GLENROSE ENGINEERING

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May 5, 2020

Texas Commission on Environmental Quality
Office of the Chief Clerk
MC-105
P.O. Box 13087
Austin, Texas 78711-3087

Subject: Proposed Silesia Properties, L.P. Permit No. WQ0015835001
Dear Chief Clerk:

I am submitting these comments on behalf of the Greater Edwards Aquifer Alliance regarding the Texas Land Application Permit (WQ0015835001) proposed for Silesia Properties, LP. The propose permit would authorize wastewater treatment and subsurface drip dispersal system disposal for 0.365 million gallons per day into the Honey Creek watershed upstream of the Honey Creek State Natural Area.

My comments are based on information provided by the applicant and on the draft wastewater permit as revised, February 3, 2020. My opinions are also founded upon my education, experience and engineering expertise in water resources, surface and groundwater hydrology, pollutant fate and transport, as demonstrated in my resume in Attachment 1.

I have been an engineer and resident of the Texas Hill Country for more than thirty years and have studied the natural character, flow, and channel conditions associated with Hill Country streams. I have also witnessed degradation of streams, pools, and springs from wastewater effluent and nutrient loads based on visual observation and on laboratory analysis of water samples I have collected.

The proposed draft permit terms and conditions fail to adequately protect downstream surface water, including Honey Creek and the Guadalupe River, the Honey Creek State Natural Area, the Trinity Aquifer and the Southern Segment of the Edwards Aquifer. Effluent limits, treatment, storage, and disposal area requirements

in the proposed permit are inconsistent and will not achieve either the proposed permit standards or Clean Water Act standards to protect downstream water.

The following paragraphs describe the sensitive hydrologic setting of the proposed sewage effluent land disposal as well as specific ways in which permit terms fail to achieve adequate water quality protection:

- Proposed effluent limits are too high to protect downstream surface water and aquifer quality. They fail to include all wastewater effluent chemicals that would degrade downstream water and aquifers.
- The proposed effluent disposal area and storage volume are both too small to prevent system overflows and irrigation during saturated soil conditions, even though such irrigation is prohibited in the permit.
- The proposed 84-acre disposal area is only large enough to accommodate about 150,000 gallons per day of effluent. Even with this smaller daily effluent volume, storage would need to be increased to 8.5 million gallons to prevent irrigation on saturated soils.
- Proposed soil, seep, and spring monitoring provisions are inadequate to protect the Honey Creek tributary.
- Setbacks from karst features are too small to prevent water and undesirable chemicals from migrating into them.
- The proposed chlorine disinfection is inappropriate. It will destroy soil health and bacteria necessary to process land disposed effluent.
- The Class C operator requirement does not provide the treatment and disposal operation oversight necessary to protect water quality and the associated aquifers.
- The proposal to seed sewage effluent disposal areas with invasive Bermuda grass is inappropriate for this environmentally sensitive location.
- The applicant proposes to supplement sewage effluent disposal authorized by this permit with reuse under the requirements of Chapter 210. Chapter 210

requirements for treatment and disposal areas, however, will not adequately protect sensitive environmental resources in the vicinity of and downstream from the proposed Honey Creek Ranch development.

- The draft permit does not address or protect mapped wetland areas on Honey Creek Ranch, including three adjacent to, with, or downstream from proposed effluent disposal areas.
- Additional public oversight and expanded availability of information is necessary to assure permit compliance and environmental protection.

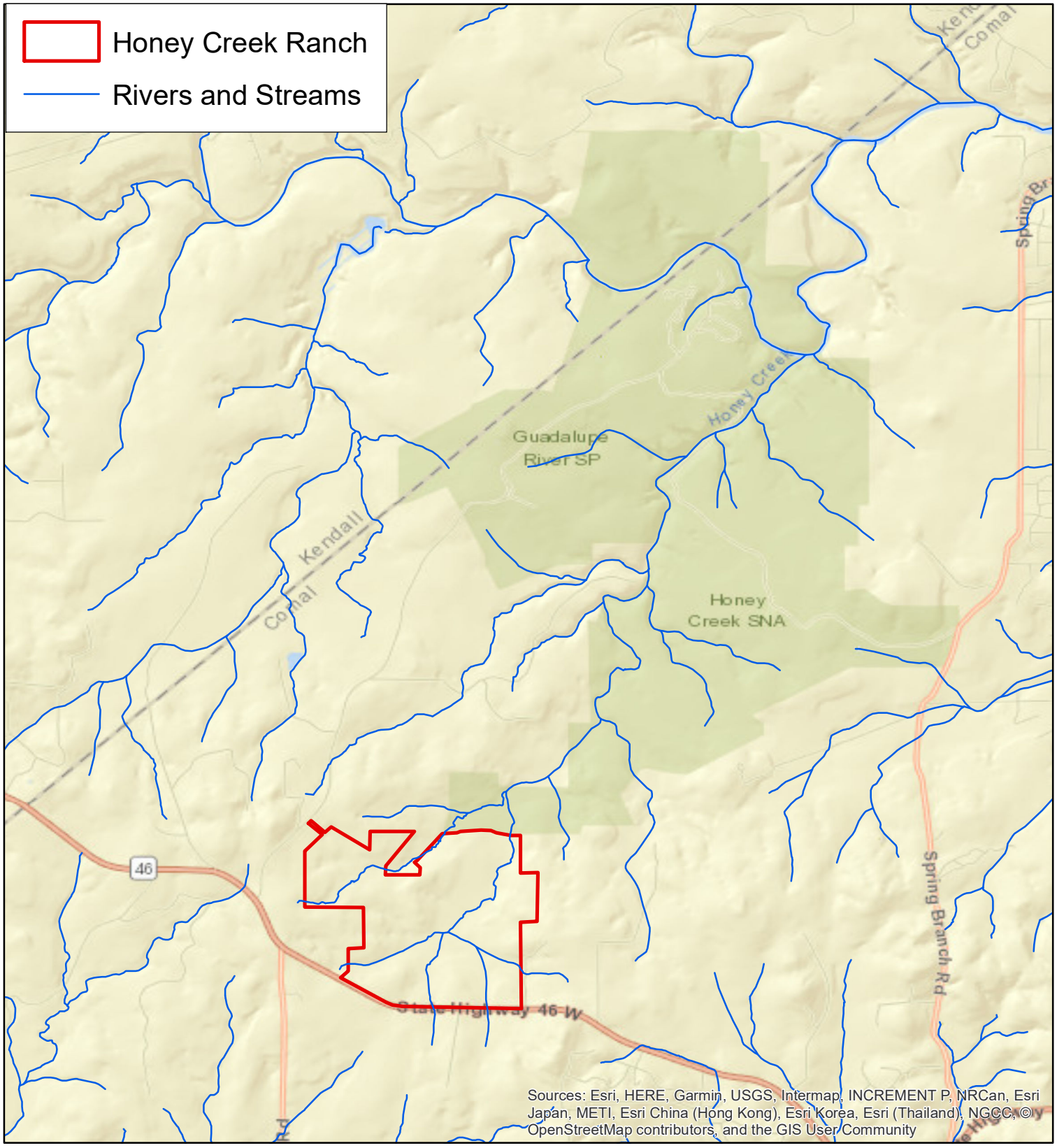
Surface Water Setting

The proposed wastewater treatment and effluent disposal would occur within the watershed of a tributary to Honey Creek. The proposed location would be upstream of the Honey Creek State Natural Area and Guadalupe River State Park, as shown on Figure 1.

The U.S. Geological Survey conducted a study of the impact of wastewater on these sensitive Hill Country streams including streams and rivers near the proposed sewage effluent treatment and disposal operations.[1] The results of the study demonstrated that Texas Hill Country streams and rivers not affected by sewage effluent naturally exhibit very low nutrient concentrations.

Streams with low nutrient concentrations like those observed in the Texas hill country are described as oligotrophic. Oligotrophic conditions create the remarkably

[1] Mabe, Jeffrey A., 2007, Nutrient and Biological Conditions of Selected Small Streams in the Edwards Plateau, Central Texas, 2005–06, and Implications for Development of Nutrient Criteria: Scientific Investigations Report 2007–5195: U.S. Geological Survey.



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N W E S

0 0.5 1 2 Miles

Figure 1. Proposed Honey Creek Ranch

clear water and visible limestone bottoms present and valued throughout the Texas Hill Country. They also create habitat for endemic aquatic life found nowhere else.

