The Toxicological Impact of the Toll Brothers' Apple Ridge Development to the Saddle River Valley Ecosystem and Its Residents

Erik S. Friis

Abstract

Based on observed rainfall amounts for northern Bergen County[1] we estimate that Toll Brothers (NYSE: TOL), due to a lack of proper erosion controls at their Apple Ridge construction site, is responsible for the release of over 177 million gallons of water containing elevated levels of the toxins, arsenic (As) and lead (Pb), directly into Pleasant Brook in Upper Saddle River (USR), New Jersey. We will demonstrate that in 2018 alone, this runoff contained the equivalent of over 24 pounds of pure arsenic causing extensive and potentially permanent damage to the ecosystems of USR and its neighboring towns.

THE TOXICOLOGY

Arsenic is a known human carcinogen and is ranked by the International Agency for Research on Cancer (IARC) as a Group A1 carcinogen—i.e., it's a confirmed human carcinogen. The carcinogenic role of arsenic compounds was first noted over 100 years ago.[2] In a 1980 review the IARC determined that inorganic arsenic compounds are skin and lung (via inhalation) carcinogens in humans. Repeated arsenic exposure is also linked to heart disease, diabetes and various other forms of cancer.[3] The occurrence of tumors in high numbers after long-term ingestion of arsenic through drinking water in relatively young patients increases the likelihood that many of the documented cancers were induced by arsenic.[4] Arsenic has been considered "the perfect poison" since it is odorless and nearly tasteless with a sugar-like appearance, will cause a slow and painful death, and is hard to detect in the body.[5] Arsenic replaces phosphate in the body and can cause neuromuscular damage, skin diseases, cancer and even death. In the past few decades, new toxicological studies have led to the tightening of screening standards for arsenic, particularly in drinking water.[6]

---

[1] National Weather Service, National Oceanic and Atmospheric Administration (NOAA).

[2] National Research Council (NRC), "Arsenic in Drinking Water", The National Academy of Sciences, Engineering, and Medicine (NASEM), Chapter 4 Health Effects of Arsenic, pg. 83, 1999.

[3] Schick, Tony, and Courtney Flatt, "Contaminated Soil Lingers Where Apples Once Grew", Oregon Public Broadcasting, 2015.

[4] NRC.

[5] Environmental Protection Agency (EPA), The Arsenic Rule: Background and Rule Provisions, 2015.

[6] Pratt, Sara E., "Natural Arsenic Levels in Ohio Soils Exceed Regulatory Standards", Earth Magazine, 2014.

Exposure to lead, especially prenatally and in childhood, can lead to neurological damage. Long-term exposure to lead and arsenic, can lower children's IQs, cause behavioral problems or increase cancer risks later in life. Health officials say no level of lead in a child's blood is safe.[7]

THE HISTORY OF APPLE RIDGE

The project in question is at the the sprawling 110-acre site formerly known as the Apple Ridge Country Club. The name Apple Ridge harkens back to the land's origins at the turn of the 20th century as an apple orchard owned by the Carlough family. The tract of land mostly lies within the borders USR and Mahwah with a smaller portion of land extending into Ramsey. In 2013, this magnificent property was sold by the Carlough family to a developer with the intent of building high-density housing. When the boroughs of USR and Mahwah balked at the idea of allowing high-density housing the property was sold to Toll Brothers for the development of 78 single family homes. There, however, was a big problem.

