Universal Leaf North America U.S., Inc.
3174 Boddie Mill Pond Road
P.O. Box 519
Nashville, NC 27856

August 26, 2013

Tony Gallagher
NCDWM/Compost and LT Branch
1601 Mail Service Center
Raleigh, NC 27699-1601

RE: Permit Renewal – Land Application

Dear Mr. Gallagher,
Please find here in, information pertaining to the annual report for our land application permit supplied by Dr. Rubin.

The permit renewal information will soon follow.

Thanks for your help,

John A. Sabatini

Assistant Vice President, Engineering

John A. Sabatini

10/22/2013 land app
Kyle 925

A.R. Rubin and Associates
Sustainable Environmental Systems
192 Fearrington Post
Pittsboro, NC, 27312

Mr. John Sabatini
Universal Leaf North America
3714 Bodie Mill Road
Nashville, NC, 28756

Dear Mr. Sabatini; 14 July, 2013

Subject: Monitoring Results; Universal Leaf North America Land Application Site, 2012-2013 processing season

Thank you and your colleagues for the opportunity to work with you on the beneficial use program to recycle and reuse the tobacco dust and agribusiness residue as generated at the Nashville facility onto the permitted land receiver sites to raise hay for use as animal feed. In 2012-2013 the volume applied was 88.6 tons. This is well below rates in previous years because of the compost production initiated during this processing season. Dust was applied onto fields 1, 2, 3 and 7; no dust was applied onto fields 4, 5, or 6.

The nutrients contained in the dust remain a valuable addition to the cropping system there at the Nashville operation. Visual examination of the fields during dust collection and the site sampling indicate that you and your colleagues have done an excellent job of controlling the Johnsongrass that has impacted your fields in years past. During the June soil and plant tissue sampling the weed coverage on fields appeared lower than in years past. Fields 4 and 7 had recently been cut and baled rendering weed cover assessment cover difficult to establish. Weed control will remain a continuing and on-going effort because of the nature of the material applied and your personnel are doing an admirable job of controlling weeds; and continued aggressive control is necessary.

Visual examination of the waste dust piles from which dust samples were collected show the materials applied were are predominantly the dust since the leaf and stem was reserved for the compost process demonstration permitted through DWM. The land treatment operation for the tobacco dust has been permitted in Nashville since the leaf processing facility opened. The continued reliance on beneficial use options such as land treatment and composting reflect your concern for agricultural operations in the area and for the sustainable use of agribusiness residues generated there.

The sampling protocol used was described in earlier reports where the top layer of organic matter was removed prior to soil sampling. The testing continues to show some

accumulation of phosphorus, potassium, zinc and copper in shallow soil, but none to levels considered deleterious to the operation or to the receiving environment and actual levels reported are lower than years past suggesting reduction of the dust load may be beneficial to the operation. Since the testing accomplished represents the end of this permitted cycle, soil samples were assessed to determine levels of additional metal levels as Arsenics (As), Cadmium (Cd), Nickel (Ni) and Lead (Pb). The soil test data is provided in the report.

The beneficial nutrients contained in the waste dust and leaf are utilized effectively by the hay and forest crops. Interest in beneficial reuse of the residue through both direct land treatment and the manufacture of the compost during this process season reflect your commitment to develop and maintain an effective beneficial use program with minimal potential impact to the environment.

Attached please find results from the 2012-2013 processing season. I will begin collecting samples of the dust from the 2013-2014 processing season as soon as product is available. This material will be tested to optimize both the permitted land treatment operation and the demonstration compost operation. I do look forward to continuing to work with you and your colleagues on this beneficial use effort.

Sincerely;

A. R. Rubin, Professor Emeritus

1 attachment: 2013-2014 annual report

Universal Leaf North America
2012-2013 Annual Report
For
NCDWM Annual Report

Thank you for the opportunity to work with you and your colleagues on the ongoing beneficial reuse effort serving as a viable dust management option and ULNA and permitted by the North Carolina Division of Waste Management (NCDWM). The land treatment operation continues to supply valuable nutrients to crops, successfully recycling valuable plant nutrients back into the plant – soil system. One element of the NCDWM permit requires annual testing. Although no dust was applied onto fields 4, 5 or 6, representative samples of soil materials were collected from these areas because that are part of the permitted land mass and these fields have been utilized as receiver areas in years past.

