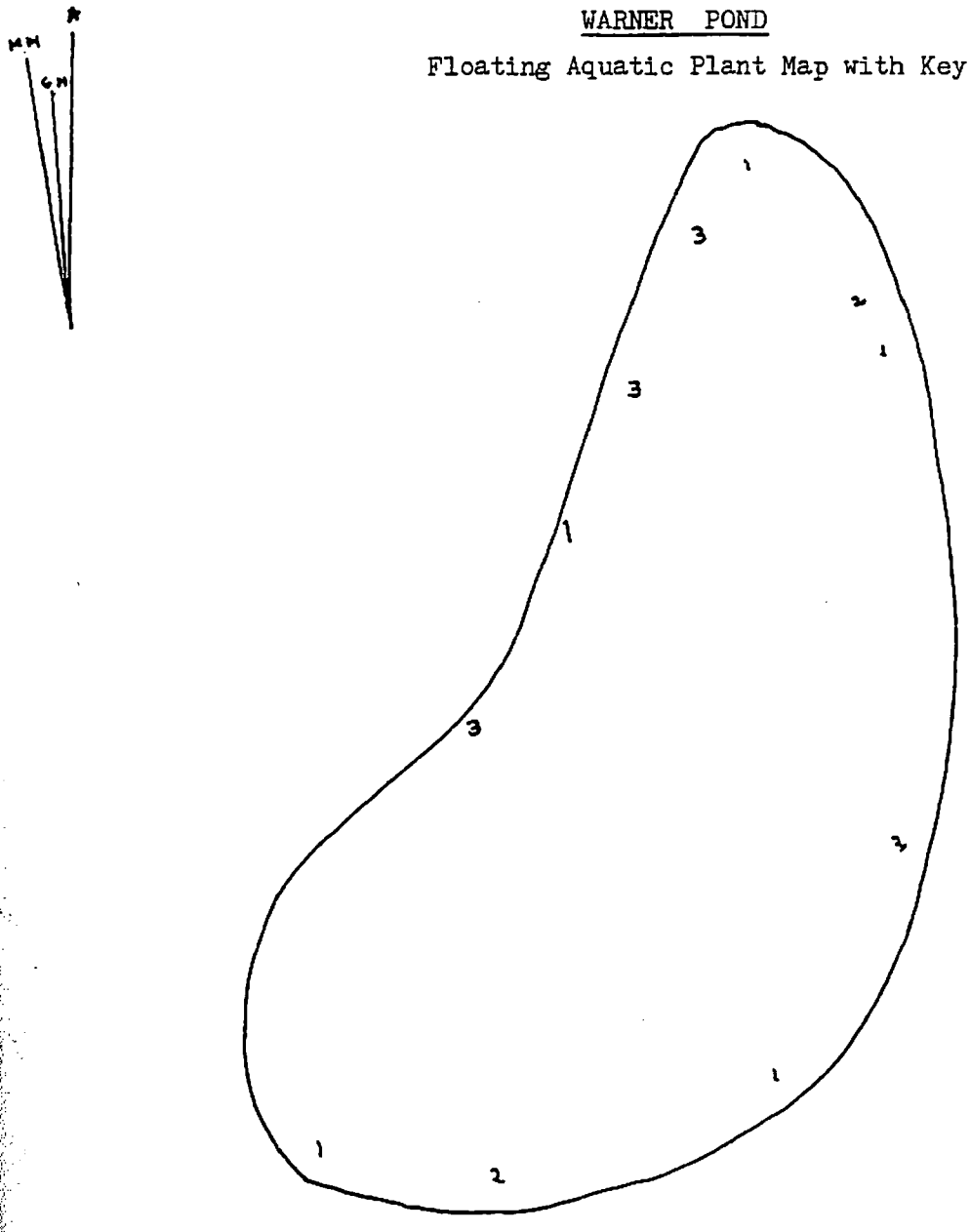


None at time of survey.

Scale 1:127

WARNER POND

Floating Aquatic Plant Map with Key



Floating plant population was classified as sparse.

