Environmental Scientific Services

ENSIS

Wandsworth Lakes

Annual report on lake monitoring and management

ECRC Research Report Number 183

Ben Goldsmith

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Wandsworth Lakes:
Annual report on lake monitoring and management 2016

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Cover Photo: King Georges Park Lake. ENSIS 2016

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1. Introduction

Lakes and rivers form an important part of the urban landscape and provide a wide range of opportunities for both people and wildlife. Within the London Borough of Wandsworth, the park lakes have a long and varied history, culminating in them delivering a wide range of functions today, including wildlife sanctuaries, fishing lakes and boating lakes and above all, they provide an important part of the diversity and inherent value of the parks to the local communities.

Over the past 19 years, ENSIS has collected extensive data on the water quality and ecological potential of the Wandsworth lakes. Through careful and informed management, we have seen very significant improvements in some of the sites, and have developed a clear understanding of the functioning and potential for each of the sites. Key to many of the management goals is good water quality, something that is very difficult to achieve within an urban environment. In addition, where water quality cannot be controlled, other factors have been addressed, such as fish management and marginal planting to improve the aesthetic quality of the sites.

1.1. Monitoring in 2016

Table 1 Sampling matrix for the Wandsworth lakes in 2016

Site	Site Code	Sample period	Water quality	Invertebrates	Aquatic plants	Blue-green algae
Battersea Park Lake	**BATT**	**Spring**	✓	✓	×	×
		Summer	✓	×	✓	✓
Wandsworth Common (Wildlife)	**WAND**	**Spring**	✓	✓	×	×
		Summer	✓	×	✓	✓
Wandsworth Common (Angling)	**WANF**	**Spring**	✓	×	×	×
		Summer	✓	×	✓	✓
Three Island Pond	**WANS**	**Spring**	×	×	×	×
		Summer	✓	×	✓	×
King George's Park Lake	**KING**	**Spring**	✓	✓	×	×
		Summer	✓	×	✓	✓
Tooting Common Lake	**TOOT**	**Spring**	✓	✓	×	×
		Summer	✓	×	×	✓

In light of past monitoring and recent efforts to introduce aquatic vegetation to some of the lakes, the focus of the current monitoring programme has been directed towards the evaluation and assessment of recent lake management. Table 1 sets out the planned monitoring for spring and Summer sampling after which a full assessment will be reported. Below are the results from the April sampling trip conducted 25th April 2016. The main management issues are discussed for each site below, but two issues are of note:

We are no longer monitoring Ladies Pond as a separate site. This is based on past data that show the pond to be reliant mainly on the water supply from the Main Pond, which is often limited and results in poor water circulation in the Ladies Pond. Water quality is therefore generally lower than the Main Lake and it is therefore best to concentrate management on the main lake.

Wandsworth Wildlife Lake and Angling Lake will be monitored separately. The shared water supply means the quality of the Wildlife Lake is dependent on the exclusion of fish, which is best assessed by monitoring the sites separately.

1.2. Water quality

One of the key requirements for good water quality in the lakes, is of course a high quality water supply. Where sites rely on run-off from the surrounding parks and urban areas, or are topped up by mains tap water, water quality will be poor. Run-off brings with it sediment and nutrients from the parkland, and mains water, although fine for drinking, is high in plant nutrients (mainly nitrogen and phosphorus) which in lakes, encourages the growth of planktonic algae and blanketweed which are detrimental to the ecological function of the lakes. Inputs from the bore-hole water supply at the Main Lake in Battersea Park have had a major impact on water quality over the past 20 years (see for Table 2chemistry). Total phosphorus concentrations have dropped from over 300 µg/l to current levels of around 100 µg/l. At King George's Park Lake, the bore hole provide excellent quality water, but more complex management problems with leaks have meant that supply cannot keep up with demand and poor quality mains water has been required to prevent the lake levels becoming critical.

Table 2 Water chemistry from the Battersea Park and King Georges Park bore-holes

pH	Conductivity μScm^{-1}	SRP μgl^{-1}	TP μgl^{-1}	Nitrate mgl^{-1}	TN mgl^{-1}
7.41	889	2.8	4.1	<0.005	0.50
7.91	520	2.3	2.6	0.014	0.62

Where lakes rely on mains-water supply, the loadings of nutrients (N & P) are inevitably higher (see Table 3) and the lakes will inevitably struggle to maintain the clearer waters needed to facilitate plant growth.

Table 3 Typical mains supply quality from the Battersea Park area (Thames Water 2014)

pH	Conductivity μScm^{-1}	SRP μgl^{-1}	TP μgl^{-1}	Nitrate mgl^{-1}	TN mgl^{-1}
7.90	596	No data	>500	5.6	No data

Under these circumstances, the presence of fish exerts additional pressures on the sites due to their impact on zooplankton population (through predation) and by causing physical disturbance of the sediments (e.g. carp). Plants are unlikely to establish where fish stocks are high (e.g. Wandsworth Common Wildlife Lake and Tooting Common Lake), but with careful management and a balance fish population, the chance of aquatic plants becoming established are higher (e.g. Battersea Park Lake).

1.3. Aquatic plants

Where aquatic plants become established, they perform a number of key functions:

- plants help to regulate the dissolved oxygen content in the water,
- they provide habitat for invertebrates and so help to increase bio-diversity,
- they provide good habitat for zooplankton, which in turn help to maintain clear water by grazing on planktonic algae,
- plants take up nutrients from the water and so reduce the availability of nutrients for algae (including blanket weed),
- Some species provided added visual appeal to the lakes (e.g. water lilies, bog bean).

To this end, ENSIS put forward a recommended planting regime for those lakes considered most suitable (Battersea Park and King George's Park Lake) and supported additional efforts to plant in Three Island Pond and the north end of The Wandsworth Common Wildlife Pond. Planting was carried out in 2015 (see appended maps for final species choice and locations)

In 2016, ENSIS conducted routine water quality monitoring in spring and late summer and undertook comprehensive macrophyte surveys of all the lakes to assess the success of the planting.

2. Results

2.1. Water Quality

Based on the spring water quality results, the sites remain relatively stable and comparable to previous years. The September samples all show elevated levels of both available, and total phosphorus. This appears to be due to nitrogen limitation in most cases, a situation whereby uptake of nitrate by plants and algae reaches a maximum and soluble P is therefore unused and builds up in the water. This is most commonly seen in summer when water temperatures are at their highest. The lack of turnover (throughput of water) allows for the unused nutrients to build up, and often they become sequested into the sediments and cause problems in the future when released back to the water.

Table 4 Water quality results for the Wandsworth Park lakes 2016

Site	pH	Cond	D.O.	Total N	Nitrate	SRP	TP	Chl a	SS	Secchi
April 2016										
BATT	8.88	577	11.1	0.7	<0.005	56	92	4.1	3.28	>85
KING	9.07	441	12.0	0.83	<0.005	265	330	3.7	<3	>80
TOOT	7.84	436	5.7	1.84	0.13	39	123	13	8.53	>75
WAND	7.71	528	2.6	2.45	0.04	332	430	13.7	9.48	>80
WANF	7.75	567	4.4	2.15	0.16	200	266	28.9	16.9	60
WANS	8.88	577	11.1	0.7	<0.005	56	92	4.1	3.28	>85
Sept. 2016										
BATT	8.40	590	10.2	0.78	<0.004	227	325	1.8	10.1	>85
KING	8.85	523	18.5	0.42	<0.004	400	447	2.8	<3.0	>75
TOOT	7.60	452	5.7	3.06	0.190	63.7	387	4.9	32.2	25
WAND	7.91	511	4.8	2.54	<0.004	984	1690	10	28.4	40
WANF	8.00	529	4.5	2.86	0.844	775	1260	12.8	29.5	35
WANS	8.20	481	9.8	1.26	0.024	347	582	86.7	12.7	>80

Key	Units
Conductivity (Cond.)	µS/cm
Dissolved Oxygen (D.O.)	mg/l
Biochemical Oxygen Demand (B.O.D.)	mg/l
Nitrate (as nitrogen)	mg/l
Soluble Reactive Phosphorus (SRP)	µg/l
Total Phosphorus (TP)	µg/l
Chlorophyll a (Chl. a)	µg/l
Suspended Solids (SS)	mg/l
Secchi disc depth (Secchi)	cm

Despite the high summer phosphorus, water clarity in Battersea Park, King George's and Three Island ponds remained good. This can be attributed to the plants in Battersea and low density of fish in the other two clear sites. Where high fish densities occurred, water clarity was very poor; Tooting common, and the main Wandsworth Common lakes. At these sites, there is little hope in getting submerged plants established until either the water quality improves considerably, or fish stocks are thinned dramatically.

2.2. Blue-green algae

Battersea Park Lake, Tooting Common Lake and the Wandsworth Common Main lakes had blue-green algae present, but the numbers were well below the levels for concern in April and September (Table 5). Conditions nonetheless remain suitable, and there is a high likelihood that blooms will occur in the future.

