

SOUND AGRICULTURAL PRACTICE
Amended Opinion Number 19-2

SUBJECT: Request for an Amended Opinion Pursuant to Section 308 of the Agriculture and Markets Law as to whether certain agricultural practices conducted by Steven Clark in the Town of Unadilla, Otsego County, are sound.

REQUESTOR: Steven Clark
138 County Highway 2
Mount Upton, New York 13809

Preliminary Statement

On August 2, 2018, Steven Clark, owner of a cattle and blueberry farm in Otsego County, requested that the Commissioner issue an Opinion pursuant to Section 308 of the Agriculture and Markets Law (AML) concerning the soundness of the use of a propane cannon to deter avian predation of his blueberry crop. On May 31, 2019, the Commissioner issued Opinion Number 19-2. In that Opinion, the Department determined that the use of propane cannons can be part of an effective integrated approach to control bird damage to small fruit; however, at the time of the Opinion, there was insufficient information due to the inability to examine the use of the propane cannon in conjunction with other devices and/or methods proposed in the management plan, and the efficacy of the newly adopted Bird Predation Management plan and other accepted alternative deterrent methods was unknown. The Department could not develop site-specific information concerning the efficacy and sound impact of the propane cannon due to a Court ordered injunction prohibiting its use.

On June 7, 2019, Acting Supreme Court Justice Brian D. Burns of Otsego County heard testimony from the attorneys representing the Plaintiffs (Ohad and Joanna Shem-Tov) and the Defendants (Steven and Victoria Clark) [Index EF2018-0575, RJI No. 2019-0251] concerning the Temporary Restraining Order prohibiting the farm's use of the propane cannon. By Temporary Order dated June 12, 2019, Justice Burns amended the 2018 Temporary Restraining Order to allow the limited use of a propane cannon. These limitations included operation of the propane cannon from 7 am to 7 pm each day for three consecutive weeks during the blueberry growing season, commencing on the 1st day the cannon is fired, and that the firing frequency must be regulated so that the blast discharges at intervals between 2 minutes to 5 minutes. The Court requested the Department to continue its review and evaluate the use of the propane cannon on the Clark farm. Justice Burns further ordered that if the Department of Agriculture and Markets cannot "...hear the propane cannon within the above stated three-week period...", Mr. Clark may seek permission to discharge the cannon for one day upon 48 hours notice.

On August 2, 2019, Robert Somers, Manager of the Department's Farmland Protection Program, visited the farm to examine and analyze updates to the farm's use of the cannon in conjunction with additional deterrents. Based upon the Department's previous findings and field information collected concerning the cannon's operation, findings arising from this recent review, the Department now determines that the farm's use of the devices described herein is sound.

The following additional information and findings have been considered in reaching this Opinion.

Information Considered in Support of the Opinion

The Blueberry Farm

1. Steven Clark owns and operates a u-pick blueberry operation on a parcel of land, Tax ID 328.00-1-10.01, in the Town of Unadilla, Otsego County, New York. The subject parcel is predominantly wooded with a 1.5-acre opening that is planted with 1,000+ blueberry bushes. In the Spring of 2019, Mr. Clark planted an additional 400 blueberry bushes. He stated that the varieties planted all ripen about the same time, early summer, but Mr. Clark intends to plant additional blueberry varieties that ripen later in the summer to extend his season. He stated that his goal is to have at least 1,500 blueberry bushes on the property. Mr. Clark's property is more fully described in the Department's May 31, 2019 Opinion.
2. The subject parcel remains in Otsego County Agricultural District No. 1, and continues to receive an agricultural assessment.
3. In the Spring of 2019, Mr. Clark removed mature trees along the northern and southern parcel boundary to allow more incident light onto the blueberry bushes and to remove roosting opportunities for birds.
4. In addition to the propane cannon, Mr. Clark interspersed flash tape and owl statutes within the blueberry bushes to scare the birds. In Mr. Clark's opinion, the flash tape, which is shiny and blows in different directions by the wind, was the most successful method to deter bird predation. However, Mr. Clark noted that the flash tape is only effective when wind is present, necessitating the continued use of the propane cannon.
5. In 2020, he intends to begin installing fencing around the perimeter of the blueberry bushes to help keep the turkey pullets off the bushes.
6. Mr. Clark stated that, during the permitted period, the firing interval was set to discharge between two to three minutes, only during morning and/or afternoon hours. The cannon never ran later than 7:00pm. Coupled with the use of the propane cannon, currently for three weeks out of the growing season, Mr. Clark believes that predation of the farm's blueberry crop will be controlled to an acceptable level.
7. Mr. Clark indicates that the bird predation threat, as described in the Department's May 31, 2019 Opinion, remains unchanged during the testing period.

Sound Level Analysis

8. Dr. Somers visited the farm on August 2, 2019 to measure sound level readings during the firing of the cannons. The Department used a downloaded app for an iPhone, developed by the National Institute for Occupational Safety and Health (NIOSH). The sound level app has an accuracy of ± 2 dBA without an external antenna. Dr. Somers determined that, when used to obtain relative sound level measurements for comparison of sound recorded at eight points across the landscape, the readings from the app were sufficient.
9. According to official meteorological data for the Binghamton Airport weather station on August 2, 2019, from 10 am to 11:30 am there was no measurable precipitation, the air temperature ranged from 73 degrees at 10 am to 77 degrees at 11:30 am, and wind speed was measured at 3 mph

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at 10 am and increased to 4 mph at 11:30 am. No wind gusts were reported on this day, which according to NIOSH, could add to background noise and interfere with recording accuracy.

10. Other variables that could affect sound measurements include background noise, distance from the cannon, slope and its position with respect to the cannon's discharge opening, vegetation and the amount of propane consumed by the cannon to produce the discharge.
11. The literature for the Zion Propane Cannon reports a variable discharge level from the cannon at 100 to 125 dBA, depending upon the amount of gas that floods into the firing chamber prior to discharge.
12. A total of eight (8) stations¹ were positioned to acquire sound recordings using the NIOSH iPhone app. At each station, three (3) measurements were taken and the highest reading obtained at each station is reported in Table 1 below and attached Exhibit 1.

Table 1 – Recorded Readings and Background Noise

Station Number	Background dBA Reading	Cannon dBA Reading
1	36.3	39.8
2	32.3	36.9
3	31.4	41.2

¹ Stations 1 through 3 were located to the north of the cannon, along the edge of Hutchinson Hill Road, in close proximity to the primary complainant's residence. The cannon's discharge point was pointed west, toward Hutchinson Hill Road. Distance, topography and vegetation were noted, which would cause a reduction in the recorded dBA levels.

Readings acquired at Stations 4 and 6 were obtained from a distance approximately 50 feet from the cannon. Station 4 recorded the noise level at a position 180 degrees from the opening of the cannon, and Station 6 recorded the noise level in front of the discharge opening. Station 6 was positioned slightly downhill from the cannon.

Station 5 recorded the noise level to the south of the cannon, positioned at an even position compared to the position of the cannon. This Station was located approximately 25 feet from the cannon. The readings at Stations 4, 5, and 6 all fell within a similar range, from 70.7 dBA to 78.4 dBA. Standing on Hutchinson Hill Road, due west of Station 6, but approximately 120 feet from the cannon, the recorded sound was 65.3 decibels. Distance from the cannon and slope may have affected the sound reading.

Station 7 was positioned on Hutchinson Hill Road, with the reading taken facing the discharge end of the propane cannon.

At Station 8, the sound reading is close to the readings taken near the cannon. Even though Station 8 was positioned approximately 725 feet from the cannon, it is believed that the shape of the land funneled the noise downslope toward Station 8. There was no vegetation between the cannon and this station, other than a few blueberry bushes, to dampen the sound.

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4	39.4	70.7
5	No Data Recorded	74.3
6	43.7	78.4
7	42.8	65.3
8	38.9	74.1

13. While standing at Station 6, Dr. Somers recorded the sound of a garbage truck driving along Hutchinson Hill Road at 78.7 dBA and 5 minutes later, a manure truck driving along the same road at 66.3 dBA. While standing at Station 2, a bird flew onto a tree branch directly above Dr. Somers' head. The bird's chirping was recorded at 47.2 dBA. Additionally, a young deer walked out onto the road slightly above Dr. Shem-Tov's yard to his residence. When the cannon fired, the deer was standing in the middle of the road. The deer appeared to not be alarmed by the sound and continued to calmly walk across the road onto the adjoining property.
14. At some Stations, the sound readings of the cannon were recorded at sound levels below some of the reported background noise levels partially explained in Footnote 1 found on page 3 of this Opinion. Although the recorded cannon readings do not have the concussive power that closer readings have (Stations 4 through 6), the firing of the cannon can still be heard due to the sharp contrast between the background noise and the sudden and short duration discharge noise.

