A Comparative Analysis Of Green Roof Designs Including Depth Of Media, Drainage Layer Materials, And Pollution Control Media

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A COMPARATIVE ANALYSIS OF GREEN ROOF DESIGNS INCLUDING DEPTH OF MEDIA, DRAINAGE LAYER MATERIALS, AND POLLUTION CONTROL MEDIA

BY

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ABSTRACT

Population growth has lead to an increase in development and impervious areas in urban settings. Post-development conditions cause several problems for stormwater management such as limited space for stormwater storage systems and the conveyance of pollution picked up by runoff to nearby water bodies. Green Roofs with cisterns have been shown to attenuate the peak flow of storm events and reduce the pollution load leaving a site and entering nearby water bodies. The purpose of this research is to expand the available research data on green roofs with cisterns by investigating the water quality and hydrology effects of different green roof designs including depth of media, an additional pollution control layer beneath the growth media, and different drainage layer materials. Furthermore, a comparison study is performed on the cistern water quality, direct filtrate water quality, and control roof filtrate water quality. Results show that phosphorus concentrations are lower when using a pollution control layer beneath the growing media, and that evapotransporation and filtrate factor values from the 4-inch media and the 8-inch media are approximately equal for one year. However, hydrograph results show that the 8-inch media design has a lower peak flow and longer attenuation when compared to the 4-inch media design for a single storm event. Furthermore, the drainage layer material has no significant effect on the water quality or hydrology of the green roof discharge. The data also emphasizes the importance and effectiveness of the incorporation of a cistern into a green roof system.

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CHAPTER ONE: INTRODUCTION, OBJECTIVES, AND LIMITATIONS

Introduction

Water is a critical resource for the earth's ecosystem as well as human survival. It is a source for natural and ornamental vegetation, drinking water, recreation, waste carriage, navigation, recharge for aquifers, propagation of wildlife habitats, and many other beneficial uses. As the population grows and urbanization spreads, water resources in the ground or on the surface are becoming depleted, and management of water will become more critical to offset the effects. The quality of water storage is being polluted by several factors such as stormwater runoff, industrial discharge, and poor air quality. Pollution in stormwater originates from contact with fertilizers and animal feces from lawns and agricultural lands; particulate matter, oil, and grease from roadways corroded materials from roof surfaces, (Good, 1993) and many other human activities.

The source of surface water pollution is classified into two categories: point source and non-point source. Point source pollution originates from single sources and is regulated; one example includes the millions of gallons of wastewater discharged from the pipes of industrial facilities and municipal sewage treatment plants into rivers, streams, lakes, and the ocean (TEP 2007). On the other hand, non-point source pollution comes from many diffuse locations caused by rainfall or temporarily stored water moving over and through the ground and is much more difficult to control and regulate. Examples of non-point source pollution include excess fertilizer, herbicides, and insecticides from agricultural lands and residential areas; sediment from improperly managed construction-sites, crop and forest lands, and eroding stream banks; bacteria and nutrients from livestock, pet wastes, and faulty septic systems; as well as, atmospheric deposition and hydromodification (EPA 2007). A majority of the stormwater runoff makes it to surface waters and if not treated, it may have a negative effect on water quality.

New technologies and management practices are being developed to mitigate the water pollution problem. One technology that is becoming more widely used in the United States is the vegetated roof, garden roof, or green roof. A green roof is a multi-layer roof made up of a waterproof layer, protection layer, drainage layer, media layer, and vegetation layer. The system enables water to be detained on the roof during rain events, attenuating the flow of runoff from the roof. Furthermore, stormwater can be stored onsite with the addition of a cistern to the system and reused for irrigation, toilet water, and other non-potable water uses. It is recognized that some additional purification of the filtrate water from the green roof may be necessary before in-door uses.

The findings of this report expand the available research data on green roofs in the state of Florida and further the development of the industry in the United States. It is an extension of the research performed by Mike Hardin in 2006 at the University of Central Florida. Water quality data are presented from full size green roofs built in Florida and compared with the data collected from test chambers with varying designs. The full size green roof samples were collected from the 2007 New American Home and the Stormwater Lab at the University of Central Florida (Kelly, Hardin, and Wanielista, 2007).

Objectives

Research on filtrate water quality and volume from green roofs in the United States is limited but the benefits of green roofs are providing interest in their use and the industry is growing. Studies have been done on stormwater attenuation, water quality and storage capacity (Hardin, 2007) of a deep (6 inch green roof) of specific design, but little documentation is available on water quality and evapotransporation for different depths, media combinations, or drainage layers. This research provides data and analysis to answer the questions dealing with these three variables.

The objective statements are:

1. The addition of a pollution control layer below the growing media of a green roof improves the water quality filtrate leaving a green roof and used for irrigation.
2. Increasing the depth of growing media on a green roof improves the water quality and attenuates the flow of filtrate water leaving a green roof.
3. A comparison of the attenuation and water quality between a gravel drainage layer and a plastic drainage layer leaving a green roof.
4. A comparison of the cistern water quality from the test chamber cisterns and the New American Home and Stormwater Lab cisterns (Kelly, Hardin, and Wanielista, 2007).
5. The identification of variables tested which result in the removal of the most nitrogen and phosphorus from the green roof filtrate and cistern.

Climate and Design Limitations

Climate

1. The experiment is limited to the Central Florida climate. From December through May, the climate is dry with temperatures ranging from 30^{o}F to 75^{o}F normally, and from June through November it is wet with temperatures ranging between 75^{o}F to 99^{o}F.

Design

1. The makeup water for the irrigation is taken from a potable source.
2. The size of each green roof chamber is 16 sq. ft.
3. The growing media is combination of expanded clay and other materials
4. The pollution control media is a combination of tire crumb and other materials
5. The cistern is designed as 5.5 inches per square foot of green roof area

CHAPTER TWO: BACKGROUND AND PREVIOUS GREEN ROOF RESEARCH

Background

Green roofs have "painted" the urban landscape for more than 4,000 years. One example is a green roof dating back to 500 B.C., the Hanging Gardens of Babylon, which was built over arched stone beams and held together and waterproofed with layers of reeds and thick tar with soil, plants and trees. The United States also has a history of green roofs, one such roof was built in the 1930's and can still be seen today at Rockefeller Center in New York (Garland, 2007).

The modern green roof industry originated in Germany and emerged in the 1960's. Between 1989 and 1999, more than 350 million square feet of green roofs were built on German buildings (Penn State, 2006). In the U.S., one of the leading green roof cities is Chicago with over 2.5 million square feet of green roofs in place with more planned (Paulson, 2006). The majority of technical literature available for construction of green roofs is written in German and has slowed the adoption in America. (Penn State, 2006).

Depth of Media

Green roofs are categorized into two groups based on the depth of media; passive (extensive) green roofs and active (intensive) green roofs. The passive green roofs have a soil depth between 2 inches and 6 inches and the active green roofs are those with a soil depth of 6 inches or greater. Active green roofs have maximum depths of 3 ft to 15 ft and are more expensive due to additional substrate material, plant selection and added structural reinforcement. (Hunt, et. al., 2003).

German research has shown that substrate depth, media type, and vegetation type directly influence the moisture-retention characteristics. Furthermore, the depth of the substrate is also directly related to the sort of vegetation that may be supported by it (Dunnet, 2004). One study of green roofs constructed in Germany showed that a 1.2-inch growing media over a 2.4-inch drainage layer retains 58% of water; a 2.4 inch vegetation layer has approximately 67% retention; and a 4.8 inch growth media layer of mixed grass and herbaceous vegetation has around 70% retention (Dunnet, 2004).

Research on green roof soil depths in the United States have consisted of mainly plant growth and a few on water retention, however, little work has been done on the comparison between passive (extensive) and active (intensive) for retention and water quality. A green roof in Portland Oregon in operation from 1999 with a soil depth of 2-3 inches retained 100% of the rainfall in the summer and 20% in the winter (Hunt, 2003). An eight inch green roof with a cistern at the University of Central Florida retained 87% of the annual precipitation (Hardin, 2006). Investigated in this report is the water quality and water retention capacity of a passive green roof and an active green roof.

Drainage Layer

The drainage layer is the component between the waterproof membrane and the media. Its' primary function is to convey excess water toward the roof drains and gutters and thus off the roof. It also helps prevent water logging of the vegetation, excess water that may cause root decay, and increases the depth of the course available for root penetration.

Two classes of drainage material are available, aggregate and geo-synthetic (Wingfield, 2005). According to the FLL guidelines, five different groups of materials may be used for the drainage layer. The five consist of an aggregate-type material (i.e. expanded clay and slate which may be broken or unbroken, etc.), recycling aggregate-type materials (i.e., brick, slag, foamed glass), drainage matting (i.e. textured non-woven matting, studded plastic matting, etc.), drainage boards (i.e. plastic foam boards, shaped rigid plastic boards, etc.), and drainage and substrate boards (i.e. boards from modified foam) (FLL, 2002). Four of the experimental chambers in this report use a 3/8" gravel rock and four use a recycled polyethylene drainage mat.

No studies exist on the water quality difference between a gravel and synthetic drainage material. Theses data of this report attempt to provide insight into whether one material provides more nutrient removal than the other and compares the volume of filtrate. The only water retention data available on the drainage layer materials is for the synthetic drainage mat that has a water holding capacity of approximately 0.16 gal/ft^2 or 0.256 inches (Hydrotech, 2007). Furthermore, the density of the synthetic material is 0.03 lb/ft^3 and the density of the gravel is approximately 40 - 50 lb/ft^3.

Black & Gold™ Pollution Control Media

Pollution Control Media is a soil composite of recycled tires, expanded clay, saw dust, and peat moss developed at the University of Central Florida. The main component of the media is recycled tires in the form of tire crumb and has been shown to remove nitrogen species from golf course runoff by Lisi et al (2004). This research motivated the further examination of recycled tires for the application of a green roof growing media by Hardin (2006). Hardin's results show that vegetated chambers are effective at reducing the concentration of ammonia and nitrate + nitrite compared to a conventional roof. Furthermore, the data of Hardin illustrates a vegetated roof increases the concentration of both ortho-phosphorus and total phosphorus when compared to a conventional roof but may be controlled with a pollution control media (Hardin, 2006).

The data of this research aims to investigate the effectiveness of a 2 inch pollution control layer beneath the growth media at removing ammonia and nitrate + nitrite and controlling the concentration of ortho-phosphorus and total phosphorus compared to a conventional roof.

Evapotransporation

Evapotransporation is the total amount of water that is transferred from the earth's surface to the atmosphere and is the combination of water that is lost from the soil through evaporation and through transpiration from plants. Evaporation and transpiration are important in cooling of plant surfaces, to maintain temperature in the range that permits photosynthetic activity and growth to occur. Transpiration is also required to transport nutrients into and within plants.

In central Florida, the amount of ET gradually increases from January to July or August and begins to decrease after that time. "Reference evapotransporation" or "ETo" is simply the amount of water needed by a particular plant and is illustrated in Figure 1 (MMWD, 2004).

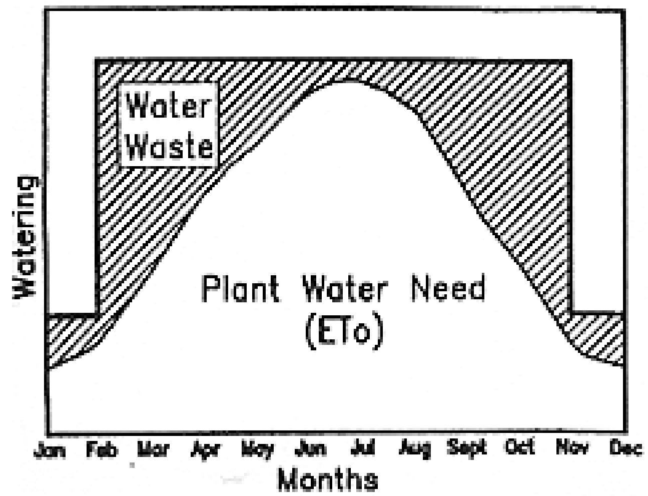


Figure 1: Annual Evapotransporation Curve (MMWD, 2004)

The area with diagonal lines shows a constant irrigation rate from February to November and a different rate between December and January. The white area labeled ETo represents the water needed for the plants, which correlates to the amount of evapotransporation. Figure 1 helps clarify that the use of a constant irrigation rate throughout the year based on a peak ET is a waste of water and signals a necessary shift towards an irrigation schedule based on the plants needs or ET for a particular area.

Figure 1 follows Hardin's (2006) findings. The ET peaked in June and July and was at a minimum during January and December. Results show that vegetation had little effect on evapotransporation rates during December and January (Hardin, 2006). This indicates that irrigation can be reduced during the winter months with no significant affect on plant vitality.

Green Roof Mathematical Model

Green roof mathematical models for stormwater retention have only recently been developed in the United States. Models exist for green roofs without cisterns but only one with a cistern. Original models predicted the runoff from green roofs using historical evapotransporation and precipitation data and a modified groundwater-modeling program to determine the filtrate from a green roof without a cistern (Hardin, 2006). More recently a mathematical model was developed for systems with a cistern or other storage device that is similar to a design of a reuse pond, which uses a mass balance approach (Hardin 2006). The mass balance approach developed by Hardin is utilized in this research and summarized in the following sections. An illustration of the inputs and outputs of the mass balance are seen in Figure 2.

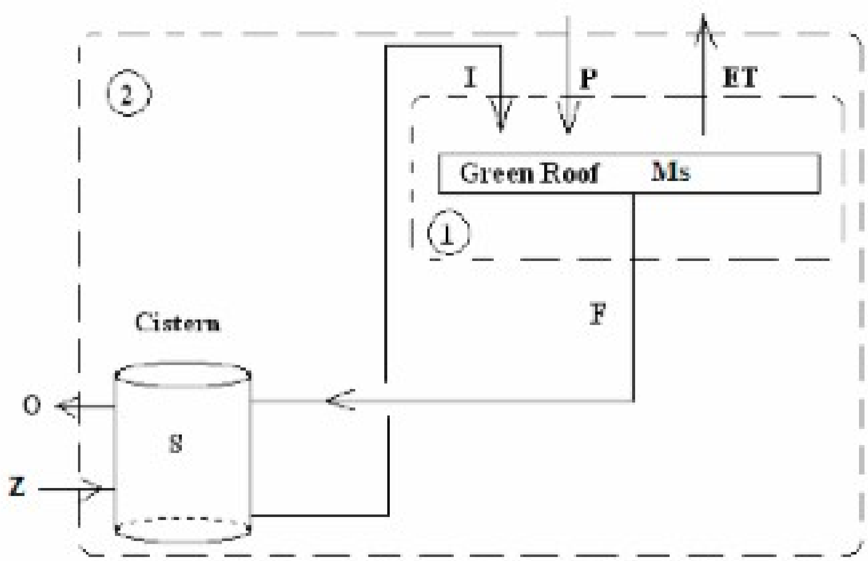


Figure 2: Green Roof Mass Balance (Hardin, 2006)
M_S = Media storage [in/ft_2 of green roof]
P = Precipitation [in/ft_2 of green roof*time]
I = Irrigation [in/ft_2 of green roof*time]
ET = Evapotransporation [in/ft_2 of green roof*time]
F = Filtrate [in/ft_2 of green roof*time]
S = Cistern storage [in/ft_2 of green roof]
Z = Makeup Water [in/ft_2 of green roof*time]
O = Overflow [in/ft_2 of green roof*time]

f Factor

According to Hardin (2006) the main factors that influence the cistern water level are the filtrate from the green roof, the irrigation rate, the rate at which makeup water is added, and the overflow rate. Of these variables, the filtrate from the green roof or f factor is the only one that is unknown. So in order to calculate the f factor, the system boundaries for the first system in Figure 2 were utilized, and an expression derived as the f factor varies with soil conditions, precipitation, evapotransporation, and irrigation amount (Hardin 2006).

$$dM_S/dt = P + I - ET - F \qquad (1)$$

By rearranging and substituting variables such as $F' = f(P'+I')$ & $0<f<1$, Where:

f = Filtrate factor, the fractional volume of precipitation and irrigation which becomes filtrate

Equation (1) simplifies to

$$f = (M_{S1} - M_{S2} + P' + I' - ET')/(P' + I') \qquad (2)$$

The resulting equation now has two unknown variables, the final soil storage and f factor, but the final storage can be found making a few assumptions. The assumptions include that the media saturation is at a volume of 20% of the growing media depth and that any precipitation and irrigation past the point of saturation will contribute to runoff (Hardin, 2006). For the purposes of this experiment, the following research was done over a one-year period and the storage was assumed to be negligible, simplifying equation (2) to

$$f = (P' + I' + ET') / (P' + I') \qquad (3)$$

Cistern Design

An equation that describes how the water level in the cistern fluctuates over time is the second step in developing the green roof model after determining the f factor. The first step to determine how the cistern behaves is to rearrange equation (2) giving:

$(M_{S1} – M_{S2}) = ET' + f(P' + I') – P' – I'$ (4)

Next, the boundaries from the second system in Figure 2 are utilized to develop the following equation:

$d(S + M_S)/dt = P + Z – ET – O$ (5)

The equation further simplifies to:

$S_2 = S_1 + (M_{S1} – M_{S2}) + Z' + P' – O' – ET'$ (6)

The final equation needed to developed the cistern model combines equation 3 and 4 to give:

$S_2 = S_1 + f(P' + I') – I' + Z' – O'$ (7)

Operating assumptions for the cistern must also be made to maximize the efficiency of the system. First the initial storage volume of the cistern is equal to the irrigation volume to provide sufficient water for the first irrigation event. The makeup water added is equal to the difference of the irrigation volume and the current cistern storage volume. Furthermore, the overflow is equal to the difference between the present cistern volume plus the filtrate in that period and the maximum cistern storage capacity.

The efficiency desired can be achieved by using this model and is defined as the volume of stormwater retained divided by the volume of precipitation. The efficiency equations is given as:

$Efficiency = [1 – (O/P)*100\%]$ (8)

Hardin's research also leads to the development of a green roof model software program called CSTORM. The software uses the previously mentioned mass balance approach, utilizing the equations and regional data to supply the user with a cistern storage value based on a desired efficiency. Figure 3 illustrates an example of a storage volume curve in the Orlando area using CSTORM. For example, by using Figure 3, a 1000 sq ft green roof in Orlando with a desired efficiency of 80%, the storage volume would be 2.5 inches or approximately 1600 gallons.

