

April 2, 2012

## **MEMORANDUM**

TO: Clayton Steele  
Regional Administrator, Lewiston Regional Office

FROM: Stephanie Ogle, P.E.  
Technical Services

SUBJECT: Staff Analysis for Draft Wastewater Reuse Permit M-028-03 (Municipal Wastewater)  
University of Idaho

### **1. PURPOSE**

The purpose of this memorandum is to satisfy the requirements of IDAPA 58.01.17.400.05, "Recycled Water Rules", for issuing wastewater reuse permits (WRPs). This memorandum addresses draft WRP No. M -028-03 for the municipal wastewater reuse system owned and operated by the University of Idaho (UI). UI's reuse system is currently permitted under the terms of WRP No. LA-000028-02.

### **2. SUMMARY OF EVENTS**

The Department of Environmental Quality (DEQ) issued Permit No. LA-000028-02 to UI on June 23, 2004, which is located in in Lewiston, Idaho in Latah County. This permit expired on June 22, 2009 and a permit renewal application was received on December 23, 2008, indicating their intent to continue operation of the permitted facility after the expiration date. The draft permit is to renew the expired permit and allow continued operation of the wastewater reuse system operated by UI.

The permit renewal application from UI largely serves as the basis for the terms and conditions contained in the draft permit. As required by the "Recycled Water Rules", the draft permit will be presented for a public comment period. After the comment period has closed, DEQ will provide written responses to all relevant comments and prepare a final permit for UI's wastewater reuse facilities.

### **3. PROCESS AND SITE DESCRIPTIONS**

The wastewater that is reused through the UI recycled water system is first treated at the City of Moscow's wastewater treatment plant. The City of Moscow's wastewater treatment plant consists of influent screening, biological treatment via anaerobic, anoxic, and aeration cells, secondary clarification, a newly installed filtration system, and disinfection. The treated wastewater is either discharged to Paradise Creek in accordance with a National Pollution Discharge Elimination System (NPDES) permit or sent to the UI's recycled wastewater system during the growing season through an agreement established between the UI and the City of Moscow in 1977. The treated wastewater that is sent to the UI recycled water system is discharged into a covered concrete basin that contains baffling for increased contact time. Additional chlorine is then added to the wastewater in the basin to provide further disinfection to meet the total coliform limits in the current permit.

During the day, treated wastewater is pumped to two storage ponds at the UI Golf Course for application to the 134 acre golf course at night. Treated wastewater may also be applied to an additional 348 acres that consists of various lawn areas, play fields, and an arboretum throughout the UI campus. Again, application of wastewater is only applied at night to avoid contact with the public. According to the permit application, only a portion of this

acreage (approximately 200 acres) is irrigated with recycled water, but the facility has included potential future irrigation areas to avoid the need for a permit modification if they decide to use those areas.

The UI land application site is also irrigated with wastewater from the UI aquaculture laboratory and from the domestic water supply. UI also has an NPDES permit for the aquaculture laboratory wastewater for discharge to Paradise Creek, but they send the wastewater to the recycled water system during the growing season. According to the annual reports for the last four years, the amount of wastewater from the aquaculture laboratory ranged between approximately three percent (3%) and approximately eight percent (8%) of the total amount of irrigation water applied to the management units (MUs). The amount of supplemental irrigation provided by the domestic supply ranged between 0.5 percent (0.5%) and approximately three percent (3%) during the past four years.

In order to demonstrate compliance with the conditions of the current permit, the permittee is required to monitor the volume of treated wastewater applied to the MUs and various constituents of the treated wastewater. Each year the permittee is also required to submit an annual report that provides all of the monitoring results as well as a discussion about the results of the monitoring. The permit renewal application discusses the monitoring results between 2004 and 2007 and the annual reports between 2008 and 2011 were available for review after the permit renewal application was submitted. It appears that the permittee has consistently performed the required monitoring and maintained compliance with the permit conditions. The nitrogen loading limit of 110 pounds (lbs)/acre/year was exceeded at least once between 2004 and 2007 with a maximum observed load of 210 pounds per acre but was never exceeded between 2008 and 2011. The maximum hydraulic loading rate and the COD loading limit were never exceeded between 2004 and 2011. The permit application does not discuss the specific results of the total coliform monitoring between 2004 and 2007, but it does state that UI was planning to implement improvements to the holding lagoon that would include a cover and baffles to increase chlorine contact time. The new storage structure has been constructed and the total coliform monitoring results between 2008 and 2011 indicate compliance with the disinfection level requirements with one exception. In 2009 all of the sample results were below the single sample maximum level of 23/100 ml, but one of the median values for the last five sample results exceeded the limit of 2.2/100 ml.

The current permit also requires that the permittee sample and analyze the soil from each MU on an annual basis. The permit contains two MU's, but one MU contains three different areas (lawns, playfields and the arboretum). The permittee decided to collect soil samples from each of the three areas instead of compositing them into one soil sample. The soil is required to be analyzed for electrical conductivity (EC), nitrate+nitrite nitrogen, ammonium-nitrogen, pH, and plant available phosphorous (PAP). It appears that the permittee performed all of the required monitoring between 2004 and 2011; however, the lab sheets indicate that the soil samples were analyzed for ammonia – nitrogen instead of ammonium-nitrogen for at least the period between 2008 and 2011. The permit renewal application indicates that the soil sample results did not show any identifiable trending between 2004 and 2007, except for a slightly increasing trend for pH as depth increases. The application also notes that the nitrogen concentration in the soil generally decreased with depth, which they say is an indication that plant uptake exceeds the available nitrogen. The monitoring data provided in the annual reports between 2008 and 2011 appears to show the same general results as noted for the period between 2004 and 2007. There was a spike in the nitrate concentration in the soil in 2008 at all four sites and at all three depths, and it is unknown why this may have occurred. The annual reports do not compare the soil concentration levels to the previous years, so there was no discussion about it in the 2008 annual report and the amount of total nitrogen applied during 2008 was below the permitted level. Again the nitrate concentration generally decreased with depth for all four sites during the 2008 to 2011 period, except for the lawns site which showed a higher concentration in the second foot of soil in 2011. The concentration of PAP and EC did not show any apparent trends for any of the sites during the 2008 to 2011 period and again generally decreased in concentration down the soil column. And the pH showed the same general trend between 2008 and 2011 of a slight increase down the soil column for all four sites. Graphs of the 2008 to 2011 data for nitrate-nitrogen, PAP, electrical conductivity and pH have been included in Appendix 1.

#### 4. PERMITTING DISCUSSION

The following sections outline changes made to the terms of the draft renewal permit, based on changes requested by the permittee, evaluations of past performance with previous permit requirements, and updates required by changes to the “Recycled Water Rules” or any other applicable regulatory standards. Terms and conditions that are unchanged from the previous permit and remain applicable to the facility are not addressed in this document.

The rules governing wastewater reuse (currently titled “Recycled Water Rules”) have been revised since the previous permit was written in June 2004 and again since the permit application was received in December 2008. The revised rules have established classifications for wastewater effluent based on the type of treatment provided for the wastewater and the level of disinfection of the wastewater. Each classification has specific effluent requirements and allowed uses for the treated wastewater. Based on the current “Recycled Water Rules”, the uses that are utilized by the permittee, such as irrigation of golf courses and parks, playgrounds, and school yards during periods of non-use, are allowed for Class B effluent or higher. Class B effluent is required to be oxidized, coagulated, clarified, and filtered, or treated by an equivalent process and adequately disinfected. Class B effluent must also meet the following turbidity limits: 1) the daily arithmetic mean of all measurements of turbidity shall not exceed five (5) Nephelometric Turbidity Units (NTUs), and 2) turbidity shall not exceed ten (10) NTU at any time. Two permit conditions and one compliance activity have been added to the permit based on these new requirements and are discussed below.