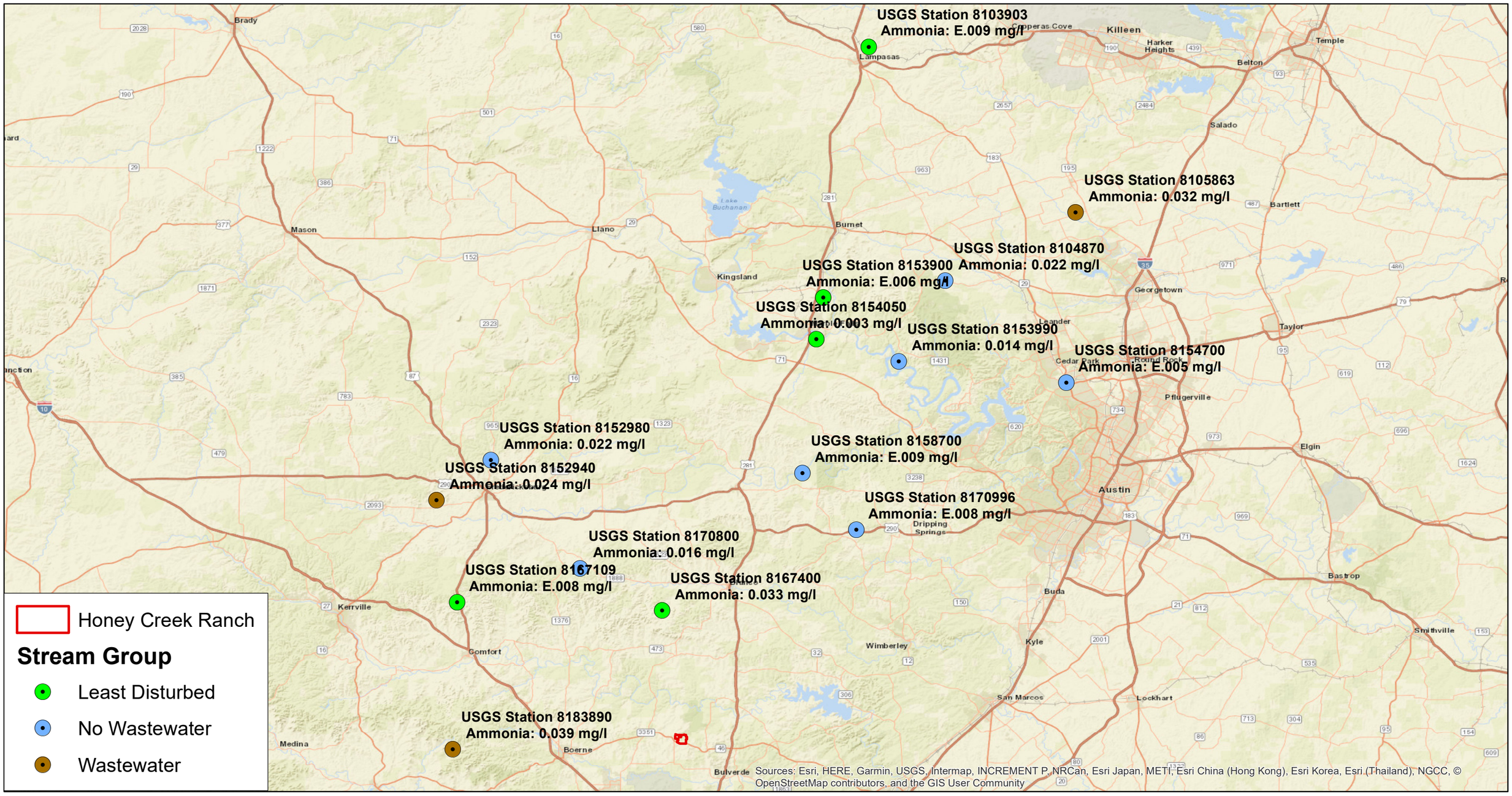
Streams in the U.S. Geological Survey study were characterized as belonging to one of three groups: least disturbed, not impacted by wastewater, or impacted by wastewater. Samples from each stream were collected and analyzed for several characteristics, including nutrient concentrations. The results of these analyses for samples collected in 2005 are mapped on Figure 2 (ammonia-nitrogen), Figure 3 (total nitrogen), and Figure 4 (total phosphorus). These nutrients, key to determining stream quality, are either much lower in natural streams than in the proposed permit (ammonia-nitrogen) or else the proposed draft permit proposes no effluent nutrient limit (total nitrogen and phosphorus).

Groundwater Setting

Surficial geology at the proposed sewage treatment and disposal areas is mapped as the Lower Glen Rose Formation. See Figure 5. This Cretaceous period formation consists of limestone, dolomite, and marl as alternating resistant and recessive beds forming the widely expressed stairstep topography of Central Texas.

The Texas Water Development Board maps the location of Honey Creek Ranch and the proposed sewage disposal fields as the outcrop of the Trinity Aquifer. This outcrop area is a source of aquifer recharge.

In addition to the Trinity Aquifer, the proposed sewage treatment and land disposal area also contributes recharge to the Southern Edwards Aquifer. It is mapped by the Texas Commission on Environmental Quality as within the Edwards Aquifer Contributing Zone. See Figure 6. Recharge would be transmitted from the site to the Edwards Aquifer through Honey Creek flows into the Guadalupe River as well as through subsurface Trinity Aquifer contributions.



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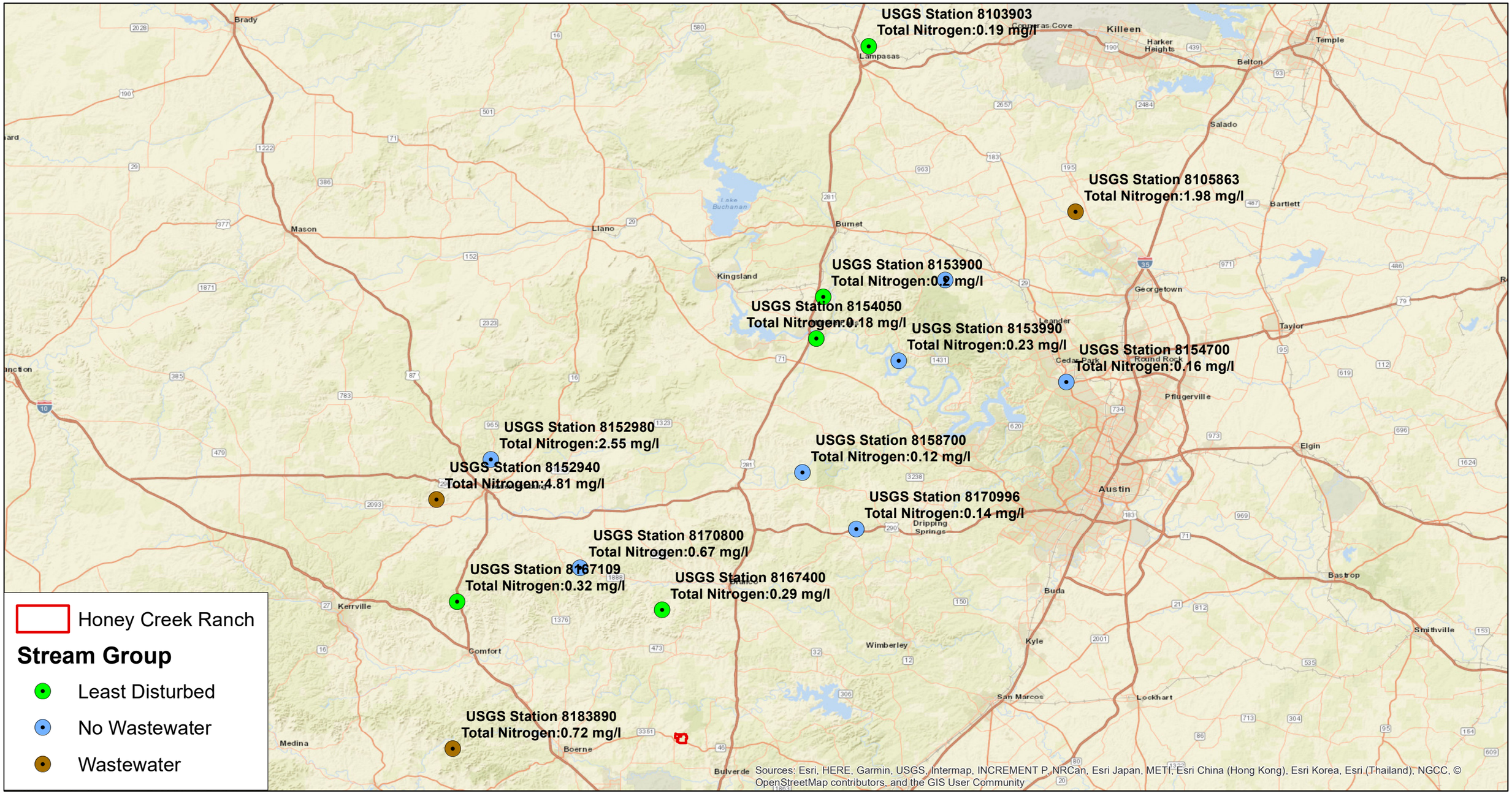
Ammonia concentrations in 2005 from USGS report by Mabe (2007), Table 3.
"E" values are estimated.

0 10 20 40 Miles

Figure 2. Ammonia Concentrations in Texas Hill Country Streams



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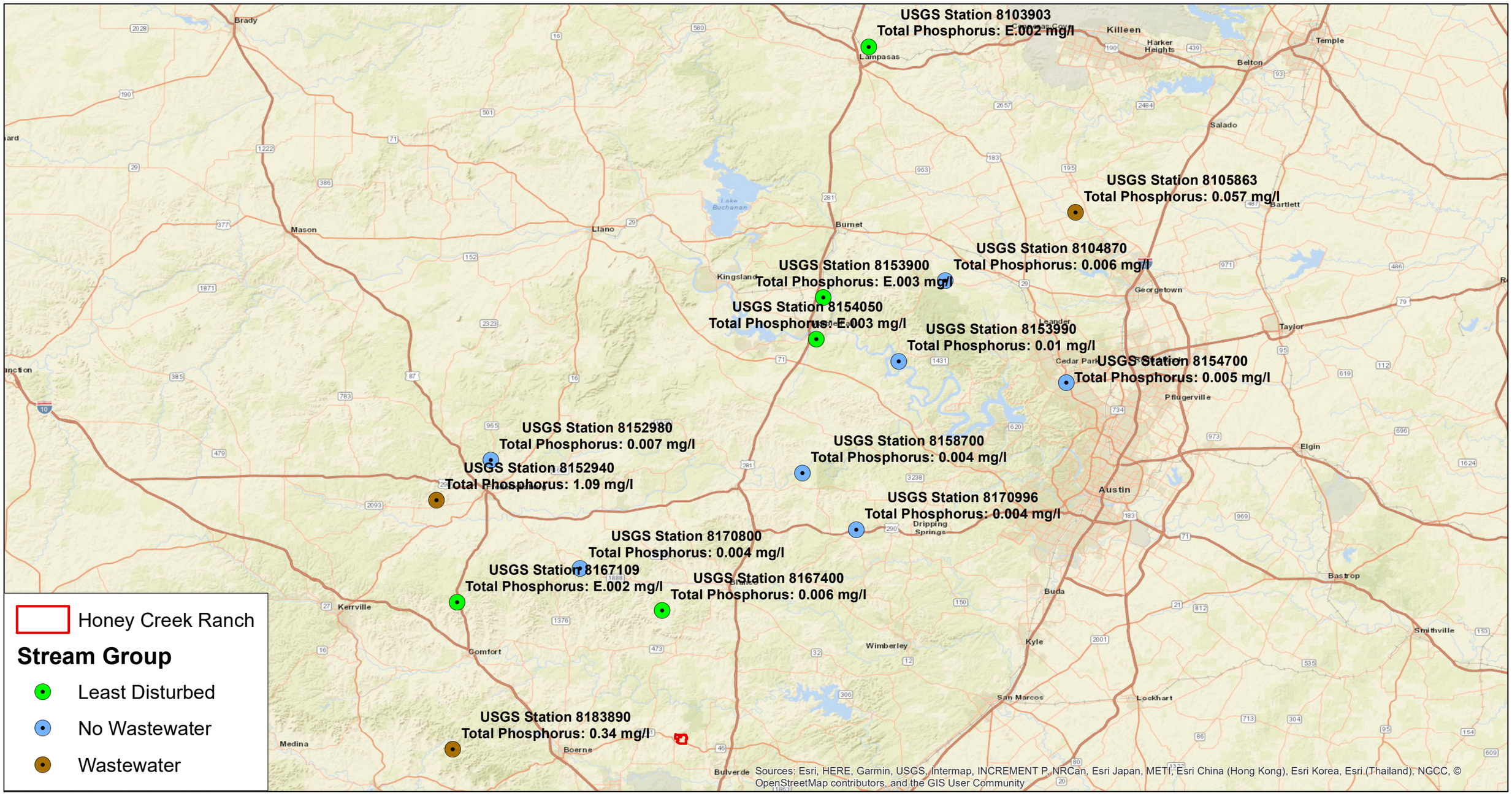
N W E S

Total nitrogen concentrations in 2005 from USGS report by Mabe (2007), Table 3.