The soil on which former apple orchards existed around the country are notorious for containing high levels of arsenic and lead—levels well above the maximum contaminant levels (MCL) for soil set by each state. These toxic by-products are leftover from the days before dichloro-diphenyl-trichloroethane (DDT) and before organophosphates, when arsenical pesticides, also known as historically applied pesticides (HAP), in particular lead arsenate (LA), were the preferred treatment in the prevention of insect damage.[8] As former orchard properties are developed for residential use, residual arsenic contamination poses a significant threat to human health.[9]

In New Jersey, for example, where background arsenic concentrations are often high, the criterion for residential soil cleanup is set at 20 mg/Kg (milligrams of arsenic per kilogram of soil) or 20 ppm (parts per million)—more than 50 times the EPA's guidelines for standards of concern beginning at 0.39 ppm[10] [11]. When soil samples were tested for arsenic and lead at hundreds of locations at Apple Ridge in USR and Mahwah, many results revealed arsenic levels many times the MCL. Some may ask why the Carlough family was not responsible for the cleanup of the toxins prior to the sale of this property. The answer rests with New Jersey law: because farmers did not know of the potential toxicity or longevity of the pesticides in use at the time, they are exempted from being held liable for contamination from legally applied pesticides.[12]

Compounding the situation was the site's subsequent history as a golf course for approximately 50 years starting in the mid-1960s. The United States Golf Association (USGA) website states that after several years of environmental research; turf-grass soils tend to accumulate phosphorous fertilizer. Adding phosphorus to soil containing arsenic mobilizes the

---

[7] Hood, Ernie, "The Apple Bites Back", Environmental Health Perspectives, Volume 144, Number 8, August 2006.

[8] Hood.

[9] Cabibbo, et al., Soil Horizons, Vol. 55, No. 6, 2014

[10] Hood.

[11] Pratt.

[12] Schick.

arsenic. “That creates an even bigger problem,” says Washington State University soil scientist Frank Peryea. “If you get the arsenic moving, it moves down into the ground-water.” Golf course managers recognize the importance of keeping fertilizer nutrients on the golf course and preventing offsite movement into surface waters such as streams, reservoirs, and lakes.[13] Arsenic is somewhat more mobile than lead. In some cases the mobility of arsenic may be significantly increased by the application of phosphate-rich fertilizers.[14]

Lead Arsenate (LA) whose chemical symbol is PbHAsO4 was introduced in 1892. Each LA molecule contains both the elements lead and arsenic. Even though arsenic residue was recognized as a problem as early as 1919, LA was the most widely used pesticide in the nation —recommended by the USDA and applied to millions of acres of crops—until the late 1940s, when DDT—considered at the time to be safer and more effective became available. LA continued to be used in some locations into the 1970s, but was ultimately banned in 1988.[15] DDT was banned in 1972 because of its harm to human health and the environment.[16] [17]

Today, apple orchard properties that were in production during the heyday of LA use are the focal point of environmental concerns and in general before anything can be built on them the soil minimally requires remediation for lead and arsenic.

LA and the other arsenical pesticides were designed to be persistent, and it is that persistence that is causing environmental contamination problems decades after their use ended. “These chemicals have just tremendously long half-lives in the ground,” says North Carolina state toxicologist Ken Rudo. “They bind very tightly to the soil.” Once LA reached the soil through over-spray, spillage, rainfall wash-off, or simply fallen fruit and leaves, the lead arsenate separated into lead and arsenic and bound to organic particles in the soil. The arsenic can be mobilized and removed by surface runoff.[18]

THE RISKS OF REMEDIATION

Carl Renshaw, a hydrogeologist at Dartmouth College, published a study in the January/ February 2006 issue of the Journal of Environmental Quality showing that arsenate in the soil can be remobilized by being disturbed. Renshaw found arsenic in the sediment of a nearby stream in amounts that very closely matched the arsenic missing from the tilled field. “The implication from our study,” says Renshaw, “is that if you’re not really careful about erosion, you’re going to end up sending a lot of arsenic down into the stream channel.”[19]

---

[13] “Prevent Phosphorus from Leaving the Golf Course”, US Golf Association (USGA), 2015.

[14] Renshaw, Carl, et al., “Impact of Land Disturbance on the Fate of Arsenical Pesticides”, Journal of Environmental Quality, Vol. 35 No. 1, 2006.

[15] Hood.

[16] Schick.

[17] “DDT - A Brief History and Status”, United States Environmental Protection Agency (EPA)

[18] Hood.

[19] Hood.

