



CITY HALL

207 Lafayette Street
P.O. Box 378
Winona, MN 55987-0378
FAX: 507/457-8212

July 5, 2012

Planning Commissioners
Winona, Minnesota 55987

Dear Commissioner:

The next meeting of the Planning Commission will be held on **Monday, July 9, 2012, at 4:30 p.m. in the Council Chambers** of the Winona City Hall.

1. **Call to Order**
2. **Approval of Minutes – June 25, 2012**
3. **Sand Moratorium Study: Air Quality**
4. **Other Business**
5. **Adjournment**

Sincerely,

A handwritten signature in blue ink, appearing to read "Carlos Espinosa".

Carlos Espinosa
Assistant City Planner

PLANNING COMMISSION MINUTES

DATE: June 25, 2012

TIME: 4:30 p.m.

PRESENT: Chairperson Porter; Commissioners Boettcher, Gromek, Buelow, Eyden, Ballard and Davis

ABSENT: Commissioners Olson and Briggs

STAFF PRESENT: City Planner, Mark Moeller; and Assistant City Planner, Carlos Espinosa

The meeting was called to order at 4:30 PM by Chairman Porter.

Approval of Minutes – May 29, 2012

The minutes from the Commission's meeting from May 29th were reviewed and it was moved by Commissioner Gromek and a seconded by Commissioner Davis to approve them as submitted. When the question was called, the vote of the Commission was unanimous to approve the motion.

Sand Moratorium Study: Habitat, Wetlands and Quality of Life

Chairman Porter noted that given the implementation of the Sand Moratorium Study in March, he had seen 3 basic public interest groups evolve. These included:

1. CASM – A group of citizens in the City of Winona and Winona County who are concerned about frac sand mining and related operations in our region.
2. Blasting Committee – A Committee which was formed to address concerns of Biesanz Stone Quarry mining operations relative to blasting.
3. A core group of sand mining industry representatives. Representing property owners, operators, and contracted services, this group has evolved for the purpose of representing industry interests.

Given the previous interests groups, Chairman Porter noted that the manner in which Commission open comment periods before, and after, Commission meetings, will change. As opposed to the previous schedule of simply allowing 2 minutes to each person who wished to speak to the Sand Moratorium Study, a total of 10 minutes will be allotted to the 3 primary interest groups. All other private comments, falling outside of interest groups, would be allotted 2 minutes to speak.

Given the previous, he called for any person present who wished to provide comments on behalf of the Blasting Committee to do so at this time.

Kim Sharpe then presented the statement as found on Exhibit A of the permanent minutes. In summary, he noted that there are over 440 residential dwellings located with the immediate neighborhood to the Biesanz property. In summary of his presentation, he noted that although he understood that the Commission would be

PLANNING COMMISSION MEETING MINUTES

JUNE 25, 2012

PAGE 2

discussing a nonconformity agreement for the Biesanz mine/quarry business later in meeting; he suggested that such an agreement not be considered by the City and that the operation should be subject to the same conditions as any other frac sand/mine operation within City limits.

Mr. Sharpe noted that although it was fully understood that the Biesanz mine/quarry has been in operation for decades, his group felt that the more historic use of the site has changed with the advent of frac sand mining and other factors listed on this written statement. Given this, he felt it was difficult to justify the nonconforming status of the property. He thanked the Commission for allowing him to make a presentation this afternoon.

At this point, Chairman Porter asked if a representative from CASM was present to speak.

Marie Kovesci, 133 Whispering Lane, thanked the Commission for allowing her, as a representative of CASM, to speak this afternoon.

She began by emphasizing that CASM's primary role is to protect citizens from the secondary effects of frac sand mining. She noted that CASM members are neighbors and have spent a significant amount of time in researching frac sand issues. She explained that many in the CASM Committee are also members of the Blasting Committee, and all have a vested interest in simply protecting the integrity of Winona neighborhoods.