Neighbor Comments

15. By letter dated November 15, 2019, the Department requested comments for a period until November 30, 2019, on Mr. Clark's updated use of the propane cannon from the adjoining landowners. Ten letters were mailed, including one to Steven and Victoria Clark, informing them that Acting Supreme Court Justice Brian Burns amended the Temporary Restraining Order on Mr. Clark's use of the propane cannon for a continuous three-week period, and requested that the Department evaluate the use of the cannon in order to amend its previously issued Sound Agricultural Practice Opinion 19-2, if warranted. The Department asked the landowners to submit comments in writing concerning this practice. Two of the adjoining landowners submitted written comments.
16. On November 27, 2019, the Department received a letter from Dave and Pauline DeForest. They stated the importance of notifying purchasers of property in an agricultural district of necessary farming practices in order to bring a commodity to market. They included a copy of an agricultural data statement form with their comments. The DeForests stated that when a farmer produces marketable products, some aspects of the operation may be objectionable to neighbors and the general public. They believe that everyone should work together to develop less objectionable methods and not harass anyone in the business of farming. They indicate that, until better solutions are available, that farmers should not be inhibited.
17. On November 30, 2019 the Department received, by email, a letter from Ohad Y. Shem-Tov, PhD, an adjoining property owner, concerning the use of the propane cannon. Dr. Shem-Tov's letter is similar to previous correspondence received by the Department. The letter presents no relevant facts concerning the new use of the cannon, during the specified time frame. Dr. Shem-Tov

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appears to seek to challenge the Department's legal authority to issue Sound Agricultural Practice Opinions and requested copies of legal material to do so. Dr. Shem-Tov states that Mr. Clark is not a farmer, that Dr. Shem-Tov has provided letters from a psychologist and audiologist on the effects of the cannon on his family's health and claims that Mr. Clark planted new blueberry bushes on land that he does not own. Dr. Shem-Tov requested an additional 30-day period upon receipt of the referenced legal material.

On December 12, 2019, the Department responded to Dr. Shem-Tov's initial comments and stated that the Department's solicitation of comments is factual and based on his observations of the practice during the limited time period specified in the Department's November 15, 2019 letter. Dr. Shem-Tov was informed that the documents requested would not be relevant in formulating factual observations of the practice. As a courtesy, however, the Department provided Dr. Shem-Tov a link to the Department's public website containing the full text of all Sound Agricultural Practice Opinions and related legal challenges, and granted an additional 10 days within which to provide factual observations. He was also informed that the Department was given authority to issue Opinions pursuant to AML Section 308(4) in 1992 and that these opinions protect farmers from private nuisance lawsuits if the Commissioner determines that a practice is sound.

On December 30, 2019, Dr. Shem-Tov responded to the Department's e-mail, again challenging the Department's authority to issue Sound Agricultural Practice Opinions and accusing Mr. Clark (and by implication the Department) of a hate crime and harassment. The response noted that the Department did not send a copy of Judge Burns' Order to him, and accordingly, the Department sent the requested document on December 31, 2019. On the same day, Dr. Shem-Tov responded with irrelevant material, cited personal issues he has experienced with Mr. Clark, and issues he experienced with his attorney. He also continued to personally attack Department staff. Accordingly, the Department did not respond to the last correspondence received from Dr. Shem-Tov.

Findings

Based upon the facts, including information contained in Sound Agricultural Practice Opinion 19-2, additional data and readings collected on August 2, 2019, and in consultation with the Advisory Council on Agriculture and the Sound Agricultural Practice Guidelines² by which agricultural practices are evaluated, I find the following:

1. The Department has found no evidence or received other information indicating that Mr. Clark has been cited for any violation of Federal, State or local law as a result of the use of the propane cannon. The Town of Unadilla has not adopted a noise ordinance, nor has it otherwise restricted the use of propane cannons. Mr. Clark was subject to a temporary court order to cease and desist the use of the cannon; however, on June 12, 2019, a revised Temporary Restraining Order was filed with the County of Otsego, as described herein,

² On November 1, 1993 the NYS Advisory Council on Agriculture published its report entitled *Protecting the Right of New York Farmers to Engage in Sound Agricultural Practices*. The Council developed guidelines to assist the Commissioner of the Department of Agriculture and Markets in determining what is sound pursuant to Section 308 of the Agriculture and Markets Law. The Guidelines state that the practice: 1) should be legal; 2) should not cause bodily harm or property damage off the farm; 3) should achieve the results intended in a reasonable and supportable way; and 4) should be necessary. The sound agricultural practices guidelines recommended by the Advisory Council on Agriculture are given significant weight in assessing agricultural practices.

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conditionally allowing the use of the cannon, as ordered by Acting Supreme Court Justice Brian D. Burns.

2. The Department has found no evidence that the use of the devices has resulted in bodily harm or property damage off the site. Neighbors adjacent to and further away from Mr. Clark's property have offered differing opinions on the use of the propane cannon and its effect on their mental health and enjoyment of property. Only one landowner submitted doctors' letters related to complaints arising from the use of the cannon. However, neither letter submitted conclusively reveals any diagnosis related to the use of the cannon other than contributing to "heightening of stress." Further, there is no documentation that reveals ongoing treatment of any conditions related to the use of the cannon.
3. Scientific literature has determined that the use of a propane cannon is a reasonable and cost-effective method of protecting blueberry crops from avian damage when used in conjunction with other deterrent methods. During the 2019 growing season, Mr. Clark used the cannon when necessary, at firing intervals in accordance with the June 12, 2019 Temporary Restraining Order. Mr. Clark also employed flash tape and owl statues, along with the cannon, to deter avian predation of his blueberries. He stated that the use of all three devices proved useful in minimizing damage to his blueberry crop. He stated that he intends to begin installing a fence around the field planted to blueberries to help deter predation from turkey pullets. Mr. Clark explained that he avoided pointing the cannon in a northerly direction towards the main complainant's house to avoid further conflict. Mr. Clark stated that the cannon was moved around the property daily and only pointed in an easterly and westerly direction. Based upon recorded sound readings, pointing the discharge opening of the propane cannon in an easterly direction as much as possible would reduce noise levels. No houses are located directly east of the blueberry bushes and the existing woodland will help dampen off-site sound levels.
4. Mr. Clark reports that he had an increase in sales of blueberries over a three-year period prior to 2018 due to the use of the cannon. After the issuance of a 2018 Court Order, Mr. Clark was unable to harvest any blueberries due to bird predation and the consumption of his crop, predominantly arising from blue jays and turkeys. It was concluded that some type of control is needed to prevent the total loss of his blueberry crop. In 2018, Mr. Clark continued to use scare-eye balloons, but their use alone was not effective. In 2019, Mr. Clark was allowed to employ the cannon within a consecutive three-week period. Its use along with the use of flash tape and owl statues effectively controlled much of the avian predation. According to various sources, a robust combination of many types of deterrents is the most effective.

As stated in Opinion 19-2, issued on May 31, 2019, the literature indicates that while netting is the most effective method of controlling bird damage, the initial capital investment, annual installation, and removal expenditures for netting are expensive, exceeding five thousand dollars. In contrast, a propane cannon may be purchased for less than \$1,000 from various sources and is also effective in preventing avian predation. While netting would avoid the off-farm noise associated with cannons, there would be substantial initial and annual expenditures for the farm operation.

Conclusion

Based on the foregoing and in accordance with section 308 of the Agriculture and Markets Law, I conclude that the use of the propane cannon on the Clark property, as described above, is sound

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due to its effectiveness in controlling avian predation of its blueberry crops when coupled with the use of other deterrents, such as flash tape and owl statues. Mr. Clark has achieved efficacy of his Bird Predation Plan and will need to continue to follow his Bird Predation Management plan. Mr. Clark may also need to use the cannon more than three weeks during each growing season, especially if he plants varieties of blueberries that ripen later in the summer to extend his growing season.