0 10 20 40 Miles

Figure 3. Total Nitrogen Concentrations in Texas Hill Country Streams



Total phosphorus concentrations in 2005 from USGS report by Mabe (2007), Table 3. "E" values are estimated.

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Figure 4. Total Phosphorus Concentrations in Texas Hill Country Streams

wells

Honey Creek Ranch

Flood Zone

100-yr Floodplain

Surface Geology

Cow Creek

Lower Glen Rose

Upper Glen Rose

Hensell Sand

Miles

0 0.5 1 2

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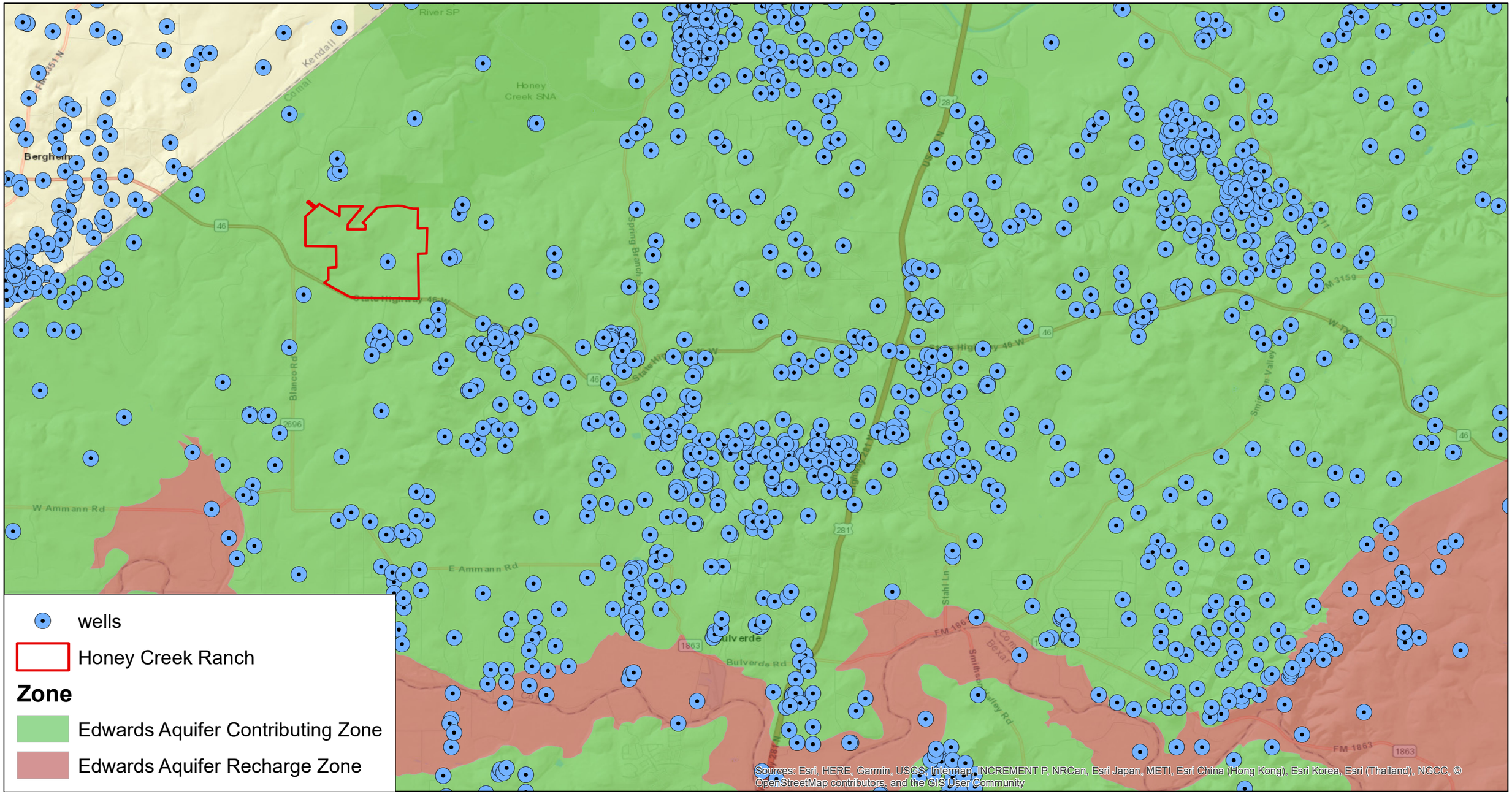
N W E S

Honey Creek Ranch boundaries delineated from Attachment 18 in the Application (November 18, 2019). The 100-year floodplain is based on GIS data from FEMA. Geology is from the US Geological Survey Geologic Database of Texas, 20007. Wells based on the Texas Water Development Board Submitted Drillers Reports and Groundwater Databases.

Figure 5. Surface Geology and Wells



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Honey Creek Ranch delineated from Attachment 18 in the Application (November 18, 2019). Well locations are based on the water production wells in theTexas Water Development Board Submitted Drillers Reports and Groundwater Databases.The Edwards Aquifer Contributing and Recharge Zones are based on GIS mapping by the Texas Commission on Environmental Quality.

Figure 6. Edwards Aquifer Recharge and Contributing Zones

The Lower Glen Rose Formation forms part of the Trinity Aquifer and locally provides water supply to numerous public and private wells. Wells near the proposed wastewater system are also shown on Figure 5.

Wells in the vicinity of the proposed sewage treatment and disposal are completed in the Trinity Aquifer. There is no laterally extensive confining bed or aquaclude within the Trinity Aquifer to impede the downward migration of effluent. Wastewater effluent would percolate to deeper groundwater zones, potentially migrating into the underlying aquifer and contaminating water wells.

Wastewater effluent, along with mobile chemicals within it, may also move laterally and be expressed in shallow seeps and springs along Honey Creek tributaries. From these seeps and springs, effluent would move into Honey Creek, through the Honey Creek State Natural Area and into the Guadalupe River. This effluent, carrying its mobile constituents, would recharge into the Trinity and Southern Edwards Aquifers.

Inadequate Effluent Limits

Effluent limits proposed for the sewage treatment and disposal facility are: 5 milligrams per liter 5-day biochemical oxygen demand; 5 milligrams per liter total suspended solids; 2 milligrams per liter ammonia nitrogen; and pH not less than 6.0 nor greater than 9.0 standard units. The permit requires a residual chlorine concentration and a maximum *E. coli* count of 126 colony forming units or most probable number per 100 milliliters.

Figures 2, 3 and 4 show the low natural nutrient concentrations in unimpacted streams northwest, north, and northeast of the proposed discharge. Effluent nutrient concentrations that could be legally discharged under the proposed draft terms are significantly higher than these natural concentrations.

Proposed effluent limits are compared to the range of reported concentrations by the U.S. Geological Survey for least disturbed and unimpacted streams for 2005 (the year

for which data is more complete) in Table 1. This table also includes expected total nitrogen and phosphorus concentrations, for effluent generated by the proposed membrane bioreactor (MBR) treatment technology,

The proposed wastewater permit would allow effluent with nutrient concentrations as much as several hundred to a thousand times higher than those measured in unimpacted Texas hill country streams. Even using land effluent disposal and stream dilution, the proposed permit terms would not control degradation from significant increases in stream nutrient concentrations. As demonstrated in the paragraphs below, stream degradation from escalating nutrient loads into Texas hill country streams have been observed and documented for other land disposal wastewater systems. See my report in Attachment 2.

Table 1. Effluent Limits and Natural Stream Nutrient Concentrations

Nutrient	Minimum in Least Disturbed and Unimpacted Streams	Maximum in Least Disturbed and Unimpacted Streams	Proposed Effluent Limit	Typical Concentration for Proposed MBR Treatment[2]
Ammonia (mg/l)	0.003	0.033	2	0.7 to 3.0
Total Nitrogen (mg/l)	0.12	2.55*	unlimited	3 to 10
Total Phosphorus (mg/l)	0.002[3]	0.01	unlimited	0.5 to 2.0

- Anomalously high. This stream was measured at 0.44 milligrams per liter in the same study in 2006.

[2] Metcalf & Eddy|AECOM et al., 2014, *Wastewater Engineering: Treatment and Resource Recovery*, 5th edition: McGraw Hill Education, Table 4-5, page 282.

[3] Estimated.

Proposed effluent limit standards in the draft permit are also inadequate because they address parameters that are largely irrelevant for sewage effluent land disposal but fail to provide effluent limits for either total nitrogen or phosphorus. Neither biochemical oxygen demand nor total suspended solids, for example, have environmental consequences in a properly designed, constructed, and managed sewage treatment and disposal system where all of the effluent disposal occurs through soil irrigation and infiltration. These effluent constituents are readily filtered by the soil and/or degraded by soil microbial activity.