Table 5 Blue-green algal cell concentrations in the Wandsworth Borough Lakes – April (top) and Sept. (bottom). (EA safe limit 20,000)

Blue-green algal type	BATT	KING	TOOT	WAND	WANF	WANS
Microcystis spp.			56	0	0	0
Oscillatoria sp.	16	0	4	0	0	0
Amphanizomenon sp.	0	5	0	0	0	0
Total per ml April	**16**	**5**	**60**	**0**	**0**	**0**

Blue-green algal type	BATT	KING	TOOT	WAND	WANF	WANS
Microcystis spp.	800	0	1640	1800	2160	0
Oscillatoria sp.	186	0	120	32	340	0
Amphanizomenon sp.	240	0	0	0	0	0
Total per ml	**1226**	**0**	**1760**	**1832**	**2400**	**0**

Aquatic macroinvertebrates

Invertebrate samples were collected from a subset of the lakes in April. In an effort to give comparison between site, invertebrate samples are taken from similar habitats in all sites. This was, where possible alongside, an area of emergent / marginal vegetation where optimal habitat opportunities exist for invertebrates. A vigorous 30 second kick and scoop sample was taken at each location with a standard FBA net.

Samples were sorted on site and the larger invertebrates removed, counted and returned to the water. Samples are then preserved with de-natured alcohol and the remaining invertebrates picked from the samples in the laboratory and identified under magnification where necessary. Identification was to family level. The results are presented in (Table 6).

Species richness gives a crude assessment of habitat quality. Battersea Park Lake and King Georges have the highest number of invertebrate families, reflecting the presence of a variety of both submerged and emergent plant species in Battersea Lake and the rich marginal vegetation at King George's Park Lake. Although there are reasonable stands of emergent vegetation at Tooting Common Lake and Wandsworth Common Lake, the diversity of plants is lower and water quality, particularly respiratory health (DO), is inadequate for some invertebrate groups.

Table 6 Aquatic macroinvertebrates recorded in the Wandsworth Park lakes – April 2016

Type	Common name	Family	BATT	TOOT	WAND	KING
Water bugs	Water boatman	Corixidae	15	2	7	8
	Saucer bugs	Naucoridae				
	Greater backswimmers	Notonectidae	5			1
	Pond skater	Gerridae	1			3
		Nepidae				
	Lesser backswimmers	Pleidae				
	Water Measurer	Hydrometridae				
Alderflies		Sialidae				
Mayflies		Baetidae	3			12
		Caenidae				
Caddis Flies		Limnephilidae				
		Molannidae				
		Leptoceridae	5			7
		Polycentropidae				
	Micro-caddisfly	Hydroptilidae				
		Psychomyidae				
Damsel & Dragonflies	Damselfly nymph	Coenagrionidae	6			6
	Dragonfly nymph	Aeshnidae				
True-Flies	Non-biting midge larvae	Chironomidae	3	28	12	20
	Phantom midge larvae	Chaoboridae				
	Cranefly larvae	Tipulidae				
	biting midge larvae	Ceratopogonidae				
	other dipteran larvae	other diptera			1	
Beetles	Squeak beetle	Hygrobidae				
	Diving beetle	Dytiscidae				
		Haliplidae				2
Crustaceans	Hoglice	Asellidae	34	15	42	33
	Freshwater shrimp	Crangonyctidae	6		12	8
	Ostracod	Ostracoda		2		
Leeches		Glossiphonidae	5	3	3	4
		Erpobdellidae	1			2
	Fish leech	Piscicolidae				
Molluscs	Ramshorn snails	Planorbidae	23		3	10
	Bladder snails	Physidae	3	2	2	
	Pond snails	Lymnaeidae		1		3
	Spire shells	Hydrobidae	143			12
	Pea/Orb mussels	Sphaeridae				6
	Lake limpet	Ancylidae				
	Operculate snail	Bithyniidae	27			
	Valve snails	Valvatidae				
Worms		Lumbriculidae				2
		Tubificidae		1		
Flatworms		*Dugesia*	5			5
		Polycelis				
Others	Water mite	*Hydracarina*	1			
	Total Individuals		**267**	**48**	**69**	**105**
	Number of Taxa		**17**	**8**	**8**	**18**

2.3. Aquatic macrophytes

Tooting Common Lake (TOOT) remains very turbid through the summer months and much of the turbidity is caused by suspended solids; most likely a result of carp disturbing the sediments during feeding. These conditions make the site unsuitable for aquatic plants.

Management of the marginal trees will help to bring more light to the water and to some extent reduce the impact of leaf litter in the lake. We support plans to cut back the trees along the wooded east shore and suggest this be extended to some of the larger overhanging trees on the island. We do not recommend any aquatic planting for sites where carp are present at high density.

Reduced shading around the island and along the west side will however promote the growth of more wetland / marginal plants and we support efforts to plant these area.

Wandsworth Common Lakes

Three Island Pond (WANS) appears to be relatively stable. Despite high levels of phosphorus, the water remains relatively clear. In the past, the main risk to this site has been from excessive growths of duckweed, mainly the non-native *Lemna minuta,* which can smother the surface and reduce oxygen levels to almost zero. Although present at the site, levels appear to have remained low in 2016. Keeping the fountain maintained and running will help to prevent major build-ups of duckweed.

Rather disappointedly, we found no evidence of the water lilies that were planted in 2015, nor did we record any *Ceratophyllum demersum, Potamogeton crispus* or *Ranunculus aquatilis agg.* also planted in the pond. To the best of our knowledge there are no fish in the site and with water clarity being consistently good, the failure of plants to establish is thought most likely to be due to a combination of filamentous algae cover and grazing by water fowl. Canada geese and coot are often abundant in the site, attracted by feeding, but readily turning back to their natural food if available. The plants are probably most susceptible just after planting, when up-rooting and grazing of young shoots probably removed the entire population before it had a chance to establish. Control of geese is unlikely to be successful given the large and mobile population of this species in and around London.

Water lilies tend to be more resilient due to having thick and tuberous rhizomes, and may therefore still become established if the potted plants where mature when planted.

Filamentous algae was abundant at the site and formed a dense mat over much of the lake bed. Blanket weed (*Cladophora* sp.) can have a major impact on aquatic plants, which are quickly out-competed for space and light by the fast-growing algal mat.

In terms of future management, the failure for plants, including potted water lilies, to establish is disappointing. High nutrient levels favours the growth of filamentous algae and the small size of the site results in water birds having a significant impact. Without better protection and regular tending of potted lilies it may therefore be difficult to get them established. When fully operational, the fountain provides a good visual feature on the lake and helps prevent duckweed reaching nuisance levels.

The areas of marginal vegetation to the east side of the pond has become very well established and continues to provide good habitat for invertebrates and birds as well as providing a good barrier between the water and the road.

The **Wildlife Lake (WAND)** was turbid and had relatively high levels of suspended solids, suggesting that the turbidity was associated with re-suspended material as well as algal biomass. These conditions are indicative of disturbance of the sediments by carp and water fowl and are a major inhibitor to the growth of plants. All available nitrate was taken up, leaving high concentrations of available phosphorus (SRP) and the high TP concentrations show the site to be very productive and hyper-eutrophic.

Under these conditions aquatic plants are very unlikely to establish. The reinstallation of a permanent fish barrier under the bridge (installed Sept 2016) will hopefully help achieve management goals here. Now the fish barrier is in place, the removal of fish from The Wildlife side should be undertaken when feasible, this will probably requiring several removals to ensure an effective reduction in fish numbers. Low fish density will help to reduce sediment re-suspension and improve the efficiency of algal grazing by zooplankton grazing and hence improve water clarity and give the best chance for plants to establish. Small fish will inevitably remain in the site and thus the Wildlife Lake would benefit from pike and perch introductions to help control small fish and balance the fish population.

There are some well established areas of marginal wetland plants around the Wildlife lake and these offer good habitat for invertebrates and birds. Conditions remain unsuitable for submerged aquatic plants within the main area of the Wildlife Pond and non were recorded during our survey.

Five species of water plant were introduced to the isolated area at the northern end of the lake in 2015: *Ceratophyllum demersum, Myriophyllum spicatum, Potamogeton crispus, Ranunculus aquatilis agg* and the hybrid water lily *Nymphaea "carnea".* Sadly, none of these were observed during our survey. Conditions at this end of the pond, while probably best suited to plants in terms of low fish disturbance, are rather shaded and this along with bird grazing are the most likely factors for failure.

Planned management of the Wildlife Pond, which will limit fish numbers, will hopefully improve conditions in the deeper, open water areas of the lake. One done, we recommend efforts are made to populate for site with plants. While tempting to suggest re-locating plants from Battersea, the presence of the non-native *Elodea nuttallii* there would preclude this. Movement of non-native species (deliberately or otherwise) goes against best practice and in some cases is illegal.

The **Angling Lake** (WAND) had very similar water quality to the Wildlife Lake, which demonstrates that they are effectively functioning as a single site at present (see comments above re fish barrier). Recognising that the main function for this side of the lake is for angling, we recommend that fish stocks are carefully monitored after the site is separated from the Wildlife lake. Carp numbers / biomass should be maintained well within recommended levels and if possible the focus moved away from carp towards a native fishery including perch and pike. We do not recommend any aquatic planting for the site while carp are present.

