REPORT ON WASTEWATER FACILITY CAPACITY EVALUATION QUAIL VALLEY LAKE SUBDIVISION JEFFERSON CITY, MISSOURI

September, 2007

INTRODUCTION

It is necessary to determine if additional residential hookups can be made to the Quail Valley Lake Subdivision Wastewater Treatment Facilities that are operated by Aqua Missouri, Inc. The Quail Valley Lake Wastewater Collection System consists of small diameter sewer pipe referred to by the designer as a Variable-Grade, Gravity Sewer (VGS) System. The Wastewater Treatment Plant (WWTP) is a package type extended aeration mechanical plant. Following is a partial listing of reports and letters providing information regarding the capacity of the Quail Valley Lake wastewater facilities with copies attached to this report. This and other information concerning this project have been evaluated.

BACKGROUND INFORMATION

An Engineering Report prepared by G. J. Harms & Associates, Inc., dated March 6, 1984 proposes that a Variable-Grade, Gravity Sewer (VGS) system be used at Quail Valley Lake Subdivision.

The Design Criteria for Quail Valley Lake Subdivision dated May 27, 1992 signed and sealed by E. A. Mueller, P.E. indicates a mechanical treatment plant within concrete cells will be constructed to serve 80 homes.

A September 28, 1993 letter to Ed Storey from Capital Utilities, Inc., a contract operations firm, reports the WWTP is essentially completed and operating. The letter indicates that "Our maintenance responsibility does not include the Customer's service line or, in the case of Quail Valley Lake, the aeration basin. You should be aware that these aeration basins located at each home are essential to the proper operation of the collection system" The letter indicates that solids should be removed on a three(3) to five(5) year schedule.

In a letter dated September 1, 2004 to Edward Storey from Brenda Bethel, P.E., MDNR, it is stated "...if additional hydraulic flow is added to the treatment plant, 10CSR 20-8.160(4)(A) requires clarifiers following the activated sludge process to have side water depths of at least 12 feet to provide adequate separation zone between the sludge blanket and the overflow weirs."

A letter dated March 7, 2005 to Aqua Missouri, Inc. from Wilbur Krogstad, P.E. indicates that Edward Storey would like to add an expansion to the WWTP. The letter indicates that "Since the present system is only permitted for part of the planned development the expansion will expand the plant to allow permitted operation for the planned total development. The letter goes on to propose a 12,000 gallon per day expansion.

A letter dated May 5, 2006 to Edward Storey from Keith B. Forck, P.E., MDNR, in response to a March, 2006 letter from ReSource Institute and a meeting. This letter includes a statement that options to upgrade the clarifier of the existing treatment plant will be submitted and points out that inflow and infiltration of the existing collection system was not addressed.

A follow-up letter to Tena Hale-Rush, Aqua Missouri, Inc., from Gregory G. Haug, P.E., ReSource Institute, addressed the Treatment Capacity issue. It states "Given the changes that can occur in a wastewater treatment system, something less than the calculated maximum loading may be appropriate. As per previous discussions, we believe it is reasonable and appropriate to add an additional 10 homes to the system over the next couple of years. Monitoring of the loadings and treatment plant effluent results will be performed to determine impacts of new hookups and to see if addition capacity is available beyond 90 homes. The letter also concludes that inflow and infiltration "...is not suspected to be a significant problem for the Quail Valley Lake Wastewater Treatment Plant." This was based on evaluation of instantaneous treatment plant effluent flow data, a judgment that the collection system consists of a limited length of sewer lines and subdivision by-laws that prohibit direct connection of inflow sources.

DISCUSSION

A review of the above information reflects a continuing concern with the hydraulic capacity of the system. In the Engineering Report dated March 6, 1984 it is proposed that a Variable-Grade, Gravity Sewer (VGS) system, be

used at Quail Valley Lake Subdivision. The system proposed and constructed includes sections with negative grades resulting in permanently surcharged sections of small diameter sewer lines. The report states that this system was proposed to be utilized because it would cost only about 20% of the cost of a conventional gravity sewer system. A DNR review comment letter requested that serving more lots with conventional 8-inch sewers be considered, however this was not done.

The cost of installation of the variable grade gravity sewer system installed at Quail Valley Lake was dramatically lower than a conventional sewer system, especially in area such as Quail Valley Lake with shallow bedrock. This system could only work well with extreme care in design, construction and maintenance. It is also imperative that a limited number of connections be made because of the low hydraulic capacity of the system. The operators of the Quail Valley Lake System have learned that the system does not have adequate hydraulic capacity in wet weather. Cleanout caps have had to be attached in order to keep them from being dislodged by wastewater backing up in the system.

Experience has shown that generally approximately half of the inflow and infiltration (I & I) into wastewater collection systems occurs on private property. At Quail Valley Lake, the potential for I & I from private property is increased by the utilization of a large tank on each property that needs to be cleaned out on a regular basis. The large surface area of these tanks and subsurface openings create an increased opportunity for I & I.

In addition, a lack of regular cleaning of the septic tanks located on each residential property has likely resulted in the discharge of solids and grease into the VGS sewer system. It can be expected that this has compromised the already limited flow capacity of the VGS system.

The utilization of WWTP effluent flow data collected once per day to evaluate I & I is not valid. Data collection for I & I flow determinations are normally done on 15 minute increments over several months during the wettest period of the year. The data needs to be collected from the actual sewer lines and not after flow equalization occurs in a WWTP. Additionally, in this particular system, it is known that the flow capacity is not adequate to transport the wet weather flow, so measuring downstream of bottlenecks in the collection system cannot provide accurate information.

A construction permit must be obtained from the Department of Natural Resources, Macon Regional Office, by the developer for a sewer line extension to serve the majority of the lots proposed for the subdivision expansion. This office of DNR can not issue the construction permit unless it is demonstrated that the WWTP has capacity for the additional connections.

A letter from Brenda Bethel, P.E., the lead review engineer in the Macon office, raises a number of concerns regarding adding additional flow to the Quail Valley Lake Subdivision WWTP, and calculates the number of homes that could be served at approximately 69. She also indicated that larger clarifiers will be required if additional flow is added to the plant.