Scale 1:127

FLOATING AQUATIC PLANTS ATTACHED

LATIN	COMMON	MAP NUMBER
Nuphar	Cow Lily, Yellow Water Lily, Spatterdock	2
Nymphaea	Water Lily, White Water Lily	1
Brasenia	Watershield	3

Addenda

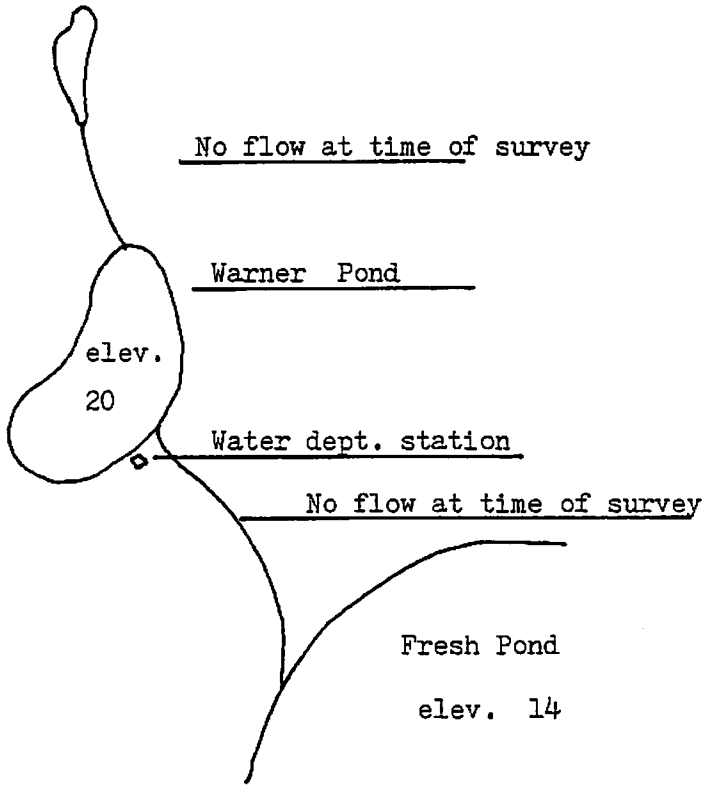
FLOATING AQUATIC PLANTS - UNATTACHED

LATIN	COMMON	MAP NUMBER
Lemna	Duckweed	
Spirodelia	Big Duckweed	
Wolffia	Watermeal	

Addenda

WARNER POND

Impoundment Map



Pond type: Kettlehole
Tributory: None
Outfall: None
Overland Flow: None
Groundwater and underground aquifer - primary source
Rainfall secondary "
Surface run-off secondary "
Agriculture practices directly affecting impoundment - none
Industrial sources " " " - None
Possible sources of nutrient influx - houses around ecosystem
Shoreline 65% high 35% low
Elevation 20' 6.1 M

Scale 1 : 510

WARNER

	IN LAKE STATION 1	2	3	OUTFALL 1	2	3	SOURCES 1	2	3
Total P	.11	.10	.11						
Nitrate (N)	.03	.03	.03						
Free Acid	0	0	0						
Total Acidity	0	0	0						
Alkalinity	0	0	0						
DO	10	11	10						
Total Hardness	32	30	32						
CO_2	18	18	18						
Ph	6.8	6.8	6.8						
Temp (C+F) 1' Levels	52	53	53 (F)						
Secchi	5	5	5						

Heavy Metals

Zn	ND
CD	ND
Sn	.010
Au	.025
Fe	.020
Po	
AL	.015
Cu	.019
Ni	.034
AG	

Benthos

Total P	12.3 mg/Kg	Dry
Total Nitrogen	8.4 mg/Kg	Dry
Total Volatile Solids (%)	1.8	
Percent Solids	66.3	
Total Kjeldahl Nitrogen (mg/kg)	15.3	Dry

All figures in mg/L unless otherwise noted.

LIMNOLOGICAL LISTING

Pond Name	Pond Type	Stratification	Trophic State
1. Long Pond	Natural	Yes	Oligotrophic
2. Little Pond	"	"	"
3. Great South Pond	"	"	"
4. Little South Pond	"	"	"
5. Bloody Pond	"	"	"
6. Fresh Pond	"	"	"
7. Gallows Pond	Kettlehole	"	"
8. Lout Pond	Natural	"	"
9. Micajah	Kettlehole	No	Mesotrophic
10. Sandy Pond	Natural	"	"
11. Clam Pudding	"	"	"
12. Black Jimmy	Kettlehole	"	"
13. Boot Pond	Natural	"	"
14. Round Pond	"	"	"
15. White Island	"	"	"
16. Little West	"	"	"
17. Ezekial	"	"	"
18. Wall Pond	Kettlehole	"	"
19. Little Sandy	Natural	"	Eutrophic
20. Island Pond (39')	Kettlehole	"	"
21. Gunners Exchange	Natural	"	"
22. Long Island Pond	"	"	"
23. Morey's Hole	Enhanced	"	"
24. Russell Mill Pond	Artificial	"	"
25. Island Pond (51')	Natural	"	"
26. Warner Pond	"	"	"
27. Beaver Dam	Artificial	"	"
28. Rabbit Pond	Kettlehole	"	"
29. Great Herring	Natural	"	"
30. Little Herring	"	"	"
31. Clear Pond	Natural	"	"
32. Big West	"	"	"
33. Kings Pond	"	"	"