The purpose of this ongoing testing is to ascertain consequences of the operation to soil and plant materials on the receiver sites; critical to this effort is continued reliance on beneficial reuse. Testing indicates that the agribusiness wastes contain valuable levels of essential plant nutrients - particularly potassium. Based on the soil and plant tissue testing accomplished, no adverse impacts were observed in plant or soil material and test results are within the ranges observed in North Carolina for the constituents assessed in the receiver environment.

With the exception of weed growth observed most recently in June, 2013, the sites on ULNA farm holdings appear in excellent condition and the aggressive weed management/crop harvest schedules implemented previously appear to be keeping weed populations at bay except as the grasses mature and the fescue enters dormancy. The Bermudagrass and fescue grass crops have been harvested in a timely manner and the dust was applied to receiver sites as weather and agricultural operations permitted. The pines established on portions of site 6 and the mixed growth forest crops regenerating on portions of site 4 appear to be growing well.

Total dust applied to the permitted sites reported for the 2012-2013 processing season was approximately 89 tons and this was applied to a portion of the permitted land at ULNA. The loading rates to field sites ranged between 2.8 and a maximum of 8.4 tons/acre. the 8.4 ton/ac load was applied only to two small portions of the land receiving the dust, the majority of the fields received either 2.8 or 5.6 tons/ac loading. Several of the permitted fields received no dust application.

The dust loading rate to ULNA sites utilized in the 2012-2013 processing season averaged less than 5 tons/acre. This loading rate is significantly less than that utilized previously because of the reduced leaf production, improved recovery of product through improved in-plant processing and implementation of a demonstration compost operation as permitted through NCDWM.

The land application program implemented as a management option to handle the tobacco dust generated at the ULNA Facility continues to operate well. One of the conditions of the operating permit requires periodic sampling of the dust generated at the facility to determine the levels of nutrients and other constituents that impact potential for beneficial reuse of the dust and a second element of the permit requires an assessment of the site, soil and vegetation on the sites receiving dust. These permit conditions were followed and these tests are intended as routine annual testing and associated reporting. The sites will continue to serve as the foundation for the beneficial use effort conducted by ULNA. Three elements of the operation were examined. These are:

1. The nutrient, lime and regulated metal content of the dust and agribusiness residue
2. Soil test results from receiver sites using standard agricultural test parameters
3. Vegetation quality and yield from receive sites

In addition, a visual assessment of the fields, the application equipment operation, and site management practices were observed during the dust sampling events and soil/plant testing activities. These program elements and observations are the subject of this report. The dust testing was accomplished monthly through the processing season while the plant and soil was tested once during the year in the summer following the conclusion of annual application operations.

Tobacco Dust Testing:

The tobacco dust testing was accomplished on a moderately frequent basis to assess seasonal differences in the quality of the dust applied to the agricultural and silvicultural sites while allowing for diversion to the compost demonstration. A series of composite samples of the dust were collected from the dust storage areas on the ULNA farm. The dust was subjected to a battery of standard analytic procedures as accomplished by NCDA, Agronomic Services to determine levels of nutrients, lime equivalency, and the concentrations of selected metals and visually to assess the level of leaf, stem, and dust in the material. The agribusiness waste samples were collected in September, November, February, March and May to reflect differences in feedstock while continuing to sampling the agribusiness residues representatively. Rule requires representative sampling; the sampling represents approximately 15 ton intervals. This is more aggressive than sampling in years past and is thought to well represent the

agribusiness residues applied. Results from these dust sampling events are presented in Table 1, Tobacco Dust Quality, ULNA Facility, below. Testing was accomplished in accordance with the North Carolina Department Agriculture, Agronomic Services Section

Table 1, Tobacco Dust Quality, ULNA Facility (as % for nutrients, Carbon and Calcium carbonate Equivalence and PPM for regulated metals), 2012-2013 Bi- Monthly Values