King George's Park Lake (KING) remains very stable with clear water, low planktonic algal biomass and very low suspended solids. Water levels were rather low in September, and necessitated addition top-ups with mains water during summer. The bore-hole supply, while still active during our visits, was nonetheless only flowing very slowly and cannot keep up with loss of water from the site which occurs either through evaporation of from a leak.

Five species of aquatic plant were introduced to the site in 2015: *Ceratophyllum demersum, Myriophyllum spicatum, Potamogeton crispus, Ranunculus aquatilis agg* and pots of white water lily *Nymphaea alba*. By September 2016 the open water was completely dominated by a very dense cover of blanket weed (*Cladophora* sp.), and we were unable to find any evidence of aquatic plants during our survey.

This situation is very disappointing, particularly given that we know the site has supported pants in the past. Good water clarity and a lack of any large fish in the lake should provide perfect conditions for plants. Coupled with high nutrients, these conditions are also perfect for the growth of blanket weed, which can quickly outcompete and smother higher plants.

Given the dominance of blanket weed in King Georges Pond we recommend alternative methods are trialled to control this algal growth, particularly the use of pond dyes. Commercially available pond dyes are relatively in-expensive, and are based on natural colours that are non-toxic and harmless to invertebrates and birds. The choice of dye can be either blue, which gives a distinctive look to the pond that may need explanation notices, or more neutral greys, that retain a more natural appearance, but still claim to be effective. There are a number of suppliers of pond dyes of which Dyofix is one, see: http://www.dyofix.co.uk/ for more information about products and pricing.

Adding dye to the water works by limiting the light penetration into the water and so inhibits photosynthesis and hence algal growth. Whilst this has the positive effect of limiting algal growth, it will also inhibit the growth of any of the more desirable aquatic plants. Although this side-effect is not altogether ideal, it is suggested that the suppression of dense blanket weed growth should be the priority in the short term. If blanket weed can be effectively controlled within the site, it will hopefully be possible to re-assess the pond for higher plants in the future.

We strongly recommend that the bore-hole remains the primary water source whenever possible. If there is a leak in the site we support any works that can repair it and thus maximise the good quality of the bore-hole supply. Furthermore, if there is any way to increase the rate of flow from the bore-hole this would benefit the site.

In contrast to the poor open water habitat, the marginal vegetation along the west shore remains an excellent feature. This is good invertebrate habitat and adds considerable interest to the site.

Battersea Park Main Lake (BATT) had poor water quality with respect to phosphorus levels, with higher than expected available P (SRP) and total P (TP), apparently a result nitrate limitation. Because plants and algae need both N & P for growth the limitation of N results in excess P accumulating which, although no problem in the short term, does mean algae can rapidly increase if more nitrate becomes available. This situation is not unusual for Battersea Park Lake, but in recent years we have not seen such high levels of P accumulate. Under these

conditions it is important to keep nitrogen inputs to a minimum and hence the use of mains water should be avoided and use of nitrate fertilizers with the park kept to a minimum.

Other water quality parameter were good. In particular, water clarity was good, particularly within the aquatic plant beds. This demonstrates the benefit of plants within the site, their presence having a direct impact on water clarity by providing good habitat for zooplankton, which in turn feed on algae and help to keep the water clear.

This year (2016) is the first time we have seen such extensive aquatic plant growth in Battersea Park Lake. In part this is due to the success of the planting carried out in 2015, but interestingly, the dominant plant was not one of the planted species, but instead was the non-native Nuttall's waterweed (*Elodea nuttallii*), a species previously recorded in the site, but not at such high density.

In addition to the Nuttall's waterweed, rigid hornwort (*Ceratophyllum demersum*) and spiked milfoil were also present in good quantities, particularly where these species were planted, but also in other areas, which is encouraging. Two species planted in 2015, Curled pondweed (*Potamogeton crispus*) and water Crowsfoot (*Ranunculus aquatilis agg.* were not found during our survey.

Two other native pondweed species were however recorded; *Potamogeton pusillus* and *P. pectinatus.* These species may have been inadvertently brought in during the planting, or were present in the seed bank and simply benefited from the clearer water and protection afforded by the high density of other plants in the lake. These species are very palatable to water fowl and might normally be grazed at low plant density, but benefit from the additional abundance of plants in the site.

Water lilies (*Nymphaea alba*) were present, but it is unclear if any of those planted in 2015 survived. The majority of water lilies were within the marginal fencing along the south site and to the north of the main Island, most of which have been established since before 2015. Two species of free-floating duckweed were present; the native *Lemna minor* and non-native *Lemna minuta.* These were mainly restricted to sheltered areas or very sparsely distributes in open water.

The boating area was almost entirely dominated by Nuttall's waterweed, with no evidence of the rigid hornwort planted to the west and north of the island. This area also had more filamentous algae than the rest of the Main Lake. The aquatic plants are summarized in Table 7 and maps presented below.

Table 7 Aquatic plant species reported in Battersea Park Main Lake

Botanical name	Common Name	Planted 2015?	Native?	Abundance
Elodea nuttallii	Nuttall's waterweed	No	No	Dominant
Ceratophyllum demersum	Rigid hornwort	Yes	Yes	Frequent
Myriophyllum spicatum	Spiked milfoil	Yes	Yes	Occasional
Potamogeton pusillus	Small pondweed	No	Yes	Occasional
Potamogeton pectinatus	Fennel pondweed	No	Yes	Rare
Potamogeton crispus	Curled pondweed	Yes	Yes	Absent
Ranunculus aquatilis agg	Water Crowsfoot	Yes	Yes	Absent
*Nymphaea alba**	White water lily	Yes	Yes*	Occasional
Lemna minor	Common duckweed	No	Yes	Rare
Lemna minuta	Least duckweed	No	No	Occasional

**N. alba* – possibly some or all of these are cultivated / hybrid species

The **Ladies Pond** had very low water levels and, as previously discussed, is reliant on water levels in the main lake being sufficient to ensure it remains full. It is thought the site is leaking and this, coupled with the 2016 summer being relatively dry, resulted in water levels dropping to 50-60 cm below the barrier into the Main Lake.

Despite this, Ladies Pond was dominated by aquatic plants, with *Myriophyllum spicatum* being most abundant. We were unable to take the boat onto this part of the lake, but conducted a number of wading transects and recorded *M. spicatum* as dominant and a smaller area with *Ceratophyllum demersum* towards the east side; both planted in 2015. Water crowsfoot (*Ranunculus aquatilis* agg.) was planted in 2015, but we did not record it in the Main Lake of Ladies Pond

With the Main Lake currently doing so well, water resources should be focused there, rather than diverting water in to Ladies Pond. We recommend that the best course of action is to quantify the extent of water loss from the ladies pool in order to ascertain the viability of the pond into the future. If, as suspected, the pond has a significant leak, fixing this should become the management priority. We are able to install a simple water level logger to determine the rate of loss from the pond.

Overall management – Battersea Park Lake

The establishment of aquatic plants is heralded as a real success and management should focus on this year as the benchmark against which to compare future years. We would like to see lower levels of the non-native Nuttall's waterweed, but without costly removal / management, we don't see this as plausible if budgets are limited, and therefore recommend that the vegetation be monitored annually and native species re-introduced if lost. The aim will be to maintain a mixed species assemblage with at least two native species present in the lake. In particular, *M. spicatum* and *C. demersum* appear to do particularly well in these conditions and should be the first choice if any future planting is required.

It would appear that the white water lilies planted out in 2015 did not survive well. Possibly they were more susceptible to fish and / or bird damage during early growth, or simply the change of conditions did not suit them. While from an aesthetic perspective it would be good to have water lilies in open water, the experimental planting suggests the likelihood of them becoming established is low and therefore not suitable at this time.

The presence of plants will help to maintain good water clarity, but water quality is also important and stress the need to maintain the bore-hole to ensure the site has a good quality supply. The volume of water is not sufficient to keep the Ladies Pond full, but we recommend water levels are allowed to fluctuate rather than turning to mains water to fill the Ladies Pond. Hopefully water levels will increase naturally during the wetter winter months.

The continued management of fish is recommended. We encourage a low density of carp and the focus transferred towards a mixed native fishery. The increase in aquatic vegetation will favour perch and pike, and these in turn will to reduce fry numbers and maintain a more balanced fishery. Working together with angling groups to promote native fisheries may also be necessary if fish stocks are to be manipulated away from a dominance by carp.

The current situation at Battersea Park Main Lake is very positive and we hope to see the aquatic plants thrive into the future. It is particularly encouraging to see the impact of pro-active management having such a positive effect on the lake.

The suspected leak at Ladies Pond requires further investigation, and in the mean time we do not recommend water is diverted away from the Main Lake to top it up until the extent of the leak is know. If the leak can be identified and fixed, options can be explored for circulating the water through Ladies Pond to ensure better water circulation and to prevent nutrient build-up in the sediments.