Another complicating factor is that current regulatory procedures require an evaluation of Water Quality impacts prior to a WWTP expansion or even a change in the permitted capacity of an existing WWTP. The scrutiny that a proposed permit change receives increases at a flow rate of just 500 gallons per day more than the current permitted flow for Quail Valley Lake Subdivision.

CONCLUSION

The existing wastewater collections system is over taxed at present. As a result it would not be advisable to connect new sewers serving additional residential areas to this system. It is a gamble to assume the reserve capacity exists in the WWTP for additional flow. While it may be reasonable to connect the few existing undeveloped lots intermingled in the present developed area, adding additional sewers and new residential areas is not advisable. Also, the Department of Natural Resources may determine that they cannot issue the construction permit for additional sewers without a WWTP expansion or the application of more stringent effluent limitations. As a result the WWTP would need to be expanded or additional treatment capability added, or both.

Randy C. Clarkson 10-12-07
Randy C. Clarkson, P. E.

Exhibit #1
6 pages

missouri registered
ENGINEERS
LAND SURVEYORS

PRELIMINARY ENGINEERING REPORT
SANITARY SEWAGE SYSTEM
QUAIL VALLEY SUBDIVISION
COLE COUNTY, MISSOURI

MARCH 1983

REVISED
MARCH 28, 1983

REVISED
MARCH 06, 1984

p.o. box 52 eldon, mo 65026 (314) 392-3312

PRELIMINARY ENGINEERING REPORT
SANITARY SEWAGE SYSTEM
QUAIL VALLEY SUBDIVISION
COLE COUNTY, MISSOURI
March 1984

SCOPE

This report will explore the technical feasibility of sanitary sewage collection and treatment for Quail Valley Subdivision.

LOCATION

Quail Valley Subdivision is a 113 acre subdivision located 4½ miles southwest of Jefferson City, Missouri on Missouri Route C. The subdivision is situated in the West 1/2 of the Northwest 1/4 of Section 29 and the East 1/2 of the Northeast 1/4 of Section 30, Township 44 North, Range 12 West, Cole County, Missouri.

The subdivision is being developed by the Greater Jefferson City Construction Company, Inc. of Jefferson City. The 135 lots range in size from approximately one-half acre to one acre.

The general topography of the subdivision can be classified as rolling. Soil overburden ranges between four (4) and six (6) feet over a large majority of the subdivision.

TECHNICIAL FEASIBILITY

The subdivision consists of a total of 135 lots. 81 lots have been platted as the first phase development.

The design of the sanitary sewage system for the subdivision is based on the following:

No. of Lots	=	135
Persons per Lot	=	3.5
BOD_5 per Person per Day	=	0.22 lb.
Hydraulic per Person per Day	=	75 gal.

It would be costly to install a central sewage system at the on-set of the project. For this reason, 1,000 gallon septic tanks and absorption fields would be installed to serve a maximum of of 40 lots or 30 percent of the total development. The actual length of the absorption fields will be sized according to percolation test results but will probably be in the range of 150 to 250 feet.

As development nears 40 lots, the central sewage system, including treatment facility, will be initiated. This will include elimination of the absorption fields and connection of the septic tanks to the central system. In the total development, 66 lots will be served by septic tanks and 69 lots will be served by conventional 8 inch sewers.

The system used for the connection of the septic tanks to the conventional system is "Variable-Grade, Gravity Sewers" (VGS)[1]. The following design criteria is used for the VGS system.

$Q_d = A \times N + 10$ gal./min.

A = 0.8 gal/min, based on 75 gal. per person per day

N = Number of connections.

The Full Pipe Flow is based on the Hazen-Williams formula with

a "C" factor of 150 for PVC Pipe.

$$Q_{fp} = \left(\frac{\text{slope}}{r}\right)^{0.54}$$

Slope = 0.5% min. for all VGS.

r = Constant of proportionality

Standard septic tanks can be utilized in the VGS system. However, it is recommended that a liquid storage tank be added, the capacity of which should be approximately 200 gallons. This tank can be incorporated into a septic tank. The transfer pipe between the tanks must be baffeled to insure that the minimum amount of solids are transferred from the septic tank to the liquid storage tank.

The criteria used to determine if lots were to be served by the VGS system or the conventional system was to select the lots which were to be sold first. Basically these are the lots around the Lake. As stated, only 30 percent, or 40 lots, will utilize absorption fields. However, after the VGS system was laid out, there are additional lots that can be more feasibily served by the VGS system. To serve only 40 lots with the VGS system, and the remainder with a conventional system, would require the construction of conventional sewers parallel to VGS. See Attachment I and II for the subdivision layout and the VGS and conventional sewer (CS) systems layout.

The treatment plant for the total development would be an extended aeration-hopper bottom based on the following criteria.

66 Lots (VGS) x 3.5 people x 0.22 BOD_5 x 80%* = 40.7 lbs. BOD_5

*20% reduction in septic tanks

69 Lots (CS) x 3.5 people x 0.22 BOD_5 = 53.1 lbs. BOD_5

TOTAL = 93.8 lbs. BOD_5

Based on 12.5 lbs. BOD_5 per 1,000 cubic feet, the capacity of the treatment facility will be 56,130 gallons.

The treatment facility will be equipped with a solids trap and chlorinator.

There are two pump (lift) stations in the VGS system and two in the CS system. The pumps in the VGS system need not be capable of pumping raw sewage but must be able to pump a small amount of sludge. The CS system pumps will be capable of pumping raw sewage and will be either grinder pumps or pumps capable of pumping four inch solids.

OPERATION AND MAINTENANCE

Periodic maintenance can be expected for the CS system. The lift stations will need to be inspected on a regular basis.

The one unanswered question about the VGS system is the frequency that the septic tanks will have to be pumped. Normally septic tanks need to be pumped every three or four years. It will be essential that large amounts of sludge not be permitted to overflow into the liquid storage tanks and that septic tanks be inspected on a regular basis until records can be developed and a history of the tanks established. Thw two lift stations in the VGS system will need to be inspected on a regular basis to insure their proper operation.