	N	P	K	Ca	Mg	Na	C	Cu	Zn	Ni	Pb	Cd	CCE
S	1.6	0.2	2.1	1.9	0.5	0.02	30.1	52	77	3.1	2.9	0.5	12.3
N	3.9	0.5	4.2	0.8	0.4	0.02	42.7	26	73	4.3	6.3	0.5	11.9
D	1.9	0.3	2.2	3.5	0.6	0.02	35.8	16.0	98.0	5.1	4.2	0.6	10.2
F	1.9	0.2	1.3	2.1	0.4	0.02	27.3	14.1	75.6	1.2	11.3	1.0	12.0
M	1.4	0.2	2.1	1.9	0.5	0.01	31.4	14.6	87	1.1	12.1	1.1	8.9
M	2.9	0.2	2.5	2.3	0.4	0.01	29.0	12.3	55	3.4	4.9	1.3	5.6
AVE	**2.3**	**0.2**	**2.4**	**2.1**	**0.5**	**0.02**	**32.7**	**22.5**	**77.6**	**3.0**	**7**	**0.7**	**10.2**

Detection level for Ni, Pb and Cd are 2.5, 2.5 and 0.25 respectively

Tobacco dust quality indicates that the material is a low analysis fertilizer. The potassium (K) levels are particularly valuable for crop production. Potassium is the limiting annual constituent in this material. The typical potassium level per ton of product ranges between 26 and 84 pounds while the "average" is 48 lb K/ton. Potassium can be consumed through luxury uptake at levels of 250 to 300 pounds per acre in the Bermudagrass provided other essential nutrients are available. This is equivalent to approximately between 5 and 6 tons per acre loading of the dust and during this processing season only 2 of the sub-fields received more than the 6 tons as justified by crop yields discussed below. The analysis does indicate valuable levels of nitrogen (averaging approximately 46 pounds per ton) and phosphorus (averaging approximately 5 pounds per ton) are present in the agribusiness residues. These values represent a total concentration and only a portion of this is plant available. The available nitrogen (plant available nitrogen or PAN) is typically 40% of the Total Nitrogen (TN) and available P is typically 40 to 50% or biologically bound phosphorus. The levels of nitrogen and phosphorus are sub-optimum to support luxury consumption of the potassium. Supplemental N and P would be required to maximize potential uptake of K.

ULNA requested analysis of organic carbon in the tobacco dust. That testing was accomplished and is reported as "C" in the table. The organic carbon levels vary through the processing season, but average near 33% and this is thought to be typical of the materials applied. Higher levels of Carbon appeared to correlate with high concentrations of visible leaf and stem in the product applied in November and December.

The dust contains moderate levels of calcium (Ca) and magnesium (Mg), with low levels of associated sodium (Na). These elements combine to determine the sodium adsorption

ratio (SAR) of a waste stream. The SAR of the tobacco dust is well below 10 units and an SAR of 10 or greater may be an issue in agriculture. The SAR is of no consequence in this operation. The moderate level of lime as indicated by the calcium carbonate Equivalence (CCE) suggests that loadings should be limited to no more than 10 tons residue per acre for the composite 2012-2013 or the equivalent of approximately 1 ton of lime per acre. Actual loads were below this agricultural limit; confirming that CCE is not the limiting constituent. High loadings of the dust may result in an unhealthy increase in soil pH and adverse impacts on crop quality; no adverse impact was observed in plant tissue testing presented subsequently.

The testing indicates low levels of regulated metals (Cd, Cu. Ni, Pb, and Zn). Levels reported are below limits established in NCDWM Regulations. Based on the analysis the levels of these regulated metals in the dust are well below the regulatory levels established in NCDWM Rule for cumulative limits in land applied materials. Based on the levels detected, no cumulative loading limits apply to the receiver site fields. Regulated metal concentrations should have no adverse impact on the continued land application effort and should have no adverse impact to compost produced at commercial facilities in the area. The soil testing presented below in Tables 2a and 2b confirms that accumulation of regulated metals in fields do not constitute an environmental issue on these sites.