Low risk is not the same as no risk, and regulatory agencies across the country are finding themselves in a thorny situation as more and more contaminated historic orchard properties are developed.[20]

There are essentially three ways to remediate toxic soil.

- Excavation
- Capping
- Blending

Excavation is the quickest and most thorough remediation method. This involves scraping up the contaminated topsoil, hauling it away to an approved landfill, and replacing it with clean soil. While excavation is the only way to truly eliminate risk, it's very expensive. Such total remediation can cost up to one million dollars or more per acre.

Capping, which involves simply putting a 12- to 18-inch layer of clean soil over the contaminated soil, has been used in some locations. This too can be costly and requires enormous amounts of clean soil to be effective. Furthermore, capping cannot be considered a permanent solution.

Soil blending is another alternative. This involves bringing clean soil to a site and mixing it with the existing contaminated topsoil, with the intent of reducing overall concentrations below levels that require health-protective actions; however, blending can be a hit-or-miss operation. The main reason is that operators cannot always achieve 100% blending, and it very much matters where the subsequent samples are taken—even a few inches between test-samples can produce dramatically different results.[21] Also, disturbing the soil as required by the blending process could actually mobilize the arsenic, as Renshaw's research showed: our results suggest that as this land is developed, attention should be given to the possibility of mobilizing previously immobile reservoirs of lead and arsenic.[22]

Over the objections by the citizens of Upper Saddle River who favored remediation by excavation to replace the toxic soil at Apple Ridge, Ken Paul of Ecol Sciences, the Licensed Site Remediation Professional (LSRP) hired by Toll Brothers, devised a Remediation Action Workplan (RAW) that relied on soil blending to affect the remediation. Instead of bringing in clean soil to blend with the contaminated soil in order to reduce the concentrations of toxins below their MCLs, Paul's plan relied on blending the contaminated soil with the clean soil in the strata below. This RAW was approved by Kevin Boswell, Vice President of Boswell Engineering—the engineering firm retained by both Upper Saddle River and Mahwah. According to Boswell's original plan, the 110 acres would be remediated in alternating parcels, much like a checkerboard, so that post-remediation soil samples could be tested to ensure proper remediation of the soil to below the MCL of 20 mg/Kg. Additionally this staged remediation would have minimized the contaminated stormwater runoff and allow the planting of grass in order to stabilize each section against further erosion as subsequent sections were addressed.

---

[20] Hood.

[21] Hood.

[22] Renshaw.

Despite the fact that blending was chosen as the remediation method over the preferred method of excavation, the plan sounded reasonable in terms of its erosion controls; however, everything changed in the late Spring of 2017.

The New Jersey Department of Environmental Protection's (NJ DEP) Division of Fish and Wildlife informed the LSRP and Boswell Engineering that the Apple Ridge property was bound by the new bat conservation initiative which takes place in the summer months when all nine bat species are active across the landscape. Given particular attention was the Northern long-eared bat (Myotis septentrionalis) that gained Federal protection as a "threatened species" in 2015. The Northern long-eared bats fly amongst the clutter of tree branches and forage over small stream corridors rather than out in the open. The thousands of trees and stream corridor of Pleasant Brook which bisects Apple Ridge is their habitat. This meant that the removal of these trees during the summer months for the staged remediation was forbidden.

Rather than simply delaying the remediation during the summer months in order to ensure the safety of this threatened species, an ill-advised decision was made in the Spring to clearcut all 110-acres of trees in one-fell-swoop. In a private conversation with Boswell he lamented his actions by stating "I suppose I could have prevented that." When pressed to reveal who had pushed for that decision he replied "I would rather not say."[23] In addition to the removal of all of the trees from the site, all of the turf which ultimately helped stabilize the site against rampant erosion was also removed. Exacerbating the problem, virtually no erosion controls were put in place during this timeframe such as the construction of sufficient retention basins, berms, and the erection of adequate silt fencing etc. to prevent the toxic runoff from flowing into the streets and directly into the stormwater basins.