In her comments, she echoed those of Mr. Sharpe relative to the City's need to undertake legal research of the ownership of the Biesanz property. With respect to this site, she questioned why the City would consider a nonconforming agreement for it versus simply requiring that it be subject to those performance standards pertaining to other mine/processing facilities.

At this point, Ms. Kovesci highlighted a number of concerns pertaining to the proposed nonconformity agreement. In part, these related to the presentation of an adequate reclamation plan, and the requirement for an environmental assessment worksheet. With regards to the worksheet, she suggested that rather than simply requiring it if excavation falls outside of the current work foot print, other thresholds should apply. This is a strategy that the County had undertaken with its worksheet requirements. She further noted that the Commission should be devoting more than one work session to various issues and that the Community has yet to see information pertaining to dust and dust control, including ambient dust control measures. With regard to dust, she stated that residents within Knopp Valley have seen an increase in dust as a result of sand mining operations.

She concluded by encouraging the Commission to conduct a thorough discussion of all issues, and to include comments of citizens in these.

PLANNING COMMISSION MEETING MINUTES

JUNE 25, 2012

PAGE 3

Chairperson Porter thanked Ms. Kovesci for her comments and asked if a representative from the mining industry wished to make comments.

Pete Schwab noted that he was a part owner in the Biesanz Quarry. He explained that Biesanz's history goes back to 1904 when it began mining limestone for a number of purposes, the most significant being the exterior applications to commercial and institutional buildings. He noted continuing demands for these applications and that Biesanz was ready to meet these demands.

Throughout its history, Mr. Schwab noted that the Company has also processed crushed stone as well as sand, gravel, and other aggregate materials. In part, some of these materials have been used for Mississippi River bank riprap.

The mining of frac sand at this site started in approximately 2011, in response to demands from the oil industry. In part, the company sees this production as being an extension of what it has been doing for the last 100 years, and that this production is part of its revenue base.

Mr. Schwab emphasized that when the company began in 1904 there were no resident homes in the area. He estimated that the sand mining operation generates approximately 40 trucks per day from the site, and that material involved is approximately ½ of 1% of the total market.

In addressing blasting concerns, Mr. Schwab noted that quarry operations require blasting to separate rock. Although minimum blasting occurred between 2008 and 2011 it has again resumed. Although he understood that people were concerned with this activity, his company was doing everything possible to mitigate problems. As part of this, Biesanz does notify neighbors prior to blasts and has been trying to keep neighbors in mind while blasting occurs. He further noted that approximately 13 blasts have occurred during the first half of the year.

Mr. Schwab noted that one characteristic of quarries and mines are that they do generate dust. Although sand mined from the Biesanz site is generally wet, dust can occur from vehicle tires on gravel roadways. Here, Biesanz is doing everything possible to control roadway dust by watering roads at regular intervals. Outside of this, he felt that distances to neighborhoods, hillsides and vegetation, provided reasonable barriers in controlling dust issues.

Mr. Schwab further noted that in addressing reclamation concerns, Biesanz has received approval to stock pile unused resources for reclamation purposes.

Chairman Porter thanked Mr. Schwab for his comments. He then asked if any other person was present to speak to the issue and noted that each would be allotted 2 minutes for this purpose.

Della Schmidt, Executive Director of the Winona Area Chamber of Commerce, emphasized that as long as any business is being conducted in accordance with

PLANNING COMMISSION MEETING MINUTES

JUNE 25, 2012

PAGE 4

applicable laws, they should be allowed to continue, and encouraged to grow. She encouraged the Commission to consider this input as it deliberates on the nonconforming agreement for Biesanz Stone.

James Johnson, 802 West Broadway, stated that grandfathering of any use should only apply if the scope of the use or business does not change. Here, he felt that the addition of frac sand mining represented a change to the previous historic use of the site. As such, he felt that this factor along with the observation that new machinery has been added to the site for the use meant that the business is no longer nonconforming. He strongly suggested that the City secure a legal opinion of the nonconformity issue before proceeding with the agreement.