CONCLUSIONS

The VGS and CS systems consist of the following quantities of materials.

VGS system
8,315 feet - 2", 2½", & 3" pipe
2 Pump Stations

CS system
12,605 feet - 8" pipe
2 Pump Stations

The construction cost of the VGS system will be approximately 20 percent of the cost of the CS system. However, the maintenance cost of the VGS system will be higher because the septic tanks will have to be pumped periodically.

For the development to be economically feasible, the initial development costs must be held to a minimum. This can be accomplished through the installation of septic tanks and absorption fields for the first 40 lots or 30 percent of the development. After the development of 40 lots, all absorption fields will be abandoned and the septic tanks will become a part of the central sewage system.

This system will provide a discharge that meets Cole County's and the Missouri Department of Natural Resources' criteria.

REFERENCES

1. Design Workbook For Small-Diameter, Variable-Grade, Gravity Sewers.
JOHN D. SIMMONS AND JERRY O. NEWMAN
United States Department of Agriculture
Agriculture Research Service
Clemson, South Carolina

Exhibit # 10

May 27, 1992

AUG 24 1992

TO WHOM IT MAY CONCERN:

Following is the Design Criteria Summary for Quail Valley Subdivision located in Sections 29, 30, Township 44 North, Range 12 West of the 5th P.M., Cole County, Missouri, owned by Ed Storey who is an on site owner.

The owner will construct a mechanical treatment plant contained within concrete reinforced cells as per plans enclosed. This plant will have future expansion capability.

80 Homes with Garbage Grinders @ 3.7 persons = 296 persons @ 0.221 lb/day/per = 65.416 lbs B.O.D.5. All homes in this subdivision are or will be served by single family aeration plants, so all effluent will be partially treated and contain few solids. It is anticipated that 46 to 50 lbs B.O.D. 5 will arrive at plant to be treated. All service lines from the homes will be equipped with cleanouts and valves to insure of no backflow problems.

Due to the existing Quail Valley Lake, elevations are somewhat limited. (See Plans And Prior Engineering Report) Four low head in line pump stations are proposed to deliver the effluent to the treatment plant located near the lowest point in the subdivision, which is below the Quail Valley Dam at the toe of slope. (See Enclosed Partial Quadrangle Map)

Collection will be by 3" to 4" diameter pipe, following variable downhill grade unless otherwise noted on the plans. All pipe will be Schedule 40 P.V.C. with tight joints, unless otherwise noted. (See Plans)

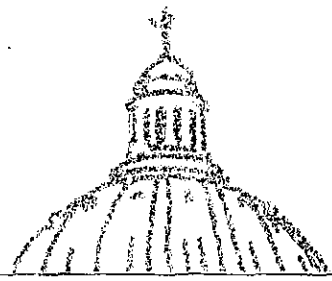
E. A. Mueller PE.

STATE OF MISSOURI
EWING A. MUELLER
NUMBER E-14558
REGISTERED PROFESSIONAL ENGINEER

Date Rec'd 8-6-92 Plat # 2453
Lot # 26-1746 Date Issued 11-3-92

Capital Utilities, Inc.

P.O. Box 7017
Jefferson City, MO 65102
(314) 634-2699



September 28, 1993

Ed Storey
2916 Foxdale Drive
Jefferson City, MO 65109

File

Re: Sewer Service - Quail Valley Lake Subdivision

Dear Mr. Storey:

This letter is to inform you of the status of your wastewater collection and treatment system currently under construction in the Quail Valley Lake Subdivision and to also introduce you to Capital Utilities, Inc. We understand you have been provided on-going updates as to the status of the system through your Association newsletter. Hopefully, the following information will contain no major surprises.

The wastewater treatment facility located below the Lake is essentially completed and operating with such items as fencing and final landscaping yet to be completed. The facility is designed to accommodate the wastewater loading generated by the complete development of your subdivision. The treatment method will meet the regulatory requirements of the Missouri Department of Natural Resources (MDNR). The wastewater collection system is approximately 30% complete with homes on the west side of the Lake now being connected to the system. Construction conditions permitting, all residents should be served by the end of the year.

The system is being constructed by the developer of Quail Valley Lake, Mr. Ed Storey, who has retained local contractors for the actual installation of the collection piping and treatment system. Any questions relating to the construction as it affects your particular property should be directed to Mr. Storey. The system, when completed, will be owned and operated by Capital Utilities, Inc.

Capital Utilities is an investor owned, Missouri PSC regulated, water and sewer utility company which was initially formed in Cole County as the successor to the Cole County Regional Sewer District. We presently own and operate twenty-seven (27) small wastewater systems in Cole and southern Callaway Counties providing sewer service to approximately 700 residences. Our rates and operating rules are regulated by the Missouri Public Service Commission (PSC) with reporting requirements to both that agency and the MDNR.

EXHIBIT
2

The two (2) principals of Capital Utilities are local area residents with over forty (40) years of combined experience in the water and wastewater field. They are professionals in their field and can assure their customers that they will be dealt with in a courteous and professional manner. You are encouraged to contact our office with any questions or comments that you may have regarding your sewer service.

The following informational items are being provided in an attempt to address many of your questions:

- The sewer service charge as currently approved by the Missouri PSC is a flat rate of $17.20 per month.

- Billing invoices are normally mailed on or about the 25th of each month for service to be provided the following month.

- Payment is due the 15th of the service month. A $5.00 late penalty may be assessed to delinquent accounts.

- Your first billing should be for the month following the month in which you were actually connected.

- An "Application for Service" will accompany the initial billing invoice. Please complete and return with your first payment. The information on this form is important in that it allows us to contact the resident(s) in case of an emergency.

- The day to day operation of the facilities are performed by a local contract operations firm, Helms Environmental Services, Inc. Your inquiries to this address and/or telephone number will normally be taken by a Helms representative. Emergency calls are answered 24 hours a day, seven (7) days a week. You are encouraged to contact the office during the hours of 8:00 A.M. to 5:00 P.M. to discuss any issues not of an emergency nature.