All of the compliance activities from the previous permit have been completed by the permittee. Four of the five compliance activities were associated with the installation of a filtration system at the City of Moscow’s wastewater treatment plant. According to the 2011 Annual Land Application Site Performance Report (J-U-B 2012), start-up of the filtration system has been completed and as-built drawings of the wastewater filtration plant have been submitted to DEQ. The fifth compliance activity was on-going and required weekly monitoring of residual chlorine within the irrigation system. This compliance activity is not included in the draft permit as a new disinfection requirement has been added to the permit that requires chlorine residual of at least 1 mg/L at the end of the disinfection process and daily chlorine residual monitoring has been added to demonstrate compliance with the disinfection permit condition.

##### 4.1 Compliance Schedule for Required Activities – Section 3

All wastewater systems are required to have an operation and maintenance manual, also called a plan of operation, in accordance with IDAPA 58.01.16, “Wastewater Rules”. Both the “Wastewater Rules” and the “Recycled Water Rules” contain requirements about the information that must be provided in the plan of operation. DEQ’s “Guidance for Reclamation and Reuse of Municipal and Industrial Wastewater” (*Reuse Guidance*) may also be used as guidance when developing the plan of operation and contains a plan of operation checklist that specifies the information that should be included. Compliance Activity No. CA-028-01 requires that the Plan of Operation be developed and submitted within one year of permit issuance.

Section 493 of the “Wastewater Rules”, currently requires all municipal wastewater lagoons to be seepage tested once every ten years. The system contains two storage lagoons at the UI Golf Course that will require seepage testing during this permitting cycle. Alternatively, UI could assume that the lagoons are leaking above the allowable amount and take one of the actions specified in Section 493.04 of the “Wastewater Rules”, one of which is determining the impact of the leaking lagoon on the environment based on ground water sampling and modeling (i.e. a ground water impact assessment). As the UI will not perform a seepage test to determine the amount of wastewater that is leaking from the lagoon, UI must assume that the lagoons are not lined. The ground water impact assessment must demonstrate that any impacts from the lagoon comply with IDAPA 58.01.11, “Ground Water Quality Rule”. Based on a phone conversation between Jerry Shaffer, P.E (DEQ) and Michael Holthaus (UI operator) on March 28,

2012, UI would prefer to do a Ground Water Impact Assessment. As such, Compliance Activity No. CA-028-02 requires that a Ground Water Impact Assessment be performed and submitted to DEQ for review and approval. The ground water impact assessment must be submitted to DEQ for review and approval within one year of permit issuance. If the assessment indicates that the requirements of the GWQR are not met, then the permittee shall submit to DEQ a schedule for implementation of necessary modifications/actions required for compliance with the GWQR. Upon approval of the schedule, the permittee shall implement the items in accordance with the approved schedule

As described previously, Class B effluent must meet certain turbidity limits. In order to demonstrate compliance with this requirement, Class B systems must have an in-line, continuously monitoring, recording turbidimeter after filtration but prior to disinfection, as required by the "Recycled Water Rules". As such, Compliance Activity CA-028-03 has been included in the draft permit to require that the turbidimeter be installed prior to UI disinfection within one year of permit issuance.

In accordance with the "Recycled Water Rules", Class B effluent may not be used to irrigate any of the permitted areas during periods of use by the public. As some areas may not be irrigated with recycled wastewater and supplemental irrigation water is not required to be utilized during periods of non-use, the permittee must demonstrate how they will ensure that recycled water is not utilized during periods of use. Compliance Activity CA-028-04 requires that the permittee submit an Irrigation Management Plan that demonstrates the allowable irrigation sites that are required to be irrigated during periods of non-use will be segregated and how the permittee will meet the requirement that the areas be irrigated during periods of non-use.

The permit requires that a permit renewal application be submitted six months prior to the expiration date of the permit if the permittee anticipates continuation of wastewater reuse. Compliance Activity CA-028-05 of the draft permit requires the submittal of the permit renewal application 180 days prior to the permit expiration date.

#### 4.2 Permit Limits and Conditions – Section 4

Three permit conditions have been added to the draft permit, three of the current permit conditions have been modified, and three permit conditions have been removed in the draft permit.

As discussed previously, in order for treated wastewater to be classified as Class B effluent, the effluent must meet the following turbidity limits: 1) the daily arithmetic mean of all measurements of turbidity shall not exceed five (5) Nephelometric Turbidity Units (NTUs), and 2) turbidity shall not exceed ten (10) NTU at any time. Consequently, the wastewater treatment system effluent turbidity limits have been added to the draft permit as a new permit condition.

Class B effluent is also required to be disinfected by a chlorine disinfection process that provides a residual chlorine at the point of compliance of not less than one (1) mg/L total chlorine residual after a contact time of thirty (30) minutes at peak flow or by an alternative disinfection process that is comparable and is approved by DEQ. Therefore, a new permit condition has been added to the draft permit stating that the total chlorine residual must not be less than one (1) mg/L after a contact time of thirty (30) minutes at peak flow, or an alternate process that is comparable. An alternate disinfection process that is comparable is acceptable, but the alternate process must be pre-approved by DEQ.

Finally, a new permit condition regarding runoff and ponding has been added to the draft permit. Runoff of treated wastewater from a hydraulic management unit is a pathway for the constituents in the treated wastewater to impact groundwater or surface water close to the land application sites, such as Paradise Creek which is approximately 60 feet away from the West Field at its closest point. Excessive hydraulic

loading to the hydraulic management unit may also cause ponding on the site, which could lead to runoff or could support vectors or insects on the site, which is not in accordance with the Section 8: General Permit Conditions of the permit. Therefore, a permit condition has been added to the draft permit that requires that the permittee, to the maximum extent possible, operate the land application site to prevent ponding and runoff.

The first permit condition modification was made based on a request by the permittee. In the permit application, the permittee requested that the allowable nitrogen loading rate be increased from 110 pounds (lb)/acre/year to 360 lb/acre/year. The requested loading rate is stated to be based on DEQ's *Reuse Guidance*, which provide an uptake value for grass hay as 60 lbs/ton at a yield of 4 tons/acre and a general nitrogen loading rate of 150% of crop uptake. However, the values provided in the *Reuse Guidance* are based on the assumption that the crop will be harvested and removed from the area, but UI does not remove the grass clippings from the management units. According to the Environmental Protection Agency's (EPA) Process Design Manual *Land Treatment of Municipal Effluents*, grass clippings that are left on-site will return approximately 48% of their nitrogen content back to the turf. (EPA 2006). Once this is taken into account, it appears that the allowable nitrogen loading limit would be 187 lb/acre/year, which has been rounded up to 190 lbs/acre/year in the draft permit. A total nitrogen concentration limit has not been added to the draft permit, but may be necessary if the results of the lagoon seepage tests or ground water impact assessment indicate that a loading limit is required to meet the "Ground Water Quality Rule". If a total nitrogen loading limit is deemed necessary by DEQ, the permit will be modified in accordance with the "Recycled Water Rules".