There being no one else present to speak at this time, Chairman Porter called on Carlos Espinosa, Assistant City Planner, to summarize today's agenda.

Mr. Espinosa noted that the primary focus of this afternoon's meeting was to obtain Commission feedback of a proposed nonconformity agreement with Biesanz Stone Company. He explained that no action by the Commission was being required. However, staff was attempting to solicit any input it could from the Commission. Mr. Espinosa reviewed the staff analysis, found as Exhibit B of the permanent minutes. In summary, he emphasized that staff was proceeding on the basis that Biesanz Stone is a nonconforming use and became so in 1996 when it was annexed into the City. As part of that annexation, the township (Winona Township at the time) had required that the City, in applying land use regulations to annexed areas continue permitting those which had existed. Given this, the Biesanz site was split zoned between agricultural, allowing for mining applications, and M-2, relating to the stone processing plant area. Since that time, the Biesanz Quarry was "grandfathered in" as a legal nonconformity when AG zoning was applied to the site in 1998. This grandfathered status meant that the quarry had been allowed to mine stone and aggregate products including sand despite not having required approvals (i.e.: CUP) as required for new extraction activities in the AG zoning district. In short, it is because of this opinion, that staff was promoting the nonconformity agreement.

At this point, Mr. Espinosa reviewed the contents of the proposed agreement, again as found on Exhibit B of the permanent minutes.

In concluding, he noted that the Commission was being presented with a significant amount of information to digest this afternoon. He emphasized that, given the nonconforming status of Biesanz; staff felt that the agreement would promote minimal performance standards to the use.

In response to a question from by Commissioner Davis, Mr. Espinosa responded that official approval of the agreement was not being sought this afternoon. As such, opinions could change between now, and the point at which the document is forwarded to Council for consideration.

PLANNING COMMISSION MEETING MINUTES

JUNE 25, 2012

PAGE 5

In response to a question from Commissioner Eyden, Mr. Espinosa noted that pursuant to the proposed agreement, the EAW requirement would only apply to sand excavation outside of the 2011 mine footprint shown on page 15 of the agreement. The agreement would not extend to stone extractions.

In response to a question from Commissioner Gromek, Mr. Espinosa stated that although grandfathering provisions work very well as applied to buildings, the application to something like mining operations is a bit more complex. In this case, given that mining operations are a diminishing asset, staff feels that if controls are needed, these are best implemented through something like a nonconformity agreement, rather than a conditional use permit.

Commissioner Eyden stated that she was a bit uneasy at this point with the proposed agreement in that it does not address dust monitoring. Given earlier testimony it appeared to her that a secondary effect of the quarry was that it was generating dust that was settling in residential developments adjacent to the quarry. She emphasized that this type of issue needs to be addressed before forwarding the agreement to Council for consideration.

Commissioner Davis noted that the issue of dust can be a bit illusive in definition. Although she understood that mining operations may generate dust to a certain extent, she questioned whether the dust, experienced by neighbors adjacent to the Biesanz operation was related to that operation or to some other source. Mr. Espinosa further noted that if the source of dust is defined, staff can address the problem.

Commissioner Eyden stated that she felt there were scientific monitors in existence that could appropriately measure ambient dust levels. Again, she suggested that some form of measurements be established as part of the nonconformity agreement. Chairman Porter observed that if dust is evolving from the mining operation, it is evolving from road beds as they dry out. He did not feel that this was an issue with sand which is being extracted from the site since it was wet when this occurs. He further emphasized that Biesanz is a quarry which has, historically, mined not only stone but sand and aggregate materials for over 100 years. In his opinion, he did not feel that is what was occurring at the site at this time is different than how the site has been used for decades. He was curious as to why it is an issue at this point. He further noted that comments have been made to the fact that Biesanz has employed new equipment to process sand extracted from the site. In his opinion, he did not feel that new equipment translated into an expanded operation.