UNCONTROLLED EROSION AND RUNOFF

As of December 2017 erosion controls were still not adequate and several major rain events caused massive flooding of toxic turbid runoff into the streets only to drain into our stormwater basins that flow directly into our streams. The turbidity was caused by the colloidal suspension of super-fine dirt particles from the site.

To make matters worse, a major wind storm occurred in January 2018 which coated the houses adjacent to the Apple Ridge tract and their snow covered front lawns with a film of fine brown silt from the exposed strata. Though this film was never tested for toxins it most likely contained the same levels of arsenic and lead as the site itself. While these homeowners were naturally quite concerned by this contamination, it is highly probable that these airborne toxins were carried much further than these properties in lesser quantities, unbeknownst to many.

This airborne event (and others like it) while the site remained un-stabilized are particularly troubling because as Howard Mielke, a leading researcher on lead exposure, points out: exposure from soil can happen through either direct or incidental ingestion or through inhalation of soil turned to dust. A growing body of research across the country points to soil as a prominent cause of lead exposure for children, with some studies concluding it's a more likely source of exposure than lead paint from old homes.[24]

The original plan for a staged remediation which should have required up to two years or more to be properly completed was rushed and completed in just over six months and according to

---

[23] Boswell, Kevin, private conversation, July 2018.

[24] Schick.

a letter from Boswell Engineering, a Response Action Outcome (RAO) was issued by the LSPR Paul on January 30, 2018 stating that all remediation was complete as of December 22, 2017. According to the RAO, the site was now suitable for unrestricted use.

A letter from Boswell Engineering further states:

"Our office independently confirmed [that] the work was performed to the satisfaction of the NJ DEP who advised [that] the site, from a regulatory perspective, should no longer be considered contaminated and [that] any continuing concerns on the property were of a Land Use nature.

Our office has continued to consult with both the project LSRP and the NJ DEP anytime new information was received which may change this position. On each occasion the NJ DEP has issued written confirmation [that] there were no new environmental concerns warranting further study."[25]

But was the remediation of the soil properly completed? Tests of the post-remediated soil samples seem to indicate yes; however, since blending is not a perfectly homogenous process and even a few inch offset in where soil samples are taken can make a difference the answer is we don't really know that it was. A former Toll Brother's subcontractor who operated heavy machinery used in the blending has informed us that large swaths of the Apple Ridge tract were not properly blended when operators encountered clay that did not blend well. This subcontractor was terminated after he complained to his superiors about not being supplied with adequate protection from airborne particles.

Although it is an established fact that stormwater-management practices are designed to mitigate the effects of runoff containing undesirable levels of constituents (arsenic, lead, metals, and other contaminants) on the quality of stream-water, Toll Brothers—under the supervision of Boswell Engineering—implemented only minimal erosion controls. In fact for erosion management practices to be effective, measurement of the constituents that are present in the runoff, particularly in areas where structures such as storm drains and detention basins have been installed to direct, contain, or sequester contaminants, is needed. No tests of the constituents present in the runoff were performed.

As Spring approached, rains continued to be heavy and flooding occurred on a regular basis. It was clear that the erosion controls implemented by Toll Brothers and overseen by Boswell Engineering were insufficient as rivers of turbid runoff continued to drain into the streets. After a sustained public outcry and a plethora of phone calls to the NJ DEP's Emergency Hotline, Boswell Engineering was forced to issue a Stop-Work Order (SWO) for the Upper Saddle River Side on the project. The majority of the 110 acres was still barren of grass to impede the continual erosion.