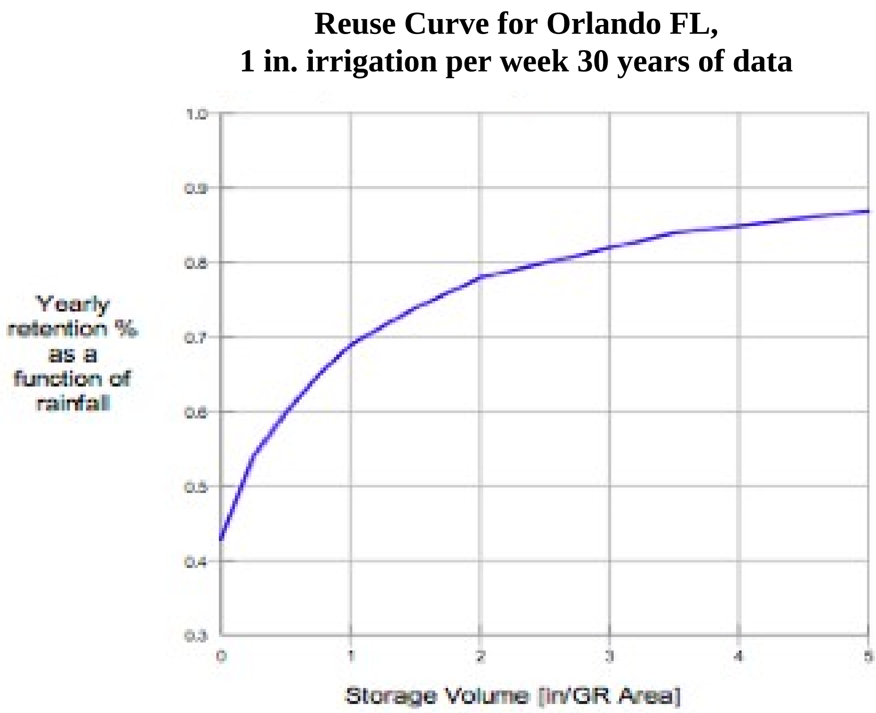


Figure 3: Cistern Storage Curve for Orlando, FL (Hardin, 2006)

The efficiency of the system is dependent on precipitation and evapotransporation for a certain region, and the cistern storage volume. The lower the precipitation and the higher the evapotransporation in a region will produce a higher efficiency green roof stormwater treatment system, while the converse yields a lower efficiency for the system. The use of a green roof without a cistern can reduce the runoff by about 33% - 51%

throughout Florida (Hardin, 2006). If no cistern is incorporated, there will be more pollutant mass from the green roof than from the control roof and an additional stormwater management technique may be needed to meet TMDL standards. Another way to increase the efficiency of the system is to irrigate additional areas, such as ground level landscaping.

Water Quality

The quality of stormwater runoff leaving a developed site is of particular importance since a majority of pollutants are transferred off of urban land and into the natural environment by means of stormwater runoff (Vaze and Chiew 2004, Ellis 2000, Good 1993). The parameters for investigating water quality of stormwater runoff can be broken into three categories, physical properties, nutrient properties, and biological properties. The physical and nutrient properties are the water quality properties measured in this report.

The physical properties are made up of the concentrations of total dissolved solids, suspended solids, total solids, conductivity, pH, alkalinity, dissolved oxygen, oxidation reduction potential, and turbidity of the water. The total suspended solids, total dissolved solids, total solids and turbidity are a measure of the particulate matter in the water, which consists of algae, organic, and inorganic particles. It is also a measure of the aesthetic quality of the water. Turbidity is an inexpensive estimate of determining total solids and sediment in the water. Florida has a criterion for discharges to be less than 29 nephelometric turbidity units (NTU) above background for Class III waters which include streams and lakes but above zero for special protected waters like the Florida Keys (FDEP, 1999). Average turbidity values for estuaries in the south western region of Florida depend on the Secchi depth and are less than 1.9 NTUs for 70 – 100% Secchi depth, between 2 and 4.1 NTUs for 40 – 69% Secchi depth, and greater than 4.2 NTUs for 0 – 39% Secchi depth (Ott et. al., 2006).

Conductivity relates to the total inorganic dissolved solids in the water and is the ability of water to pass an electrical current. Organic compounds such as oil, phenol, alcohol, and sugar do not conduct electrical current as well as inorganic compounds such as chloride, sulfate, phosphate anions, sodium, magnesium, calcium, iron, and aluminum cations. The conductivity of rivers in the U.S. range between 50 and 1500 μmhos/cm and inland fresh waters that support good mixed fisheries range between 150 and 500 μmhos/cm (EPA, Nov. 2006).

Conductivity is also of importance when irrigation is utilized. The primary effect of high conductivity on vegetation productivity is the inability of the plant to compete with ions in the soil solution for water. The higher the conductivity, the less water is available to plants, even though the soil may appear wet. Because plants can only transpire "pure" water, usable plant water in the soil solution decreases dramatically as conductivity increases. The ideal conductivity criteria for plants are below 750 μmhos/cm, however, permissible values range between 750 to 2000 μmhos/cm (Baudin, 2003).

Alkalinity is a measure of a waters resistance to neutralize acid (buffering capacity) or change the pH and is an important parameter in surface-water quality since most aquatic life is sensitive to significant changes in pH. The pH is a measure of the potential of hydrogen in a liquid usually water. The pH of a natural surface-water will vary with geography, but will remain about neutral with a value of 7. Living organisms, especially aquatic life, function best in a pH range of 6.5 to 8.5 and any significant deviation either up or down makes the water highly corrosive (UF, 2003).

Studies have been done on the buffering capacity of green roofs on acid rain and data suggest that common commercial green roof media can neutralize acid rain for 10-30 years depending on acid deposition rates (Berghage, 2007). Previous research from Hardin (2006) further supports the buffering capacity of green roofs with results showing a pH value of 8.78 measured in the cistern (Table 1) compared to an average control roof pH value of 5.9.

Dissolved oxygen (DO) refers to the oxygen gas that is dissolved in water. Aquatic organisms are dependent on this colorless, tasteless and odorless substance that is continuously entering water from plants and the atmosphere above. The amount of oxygen in the water is dependent on water temperature, atmospheric pressure, and salinity. The more dissolved salts in the water decrease the ability for oxygen to dissolve in the same water. Conversely, as atmospheric pressure increases, the more oxygen water can hold. Cool waters generally hold more oxygen, for example, 45^{o}F water can hold 11.9 mg/L of DO where 90^{o}F water can only hold 7.4 mg/L of DO at saturation (UF, 2003). Photosynthesis also plays a large role in supplying water with oxygen in that one of the by products of it is gaseous oxygen. As a result, dissolved oxygen levels are higher in the middle of the day when photosynthesis is at its peak and drops off at night. Oxygen level may further be reduced when there is too much bacteria or algae in the water. When the algae complete its life cycle and die, bacteria consumes the dead algae and the oxygen dissolved in the water. This consumption of oxygen by the bacteria can lead to decreased levels of dissolved oxygen and in some cases completely strip the water of all DO. When the dissolved oxygen drops below 3 mg/L, fish kills and death to other aquatic organisms occurs (FOS, 2003).

Oxidation-reduction potential (ORP) is the measure of oxidizing and reducing agents in the water by their specific electrical charge and is measured in mV. Wastewater treatment facilities have monitored ORP to determine what biological reaction is occurring in the system for years. These reactions include nitrification, which is the oxidation of ammonia to nitrate (+100 to +350 mV), denitrification, which is the reduction of nitrate to nitrogen gas (-50 to +50 mV), biological phosphorus release (-100 to -225 mV), and biological phosphorus removal (+25 to +250 mV) (Gerardi, 2007). The biological phosphorus release is achieved in an anaerobic environment with fermentative bacteria that produce fatty acids. Phosphorus is released when the bacteria absorbs the acids. Once the bacteria are in an aerobic environment, degradation of the acids begins and storage of the energy in phosphorus granules occurs. The storage of this energy requires large amounts of phosphorus that is in the solution thus providing phosphorus removal (Gerardi, 2007). Generally, ORP values above 400 mV are harmful to aquatic life (Enviroequip, 2003). Furthermore, research has shown that at values of 650 to 700 mV, bacteria such as E. coli and Salmonella are killed within a few seconds (Suslow, 2007).

The nutrient properties include species of both phosphorus and nitrogen, measured by ortho-phosphorus, total phosphorus, ammonia, nitrate + nitrite, and total nitrogen concentrations. Nutrients are the most significant parameters linked to water quality impairment within the State of Florida (Harper, 2007). Furthermore, treatment practices using nutrients as a basis will achieve removal for other parameters because nutrients are among the most difficult to remove (Harper, 2007). Nitrogen and phosphorus cause uncontrolled and unwanted growth of algae and aquatic weeds such as hydrilla and hyacinth (Livingston, 1991). Phosphorus is considered the limiting nutrient for the growth of aquatic plants. When there is an excess of nutrients, the process is termed eutrophication.

Total phosphorus includes all forms of phosphorus including the phosphorus bound in plant and animal tissue, attached to soil particles, and ortho-phosphorus (King County, 2007). Ortho-phosphorus is a dissolved form of phosphorus that is readily available for plants and algae. When oxygen concentrations are low in water bodies, the iron-phosphorus bond that holds phosphorus to sediment particles is broken and the dissolved nutrient is released into the water column (King County, 2007).

Total nitrogen includes dissolved forms of nitrogen (ammonia and nitrate) plus organic nitrogen. Ammonia-nitrogen and nitrite + nitrate-nitrogen are highly soluble in water and is one of the dissolved forms of nitrogen, which are the components of fertilizers, sewage effluent and manure. In the normal aquatic environment, the majority of ammonia and nitrite + nitrate are formed through the decomposition of organic matter (King County, 2007). Nitrate has also been found to cause blue baby syndrome in infants at high concentrations.

Vaze and Chiew (2004) found that most of the total nitrogen and total phosphorus loads associated with urban stormwater was due to particulate matter being dissolved in the runoff from the storm event. A relationship between sediment size and the expected total nitrogen and total phosphorus loading associated with a certain particle size was studied. Results showed that 10% of TN and TP were attached to particles larger than 300 μm, approximately 15% of the TN and about 25% of the TP were dissolved or smaller than 0.45µm,, and more than 70% of the TN and more than 60% of the TP fell within the size range of 11 and 300µm (Vaze and Chiew, 2004).

One green roof study (Betzlaff, 2007) comparing the nitrate concentrations discharging from Green Roof Block (tray) systems and built in place systems (continuos) found concentrations between 10 and 40 mg/L for the Green Roof Block systems and between 6 and 12 mg/L for the built in place systems. The built in place systems had an overall lower concentration of nitrate than the Green Block system and the deeper media depths (10cm, 15cm, and 20cm) had a lower concentration than the shallow media depth (5cm). The study used a nitrogen-based fertilizer and did not state the amount applied to the study or when it was applied in relation to sampling.

Table 1 shows some of the water quality properties in stormwater compared to those from a green roof. The values for the green roof were taken from the cistern following a fertilized green roof. The green roof experiment in this research will explore the values of both the direct filtrate and cistern water quality values of an unfertilized green roof.

Table 1: Average Water Quality Values for Stormwater Systems in Florida

	City of Orlando lake median value (1)	Central Florida Stormwater average (2,3)	Central Florida Stormwater Standard Deviation (2)	South Eastern Stormwater median Value (4)	Orlando Green Roof Values Using Expanded Clay Growing Media (5)
Ortho Phosphorus (OP) (mg/L as P)	0.004	-	-	0.11	0.79
Total Phosphorus (TP) (mg/L as P)	0.038	0.05 (2)	0.07	0.22	1.39
Total Nitrogen (TN) (mg/L as N)	0.87	0.79 (2)	0.18	-	0.9
Nitrate (NO3) (mg/L as N)	0.026	< .004 (±)(3)	-	0.6 (±)	0.11 (±)
Ammonia (NH4) (mg/L as N)	0.02	.013 (3)	-	0.5	0.045
TKN (mg/L as N)	0.85	1.94 (3)	-	1.6	0.8
Turbidity (NTU)	-	14.3 (3)	-	-	3.08
TSS (mg/L)	4.9	-	-	42	16.5
TDS (mg/L)	122	76 (2)	40	74	391
pH	7.8	6.9 (2)	0.2	7.3	8.78
Alkalinity (mg/L as CaCO3)	45.9	54 (₣) (2)	20	38.9	85

(1) www.cityoforlando.net/public_works/stormwater/
(2) Wanielista & Yousef (1993)
(3) FDEP (1999)
(4) Pitt & Maestre (2004)
(5) Hardin (2006)

± Nitrite and Nitrate
₣ Alkalinity given as HCO_3^-
¥ Based on 2004 data

Irrigation

To ensure the success of a green roof and healthy plant growth, the plants need adequate watering. Every geographical region has a different annual precipitation rate and depending on the climate may need irrigation to ensure plant survival. In the case of Florida, irrigation is mandatory for the plants' continued existence. (Hardin and Wanielista, 2006).

According to "Planting Green Roofs and Living Walls" (Dunnet, 2004) there are four methods of irrigation (i.e. traditional sprinkler system, capillary systems, standing-water systems, and drip and tube systems). The surface sprays water and encourage surface rooting which is vulnerable to extreme temperatures like in Florida. Capillary systems use porous mats that deliver water to the base of the substrate and are ideal for depths less than 8 inches. Standing water systems maintain a layer of water at the base of the roof and can be maintained by float-control devices. The final method mentioned is drip irrigation, which use plastic tubing either laid on the surface of the media or buried beneath the substrate. This irrigation system loses less water than spray irrigation and if buried will lose less water to evaporation. Weed seedlings are less likely to germinate as well if the surface is kept dry, however, maintenance of the tubing may be more cumbersome. Drip irrigation is used on the New American Home and Stormwater Lab green roofs.

Hardin (2006) found that by increasing the irrigation rate the evapotransporation rates increased but significantly increased the filtrate factor. By increasing the evapotransporation, the water budget is maintained and the runoff is decreased while the increase in the filtrate factor increases the runoff. Results show that during the winter months the filtrate factors were high and the evapotransporation rates for the vegetated chambers are equal to the non-vegetated chambers. The higher the soil moisture the greater the filtrate factor, which means that the green roof will have larger filtrate volumes if the soil moisture is kept relatively wet during most of the year. Hardin and Wanielista (2006), suggest reducing the irrigation rate during the winter months to 0.5 inches/wk, 1 inch/wk during the spring and fall, and 1.5 inche per week in the summer.

Hardin (2006) suggested a green roof irrigation schedule for the Central Florida area as follows:

1. December, January, February, and half of March with 0.5 inches/wk
2. The rest of March, April, May, September, October, and November with1.0 inch/wk
3. June, July, and August with 1.50 inches/wk

Type of Plants

Green roof plants vary from region to region. Since the majority of green roofs in the United States have been installed in the Northeast, central North, and on the Northern West coast, the plant selection for the south such as Florida is limited. Northern regions found that species such as sedums and delosperma are ideal green roof plants for their climate (Berghage et.al., 2007). These plant species are not native to the Florida region and are not recommended for use in the southern climate.

The research on green roof plants in Florida is limited and further studies are necessary to distinguish the ideal plants for the region. The plant data that are available are found in the research done by Hardin (2006). The plant species used by Hardin on the UCF Student Union utilized include Helianthus debilis (Dune sunflower), Gaillardia pulchella or aristata (Blanket flower), Lonicera sempervirens (Coral honeysuckle), Muhlenbergia capillaris (Muhly Grass), Myricanthes fragrans (Simpson's stopper), Clytostoma callistegioides (Argentine trumpet vine), Tecomeria capensis (Cape honeysuckle), and Trachelospermum jasminoides (Confederate jasmine). The first five are native or have existed for a long time in central Florida and the last three are recently introduced but grow well in the area. Hardin's study did not attempt to quantify the health or growth capacity of the plants. However, it was noted that after one year all species appeared to have healthy growth and only a few plants had to be replaced (Hardin, 2006). The observation of the plants after three years shows that the plants remain healthy and continue to grow.

The plant species in the test chambers are Zamia integrifolia (Coontie Palm), Muhlenbergia capillaris (Muhly Grass), Helianthus debilis (Dune sunflower), and Gaillardia pulchella or aristata (Blanket Sunflower Daisy). The plant selection on the New American Home include Zamia integrifolia (Coontie Palm) and Muhlenbergia capillaris (Muhly Grass); the Stormwater Lab plants are Lonicera sempervirens (Coral honeysuckle) and Helianthus debilis (Dune sunflower) (Kelly, Hardin, and Wanielista, 2007).

Atmospheric Quality

Green roofs are expected to improve air quality. A study done by Beth Anne Currie and Brad Bass shows that by using trees, shrubs, and green roofs, gases and particulate matters such as NOx, SO_2, CO, PM, and O_3 can be reduced (Bass, Currie 2005). Green plants take up gases through the leaf stomata and react with water to form different chemicals (Bass, Currie 2005). Particulate matter is adsorbed on the outside of the leaf as it is blown into the path of the plant and washed off into the soil after it rains.

The study used the Urban Forest Effects (UFORE) model developed by the USDA Forest Service Northeastern Regional Station to estimate the pollutant removal capacity of 7 different scenarios; the scenarios included buildings with and without green roofs at different green roof surface percentages. The study found that one green roof will not make a significant impact on the quality of ambient air however a city plan with a number of green roofs will make a difference on air quality (Bass, Currie 2005).

Nitrous oxide is a major green house gas pollutants which has 300 times the effect of carbon dioxide on the atmosphere (Greenhouse Gas Mitigation Program, 2006). Nitrous oxide is part of the denitrification of excess nitrogen in the soil. While the majority of nitrogen in the soil is converted to nitrogen gas, a small percentage is left as N_2O (Greenhouse Gas Mitigation Program, 2006). When it rains and the soil becomes saturated at a temperature above 50 degrees Fahrenheit, the environment becomes anaerobic and deprives the denitrifying bacteria of oxygen. Because these bacteria are both aerobic and anaerobic bacteria, when oxygen is not available in the form of O_2 the bacteria begin to consume oxygen from nitrate in the soil, a process called denitrification (Northwest Research and Outreach Center, 2004). Excess nitrogen is used to fertilize agricultural crops; for example in Florida nitrogen fertilizers are added to tomato crops at a rate of 311 lb per acre (Environmental Working Group, 1996). Nitrous oxide emissions can range from 0.5 to four pounds of nitrogen per acre per year (Greenhouse Gas Mitigation Program, 2006).

CHAPTER THREE: METHODOLOGY AND EXPERIMENTAL DESIGN

Methodologies

The following are a summary of the methodologies used to the experimentation and comparative analyses

1. The measurement and comparison of the quantity of water introduced and removed from the system at different times of the year for a 4-inch and 8-inch media depth, a gravel and plastic under layer, and a design with a 2-inch pollution control layer beneath the growing media and a design without a pollution control layer.
2. The measurement and comparison of nitrogen and phosphorus concentrations in the cistern and the filtrate for a 4inch and 8inch media depth, a gravel and plastic under layer, and a design with a 2-inch pollution control layer beneath the growing media and a design without a pollution control layer.
3. The comparison of nitrogen and phosphorus concentrations in the cistern and filtrate waters to the concentrations of the controlled conventional covered roof water.