- Our local office is located at 312 Lafayette Street and is open during the 8-5 hours noted above. You are invited to stop by and discuss any aspect of your wastewater service.

- Our maintenance responsibility does not include the Customer's service line or, in the case of Quail Valley Lake, the aeration basin. You should be aware that these aeration basins located at each home are

essential to the proper operation of the wastewater collection system. They will require routine maintenance with the periodic removal of accumulated solids the major responsibility. Your aeration basin should have solids removed on a three (3) to (5) year schedule. This service can be provided by our Company or any qualified septic tank hauler.

Again, should you have any questions regarding your sewer service, feel free to contact us. We feel being responsive to the concerns of our customers is a very important building block to establishing a good, long lasting relationship.

Sincerely,

Milton E Leeds

CAPITAL UTILITIES, INC.

Bob Holden, Governor • Stephen M. Mahfood, Director
STATE OF MISSOURI
DEPARTMENT OF NATURAL RESOURCES
www.dnr.mo.gov

5.200 Aqua Missouri - Quail Valley Lake
Cole County

September 1, 2004

Mr. Edward Storey
2916 Foxdale Drive
Jefferson City, MO 65109-9208

Dear Mr. Storey:

The Department of Natural Resources was contacted by you concerning the Quail Valley Lake subdivision wastewater treatment facility in Cole County. The concern was that you have another 22 lots that you would like to develop and sell, but the entity that operates the treatment facility has indicated to you that you could not connect another 22 homes without a new facility or upgrading the existing facility. On July 9, 2004, I spoke with you regarding the concerns you have with the wastewater treatment facility. On July 16, 2004, Mr. Keith Forck of the Northeast Regional Office and I met with Aqua Missouri, the continuing authority of the wastewater treatment facility, to address your issues. I have summarized the findings of your questions and they are listed below:

Mr. Story Concern 1: He started the development and required aerated (septic) systems at each home. A centralized system was built after 40 homes were established. The subdivision continues to have aerated (septic) systems and only the effluent and not the solids are sent to the plant. He believes a 35% credit should be given to the removal of five-day biochemical oxygen demand for having the septic tanks at each home.

Response to Concern 1: Missouri Clean Water Commission regulation 10 CSR 20-8.020, "Design of Small Sewage Works," under (13)(A)(2)(C) indicates that, "Where complete primary treatment is provided for any waste stream entering the pond system, the BOD loading of that stream may be reduced by thirty-five percent (35%) when determining the required pond system surface area or detention time." In general, it is considered that a septic tank can provide influent BOD reductions by removing readily settleable solids and floating

material. The percent removal of BOD varies on the design of the septic tank, for example a two-compartment tank over a single compartment tank. The percent removal of BOD also varies on the operations and maintenance the tank receives. Routine maintenance on the tank would include performing inspections of the tank and have the tank pump out to remove accumulating sludge, about every two to five years depending on population the tank is serving and if garbage grinders are in use.

In this case, the septic tanks are the responsibility of each of the homeowners on the system. There is no authority oversite for routine maintenance by a valid continuing authority. For design purposes, BOD reduction credit for septic tanks is given when a valid continuing authority oversees the septic tank operations and maintenance for all the septic tanks at the owners lots, or when an appropriate sized septic tank is located at the plant site and is operated and maintained by a valid continuing authority.

On July 16, 2004, a routine inspection was performed at Aqua Missouri – Quail Valley Lake wastewater treatment facility. It was noted that solids were accumulating on the bar screens. Also, Aqua Missouri commented that three main lift stations operated and maintained by Aqua Missouri had to change the pumps from effluent pumps to grinder pumps due to solids build up.

Mr. Story Concern 2: Aqua Missouri was approached to see if he could run tests to determine if the plant could treat the whole subdivision and Aqua Missouri said no. There is no cooperation from Aqua Missouri. The original engineer on the project states that the plant is expandable, but Aqua Missouri states they cannot expand the plant. Mr. Story wanted Murdon from St. James to test the plant and determine if it is expandable. He states he wants to know if he can expand the plant and if the answer is no, why.

Response to Concern 2: Aqua Missouri's comment to this concern was that there was no refusal, however, you would have to bear all costs and not Aqua Missouri.

Mr. Story Concern 3: He spent several hundred thousands on the plant and he just handed it over to Aquasource (Aqua Missouri).

Response to Concern 3: Aqua Missouri is a private sewer company that is regulated by the Missouri Public Service Commission. Aqua Missouri indicated that this issue is regulated under the Public Service Commission and mentioned that Aqua Missouri's tariffs can be viewed from the Public Service Commission's web page by going into the Electronic Filing and Information system. Please also review a Warranty Deed dated November 1, 2002.

The wastewater treatment facility appears to be four aeration tanks in series. Each aeration tank is approximately six feet by 12 feet by 10 feet. The total volume for the aeration tanks at the facility is 2,880 ft^3. The Missouri Clean Water Commission regulation 10 CSR 20-8.20(13)(B)(6) states,

"the aeration tanks shall be sized on the basis of an applied BOD load of fifteen pounds (15 lbs.) per one thousand (1000) cubic feet of aeration tank capacity per day. The design BOD loading rate shall include all recycle streams except return activated sludge." Furthermore, according to 10 CSR 20-8.020(13)(B)(6), the aeration tanks shall be designed to allow for twenty-four hour sewage detention time.

The Aqua Missouri – Quail Valley Lake subdivision system should handle 43.2 lbs. of BOD per day based upon the total aeration volume of 2,880 ft^3. Domestic waste treatment design is based upon 0.17 lbs. of BOD per capita per day, but when garbage grinders are in use in the area the domestic waste treatment design would be based upon 0.22 pounds of BOD per capita per day. Unless other data is available, domestic waste treatment design is based upon 3.7 residences per home. Based on this information, this would be an approximate 254 population equivalent and approximately 69 homes that do not use garbage grinders would be the capacity of the Aqua Missouri – Quail Valley wastewater treatment facility.