3/19/20

DATE



RICHARD A. BALL

Commissioner of Agriculture and Markets

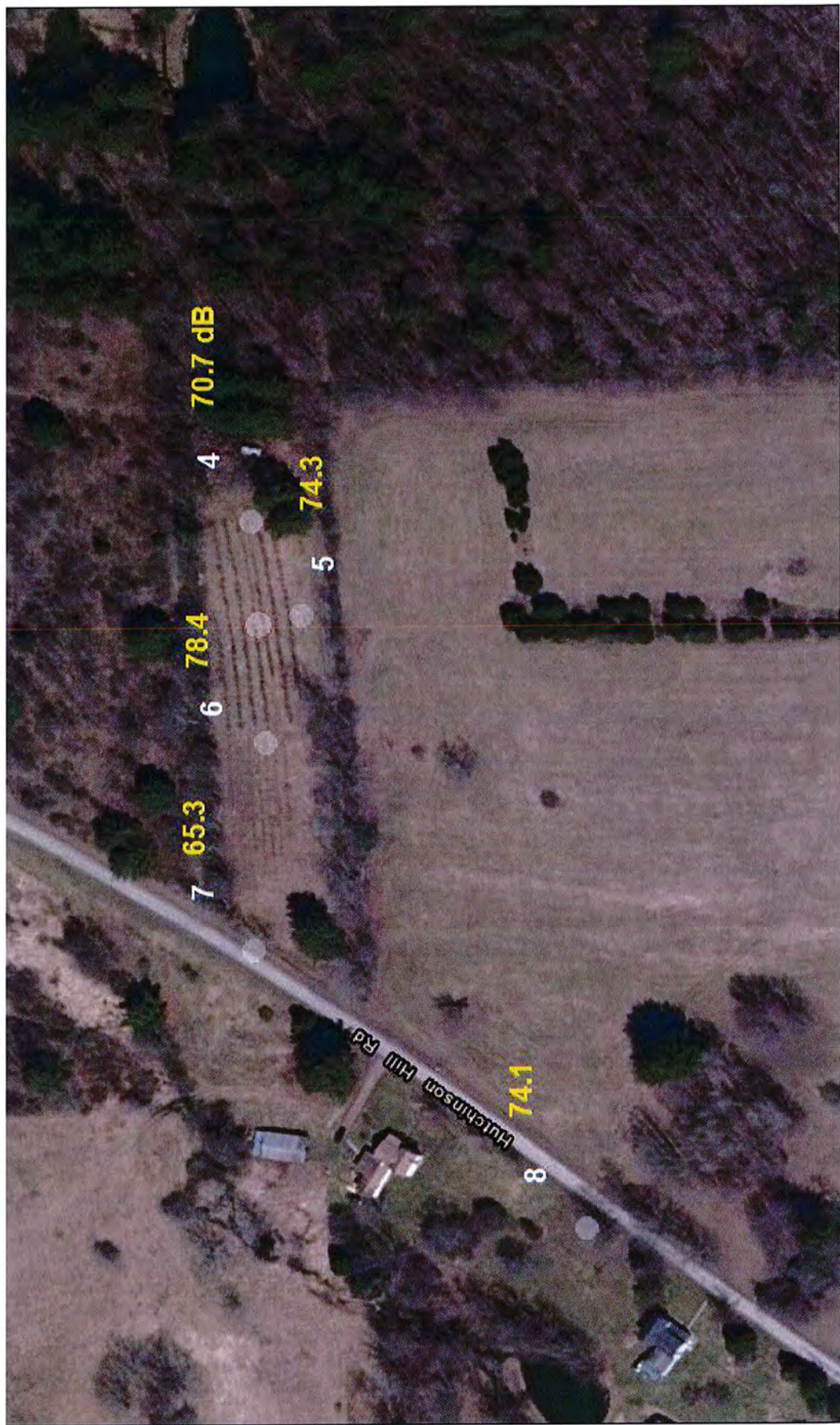
Exhibit 1











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REQUESTOR: Steven Clark
138 County Highway 2
Mount Upton, New York 13809

Preliminary Statement

By e-mail dated August 2, 2018, Steven Clark, owner of a cattle and blueberry farm in Otsego County, requested that the Commissioner issue an Opinion pursuant to Section 308 of the Agriculture and Markets Law (AML) concerning the soundness of the use of a propane cannon to deter avian predation of his blueberry crop.

The Department conducted a sound agricultural practice review concerning Mr. Clark's use of a propane cannon to protect his blueberry crop from predation. The Department determines that, while the use of propane cannons can be part of an effective integrated approach to control bird damage to small fruit, there is currently insufficient information concerning the use of the cannon to make a determination as to whether the practice is sound. In this regard, the Department has been unable to develop site specific information concerning the efficacy and sound impact of the propane cannon due to the Court injunction prohibiting its use. Further, the Department would need to collect data concerning the implementation of the farm's bird predation management plan and other alternative deterrent methods to make a determination on the soundness of the use of the cannon.

The following information and findings have been considered in reaching this Opinion.

Information Considered in Support of the Opinion

The Blueberry Farm

1. Steven Clark owns and operates a u-pick blueberry operation on one parcel [Exhibit 1, Tax ID 328.00-1-10.01] in the Town of Unadilla, Otsego County, New York. The subject parcel is predominantly wooded with a 1.5-acre open area that has been planted to 650 blueberry bushes. Mr. Clark has purchased an additional 400 bushes, which will be planted in 2019.
2. According to information provided by Larry Oralls, local tax assessor for the Town of Unadilla, the parcel is subject to a partial agricultural assessment for those portions of the parcel used to produce crops, livestock and livestock products as defined in AML §301(2).
3. On March 7, 2019, by Resolution No. 94-20190306 of the Otsego County Board of Representatives, the subject parcel was added to Otsego County Agricultural District No. 1. The inclusion was certified by me, pursuant to AML §303-b on March 19, 2019, effectuating the inclusion of the parcel in the agricultural district.

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4. At the start of his blueberry operation in 2013, Mr. Clark stated that he purchased mature plants from another blueberry operation that went out of business and planted these bushes on his property. These bushes are planted from the middle of the plot of land, extending in an eastwardly direction away from Hutchinson Hill Road [Exhibit 2]. In 2014, Mr. Clark indicated that he planted young blueberry bushes closer to Hutchinson Hill Road. The bushes to be planted in 2019 will be located to the south of the existing bushes. Mr. Clark stated that all of the planted bushes are similar in that the berries generally mature at the same time from late July to early August.
5. Mr. Clark noted that he is currently clearing trees near the boundary line to bring more light to the blueberry bushes, eliminating roosting trees for birds, and placing more land into production. The pond in the center of the parcel is used to irrigate the young bushes, as well as the remainder of the orchard during periods of drought. Mr. Clark established a dripline system for the distribution of water to the plants.
6. Mr. Clark stated that his blueberry operation is a u-pick operation. The operation advertises and verbally informs potential clients when the berries are available. Mr. Clark indicated that the operation provides baskets for picking or clients can bring their own, at their selection. A stand has been constructed where the baskets are placed. Clients have the option of either paying the Clarks directly, if they are on site, or leaving the money in a designated can.
7. Agriculture and Markets Law §308(1) requires that the Commissioner consider whether an agricultural practice is conducted by a farm owner or operator as part of his or her participation in the Agricultural Environmental Management (AEM) Program as set forth in Agriculture and Markets Law Article 11-A. Mr. Clark stated that the farm is not a participant in AEM. However, the agricultural practice of using a propane cannon to protect blueberry crops is not a water quality concern which would be evaluated under AEM.

Use of Avian Deterrents in Agricultural Operations

8. According to the literature for the Zon Mark 4 Propane Cannon used by Mr. Clark, the intent of the cannon is to repel birds and other wildlife with a sonic blast. The company advertises that the automatic cannons have been used for over 50 years to control pest birds and other wildlife. A single propane cannon can be used to protect up to five-acres of land, depending upon the shape and topography of the land. Blast intervals can be set as frequently as 40 seconds to a maximum of 30 minutes, with the blast volume varying from 100 to 125 decibels.
9. The Zon Mark 4 User's Manual provides several recommendations for using the cannon. One recommendation directs the user to avoid placing "any heavy objects on the detonating device...[or] block[ing] the air circulation." The manual also states "[i]t is important to move the device regularly in order to increase its effectiveness."
10. The most comprehensive guide in New York State on management strategies to control bird damage to small fruit is published by Cornell University (Cornell Guide).¹ The author, Cathy Heidenreich, was a Berry Extension Support Specialist with Cornell Cooperative Extension. Ms. Heidenreich writes that the best bird management strategy is an integrated approach

¹ Heidenreich, Cathy. Bye Bye Birdie – Bird Management Strategies for Small Fruit. Cornell University, College of Agriculture and Life Sciences, Cornell Cooperative Extension. New York Berry News, Vol. 6, No. 6, June 22, 2007.

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that uses multiple methods to reduce damage to small fruit crops. Common damage to fruit crops arising from bird predation includes whole berry removal, fruit knocked off the plant by foraging birds, and bird peck. The amount of damage depends upon the site and the types of birds that are in the area when the fruit begins to ripen. She states that once a feeding pattern is established, it becomes more difficult, if not impossible, to change bird behavior.