The crop uptake values provided for nitrogen in DEQ's *Reuse Guidance* also assumes that the crops are water substantially at their irrigation water requirement. If excessive irrigation water is applied to the site, nitrogen and other constituents could be carried down past the root zone and into the water table below the irrigation area. And if the crops are watered at an irrigation deficit, the crops may not be healthy and will not take up as much of the constituents from the soil. As such, the maximum hydraulic loading limit has been changed from the previous permit value of 121.5 million gallons to substantially follow the irrigation water requirement for the crop. The hydraulic loading limit includes both the treated wastewater and any supplemental irrigation water that is applied to the hydraulic management unit.

The third permit condition that has been modified is the supervision requirement in the current permit. Currently, the system is required to be operated by a trained operator and have a trained back-up operator available. The "Wastewater Rules" require that all operating personnel at public wastewater systems must hold a valid license issued by the Idaho Bureau of Occupational Licenses. As such, the draft permit contains a condition that the reuse system must be operated by personnel certified and licensed in the State of Idaho wastewater operator training program at the operator class level specified in IDAPA 58.01.16.203, "Wastewater Rules", and properly trained to operate and maintain the system. Operation of the wastewater treatment system must be monitored on a 24-hour basis for alarm conditions, including notification of the qualified operating personnel under alarm conditions.

The first permit condition that has been removed is the chemical oxygen demand (COD) loading limit. According to the permit renewal application, the maximum observed loading rate for the constituent of chemical oxygen demand (COD) between 2004 and 2007, was 0.83 lbs/acre/day, which is substantially less than the current permit COD loading limit of 50 lbs/acre/day. The annual reports for 2008 to 2011 also show a COD loading rate of significantly less than the loading limit with a maximum loading rate of 1.87 lbs/acre/day. As such, the COD loading limit has been deemed unnecessary and has been removed from the draft permit.

The second permit condition that has been removed is the requirement that a DEQ approved backflow

prevention device is required for systems with wastewater and fresh irrigation water interconnections. According to the 2011 Annual Land Application Site Performance Report, a direct connection between the domestic water supply and the irrigation system does not exist. Supplemental irrigation from the domestic water supply is added to the irrigation system through a discharge pipe that is located 35 inches above the maximum water level in the holding pond. Therefore, a backflow prevention device is not required.

The final condition that was removed is the condition that specified that an odor management plan must be developed if a public health hazard or nuisance condition developed with regards to odor. The annual reports for the facility for the past five years all indicate that the permittee has not received any odor complaints with respect to the land application operations. General Permit Condition 8.1.3 still requires that the permittee operate the reuse facility in a manner that does not create a public health hazard or nuisance condition. And the plan of operation should also address odor management. Therefore, the odor management permit condition did not seem necessary for this permit cycle, but may be revisited during the next permit renewal.

Finally, the buffer zone requirements in the current permit have been maintained in the draft permit; however, DEQ's *Reuse Guidance* recommends a buffer distance of 100 feet between the boundaries where wastewater land application ceases and inhabited dwellings. The permit application indicates that there are offices or other buildings such as the Kibbie Dome that are within 60 feet of the hydraulic management units. In accordance with the *Reuse Guidance*, a microbial risk analysis was performed for the site and the analysis indicates that there is a de minimis risk of exposure to the public if they are 60 feet from the wastewater land application boundary. The microbial risk assessment inputs and resulting graphs are provided in Appendix 2 of this staff analysis. Also, the permittee irrigates these areas in early morning hours to reduce the potential for public exposure and the permit requires that the areas be irrigated during periods of non-use. Based on the microbial risk assessment and the requirement to irrigate during periods of non-use, a buffer zone of 60 feet to inhabited dwellings is sufficient for protection of human health and the environment for this permit.

#### 4.3 Monitoring and Reporting – Sections 5 & 6

Generally, the facility is required to monitor the volumes of wastewater and supplemental irrigation water applied to the land application sites on a daily basis, while wastewater effluent sampling is required on a monthly basis when effluent is being applied to the site. There have been a number of changes associated with the monitoring requirements in the draft permit based on new rule requirements and the changes made to the permit conditions that are discussed in the previous section. The first two new monitoring requirements are related to the turbidity and disinfection requirements for a Class B system. Once the turbidimeter is installed, as required by Compliance Activity CA-028-03, the permittee will be required to continuously monitor and record the turbidity of the wastewater filtration effluent prior to disinfection to demonstrate compliance with the turbidity limit. The permittee is also now required to monitor the chlorine residual of the treated effluent post disinfection on a daily basis to demonstrate compliance with the Class B disinfection permit condition, as required by the "Recycled Water Rules".

The last new monitoring requirement is the requirement to monitor the volume of treated effluent discharge to each pond on the golf course. This information will be required to conduct a ground water impact assessment for the discharge of treated effluent to the ponds and then to demonstrate compliance with the results from the ground water impact assessment. If the permittee decides to seepage test the lagoons instead of performing a ground water impact assessment and the seepage tests demonstrate that the lagoons are seeping less than the allowable amount, the permittee may request that this monitoring requirement be removed from the permit.

Three of the current monitoring requirements have been modified in the draft permit. The first modification was made to the frequency of the total coliform sampling. The current permit requires that a grab sample be collected twice weekly during the application season and analyzed for total coliform. The permittee requested that this be reduced to weekly in the permit renewal application. However, the "Recycled Water Rules" require that Class B recycled water be sampled and analyzed daily for total coliform when allowed uses specifically require Class B recycled water. As such, the frequency for total coliform sampling has been increased from two times per week to daily in the draft permit.

The second monitoring requirement that has been modified is the monthly grab sample of the treated effluent. The permittee requested that this be reduced to bi-annually (in June and August), but does not provide justification for the reduction. DEQ does not agree that biannually will sufficiently detect changes in the nutrient concentrations in the wastewater and monthly sampling is still required in the draft permit. However, the grab sample is no longer required to be analyzed for total dissolved solids (TDS), pH, or COD. Neither permit contains a TDS loading limit nor is ground water monitoring required that might establish a correlation between TDS loading and the TDS concentration in a down gradient monitoring well. As discussed previously, COD loading has been significantly below the COD loading limit in the current permit. Therefore, the COD loading limit has been removed from the draft permit and the COD concentration in the wastewater effluent is no longer required to calculate the COD loading rate.

The third monitoring requirement that has been modified is the soil monitoring requirement. In the current permit, the permittee is required to sample each soil monitoring unit once per year. In the permit application, the permittee requested that the soil sampling be reduced to once per permit cycle as it would provide sufficient information to identify trends throughout the soil column. Based on results of the soil sampling from the previous permitting cycle, DEQ concurs that once per cycle should be sufficient to identify trends. The soil sample is required to be collected after the growing season in the final year of the permit so that the results of the sampling can be included in the permit application for the next permit. The soil sample will be required to be sampled for the same constituents as required by the current permit.

A number of monitoring requirements have been removed from the monitoring section, but are still required by Section 6: Reporting Requirements in the draft permit. This includes the number of acres used for land application (required to determine loading rates), nitrogen and phosphorous loading from fertilizers and non-wastewater application, nitrogen and phosphorous loading calculation from wastewater, calculation of the irrigation water for the crop that is grown, and calculation of the wastewater loading rate. The irrigation water requirement should be calculated before the start of the month and adjusted as necessary to ensure that the site is irrigated substantially at the irrigation water requirement.