Soil Testing:

Representative samples of the soil material from each of the sites receiving dust from the ULNA facility in Nashville, NC were collected in a manner utilized in recent years to assess soil quality. Historically the soil samples were collected by simply removing vegetation from the soil surface and advancing a soil probe to collect the sample. During these recent sampling periods the "O" horizon was scratched away to eliminate dust and collect only soil. This was accomplished because previous sampling efforts show the levels of potassium and phosphorus as trending upward, albeit not to levels considered a hazard to crop production, human health or ecosystem vitality.

In samples collected to represent the 2012-2013 processing season, P and K levels in soil materials were observed to stabilize. These samples were collected by removing the decaying vegetation and organic matter which accumulates on the soil surface and then advancing a soil core into the bare soil more representative of an "A" horizon and less typical of an "O" horizon. Since this report reflects the history of the site since the permit process began soil materials were tested to determine standard soil test parameters as well as the additional regulated metals arsenic, cadmium, nickel, lead and selenium. These metals are listed as pollutants of concern by USEPA and levels are important for compliance purposes. Only permitted fields 1,2,3 and 7 were utilized to receive the agribusiness residue from the processing season; the bulk of the material generated

during the season was stored in the bunker for use in the compost demonstration permitted through DWM.

Approximately 20 to 25 small, 1 inch diameter cores from just below the soil surface to between approximately 4 and 6 inches below the surface were collected and representative composites were developed from each of the fields or land management units. These were subjected to a battery of standard soil fertility tests as accomplished by North Carolina Department of Agriculture, Agronomic Services. Results from the annual sampling are summarized in Tables 2a for nutrients and 2b for regulated metals for the 2012-2013 processing season below.

The concentrations of constituents detected were converted to index values as used by the NCDA in standard soil tests. The index units for P and K are moderate to high, but lower than in some testing from some of the sampling results from previous years. Any index over 100 suggests the constituent is present at a level in excess of a crops immediate need. The P and K values are considered moderate to high. Only site 7 shows a very high P level, but this is below levels reported previously. The sample designated with a "C" was collected as a "control" sample from the area adjacent to fields, but in a buffer zone and outside the actual application area. This is a composite from several field areas.

In addition, the soil pH is elevated on several of the permitted receiver sites. The CCE and Calcium levels in the dust are responsible for these elevated soil pH values. Optimum soil pH for fescue grass and Bermudagrass is between 6.2 and 6.5 standard pH units while forest crops require a more acidic or lower pH soil. Measured soil pH values in excess of 7.5 may require addition of sulfur at some time to depress soil pH and at this sampling no soil exhibited a pH in excess of 7.0. Soil pH is important because of the influence on nutrient uptake by plant material.

Since the data generated during this processing season will be used in the permit renewal process, samples were tested for additional regulated metals. Levels of arsenic (As), cadmium (Cd), lead (Pb), nickel (Ni), Chromium (Cr) and Selenium (Se) were assessed. These levels are very low and well below any regulatory levels established for these metals in DWM Rule or EPA Rule for management of domestic waste.

Table 2a, UNLA Soil Test Results for Nutrients from Dust Receiver Sites and Check Receiving no Dust, 2012-2013 Processing Season (values as standard NCDA test results or mg/kg)

Site	1	2	3	4	5	6	7	Check
OM %	0.51	0.36	0.23	0.32	0.51	0.60	0.41	0.56
pH	6.4	6.8	7.0	6.2	6.1	6.0	6.3	5.2
P	75	112	69	178	166	132	290	14
K	182	251	154	100	68	115	199	61
Ca	61	64	60	63	55	57	60	25

Mg	16	20	31	19	16	15	21	11
Na	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.1

Table 2b, ULNA Soil Test results for Regulated Metals from Dust Receiver Sites and Check, 2012-13 Processing Season (Values as NCDA Index or mg/kg)

	1	2	3	4	5	6	7	C
Zn (I)	83	141	138	177	211	123	229	52
Cu (I)	138	331	228	418	433	358	188	99
As Mg/kg)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Cd (mg/kg)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Pb (mg/kg)	2.4	2.7	2.6	4.5	4.5	2.7	2.8	2.1
Ni (mg/kg)	0.1	0.5	1.3	0.7	0.7	0.4	0.3	0.2
Cr (mg/kg)	0.2	0.1	0.4	0.2	0.2	0.2	0.2	0.2
Se (mg/kg)	0.2	0.3	0.3	0.3	0.3	0.2	0.2	0.3