Commissioner Buelow echoed concerns presented by Commissioner Eyden in that a method of measuring ambient air quality should be a part of the agreement. Through these measurements, the agreement should also identify acceptable standards for dust control and how problems will be mitigated.

On a recent trip through Chippewa Falls, Mr. Buelow noted that he had passed a sand processing operation which, appeared to him, to be generating a fair amount of dust.

PLANNING COMMISSION MEETING MINUTES

JUNE 25, 2012

PAGE 6

Again, he was not stating that problems will exist. Rather, if they should exist, some method of mitigating the problem should be identified.

Commissioner Davis felt that dust issues at the Biesanz site could be adequately mitigated by simply ensuring that roadways are watered.

Chairman Porter stated that given the absence of the nonconformity agreement, Biesanz does not operate in a vacuum. At present, there are a number of entities that monitor and regulate every aspect of the operation.

At this point, Chairman Porter opened the second session of public comments.

Kim Sharpe noted a number of concerns with the draft nonconformity agreement. These included:

- The lack of any reference related to traffic/traffic flow to and from the quarry.
- The lack of dust control monitoring requirements and mitigation standards (should problems occur).
- Although hours of operations are mentioned, he suggested that the distance of the mine from adjoining residential development be a consideration in establishing these.

Marie Kovesci noted that blasting, compounded by prevailing winds through the area, can have an adverse affect on adjoin residential development to the Biesanz site. Another concern she had related to the depth of frac sand mining activities. At present, activities were being conducted within the Jordan sandstone level. She had concerns that this activity could lead to potential ground water pollution. She suggested that this be a consideration in standards pertaining to the Biesanz site.

Jim Gurley, 22505 Betty Jane Drive, Winona, thanked the Commission for maintaining an opened mind to comments that are being made. As stated by others, he emphasized that the interest in this issue directly relates to maintaining as high as an environment as can be achieved in the Winona area.

James Johnson, 802 West Broadway, stated that he felt more information was needed before the agreement could be forwarded to Council. In part, he strongly suggested that staff solicit a legal opinion from the City Attorney pertaining to the nonconformity status of Biesanz Stone. In his opinion, the issue needs more study and he did not feel it needed to be forwarded to Council until a later date.

Tammy Palubicki, 394 Pleasant Hill Drive, noted that she had resided in Knopp Valley for approximately 13 years. During that time, although she has experienced blasting impacts, these activities picked up significantly in 2011. It was not until then that people became concerned not only of the impacts of the blasting, but also of the dust, and other issues related to blasting.

Alice Keller, 407 Pleasant Hill Drive, noted that she and her husband had been part of the development team for the Knopp Valley Development. She emphasized that the

PLANNING COMMISSION MEETING MINUTES

JUNE 25, 2012

PAGE 7

Planning Commission had approved the development in the early to mid 1970s and that blasting was not an issue at that time.

Janel Schultz, 406 Pleasant Hill Drive, stated concerns with mining and processing machines. She suggested that the hours of operation for the Biesanz mine be limited to a 12 hour period between 6 am and 6 pm rather than the currently proposed 6 am to 10 pm timeframe.

There being no other person present to speak further, Chairman Porter called for other business.

Other Business

In response to a question from Commissioner Eyden, Mr. Espinosa responded that the Commission's next meeting will be held on July 9th. In addressing potential speakers, he suggested that staff coordinate this issue rather than requiring formal applications and approval by the Planning Commission. Commissioner Eyden stated that she had asked Dr. Frank Bures to speak to the Commission at its next meeting. The consensus of those present was that coordinating speakers through staff would be a bit more user friendly than what had been proposed. This concept was supported on the basis that speakers are limited to a maximum of 20 minutes speaking time and that speakers provide bios as to what their expertise is in addressing specific issues.

Adjournment

There being no further business to come before the Commission, the meeting was adjourned.

Mark Moeller
City Planner

Exhibit A

Planning Commission – Biesanz status

Thank you for your time and the opportunity to present to you today.