Experimental Design

The experiment was set up by building ten 4' x 4' chambers with sides built up approximately 12-inches and lifted 12-inches off the ground. Two 20-gallon bins are placed beneath the drains of the chambers to collect the direct runoff and on each of the irrigation dates the filtrate is measured and stored in a 55-gallon barrel (Cistern) in front of each chamber. There are eight chambers built with different green roof designs and two chambers with only a waterproof membrane, which are the control chambers. An example cross section of one of the chambers is seen in Figure 4 which shows the 8-inch media chamber with a pollution control layer and synthetic drainage material. The nomenclature for each green roof experimental chamber is presented in Table 2 and the experimental design is illustrated in Figure 5. The control chambers are labeled C1 and C2.

Table 2: Description of Each Experimental Chamber

	8 Inch Media Depth	4 Inch Media Depth	
With Pollution Control Media	8PCS	4PCS	Synthetic Drainage Material
Without Pollution Control Media	8S	4S	Synthetic Drainage Material
With Pollution Control Media	8PCG	4PCG	Gravel Drainage Material
Without Pollution Control Media	8G	4G	Gravel Drainage Material

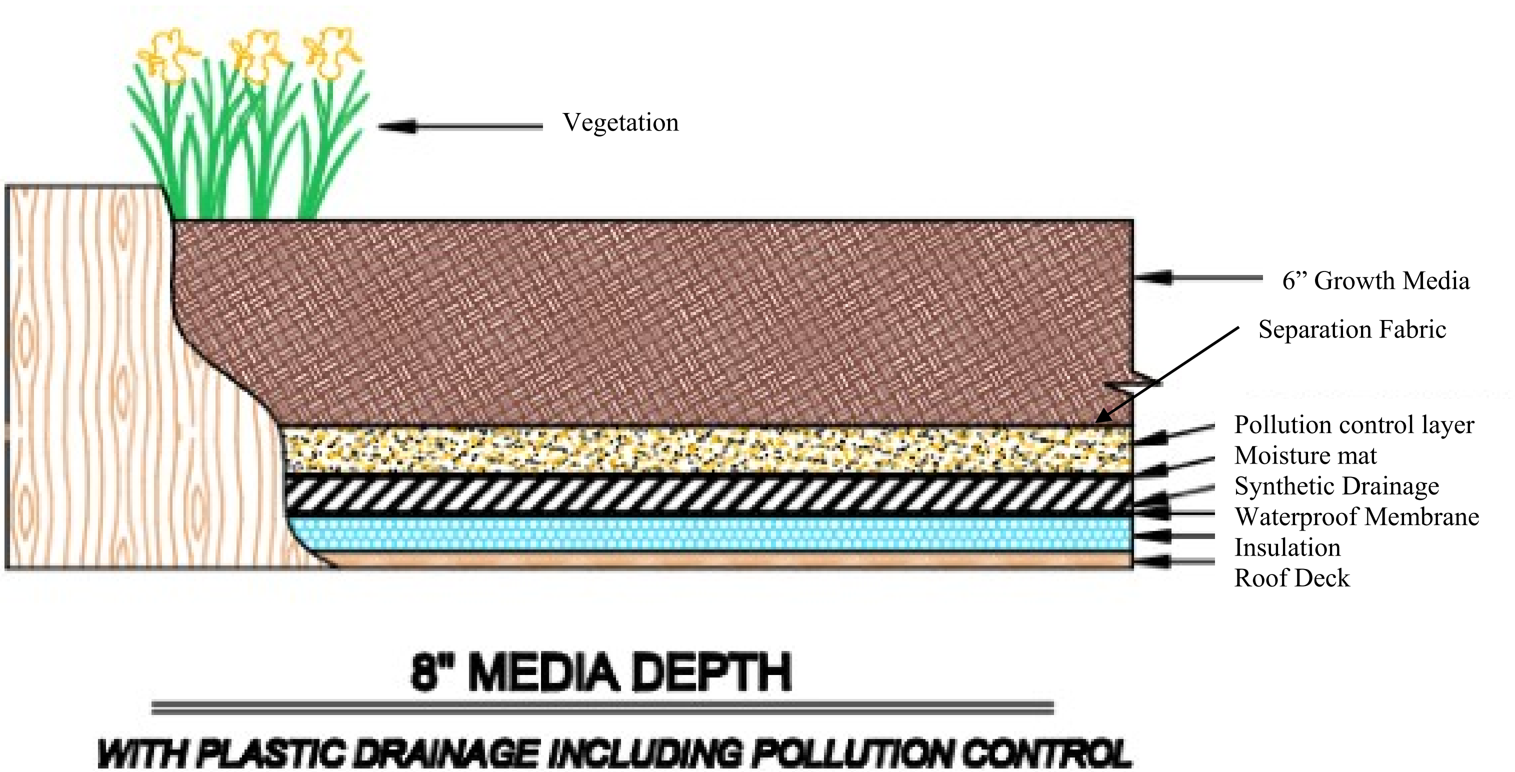


Figure 4: Chamber Cross Section (8PCS)

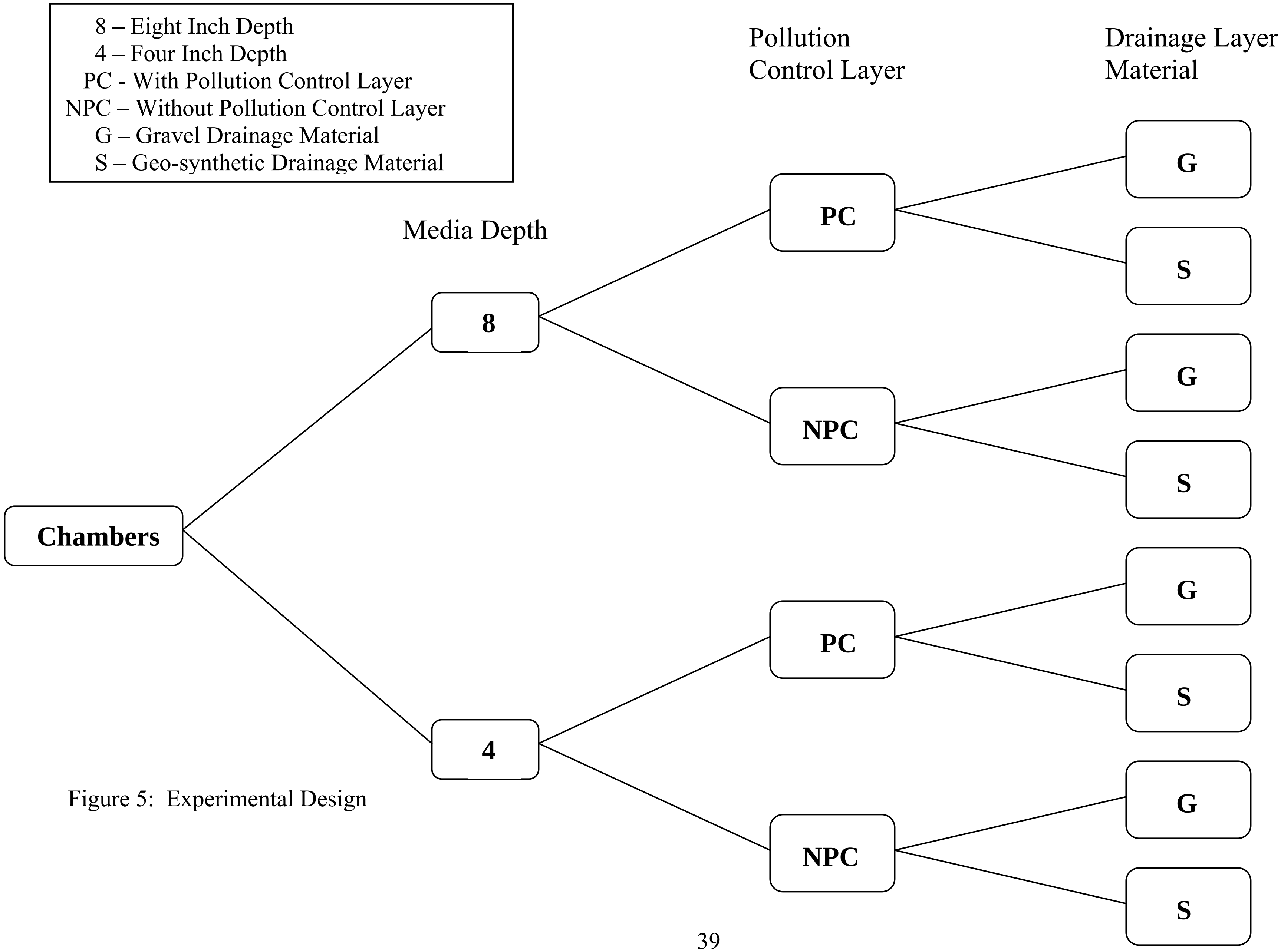


Figure 5: Experimental Design

CHAPTER FOUR: ET, F FACTOR, AND HYDROGRAPH RESULTS

ET Results

Shallow Depth vs Deep Depth

The annual ET results show no significant difference with a 90% confidence interval between the 4-inch and 8-inch depths. The eight-inch chamber with pollution control and synthetic drainage has the lowest annual average ET (0.12 inches), and both the four-inch and eight-inch chambers with no pollution control and gravel drainage have the highest ET (0.14 inches). The annual ET averages for every chamber and the number of samples used for the comparisons are shown in Table 3. All the experimental data results are listed in Appendix C.

Table 3: Average Annual ET (inches per day)

Chamber	8PCS	8PCG	8S	8G	4PCS	4PCG	4S	4G
Average	0.12	0.13	0.13	0.14	0.13	0.12	0.13	0.14
n	97	98	98	98	97	97	97	98

The monthly averages in general follow Figure 1 but shown gradual increase in the spring and decrease in the fall. Figure 6 is a comparable graph to Figure 1 for Orlando conditions and climate. Table 4 shows the monthly averages and Figure 7 illustrates how the ET changes over the year for each chamber. All of the graphical ET comparisons are found in Appendix A.

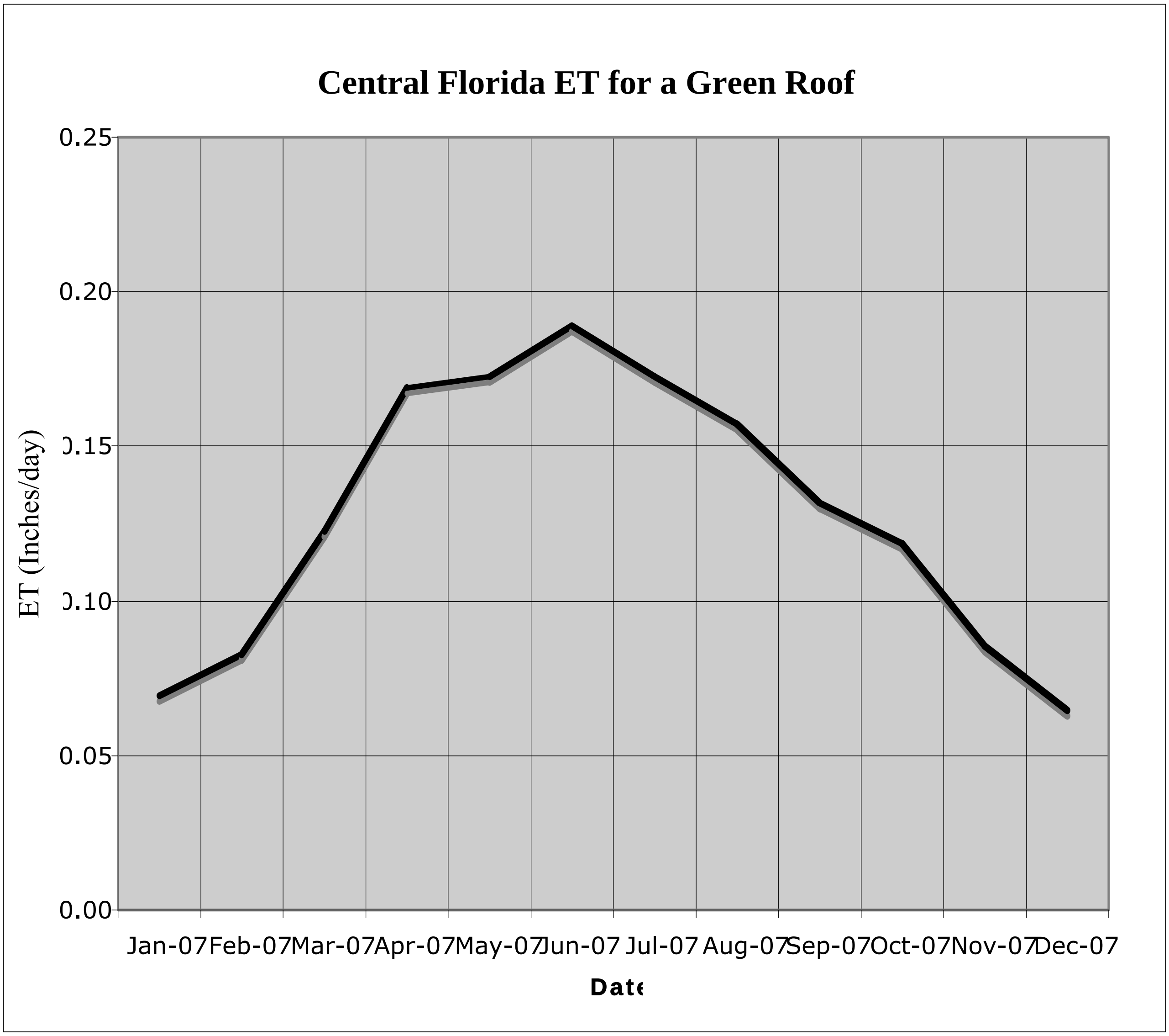


Figure 6: Green Roof ET Curve for Central Florida

Table 4: Average Monthly ET (inches per day)

Date	8PCS	8PCG	8S	8G	4PCS	4PCG	4S	4G
Jan-07	0.08	0.08	0.08	0.08	0.07	0.08	0.08	0.08
Feb-07	0.08	0.09	0.09	0.09	0.08	0.08	0.08	0.09
Mar-07	0.11	0.13	0.13	0.13	0.12	0.12	0.12	0.13
Apr-07	0.15	0.16	0.15	0.15	0.17	0.16	0.16	0.17
May-07	0.15	0.16	0.16	0.18	0.17	0.16	0.17	0.16
Jun-07	0.17	0.16	0.16	0.19	0.19	0.16	0.18	0.19
Jul-07	0.15	0.16	0.17	0.15	0.17	0.16	0.17	0.17
Aug-07	0.17	0.18	0.15	0.17	0.16	0.15	0.17	0.17
Sep-07	0.14	0.15	0.12	0.14	0.13	0.13	0.14	0.15
Oct-07	0.12	0.11	0.12	0.13	0.12	0.11	0.11	0.13
Nov-07	0.08	0.09	0.09	0.09	0.09	0.09	0.09	0.09
Dec-07	0.05	0.06	0.07	0.07	0.06	0.07	0.06	0.07

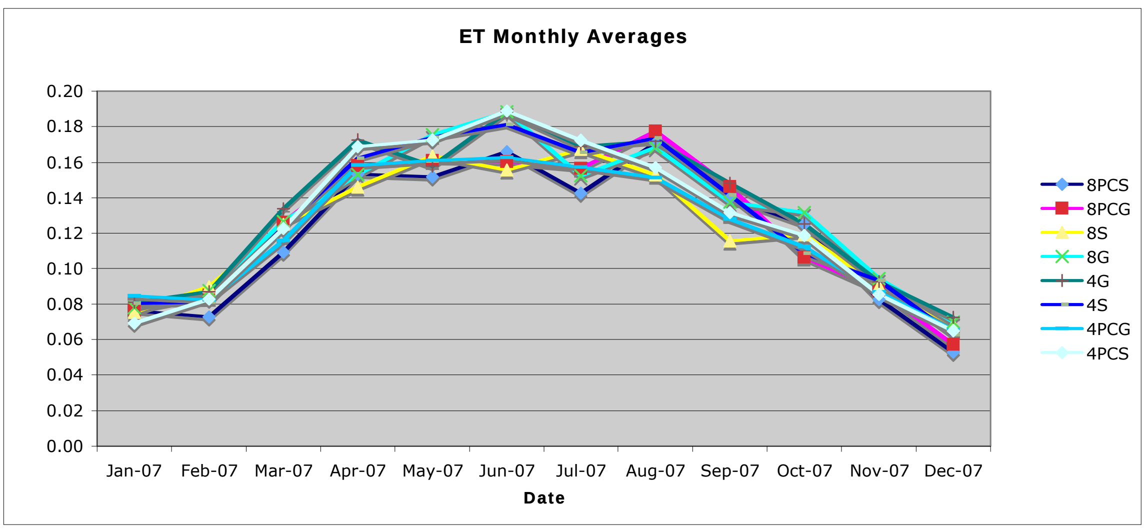


Figure 7: Monthly ET Average Curves (inches / day)

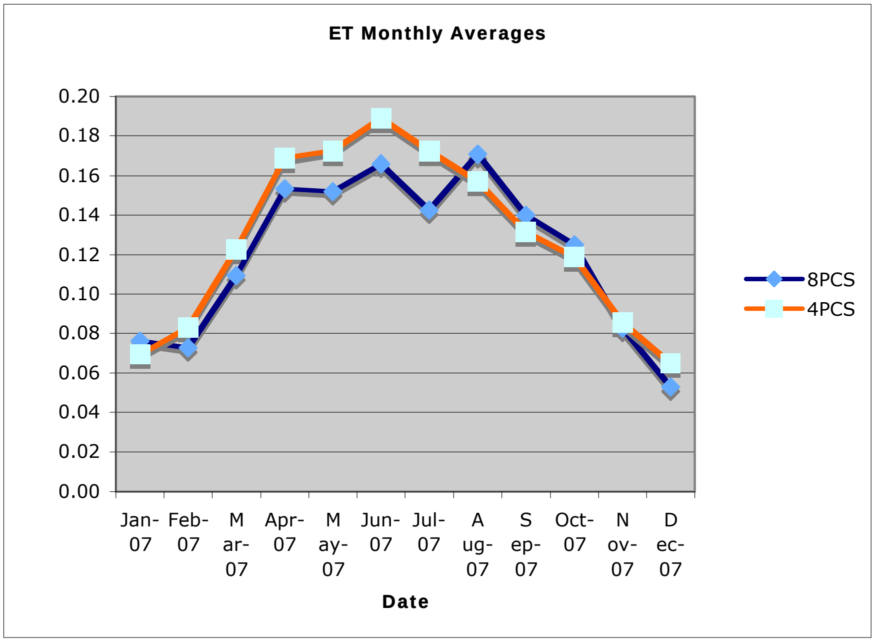


Figure 8: ET Comparison Between 8PCS AND 4PCS (inches / day)

Pollution Control Media vs No Pollution Control Media

The addition of a pollution control layer beneath the growing media has no significant affect on the ET at a confidence interval of 90%. The annual ET averages are displayed in Table 3 and monthly averages in Table 4. Graphical comparisons of the ET between chambers with pollution control media and without holding the drainage media and depth constant for the year are seen in Figure 9.