In order to stem the tide on the rivers of turbid runoff flowing into the streets during even ordinary rain events, Toll Brothers embarked on a plan to excavate a series of runoff retention basins. It is now clear that Boswell Engineering should have insisted on the construction of these basins up front as a proactive and preventative step in controlling the runoff and erosion. Sadly, nearly every runoff and erosion control measure put in place by Toll Brothers has been reactive as opposed to proactive. This *modus operandi* by Toll Brothers and its total disregard for the environment has been borne-out by its settlement with the U.S. Environmental Protection Agency (EPA) and the U.S. Department of Justice (DOJ) for Clean Water Act

---

[25] Boswell, Kevin, Letter to USR Mayor Minichetti and Council, October 17, 2018.

violations at 370 of its construction sites in 23 states[26]. The penultimate number of violations were in New Jersey (43), exceeded only by Pennsylvania (55), the state in which Toll Brothers is headquartered.

It is not surprising to find that the EPA violations were stated as follows.

Failure to comply with the conditions of permits issued pursuant to CWA Section 402, U.S.C. § 1342, resulting in the discharge of pollutants in stormwater from construction sites, which is a violation of CWA Section 301. Permit violations include the failure to stabilize disturbed soil and properly install and/or maintain stormwater controls such as silt fences, swales, sediment basins, sediment traps, storm drain inlet protection, and construction entrances and exits.

As has been typical with this Toll Brothers project from the beginning, the retention basins to hold the runoff were not big enough and started to overflow causing turbid runoff to again pour into the streets and storm drains surrounding the construction site. The agency in charge of helping monitor and control erosion on such projects is the Bergen Country Soil Conservation District (BCSCD) headed by Angelo Caruso. He has admitted that the erosion controls put in place by Toll Brothers were insufficient, but instead of shutting down the project to conduct a thorough assessment of the failure while determining a proper solution, he replied that "Toll Brothers is doing it's best to get the runoff under control." Standard practice for the BCSCD according to Caruso is to allow a contractor to pump runoff from overflowing retention basins into a nearby stream for disposal—in the case Pleasant Brook. When it was pointed out that the Apple Ridge strata, though remediated, still contain arsenic, albeit at diluted levels at or below 20 mg/Kg, his response was simply that the BCSCD does not have jurisdiction over contaminants and that that responsibility to stop a contractor from pumping contaminated water into waterways lies with the NJ DEP.

Although flocculant was added to the retention basins to help reduce the turbidity of the runoff they contained, the pumping of turbid runoff continued throughout the Spring and Summer of 2018. The runoff was filtered through bales of hay and sediment bags in order to attempt to prevent rough sediment from entering the brook. These devices however are invisible to arsenic and lead and did little to stem the tide of the fine silt from the site. During this timeframe residents of Upper Saddle River and Saddle River noticed that on clear sunny days Pleasant Brook would often run brown not unlike the color of chocolate-milk. On at least two occasions the stream ran a surrealistic fluorescent emerald-green from unknown chemicals that were used on site.

These occurrences were reported to local police as well as the NJ DEP. The NJ DEP's response was baffling as well as ironic. Instead of finding fault with the pumping of massive amounts of runoff known to contain arsenic directly into a brook, they replied:

Blending of Historically Applied Pesticides (HAP) contaminated soil at former agricultural properties, as well as former golf courses, has been and will continue to be, an appropriate remedy as outlined in the Historically Applied Pesticide Site Technical Guidance document. Over 1,100 environmental samples were collected at the site in accordance with DEP guidance and, based on the results, an entire site Response Action Outcome (RAO) was issued on

---

[26] Toll Brothers - Inc. Clean Water Act Settlement, United States Environmental Protection Agency, Washington, DC, June 2012. Affected states and sites include AZ (15), CA (26), CO (7), CT (13), DE (9), FL (37), GA (1), IL (9), MA (10), MD (22), MI (13), MN (3), NC (11), NJ (43), NY (18), NV (21), OH (1), PA (55), RI (4), SC (2), TX (32), VA (17), WV (1).

January 18, 2018. As such, the remediation associated with the Apple Ridge Golf Course was considered complete.

The second part of their response by telephone stated that the BCSCD is in charge of erosion and since the NJ DEP no longer considers this to be a contaminated site (due to the theoretically completed remediation), the BCSCD has sole jurisdiction over whether runoff can be pumped into Pleasant Brook.