The requirement to annually sample the supplemental irrigation water has been removed from the draft permit. It is the responsibility of the permittee to sample the supplemental irrigation water as necessary to determine accurate loading rates from the supplemental irrigation water. The COD loading calculation monitoring requirement and the crop nitrogen, phosphorous, and ash removal calculations have also been removed from the draft permit. The COD loading calculation has been removed due to very low COD loading rates during the previous permit cycle and the crop nutrient removal has been removed because the permittee does not remove the crop from the site.

The permittee is also required to submit an annual report that includes 1) all monitoring conducted under the terms of the permit, 2) the hydraulic management unit reporting requirements in Section 6 of the draft permit, 3) the status of compliance activities required by the permit, and 4) an interpretive discussion of the monitoring data with particular respect to any potential environmental impacts. The annual report is

due by January 31<sup>st</sup> of each year, and should address operations conducted from the previous reporting year.

## 5. RECOMMENDATIONS

Based on review of applicable state rules, staff recommends that DEQ issue draft WRP No. M -028-03 for a public review and comment period. Based on the fact that the permittee has complied with all of the previous permit requirements, submitted all of their annual reports during the previous permitting cycle, and have not had any issues identified during their inspections, this permit is recommended for a 10 year permitting cycle. The draft permit contains effluent quality requirements for the reuse system, as well as terms and conditions required for operation of the reuse system. Monitoring and reporting requirements to evaluate system performance and to determine permit compliance have been specified, and compliance activities have been incorporated into Section 3 of the permit.

### References

- (1) University of Idaho Annual Land Application Site Performance Report, 2008 – 2011. J-U-B
- (2) Idaho Department of Environmental Quality, September 2007. Guidance for the Reclamation and Reuse of Municipal and Industrial Wastewater. Available online at [http://www.deq.idaho.gov/water/permits\\_forms/permitting/guidance.cfm](http://www.deq.idaho.gov/water/permits_forms/permitting/guidance.cfm)
- (3) Environmental Protection Agency, 2006. Process Design Manual: Land Treatment of Municipal Effluents. EPA/625/R-06/616.