Battersea Park Aquatic Plant Maps

The vegetation was mapped using multiple geo-referenced points. At each point, the vegetation around the boat was identified and the abundance assessed on a 1-5 scale based on the “DAFOR” system, whereby: 5 = > 50% cover (**D**ominant); 4 = 25 – 50 % cover (**A**bundant); 3 = 10 - 25% cover (**F**requent); 2 = 2.5 – 10% cover (**O**ccasional); 1 = <2.5% cover (**R**are). For clarity, species are mapped individually. The maps are presented below in Appendix I – Battersea Park Aquatic Plant Maps.

3. Appendix I – Battersea Park Aquatic Plant Maps

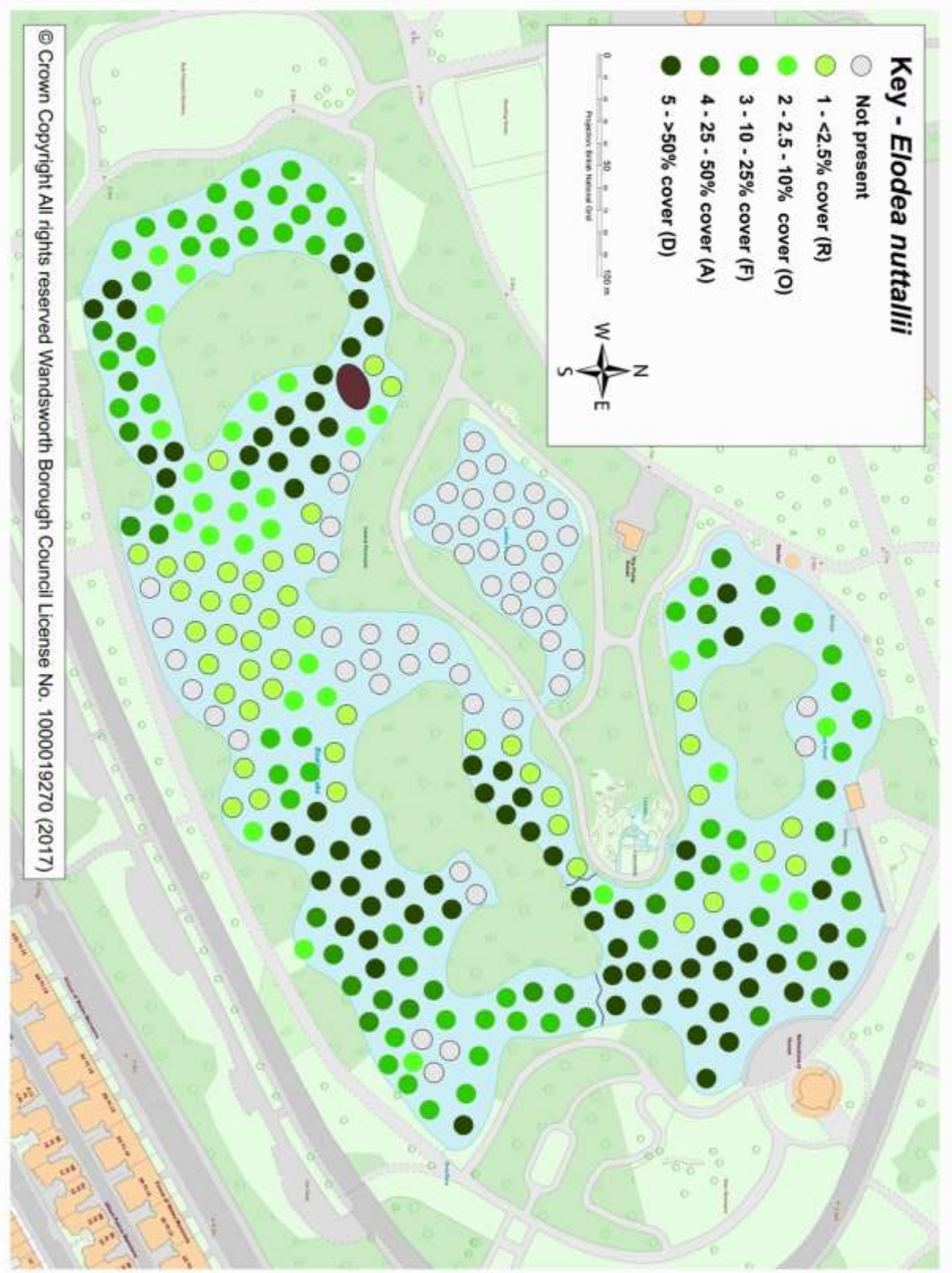


Figure 1. Abundance and distribution of *Elodea nuttallii* in Battersea Park Lakes

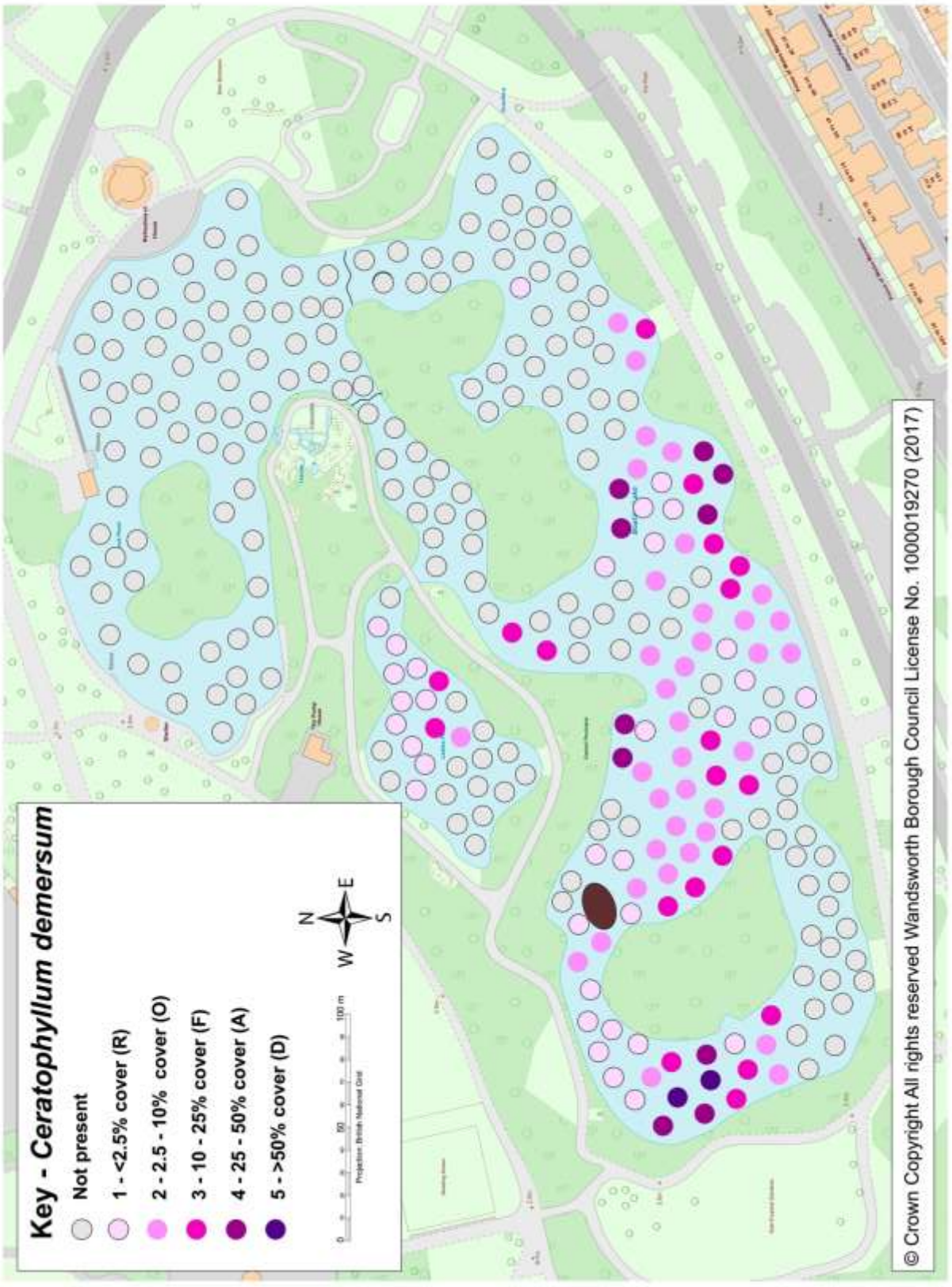


Figure 2. Abundance and distribution of *Ceratophyllum demersum* in Battersea Park Lakes