11. The Cornell Guide states that the "[t]actics to consider include... cultural practices, exclusion, sensory deterrents, scare devices, and protection/development of predator habitat." Cultural practices comprise of such tactics as relocating new plantings away from cover or perch sites such as woods, hedgerows, power lines and brushy fields. Grass and weeds should also be controlled to limit seed-eating birds because bird damage is usually greater on early ripening varieties since other sources of food are not available. Exclusion practices include netting and other types of physical barriers. While netting is the most effective method to control predation, it is also exorbitantly more expensive and labor intensive than other methods. Sensory deterrents consist of those methods which affect the senses such as smell, taste, auditory and visual. Some chemical repellents are also available; however, the label should specify the safety of use on food crops.
12. In reference to scare tactics, Ms. Heidenreich states that it is best to use several types simultaneously with variation in the type and location of the devices so that birds do not become accustomed to particular scare tactics. Visual deterrents include flash tape, wide-eyed balloons, "ScareWyndmills" and predator kites. If a feeding pattern has already been established where the use of the scare tactics has failed, another option that may be employed is the dissemination of feeders filled with sunflower seeds, millet, nectar and peanuts to distract the birds from the fruit.
13. Ms. Heidenreich explains that sound may be used as a bird repellent by causing "...fear, pain, disorientation, communication jamming, audiogenic seizures or internal thermal effects." Sound deterrents include distress calls and noise makers such as propane cannons. Distress calls require identification of the damage causing birds as these types of calls are species specific and are effective for 7 to 10 days to drive birds from fields and roosts.
14. Propane cannons, pyrotechnics and other noise making devices only provide short term control of birds when used alone. These devices not only affect the birds, but also often have an impact on customers and neighbors.
15. Bird predation management plans are helpful in developing effective strategies to combat crop loss. The Ministry of Agriculture and Lands, British Columbia, developed a factsheet on how to create an effective bird predation management plan for blueberries (British Columbia Factsheet).² The factsheet states that a good bird management plan minimizes crop loss and disruption to neighbors. It also accords with the Cornell Guide in that a good plan requires an integrated approach to effectively manage damage from birds. It further states that potentially disruptive devices, such as propane cannons, should only be used when flocks of birds are found in the area. It is important to identify the type of birds that are in the area, and the associated feeding behavior and determine the most effective method(s) for control.

² Ministry of Agriculture and Lands, British Columbia. Bird Predation Management Plan – Blueberries. Order No. 670.300-1, July 2009.

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16. The British Columbia Factsheet also explains that the use of noise devices should begin as soon as the birds begin to visit the blueberry bushes. Scaring devices must be moved frequently to prevent birds from becoming accustomed to them in order to maintain the effectiveness of the devices. It suggests that infrequent firing of the cannon should begin at the start of the harvest season and increase the firing frequency as feeding pressure increases. The factsheet states that single shot cannons should not be fired more frequently than once every 5 minutes. Both the British Columbia Factsheet and the Cornell Guide state that, in general, more frequent firings should occur in the early morning and late afternoon through to dusk. The cannon should not be fired as intensively in the afternoons when feeding pressure is low. Observations on the success or failure of the firing frequency should be evaluated and modified accordingly.
17. The British Columbia Factsheet also discusses the use of scaring devices. It states that the first encounter with the device will force the bird to flee. Once the bird becomes accustomed to the device, it will start to explore it and then eventually ignore the device, at which point it should be removed. The factsheet states that such device should be moved around the blueberry field frequently.
18. The Ministry of Agriculture, Food and Rural Affairs, Ontario, Canada also developed a factsheet entitled "Using Propane-Fired Cannons to Keep Birds Away from Vineyards."³ They report that bird-scaring cannons are used in over 80 countries to control crop damage. The most effective cannons are the ones that can be programmed to triple-fire. The factsheet discusses neighbor complaints and provides eleven best management practices that should be followed. One such practice specifies that neighbors living within 575 feet of the cannons should be notified when the equipment will be used. The authors found that, with a series of three shorts over seventeen seconds, the first startles the birds, the second drives them away, and the third makes sure that they do not return. They also indicate that the emitted sound level varies after its release due to weather, wind speed and direction, topography, ground cover, direction of firing and obstructions.
19. According to another factsheet from the Ontario Ministry of Agriculture, Food and Rural Affairs (Ontario Factsheet)⁴, "[u]nchecked, birds can completely destroy an entire crop. A flock of 5000 starlings can consume up to 1 ton of food over a 10-day period." The factsheet also points out that bird damage is increasing because "bird populations are increasing, and there have been changes to migration patterns due to climatic changes." The Ontario Factsheet notes that birds usually feed early in the morning around sunrise and late in the afternoon around sunset.
20. According to the Ontario Factsheet, birds react more to acoustical deterrents than visual deterrents. Visual deterrents should be used with acoustical systems, as they rarely provide adequate protection by themselves. The document recommends an integrated approach to controlling bird damage, including:
 - Setting the firing intervals at least 3 minutes apart;

³ Fraser, H.W. and P. Eng. 2010. Using Propane-Fired Cannons to Keep Birds Away from Vineyards. OMAFRA Factsheet '0-053, AGDEEX 730/658. Ontario Canada.

⁴ Fraser, Hugh W., K. H. Fisher and I. Frensch. Bird Control on Grape and Tender Fruit Farms. Ontario Ministry of Agriculture. 1998, pp. 1-11.

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- Moving the propane cannon around the property;
 - Placing the cannon away from neighbors' houses;
 - Using a combination of scaring methods that affect the bird's sense of sight and sound and create a sense of fear; and
 - Positioning devices along the perimeter of the area to be protected, near trees and at entry areas.
21. The Ontario Factsheet also explains that, while netting can be costly, it is "the best way to ensure crop protection." According to several sources, netting is a better option for small producers than larger operations due to both its cost and labor-intensive nature.
22. The United States Environmental Protection Agency's (EPA) Noise Control Handbook⁵ (Handbook) contains information on the health effects of noise. According to the Handbook, "the magnitude of noise-induced hearing loss depends upon the noise level to which the ear has been habitually exposed, the length of time for which it has been exposed to those levels, and the susceptibility of the individual." The Handbook states that the EPA has established that an intermittent environmental noise level of no more than 70 dB is the "best present estimate" for protecting "96 percent of the general population from a hearing loss of greater than 5 dB at 4000 Hz." The Handbook also indicates that studies have examined the health effects due to exposure to environmental noise. While the "studies are viewed as exploratory rather than confirmatory, evidence has been obtained for increased rates of hypertension and cardiovascular disease, increased usage of various prescription drugs, increased rates of physician's visits, and increased subjective and self-reported symptoms and complaints." Other health issues related to noise that are identified in the Handbook include: headaches, fatigue, insomnia and irritability. According to the Handbook, noises "that are abrupt, intermittent, or fluctuate with time can be very annoying as well."
23. Cornell University also published a crop profile on blueberries grown in New York.⁶ The publication states that damage to blueberry crops by birds is serious in many areas of the State. "Visual scare devices such as whirlers, streamers, reflectors, and plastic hawk and owl models are used in combination with sound devices such as exploders, alarms, or recorded devices. For sound devices to be effective, their location and the frequency of sounds are changed daily." These devices must be in place prior to the fruit ripening. The authors suggest that the most effective sound devices are those with species-specific bird distress calls programmed into the device. The document also describes that plastic, acrylic, nylon, cotton, and polyethylene netting are available to protect the fruit. While most netting is expensive, it can generally be reused for many years. "Methyl anthranilate formulations for bird repellency are labelled for use but have not proven to be effective, especially with crops like blueberries that ripen over a long period of time." The document also concludes that repeated applications during the fruiting season are required.
24. Small Fruit and Berry Specialist Laura McDermott for the Washington County Cornell Cooperative Extension commented that protection of small fruit from bird predation is a

⁵ U.S. Environmental Protection Agency. Noise Effects Handbook. 1981. EPA 500-9-82-106.

⁶ Harrington, Eric and George Good. March, 2000. Crop Profile: Blueberries in New York. Cornell University, Ithaca, New York

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difficult problem with no easy solution. Ms. McDermott states that, while the use of propane cannons is one of the management techniques which growers employ that is especially effective against flocking birds, when used alone the efficacy will fall dramatically. Many other types of bird deterrents must also be used in concert with propane cannons in order to achieve reasonable efficacy due to the adaptive nature of birds.