Meanwhile neither nitrate nor total nitrogen is limited in the proposed permit. The U.S. Geological Survey, however, found the following:

> *Neither OSSFs nor TLAPS involve intentional discharge to surface water, yet even without any intentional discharges the concentration of nitrate in the streams crossing the contributing zone increased relative to similar flow conditions by a factor of 3 (Barton Creek, medium-flow conditions) to 11 (Onion Creek, medium-flow conditions).*[4]

Nutrient pollution is one of the leading causes of water quality impairment in the United States. Impacts from nutrient pollution include:

- Human health affected by methemoglobinemia ("blue baby syndrome");
- Human health affected by neurotoxic, paralytic, and diarrheic toxic algal blooms;

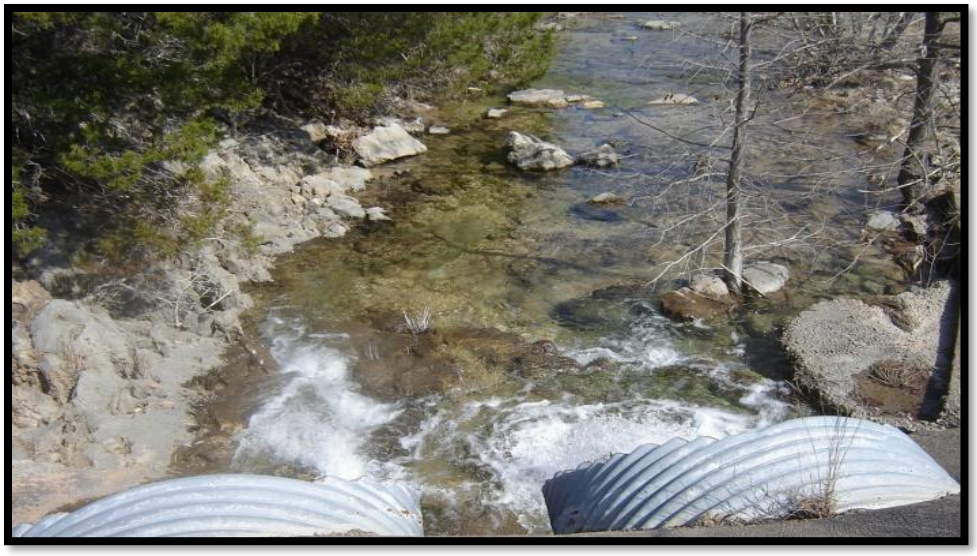
[4] Mahler, Barbara, MaryLynn Musgrove, Chris Herrington, and Thomas Sample, *Recent (2008-10) Concentrations of Isotopic Compositions of Nitrate and Concentrations of Wastewater Compound in the Barton Springs Zone, South-Central Texas, and their Potential Relation to Urban Development in the Contributing Zone,* U.S. Geological survey, Scientific Investigations Report 2001-5018, 2011, p. 33.

- Increased costs to treat water to potable standards;
- Reduced aesthetics, impaired recreation and tourism;
- Impaired navigation; and
- Hypoxic and anoxic dissolved oxygen levels.

Nitrogen and phosphorus pollution stimulates excessive algal blooms, depresses dissolved oxygen concentrations, kills fish, clouds water, and impairs desirable plant and animal habitat. Increased algae and turbidity lead to higher chlorination requirements for safe drinking water, which increases treatment costs and produces higher concentrations of disinfection by-products that increase cancer risks.

Harmful algal blooms, stimulated by excessive nutrients, affect tourism, commercial fisheries, property values, and human health. Associated costs for these outcomes have been documented in Texas, Ohio, and Florida. The presence of additional algae in in Honey Creek and the Guadalupe River would impair uses, including swimming, contact and non-contact recreation, and species habitat.

I have observed algae impacts similar to those described above in Texas hill country streams downstream from treated sewage effluent land disposal. Photographs 1 through 3 illustrate such increases in stream algae in Lick Creek, a tributary to the Pedernales River.



By Lauren Ross, Ph.D., P.E.

Photograph 1. East Lick Creek Unaffected by Wastewater Effluent

By Lauren Ross, Ph.D., P.E.

Photograph 2. West Lick Creek below Wastewater Treatment and Effluent Land Application

Other effluent constituents of concern that are known components of wastewater effluent (including compounds like caffeine)[5] have been detected in water downstream from sewage effluent disposal or discharge. The proposed wastewater permit has no terms, requirements, or standards to address these chemicals.

By Lauren Ross, Ph.D., P.E.

Photograph 3. Cladophora Algae in West Lick Creek

Inadequate Effluent Disposal Area and Effluent Storage Volume

Preventing wastewater migration through the soil and into the Honey Creek tributary and the Trinity Aquifer requires an adequate land area for disposal. It also requires adequate storage to retain effluent and eliminate irrigation during saturated soil conditions. The proposed 3.36 acre-feet of storage, however, is much less than the

[5] Mahler, Barbara, MaryLynn Musgrove, Chris Herrington, and Thomas Sample, *Recent (2008-10) Concentrations of Isotopic Compositions of Nitrate and Concentrations of Wastewater Compound in the Barton Springs Zone, South-Central Texas, and their Potential Relation to Urban Development in the Contributing Zone,* U.S. Geological survey, Scientific Investigations Report 2001-5018, 2011.

volume required to retain effluent during extended rain events when soils are saturated.

I have performed a preliminary water balance for 365,00 gallons per day of effluent disposed onto 84 acres. In conducting this water balance, I used site-specific soil properties published by the Natural Resources Conservation Service for the proposed effluent disposal areas. The water balance uses daily precipitation and evapotranspiration from January 1, 1954 through December 31, 2014 to determine the daily volume of effluent that can be accommodated up to the point of saturated soils. Volumes in excess of the soil's saturated capacity cannot, under the terms of the permit, be irrigated. The model calculates these excess effluent volumes.

While the proposed draft permit prohibits irrigation on saturated or frozen soil, there are no enforcement mechanisms to prevent it. Given the trouble and expense of hauling excess wastewater, the simple solution is to send excess effluent to the irrigation field even when soils are saturated.

My comparison of irrigation volumes and rainfall records for other effluent land disposal operations, conversations with neighbors adjacent to disposal fields, and downstream stream degraded water quality all support the presumption that effluent irrigation occurs onto saturated soils. Wastewater irrigated onto saturated soil runs off toward adjacent property and waterways. It migrates below the plant root zone to contaminate groundwater, perched groundwater, springs, and the downstream water into which they flow.

My preliminary calculations indicate that effluent ranging from 11 percent to 30 percent of the proposed effluent volume, on an annual basis, would not be accommodated within the proposed storage volume and disposal area without over-saturating soils. Wastewater effluent would exceed the proposed system capacity for 69 to 157 days in each of the 61 years from 1954 to 2014.

The total volume of excess effluent over this 61-year period would be 1.8 ***billion*** gallons. Twenty-two percent of the proposed effluent volume proposed in the permit would be either irrigated onto saturated soils or else pumped and hauled to another treatment facility.

The proposed 84-acre effluent disposal area would be sufficient to dispose of 150,000 gallons per day of effluent, without over-saturating soils, if effluent storage was increased to 8.5 million gallons.

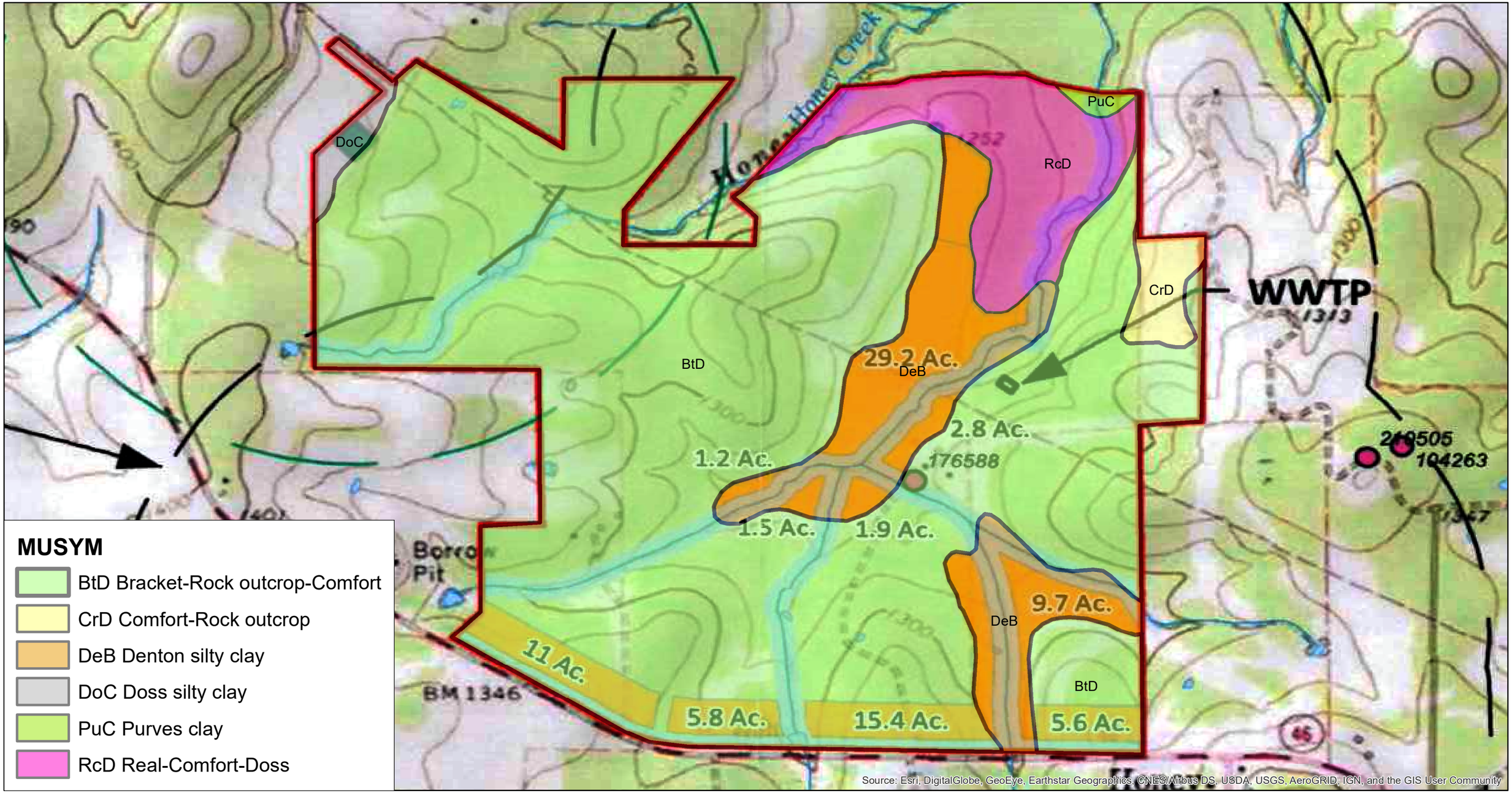
Inadequate Soil Depth and Necessary Soil Importation Standards

Soils proposed for sewage effluent disposal under the draft permit are mapped by the Natural Resources Conservation Survey as Brackett-Rock outcrop-Comfort complex with 1 to 8 percent slopes (BtD) and Denton silty clay, 1 to 3 percent slopes (DeB). as shown on Figure 7. These soils are identified as Hydrologic Soil Group D. They consist chiefly of clays with very slow infiltration rates and high runoff potential.

Soils on Honey Creek Ranch proposed for irrigation are also described by the Natural Resources Conservation Service as shallow, with soil depths of less than 20 inches. Because of these shallow depths, the Natural Resource Conservation Services has described all of the proposed disposal area soils as either very limited or somewhat limited for subsurface drip irrigation, as shown on Figure 8. Some of the area proposed for effluent disposal includes rock outcrop over which soil depths would be essentially zero.