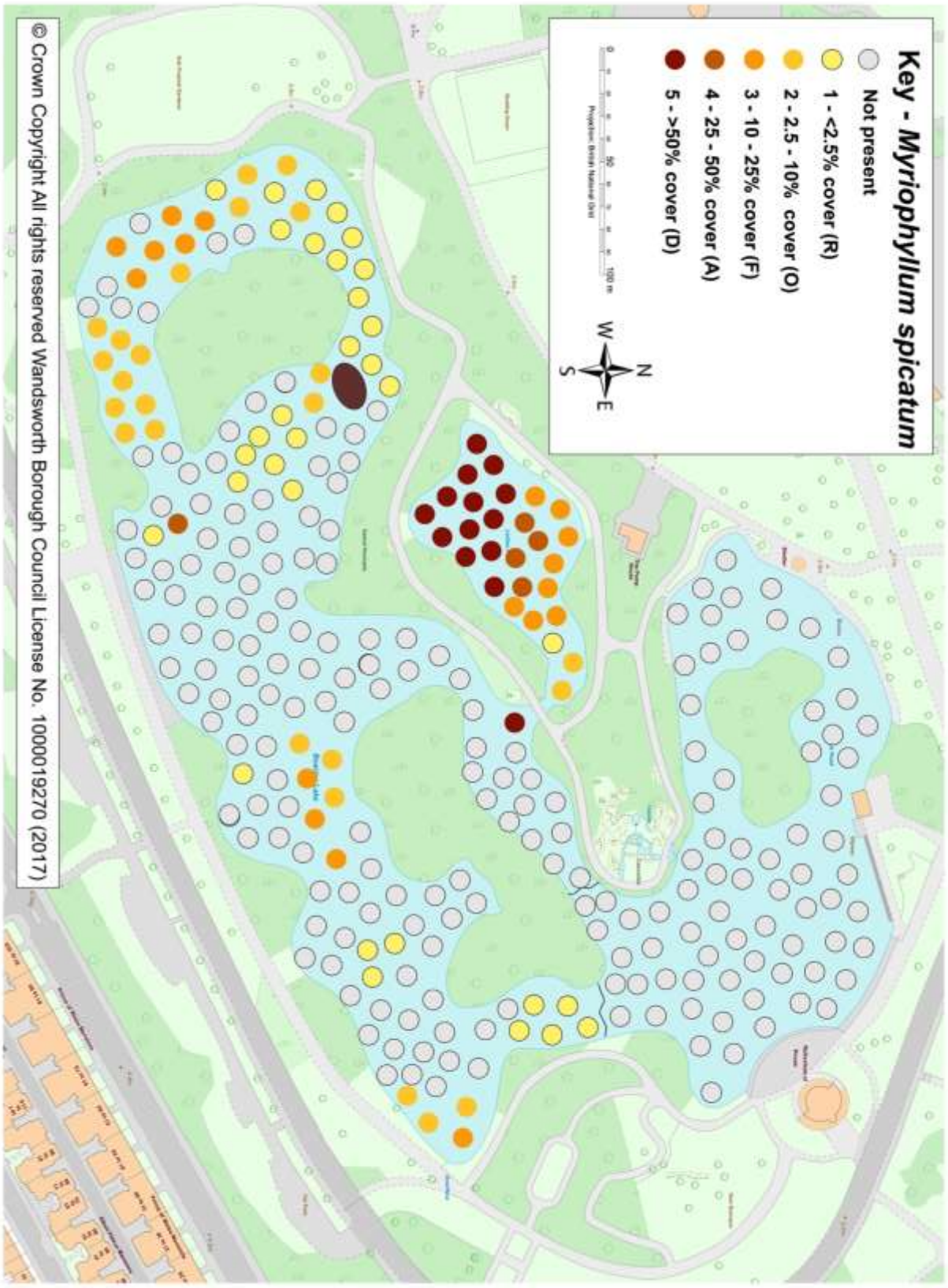


Figure 3. Abundance and distribution of *Myriophyllum spicatum* in Battersea Park Lakes

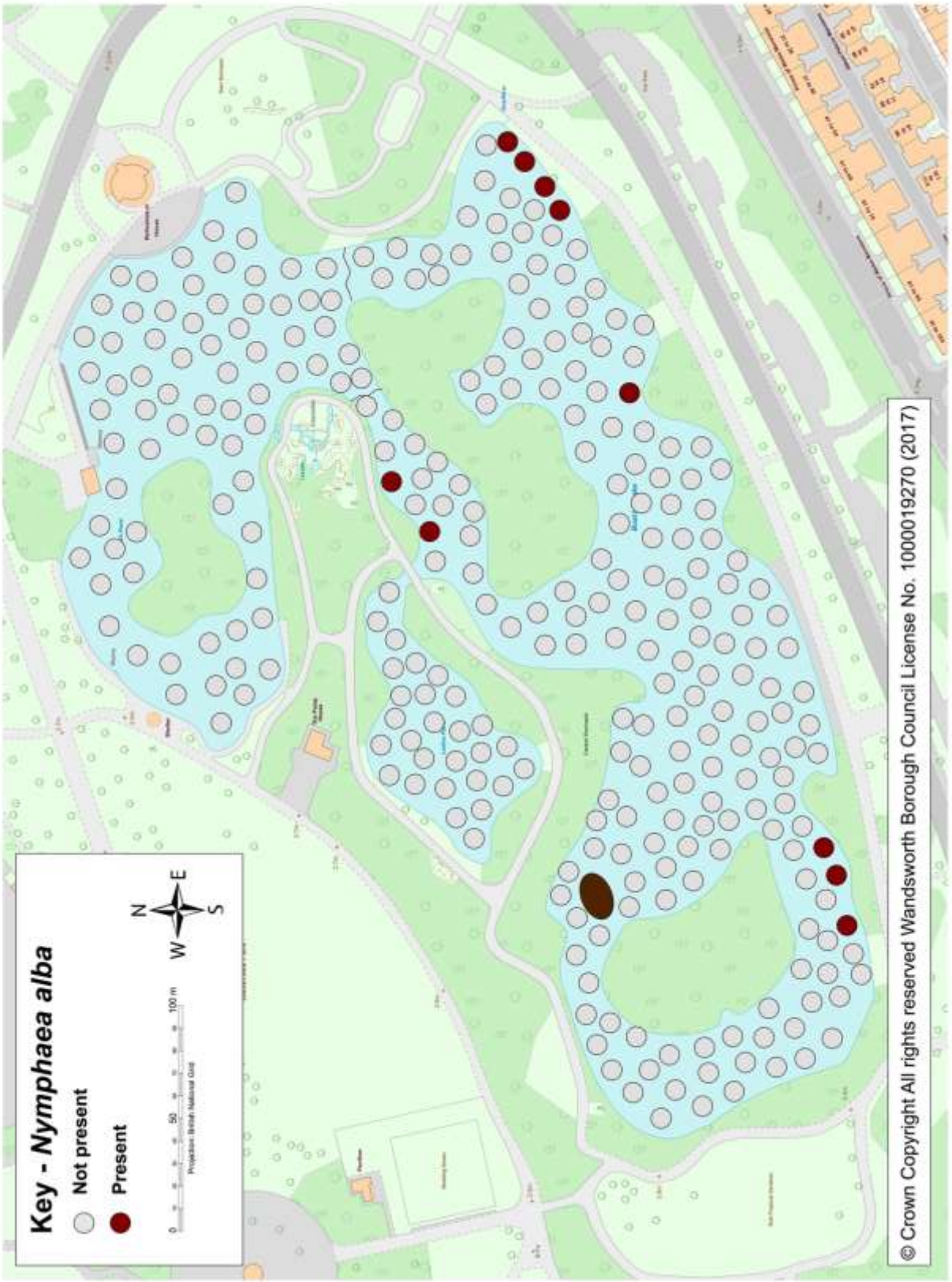


Figure 4. Abundance and distribution of *Nymphaea "alba"* in Battersea Park Lakes