**Appendix 1: Soil Monitoring Results**

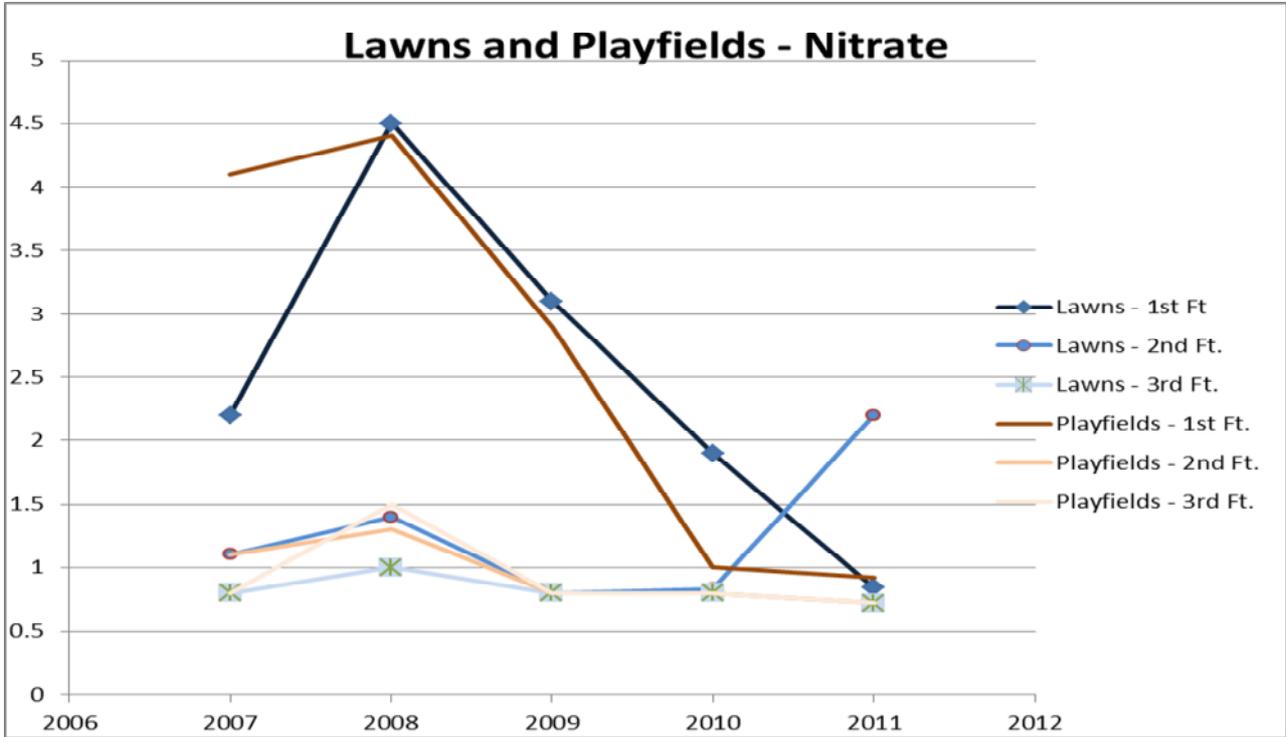


Figure 1: Lawns and Playfields - Nitrate -Nitrogen

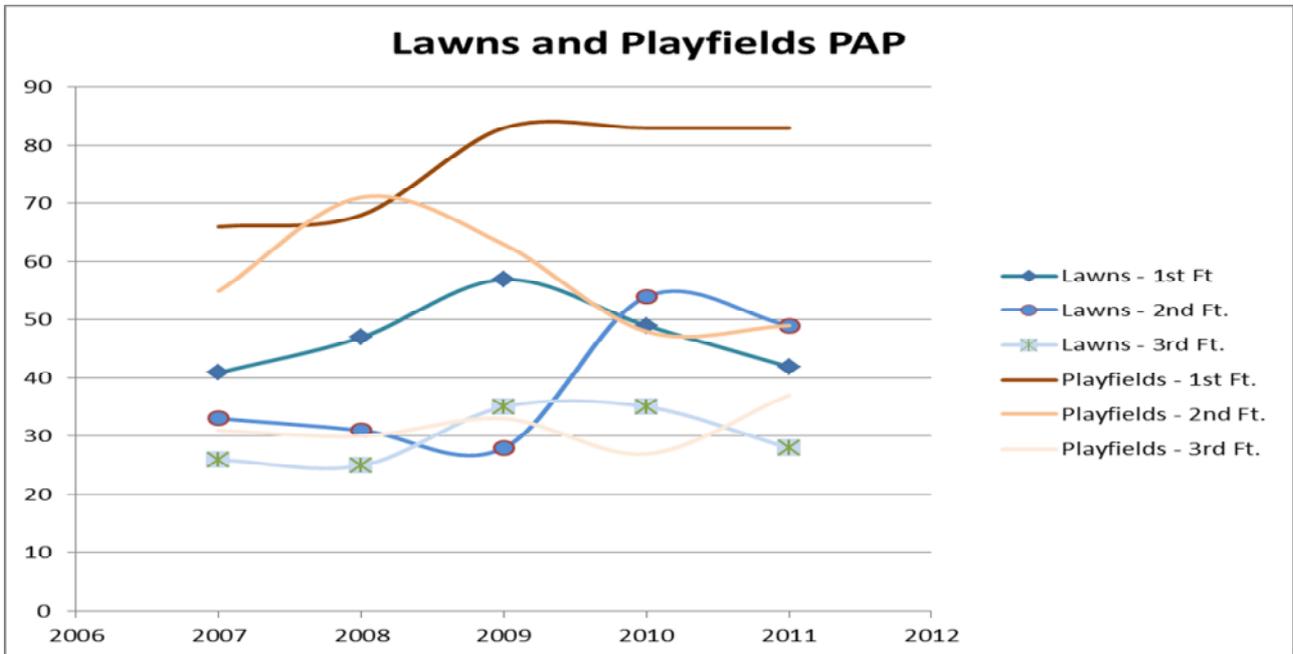


Figure 2: Lawns and Playfields - Plant Available Phosphorous

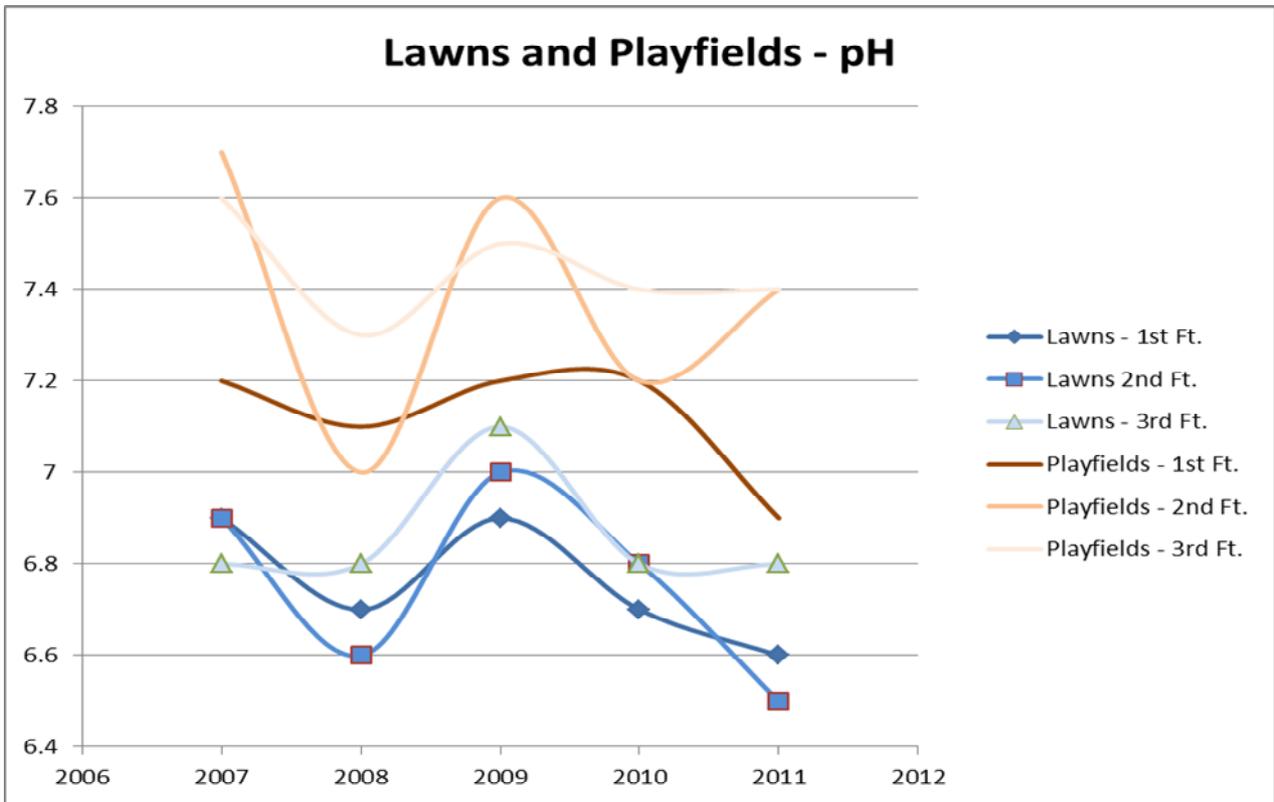