We are residents and taxpayers, living in the valleys adjacent to Biesanz's mine in the City of Winona. This includes over 440 residential dwellings.

This new and expanded business has had a negative impact on our neighborhoods. Blasting, dust, traffic and noise have decreased our quality of life. Biesanz's has historically been a good neighbor, until they changed their business model to Frac sand mining.

We believe the city of Winona has a legal obligation to protect their citizens and their property. The city is still issuing building permits in these neighborhoods today, indicating the city continues to believe this is a good place for a residential neighborhood.

We disagree that Biesanz should be Grandfathered in:

- We have requested the city attorney provide a written legal opinion on Biesanz's grandfathered status concerning scope, ownership, and expansion
 - Regarding scope: This is a new business, now extracting Frac sand. Many Counties in MN have established moratoriums to provide more time to better study this new industry and its impact on the area; this includes the City of Winona with a one year moratorium as well. This industry extracts crystalline silica, a known carcinogen, as described last week by the MN Department of Health, a material before not extracted in high volumes.
 - This change in scope started in 2011 when the business focus went from veneer rock to Frac sand
 - More than 100 blasts in a 4 month period, this has never been done before at Biesanz
 - These are high intensity air over-pressure blast waves shaking homes and carrying dust into our neighborhoods
 - Moving 1000's of tons of overburden by trucks to adjacent property, this also has never been done before at Biesanz
 - This truck traffic generates both dust and noise moving across our valleys.
 - Hundreds of semi's per day are hauling frac sand down township roads into Winona, this has never been done before at Biesanz
 - Regarding ownership: We believe there is a change in principal ownership of Biesanz's, which the city attorney will also research
 - Regarding expansion: A number of expansion factors have also occurred in 2011
 - Additional land has been acquired
 - New equipment purchased (pictures)
 - 68,000 lb, Sandvik QA340 sand screening machine (approximately 58 x 55 x 20 feet footprint)

- 22,000 lb, 80 foot, Edge MS80 conveyor which can stockpile sand up to 37 feet.
 - Biesanz's also received a Winona County CUP to stock pile 1000's of tons of overburden on 155 acres, so they can get access to the frac sand (pictures)
- Again we, your resident, disagree with the Cities Grandfathered position
- We have also requested the Biesanz Permit include a re-open clause. This would include:
 - Any conditions agreed upon by the Blasting Committee in the future can be added to the permit
 - Please understand the scope of the blasting committee meeting is only blasting; ~~dust~~ dust, noise, hours of operations, property value were not allowed to be discussed at these meetings.
 - Any information from the city attorney that may impact the permit needs to be included
 - Any additional conditions / ordinances would be added to the permit as well
- We believe there should be established a fund to handle any cost impact associated with property damage or home value depreciation
 - This has been done in other cities to handle the impact of reduced property values due to the mining activity
 - I have an example of a similar commitment from a mine in the Town of Howard, WI (Eau Claire, WI)

The county has wisely put in-place CUPs and conditions to help protect their residence, environment and quality of life. Many Counties and Cities are putting in new ordinances and conditions to better control this industry and reduce the impact on their communities; Biesanz should not be an exception, now that they are in the frac sand business.

Winona City is adopting the Winona County conditions and is working to align the CUP conditions used in the County with the City of Winona ordinances and conditions. Please allow this process to finish so we do not adopt an inaccurate or incomplete set of conditions. A good example is in the Biesanz "nonconformity agreement" before you, number 4, calls out hours of operation to be 6 to 10, however I believe the city sand processing is 7 to 7. The County does call out 6 to 10, but the mine is 1000 feet from a home vs. the 450 for Biesanz. The conditions need to be looked at as a whole

I ask the Planning commission not to accept these conditions for a "nonconformity agreement" with Biesanz. With Biesanz operating as a frac sand mine, they should fall under the same conditions as any other frac sand mine operation.