If a valid continuing authority is found to operate and maintain the septic tanks at each of the homes or an appropriate sized septic tank is placed at the plant, the capacity of the treatment facility could be estimated to have the ability to treat an increase in BOD. However, if additional hydraulic flow is added to the treatment plant, 10 CSR 20-8.160(4)(A) requires clarifiers following the activated sludge process to have sidewater depths of at least 12 feet to provide adequate separation zone between the sludge blanket and the overflow weirs.

Aqua Missouri has indicated that currently there are 78 connections.

If you have any questions, please contact me at (660) 385-8000 in the Northeast Regional Office, 1709 Prospect Drive, Macon, MO 63552.

Sincerely,

NORTHEAST REGIONAL OFFICE

Brenda Bethel, P.E.
Environmental Engineer III

BB/ks

c: Mr. Jim Hull, Water Protection Program
Mr. Peter Goode, Water Pollution Control Branch
Ms. Tena Hale-Rush, Aqua Missouri

Exhibit #20
2 pages

ADVENTURES WITH PROFESSIONAL
TECHNOLOGIES, L.L.C.
3363 ZENITH DR.
HOLTS SUMMIT, MO. 65043
PHONE/FAX; 573-295-4400

Mar. 7, 2005

Ref; Quail Valley Subdivision

plat

Aqua Missouri, Inc.
P.O. Box 7017
Jefferson City, Mo. 65102

Dear Mrs. Tina Hale-Russ

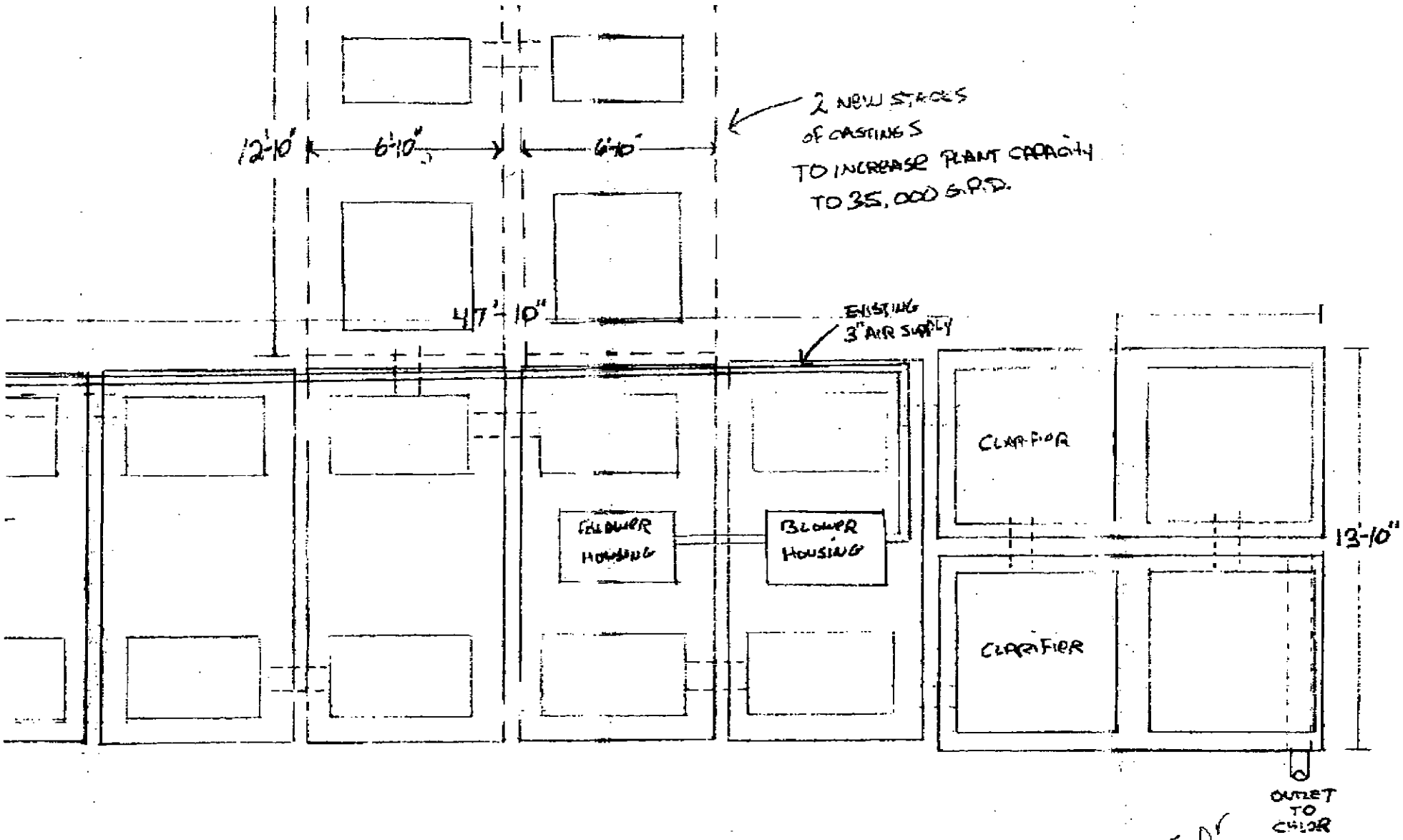
Mr. Edward Storey the owner and developer of the referenced subdivision would like to add an expansion the sewerage treatment facility that presently serves the subdivision. Since the present system is only permitted for part of the planned development the expansion will expand the plant to allow permitted operation for the planned total development.

The expansion is purposed to be by the same company that built and installed the initial plant and will provide storage and aeration for an additional 12,000 G.P.D. and the existing aerators motors will be increased from 5 H.P. to 7 H.P. and the miscellaneous improvements to complete the addition.

Approval is hereby requested for the purposed expansion so completed plans and all other approvals obtained for the permitted expansion. To complete any plans needed I request permission to access the existing facility to verify the dimensions and changes needed for these improvements.

Sincerely

WILBUR D. KROGSTAD, P.E.