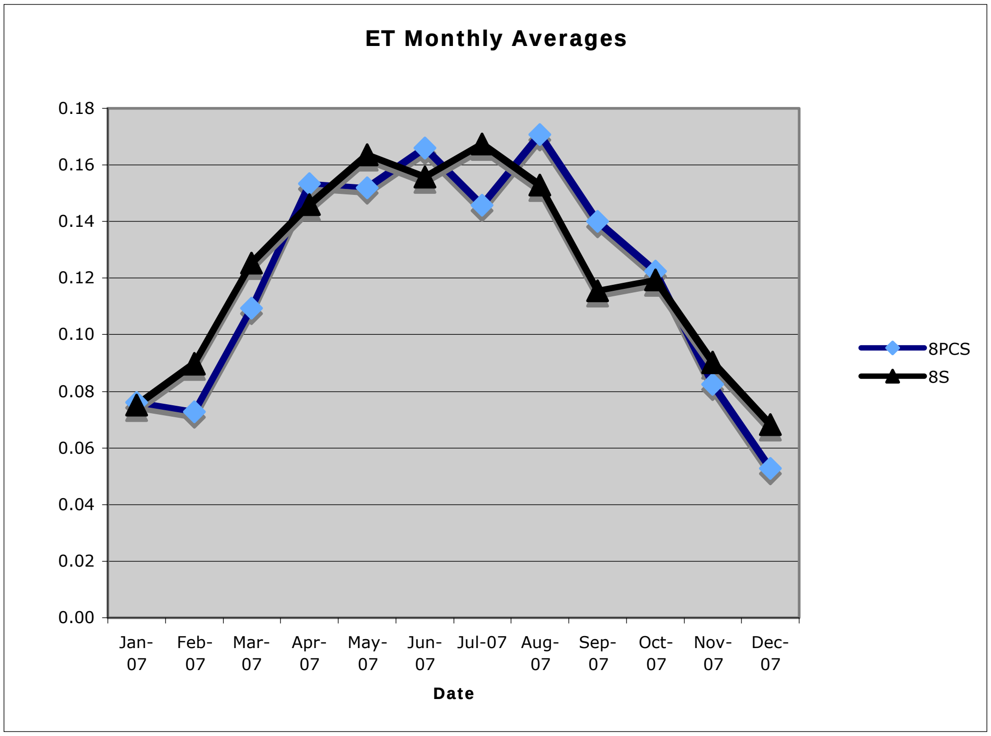


Figure 9: ET Comparison Between 8PCS AND 8S (inches / day)

Gravel Drainage Material vs Synthetic Drainage Material

The drainage material has no affect on the ET and the findings show with 90% confidence that no significant difference exists for the ET while holding the depth and pollution control media constant. Table 3 and Table 4 show the annual ET and monthly ET respectively. Figure 10 shows the graphical comparisons for the drainage material test.

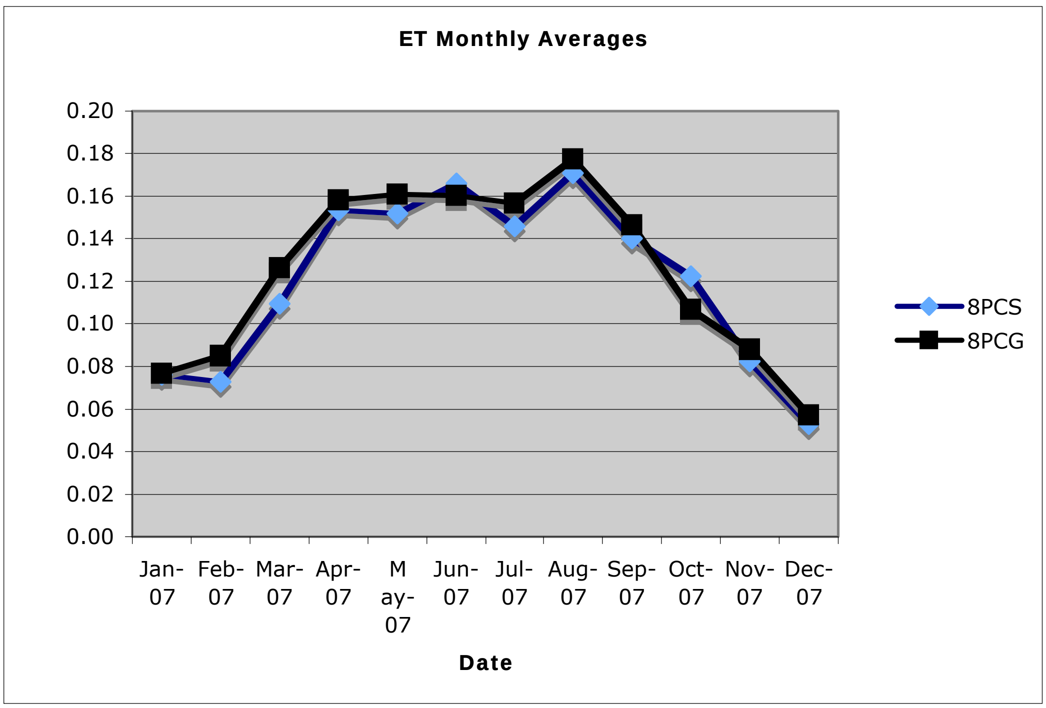


Figure 10: ET Comparison Between 8PCS AND 8PCG (inches / day)

Cumulative ET

The cumulative ET results show the greatest difference between 4G and 8PCS, with the 4-inch gravel drainage media (4G) having the highest ET volume over the study area. This is presumably because the water in the media has more exposure to the atmosphere relative to the other combinations of depth and drainage. A little over 4 inches more evapotransporation occurred during the year for chamber 4G (44.95 inches) than the chamber 8PCS (40.87 inches). The cumulative ET begins to increase in chamber 4G between the months of May and June when the atmospheric temperature increases. Figure 11 illustrates the difference.

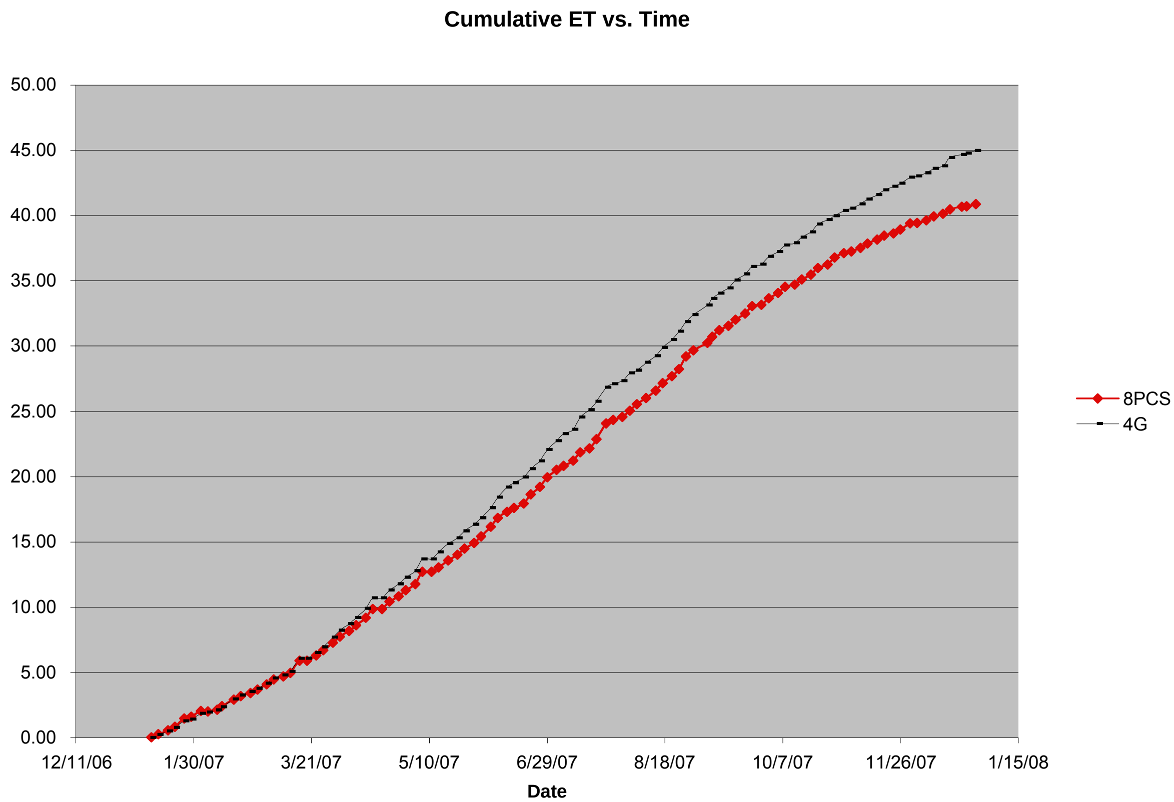


Figure 11: 8PCS Cumulative ET and 4G Cumulative ET (inches)

f Factor Results

Shallow Depth vs Deep Depth

The results show that at a 90% confidence interval the 4-inch depth and the 8-inch depth have no significant difference in filtrate for the year. The filtrate Factor (f) defined as the ratio of filtrate volume to rainfall and irrigation per measured time period ranges between 0.36 and 0.42 with 8PCS having the highest value (0.42) and 4G having the lowest f Factor (0.36) for the year. This is expected because as the ET increases the f Factor decreases. Table 5 illustrates the average f Factor for each measurement time and for each chamber over the year.

Table 5: Average Annual f Factors (dimensionless)

8PCS	8PCG	8S	8G	4PCS	4PCG	4S	4G
0.42	0.41	0.40	0.38	0.38	0.41	0.37	0.36

Note: Each average had a sample size of 97 or n = 97

Examining every chamber on a monthly basis, the monthly f Factor increases between January and December; starting between 0.1 and 0.13 and increasing to between 0.51 and 0.62. The f Factor peaks in July (0.62 to 0.71) when there is the highest precipitation; it drops in August (0.34 to 0.45); and it increases and begins to level off between September and December (0.51 to 0.62). Table 6 shows the monthly f Factor values, and Figure 12 illustrates the change in the f Factor for every chamber throughout the year. By visual inspection of Figure 12, every chamber has an equivalent filtrate factors. All of the comparisons for the f Factor values are found in Appendix A and typical comparisons are seen in Figure 13 and 14.

Table 6: Average Monthly f Factor (dimensionless)

f Factor Monthly Average Comparison of all the Chambers								
Date	8PCS	8PCG	8S	8G	4PCS	4PCG	4S	4G
Jan-07	0.12	0.12	0.10	0.12	0.13	0.13	0.15	0.16
Feb-07	0.21	0.28	0.25	0.25	0.27	0.27	0.29	0.24
Mar-07	0.14	0.07	0.13	0.06	0.06	0.10	0.07	0.10
Apr-07	0.22	0.20	0.19	0.14	0.16	0.20	0.14	0.13
May-07	0.20	0.15	0.14	0.08	0.11	0.17	0.08	0.12
Jun-07	0.50	0.50	0.50	0.45	0.44	0.50	0.46	0.43
Jul-07	0.70	0.71	0.65	0.68	0.63	0.67	0.65	0.65
Aug-07	0.39	0.38	0.45	0.39	0.44	0.44	0.37	0.38
Sep-07	0.61	0.57	0.62	0.58	0.59	0.59	0.53	0.53
Oct-07	0.55	0.57	0.53	0.50	0.50	0.55	0.54	0.49
Nov-07	0.55	0.52	0.49	0.46	0.50	0.51	0.44	0.46
Dec-07	0.62	0.60	0.54	0.52	0.55	0.54	0.56	0.51

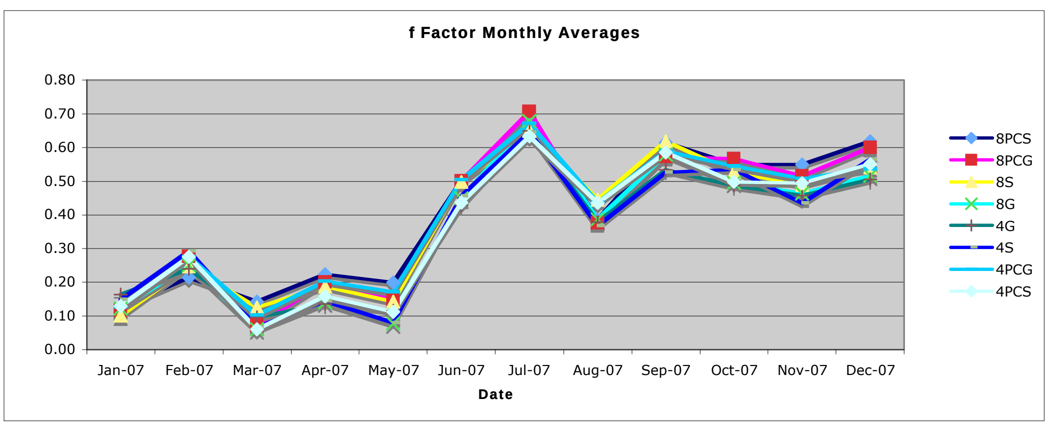


Figure 12: f Factor from January 2007 to December 2007 (dimensionless)

Pollution Control Media vs No Pollution Control Media

The addition of a pollution control layer beneath the growing media has no significant affect on the f Factor at a confidence interval of 90%. The annual f Factor averages are given in Table 5 and monthly averages in Table 6. The typical graphical comparison of the f Factor between the chambers with pollution control media and without is seen in Figure 13.

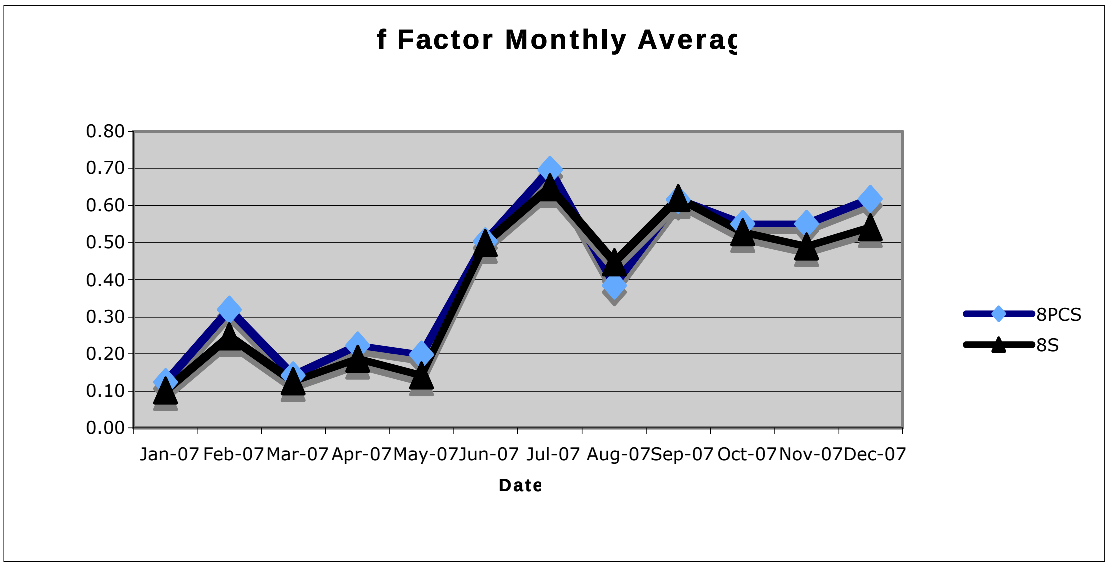


Figure 13: f Factor Comparison Between 8PCS and 8S (dimensionless)

Gravel Drainage Material vs Synthetic Drainage Material

The findings show with a 90% confidence interval no significant difference exists for the f Factor after holding the depth and pollution control media constant and comparing the gravel and synthetic drainage material designs. Table 5 and Table 6 show the annual f Factor and monthly f Factor, respectively. Figure 14 shows the typical graphical comparison for the drainage material test.

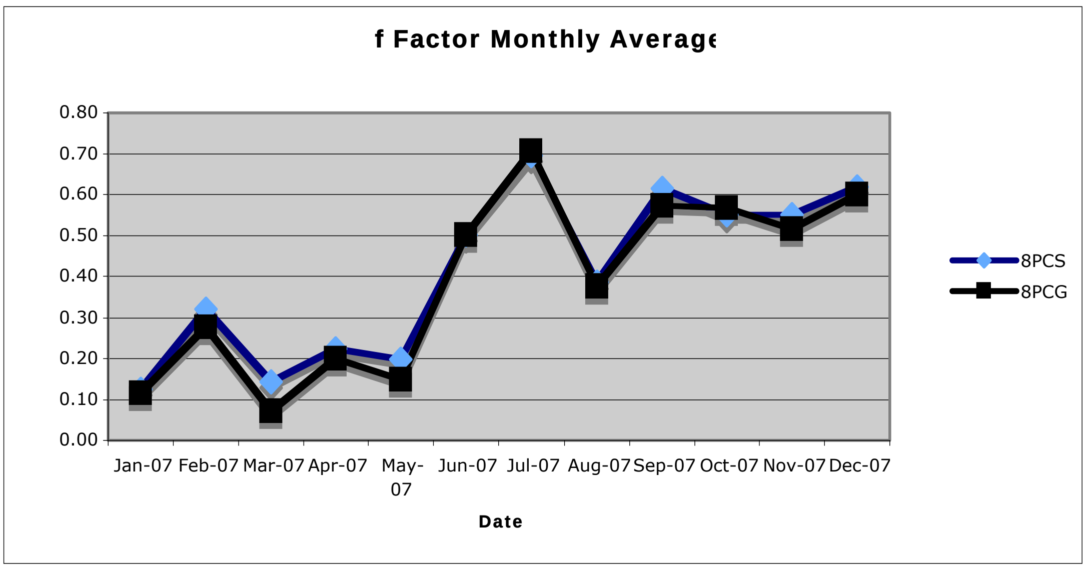


Figure 14: f Factor Comparison Between 8PCS and 8PCG (dimensionless)

Hydrograph Results

Hydrograph data for three events were obtained; one in June after a dry period and an irrigation event of 0.5 inches; one in October after a rainstorm of 1.35 inches and an irrigation event of 0.5 inches; and one in December after a short dry period and an irrigation event of 0.25 inches. A six-inch per hour storm was applied to each chamber until less than exited per minute.