Thank you again for your time

PLANNING COMMISSION

AGENDA ITEM: 3. Sand Moratorium Study: Air Quality

PREPARED BY: Carlos Espinosa

DATE: July 9, 2012

Summary

During the past year of discussion about frac sand and air quality, one of the recurring themes is the need for more information about the health effects of silica in the ambient air. This information will likely come from future ambient air monitoring that specifically considers the amount of crystalline silica in the air (such as the monitoring currently planned for a sand processing facility in Jordan, MN). Until this information is provided and analyzed by the appropriate state or federal agency, the following quote from the 2011 Wisconsin DNR's Silica Sand Report will remain to be true:

A recurring theme from the literature review and survey is that very little conclusive information exists regarding sources, controls or levels of silica present in ambient air. This lack of data means it is not currently possible to determine conclusively whether or to what extent the quantity, duration or types of silica emission in the state [Wisconsin] may be a public health concern (pg. 2).¹

However, this does not mean that the City cannot require ambient air monitoring for frac sand facilities in Winona. At this time, the City is talking with air quality consultants and investigating different air monitoring strategies for potential inclusion in City Code. But air quality monitoring is very complex, and when designing an air monitoring program a number of questions have to be answered. These questions include:

- Where should the samples be taken from?
- Where are the analyses of the air samples going to be conducted?
- What is the limit of detection?
- How long is sampling conducted and at what air flow rate?
- How frequently should sampling be performed to account for different conditions in the facility and in the environment?

The City does not have the resources or expertise to answer these questions (or properly review answers and data related to these questions). The resources and expertise for air quality monitoring lie with air quality consultants and the MPCA. Thus, if air monitoring requirements for frac sand operations are added to City Code, it will be

¹ See: <http://dnr.wi.gov/air/pdf/finalsilicareport.pdf>

the responsibility of frac sand operations (most likely through consultants) to conduct air quality monitoring according to state (MPCA) specifications.

Another approach to ensure that ambient crystalline silica from frac sand operations does not become a public health issue is to require that all the sand is wet (above 3% moisture) when being handled in Winona. This is a preventative measure which can be done by moisture testing sand at all frac sand operations (existing and new) in the city.

The Effects of Moisture Content in Sand

A minimal amount of dust is created by frac sand when it is wet. According to a document from the Texas Commission on Environmental Quality, "Wet to saturation is a condition where water is observed running the material or wet sand material can easily be clumped. These conditions would be concurrent with an expected moisture content or greater than 3%."² This is important because according to the Environmental Protection Agency (EPA):

Emissions [including crystalline silica emissions] from the production of sand and gravel consist primarily of particulate matter (PM) and PM less than 10 micrometers (PM10) in aerodynamic diameter that are emitted by many operations at sand and gravel processing plants, such as conveying, screening, crushing, and storing operations. Generally, these materials are wet or moist when handled, and process emissions are often negligible (pg. 2.-11).³

Thus, when sand has a moisture content greater than 3%, the potential dust emissions produced by moving sand around are vastly reduced. If frac sand operations maintain a moisture level of sand at greater than 3%, the potential for public health risks from crystalline silica dust are also vastly reduced.

Sand at existing frac sand operations in Winona already has the following approximate moisture contents:

1. Mined/Unprocessed sand = 5% - 15%
2. Washed sand = 15% - 25%
3. Stockpiled sand = 4% - 15%
4. Stockpiled sand during winter 4% - 5%

A requirement for 3% moisture content would presumably reflect these existing conditions and provide publicly available information about moisture content for sand operations in Winona.

² See: http://www.tceq.texas.gov/assets/public/permitting/air/memos/wetsand_memo2_09.pdf

³ See: <http://www.epa.gov/ttn/chief/ap42/ch11/bgdocs/b11s19-1.pdf>

Implementation

A requirement for sand moisture testing would best be placed in the Performance Standards section of the zoning ordinance. Because concerns about Particulate Matter are not limited to frac sand, the specific regulation should potentially apply to other commercial operations in Winona through a performance standard such as the following:

Moisture testing of sand or other materials with the potential to produce Particulate Matter emissions may be required to ensure that moisture levels are above 3%.