34. Deer Pond	Kettlehole	No	Eutrophic
35. Hoyt's Pond	Natural	"	"
36. Forge Pond	Artificial	"	"
37. Scokes Pond	Kettlehole	"	"
38. Little Long Pond	Natural	"	"
39. Billington Sea	"	"	"
40. Savery Pond	"	"	"
41. Shallow Pond	"	"	"
42. Ship Pond	"	"	"
43. Bartlett Pond	"	"	"
44. Hedges Pond	Kettlehole	"	"
45. Indian River Pond	Artificial	"	"
46. Fresh Meadow Pond	"	"	"
47. Halfway Pond	Natural	"	"
48. Spring Pond	"	"	"
49. N. Triangle Pond	Kettlehole	"	"
50. Grassy West Pond	Natural	"	"

Pond Types

Natural - Usually with an inlet & outlet.

Artificial - An impoundment.

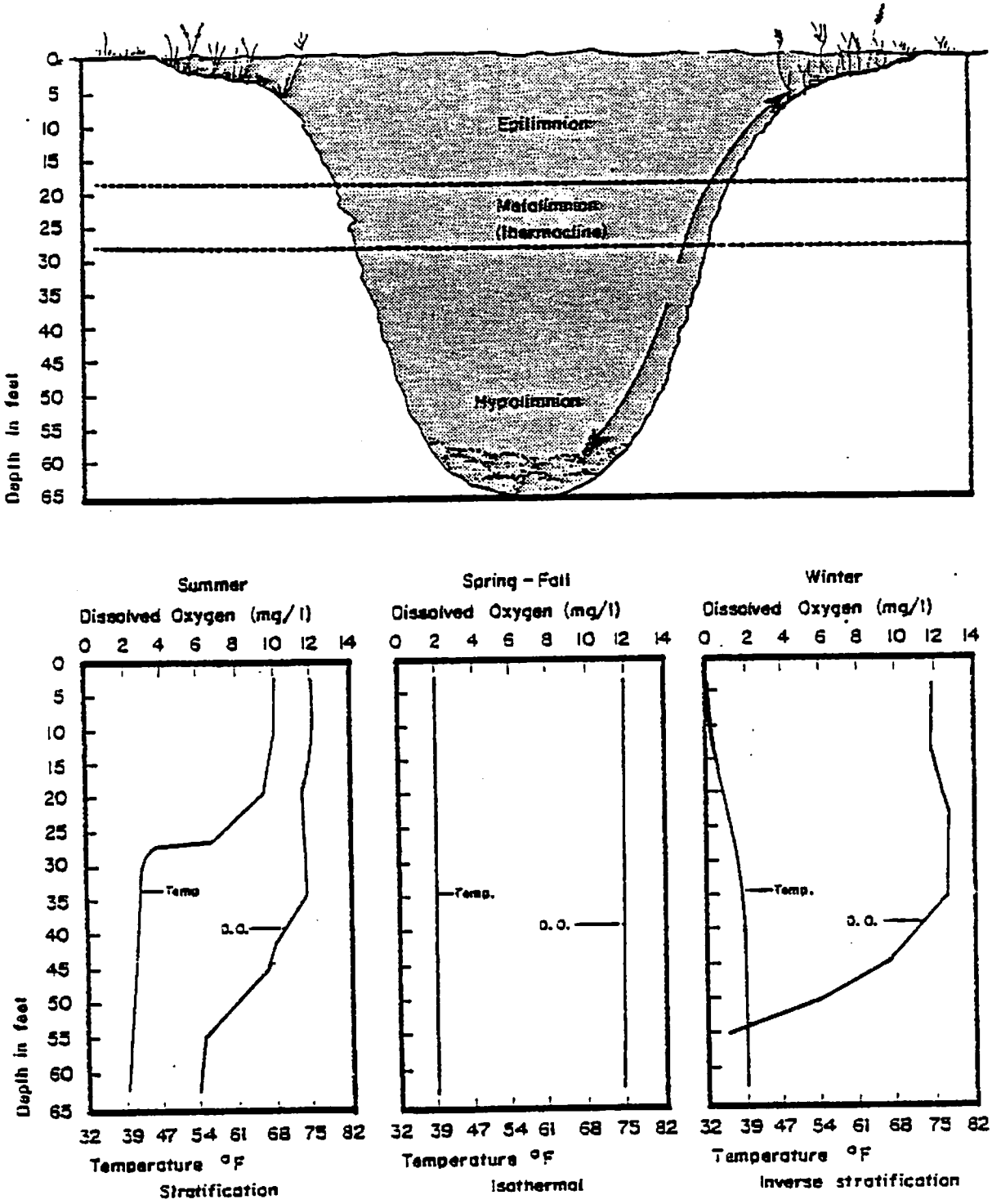
Enhanced - Natural pond deepened by damming or dredging.