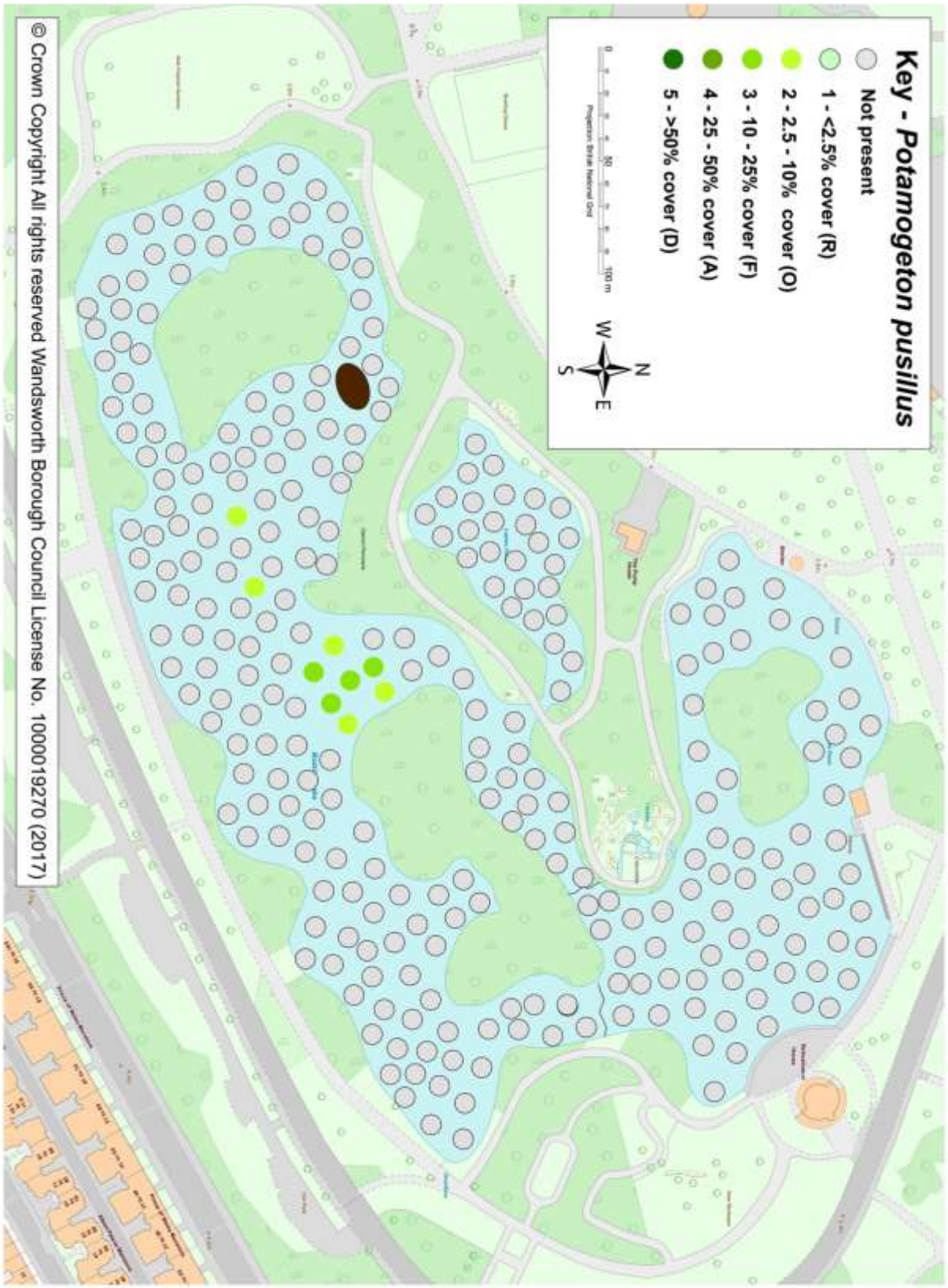


Figure 5. Abundance and distribution of *Potamogeton pusillus* in Battersea Park Lakes

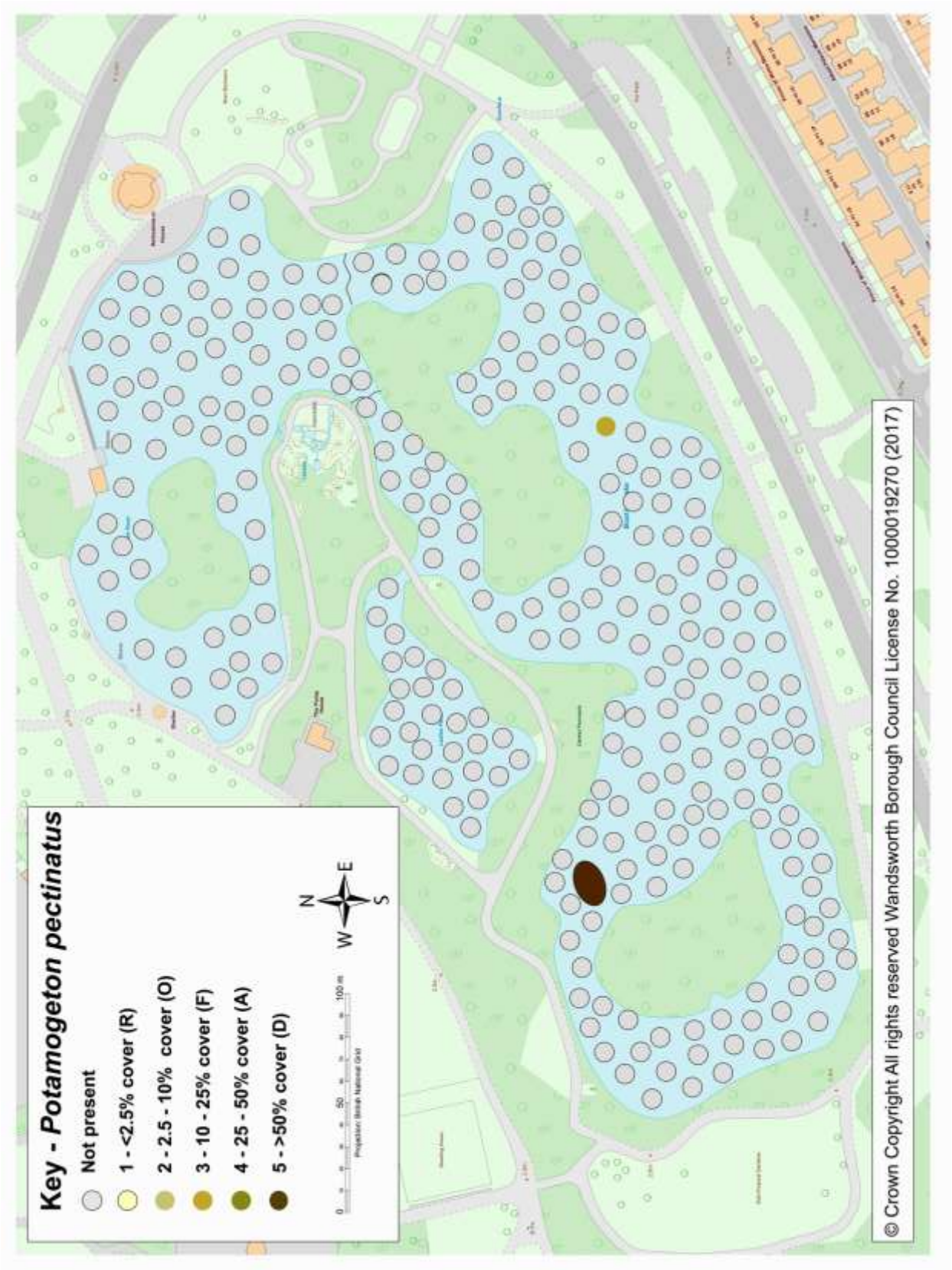


Figure 6. Abundance and distribution of *Potamogeton pectinatus* in Battersea Park Lakes