23,000 GPD JET SEWAGE TREATMENT PLANT – EXISTING PLANT

PLAN VIEW

+"gravity"+

(3)

Lots = 105 or 106

STATE OF MISSOURI
Matt Blunt, Governor • Doyle Childers, Director
DEPARTMENT OF NATURAL RESOURCES
www.dnr.mo.gov

5.200 Aqua Missouri Quail Valley Lake
Cole County
#MO-0114081

May 5, 2006

Mr. Edward Storey
2916 Foxdale Drive
Jefferson City, MO 65109-9208

Dear Mr. Storey:

The Department of Natural Resources has received the March 7, 2006 letter from ReSource Institute following up on the March 2, 2006 meeting with you, Mr. Greg Haug – your engineer, and Mr. Mark Ludwig – your attorney. Representing the department at the meeting were Mr. Ed Galbraith, Mr. John Hoke, Mr. Refaat Mefrakis, and myself, Mr. Keith Forck.

During the meeting, the items of discussion were downstream water quality impacts – algae, nutrients, duckweed, chlorine residual, sludge in the stream, and how more houses could be connected to the existing treatment plant with little or no upgrade. Your letter highlights several action items discussed during the meeting. The department's response is below each action item.

1. A census was taken to develop the total number of people in the Quail Valley Subdivision. The result of this census showed that there are currently 229 people in the 77 homes.

   With Aqua Missouri's acceptance of more connections, the department would consider the lower population equivalent per house based on this actual survey data.

2. Water records from Cole County Public Water Supply District #1 showed a water usage of 425,900 gallons for 75 homes in the month of January.

   Was the billing period for the month actually 31 days?

3. The By-laws of the Homeowner's Association will be revised to require the solids from the septic tanks be pumped at a minimum of once every three years.

   For additional houses to be considered for connection, adequate primary treatment must be provided to reduce the organic loading to the treatment plant. The department has some reservations about the homeowner's association maintaining the septic tanks over the long term. How can the department be assured that this requirement will be enforced?

EXHIBIT
4

4. The initial pumping of each septic tank will occur before June 1, 2006.

   According to the department's September 1, 2004 letter, the treatment plant has limited organic capacity. Therefore, primary treatment must be provided before considering the connection of additional residences.

5. The Missouri Department of Natural Resources' inspectors will evaluate the water quality impact below the outfall this summer.

   The department has limited resources, but will attempt to follow-up this summer with an on-site evaluation of the stream.

6. Options to upgrade the clarifier of the existing treatment plant will be submitted. Options include tube settling and chemical treatment.

   The department will review the engineering report when submitted. These options are not included in 10 CSR 20 Chapter 8 Design Guides, so documentation must be included showing the capability, reliability, and operation and maintenance requirements of the proposed upgrade.

7. The developer will begin hooking up additional homes within the development as the flow and discharge parameters are below the permitted values.

   Aqua Missouri regulates service connections as they are the permittee of the treatment facility and they must be notified before making service connections to the wastewater treatment system. Note the department's concerns regarding the organic loading of the wastewater treatment plant.

8. In accordance with their operating permit, Aqua Missouri is required to install a dechlorination system.

   The current operating permit has a schedule of compliance to upgrade the system by adding a dechlorination system.

9. Influent samples will be collected to document the removal efficiency improvements from now until after all of the septic tanks have been pumped.

   Without sufficient influent data, the department does not know what the actual concentration of the wastewater is and would use the default design guide loading rates.

10. A follow-up meeting with Mr. John Hoke and Mr. Keith Forck will be requested during the fall of 2006 to evaluate the effectiveness of the well-maintained septic tanks, results of the water quality evaluation and discharge monitoring reports.

The department is open to another meeting to discuss the wastewater treatment and water quality issues. One issue that was not addressed is inflow and infiltration of the existing collection system.

The department recommends that you coordinate with Aqua Missouri and submit a short report on the capacity of the treatment plant and the potential of remaining capacity. Upon submittal of this report, the department will review and would likely agree with Aqua Missouri's analysis of the capacity of the treatment plant, as they are ultimately responsible for the treatment plant and the water quality of the effluent therefrom.

If you have any questions regarding these matters, please contact me at (573) 526-4232 or (660) 385-8000 in the Northeast Regional Office, 1709 Prospect Drive, Macon, MO 63552.

Sincerely,

NORTHEAST REGIONAL OFFICE

Keith B. Forck, P.E.
Environmental Engineer

KBF/ks

c: ReSource Institute
Mr. Ed Galbraith, Water Protection Program
Mr. John Hoke, Water Pollution Control Branch
Aqua Missouri

ReSource Institute

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September 14, 2006

Ms. Tena Hale Rush
Aqua Missouri, Inc.
P.O. Box 7017
Jefferson City, MO 65102

RE: Quail Valley Wastewater Treatment Plant

Dear Ms. Rush:

On behalf of Mr. Edward Storey and the Quail Valley Homeowners' Association, I would like to submit information to you concerning additional investigations conducted over the last three months at the Quail Valley Wastewater Treatment Plant. These investigations resulted as a follow-up to the meeting held with the Missouri Department of Natural Resources and the follow-up letter received from Mr. Keith Forck of MDNR dated May 5, 2006. In this May 5th letter, Mr. Forck recommended that we submit a short report on the capacity of the treatment plant and the potential remaining capacity. Therefore, following in this letter is additional information recommended to be investigated by MDNR.

1) Census Data

Based on the census data, 229 people are occupying 77 homes in the Quail Valley subdivision. This equates to 2.97 people per home in the Quail Valley subdivision. It is recommended that this value be utilized for calculating existing and proposed plant loadings.

2) Actual records were obtained from Cole County Public Water Supply District #1 and showed that 425,900 gallons of water usage occurred in 75 homes in the development. This was based on a 31-day billing cycle; however, some homeowners are self-readers and may not have read on the exact 31-day timeframe. Based on the best information available from the water district, the average water usage per household was 183 gallons per day. It is recommended that this average water usage be utilized in calculating influent wastewater hydraulic load.

3) The Quail Valley Homeowners' Association has modified the by-laws to require that the septic tanks be pumped a minimum of once every three years. The Homeowners' Association will be responsible for ensuring that the septic tanks are pumped. The Homeowners' Association recently completed pumping of all existing septic tanks in the development.