All of the 46.3 acres within Honey Creek Ranch that are not ***very limited*** for sewage effluent drip irrigation have been proposed for sewage effluent disposal. An additional 37.7 acres must be on soil identified by the U.S. Natural Resources Conservation Service as “very limited” for that purpose.

In addition to shallow depths, published saturated hydraulic conductivity of the proposed disposal site soils is severely limited. For some of the proposed sewage



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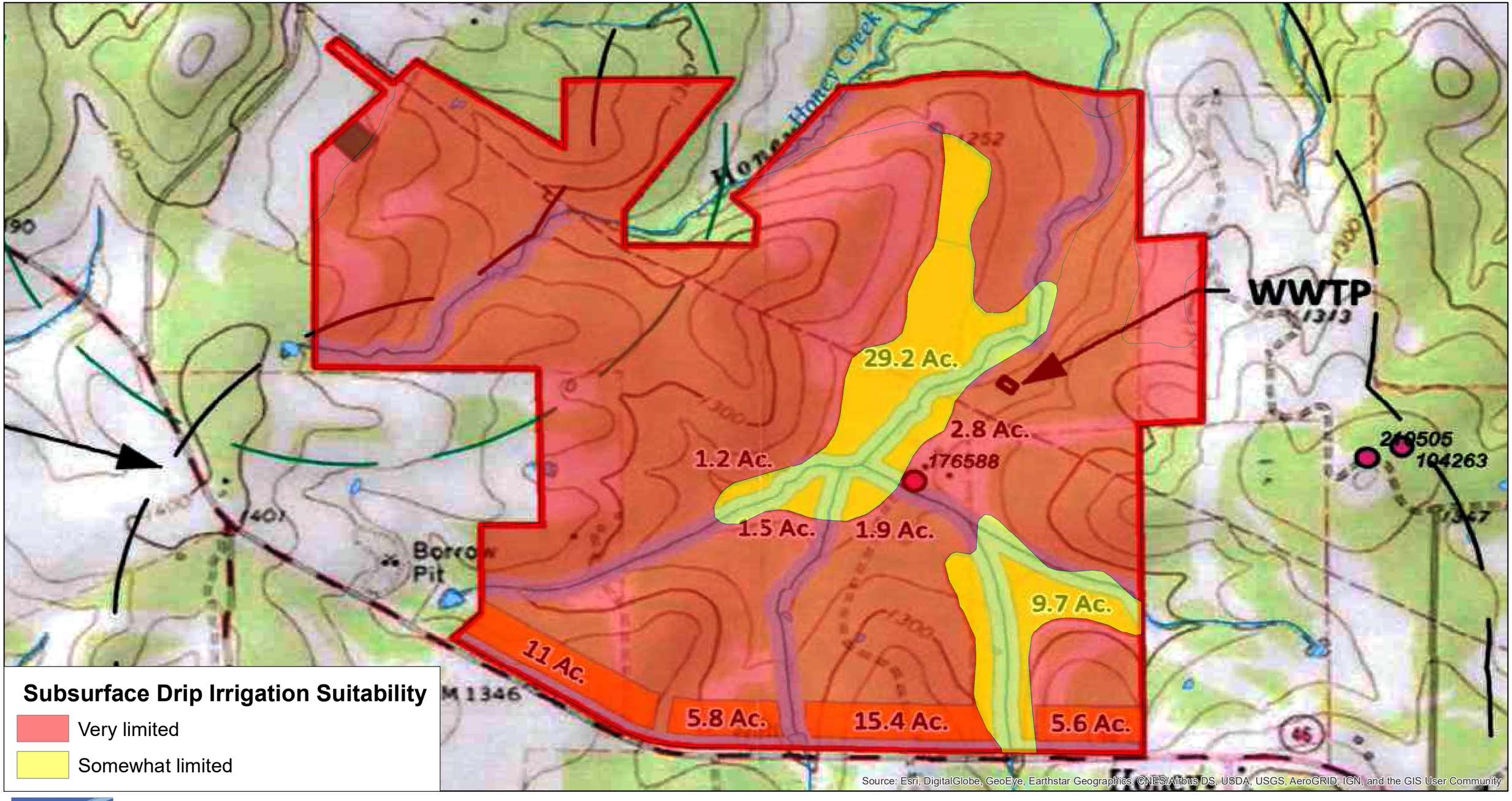
Base map is Attachment 18 of application in ESRI ArcMap by Lauren Ross, Ph.D., P.E. on 17 March 2020. All soil data from the Natural Resources Conservation Service Soil Web Survey.

Figure 7. Soils



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Base map is Attachment 18 of application in ESRI ArcMap by Lauren Ross, Ph.D., P.E. on 17 March 2020. Soil suitability data from the Natural Resources Conservation Service Soil Web Survey.

Figure 8. Soil Suitability for Subsurface Drip Irrgation

effluent disposal areas, published saturated hydraulic conductivity is as low as 0.06 inches per hour. The consequence of low conductivity soils is an inability to absorb applied sewage effluent and consequently earlier ponding and runoff. Neither the proposed effluent storage volume nor the 84-acre disposal area in the proposed permit account for low-conductivity soils.

While the permit allows for soil importation to supplement inadequate soil depth, there are no permit terms to assure shallow soil areas will be identified and supplemented with suitably permeable soils.

Inadequate Soil, Seep and Spring Monitoring Permit Provisions

Draft permit Special Provision 21.a. proposes quarterly field checks at the drip irrigation fields and down-gradient of the fields to identify emerging springs or seeps. This proposed quarterly monitoring is too infrequent. Seeps and springs would be expected only during wet conditions. The seeps and springs might last only a few days, while the consequential algae would be much more persistent in the stream.

Quarterly monitoring is likely to miss temporary springs and seeps, leading to the erroneous conclusion that there is no effluent migration from the field. Monitoring should be required within 2 days of rain events of more than one-half inch, with a quarterly monitoring requirement as a minimum.

The proposed list of seep and spring monitoring parameters fails to include metals or biochemically active compounds, even though these compounds have been detected in wastewater effluent and in springs and seeps downstream from sewage effluent disposal areas. The permit should require springs and seep samples to be tested for these additional parameters: sodium, chloride, fluoride, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, zinc and organic and biochemically active compounds.

The permit requires corrective measures if seeps or springs develop after sewage effluent disposal begins. There is, however, no mechanism for determining whether a seep or spring was present before sewage effluent disposal.

Furthermore, after the subdivision is developed options to increase the disposal area to prevent seeps and springs would be eliminated by the occupation of available land by homes and yards. Volume reductions are also difficult to achieve after homes are built. Families are unlikely to stop flushing toilets, taking showers, or washing dishes.

Inadequate Setbacks from Karst Features

The proposed setback of 50 feet from karst features is a minimally protective standard. Each feature should be evaluated in terms of its potential lateral subsurface extent and sewage effluent disposal prohibited above or within 50 feet of a feature's surface or subsurface lateral extent. Because of the potential for sewage effluent runoff from the low-permeability soils proposed for disposal, an upgradient buffer should be at least 300 feet.

Alternative Disinfection

Of numerous ways to achieve effluent disinfection, the draft permit proposes chlorine. Chlorination, however, has several unique disadvantages compared to alternative processes:[6]

- Chlorine is highly corrosive and toxic. Storage, shipping, and handling pose safety risks.
- Chlorine is toxic to aquatic life at low concentrations.

[6] U.S. Environmental Protection Agency. *Wastewater Technology Fact Sheet: Chlorine Disinfection.* EPA 832-F-99-062. (September 1999).

- Chlorine oxidizes wastewater organic matter, creating hazardous compounds like trihalomethanes that can be toxic and/or carcinogenic and harmful to human health and aquatic life.
- Long-term effects of disposing chlorinated water and/or chlorinated compounds into soil are unknown, but likely deleterious.

There are alternatives to chlorine disinfection that could be employed at the proposed wastewater treatment facility that would eliminate these disadvantages. One such option is disinfection using ultraviolet light.

Operator Class

The importance of well-controlled treatment facility operation to achieve significant nutrient reductions in wastewater effluent is well-documented: [7]

> *"Achieving significant reductions in both nitrogen and phosphorus requires careful design, analysis,* ***and process control*** *to optimize the environment of nutrient removing organisms. (emphasis added)"* [8]

The proposed draft permit requires the plant operator to hold a Wastewater Class C operator license. Qualifying requirements for such a license are a high school diploma or equivalent, two years of work experience, and training courses. Neither core nor elective courses for the Wastewater Class C operator license, however, require training on nutrient reduction processes or the type of tertiary treatment system proposed in the draft permit. These Class C operator license requirements are insufficient to assure adequate operation of the treatment and sewage effluent disposal system and/or timely and accurate response to monitoring data.

[7] https://www.tceq.texas.gov/licensing/licenses/wwlic/#WWacceptC.
[8] Water Environment Federation. *Nutrient Roadmap Version 1.0.* (September 2014): 6.

Proposed Invasive Grass for Irrigation Area Vegetation

The draft permit requires maintenance of Bermuda grass and Ryegrass on the sewage effluent disposal areas. Bermuda grass is identified as invasive and its use is incompatible with the proposed disposal area location upstream from sensitive Honey Creek State Natural Area.

Additional Requirements Necessary for Beneficial Reuse

As discussed above, there are natural limitations to the suitability of land within the proposed development for sewage effluent disposal. These natural site suitability limitations include thin soils, sensitive and transmissive karst limestone, and the presence of sensitive, low-nutrient creeks.

The proposed permit includes standards for designated effluent disposal areas to address sensitive area characteristics: limited sewage effluent application rates; disposal prohibitions on frozen or saturated soils; requirements to import and supplement thin soils; requirements to provide well, stream and karst feature buffer setbacks; and soil, seep and spring monitoring requirements.

None of these standards, however, apply to disposal of sewage effluent under Chapter 210 Use of Reclaimed Water. Chapter 210 requires effluent limits stricter than those in the proposed permit ***only*** for fecal coliform and *Enterococci*.[9] Chapter 210 effluent standards fail to address nutrient and biochemical effluent constituents that would cause public health concerns and environmental degradation.

[9] 30 TAC §210.33(1).