Since lead arsenate sprays were widely used in apple orchards for more than a century and they represent the largest single anthropogenic input of arsenic into the environment, what happened to the high levels of arsenic that were revealed when the soil was initially tested?

In actuality, all of the original arsenic is still there in the same quantity, but in a theoretically diluted state somewhere at or below the 20 mg/Kg MCL. The problem is that the MCL for drinking water in New Jersey is 5 µg/L or 5 parts per billion (ppb). Remediated soil in New Jersey can contain up to 4000 times the maximum level of arsenic that's allowed in drinking water by law—that's a difference of more than three orders of magnitude.

Our concern has been that any runoff—even from this remediated site—that enters our waterways may contain levels of arsenic than are much higher than that which is allowed in drinking water. While it is generally understood that people do not regularly ingest water directly from Pleasant Brook, it can happen both directly and indirectly. Our children and pets bathe in it, adults wade in it, and most of the homes in Upper Saddle River, as well as those along Pleasant Brook use well-water as their potable sources of water. Additionally, as Pleasant Brook enters the larger Saddle River tributary where water is pumped by various boroughs and used as drinking water; this water will inevitably find its way into our aquifers. Common sense would dictate that it would be illegal to pump any water containing arsenical levels greater than the MCL for drinking water into any waterway. Why then would it be acceptable or knowingly allowed for contaminated water to flow freely into our storm drains and streams?

PUTTING OUR THESIS TO THE TEST

With this in mind, a group of concerned local citizens set out to obtain three grab-samples of water containing runoff in order to send them to an accredited lab, Alpha Analytical (lab number L1839803) in Westborough, MA for arsenical testing.

Using sample collection instructions and sterilized containers provided by Alpha Analytical, three grab-samples were carefully obtained on September 30, 2018, one day after a rain event at three location on and near the Apple Ridge property. Alpha Analytical received the samples on October 3, 2018.

The first location where a sample was obtained was from a corrugated discharge pipe emanating from the base of the site's largest retention basin, where the turbid runoff flowed directly into the Pleasant Brook after traveling approximately 10 yards. This location is known as Site A (Alpha Sample ID L1839803-01).

The second sample location was from the water in a retention basin on the Apple Ridge property itself which directly fed the corrugated pipe mentioned above. This location is known as site B (Alpha Sample ID L1839803-02).

The third and final sample was taken from Pleasant Brook itself approximately 20 yards upstream from where the water from the corrugated discharge pipe enters Pleasant Brook.

While this sample did not appear to contain direct discharge from the waters sampled at sites A and B, the stream water was turbid from Apple Ridge runoff further upstream. This location is known as site C (Alpha Sample ID L1839803-03).

Bearing out our thesis the sample from Site A tested for arsenic at 16.27 µg/L. Showing expected consistency, the sample from Site B tested at 16.66 µg/L. And the diluted sample obtained 20 yards upstream from where the runoff entered Pleasant Brook tested at 7.272 µg/L. In summary the samples ranged from 145% to 333% of the MCL for drinking water. These results were immediately made available to Boswell Engineering.

On October 16, 2018, approximately six days after any pumping of the retention basins (or gravity fed runoff) into Pleasant Brook had terminated, Boswell Engineering took five surface water samples from Pleasant Brook and the Saddle River.

The locations where these samples were collected are as follows:

1. Northern property boundary of Apple Ridge tract on Pleasant Brook (upstream background sample).
2. Pleasant Brook at Meadowbrook Road (immediately downstream of Apple Ridge tract)
3. Pleasant Brook at Lake Street (0.8 mile downstream from Apple Ridge tract)
4. Saddle River at Lake Street (background sample)
5. Saddle River below confluence with Pleasant Brook (1.6 miles downstream of Apple Ridge tract)

These samples were also sent to Alpha Analytical for arsenical testing. These unfiltered samples tested for arsenic at 0.59 µg/L, 2.18 µg/L, 0.86 µg/L, 0.59 µg/L, and 0.58 µg/L. Boswell Engineering concludes that these water samples meet both the federal (MCL of 10 µg/L) and state drinking water standards (5 µg/L).[27]

Our concern with these data are that they are all background samples as any flow of turbid runoff from the Apple Ridge site had been terminated six days prior to these samples being collected. Thus, these sample results provide little direct information regarding the arsenic contribution to Pleasant Brook from Apple Ridge after rain events.