4) Septic Tank Pumping

All septic tanks were pumped before August 1, 2006. A sample was taken shortly thereafter. Two samples of the influent had previously been taken to get a reading before cleaning septic tanks. An additional sample was taken on August 21, 2006, after several weeks had passed following pumping of all septic tanks. All of this data is included in Table 1 attached to this letter. The average BOD influent from the four samples was 83 mg/l while the TSS concentration was 34 mg/l. Both of these values are significantly less than typical sanitary wastewater design parameters indicating that the plant is not overloaded.

5) Infiltration Inflow Analysis

As shown in Table 2, attached to this letter, an analysis of wastewater flows recorded at the wastewater treatment plant at Quail Valley was conducted. The high flow rate recorded at the treatment plant was 30,436 gallons per day. The average flow rate was 11,744 gallons per day. It is understood that the readings recorded are instantaneous; however, with over 160 readings taken, a statistically significant indication of the peak flows realized at the wastewater treatment plant is provided. Given the lack of an extensive gravity flow collection system, infiltration is not considered to be a significant contributor to the wastewater plant flows. By-laws for the Homeowners' Association also prevent direct connection of inflow sources to the wastewater system. Infiltration and inflow is not suspected to be a significant problem for the Quail Valley Wastewater Treatment Plant.

6) Treatment Capacity Calculations

As shown in the attached Table 1, maximum loading to the wastewater treatment plant has been calculated based upon effluent from the septic tanks. Using the average organic and solids concentrations of the four samples taken, calculations show that the wastewater plant has capacity for additional loading. In calculating the existing aeration basin and settling basin capacities, organic and solids loadings are within Missouri Department of Natural Resources design criteria guidelines based upon a projected maximum development of 120 homes in the Quail Valley Development. Hydraulic loadings, based upon water usage and census data, projected for 120 homes are also within design guidelines. Based upon this data, the wastewater treatment system is capable of accepting flow from an additional 40 homes. It should be noted that good engineering practice generally includes a safety factor to account for varying field conditions. Given the changes that can occur in a wastewater system, something less than the calculated maximum loading may be appropriate. As per previous discussions, we believe it is reasonable and appropriate to add an additional 10 homes to the system over the next couple of years. Monitoring of loadings and treatment plant effluent results will be performed to determine impacts of new hookups and to see if additional capacity is available beyond 90 homes. Table 3 shows the loadings with a maximum of 90 homes connected to the system.

7) Summary and Recommendations

Based upon the data provided, it is recommended that Aqua Missouri, Inc. allow a total of 90 homes from the Quail Valley Subdivision Development to be hooked-up to the wastewater treatment system. In accordance with MDNR's May 5, 2006 letter, Aqua Missouri's analysis of the capacity of the treatment plant is required as Aqua Missouri is ultimately responsible for the treatment plant and the water quality of the effluent there from.

Therefore, Mr. Ed Storey and the Quail Valley Homeowners' Association requests approval to hook-up a total of 90 homes to the wastewater treatment system based upon the data provided herein.

If you have any questions or need further information, please give me a call at (573) 634-5008.

Sincerely,

Gregory G. Haug, PE

Attachments

cc: Mr. Keith Forck, MDNR
Mr. Ed Storey
Quail Valley Homeowners' Association
Mr. Mark A. Ludwig, Carson & Coil ✓

Table 1

Rev 9/14/06

Quail Valley Lake Subdivision WWTP
Quail Valley Lake, Route C
Jefferson City, MO 65109
Permit No. MO-0114081

Owner/Continuing Authority: Aqua Missouri, Inc

Permit Description:
Extended Aeration/chlorination/sludge hauled to Jefferson City WWTP

	Based on Permit		Actual		Max Capacity		Proposed	
Population Equiv.	296		229	*	352		264	
Plant Flow	22000	GPD	14274	GPD **	21960	GPD **	16470	GPD **
Flow per PE	74	GPD	62	GPD	62	GPD	62	GPD
Sludge Production	5.3	dry TPY	0.375	dry TPY	0.58	dry TPY	0.43	dry TPY
BOD loading	50	lbs/day	9.9	lbs/day	15.2	lbs/day	11.4	lbs/day
Homes connected	**80**		**78**		**120**		**90**	
Flow per home	275	GPD	183	GPD **	183	GPD **	183	GPD **

Wastewater Plant Description
23,000 GPD Extended Aeration Plant
6450 Gallon sludge holding tank
Chlorine contact tank with tablet chlorinator
Effluent flow measurement = V-notch weir
Settling zone capacity = 3958 gallons
Settling zone area = 72 square feet
Weir length = 11'
Air for lift pumps = 36,200 CFD
Motor = 5 HP
Blower speed = 2050 RPM
Air available = 134,000 CFD (93 CFM)
Operating psi = 5
Plant length = 47' 10"
Plant width = 13' 10"

Plant Influent Testing	**BOD (mg/l)**	**TSS (mg/l)**	
4/5/2006	81	33	before septic tank cleaning
6/1/2006	84	32	before septic tank cleaning
8/4/2006	98	44	shortly after septic tank cleaning
8/21/2006	68	28	2 weeks after septic tank cleaning
Average	**83**	**34**	

* Obtained from census of the development
** Actual January water usage for Quail Valley (425900 gal/75 homes/31 days = 183 gal/home)

Table 2

Quail Valley Lake Subdivision WWTP
Quail Valley Lake, Route C
Jefferson City, MO 65109
Permit No. MO-0114081