Existing Avian Predation Threat

25. On August 15, 2018, Robert Somers, PhD, Manager of the Department's Farmland Protection Unit, performed a site visit to examine the blueberry operation and discuss the use of a propane cannon to deter avian predation of the fruit. At the time of his visit, Dr. Somers indicates that he observed two ages of blueberry bushes on the property, an older grouping of bushes which should produce berries and a younger set of bushes closer to the road. The bushes appeared healthy and had compost around their roots to conserve water. Drip trickle lines were also observed paralleling the planted bushes. A review of the bushes and surrounding area indicated that the plantings had been picked clean and no residual fruit was observed on the ground beneath the plants [See Field Report, attached hereto as Exhibit 3].
26. When the bushes began producing berries, Mr. Clark explained that he started experiencing trouble with bird predation. Initially, he tried using scare-eyed balloons as a deterrent. However, he found that the balloons alone were not effective against the birds. As a result, in 2016, he purchased and began using a Zon Mark 4 branded propane cannon. The use of the cannon coupled with scare-eyed balloons proved to be effective deterrents and the number of blueberries lost to predation was substantially reduced.
27. When discussing the use of the propane cannon, Mr. Clark noted that he generally uses the device for approximately three weeks out of the year when the blueberries are almost ripe, from July to August during the hours of 7 am to 7 pm. He described the firing interval as varying from as frequently as every two minutes up to a maximum interval of five minutes. He stated that the firing interval is adjusted so that the birds do not become accustomed to the regularity of the discharge. Mr. Clark further indicated that he uses scare-eyed balloons in conjunction with the cannon to help scare off the birds from the blueberry crop. He said that he never points the cannon toward the complainant's house, and that he routinely changes the position of the cannon daily, pointing the cannon parallel to the existing rows of blueberries. The propane cannon typically sits on the ground and is not elevated on a tripod. Mr. Clark has not observed or indicated results obtained from the use of other deterrent methods.
28. In 2018, adjoining neighbors, Ohad and Joanna Shem-Tov, filed a nuisance court action against the Clarks to prevent the use of the propane cannon. In an Order to Show Cause (Order), Index No. EF2018-575, Ohad Shem-Tov and Joanna C. Shem-Tov (Plaintiffs) against Steven R. Clark and Victoria A. Clark (Defendants), the Honorable Brian D. Burns, Acting Justice of the Supreme Court of Otsego County, dated July 23, 2018, ordered the Defendants to stop using the propane cannon on their property until further directed by the Court. As a result, Mr. Clark has not been able to protect his fruit from being consumed by birds and turkeys and the operation was not able to produce a marketable crop in 2018. Due to the Order in effect at the time of the visit, Dr. Somers was unable to evaluate the sound emanating from the propane cannon since Mr. Clark is prohibited from discharging the device.

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29. Mr. Clark stated that blueberry sales increased annually from \$756 in 2015, \$1,251 in 2016 to \$2,580 in 2017. There were no sales in 2018 due to the effect of the Order, resulting in a complete loss of the blueberry crop to bird predation. Mr. Clark stated that, based on observation, blue jays and turkey pullets appear to be the most common birds feeding on the blueberries. He states that small song birds are also an issue, but to a lesser degree.
30. Mr. Clark prepared a Bird Predation Management Plan dated February 10, 2019 that will be in use for the 2019 growing season. The plan states his intention to use a wider variety of methods to scare birds from his blueberry field than currently being utilized. These methods involve an integrated approach involving scare-eye balloons, streamers and flash tape, owls, and the propane cannon, if permitted.
31. For the next growing season, Mr. Clark will be able to evaluate his bird predation management plan and adjust as needed. The visual devices will be moved every 7 days and the cannon every two days (if permitted). Mr. Clark also plans on removing the vegetation/hedge rows adjacent to the blueberry field to eliminate landing and roosting areas for the birds. Mr. Clark will also have to evaluate whether a fence around the blueberry field will be needed to deter turkeys from coming into the field where the blueberry bushes have been planted. If the use of these devices is ineffective, netting will have to be considered.
32. A digital aerial image depicting the Clark parcel was used to measure the approximate length of the rows of blueberry bushes on his property. Cumulatively, the rows of bushes are approximately 2,000 linear feet. A review of garden netting on the Internet indicates that one company, Bird B Gone, sells netting in rolls of 100 and 200 feet. Generally, ten rolls measuring 200 feet each would be needed to cover the bushes currently existing on the subject parcel. Applicable literature suggests that 1/2-inch netting is sufficient to keep smaller birds away from the fruit. The advertised price of a 14-foot x 200-foot roll with 1/4-inch hexagonal shaped mesh is \$530 per roll. The 1/2-inch hexagonal shaped mesh is \$455 per roll. The 100-foot rolls are more expensive. The cost of netting alone would range from a minimum of \$4,550 to more than \$5,300 to cover the bushes, exclusive of any labor or construction of a trellis system to keep the netting off bushes. Placing the netting on the bushes would make removal at the end of the season difficult. It would also require the public to remove portions of the netting to reach the mature berries as part of the Clark's u-pick operation, which could reduce the useful life of the netting, and present logistical problems for the operation of the u-pick operation.
33. One commonly used method available for estimating dissipating sound with increasing distance from the source of the noise is the inverse square law. This law assumes equal sound propagation in all directions and no interference with the sound wave. Exhibit 4 represents the calculated dB level at the Shem-Tov residence based upon this law. If accurate, the dB level at their residence is below the EPA recommended "safe" 70dB level. In any event, dB levels should also account for noise dampening vegetation and topography, which would further decrease the dB level. In this case, the Department was unable to reliably measure potential sound using the inverse square law due to the observed position and topography of the parcel. The Court Order prevented Mr. Clark from firing the propane cannon, and the Department, therefore, could not reliably evaluate the dB levels at the complainant's residence or other residential structures adjacent to the farmed parcel. Further, because the cannon has not been fired in over a year, the previous complaints, if true, do not account for changed circumstances.

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Neighbor Comments

34. By letter dated August 13, 2018, the Department requested comments on Mr. Clark's use of the propane cannon from the adjoining landowners to tax parcel 328.00-1-10.01. Ten letters were mailed, including one to Steven and Victoria Clark, stating that Mr. Clark requested a Sound Agricultural Practice Opinion on the use of a propane cannon to prevent birds from consuming blueberries grown on the farm. The Department asked the landowners to submit comments in writing concerning this practice. Five adjoining landowners submitted written comments. Unsolicited comments were also received from another individual living near the subject parcel of land. The narrative below is arranged in order of receipt by the Department, beginning with the earliest submission.
35. One set of adjoining neighbors stated that they believe that the use of a propane cannon poses a fire hazard and will negatively affect wildlife and people's hearing. They do not want the device used in their area and believe that the use of the cannon began several years ago without permission. They do not like hearing the cannon being fired and do not believe that a blueberry patch qualifies as a farm.
36. A person living across from the blueberry patch stated that she has lived in her home for over 50 years. She feels fortunate to live in a rural area and have access to fresh fruit and vegetables. She writes that, in an agricultural community, certain practices are necessary to ensure the success of crops. She states that the propane cannon is only used during daylight hours and does not interfere with her daily activities. She understands the need for this type of equipment and approves of its use.
37. Another adjacent landowner writes that the application of the propane cannon is sound and cost effective. He states that the cannon operates during the 3 to 4-week berry season and is no louder than the sound of a shotgun discharging during hunting season. This landowner confirmed that the cannon is only in use during daylight hours and, to his knowledge, does not violate any local ordinances. He said that, within reason, local farmers should be encouraged to produce locally grown crops as it is vital to the farm's viability and the local economy.
38. Another set of adjoining landowners state that they are able to hear the propane cannon but understand the necessity to protect one's investment. They state that cannon systems have been used within the area for years, specifically to protect sweet corn crops. They believe support should be provided to these farms until more user-friendly ideas to deal with wildlife become available. They explained that the cannon is not fired 24/7 and does not eliminate the wildlife in the area. These landowners indicate they personally have experience with a small grove of blueberry bushes they planted 10 years ago, which were consumed by deer and birds before they were ready to pick.
39. Another landowner stated that he is a neighbor of the complainant and received a copy of the Department's solicitation letter from the complainant. He states that the area in question is strictly residential in nature and has been that way for the entire 12 years that he has lived there. He states that Mr. Clark has made inaccurate claims in his court filings about the scope of the blueberry farm and his use of the cannon. The area planted to blueberries is less than 2 acres. He said that they did not start growing blueberries in 2013, but rather, in 2015. He said that he has never seen anyone picking the blueberries, which Mr. Clark claims is the

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business activity engaged in. He fires the cannon from 4 am to dusk, anywhere from every 30 seconds to every 3 minutes. He indicated that it is extremely disruptive to the quiet enjoyment of his property, upsets their pets, and is obnoxious.