Figure 3: Lawns and Playfields - pH

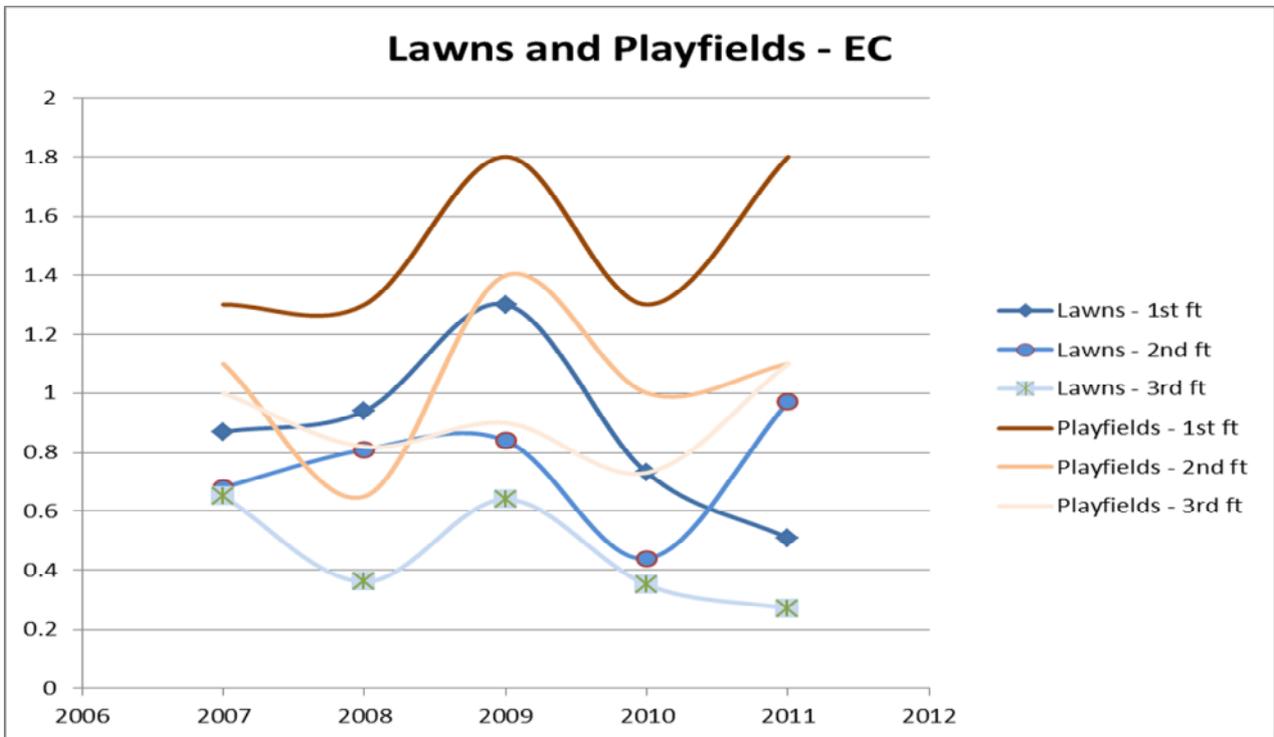


Figure 4: Lawns and Playfields - Electrical Conductivity

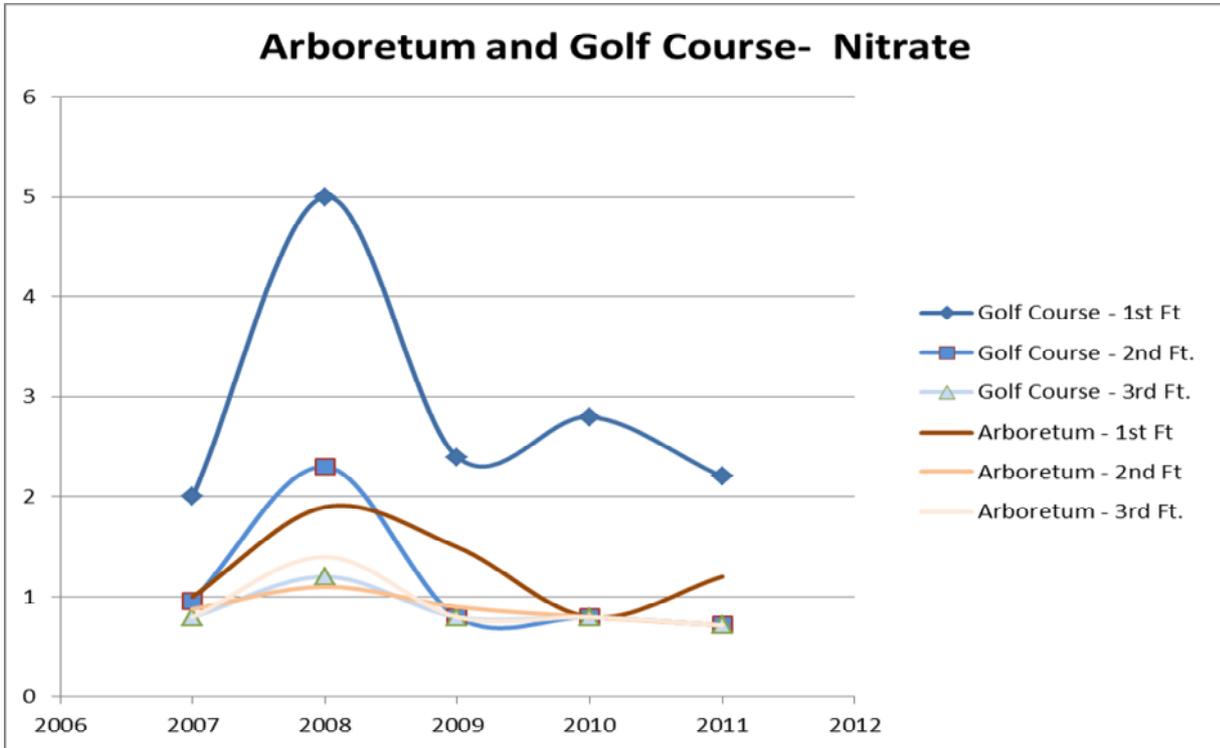


Figure 5: Arboretum and Golf Course - Nitrate-Nitrogen