Date	Flow (gpd)		Monthly Average	Monthly Low	Monthly High
11/1/05	7,609	November-05	9,671	1,902	15,218
11/3/05	11,413				
11/4/05	7,609				
11/7/05	9,131				
11/8/05	5,707				
11/9/05	11,413				
11/10/05	7,609				
1/11/05	3,801				
11/14/05	15,218				
11/15/05	11,413				
11/16/05	15,218				
11/17/05	1,902				
11/18/05	5,707				
11/21/05	7,609				
11/22/05	11,413				
11/23/05	15,218				
11/28/05	11,413				
11/29/05	9,131				
11/30/05	15,218				
10/3/05	15,218	October-05	10,228	1,660	22,827
10/4/05	5,707				
10/5/05	4,565				
10/6/05	11,413				
10/7/05	9,131				
10/10/05	2,853				
10/11/05	15,218				
10/13/05	7,609				
10/14/05	11,413				
10/17/05	1,902				
10/19/05	18,261				
10/20/05	22,827				
10/24/05	15,218				
10/25/05	1,660				
10/27/05	13,044				
10/31/05	7,609				
9/1/05	7,608	September-05	10,558	2,853	15,218
9/2/05	7,609				
9/6/05	15,218				
9/8/05	15,218				
9/9/05	15,218				
9/12/05	5,707				

9/13/05	9,131				
9/16/05	11,413				
9/20/05	15,218				
9/23/05	13,044				
9/26/05	11,413				
9/29/05	2,853				
9/30/05	7,609				
8/1/05	7,609	August-05	12,098	4,565	22,827
8/2/05	11,413				
8/3/05	7,609				
8/8/05	15,218				
8/9/05	7,609				
8/11/05	11,413				
8/15/05	4,565				
8/17/05	11,413				
8/18/05	22,827				
8/19/05	11,413				
8/22/05	7,609				
8/23/05	22,827				
8/25/05	22,827				
8/29/05	11,413				
8/30/05	5,707				
7/1/05	11,413	July-05	11,426	2,075	22,827
7/5/05	15,218				
7/7/05	11,413				
7/11/05	15,218				
7/12/05	11,413				
7/15/05	7,609				
7/18/05	15,218				
7/19/05	11,413				
7/20/05	15,218				
7/21/05	11,413				
7/26/05	22,827				
7/27/05	2,075				
7/28/05	3,804				
7/29/05	5,707				
6/6/05	7,609	June-05	10,711	4,565	22,827
6/9/05	5,707				
6/11/05	11,413				
6/13/05	22,827				
6/14/05	4,565				
6/17/05	5,707				
6/20/05	7,609				
6/21/05	11,413				
6/23/05	11,413				
6/24/05	11,413				
6/27/05	9,131				
6/28/05	15,218				
6/30/05	15,218				
5/2/05	15,218	May-05	8,574	1,440	15,218
5/3/05	9,130				
5/5/05	15,218				

5/6/05	11,413				
5/9/05	7,609				
5/10/05	5,707				
5/12/05	13,044				
5/13/05	11,413				
5/16/05	7,609				
5/19/05	3,804				
5/20/05	3,261				
5/23/05	1,440				
5/24/05	11,413				
5/26/05	2,853				
5/27/05	11,413				
5/30/05	11,413				
5/31/05	3,804				
4/5/05	15,218	April-05	14,524	4,565	22,827
4/7/05	18,262				
4/8/05	13,044				
4/11/05	15,218				
4/12/05	18,262				
4/14/05	15,218				
4/15/05	11,413				
4/18/05	11,413				
4/19/05	9,130				
4/25/05	4,565				
4/26/05	11,413				
4/28/05	22,827				
4/29/05	22,827				
3/1/05	11,413	March-05	12,355	1,630	22,827
3/3/05	3,804				
3/4/05	3,804				
3/7/05	15,218				
3/8/05	15,218				
3/10/05	22,827				
3/14/05	15,218				
3/15/05	15,218				
3/17/05	15,218				
3/18/05	4,565				
3/21/05	1,630				
3/22/05	15,218				
3/24/05	13,043				
3/25/05	22,827				
3/28/05	11,413				
3/29/05	11,413				
3/30/05	9,130				
3/31/05	15,218				
2/1/05	11,413	February-05	13,593	2,536	22,827
2/3/05	2,536				
2/4/05	7,609				
2/7/05	15,218				
2/8/05	11,413				
2/9/05	5,707				
2/11/05	11,413				

2/14/05	22,827				
2/15/05	22,827				
2/17/05	22,827				
2/18/05	15,218				
2/21/05	11,413				
2/22/05	7,609				
2/24/05	22,827				
2/25/05	15,218				
2/28/05	11,413				
1/3/05	30,436	January-05	16,039	2,536	30,436
1/4/05	22,827				
1/5/05	30,436				
1/6/05	30,436				
1/7/05	22,827				
1/10/05	2,536				
1/11/05	11,413				
1/13/05	5,707				
1/14/05	5,707				
1/17/05	15,218				
1/19/05	15,218				
1/21/05	14,400				
1/25/05	15,217				
1/27/05	11,413				
1/28/05	11,413				
1/31/05	11,413				
Avg Flow	11,744				
High Flow	30,436				
Low Flow	1,440				

Table 3

Quail Valley Lake Subdivision WWTP
Quail Valley Lake, Route C
Jefferson City, MO 65109
Permit No. MO-0114081

rev. 9/14/06

Alternative: Pretreatment with Maintained septic tanks

Proposed Design Parameters:	Septic effluent **WW Plant Influent**		
Homes connected	90		
Pop. Equiv. =	264		
Flow =	16470	GPD	
BOD =	11	lbs/day	(83 mg/l influent **)
TSS =	5	lbs/day	(34 mg/l influent **)
sludge prod. =	0.9	dry tons/yr	

Aeration Basin

basin size req'd	5685	gallons @ 15 lbs/1000 CF
air required	29642	CFD @ 2600 CF/lb BOD

Keep current plant the same

Current aeration volume =	22081	gallons	
Added aeration volume =	0	gallons	
Total aeration volume =	22081	gallons	
Air for lift pumps =	36200	CFD	
Motor =	5	HP	
Blower speed =	2050	RPM	
Air available =	134,000	CFD (93 CFM)	
Operating psi =	3. 5		

Settling Basin

Existing clarifier =	72	square feet	
Min. Depth = 10.25'	5520	volume in gallons	
Detention time =	8.04	hours	
Total Weir length =	11	linear feet	
Recorded Peak Flow	30436	GPD	(based upon records from Aqua MO)
Detention time =	4.35	hours	

** Based upon the average of 4 samples taken of the WW plant influent
two samples were taken before septic tank cleaning and two samples after cleaning