Results as NCDA index, mg/kg or % CEC – an index over 100 suggests availability, an index over 400 suggests an excess of the nutrient (units listed adjacent to analyte)

The levels of copper and zinc in the soil materials tested are beginning to show signs of moderate accumulation, but well below regulatory levels established in rule (40 CFR Part 503 or NCDWM). The additional regulated metals listed in DWM Rule and for which waste testing was required initially are well below limits. None of the regulated metals are present in the soil approaching the regulatory limits imposed by USEPA, but sensitive crops such as peanuts may be difficult to produce on the sites with elevated levels of arsenic, copper or zinc. An elevated copper or zinc level is any level over 200 units and while some fields show these levels, there is no imminent hazard to the pasture/forage crops or the forest crops in the plant – soil system or to surface and groundwater in the area. Elevated arsenic level would be defined by the DWM septage rule or the 503 rule as over the Cumulative Pollutant Load of 41 PPM. The levels detected are well below that.

Plant Tissue Testing:

Plant materials serve as indicators of the biological integrity of a land based treatment system. Plant materials serve as the ultimate host for the materials applied to a site. Samples of vegetation were collected near each of the 20 to 25 locations in the receiver sites where a soil sample was collected. A control sample of the Coastal Bermudagrass vegetation was collected from an area near the entrance road on the western - most portion of the ULNA site (Field 2). The plant samples were placed in paper bags when collected. Plant tissue was subjected to a battery of standard tests as accomplished by the North Carolina Department of Agriculture. The results from the plant tissue testing are presented in Table 3, below.

The elevated levels of nitrate (NO3) in several of the samples may be cause for caution. Feeding forage with elevated nitrate levels to young or lactating cattle may cause problems. Where nitrate levels in forage exceed 2500 PPM, the grazing operations should be monitored or forage with low nitrate could be mixed and blended with the high nitrate forage. No sample of the Fescue grass forage samples showed a nitrate level near the 2500 PPM (0.25%) level for concern, nonetheless, continued nitrate testing should be accomplished routinely.

The samples of warm season forage grasses were collected in June, the typical growing season and this time is least favorable for these cool season grasses. Consequently, the cool season grass field was sampled in April to assure more relevant sample data. The Bermudagrass/Rye is most prevalent on fields 2, 3, 4, 5 and 7. Fescue is most prevalent on fields 1 and 6. Plant tissue samples were collected from the newer bales on the Bermudagrass fields and from the pasture on the Fescue sites. Neither the baled forage nor the pasture show high nitrate levels. Forage samples should continue to be collected as a routine part of the land application operation to assure forage quality does not pose hazard to animals feeding on the bales.

In addition to the forage testing, the weed control program implemented during this processing season must be continued annually to prevent accumulation of the weedy vegetation on fields. The material applied to the fields is from fields throughout the leaf growing area. Weed seed is a common contaminant in the land applied soil materials. At the time of the sampling, weed growth was responsible for a very slight and insignificant percentage of plant materials present on the fields 1,2,3,4 and 7. Weed growth was significant on fields 5 and 6. Weed seed is present in the dust applied and aggressive weed control measures remain a necessity to prevent growth of noxious vegetation which may be deleterious to animals consuming the hay.

Cool season forage (fescue grass) should be tested in the spring and again in the fall. Fescue was not the predominant grass on the site. The warm season Bermudagrass crop was planted on most of the fields in 2009 and this crop has done well and is replacing the Fescue initially planted. This warm season grass is very well suited for this activity and it should be tested in the late spring or early summer to assess nutrient levels.