Kettlehole - A natural body of water having no surface inlet or outlet.

Stratification

Figure A shows the various zones of a typical stratified lake. In addition to a lake's life history mentioned above, a lake also has characteristic annual cycles. Depending on the season, a lake has a particular temperature and dissolved oxygen profile (Figure A). During the summer season, the epilimnion, or warm surface water, occupies the top zone. Below this is the metalimnion which is characterized by a thermocline. In a stratified lake, this is the zone of rapid temperature change with depth. The bottom waters, or hypolimnion, contain colder water. The epilimnion is well mixed by wind action, whereas the hypolimnion does not normally circulate. During the spring and fall seasons, these regions break down due to temperature change and the whole lake circulates as one body. In shallow lakes (i.e., 10 to 15 feet maximum depth) affected by wind action, these zones do not exist except for short periods during calm weather.

Diagrammatic sketch showing thermal characteristics of temperate lakes



Source: Measures for the Restoration and Enhancement of Quality of Freshwater Lakes. Washington, D.C.: United States Environmental Protection Agency, 1973.

FIGURE A

LAKE TROPHIC CHARACTERISTICS

1. Oligotrophic Lakes

    a. Very deep, thermocline high; volume of hypolimnion large; water of hypolimnion cold.

    b. Organic materials on bottom and in suspension very low.

    c. Electrolytes low or variable; calcium, phosphorus, and nitrogen relatively poor; humic materials very low or absent.

    d. Dissolved oxygen content high at all depths and throughout year.

    e. Larger aquatic plants scarce.

    f. Plankton quantitatively restricted; species many; algal blooms rare; Chlorophyceae dominant.

    g. Profundal fauna relatively rich in species and quantity; Tanytarsus type; Corethra usually absent.

    h. Deep-dwelling, cold-water fishes (salmon, cisco, trout) common to abundant.

    i. Succession into eutrophic type.

2. Eutrophic Lakes

    a. Relatively shallow; deep, cold water minimal or absent.

    b. Organic materials on bottom and in suspension abundant.

    c. Electrolytes variable, often high; calcium, phosphorus, and nitrogen abundant; humic materials slight.

    d. Dissolved oxygen in deep stratified lakes of this type minimal or absent in hypolimnion.

    e. Larger aquatic plants abundant.

    f. Plankton quantitatively abundant; quality variable; water blooms common, Myxophyceae and diatoms predominant.

    g. Profundal fauna, in deeper stratified lakes of this type: poor in species and quantity in hypolimnion; Chironomus type; Corethra present.

    h. Deep-dwelling, cold water fishes usually absent; suitable for perch, pike, bass, and other warm-water fishes.

    i. Succession into pond, swamp or marsh.

3. Mesotrophic Lakes

It is characterized by nutrient levels and amounts of plant bidmass that are intermediate to those found in eutrophic and oligotrophic lakes and ponds.

A D D E N D A

Revision of Pollution Definition

The general approach is to stress violation of coliform bacteria standards, research shows that nutrient pollution over a period of time is as important, or may be more important than bacterial pollution. A set of general standards should be put forth and it is suggested that violation of nutrient standards be incorporated in the pollution standards.

GENERAL GUIDELINES

	Permissible levels	Critical
Total phosphorous mg/l	.025	.04
Orthophosphorous mg/l	.004	.01
Organic Nitrogen mg/l	.20	.40
Ammonia mg/l	.02	.03
Nitrate mg/l	.10	.25
Nitrite mg/l less than	.001	.00
Inorganic Nitrogen mg/l	.12	.30

Incorporation of the above nutrient levels in the general pollution standards would be a positive approach toward solving the problem of nutrient loading from all sources and would redefine pollution as it is generally understood.