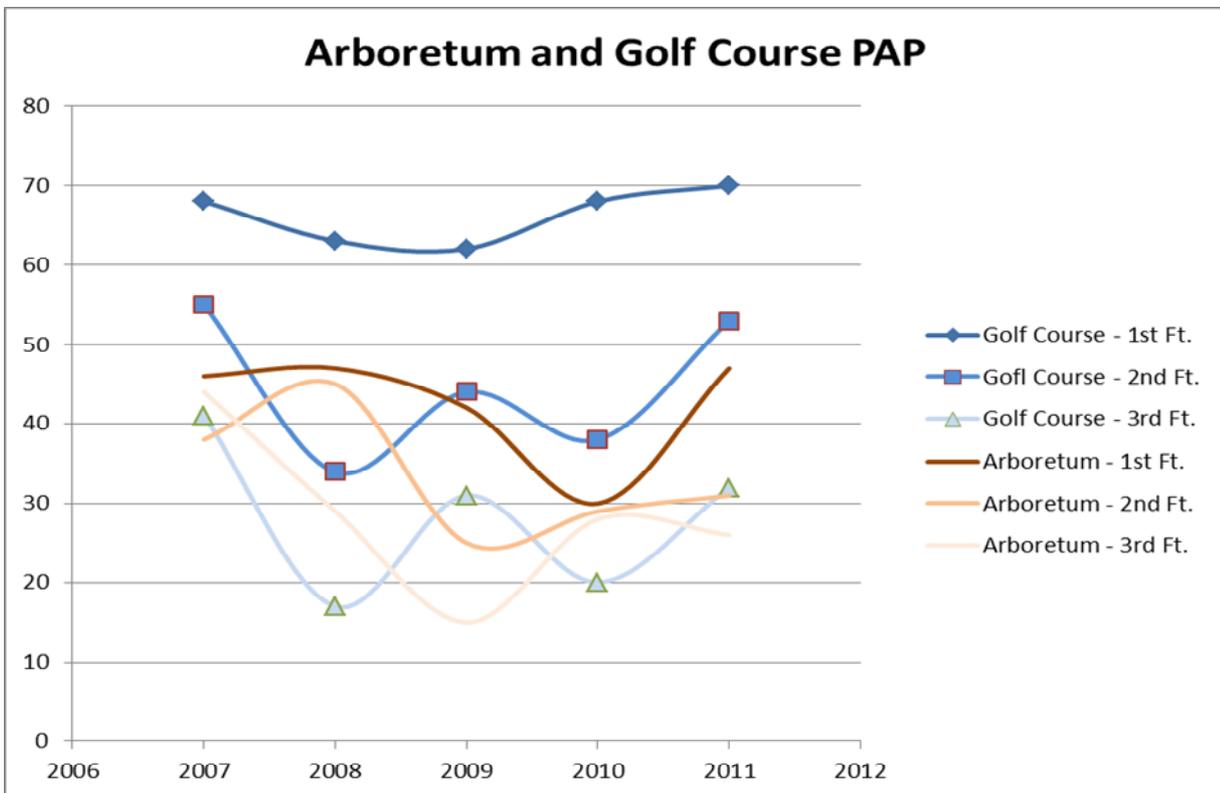


Figure 6: Arboretum and Golf Course - Plant Available Phosphorous

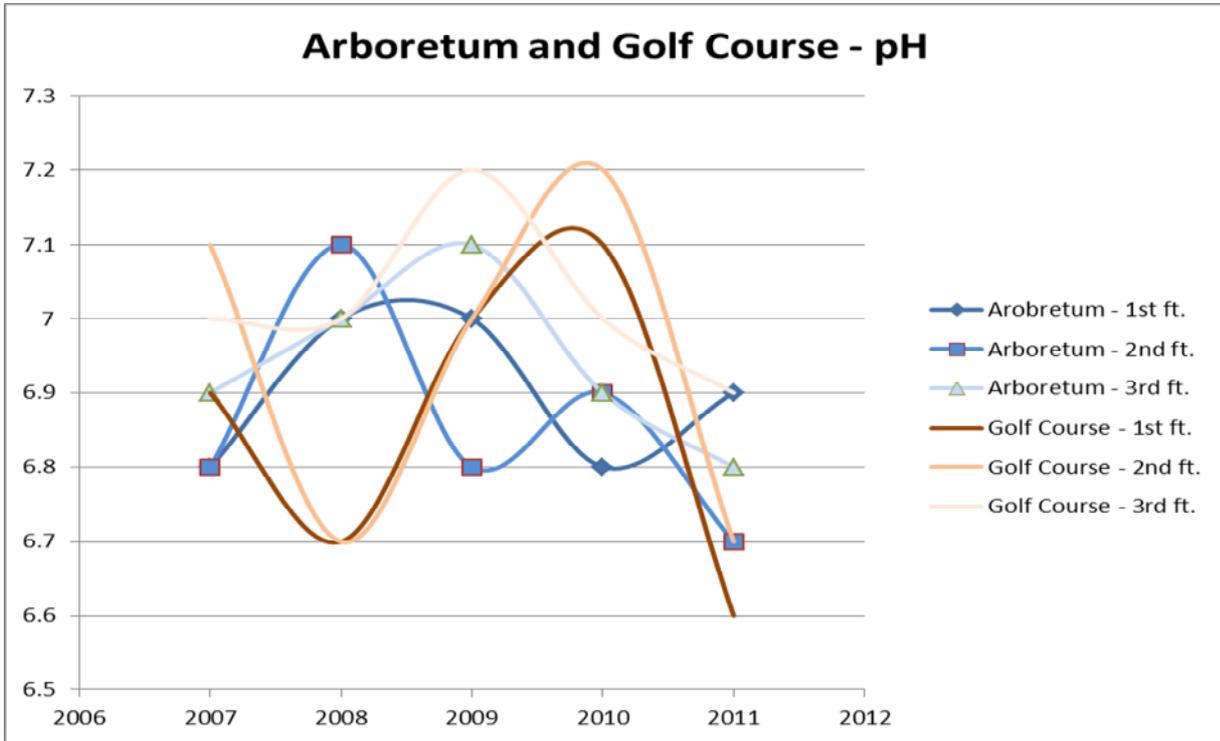


Figure 7: Arboretum and Golf Course - pH

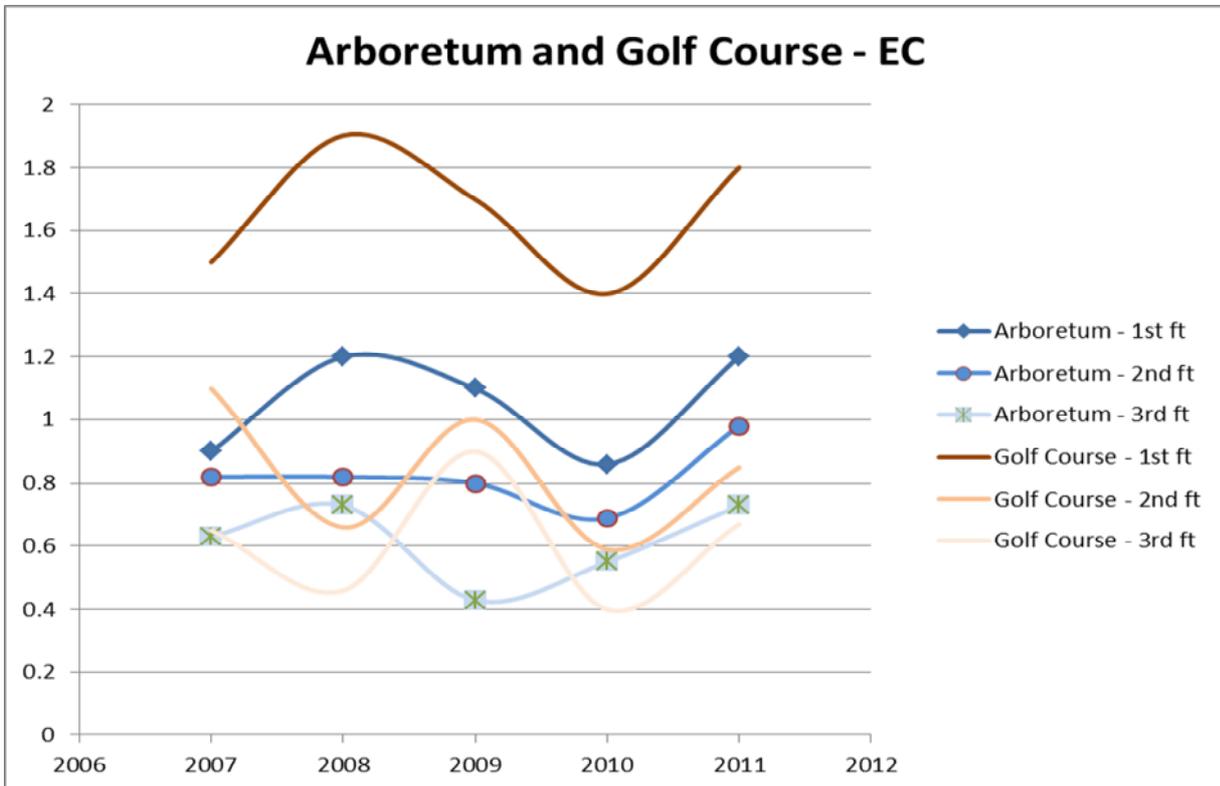
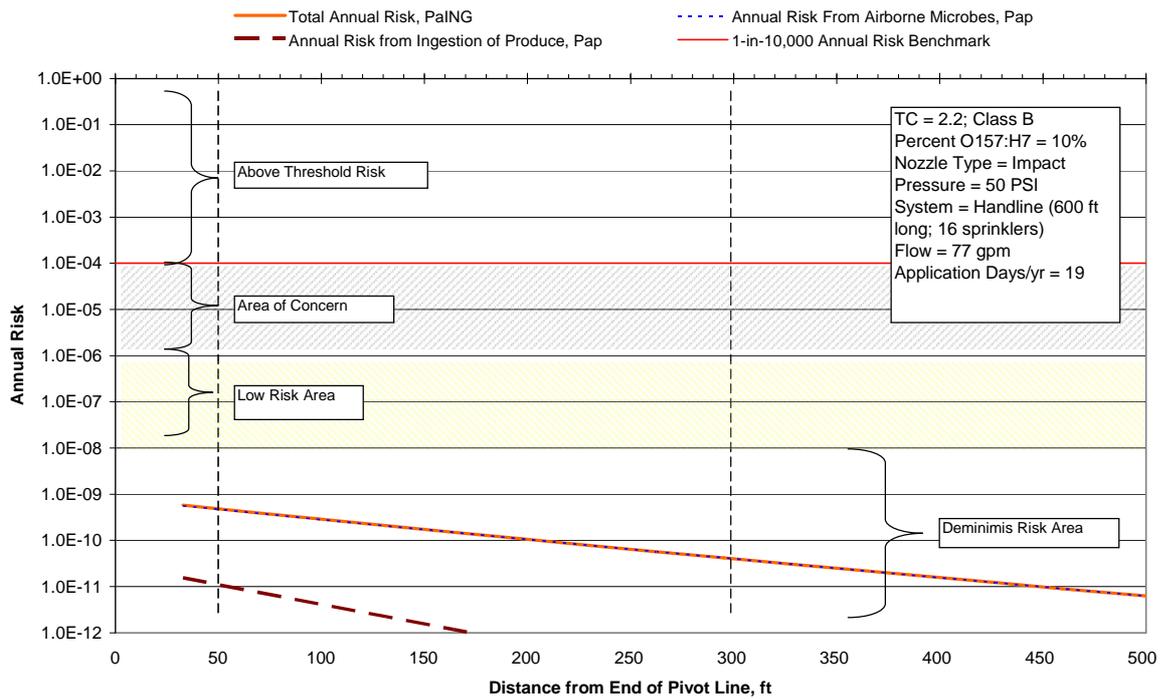