40. Another letter received by the Department is extensive and includes comments broader in scope than solely the use of the propane cannon. The landowner believes that Mr. Clark intends to harass the landowner's family through his use of the cannon. He alleges that Mr. Clark shoots the cannon every 30 seconds from 4 am to 9 pm, 7 days a week during July and August. He states that Mr. Clark began using the cannon in 2016, and he contends that Mr. Clark is not a blueberry farmer, but the owner of a construction company. He also states that Mr. Clark operates another patch of blueberry bushes next to his own residence and chooses to use netting there. He noted that his wife intends to open a private practice of horse/animal therapy on their property, which would be impossible if Mr. Clark regularly shoots the propane cannon on the property line. He also claims that Mr. Clark used the cannon in 2016 and 2017 and attempted to use it again in 2018, but the Otsego County Court issued a temporary order to stop the firing of the cannon. He said that it is impossible to enjoy their property, they are unable to sleep, and they do not feel comfortable having guests over to their house. He said that they continue to seek legal support to bring this matter to an end. He states that Mr. Clark asserts that he makes approximately \$2,500 annually from the sale of blueberries. The neighbor contends that he is not a farmer as it is not feasible to live off that amount of income. He believes that Mr. Clark does not live on the parcel where the blueberries are grown, and his agricultural pursuits of raising cattle and growing blueberries are instead a hobby.

On March 16, 2019, by e-mail with attachments, the Department received further correspondence from this landowner, concerning the effects the use of the propane cannon has had on his family. The attachments included a letter from psychologist Mark P. Vogel, Ph.D.; a letter from David Glasser, Au.D., CCC-A, FAAA, Doctor of Audiology; a copy of a deposition of Steven Clark held on January 9, 2019; a copy of the Second Memorandum of Law, Index No. EF2018-575, RJI NO. 2018-0251 dated July 31, 2018; and an e-mail from Dr. Somers to the landowner dated July 22, 2016.

The letter from Dr. Vogel, dated January 13, 2019, states that the landowner and his spouse requested a letter based upon discussions he has had with them concerning their reaction to sounds originating from the use of the propane cannon. He states that they have suffered from "repetitive and startling auditory intrusion" and the repetitive blasts have created ongoing anxiety for the landowner's wife. Dr. Vogel states that she reports that the children have become frightened. The landowner states that he suffers from "some degree of trauma related to experiences from his military service" and that the blasts "restartle and to some extent retraumatize him." The landowner also indicates that he moved his home office to another facility due to the noise. However, Dr. Vogel does not indicate if he is actively treating the landowners for the various reactions they are experiencing, or if he has diagnosed them with any medical conditions related to these events. Dr. Vogel does not note any physical manifestations due to the use of the cannon by Mr. Clark.

The letter from Dr. Glaser, dated January 29, 2019, explains that he has had prior experience with a case similar to the one confronting the landowners. He cites the EPA Handbook, which establishes an intermittent environmental noise level of no more than 70dB for protecting 96% of the general population from hearing loss. He notes that he has neither met the landowner or his family, nor has he performed audiological diagnostic testing related to this

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case. He further clarifies that he has not evaluated the propane cannon or the intensity level of the firing. It is his recommendation that the family wear hearing protection during the months of July to August when the cannon is being used.

Moreover, the affected landowner continues to refer to an e-mail from Dr. Somers, dated July 22, 2016 to support the contention that Mr. Clark is not eligible to request a sound agricultural practice opinion. The response provided in the referenced e-mail was solely based upon the information provided by the landowner at the time. During the investigation performed in connection with this sound agricultural practice review, however, it was determined that Mr. Clark qualifies and receives an agricultural assessment. The subject parcel is also now located in the Otsego County Agricultural District No. 1. Therefore, he meets the statutory criteria to be eligible for protection from a private nuisance action should such a practice be determined as sound pursuant to AML §308(3).

Local Laws and Noise

41. In August 2016, a petition was signed by individuals living in four different residences on Hutchinson Hill Road and presented to the Town Board. The petition states that half an acre of blueberries is being grown on the subject parcel, loud shotgun type sounds begin at approximately 4:30 am and end at approximately 9:00 pm and the sound varies at intervals of 30 seconds to 5 minutes. The petition alleges that the sound disturbs the peace and they have determined the practice to be a private nuisance. They requested that Mr. Clark stop using the propane cannon as they believe there are other methods of protecting blueberry bushes, such as netting or fencing.
42. On or about June 25, 2016, Mr. Clark stated that he called the State Police concerning harassment by a neighbor concerning both himself and a customer picking blueberries. Trooper Justin Hawkes and Trooper Ian Bilek investigated the complaint and talked to the neighbor. The officers subsequently arrested the neighbor. Mr. Clark indicated that the Assistant District Attorney Michael Getman suggested, and the Judge agreed to, an "Adjournment in Contemplation of Dismissal" (ACOD) and a 6 month order of protection.
43. On February 19, 2019, Dr. Somers contacted Town Supervisor George DeNys, who stated that the Town of Unadilla does not have any zoning laws or a noise ordinance. Supervisor DeNys stated that Dr. Shem-Tov approached the Town about Mr. Clark's use of the propane cannon, but the Town does not have any laws that would prohibit its use. Mr. Clark stated that the Town Board did not address the petition and stated that they did not intend to adopt a noise ordinance. To date, there have been no further incidents involving alleged violations or citations involving local laws.

Findings

Based upon the facts, information and circumstances described above, and in consultation with the Advisory Council on Agriculture; the New York State College of Agriculture and Life Sciences at Cornell and the Sound Agricultural Practice Guidelines⁷ by which agricultural practices are evaluated, I find the following:

⁷ On November 1, 1993 the NYS Advisory Council on Agriculture published its report entitled *Protecting the Right of New York Farmers to Engage in Sound Agricultural Practices*. The Council developed guidelines to assist the Commissioner of the Department of Agriculture and Markets in determining what is sound pursuant to Section 308 of the Agriculture and Markets Law. The Guidelines state that the

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1. The Department has found no evidence or received other information indicating that Mr. Clark has been cited for any violation of Federal, State or local law as a result of the use of the propane cannon. The Town of Unadilla has not adopted a noise ordinance, nor has it otherwise restricted the use of propane cannons. Mr. Clark is subject to a temporary court order to cease and desist the use of the cannon, however, he is not in violation of the Order.
2. The Department has found no evidence that the use of the devices has resulted in bodily harm or property damage off the site. Neighbors adjacent to and further away from Mr. Clark's property have offered differing opinions on the use of the propane cannon and its effect on their mental health and enjoyment of property. Only one landowner submitted doctors' letters related to complaints arising from the use of the cannon. However, neither letter submitted conclusively reveals any diagnosis related to the use of the cannon other than contributing to "heightening of stress." Further, there is no documentation that reveals ongoing treatment of any conditions related to the use of the cannon.
3. Scientific literature has determined that the use of a propane cannon is a reasonable and cost-effective method of protecting blueberry crops from avian damage when used in conjunction with other deterrent methods. Mr. Clark used the device when necessary, during the daylight hours, and only during that time of year when the crops were ripening and ready to pick (3 to 4 weeks out of the year). However, at times it appears that the firing intervals were not consistent with recommended practice and are more frequent than every three to five minutes or longer firing intervals. Mr. Clark intends to address this in his 2019 Bird Predation Management Plan, which has yet to be implemented. Although the literature suggests that the cannon should be rotated in all directions to be the most effective, Mr. Clark explained that he avoided pointing the cannon in a northerly direction towards the main complainant's house to avoid further conflict. Mr. Clark stated that the cannon was moved around the property daily and only pointed in an easterly and westerly direction. Once the efficacy of other methods has been evaluated, a determination may be made concerning the soundness of the use of the cannon. Further, the ability to obtain site specific information, precluded by the Court Order, would assist the Department's evaluation.
4. Mr. Clark experienced an increase in sales of blueberries over a three-year period prior to 2018 due to the use of the cannon. After the issuance of the Order, Mr. Clark was unable to harvest any blueberries directly related to bird predation, predominantly arising from blue jays and turkeys. Some type of bird control is needed to prevent total loss of his blueberry crop, in addition to visual deterrents. In 2018, Mr. Clark continued to use scare-eye balloons, but their use alone was not effective. According to various sources, a robust combination of many types of deterrents is the most effective.

The literature indicates that while netting is the most effective method of controlling bird damage, the initial capital investment, annual installation, and removal expenditures for netting are expensive, exceeding five thousand dollars. In contrast, a propane cannon may be purchased for less than \$1,000 from various sources and is also effective in preventing avian predation. While netting would avoid the off-farm noise associated with cannons, there would be substantial initial and annual expenditures for the farm operation. Once the results

practice 1) should be legal; 2) should not cause bodily harm or property damage off the farm; 3) should achieve the results intended in a reasonable and supportable way; and 4) should be necessary. The sound agricultural practices guidelines recommended by the Advisory Council on Agriculture are given significant weight in assessing agricultural practices.