The control chambers used in this research were the same chambers used in Hardin's experiment, so the control hydrograph was taken from Hardin (2006) to compare with the present project, as shown in Figure 15.

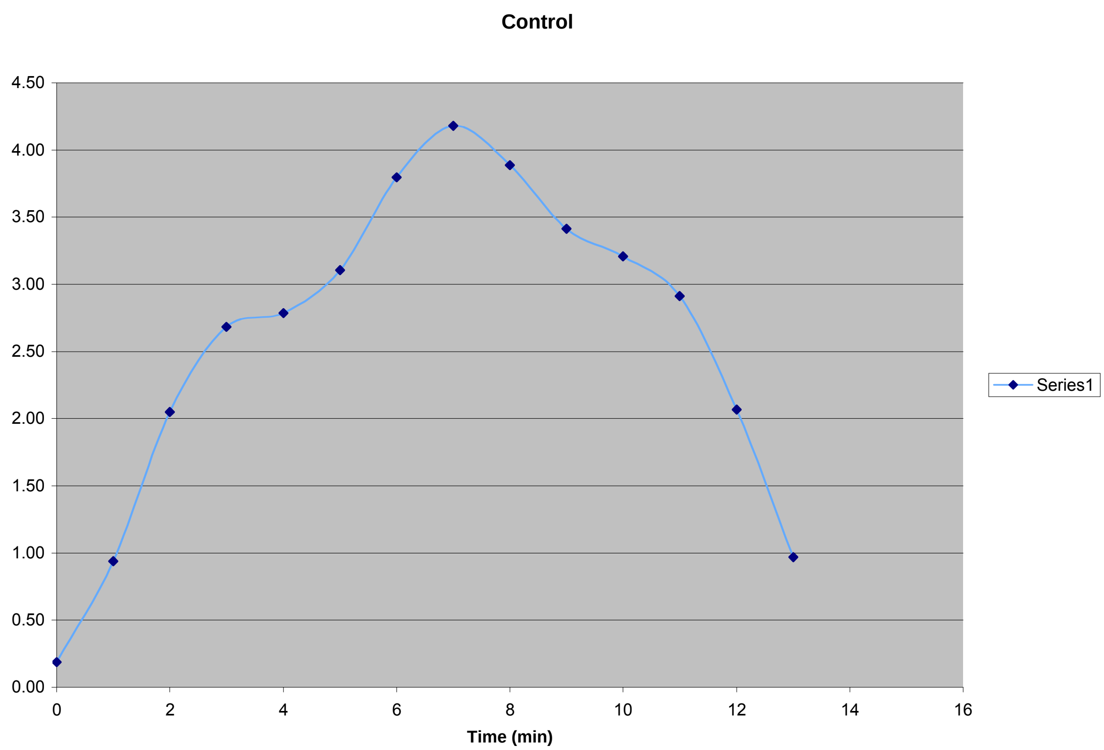


Figure 15: Control Chamber Hydrograph (Hardin, 2006)

Each hydrograph event resulted in the 4-inch depth having a higher peak runoff and a shorter time to peak than the 8-inch depth. For both depths, the time to peak and the peak runoff were longer and lower than the control chamber, respectively. Figure 16 presents the findings in a graphical form, comparing 4S, 8S, and the control chamber.

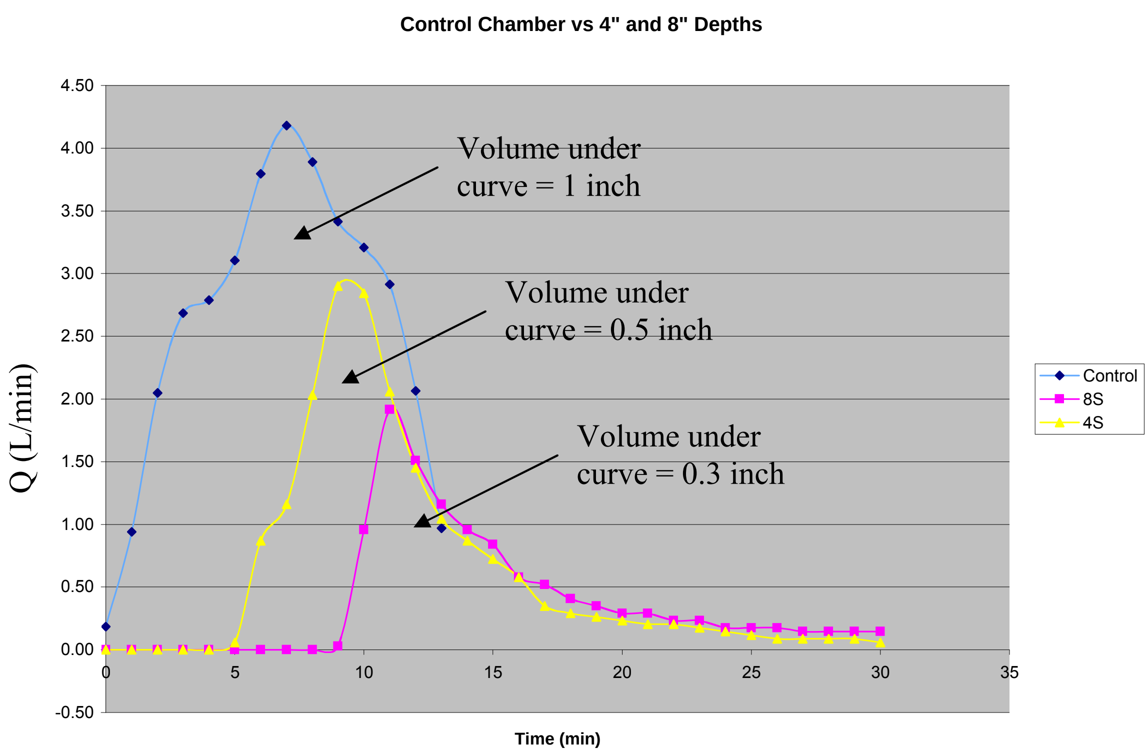


Figure 16: Hydrograph Comparison Between the Control, 8S, and 4S Chambers in December 2007 (L/min)

The cumulative volume was also calculated for each chamber and is graphically displayed in Figures 17 thru 19. The cumulative volume in June was between 5L and 15L; October was between 12L and 22L; and December was between 10L and 20L. The June Hydrograph was performed after no rain for several weeks and an irrigation event of

0.5 inches four days prior. The October event was performed after 1.35 inches of rain and a 0.5-inch irrigation event four days prior to the experiment. The December event was initiated after no rain for a couple of weeks and an irrigation event of 0.25 inches four days prior to the test.

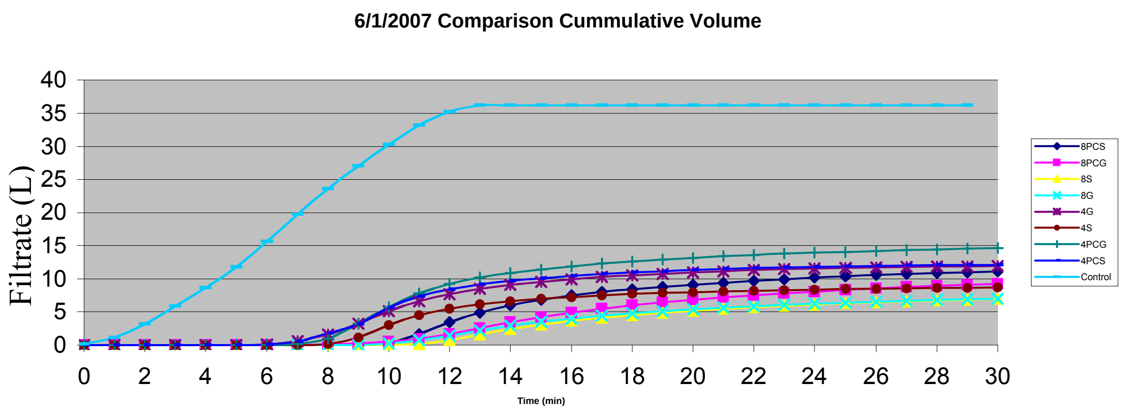


Figure 17: Cumulative Volumes For June Hydrographs

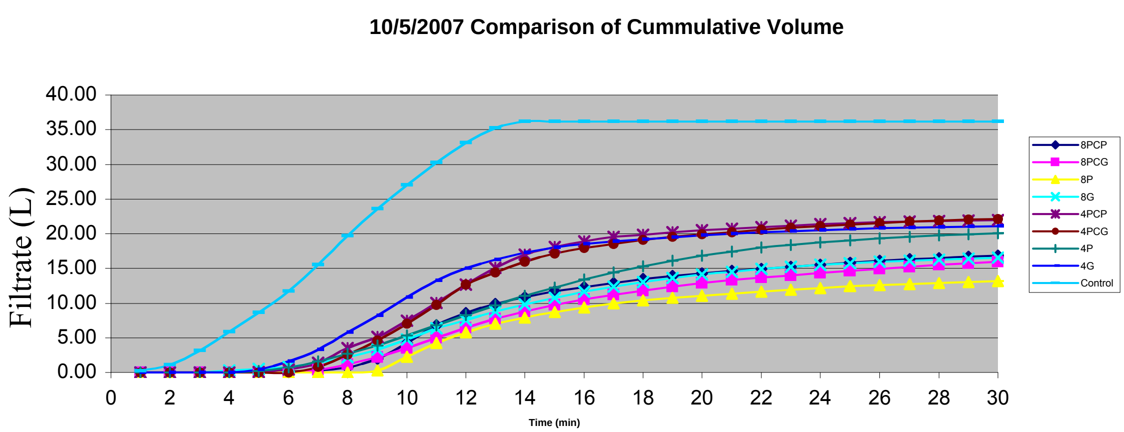


Figure 18: Cumulative Volumes For October Hydrograph

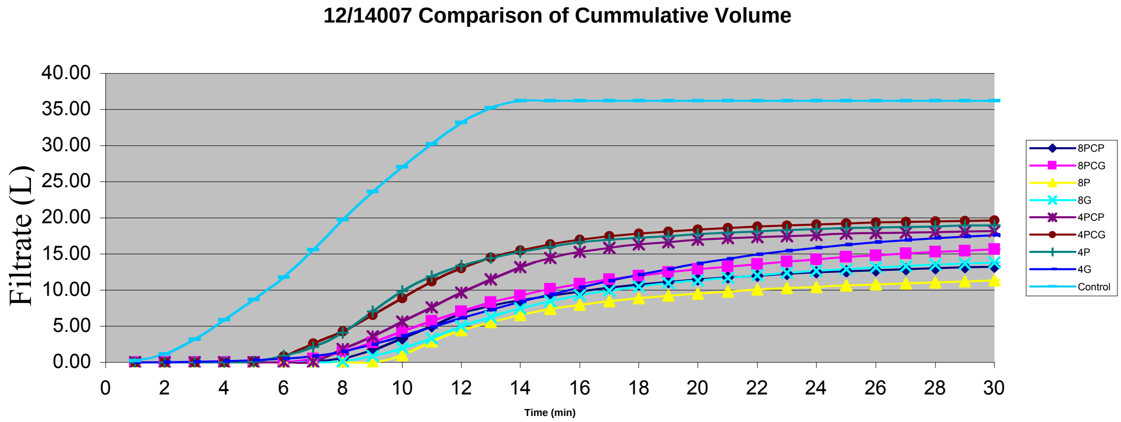


Figure 19: Cumulative Volumes For December Hydrographs

Shallow Depth vs Deep Depth

The filtrate and storage percentages as a function of the control roof volume of runoff for the three-hydrograph events are seen in Tables 7 thru 9. For every hydrograph the average storage percentage was greater for the 8-inch configurations. The storage percentage decreases from June (4-inch, 68.5%; 8-inch, 77.5%) to October (4-inch, 43.5%; 8-inch, 58.5%), which is expected because of the increase in precipitation and irrigation over the summer. The storage then increases slightly between October (4-inch, 43.5%; 8-inch, 58.5%) and December (4-inch, 50.75%, 8-inch, 64.5%) once the rainy season had subsided, more dry events occurred, and the irrigation volume was decreased.

Table 7: Depth Comparison using filtrate and storage for June 2007

Jun-07			
No rain and irrigated .5inches previous date			
Chambers	**Cumulative Inches after 30 min**	**Filtrate**	**Storage**
Control	0.96		
4S	0.23		
4G	0.32		
4PCS	0.32		
4PCG	0.39		
Average of 4 inches	0.315	31.50%	68.50%
8S	0.18		
8G	0.18		
8PCS	0.3		
8PCG	0.24		
Average of 8 inches	0.225	22.50%	77.50%

Table 8: Depth Comparison using filtrate and storage for October 2007

Oct-07			
Rained 1.35inches and irrigated with .5inches previous date			
Chambers	**Cumulative Inches after 30 min**	**Filtrate**	**Storage**
Control	0.96		
4S	0.53		
4G	0.56		
4PCS	0.58		
4PCG	0.59		
Average of 4 inches	0.565	56.50%	43.50%
8S	0.35		
8G	0.44		
8PCS	0.45		
8PCG	0.42		
Average of 8 inches	0.415	41.50%	58.50%

Table 9: Depth Comparison for December 2007

Dec-07			
No Rain and irrigated .25inches previous date			
Chambers	**Cumulative Inches after 30 min**	**Filtrate**	**Storage**
Control	0.96		
4S	0.5		
4G	0.47		
4PCS	0.48		
4PCG	0.52		
Average of 4 inches	0.4925	49.25%	50.75%
8S	0.3		
8G	0.36		
8PCS	0.35		
8PCG	0.41		
Average of 8 inches	0.355	35.50%	64.50%

The cumulative volume from the 4-inch chambers was lower than the 8-inch chambers for every hydrograph event. Over time the drainage from the 4-inch chambers slows more than the 8-inch chambers and the volume from the 8-inch chambers eventually equals that from the 4-inch chambers. The comparison of each configuration can be seen in the Appendix B.

Pollution Control Media vs No Pollution Control Media

The hydrograph comparisons revealed that on average the chambers without pollution control media have a lower or approximately equal cumulative volume compared to the chambers with the media. Every 8-inch chamber with pollution control media with the exception of 8PCG in October discharged less filtrate than the 8-inch chambers without the media. On the other hand, the 4-inch chambers with pollution control media discharged approximately equal amounts of filtrate except for chambers 4PCG and 4PCS in June, which the non-pollution control chambers retained more volume.

Gravel Drainage Material vs Synthetic Drainage Material

The chambers with gravel and synthetic drainage materials vary when compared with cumulative volumes from the hydrographs. The 4-inch chambers with gravel drainage material discharge more filtrate in June but discharge approximately the same amount for October and December. The 8-inch chambers vary more with the chambers 8PCG discharging more filtrate in December than 8PCS and 8G discharging more filtrate in December and October compared to 8S. However, 8PCG retains more volume than 8PCS in June and October, and 8G discharges approximately the same volume as 8S in June. Figures 20 thru 23 present the more established (i.e. December hydrographs) comparison between chambers with gravel and synthetic drainage materials. As seen in Figure 20 and 21 the 4-inch configurations have approximately equal cumulative volume; and seen in Figure 22 and 23, the 8-inch chambers with gravel drainage material have a greater discharge than the chambers with synthetic material.