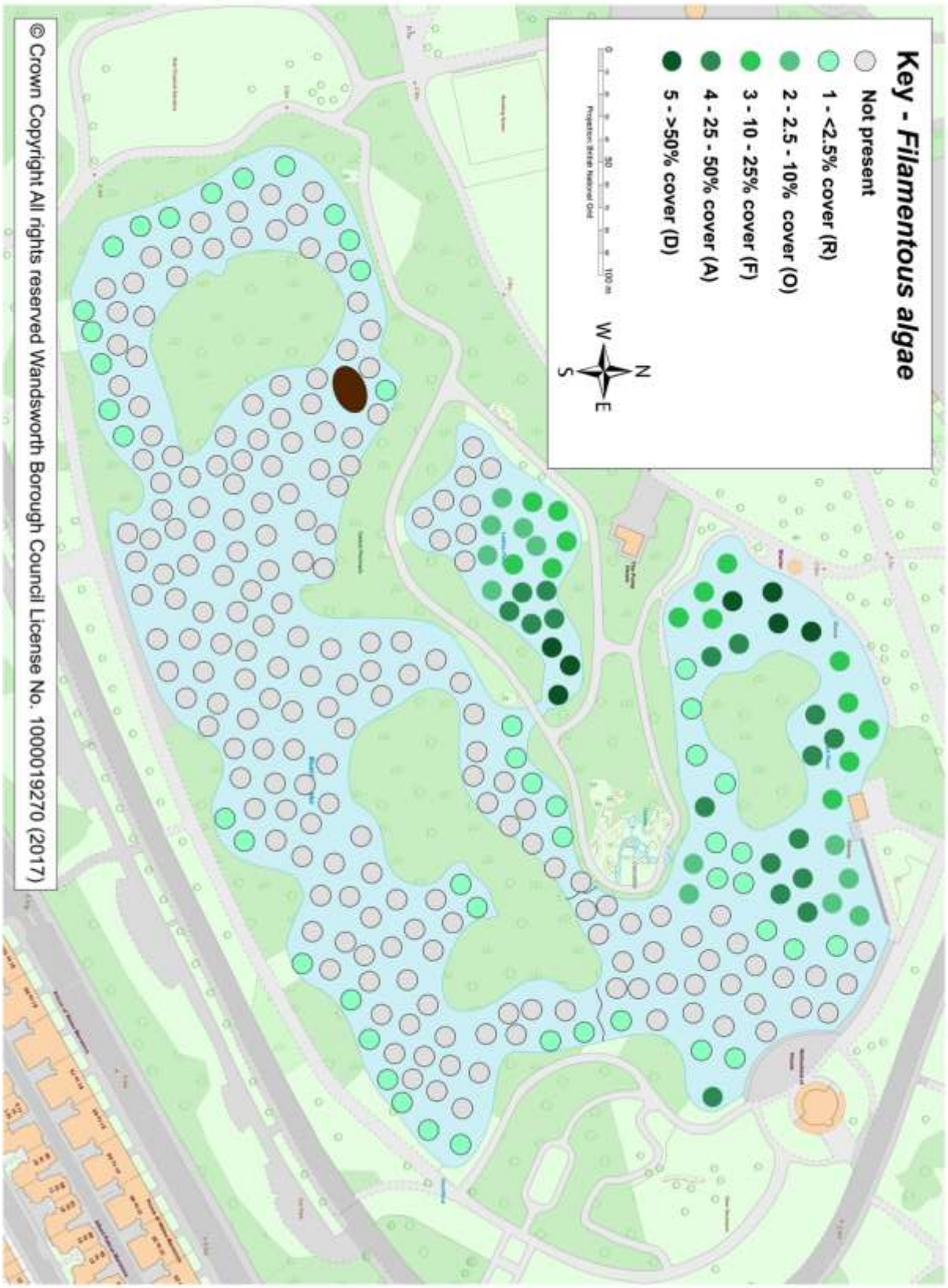
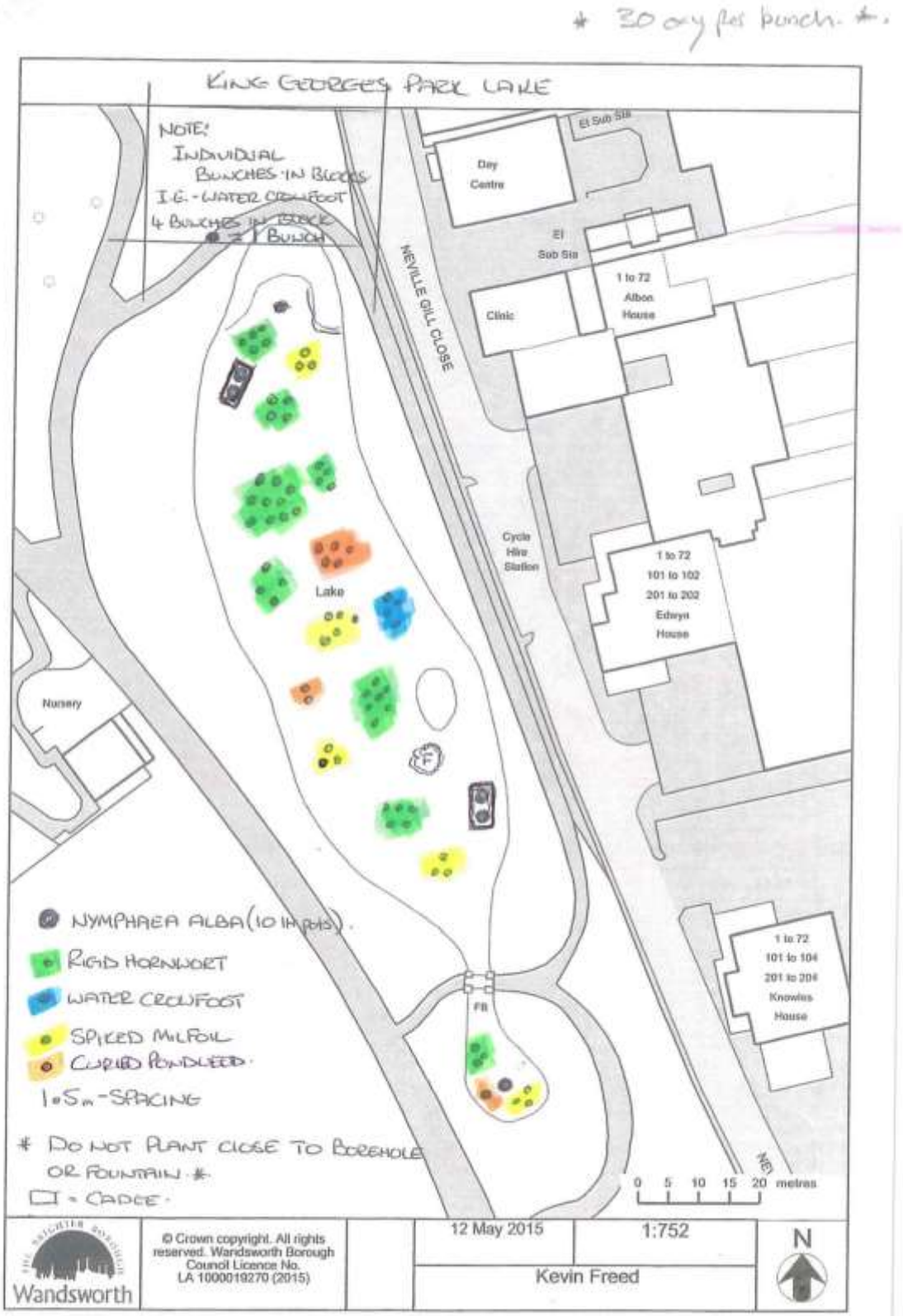
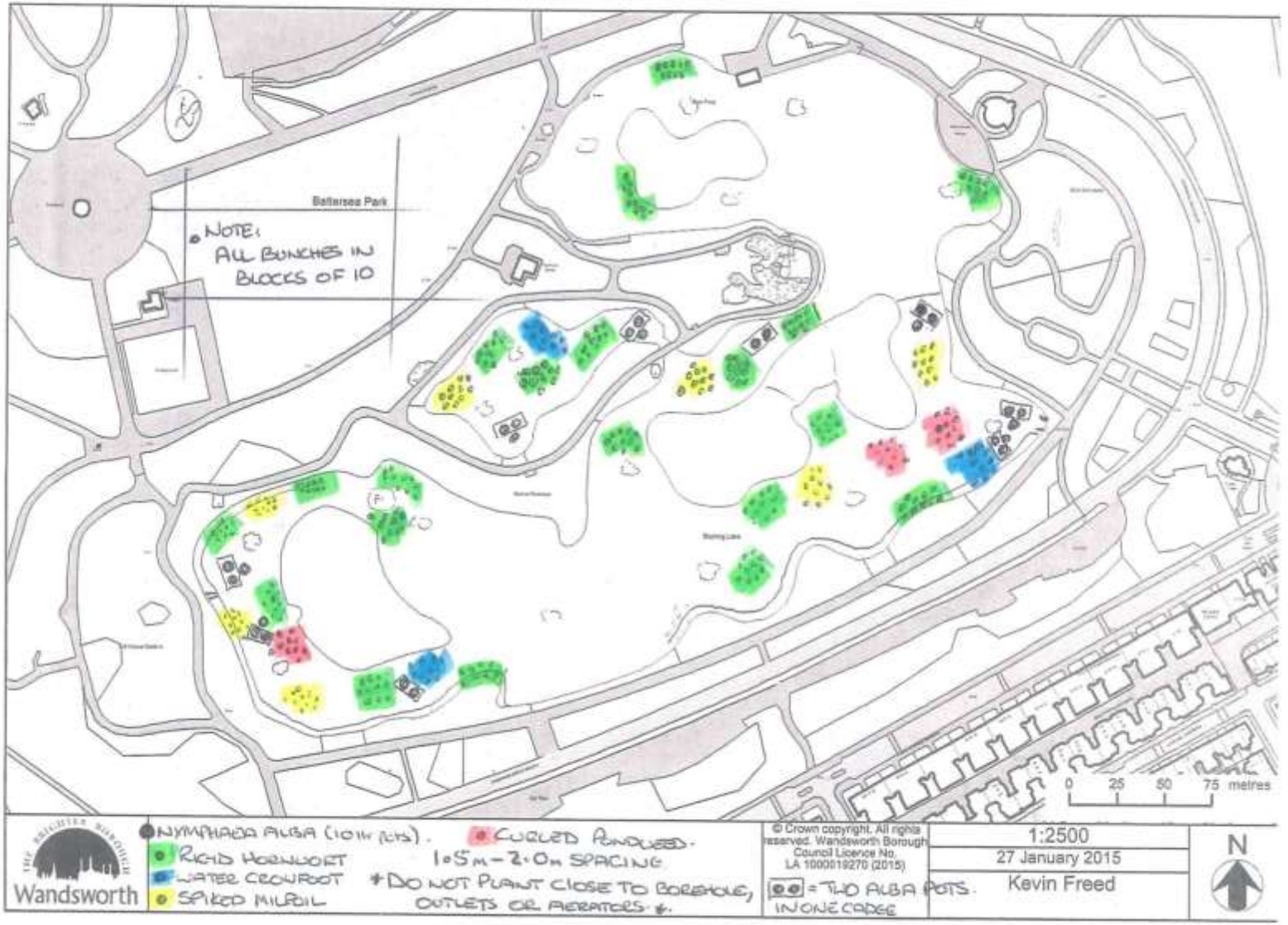