Figure 8: Arboretum and Golf Course - Electrical Conductivity

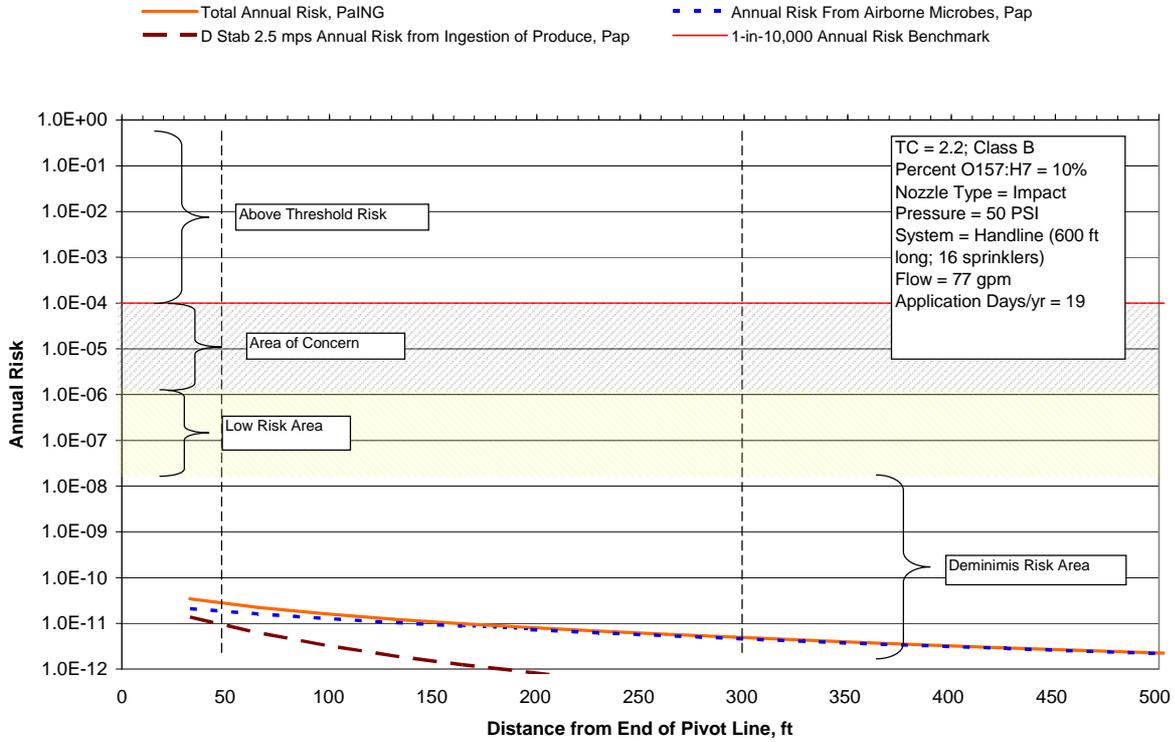
**Appendix 2: UI MIRA Results (created by Mike Cook)**

Tier I Quantitative Microbial Risk Analysis - E. Coli			
<b>Input Parameters</b>			
Total Micro-organism Loading in Wastewater:	2.2	CFU/100ml	
Fraction Pathogen (ie O157:H7):	0.100		
Total Wastewater Flow Rate:	77	gal/min	
Application Days per Year:	19	d/yr	
<b>System Parameters</b>			
Sprinkler Type/Orifice:	4	Enter #:	
System Pressure:	50	psig	
<b>Resulting Aerosolization Efficiencies</b>			
Aerosolization Efficiency, E (Fraction < 100um):	0.0027		
Fraction of Droplets 100 um to 200um	0.0060		
		<b>Modeled Parameters</b>	
		<b>Range</b>	
#	Nozzle Type	Low Limit	Upper Limit
1	Rotators	10	30
2	Flat Spray	10	30
3	Wobbler	10	40
4	Impact	20	80
5	End Gun	30	90
6	Enter 6 and put values here t		0.003
		Fr<100um	100-200um
		50	psig
		0.0041	0.0104
		0.0039	0.0111
		0.0024	0.0083
		0.0027	0.0060
		0.0013	0.0040
		0.0030	0.0030

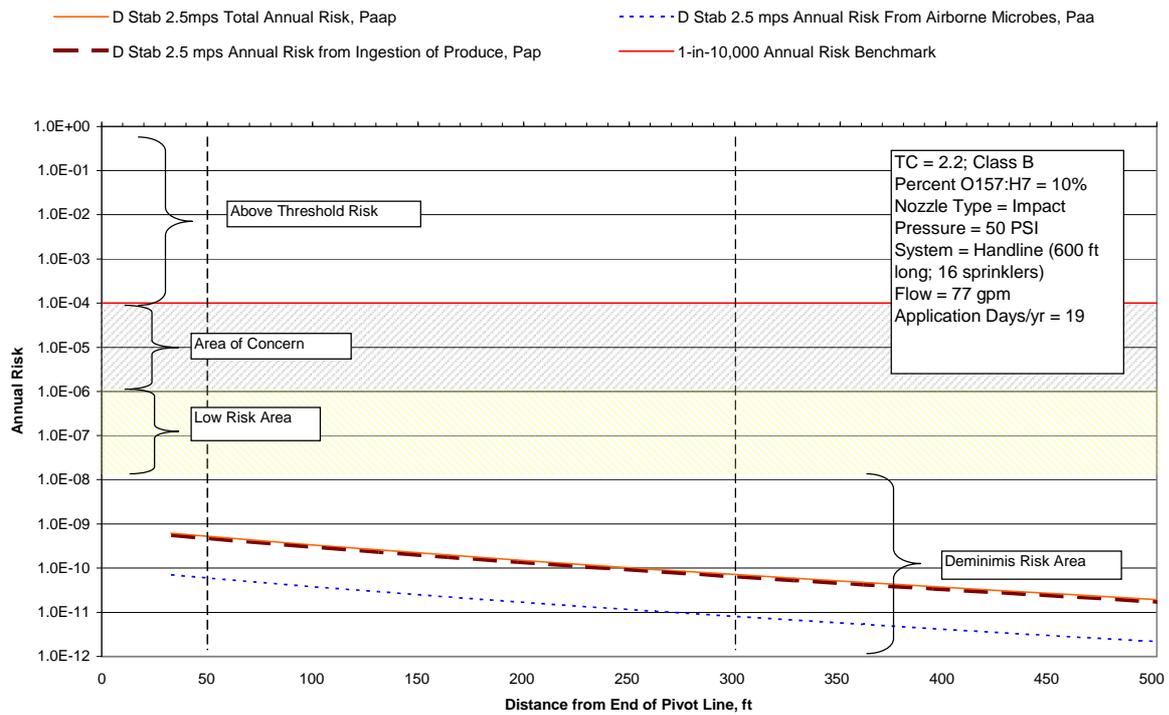
**Poor Dispersion Conditions Low Windspeed, Stable Air (F Stability, 1mps)**



**Windy Conditions, 22 mph (D Stability, 10mps WS)**



**Typical Daytime Conditions, (D Stability, 2.5mps Wind )**



Typical Daytime Conditions, (B Stability, 1mps Wind)