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of utilizing other deterrent methods is appropriately evaluated, a determination can be made concerning the necessity of the use of the cannon.

Conclusion

Based on the foregoing and in accordance with section 308 of the Agriculture and Markets Law, I am unable to conclude that the use of the propane cannon on the Clark property, as described above, is sound due to the inability to examine the use of the propane cannon in conjunction with other devices and/or methods proposed in the management plan, the unknown efficacy of the newly adopted Bird Predation Management plan and other accepted alternative deterrent methods.

5/31/18

DATE



RICHARD A. BALL

Commissioner of Agriculture and Markets

Pursuant to Agriculture & Markets Law §23, I hereby certify that this document, consisting of 26 pages, is a true copy of the original thereof on file with the Department of Agriculture & Markets.

Signature
Title:



Counsel

Date:

5/31/19

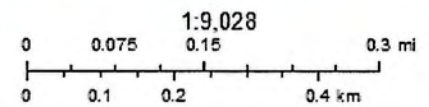
Steven and Victoria Clark Property

Sound Agricultural Practice Opinion

Exhibit 1



☐ Otsego County Parcel Boundaries




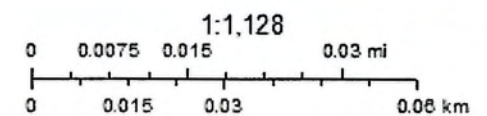
ROBERT C JR SOMERS 28-DEC-2018 @ 12:28:04

Portion of Property Planted to Blueberries

Exhibit 2



 Otsego County Parcel Boundaries



Field Review – Steve Clark indicated that the propane cannon is aligned so that it fires east and west, parallel to the rows of blueberry bushes – image looking west toward Hutchinson Hill Road

Exhibit 3

August 15, 2018



Tree line is the approximate property boundary, looking north.
Mature bushes and housing for Zon Mark 4 Propane Cannon.



Example of a mature blueberry bush – no berries found on the bush or the ground.

Mr. Clark intends to clear the adjacent tree line on his property and the trees within the area planted to blueberries to eliminate roosting areas for birds and to provide additional land to plant another 400 blueberry bushes in 2019.



Irrigation line following rows of blueberries



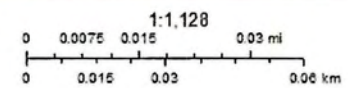
Storage place for zon Mark 4 Propane Cannon when not in use on the farm.



Portion of Property Planted to Blueberries



☐ Otsego County Parcel Boundaries



ROBERT C JR SOMERS 28-DEC-2019 12:34:47

Estimating Sound Levels – Inverse Square Law

The closest distance from the blueberry bushes to the Shem-Tov Residence is approximately 890 feet. Distances to the residence from the blueberry bushes range from 890 feet to 1050 feet. See calculations in Exhibit

Calculated dB

dB at Source – 100 dB	
<u>DISTANCE</u>	<u>CALCULATED dB</u>
889 feet	31.34
1,050 feet	29.90

dB at Source – 125 dB	
<u>DISTANCE</u>	<u>CALCULATED dB</u>
889 feet	56.34
1,050 feet	54.90



"Inverse Square Law – calculations assume exactly equal sound propagation in all directions. This is only an estimate of the sound that would be registered at a distant point in a reasonably open area.

[Index](#)[Auditorium
acoustics](#)

Estimating Sound Levels With the Inverse Square Law

In the real world, the [inverse square law](#) is always an idealization because it assumes exactly equal sound propagation in all directions. If there are reflective surfaces in the sound field, then reflected sounds will add to the directed sound and you will get more sound at a field location than the inverse square law predicts. If there are barriers between the source and the point of measurement, you may get less than the inverse square law predicts. Nevertheless, the inverse square law is the logical first estimate of the sound you would get at a distant point in a reasonably open area.

If you measure a sound level $I_1 = 100$ dB
at distance

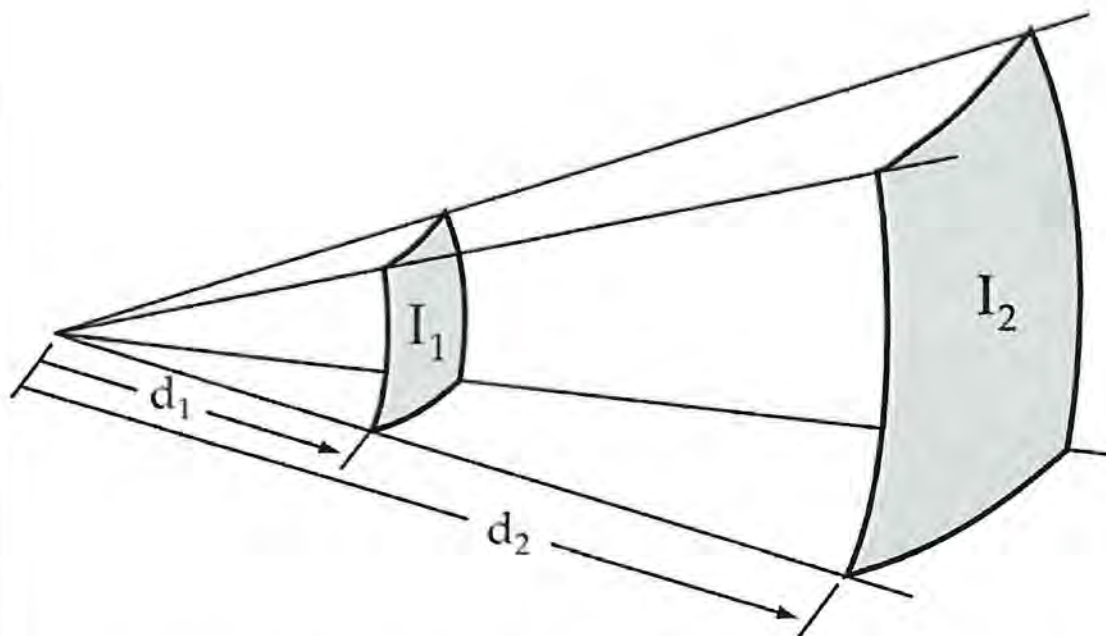
$d_1 = 0.1$ m = 0.32808398 ft

$$\frac{I_2}{I_1} = \left[\frac{d_1}{d_2} \right]^2 \quad \text{then at distance}$$

$d_2 = 271$ m = 889.107611 ft

the inverse square law predicts a sound level

$I_2 = 31.3406141$ dB



You can explore numerically to confirm that doubling the distance drops the intensity by about 6 dB and that 10 times the distance drops the intensity by 20 dB.

[Decibel definition](#) [Decibel calculation](#)

[Calculating dB for distance ratios](#)

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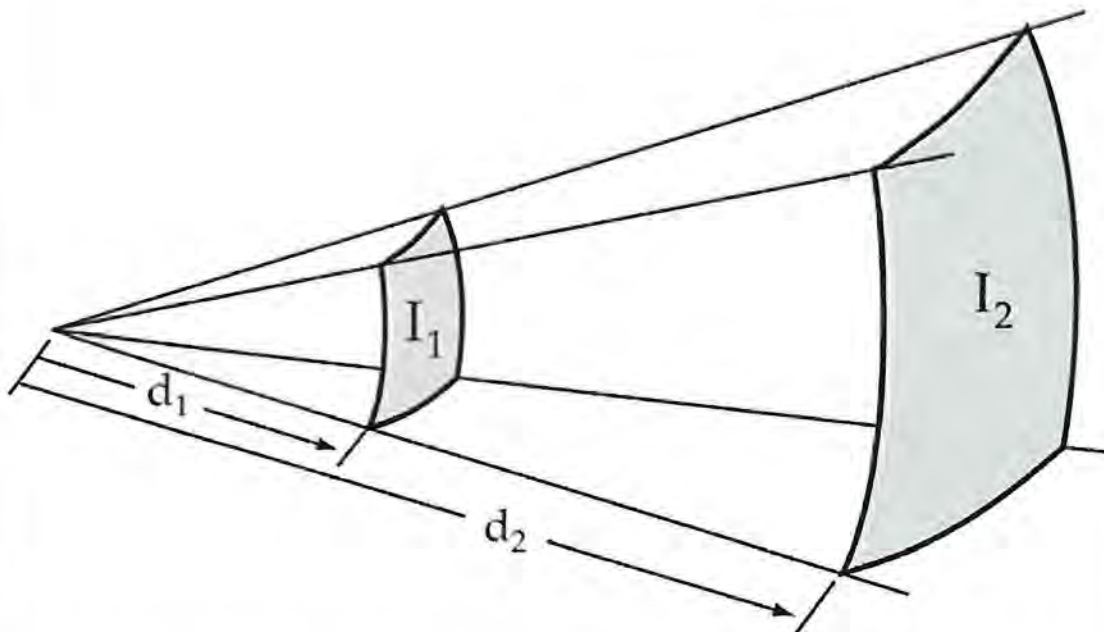
$$\frac{I_2}{I_1} = \left[\frac{d_1}{d_2} \right]^2$$

then at distance

$d_2 = 320$ m = 1049.86876 ft

the inverse square law predicts a sound level

$I_2 = 29.8970004$ dB



You can explore numerically to confirm that doubling the distance drops the intensity by about 6 dB and that 10 times the distance drops the intensity by 20 dB.