Wetlands Protection

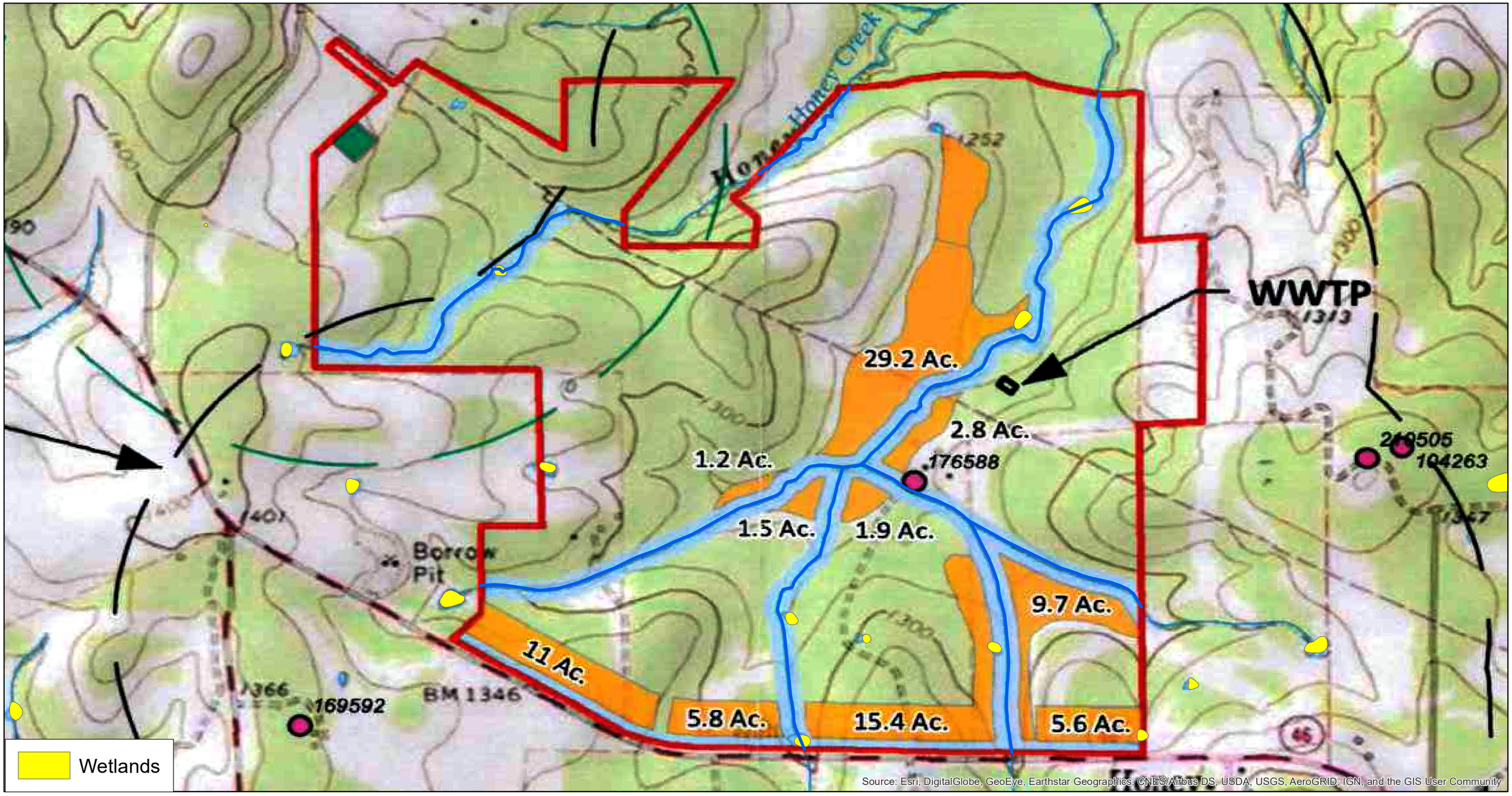
The database of Texas wetland areas includes eight freshwater ponds and one freshwater emergent wetland within Honey Creek Ranch, as shown on Figure 9.[10] Three of these features are within, adjacent to, or downstream from proposed wastewater effluent disposal areas. The proposed permit fails to protect these sensitive wetland features.

Inadequate Public Oversight

Because of the sensitivity of the Honey Creek State Natural Area and other local and public downstream sensitive resources, the community should be granted reasonable access to information regarding wastewater treatment and disposal operations. This public information access should include, at a minimum, records of daily sewage effluent disposal rates, volume of effluent applied, monitoring data, soil sensor data and vegetation management: planting, over-seeding, mowing, fertilizing, and harvesting, pond leakage and/or liner maintenance, daily effluent storage volumes, plant or disposal system leaks and spills, and any pump-and-haul incidences.

The permit requires the operator to maintain all of this information and make it available to the Texas Commission on Environmental Quality. The additional burden to make the information publicly available is reasonably offset by the public interests potentially diminished by the proposed treatment and disposal operations.

[10] U.S. Fish & Wildlife Service national Wetland Inventory accessed and downloaded on July 12, 2016.



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N W E S

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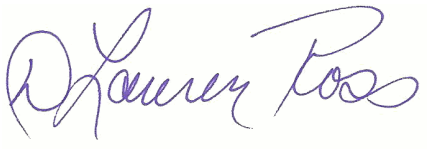
Base map is Attachment 18 of application.
Wetlands were delineated by the U.S. Fish and Wildlife Service using aerial imagery as the primary data source: https://www.fws.gov/wetlands/data/data-download.html.

Figure 9. Wetlands

Reservation for Additional Comments

On behalf of the Greater Edwards Aquifer Alliance, I reserve the right to supplement or amend these comments based on new or additional or corrected information on or before June 9th. the date to when the hearing has been rescheduled.

Sincerely,



Lauren Ross, Ph. D., P. E.
President
Glenrose Engineering, Inc.

Sealed on May 4, 2020

D. Lauren Ross, Ph. D., P. E. – Principal Engineer

Dr. Lauren Ross is an environmental engineer and owner of Glenrose Engineering, Inc. in Austin, Texas since 1987.

Education

Ph. D. Civil Engineering, University of Texas at Austin; 1993.
M. S. Civil Engineering, Colorado State University, Fort Collins, Colorado; 1982.
B. S. Civil Engineering, University of Texas at Austin; 1977, *summa cum laude*

Registration and Certification

Registered Professional Engineer: State of Texas, 1984
OSHA 40-hour Hazardous Waste Health and Safety Training, 1993
Certified Professional in Erosion and Sediment Control, 2009.

Experience

Wastewater Engineering and Permitting

- Design of a constructed wetland system to treat high biochemical oxygen demand and concentrated nutrient wastewater from a tofu production facility.
- Soil, spring, and groundwater monitoring system recommendations for Texas land application systems: Barton Creek West Water Supply Corporation, Rocky Creek Wastewater Utility, Austin Highway 290 (Headwaters), City of Dripping Springs, Travis County Municipal Utility District No. 4, Scenic Greens, Hays County Water Control and Improvement District No. 1, Prentiss Properties Acquisition Limited Partnership
- Water balance modeling for septic systems in the Barton Springs Edwards Aquifer Recharge and Contributing Zones
- Water balance modeling for Three Rivers Refinery wastewater effluent irrigation
- Environmental sampling and/or data analysis associated with wastewater effluent irrigation at Barton Creek West WSC, Hays County Water Control and Improvement District No. 1 (Belterra), Hays County Municipal Utility District No. 5 (Highpointe) Three Rivers Refinery, and West Cypress Hills wastewater effluent irrigation

Ground Water

- Pollution concentration predictions in Barton Springs from a pipeline leak using a numerical model based on field dye trace data
- Evaluation of environmental data to determine coal combustion waste disposal impacts in the Four Corners region
- Groundwater contamination study, waste evaluation, sampling, and analysis for petroleum refinery.
- Closed landfill study: field investigation, compiled and reviewed historical records, assessed potential environmental consequences, installed, sampled, and evaluated data from monitoring wells.
- Conducted geologic assessment, designed and installed groundwater monitoring well system for municipal landfills.

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- Designed a system to limit methane and leached organic chemical migration from a closed municipal landfill into a karst limestone sole-source drinking water aquifer.
- Developed groundwater management alternatives to limit withdrawal and related land subsidence.

Environmental Assessment

- Baseline and impact assessment for wastewater line remediation project including evaluation of soils, geology, topography, and flow regimes.
- Environmental Assessment evaluation for a proposed project to convert an inactive crude oil pipeline, largely constructed in 1950, into active service as a high-pressure fuel transmission line. Work included: evaluating historical spill records; calculating statistical failure probabilities for different pipeline reaches and spill sizes; predicting time and concentrations of toxic and carcinogenic constituent migration through and discharge from a karst limestone aquifer; and evaluating the Operational Reliability Assessment performed for the pipeline.

Solid Waste

- Investigated waste metal migration in soil for petroleum land treatment unit.
- Investigated geologic setting and groundwater contamination and designed recovery well system for groundwater remediation at a commercial RCRA waste storage impoundment.
- Designed petroleum waste land treatment units: baseline soil and groundwater characterization; monitor well system design and installation; lysimeter systems; and land treatment demonstrations to determine maximum waste capacity and loading rates.
- Developed sampling procedures and in-place treatment for RCRA waste at electrical generation power plants.
- Managed and prepared technical phases of Industrial Solid Waste Permit Applications under RCRA and Texas Natural Resource Conservation Commission regulations for waste management facilities: land treatment units, surface impoundments, container storage areas.
- Designed closure plans for RCRA waste impoundments to store, treat and dispose of inorganic acids, spent pickle liquor, and organic chemicals.
- Review of proposed municipal solid waste landfill applications.

Water Quality and Engineering Design

- Gravity-flow retention and irrigation water pollution control system for a large hospital complex within the contributing watershed of the karst Barton Springs Aquifer.
- Design of an innovative bioretention water quality control system for a municipal complex located on the Barton Springs Edwards Aquifer Recharge Zone and permitting under Texas Commission on Environmental Quality Edwards Aquifer protection rules.
- Design of an innovative pervious pavement storm runoff detention and treatment system for a proposed parking lot to be located on the Northern Edwards Aquifer Recharge Zone and permitting under stringent City of Austin and Texas Commission on Environmental Quality water quality protection rules.
- Wet pond design and detention basin retrofit to treat stormwater from existing residential and commercial development in the Oak Springs neighborhood in East Austin.