Boswell Engineering further contends that all of these samples contain levels of arsenic well below the EPA's Aquatic Chronic Standard for Fresh Water[28] of 150 µg/L. This standard, however, is for aquatic life not humans and represents the highest concentration of arsenic in water that is not expected to pose significant risk to the majority of species in a given environment. In the EPA's National Recommended Water Quality Criteria there exists an aquatic life and human health criteria. The human standard defined by the EPA is called the Surface Water Quality Standard (SWQS)[29] and is set at 0.017 µg/L. The EPA states that this criteria represents the specific level of arsenic in a water body that is not expected cause adverse effects to human health. This human health criteria was developed by the EPA under Section 304(a) of the Clean Water Act.

---

[27] N.B. that the sample obtained closest to the Apple Ridge construction site even after pumping of turbid runoff into Pleasant Brook had been terminated for six days is significantly higher than the other samples taken upstream and further away.

[28] "National Recommended Water Quality Criteria - Aquatic Life Criteria Table", United States Environmental Protection Agency (EPA).

[29] "National Recommended Water Quality Criteria - Human Health Criteria Table", United States Environmental Protection Agency (EPA).

Julia L. Barringer cites the SWQS when discussing the arsenic contamination of the waters of Raccoon Creek in southern New Jersey by runoff from detention basins:

The waters of Raccoon Creek commonly exceed the State's Surface Water Quality Standard for freshwater of 0.017 micrograms per liter (µg/L). In order to assess contributions of arsenic from residential runoff to the creek, samples of runoff water were collected from a detention basin in each of two residential developments underlain by different geologic formations and at the outlets of those basins[30].

The Barringer paper also discusses the importance of collecting samples for arsenical testing at the detention basins and their outlets in direct contradiction to a statement made by Mike Kelly of Boswell Engineering at a Mahwah Council meeting in November 2018 that there was no benefit in performing arsenical testing on samples taken from the detention basins at Apple Ridge.

SUMMARY

So how much arsenic has been introduced into Pleasant Brook by runoff from the Toll Brothers' Apple Ridge construction site? Additionally, what are the medium and long-term effects of allowing these toxins to enter Pleasant Brook? And finally, who knew, or should have known, about these problems, and what are the proposed remedies to the affected townships and residents?

We do know that the Apple Ridge tract encompasses approximately 110 acres or approximately 445,154 square meters. We also know that in 2018, Upper Saddle River and Mahwah received approximately 66 inches or 1.676 meters of rain which equates to 746,078 cubic meters of water runoff. Assuming a 10% evaporation rate, we arrive at a nominal figure of 671,470 cubic meters of runoff. One cubic meter equates to 1000 liters and with 671,470,000 liters of runoff containing approximately 16.6 µg/L of arsenic the total yield in arsenic is 11,079 grams or approximately 11 Kg (24.25 pounds) of arsenic that has entered Pleasant Brook in just 2018 alone due to inferior and woefully inadequate erosion controls put in place at this Toll Brothers construction site.

Lastly, this runoff of approximately 14.7 million gallons per month also contains other heavy metals such as lead, dangerous elements such as nitrogen and phosphorous, and chemicals like DDT that haven't even been tested for. In all, we are witnessing the destruction of an invaluable and irreplaceable ecosystem.

ACKNOWLEDGMENT

I would like to gratefully acknowledge the invaluable contributions and edits made to this paper by Frank T. Pallotta.

[30] Barringer, Julia L., et al., "Arsenic, Metals, and Nutrients in Runoff from Two Detention Basins to Raccoon Creek, New Jersey Coastal Plain", 2008