[Decibel definition](#) [Decibel calculation](#)

[Calculating dB for distance ratios](#)

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If you measure a sound level $I_1 = 125$ dB
at distance

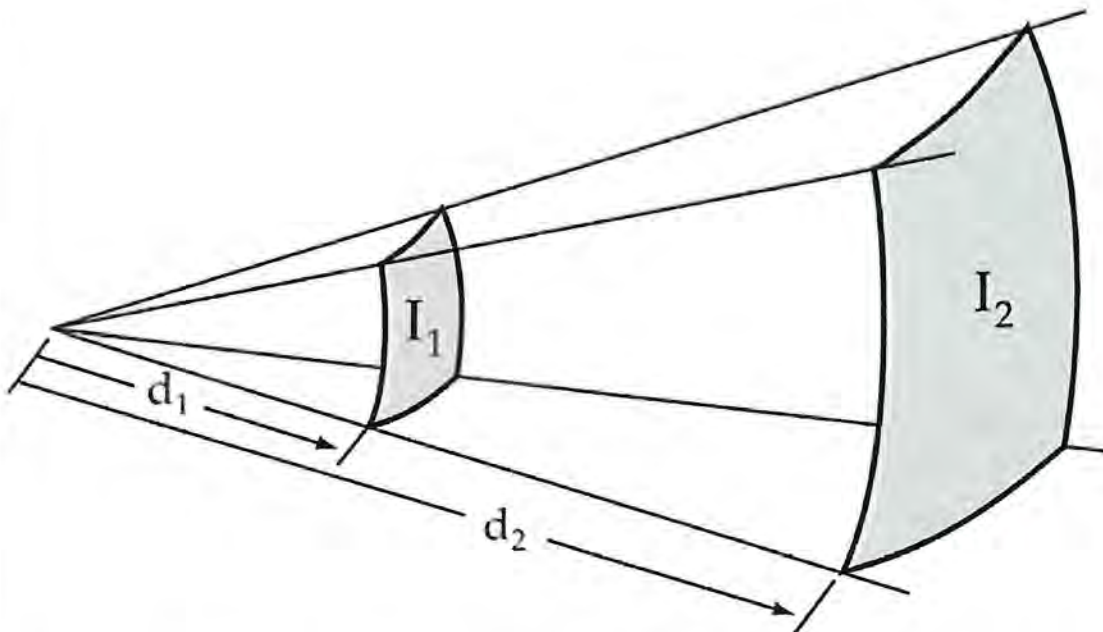
$d_1 = 0.1$ m = 0.32808398 ft

$$\frac{I_2}{I_1} = \left[\frac{d_1}{d_2} \right]^2 \quad \text{then at distance}$$

$d_2 = 271$ m = 889.107611 ft

the inverse square law predicts a sound level

$I_2 = 56.3406141$ dB



You can explore numerically to confirm that doubling the distance drops the intensity by about 6 dB and that 10 times the distance drops the intensity by 20 dB.

[Decibel definition](#) [Decibel calculation](#)

[Calculating dB for distance ratios](#)

Estimating Sound Levels With the Inverse Square Law

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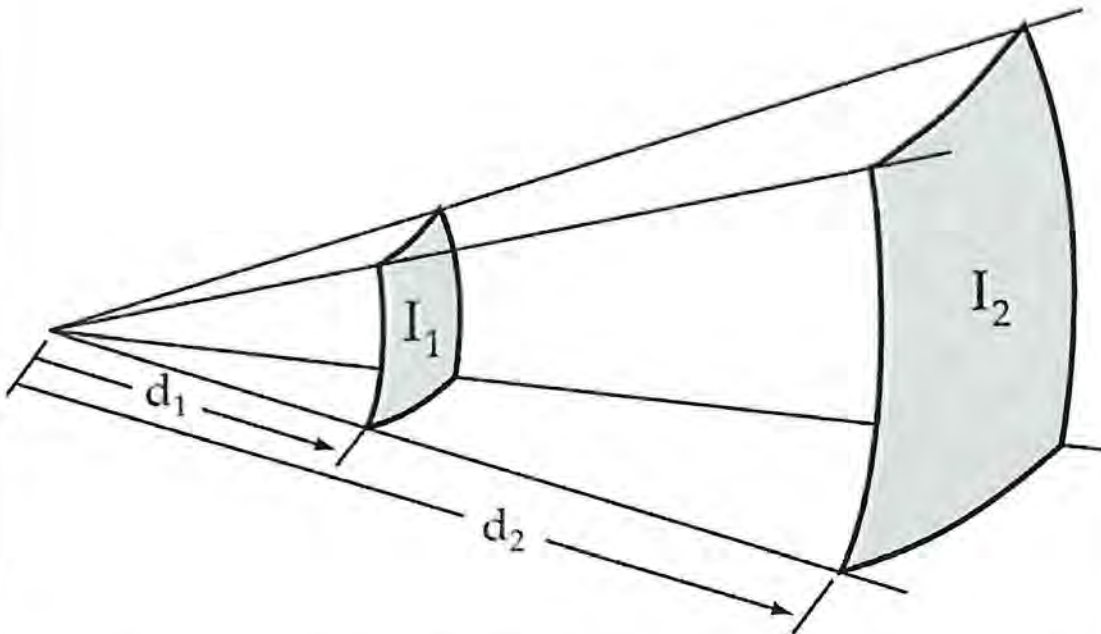
$d_1 = 0.1$ m = 0.32808398 ft

$$\frac{I_2}{I_1} = \left[\frac{d_1}{d_2} \right]^2 \quad \text{then at distance}$$

$d_2 = 320$ m = 1049.86876 ft

the inverse square law predicts a sound level

$I_2 = 54.8970004$ dB



You can explore numerically to confirm that doubling the distance drops the intensity by about 6 dB and that 10 times the distance drops the intensity by 20 dB.

[Decibel definition](#)
[Decibel calculation](#)
[Calculating dB for distance ratios](#)

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Noise Level Chart

Link 401

A noise level chart showing examples of sounds with dB levels ranging from 0 to 180 decibels.

dB(A)	Example	Home & Yard Appliances	Workshop & Construction
0	healthy hearing threshold		
10	a pin dropping		
20	rustling leaves		
30	whisper		
40	babbling brook	computer	
50	light traffic	refrigerator	
60	conversational speech	air conditioner	
70	shower	dishwasher	
75	toilet flushing	vacuum cleaner	
80	alarm clock	garbage disposal	
85	passing diesel truck	snow blower	
90	squeeze toy	lawn mower	arc welder
95	inside subway car	food processor	belt sander
100	motorcycle (riding)		handheld drill
105	sporting event		table saw
110	rock band		jackhammer
115	emergency vehicle siren		riveter
120	thunderclap		oxygen torch
125	balloon popping		
130	peak stadium crowd noise		
135	air raid siren		
140	jet engine at takeoff		
145	firecracker		
150	fighter jet launch		
155	cap gun		
160	shotgun		
165	.357 magnum revolver		
170	safety airbag		
175	howitzer cannon		
180	rocket launch		
...			
194	sound waves become shock waves		

Most noise levels are given in **dB(A)**, which are decibels adjusted to reflect the ear's response to different frequencies of sound. Sudden, brief impulse sounds, like many of those shown at 120 dB or greater, are often given in dB (no adjustment).

Noise Chart

Specifics about the measurement of a particular sound source can be found in the [Noise Navigator® Sound Level Database, E-A-R 88-34/HP, by Elliott H Berger, Rick Neitzel, and Cynthia A Kladden, E•A•RCAL Laboratory, 3M Occupational Health & Environmental Safety Division](#), an extensive compilation of data on noise level measurements, including many of the values appearing on this chart.

Learn more:

[What is a decibel?](#)

[What are the safe noise exposure limits?](#)

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Sarinn Fox
Creator and author of noisehelp.com

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