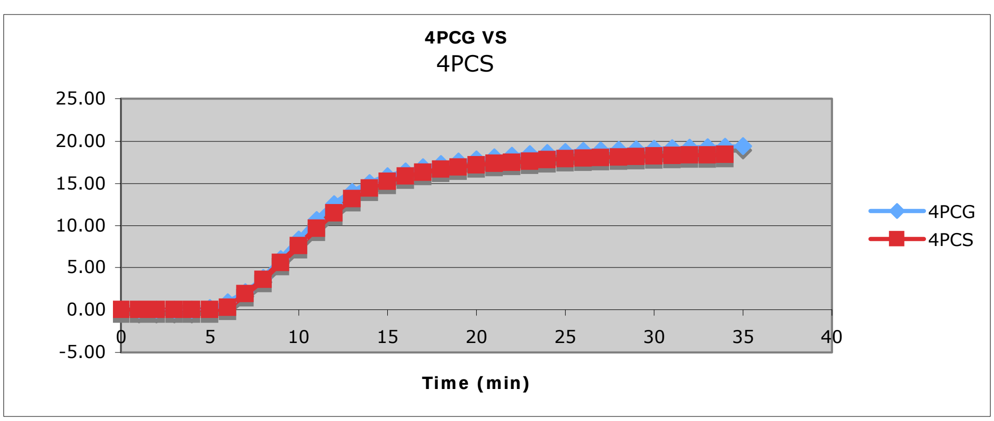


Figure 20: Cumulative Volume Comparison Between 4PCG and 4PCS

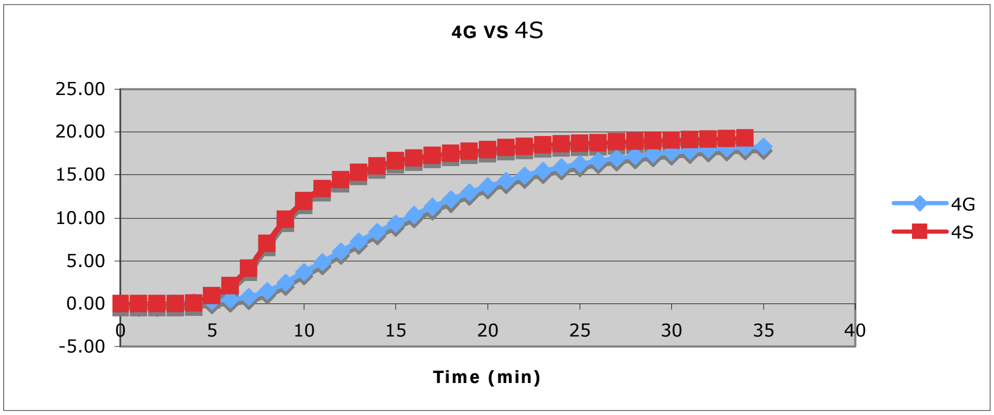


Figure 21: Cumulative Volume Comparison Between 4G and 4S

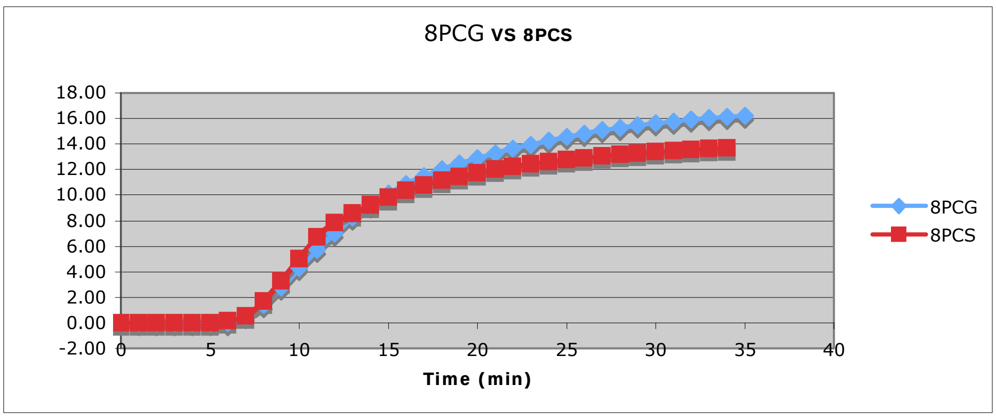


Figure 22: Cumulative Volume Comparison Between 8PCG and 8PCS

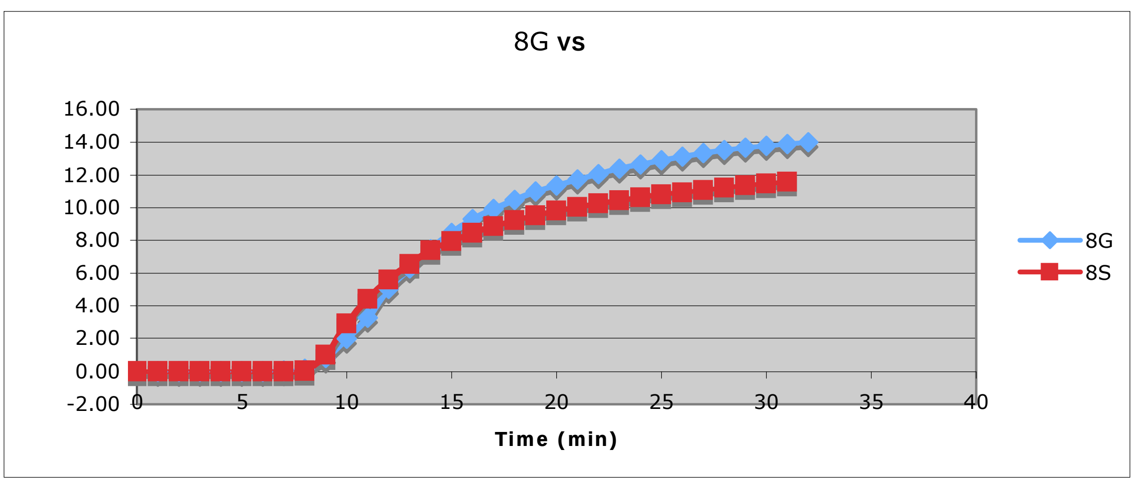


Figure 23: Cumulative Volume Comparison Between 8G and 8S

Water Volume Efficiency

The efficiency is estimated from the cistern overflow (O) and precipitation (P) volumes using equation (8). Using the efficiency equation and the average overflow from both the 4-inch media depth and the 8-inch media depth and the precipitation, the efficiencies are calculated.

Efficiency = [1 – (O/P)*100%]

Efficiency (4-inch) = [1 – (9 in. / 43 in.) * 100%] = 80%

Efficiency (8-inch) = [1 – (10 in. / 43 in.) * 100%] = 77%

The lowest water volume efficiency is chamber 8PCG with an efficiency of 75% and the highest efficiency is chamber 4G with an efficiency of 82%. The volumes are calculated in Appendix C.

Irrigation Rates

The irrigation rates varied from a low of 0.18 in/cycle in the month of January to a high of 0.72 in/cycle in the month of August. The average yearly irrigation rate was 0.44 in/cycle. There were eight days during which no irrigation was applied because of sufficient rainfall conditions.

CHAPTER FIVE: WATER QUALITY RESULTS

Shallow Depth vs Deep Depth

Nitrogen

The nitrogen species measured in this experiment include ammonia, nitrate + nitrite, and total nitrogen. For the three nitrogen species neither depth is significantly different than the other. The mean values are compared for ammonia and total nitrogen at the 8-inch depth and 4-inch depth using a t-statistic and find that the null hypothesis is not rejected at an alpha value of 0.05. Meaning there is not sufficient evidence to support a significant difference between the means. The total nitrogen concentrations in the cisterns range between 1.38 to 1.78 mg/L as N at the 8-inch depths and 1.42 to 1.68 mg/L as N at the 4-inch depths with sample sizes between 15 and 20. The raw data and hypothesis tests are seen in Appendix G and H.

When the mean values are compared for nitrate + nitrite, no significant difference exists between the 8-inch depth and the 4-inch depth except for one. A significant difference occurs between the chambers without pollution control and gravel drainage media. The 8-inch depth has a significantly higher mean concentration than the 4-inch depth at an alpha value of 0.05 using the z-statistic. The hypothesis results for nitrate + nitrite can be seen in Table 10.

Table 10: Nitrate + Nitrite Hypothesis Test For Depth

H_{O1}	When PC layer and Drainage Layer are held constant, The NOx for 4" depth = NOx for 8" depth							
H_{a1}	When PC layer and Drainage Layer are held constant, The NOx for 4" depth not equal NOx for 8" depth							
	Depth Comparison							
	8PCS	**8PCG**	**8S**	**8G**	**4PCS**	**4PCG**	**4S**	**4G**
Average (mg/L)	0.030	0.030	0.028	0.031	0.027	0.028	0.029	0.023
Stand. Dev. (mg/L)	0.013	0.015	0.014	0.026	0.012	0.016	0.017	0.016
Var	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000
n	35	34	34	36	33	36	37	34
HO1 (95% CI)	A	A	A	A				
HO1 (90% CI)	A	A	A	R				
$T_{0.025}$ (95% CI)	1.96	1.96	1.96	1.96				
$T_{0.05}$ (90% CI)	1.645	1.645	1.645	1.645				
z1	1.249	0.366	-0.118	1.659				

Phosphorus

The phosphorus species in this research include soluble reactive phosphorus (ortho-phosphorus) and total phosphorus. The mean values for the ortho-phosphorus concentrations between the 4-inch depths and the 8-inch depths except for the non-pollution control / gravel drainage material are significantly different. For the three cases with a significant difference, the 8-inch depths are significantly higher at a confidence interval of 95%. Table 11 presents the hypothesis test results for ortho-phosphorus.

Table 11: Hypothesis Test Results for Ortho-Phosphorus Depth Comparison

H_{O1}	When PC layer and Drainage Layer are held constant, The PO4 for 4" depth = PO4 for 8" depth							
H_{a1}	When PC layer and Drainage Layer are held constant, The PO4 for 4" depth not equal PO4 for 8" depth							
	8PCS	**8S**	**8PCG**	**8G**	**4PCS**	**4S**	**4PCG**	**4G**
Average (mg/L)	0.047	0.069	0.049	0.039	0.036	0.044	0.031	0.045
Stand. Dev. (mg/L)	0.025	0.063	0.027	0.026	0.021	0.037	0.022	0.027
Var	0.001	0.004	0.001	0.001	0.000	0.001	0.000	0.001
n	39	40	41	39	39	39	41	39
HO1 (95% CI)	R	R	R	A				
HO1 (90% CI)	R	R	R	A				
z0.025 (95% CI)	1.96	1.96	1.96	1.96				
z0.05 (90% CI)	1.645	1.645	1.645	1.645				
z1	2.221	2.165	3.404	-0.909				

The mean concentrations for total phosphorus are significantly different at a confidence interval of 90% for the chambers with pollution control / synthetic drainage media and the chambers with non-pollution control / gravel drainage media. In general, the 4-inch chamber concentrations are either equal to the 8-inch chamber concentrations or the 4-inch depths are higher than the 8-inch depths; see Figure 24.

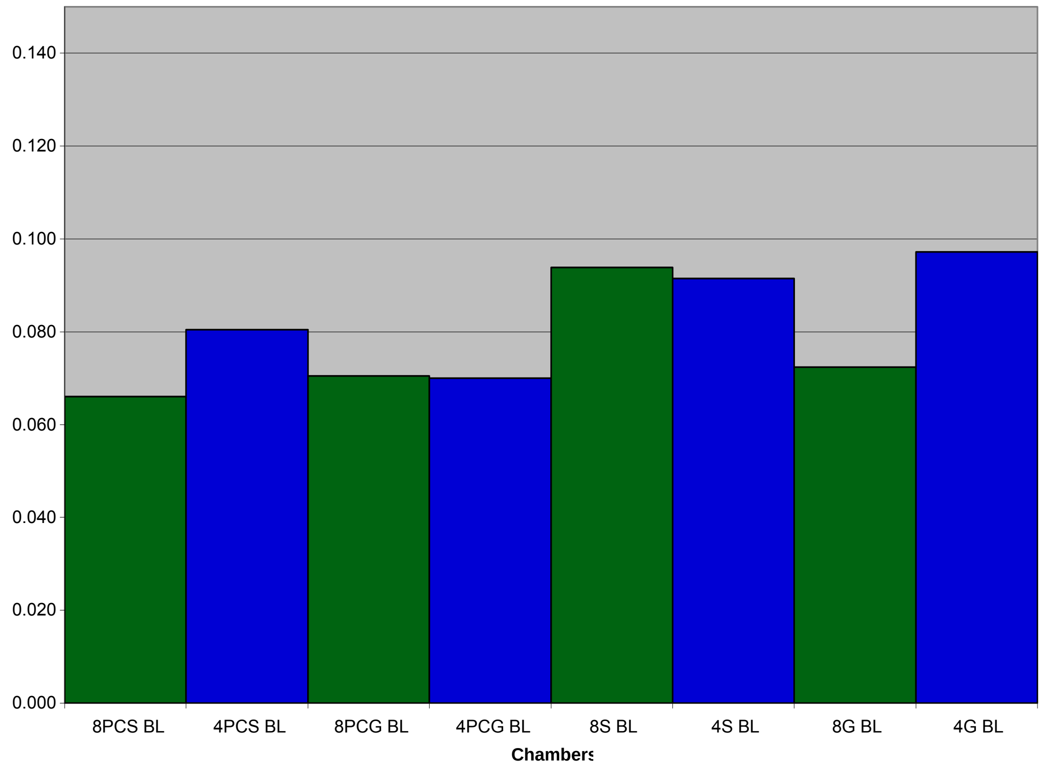


Figure 24: Total Phosphorus Depth Comparison (mg/L) (Green is 8-inch and Blue is 4-inch)

In general, the 8-inch depth ortho-phosphorus concentrations are higher than the 4-inch depth concentrations, and conversely the 4-inch depth concentrations have a higher total phosphorus concentration than the 8-inch depth concentration

Dissolved Oxygen and ORP

The dissolved oxygen within the cistern has no significant difference between the depths at an alpha value of 0.05. The values range between 3.6 mg/L and 4 mg/L. The ORP values however do show a significant difference between 8PCS and 4PCS and 8PCG and 4PCG. By visual inspection every chamber with a 4-inch depth had a higher

ORP value than the 8-inch depth whether significant or not; see Figure 25. The values range between 60 and 75 mV.

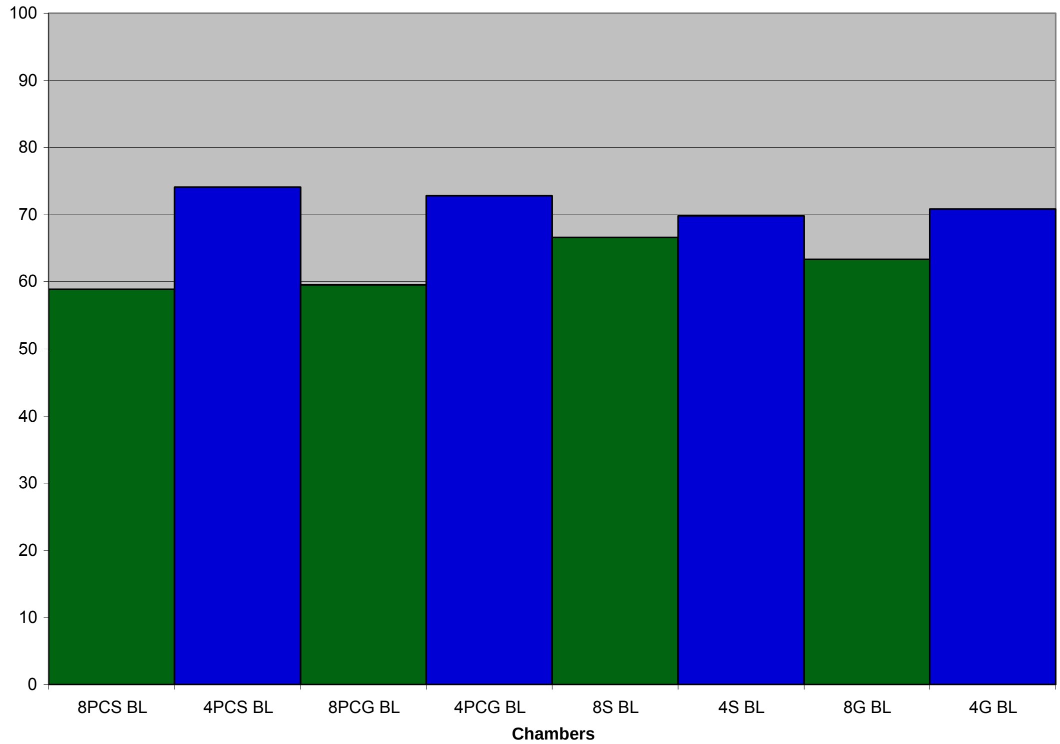


Figure 25: Depth Comparison of ORP Values (mV)

Solids (TSS, TDS, TS)

The TDS and TS concentrations are significantly higher for the 8-inch chambers than for the 4-inch chambers at a confidence interval of 90%. The 4-inch chambers have a higher TSS concentration in general, and a significant difference exists between the 4-inch depth and 8-inch depth with no pollution control and gravel drainage material. The TS concentrations for the 8-inch chambers are similar to one another as are the 4-inch chamber concentrations, which are viewed in Figure 26.

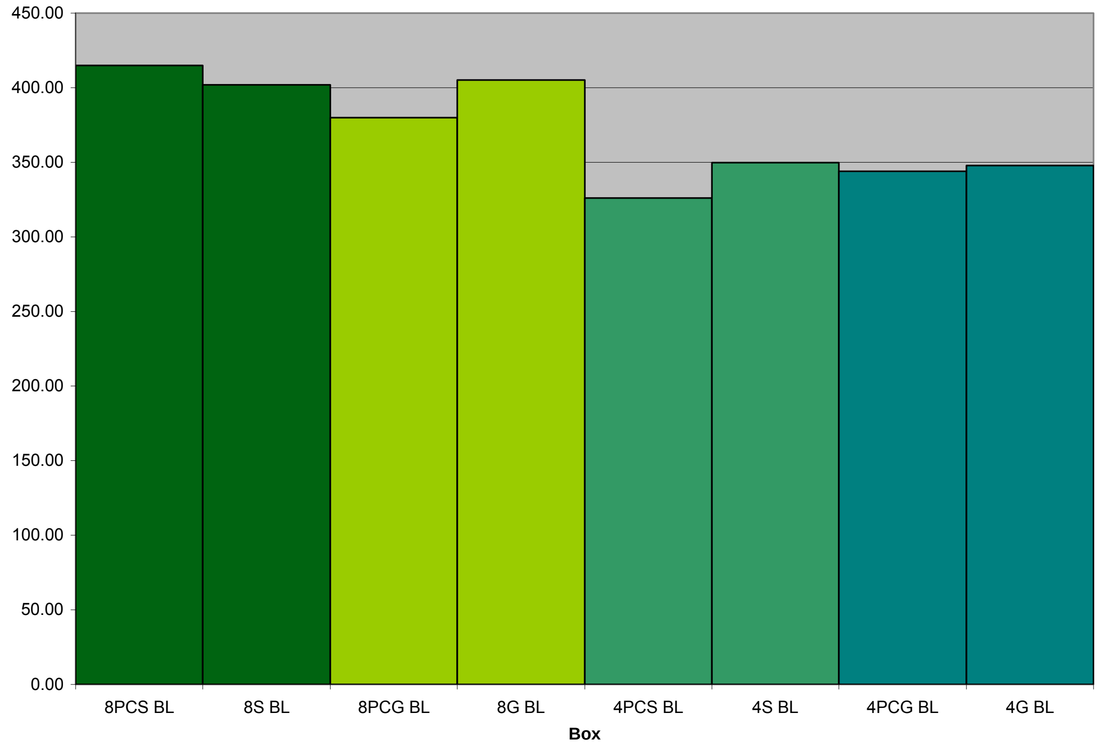


Figure 26: Total Solids Concentrations For Every Chamber (mg/L)

Conductivity

The conductivity in each cistern from the 8-inch chambers is significantly higher than that of the cisterns of the 4-inch chambers at a 95% confidence interval. The conductivity concentrations are illustrated in Figure 27.