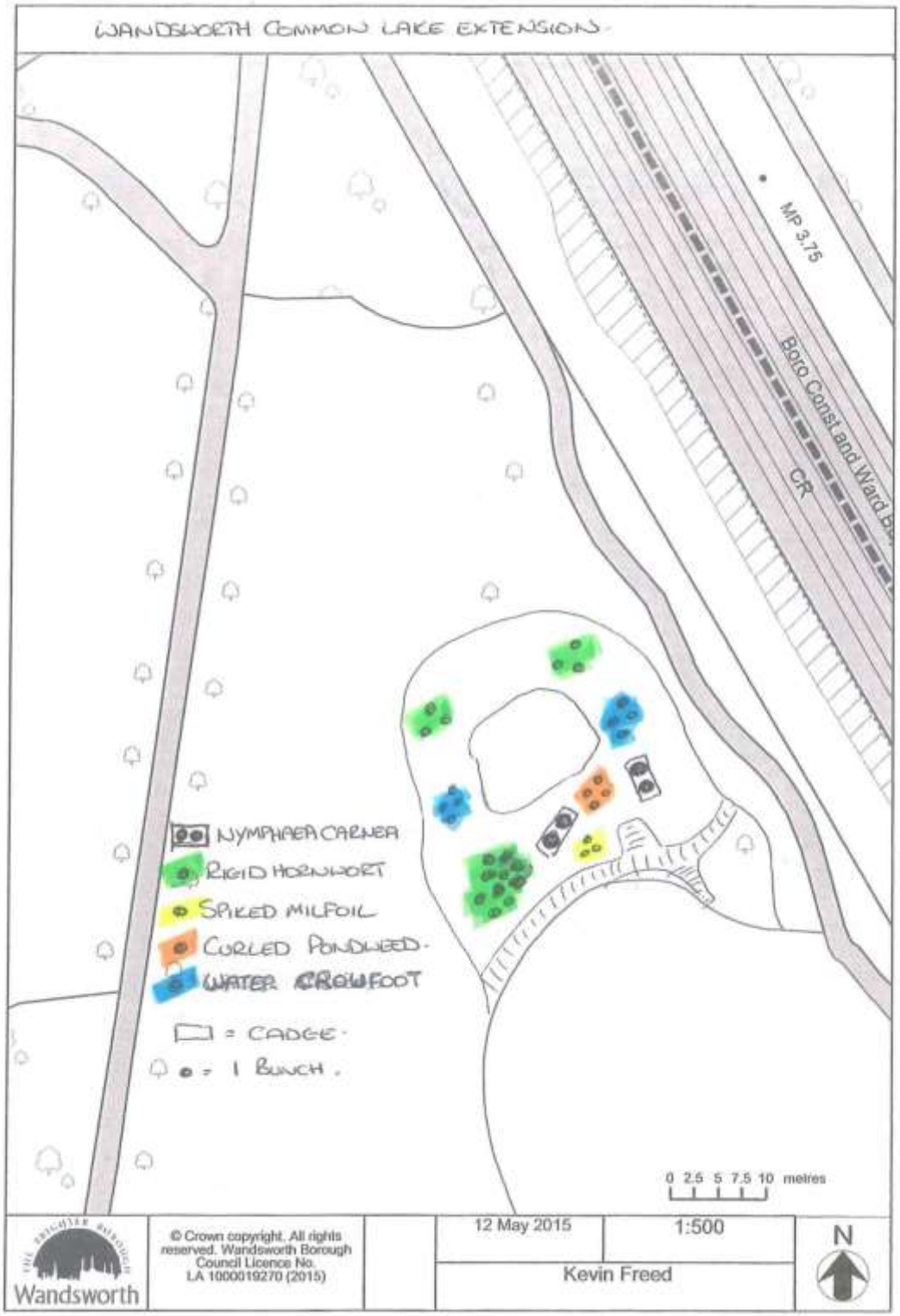
Figure 7. Abundance and distribution of Filamentous green algae in Battersea Park Lakes

4. Appendix II – 2015 Planting maps



BATTERSEA PARK LAKE.




WANDSWORTH COMMON LAKE EXTENSIONS.
MP 3.75
Boro Const and Ward B
CR
NYMPHAEA CARNEA
RIGID HORNWORT
SPIKED MILFOIL
CURLED PONDWEED.
WATER CROWFOOT
= CAGE.
= 1 BUNCH.
0 2.5 5 7.5 10 metres
Wandsworth
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12 May 2015
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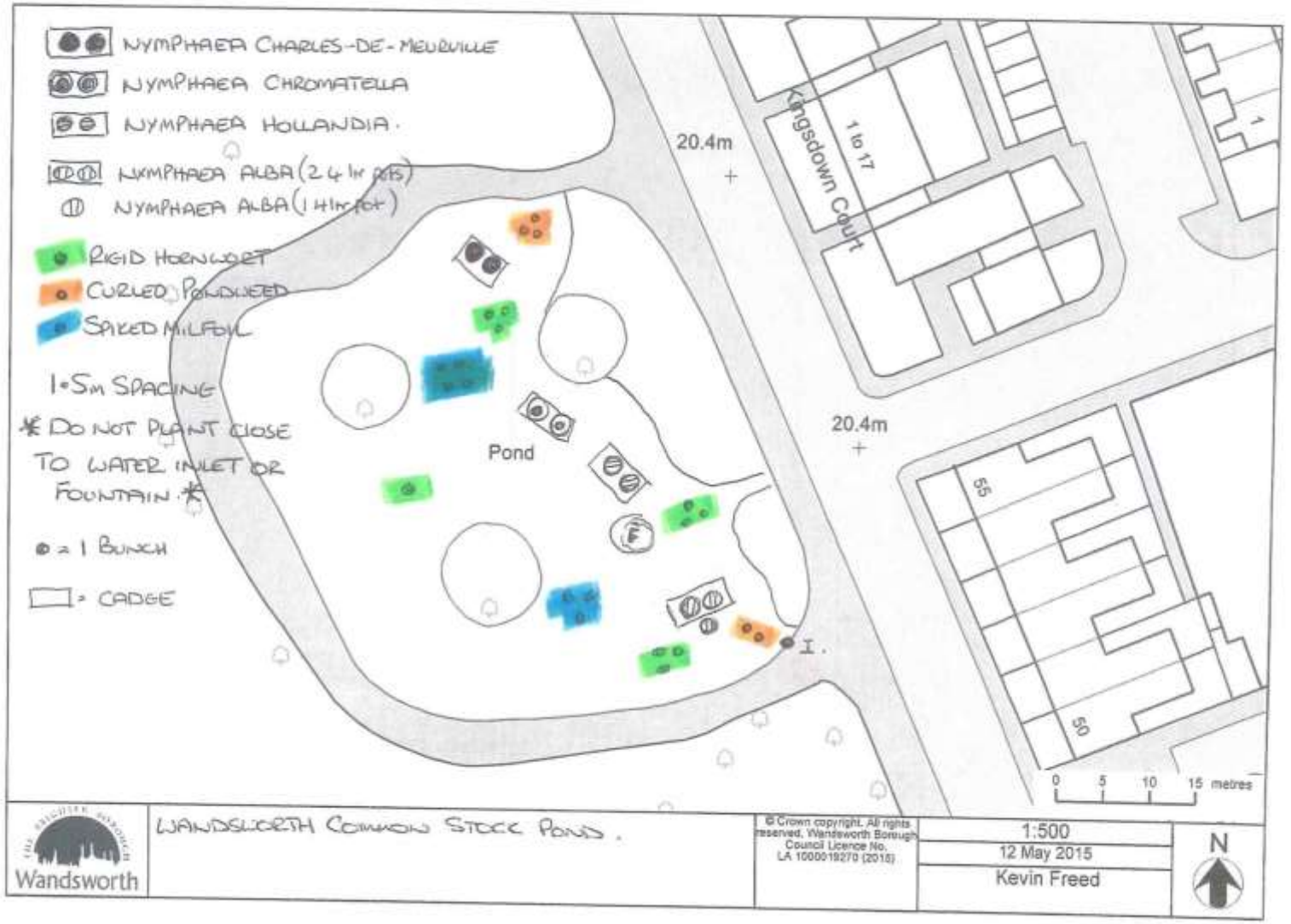
Kevin Freed
N


NYMPHAEA CHARLES-DE-MEURVILLE
NYMPHAEA CHROMATELLA
NYMPHAEA HOLLANDIA.
NYMPHAEA ALBA (2 4 hr pots)
NYMPHAEA ALBA (1 HINGE)
RIGID HORNWORT
CURLED PONDWEED
SPIKED MILFOIL
1-5m SPACING
* DO NOT PLANT CLOSE TO WATER INLET OR FOUNTAIN *
= 1 BUNCH
= CAGE
20.4m
Kingsdown Court
1 to 17
1
20.4m
Pond
55
50
0 5 10 15 metres
WANDSWORTH COMMON STOCK POND.
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1:500
12 May 2015
Kevin Freed
N
Wandsworth

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