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- Combined wet pond and bioretention design for commercial storm runoff.
- Combined wet pond and retention/irrigation design for an existing 162-acre residential development over the sensitive Barton Springs recharge zone in the City of Austin, Texas.
- Municipal engineer responsible for all water quality design, review, inspection, rules, and ordinances for the City of Sunset Valley, Texas since 1994.
- Analyzed nonpoint pollution sources and structural and non-structural retrofit controls for recharge and contributing zone of a sensitive karst aquifer.
- Analyzed nonpoint pollution sources and structural and non-structural retrofit controls as water quality engineer for the City of Sunset Valley, Texas.
- Technical consultant to the City of Austin on implementation of the 1991 Comprehensive Watersheds Ordinance and associated water quality monitoring system.
- Analyzed stormwater conveyance and flooding potential, designed regional detention basin to protect natural ecological systems for Armand Bayou Master Drainage Study.
- Estimated long-term groundwater yields based on rainfall rates, soil type, and river losses for Chisumbanje region of Zimbabwe, Africa.
- Evaluated land use, soils, agricultural and silvicultural practices to assess non-point pollution potential in the San Jacinto River Basin.
- Designed storm water drainage for subdivisions and regional water detention facilities.

Teaching and Presentations

- Semester Course in Statistics for Environmental Monitoring; University of Texas at Austin; Fall 1995.
- Semester Course in Water Resources, University of Texas at Austin.
- Land Development Seminar; Travis County Bar Association, 12 July 1996.
- Water Quality Protection Programs to Reduce Nonpoint Source Pollution, a presentation to the Barton Springs/Edwards Aquifer Conservation District's Watershed Management: Challenges and Innovations--A Nonpoint Source Pollution Conference, 25 July 1996.
- Presenter at Emerging Issues in Groundwater Regulation panel discussion, Key Environmental Issues in U.S. EPA Region VI conference, hosted by U.S. EPA and the American Bar Association, May 12-13, 1997.
- Short Courses in Statistics for Environmental Monitoring; University of Texas Continuing Engineering Studies Program: Spring 1995, Fall 1995, Spring 1996, Spring 1997, Spring 1998.
- Short Courses in Statistics for Environmental Monitoring; Louisiana Department of Environmental Quality. Focus on surface water sampling considerations, trend analysis and methods to assess the achievement of data quality objectives.

Statistics

- Evaluated surface and groundwater measurements for normality, differences in mean, spatial variability, and time series analysis. Techniques used include Student's t-test, Wilcoxon test, parametric and non-parametric ANOVA, Fourier series decomposition, Shapiro-Wilkes test, and Chi-squared tests.
- Geostatistical analysis and kriging of groundwater transmissivity data.

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- Statistically-based sampling design including optimum sample number, stratified random sampling, and assessment of monitoring parameters to achieve efficient sampling designs.

Field/ Laboratory Experience

- Field supervision of auger drilling, rotary-bit drilling, well installation, Shelby-tube core and split-spoon sampling, and soil type identification using the Unified Soils Classification System.
- Surface, groundwater and hazardous waste sampling for a variety of constituents, including volatile organic constituents, dioxins, nutrients, metals, anions, cations, and other collection-sensitive parameters.
- Laboratory experiments to measure unsaturated hydraulic conductivity, water content versus soil water pressure, and other geophysical soil properties.

Reports and Publications

- *Black Mountain Sand Mine Review,* Wintergarden Groundwater Conservation District, January 2019.
- *Soils, Surface Water and Groundwater Hydrology in the Vicinity of the Peeler Ranch in Atascosa County, Texas,* Mary Whittle, attorney, August 2018.
- *June 28 to 29, 2018 Field Investigation Report for Peeler Ranch, Atascosa County, Texas,* Mary Whittle, August 2018.
- *Sampling Plan for June 28 to 29, 2018 Peeler Ranch Atascosa County, Texas,* Mary Whittle, June 2018.
- *City of Houston Sanitary Sewer Overflow Data Summary: Preliminary Report,* Eric Allmon, attorney, June 2018.
- *Review of Proposed City of Dripping Springs Wastewater Effluent Discharge to Onion Creek,* Protect Our Water, November 2016.
- *Prefiled Testimony on Application of 130 Environmental Park, LLC for Proposed TCEQ Municipal Solid Waste Permit No. 2383,* attorney Marisa Perales, June 2016.
- *Barnes Family Farm Water Availability Report*, Barnes Family Farm, Inc., April 2015.
- *Preliminary Engineering Design of Storm Runoff Treatment System,* Parkside Montessori Community School, February 2015.
- *Declaration regarding Wetlands Development in Galveston Baykeeper, Inc. vs. Trendmaker Homes, Inc.,* Galveston Baykeeper, Inc., November 2014.
- *Prefiled Testimony on Application of DHJB Development, LLC for a Major Amendment to TPDES Permit No. WQ 0014975001,* attorney Mary Conner, October 2014.
- *Potential Improvements to the Join Task Force Municipal Separate Storm Sewer MS4 Permit,* Houston Parks Board, Galveston Bay Foundation, Buffalo Bayou Partnership and Bayou Preservation Association, March 2014.
- *Circle Acres Environmental Sampling Report*, Ecology Action, January 2014.

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- *Potential Improvements to the Harris County Municipal Separate Storm Sewer MS4 Permit*, Houston Parks Board, Galveston Bay Foundation, Buffalo Bayou Partnership, and Bayou Preservation Association, January 2014.
- *Circle Acres Preliminary Engineering Biofilter Design*, Ecology Action, August 2013.
- *Circle Acres Storm Water Management Concept Plan*, Ecology Action, May 2013.
- C*omments on Draft Environmental Assessment of the Proposed Longhorn Pipeline Reversal*, City of Austin, September 2012.
- *Water for Coal-Fired Power Generation in Texas: Current and Future Demands,* for Sierra Club, February 2012.
- *Land-Applied Wastewater Effluent Impacts on the Edwards Aquifer,* for Greater Edwards Aquifer Alliance and Save Our Springs Alliance, November 2011.
- *Proposed White Stallion Coal-Fired Power Plant Water Demands and the Highland Lakes Water Supply,* for Sierra Club, June 2011.
- *Water Treatment Plant #4 Environmental Monitoring Program,* for City of Austin, with INTERA, Inc., June 2011.
- *Remediation to Protect the Conemaugh River from Acidic Groundwater,* for Environmental Integrity Project, Lisa Widawsky, attorney, March 2011.
- *What Would You Drink if the Well Ran Dry? Nolan County Water and the Proposed Tenaska Coal-Fired Power Plant,* for Lone Star Chapter of the Sierra Club, November 2010.
- *A Unique Water Quality Retrofit Project in Austin, Texas,* with Scott Muchard, Rebecca Batchelder, and Tom Franke, StormCon; The North American Surface water Quality Conference & Exposition, August 5, 2010, San Antonio, Texas.
- *Potential Stormwater Impacts from Sand and Gravel Excavation on the Llano River, Texas,* for Brad Rockwell, attorney, February 2010
- *Engineering Analysis of Jeremiah Ventures L.P. Propose Wastewater Irrigation Areas,* submitted to City of Austin, December 2009.
- *Pease Park Water Quality and Stream Restoration: Preliminary Engineering Report*, with PBS&J, Inc., for City of Austin, August 2009.
- *Fort Branch Watershed Management Area Reaches 6 and 7; Final Environmental Assessment,* for City of Austin, August 2009.
- *Tannehill Branch Wastewater Line Environmental Assessment,* for City of Austin, August 2009.
- *Water Quality and Quantity Impacts from Proposed South Texas Plant Expansion,* submitted to Sustainable Energy and Economic Development (SEED) Coalition, April 2009.
- *City of Sunset Valley Environmental Monitoring Program: Air Quality,* submitted to the City of Sunset Valley, Texas, November 2008.
- *Recommendations to Stabilize Construction at Ranches at Hamilton Pool,* submitted to Brad Rockwell, attorney, October 2008.

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- *Williamson Tributary 2 Water Quality Retrofit: Preliminary Design,* prepared for the City of Austin, October 2008.
- *Twin Oaks Community: Conceptual Design for Tofu Wastewater Treatment,* submitted to Twin Oaks Intentional Community, June 2008.
- *City of Sunset Valley Surface Water Quality Monitoring Program,* for the City of Sunset Valley, Texas, June 2008.
- *Storm Sewer Retrofit Alternatives to Improve Water Quality in Fort Branch Creek Reaches 6 and 7,* for City of Austin, December 2007.
- *Lundelius-McDaniel Water Quality Retrofit Project: Phase I Environmental Assessment* for HDR Engineering, Inc., September 2007.
- *Effects of Four Corners Power Plant Coal Combustion Waste Disposal on Surface and Groundwater Quality,* submitted to Lisa Evans, Earth Justice Attorney, August 2007.
- *Preliminary Review of the McCarty Road Landfill Proposed Major Permit Amendment*, submitted to Monica Jacobs, Attorney, August 2007.
- *Surface Water and Sediment Sample Results Associated with the Walsh Cresson Ranch and Walsh West Ranch,* submitted to Mary Sahs, attorney, May 2007.
- *Biofiltration Water Quality Control Design Standards,* submitted to the City of Sunset Valley, Texas, 2007.
- *Review of Proposed XTO Energy, Inc. Centralized Landfarm Facility, Jack County, Texas,* submitted to Robert Thompson, Ph.D., July 2006.
- *Carson Creek Watershed Flood Mitigation Project: Impacts on Erosion and Water Quality,* submitted to PBS&J, Inc., December 2005.
- *Water, Mud, Mold, and More: Toxic Chemicals and Staying Safe When Returning to Coastal Louisiana*, Common Ground Relief, December 2005.
- *West Lamar Wastewater Replacement Line: Phase I Environmental Assessment,* prepared for City of Austin, December 2005.
- *Lundelius-McDaniels Water Quality Retrofit Project Preliminary Engineering Report,* submitted to City of Austin with HDR Engineering, Inc., October 2005.
- *Surface Water and Sediment Sample Results Associated with the Diamond Shamrock Three Rivers Refinery Wastewater Irrigation Fields,* submitted to: Ms. Mary Sahs, attorney, September 2005.
- *Diamond Shamrock Three Rivers Refinery Wastewater Irrigation Water Balance* submitted to: Ms. Mary Sahs, attorney, June 2005.
- *Intrawell Comparisons for Arsenic and Benzene Concentration Measurements in Maxwell Landfill Monitoring Well 4.* Submitted to: Robert S. Kier Consulting, Inc., June 2005.
- *Groundwater Sampling Protocols: Ruby Ranch Subdivision.* Submitted to Neighbors Organized in Defense of the Environment. May 2005.
- *Oak Springs Detention Pond Retrofit for Water Quality,* for the City of Austin, February 2005.