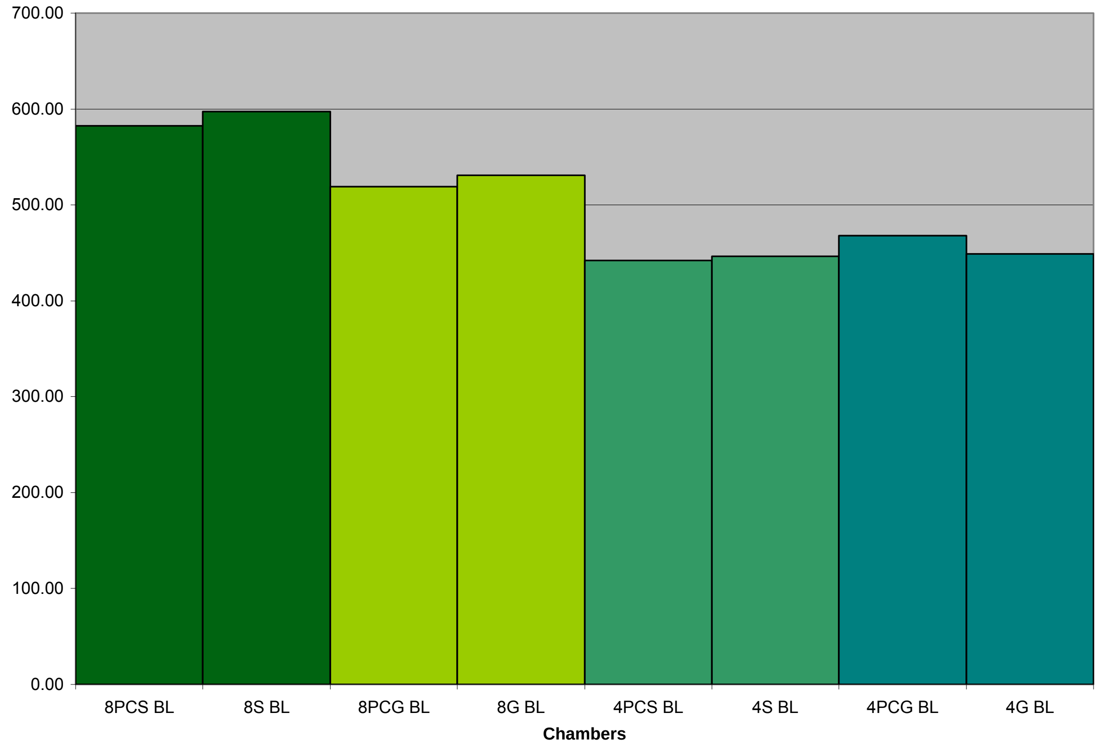


Figure 27: Conductivity Averages for Depth Comparison (μmhos/cm)

Turbidity, pH, and Alkalinity

The turbidity is significantly lower (alpha 0.05) in the 4-inch chambers than the 8-inch chambers for every combination except for the chambers with pollution control and gravel drainage material. The alkalinity is significantly higher (alpha 0.025) in the 8-inch chambers than the 4-inch chambers for every combination except for the chambers without pollution control media and gravel drainage media. In general, all of the 8-inch chambers have a higher alkalinity than the 4-inch chambers. The pH values for every chamber range between 8.1 and 8.5 and has no significant difference between the depths at an alpha value of 0.05.

Pollution Control Media vs No Pollution Control Media

Nitrogen

An additional pollution control layer beneath the growing media of the green roof chambers doesn't have a significant effect on the nitrogen species at an alpha value of 0.05. In general, the total nitrogen concentration is lower for the chambers with pollution control except for the chamber with an 8-inch depth and synthetic drainage material. On average, the 8-inch (1.58 mg/L as N) and 4-inch (1.45 mg/L as N) pollution control chambers are lower than the 8-inch (1.65 mg/L as N) and 4-inch (1.64 mg/L as N) non-pollution control chambers.

Similarly, the ammonia concentrations are generally lower for the pollution control chambers on average; the average concentration of every chamber with pollution control is 0.058 mg/L as N while the concentration of every chamber without pollution control is 0.065 mg/L as N.

The nitrate + nitrite concentrations are approximately equal to each other for chambers with pollution control and without; a concentration of approximately 0.03 mg/L as N. The 4-inch chamber with synthetic drainage and without pollution control media has the lowest average concentration at 0.023 mg/L as N.

Phosphorus

The chambers with pollution control media have on average a lower ortho-phosphorus concentration than the chambers without pollution control media; with pollution control the concentration was 0.041 mg/L as P; and without the media the concentration is 0.051 mg/L as P. Two chamber combinations have a significantly lower concentration of ortho-phosphorus with the use of pollution control media than without it at a confidence interval of 95%; 8PCS and 4PCG. The chamber 4PCS also has a lower concentration of ortho-phosphorus than 4S but not a significant one. The concentration of 8PCG is higher than 8G in the cistern but is lower in the filtrate; this is discussed in the Cistern vs Filtrate section.

Similarly, the chambers with pollution control have lower total phosphorus concentrations than those without the media; chambers with pollution control media has a concentration of 0.07 mg/L as P; chambers without pollution control media has a concentration of 0.09 mg.L as P. The total phosphorus concentration for 8PCS and 4PCG are significantly lower than the concentrations of 8S and 4G at a 95% confidence interval. The remaining chambers with pollution control have concentrations that are generally lower than that of the chambers without pollution control media.

Dissolved Oxygen and ORP

The pollution control media does not have a significant effect on the dissolved oxygen concentration or oxygen reduction potential. In general, the chambers with pollution control have a slightly lower dissolved oxygen concentration than the chambers without it. The DO concentrations range between 3.7 mg/L and 3.9 mg/L. The ORP values ranges between 59 and 74 mV.

Solids (TSS, TDS, TS) and Conductivity

The pollution control media has no significant effect on the solids concentrations and conductivity. The hypothesis test shows no difference at an alpha value of 0.025.

Turbidity

The pollution control media has no significant effect on the turbidity except in the chamber with 8-inch depth and synthetic drainage material (8PCS and 8S), which has a difference at a 95% confidence interval. The chamber with pollution control has an average turbidity of 2.4 NTUs where the chamber without it has a turbidity of 1.8 NTUs.

pH and Alkalinity

The pH for the chambers with pollution control media (8.3) has a lower value on average compared to the chambers without pollution control media (8.5). There is a significant difference in pH between the 8-inch and 4-inch depths with synthetic drainage material at a 90% confidence interval. In general, the alkalinity is higher on average for the chambers with pollution control media (121 mg/L as $CaCO_3$) compared to the chambers without it (110 mg/L as $CaCO_3$). Both 8-inch chambers with pollution control media (8PCS and 8PCG) are significantly higher than the chambers without pollution control media (8S and 8G) at a 90% confidence interval.

Gravel Drainage Material vs Synthetic Drainage Material

Nitrogen

The nitrogen species concentrations for the chambers with gravel drainage material don't differ significantly compared to the chambers with synthetic drainage material. The most noticeable occurrence is that the total nitrogen concentration is higher in general in the filtrate for the chambers with gravel drainage material but is lower when compared to the chambers with synthetic drainage material in the cistern.

Phosphorus

The ortho and total phosphorus concentrations from the chambers with gravel drainage material don't have a significant difference between the chambers with the synthetic drainage material. The z statistic shows this to be true at a confidence interval of 90%.

Dissolved Oxygen and ORP

There was not a significant difference between the DO and ORP concentrations between chambers with gravel drainage material and synthetic drainage material.

Solids (TSS, TDS, TS)

The TSS concentrations from the chambers with gravel drainage material and without pollution control media (8G and 4G) were significantly higher than the concentration of the chambers with synthetic drainage material (8S and 4S). The TDS concentrations of the chambers with gravel drainage material are not significantly different from the chambers with synthetic drainage material except for the 8-inch chamber with pollution control (8PCG). The 8-inch chamber with pollution control and synthetic drainage material (8PCS) is significantly higher concentration than the like chamber with gravel drainage material (8PCG). Similarly, the TS concentrations for 8PCS is significantly higher than chamber 8PCG while the remaining chambers don't have sufficient evidence to support a difference between the gravel and synthetic drainage materials.

Conductivity

The conductivity from the 8-inch chambers with synthetic drainage material (8PCS and 8S) are significantly higher (alpha 0.025) than that of the 8-inch chambers with gravel drainage material (8PCG and 8G). The conductivity from the 4-inch chambers is approximately equal and had no significant difference between the chambers with gravel and synthetic drainage material.

Turbidity

The turbidity from the chambers with gravel drainage material and without pollution control media (8G and 4G) is significantly higher (alpha 0.05) than that of like chambers with synthetic drainage material (8S and 4S). The hypothesis test for turbidity in the chambers with pollution control media doesn't have enough evidence to support a significant difference between the gravel and synthetic drainage materials.

pH and Alkalinity

The pH from chamber 8PCS is significantly higher than 8PCG (alpha 0.025), and the alkalinity of chamber 8S is significantly higher than chamber 8G (alpha 0.025). There is not sufficient evidence to support a significant difference between the gravel drainage material and the synthetic drainage material for the remaining chambers.

Green Roof vs Control Roof

Nitrogen

The nitrate + nitrite concentration in the cisterns from the green roof chambers are significantly lower than that of the control roof filtrate (alpha = 0.025). The annual average concentration of nitrate + nitrite in the control roof filtrate is 0.17 mg/L as N compared to a range of concentrations at approximately 0.03 mg/L as N from the green roofs.

The ammonia concentrations for the chamber cisterns were significantly lower for all of the chambers with pollution control media except for 4PCS. The only significant difference observed for the chambers without pollution control existed within the chamber 8G. In general, all chamber cisterns had a lower concentration of ammonia than that of the control roof filtrate (average of 0.12 mg/L as N).

The total nitrogen observed in the chamber cisterns had a higher concentration in general than that of the control roof filtrate. A significant difference occurred in chambers 8PCS, 4PCS, and 8S at an alpha value of 0.05. The average annual total nitrogen concentration was 1.05 mg/L as N for the control roof filtrate and the green roof chambers ranged between 1.38 mg/L and 1.78 mg/L as N.

Phosphorus

The ortho-phosphorus concentrations in the green roof chamber cisterns are not significantly different than the concentration in the control roof filtrate. The annual average concentration of ortho-phosphorus in the control roof filtrate is 0.046 mg/L as P. It is important to note that the concentrations in the filtrate (not cistern) from the chambers without pollution control are significantly higher (alpha = 0.025) than the control roof filtrate while the filtrate concentrations from chambers with pollution control media are higher but not significantly higher.

The total phosphorus concentration within the cisterns of the green roof chambers are significantly lower than that of the control roof filtrate (0.12 mg/L as P) at an alpha value of 0.025 for all of the chambers with pollution control media and chamber 8G. In general, every chamber had a lower concentration than the control roof filtrate however there was not sufficient information to conclude a significant difference between the control roof filtrate and chambers 8P, 4P, and 4G.

ORP and Dissolved Oxygen

The green roof chamber cisterns' ORP and DO concentrations are not significantly different than that of the concentrations in the control roof runoff. At a confidence interval of 90%, there is no difference in concentration. The DO for the green roof chambers ranges between 3.66 and 4.71 mg/L and the control roof runoff falls in between the range at 3.96 mg/L. The ORP for the green roof chambers falls between 59 and 88 mV and the control roof runoff average ORP is 83 mV.

Solids and Conductivity

The total solids concentrations are significantly higher (alpha = 0.025) in the green roof chambers than that of the control roof filtrate. The total suspended solid concentrations are slightly higher in the control roof filtrate than the green roof chambers but not significant. The total dissolved solids concentrations however are significantly higher in the green roof chambers than that of the control (alpha = 0.025). The conductivity is also significantly higher in the green roof chambers than that of the concentration in the control chamber runoff. The conductivity concentration from the control chambers was 33 μmhos/cm vs a range of 442 μmhos/cm and 597 μmhos/cm in the green roof chamber cisterns.

Turbidity

The turbidity is slightly lower in most of the green roof cisterns and significantly lower in chambers 8PCS, 8P, and 8PCG (alpha 0.05) compared to the concentrations in the control roof runoff. The control roof filtrate turbidity is averaged at 3.85 NTUs and the green roof turbidity from the cisterns ranged between 1.83 NTUs and 4.5 NTUs.

pH and Alkalinity

The pH and alkalinity from the green roof chambers are significantly higher than that of the control roof values. The alpha value using the z statistic was 0.025. The average pH from the control roof is 5.4 and the average alkalinity is 14 mg/L as CaCO3. The green roof chambers' average pH ranges between 8 and 8.5 and average alkalinity ranges between 99 and 137 mg/L as CaCO3.

Cistern vs Filtrate

Annual Average Concentration

Nitrogen

The nitrogen concentrations from the chamber cisterns compared to the chambers direct filtrate are not significantly different for the nitrate + nitrite and ammonia values. In general, the total nitrogen concentration is lower in the cistern than the filtrate except for chamber 8PCS. The cistern concentrations for the 4-inch chambers with gravel media

(4PCG and 4G) are significantly lower than the direct filtrate with an alpha value equal to 0.025.

Phosphorus

The ortho-phosphorus concentrations in the cisterns are significantly lower than the concentrations of the filtrate at an alpha value of 0.025 except for chambers 8S and 8PCG. The concentrations of the two chambers are still lower in the cistern then in the filtrate but don't have sufficient information to support a significant difference. The total phosphorus concentrations in the cisterns are also significantly lower than the filtrate at an alpha value of 0.05 for every chamber except for chamber 4S.

Solids and Conductivity

The total solids are significantly lower in the cisterns with an alpha of 0.025 compared to the filtrate. The total dissolved solids are significantly lower in the cistern than the filtrate but the total suspended solids in the cistern have no significant difference. Conductivity is significantly lower in the cistern compared to the filtrate except for chamber 8PCS, which is lower in the cistern but not significantly lower.

Turbidity

The turbidity concentration is not significantly different in the cistern water compared to the filtrate water. The hypothesis test did not support a difference at a confidence interval of 90%.

pH and Alkalinity

The pH in the cistern is significantly higher than the filtrate except for chamber 8PCS. The alkalinity is only significantly lower in the cistern for the chambers without pollution control and gravel drainage material (8G and 4G) at an alpha value of 0.025.

ORP and DO

Dissolved oxygen and the ORP values are lower in the cistern water compared to the filtrate water. ORP values have a significant difference between the cistern and filtrate in chambers 8PCS, 8PCG, 8G, and 4G at an alpha value of 0.05. The dissolved oxygen values are significantly lower in the cistern than the filtrate at an alpha value of 0.05 for every chamber except for 4PCS.

Annual Mass Discharge

The total filtrate and cistern overflow from each chamber for the year was recorded and is displayed in Table 21 and 22 in the Appendix. The total filtrate mass loading for each chamber was calculated by multiplying the average concentration of each nutrient by its respective filtrate volume. The same was done for the cistern overflow and control mass loading but using the volume lost to overflow and control runoff volume. On average the nutrient mass loading discharged from the cistern is lower than both the filtrate and the control roof for the year. The green roof filtrate pollutant mass loadings are between 6 and 9 times greater than the mass loading from the cistern. The control roof is higher than the filtrate only in the case of nitrate + nitrite. The values are shown in Table 12. The comparison between all three locations is best illustrated in a graph of total phosphorus, Figure 28. The values were calculated using the average concentration (Appendix G or H) for the year for each parameter and the yearly filtrate collection volume or overflow volume (Appendix C).

Table 12: Mass Discharge Comparisons

	OP [mg P]	TP [mg P]	NO_X [mg N]	NH_3 [mg N]	TN [mg N]
Average Cistern	16	28	10	22	553
Average Filtrate	149	219	56	126	3619
Average Control	37	90	140	99	968

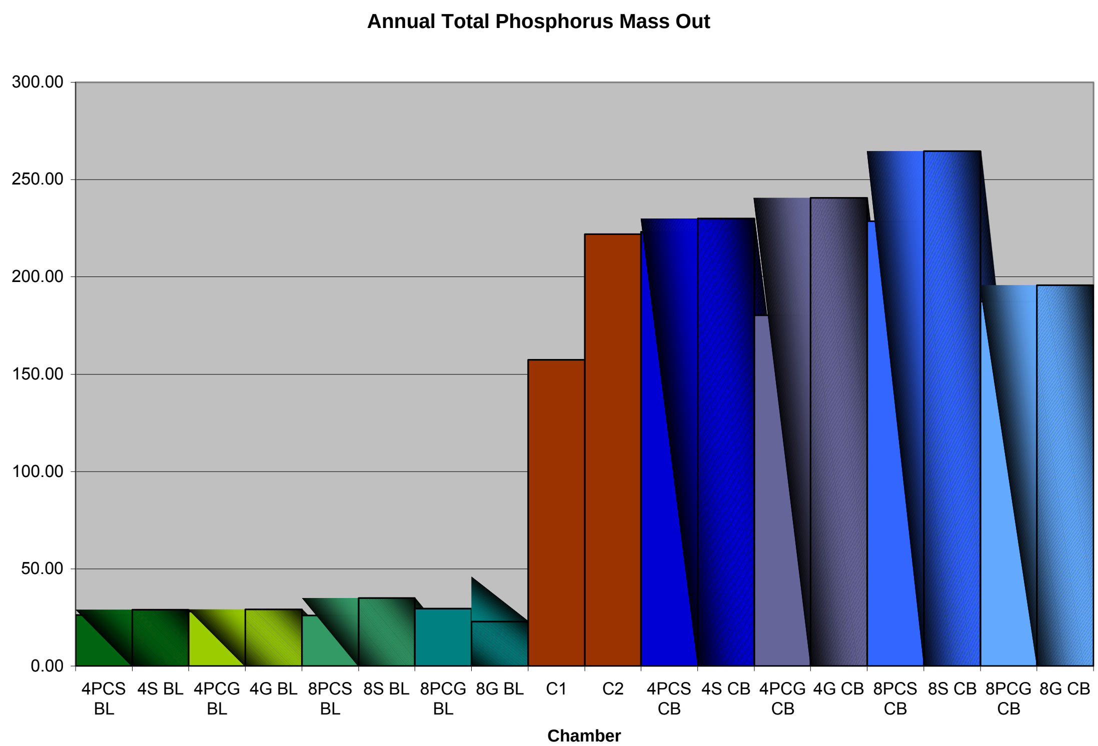


Figure 28: Total Phosphorus Mass Discharge Comparisons

Green Roof Chambers vs New American Home and Stormwater Lab Cistern

Water quality samples were taken from two full size green roofs and compared to the green roof chambers of this research. The New American Home (NAH) is a residential home in downtown Orlando and the Stormwater Lab is a municipal building on the campus of the University of Central Florida (Kelly, Hardin and Wanielista, 2007). Three sample events were taken from the New American Home from three different sites before entering the cistern as well as the cistern itself and then compared to samples from the filtrate and cistern of a similar configuration of pollution control media and drainage layer material. Table 13 illustrates a decrease in total solids and conductivity in the cistern for the NAH and the 4-inch and 8-inch chambers; and respective increase in pH and alkalinity from filtrate to cistern for the three locations.

Table 13: Average Water Quality Values from the NAH Compared to the 4PCS and 8PCS

Sample Location	pH	Alkalinity	TSS	TDS	Total Solids	Conductivity	Turbidity
		(mg/l)	(mg/l)	(mg/l)	(mg/l)	µS @ 25C	NTU
Drainage Basin	6.27	45	12	107	119	129	2.96
Before Filter	6.81	45	24	134	158	140	1.72
Sump Pump	6.88	45	7	135	142	137	2.30
Cistern	7.45	88	2	161	163	216	0.76
4PCS Filtrate	8	113	8	404	412	512	3.38
4PCS Cistern	8.24	115	12	314	327	442	3.19
8PCS Filtrate	8	134	7	468	475	611	2.02
8PCS Cistern	8.14	137	9	407	416	583	2.37

Reviewing Table 14 shows the ammonia decreases in the cistern of the NAH but increases slightly in the chambers, however, the cistern values from the NAH are within 0.02 mg/L of the concentration of 4PCS cistern and 0.006 mg/L of the concentration in 8PCS cistern. The nitrate + nitrite concentration decreases significantly in the NAH cistern but remains relatively equal in the chamber cisterns. The total nitrogen concentration decreases from the filtrate to the cistern for both the NAH and the green roof chambers. Ortho-phosphorus increases slightly in the NAH cistern but the total phosphorus concentration decreases while the chambers concentration of both phosphorus species decreases in the cisterns.