Table 3, ULNA Plant Tissue Quality from Dust Receiver Sites and Check Receiving no Dust ("L" indicates a low level and "H" indicates a high level for the constituent labeled) for the 2012-2013 Season

Parameter	1 F	2 CB	3 CB	4 CB	5 CB	6 F	7 CB	Check
N %	2.47	3.44	3.05	2.67	2.25	3.46	2.58	1.50 L
P %	0.42	0.28	0.3	0.32	0.19	0.3	0.29	0.2 L
K %	2.46	2.79	2.36	2.87	1.98	3.11	2.37	2.0 L
Zn PPM	22.6	33.1	38.7	30.9	22.6	30.0	25.3	31.0
Cu PPM	7.43	11.5	10.9	14.3	7.9	11.0	11.8	7.52
NO3 %	0.067	0.058	0.061	0.06	0.049	0.05	0.039	0.11

Vegetation raised on the permitted receiver sites serves as the indicator of the biological integrity of the land treatment system. Continued testing of the plant material is important to the long term operation of this or any other land treatment system.

Typical removal efficiencies resulted in harvests of between 6 and 10 tons per acre during the 2012 – 2013 harvest season. These high crop removals resulted in the transport of nutrients off site to fields where the hay was fed to cattle. Based on the low yield of 6 tons per acre per year, the nutrient removals are summarized in Table 4, Nutrient Removal as Pounds per Acre, ULNA Facility for the 2012-2013 growing season, below.

Table 4; Average Nutrient Removal Through Harvest as Pounds Nutrient per Acre for Six(6) Ton/Ac Crop Removal , ULNA Facility for the 2012-2013 Processing Season

	1	2	3	4	5	6	7	C
N	300	413	366	320	270	415	310	180
P	50	34	36	38	23	36	35	24
K	295	335	283	344	238	373	284	240

Based on crop quality and typical yields, the quantity of potassium (K) removed is very significant. Typical nutrient ratios in hay crops suggest a N:K ratio of 2:1. These values suggest there is luxury uptake of potassium through the Coastal Bermudagrass and the fescue. The N:K ratios are typically lower suggesting higher ratios of potassium to nitrogen than is generally encountered in plant materials and this finding supports the "luxury consumption" theory. This trend follows on the control field and this may be associated with dust entering this area as wind driven dust or over-spreading during windy weather. The cropping system is capable of achieving high levels of potassium removal.

Table 5 below summarizes the nutrient loadings on fields utilized for the 2012-2013 land application program. Dust loadings ranged typically between 2.8 and 5.6 tons/ac with small portions of field 1 and 3 receiving 8.4 tons/ac and the average loading was 5.6 tons/ac. The total tonnage of dust applied in the 2012-2013 season was 86.8 tons. The loading history was provided by ULNA. Several fields (4, 5, and 6) received No dust application during the processing season. Given dust loading as listed in Column 2 and the average characteristic for the dust, loadings to the fields are summarized in Table 5, Typical Macro-Nutrient Loads ULNA Receiver Sites, Below.

Table 5, Typical Macro-Nutrient Loads ULNA Receiver Sites (as Lb/ac) at Moderate Load Level

	Loading (T/ac)	N	P	K
1	5.6	258	23	269
2	5.6	258	23	269
3	5.6	258	23	269
7	5.6	258	23	269

The rates of removal listed in the table above suggest the nutrient removal described in Table 4 exceeds the applications described in Table 5. This is clearly beneficial and indicates luxury consumption for both applied nutrients or constituents and those stored on the site from previous applications and mineralization of crop residue.

Conclusions:

The land application operation has served as an effective receiver for the dust generated at the Universal Leaf North America facility since opening day. Previously dust from other facilities was applied to land beneficially. Accumulation of plant nutrients can be an issue whenever the quantity applied exceeds the quantity removed. Based on the soil test results, there is some accumulation of phosphorus, potassium, zinc and copper in the shallow soil and the soil pH is generally high for a pasture operation.

Plant tissue testing and yield measures suggest luxury consumption for these crops. The levels of parameters detected in soil material and plant material demonstrate no adverse impact to the receiver environment. Potentially adverse impact can be averted and controlled by careful operation of the facility, representative sampling and testing, and aggressive harvest and removal of the receiver site crops. In addition, the management at the ULNA facility should examine opportunities to increase available land onto which these materials can be applied and continue the additional option afforded through composting to provide sustainable, long term outlets for these beneficial materials.