In this manner, moisture testing can be required of all frac sand operations (because of concerns about crystalline silica emissions), and other commercial operations as appropriate. The “appropriateness” of requiring other commercial operations to conduct moisture testing may be determined by: 1) Examining evidence of visible dust (indicating dry conditions), 2) The level of activity (Is material transfer occurring every day?), and 3) The unique characteristics of the operation (Is it enclosed? How far away is it from residential property?).

Test Frequency

Individual sand operations would be responsible for sampling moisture content on a weekly basis (when operating) for all non-enclosed sand on their property. This may involve moisture testing of stockpiles, or testing before or after sand is loaded into a container (e.g. truck, rail car, or barge).

Test Method

The test method to determine moisture content would be from the American Society for Testing and Materials and involve weighing a wet sample, heating it, and then weighing it again. If the moisture content is less than 3%, the operation would be required to use a moisture addition device at or immediately prior to loading or processing (e.g. watering stockpiles or wetting sand before it is run through conveyors). Records of moisture testing would be required to be kept by operators and provided to the City.

Enforcement

In addition to asking for copies of test records, the City may also randomly check sand using a probe (see Attachment A) as a general measure of moisture content. If readings are below 3%, the City could ask that moisture be added prior to loading or processing. If readings are consistently below 3%, additional enforcement action would require using the ASTM test method.

Next Steps

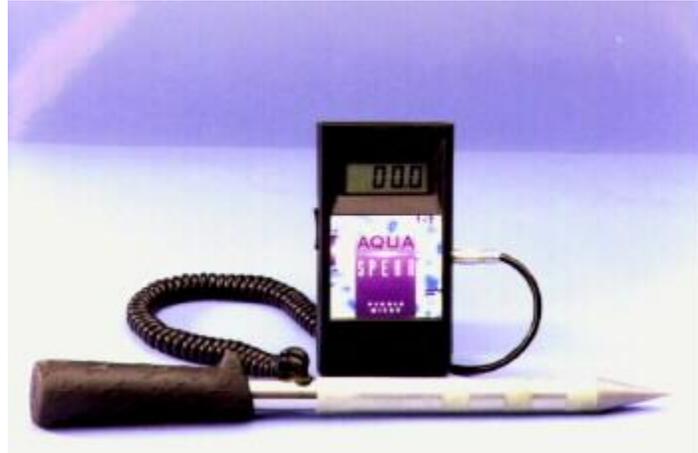
Staff requests the Planning Commission review and comment on the moisture testing approach. If suitable, a motion to include moisture testing (as detailed above) in proposed ordinance modifications related to frac sand would be in order.

Commissioners may also make other recommendations regarding air quality after hearing presentations from speakers and input from those present at the meeting.

Attachments:

- A) Example moisture probe

AQUA-SPEAR



Aqua-Spear

Moisture Indicator

The Aqua-Spear is a totally new concept for measuring the moisture content of bulk granular materials. Using state of the art electronics, the Aqua-Spear measures the Dielectric content of the material to determine its moisture content.

The stainless steel probe is simply inserted into the material and the percentage moisture content is displayed instantly on the LCD.

The Aqua-Spear has been used successfully on a wide range of materials including sand, ceramic powder, cement, paracetamol etc, where it is possible to achieve an accuracy of $\pm 0.1\%$.

The Aqua-Spear has been designed as a moisture indicator and has a valuable role to play in identifying areas for further investigation.

Moisture gradients usually exist in stockpiled materials and although test methods like the oven test or infra-red balance offer an acceptable degree of accuracy, they are much too slow to allow enough samples to be tested at different points in the material to build up an accurate moisture profile. With the Aqua-Spear you will no longer have this problem as test results are available instantly and therefore several checks can be carried