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- *TR-20 Computer Simulations to Determine Runoff Detention Stage/Storage/Discharge Relationships Meeting Specified Erosion Control Criteria* for City of Austin, January 2005.
- *Potential for Surface and Groundwater Contamination at the Waste Management of Texas, Inc. Westside Landfill,* submitted to Mary K. Sahs, attorney, September 2004.
- *Recommendations for Edwards Aquifer Authority Water Quality Regulations.* Presented to the Edwards Aquifer Authority Water Quality Task Force in San Antonio, Texas, 17 February 2004.
- *Tanglewood Forest Regional Detention Pond: Phase I Environmental Assessment,* prepared for City of Austin, October 2003.
- *Effects of Impervious Cover Limits to Improve Water Quality*, submitted to City of Sunset Valley, January 2003.
- *EcoCreto ™Pervious Pavement Water Quality & Flood Control Design.* January 2003.
- *Sampling at the Alcoa Sandow Lignite Mine.* For Neighbors for Neighbors, Inc. December 2002.
- *Preliminary Review of Northern Hays and Southwestern Travis Counties Water Supply System Project Environmental Impact Study; October 2001,* 15 January 2002.
- *Water Quality Design Calculations Wells Branch Church of Christ Austin, Texas* for EcoCreto, Inc. September 2001.
- *Product Pipeline Hazards over Karst Aquifers.* American Society of Civil Engineering Environmental and Pipeline Engineering Convergence 2000. July 23 – 26, 2000, Kansas City, Missouri.
- *Review of the Environmental Assessment of the Proposed Longhorn Pipeline System.* January 2000.
- *Comments on the Final Environmental Assessment of the proposed Longhorn Pipeline System.* January 2001.
- *Water Fights: Citizens Struggle to Shape a City in Central Texas.* 1999. From *Under the Blade: The Conversion of Agricultural Landscapes,* Westview Press, Boulder, Colorado.
- *Hydrogeologic Setting and Potential Contamination of Barton Springs from a Longhorn Pipeline Discharge.* September 1998.
- *Watershed Protection Utility Master Plan: Integrated Solutions Regulatory Inventory.* Prepared for the City of Austin. August 1998.
- *Watershed Protection Utility Master Plan: Integrated Solutions Regulatory Protocols.* Prepared for the City of Austin. July 1998.
- *Statistical Analysis of Soil Samples for Quanex Land Treatment Unit.* December 1997. Prepared Quanex Gulf States Tube Division.
- *A Scientific Basis for Edwards Aquifer Protection,* prepared for the American Bar Association Conference: Key Environmental Issues in U.S.EPA Region VI, May 1997. P
- *Robert Mueller Municipal Airport Phase II Environmental Assessment Work Plan.* April 1997. With Geomatrix, Inc., prepared for the City of Austin.

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- *Water Quality Protection Programs to Reduce NPS Pollution.* July 1996. Presented at Barton Springs/Edwards Aquifer Conservation District Conference: Watershed Management: Challenges and Innovations.
- *Water Quality Ordinance Amendments to the City of Sunset Valley Land Development Code.* April 1996. Prepared for the City of Sunset Valley.
- *Soil and Water Quality Monitoring Plan for the City of Austin Municipal Golf Courses.* January 1996. Prepared for the City of Austin.
- *D. C. Reed Estate Water Quality Protection Zone Monitoring Program.* January 1996.
- *Soil Monitoring Plan for Utility Trench Segment through SWMU 216.* January 1996. Prepared for the City of Austin.
- *Waller Creek Flood Control Master Plan.* December 1995. Prepared with Loomis and Associates for the City of Austin.
- Barton Springs Water Protection Efforts Challenged. August/September 1995. *Nonpoint Source News-Notes,* published by U. S. EPA.
- *Statistical Methods for Environmental Monitoring*. 5 to 7 April 1995. Lecture notes for Continuing Engineering Studies Short Course, University of Texas at Austin.
- *"Don't Mess with Texas" Litter Survey.* April 1995. Prepared for GSD&M Associates, Inc. With Capitol Environmental Services.
- *Long Term Viability of the Edwards Aquifer for the City of Sunset Valley Water Supply.* February, 1995. Report prepared for the City of Sunset Valley.
- *Character and Magnitude of Degradation in* the *Barton Springs Zone.* December 1994. Report prepared for Loomis and Associates as part of the Barton Springs Zone Retrofit Project, Austin, Texas.
- *Report on Septic Systems in* the *Barton Springs Zone.* December 1994. Report prepared for Loomis and Associates as part of the Barton Springs Zone Retrofit Project, Austin, Texas.
- *"Don't Mess with Texas" Litter Survey Work Plan.* October 1994. Report prepared for GSD&M Associates, Inc. With Capitol Environmental Services.
- *Statistical Analyses to Establish Constituent Action Limits for Detection Monitoring: Industrial Waste Control Site, Sebastian County, Arkansas.* June 1994. Prepared for IT Corporation.
- *Review of Environmental Information Document for Proposed Lacey Pig Operation.* April 1994. Letter report prepared for Mr. Michael J. Hobbs.
- *Barton Creek and Barton Springs: Petition to Texas Natural Resource Conservation Commission for Designation as Outstanding National Resource Waters.* April 1994. (with others).
- *Base Flow in Barton Creek and Statistical Analysis of Water Quality Data for Barton Creek and Barton Springs, Austin, Texas.* March 1994. Report prepared for Loomis, Santos and Associates.
- *Statistical Analysis: Background Sampling Investigation at Bergstrom Air Force Base, Texas.* January 1994. Prepared for Southwest Laboratories.

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- *Multivariate Statistical Analysis of Environmental Monitoring Data.* November 1993. Petroleum Hydrocarbons Conference sponsored by the National Ground Water Association and American Petroleum Institute, Houston, Texas.
- *An Environmentalist's Perspective on Pump-and-Treat Groundwater.* 1993. In *Ground Water Monitoring and Remediation*, Vol. XIII, No. 4.
- *The Importance of the SOS Water Quality Ordinance to the Protection of the Barton Springs Segment of the Edwards Aquifer.* September 1993. Prepared for the Texas Natural Resource Conservation Commission.
- *Statistical Analyses to Establish Constituent Action Limits for Detection Monitoring.* June 1993. Report prepared for IT Corporation for IWC Site in Fort Smith, Arkansas.
- *Multivariate Statistics for Environmental Monitoring Data.* May 1993. Doctoral Dissertation for the University of Texas at Austin.
- *Statistical Analyses to Establish Constituent Action Limits for Detection Monitoring.* May 1993. Prepared for IT Corporation.
- *Statistical Analysis of Phase I and Phase II Background Soil Measurements.* February 1993. Report prepared for Quanex Corporation.
- *Sampling Recommendations to Detect Chromium Contamination in Soils.* 16 August 1993. Letter report to Mr. Phil Bullock, Southwest Laboratories.
- *Recommendations for Sampling: West Dallas Lead Project.* August 1992. Prepared for International Technology Corporation.
- *Implementation Strategy for the Pollution Reduction Standard of the SOS Water Quality Referendum.* July 1992. Prepared for Save Our Springs Coalition (SOS).
- *Statistical Determination of Background Values for Groundwater Based on Student's T-Test, Tolerance Interval and Mann-Whitney Analysis.* September 1991. Prepared for Quanex Corporation.
- *Phase I Environmental Site Assessment: Jollyville/360 Tract; 9401 Capitol of Texas Highway; Austin, Texas.* June 1991. (with others).
- *Statistical Analysis: Koch East Plant Soil Samples.* May 1991. (with others).
- *Soil Metal Evaluation Final Report*. October 1990. Prepared for Chevron USA, Inc. (with others).
- *Review of Hydrogeology and Potential Contamination of Ramada Inn Site.* September 1990. Report prepared for Capitol Environmental Services.
- *Malone Service Company Compliance Plan.* October 1989. Prepared as part of a RCRA hazardous waste facility permit application.
- *Malone Service Company Geology Report.* October 1989. Prepared as part of a RCRA hazardous waste facility permit application.
- *HST3D Groundwater Model to Predict Waste Migrations.* November 1988. Report for Union Carbide Corporation.

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- *Statistical Issues in Monitoring Groundwater Quality.* Fall 1987. (with others). Prepared for Texas Water Commission.
- *Land Treatment of Sugar Cane/Ethanol Process Waste.* May 1987. (with others).
- *Phase 1: Feasibility Study for the Development of Groundwater for Irrigation in the Chisumbanje Area*. January 1987. Prepared for the Zimbabwe Regional Water Authority. (with others).
- *Morton Thiokol, Inc. RCRA Hazardous Facility Part B Permit Application*. 1985. (with others).
- *Air Products Company RCRA Hazardous Facility Part B Permit Application*. 1985. (with others).
- *Quanex Corporation: Gulf States Tube Division RCRA Hazardous Facility Part B Permit Application*. 1985. (with others).
- *Union Carbide Corporation RCRA Hazardous Facility Part B Permit Application*. 1985. (with others).
- *Koch Refining Company RCRA Hazardous Facility Part B Permit Application*. 1984. (with others).
- *Evaluation of Proposed Waste Disposal in Salt Caverns in the Boling Dome.* February 1985. Prepared for the County of Wharton, Texas. (with others).
- *Closure Plans for Two Cooling Tower Blow-Down Impoundments.* 1984. Prepared for Houston Lighting and Power.
- *Landfills in the Vicinity of Austin, Texas.* November 1984. Prepared for the City of Austin. (with others).
- *Maximizing the Statistical Performance of Groundwater Monitoring Systems.* November 1984. Prepared for Petroleum Hydrocarbons and Organic Chemicals in Groundwater Conference, sponsored by the National Water Well Association.
- *Applicability of Student's t-test to Groundwater Monitoring.* April 1984. American Geophysical Union Conference, Fort Collins, Colorado.
- *An Analytical Model to Predict Soil Water Profiles.* June 1982. Master's Thesis, Colorado State University, Fort Collins, Colorado.
- *Groundwater Management Options for the Harris/Galveston Coastal Subsidence District.* 1979. (with others).
- *Armand Bayou Master Drainage Study*. August 1979. Espey Huston and Associates, Inc. (with others).
- *Non-Point Source Pollution Assessment for the San Jacinto Watershed.* 1978. Espey Huston and Associates.

Land-Applied Wastewater Effluent Impacts on the Edwards Aquifer

Prepared for:

Greater Edwards Aquifer Alliance

and

Save Our Springs Alliance

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4 November 2011

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https://aquiferalliance.org/Library/GEAAPublications/GlenroseEdwardsWastewaterReport20111103.pdf