Respectfully Submitted;

A. R. Rubin, Professor Emeritus

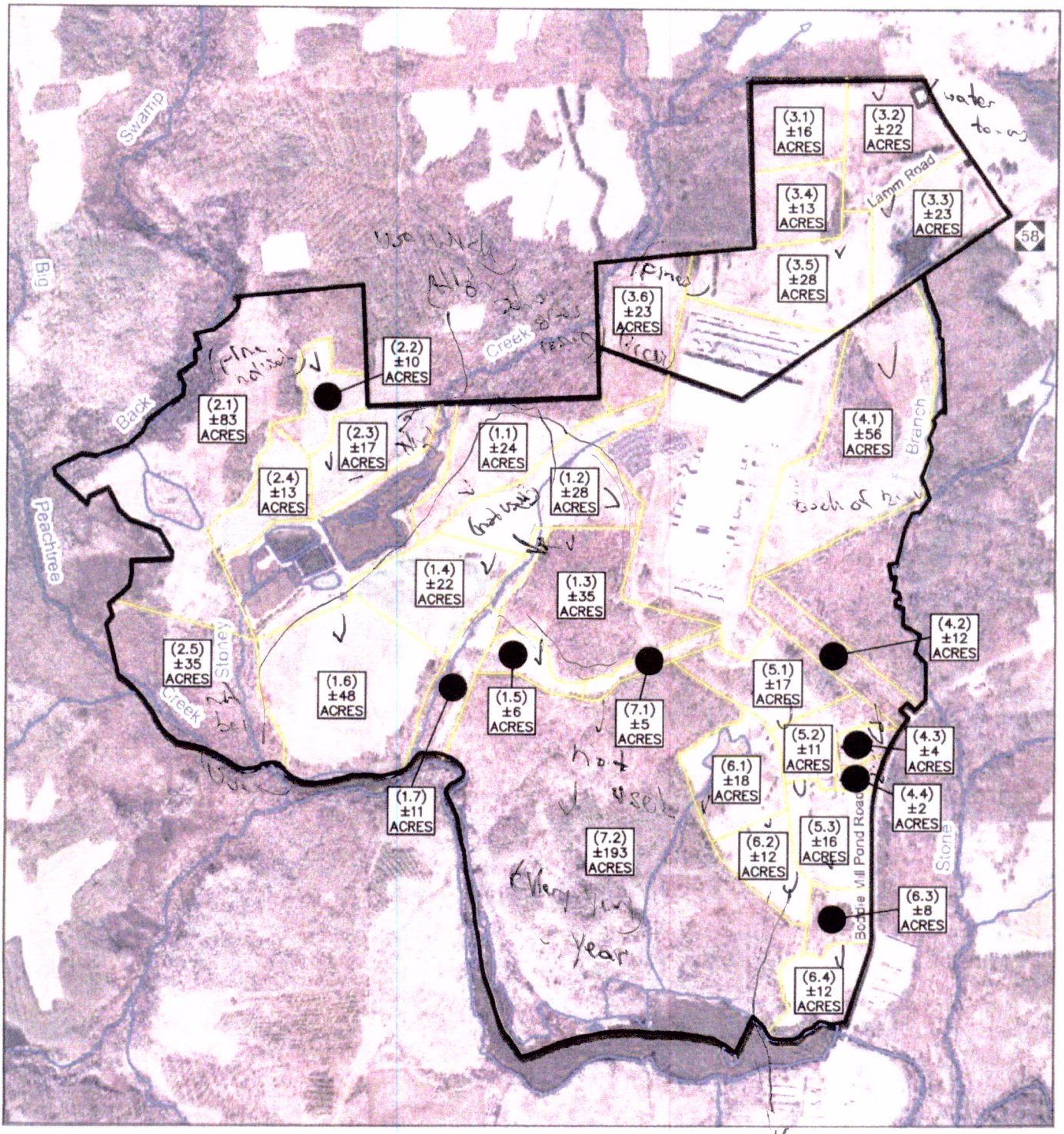
10/22/2013 notes: (Field 2.5 pines the not being used)

(Use with)

Universal Leaf North America U.S., Inc. Nash Facility
Sites for Land Application of Dirt

(Have further divided the fields applying .6 tons per ac.)

THIS IS NOT A SURVEY – ALL ACREAGE AMOUNTS AS SHOWN ARE APPROXIMATE



(winter rye)
(Volunteers)