Table 14: Average Nutrient Values from the NAH Compared to 4PCS and 8PCS

Sample Location	NH3	NOx-N	TN	SRP	TP
	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)
Drainage Basin	.270	.333	4.706	.024	.118
Before Filter	.481	1.161	5.190	.039	.216
Sump Pump	.191	1.437	6.144	.039	.091
Cistern	.048	.185	.329	.046	.076
4PCS Filtrate	.061	.025	1.67	.068	.11
4PCS Cistern	.072	.027	1.47	.036	.08
8PCS Filtrate	.031	.027	1.53	.064	.11
8PCS Cistern	.054	.03	1.78	.047	.07

The Stormwater Lab concentrations were compared to the 4-inch chamber with pollution control media and synthetic drainage material. As seen in Tables 15 and 16, the water quality values from the green roof chamber cistern and the stormwater lab cistern are very similar for the exception of the total nitrogen concentration and alkalinity. The drainage material is a different type of synthetic material and the pollution control media a different mixture. Furthermore, only two samples were taken from the stormwater lab cistern directly after construction compared to the thirty taken from the chamber cistern over a course of a year. Because the samples were taken shortly after the vegetation was planted, there was less plant growth and a lower capacity of the plants to uptake nitrogen.

Table 15: Average Values from the Stormwater Lab Cistern and the 4PCS

	pH	Alkalinity	TSS	TDS	Total Solids	Conductivity	Turbidity
		(mg/l)	(mg/l)	(mg/l)	(mg/l)	µS / cm	NTU
Stormwater Lab Cistern	7.90	180	5	352	357	516	1.18
4PCS Cistern	8.24	115	12	314	327	442	3.19

Table 16: Average Values from the Stormwater Lab Cistern and 4PCS

	NH3	NOx-N	TN	SRP	TP
	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)
Stormwater Lab Cistern	.070	.030	4.633	.037	.053
4PCS Cistern	.072	.027	1.47	.036	.08

Media Analysis

A media analysis was performed on the substrate utilized in the present experiment as well as previous research done by Mike Hardin. The tests were performed by Penn State's Agriculture lab and include physical parameters, chemical constituents, Mehlich 3 analysis, saturated media extract analysis, and calcium carbonate equivalents.

The media tested includes the pollution control and growing media from the present research and the tire crumb growing media and expanded clay growing media from previous research. The present research analyzed both medias (growth media and pollution control media) at the start of the project and approximately one year later. The substrates utilized in previous research (tire crumb growing media and expanded clay growing media) were tested approximately one year following the completion of the experiments, and a freshly mixed batch of both medias were tested to provide a before and after comparison of the medias. In addition, the physical and chemical properties were analyzed for the fresh gravel drainage media that was utilized on both past and present research. The mixture ratios are seen in Table 17.

Table 17: % Ratio of Media Mixtures

Type of Material	Growing Media	Pollution Control Media Chambers and NAH	Pollution Control Media Stormwater Lab	Tire Crumb Growing Media	Expanded Clay Growing Media
Tire Crumb		45	40	40	
Ex Clay	60	45	40	20	60
Verm	15			10	10
Pete Moss	15			15	15
Perlite				15	15
Saw Dust	10	10	20		

Past Research

Expanded Clay Growing Media

Differences existed between the fresh clay media and the one-year clay media for almost every parameter. A significant decrease in particle size (51%) and increase in water permeability (339%) occurred over the course of one year. The results for the physical parameters and a percent of increase or decrease are illustrated in Table 18. The remaining comparisons are in Appendix I.

Table 18: Physical Properties Comparison Between Previous Research's Expanded Clay Growing Media

Type of Media	Units	Fresh Expanded Clay Growing Media	After 1yr Expanded Clay Growing Media	% Increase or Decrease
Paticle Size ≤ 0.05mm	mass %	6.9	3.4	-51
Bulk Density (Dry)	lb/ft3	43.46	42.72	-2
Bulk Density (Wet)	lb/ft3	71.25	80.45	13
Moisture	mass %	13.5	28.6	112
Pore Volume	Vol. %	60	63.5	6
Max Water Holding Capacity	Vol. %	47.2	60.4	28
Water Permeability	in/hr	18.72	82.14	339

In the chemical analysis of the clay media over a year, the pH and Nitrate, and Ammonia values increased and the organic content, phosphorus, potassium, and magnesium values decreased. The Mehlich 3 analysis, for soil conditions (mg/kg), recorded an increase in phosphorus and calcium; and a decrease in potassium and magnesium. The extracted saturation test which looks at the filtrate (mg/L) found an increase in pH, nitrate, calcium, and zinc values; and a decrease in soluble salts, phosphorus, potassium, magnesium, boron, copper, iron, manganese, sodium, and ammonia values. The calcium carbonate equivalent decreased slightly over the year. The values for each test can be seen in the Appendix I.

Tire Crumb Growing Media

As in the clay growing media, the tire crumb growing media properties were different after a year of operation. The test results and comparisons are presented in appendix XX. The physical parameter results are shown in Table 19. The particle size, dry bulk density, and water permeability decreased over time while the wet bulk density, moisture, pore volume, and maximum water holding capacity increase over one year.

Table 19: Physical Properties Comparison Between Previous Research's Tire Crumb Growing Media

Type of Media	Units	Fresh Tire Crumb Growing Media	After 1yr Tire Crumb Growing Media	% Increase or Decrease
Paticle Size ≤ 0.05mm	mass %	9.9	9.2	-7
Bulk Density (Dry)	lb/ft3	34.1	30.4	-11
Bulk Density (Wet)	lb/ft3	59.72	70.99	19
Moisture	mass %	13.9	26.8	93
Pore Volume	Vol. %	61.4	67.6	10
Max Water Holding Capacity	Vol. %	42.1	65.2	55
Water Permeability	in/hr	120	77.04	-36

For the chemical constituents, the pH, nitrate, and ammonia increased like the expanded clay media, however for the tire crumb growing media had a higher concentration of the organic content and phosphorus; and the potassium and magnesium concentrations decreased over the year. The Mehlich 3 results presented an increase in every parameter; the greatest increase was in the phosphorus and calcium concentrations.

The filtrate values showed an increase in pH, nitrate, calcium, copper, and zinc; and a decrease in phosphorus, potassium, magnesium, boron, iron, manganese, sodium, and ammonia. The soluble salt value was essentially the same after a year, and the calcium carbonate equivalent for the tire crumb growing media decreased, as did the clay growing media.

Present Research

Growing Media

The physical characteristics of the growing media didn't change much over the year except for the particle size and the water permeability which decreased (16%) and increased (52%) respectively. The chemical constituent results found that the pH and organic content remained approximately the same over a year; a decrease occurred for the potassium, magnesium, nitrate, and ammonia concentrations; and the phosphorus increased over the one year period. The Mehlich 3 results showed a decrease in phosphorus and potassium while there was and an increase in calcium and magnesium. The filtrate analysis resulted in a increase in copper, iron, manganese, and zinc; and a decrease in soluble salts, nitrate, phosphorus, potassium, calcium, magnesium, boron, sodium, and ammonia. Furthermore, the calcium carbonate equivalent increased. The results are illustrated in the Appendix I.

Pollution Control Media

The difference in the physical parameters over the year was found in the moisture (43%) and max water holding capacity (-52%). The remaining parameters changed very little over time and are seen in the Appendix. The chemical constituent results have a very small difference in pH and organic content and a more significant decrease in phosphorus, potassium, magnesium, nitrate, and ammonia. The Mehlich 3 results are similar to the growing media in that there is a decrease in phosphorus and potassium, and an increase in calcium and magnesium. The filtrate values show a decrease in pH, soluble salts, nitrate, phosphorus, potassium, calcium, magnesium, boron, manganese, and ammonia; an increase in copper and zinc; and no change in iron and sodium. The calcium carbonate equivalent decreases over the year.

Past and Present Media Physical and Chemical Constituent Comparisons Including the Drainage Media

The particle size remained between 9% and 12 % mass except for the expanded clay growing media (3.4% to 6.9%) and the drainage media (0.5%). The bulk density is higher for the growing media and the expanded clay growing media compared to the pollution control media and the tire crumb growing media. The drainage media bulk density is sometimes double that of the other medias. The dry bulk density decreases in all cases over a year period, however the wet bulk density increases for the previous research but decreases for the present research. The moisture content decreases for the present growing media and decreases for the pollution control media and the previous growing medias. The pore volume increases for all medias and the max water holding capacity statys the same for the present growing media and decreases for the pollution control media; and increases for the previous growing medias. The water permeability increases for the present growing media, pollution control media, and expanded clay growing media; the tire crumb growing media is the only media to have a decrease in permeability. The drainage layer parameters are lower compared to the other medias except for the bulk densities. Table 20 illustrates the values for the physical parameters.

Table 20: Physical Properties Comparison of All Media Results

Type of Media / **Parameter**	**Units**	**Growing Media**	**After 1yr Growing Media**	**Pollution Control Media**	**After 1yr Pollution Control Media**	**Fresh Tire Crumb Growing Media**	**After 1yr Tire Crumb Growing Media**	**Fresh Expanded Clay Growing Media**	**After 1yr Expanded Clay Growing Media**	**Drainage Media**
Paticle Size ≤ 0.05mm	mass %	12	10.1	10.7	10.5	9.9	9.2	6.9	3.4	0.5
Bulk Density (Dry)	lb/ft3	38.2	38.54	34.87	33.8	34.1	30.4	43.46	42.72	106.67
Bulk Density (Wet)	lb/ft3	77.8	77.62	61.35	60.23	59.72	70.99	71.25	80.45	128.15
Moisture	mass %	34.9	33.7	21.8	31.1	13.9	26.8	13.5	28.6	0.1
Pore Volume	Vol. %	66.9	70.6	62.4	65.8	61.4	67.6	60	63.5	35.4
Max Water Holding Capacity	Vol. %	64.9	64.6	44.1	21.1	42.1	65.2	47.2	60.4	32.1
Water Permeability	in/hr	18.18	27.6	227.04	228.42	120	77.04	18.72	82.14	34.62

The chemical characteristics from the test are illustrated in Table 21. The pH was between 7 and 8 for all medias except for the fresh tire crumb growing media and the expanded clay growing media. There was more organic content found in the pollution control media and the tire crumb growing media. The organic content remained the same for all of the substrates over a year except for the tire crumb growing media, which is suspect. The drainage media had the lowest content (0.4% mass), which was expected.

The phosphorus content was measured in P2O5 and was found to increase in the present growing media over a year, decrease in the pollution control media, increase in the tire crumb growing media, and remain relatively the same in the expanded clay growing media. The drainage media exhibited the highest phosphorus concentration at 78.4 mg/L as P_2O_5. the potassium concentration in the media decreased for every substrate over the one year period; the greatest decrease in potassium occurred in the past research medias; and both the present growing media and past expanded clay media exhibited the highest potassium concentrations between all the medias. The drainage media had the lowest concentration at 28.9 mg/L as K_2O. The magnesium concentrations decreased for every substrate over the year and the drainage media contained the least amount of magnesium at 10.2 mg/L and the pollution control media has the second lowest concentration at 18.1 to 15.4 mg/L. The nitrate and ammonia concentrations decreased for both present medias while the previous medias increased over time. The drainage media contained the highest concentration (17.1 mg/L N) out of all the medias.

Table 21: Chemical Characteristics Comparison of All Media Results

Type of Media / **Parameter**	**Units**	**Growing Media**	**After 1yr Growing Media**	**Pollution Control Media**	**After 1yr Pollution Control Media**	**Fresh Tire Crumb Growing Media**	**After 1yr Tire Crumb Growing Media**	**Fresh Expanded Clay Growing Media**	**After 1yr Expanded Clay Growing Media**	**Drainage Media**
pH		7.5	7.5	7.2	7.1	5.3	7	6.5	7.5	7.6
Organic Content	mass %	8.8	8.6	37	37.8	36.8	105	2.2	1.9	0.4
P P2O5	mg/L	29.7	44.5	16.7	11.6	13.5	41.7	29.7	27.7	78.4
Postassium K2O	mg/L	129.5	119.5	39.1	33.2	85.2	40.5	107.4	39.3	28.9
Magnesium	mg/L	61.1	48.1	18.1	15.4	67	55.3	60.6	29.3	10.2
Nitrate & Ammonia	mg/L	11.4	4.4	11.8	3.6	5.7	6.6	6.1	9.7	17.1

CHAPTER SIX: SUMMARY AND CONCLUSIONS

Summary

With the growth of population in Florida and the increased impervious areas in urban landscapes, quality and quantity impacts from stormwater management are more important if the problems of limited space and resources are not addressed. The increased knowledge of green roof benefits among the public and the implementation of them provides a viable alternative and solution to the growing crisis. The results of this research provide additional information supporting the benefits of an irrigated green roof with a cistern for water reuse over one year using different designs. The designs shown are a comparison between two different depths of media, an addition of a Black and Gold ™ pollution control layer, and two different drainage materials. The green roofs are continuous in structure. No tray or discontinuous systems were evaluated.

The project consisted of ten 4' x 4' chambers, two as control chambers with only a waterproof membrane, four chambers with a total media depth of 4-inches, and four chambers with a total media depth of 8-inches. The 4-inch and 8-inch chambers alternated gravel and synthetic drainage layer material in addition to chambers with and without Black and Gold TM pollution control media below the growth media. The plants used in each green roof chamber included two muhly grass, two coontie palm, one dune daisy, and two fire wheel daisies. The experiment spanned a period of one year from January 2007 to December 2007.

The water quality parameters were also checked for accuracy and precision by running two duplicates and spiking two additional samples with a known concentration. The relative percent difference (RPD) was calculated using the duplicates and the percent recovery (%R) was calculated using the additional spiked samples. The RPD follows equation (9) given as:

$$RPD = (\text{Sample mg/L} - \text{Duplicate mg/L}) / (\text{Average of the two mg/L}) * 100 \quad (9)$$

The %R is shown in equation (10) as:

$$\%R = (\text{Spiked Sample mg/L} - \text{Sample mg/L}) / (\text{mg/L added to sample}) * 100 \quad (10)$$

The RPD was calculated for all of the parameters except for DO and ORP, and the %R was found for nitrite + nitrate, ammonia, total nitrogen, ortho-phosphorus, and total phosphorus. The DO and ORP were field measurements and no sample taken for these readings. The RPD and %R values for the parameters discussed are found in Appendix K (Water Quality Assurance and Quality Control).

The direct filtrate from the chambers and cistern water quality were analyzed, focusing on parameters such as pH, alkalinity, TS, TDS, TSS, conductivity, turbidity, dissolved oxygen, ORP, ammonia, nitrate + nitrite, total nitrogen, ortho-phosphorus, and total phosphorus. These parameters were used to determine the effectiveness of one design over the other. Furthermore, the direct filtrate was measured twice a week and stored in the respective cisterns as well as irrigation was measured and taken from each cistern. The ET and f factor were calculated by gathering the inputs and outputs of the system. Three 6-in/hr-storm events were simulated in each box throughout the year measuring the amount of filtrate that discharged every minute for 30 to 40 minutes. The test process led to the creation of hydrographs and to the determination of the peak flow and attenuation of each design.

Three samples were also taken from different locations at the New American Home, and two samples were taken from the cistern at the Stormwater Academy Lab. The water quality analysis from these locations presented a field data set to be compared to the laboratory data set (chambers). The direct filtrate and the cistern water were analyzed from the New American Home and the cistern water analyzed from the Stormwater Lab. The parameters were the same as the present research.

There are four soil samples that were taken and sent to Penn State to be analyzed during this project. The first soil sample was taken from a freshly mixed batch of expanded clay growing media and tire crumb growing media from Mike Hardin's research and then one taken from a batch a year after the research had finished. The final to soil samples were taken from the start and finish of the present research and included growth media and Black and Gold$_{TM}$ pollution control media.

Conclusions

Depth of Media

The shallow media depth (4-inch) and the deep media depth (8-inch) comparison results showed the ET and f factor to have no significant difference over a year. However, the hydrograph results for three storm events illustrated that the deep media depth had a lower peak flow and higher attenuation than the shallow media depth over a 30-minute time frame. The conclusion is drawn that the filtrate from both depths approximately equal each other over a long period of time but the deep media depth will attenuate individual storms more effectively.

The water quality results between the two depths showed significantly higher solids, conductivity, alkalinity, turbidity, and ortho-phosphorus concentrations with the deep media depth than the shallow media depth for the majority of combinations. The total phosphorus concentration in the shallow media depth was either significantly higher or approximately equal to the concentration in the deep media depth. This could be because the deep media depth retains more water for a longer period of time, leaving the deep media moist longer thus giving more time for the organic phosphorus to dissolve and convert to ortho-phosphorus.

Pollution Control Layer

In the case of a Black and Gold TM pollution control media beneath the growing media compared to the design without it, the ET and f factor results showed no significant difference spanning a year. The hydrograph results showed a higher attenuation with the pollution control media in the deeper media and an approximately equal attenuation in the shallow depths with a few exceptions. The conclusion can be drawn that the addition of a pollution control layer would have little affect on the hydrology of the green roof design.

The water quality results show lower ammonia, total nitrogen, ortho-phosphorus, and total phosphorus concentrations in general for all of the test chambers with pollution control compared to without the media. The pollution control media beneath the growing media represents an improvement compared to a green roof design without it when limiting nutrients discharged from the cistern.

Drainage Layer Material

The comparison between the different drainage layers (gravel and geo-synthetic) had little effect on the ET, f factor, hydrograph, or water quality results. It is concluded that neither drainage material is better than the other when compared using all of the research parameters. Other variables will affect the decision on whether to choose gravel or synthetic material. These would consist of but are not limited to price, weight, and ease of installation.

Green Roof versus Control Roof Discharge

As in past work (Hardin, 2006), the water quality from the chambers' filtrate was compared to control roof filtrate. The control roof filtrate had higher concentrations of nitrite + nitrate, ammonia, total phosphorus, and turbidity than the green roof chamber cisterns. The green roof chambers, however, had a higher concentration of total nitrogen, solids, conductivity, pH, and alkalinity. The additional pH and alkalinity is desired especially in regions with acid rain. The higher concentration of total nitrogen is good when using a cistern and reusing the water in that it provides more nutrients for the plants.

Filtrate versus Cistern Water

Water quality samples were also taken from the direct filtrate to compare with the cistern water. The findings showed no difference in nitrate + nitrite, ammonia, TSS, and turbidity. However, total nitrogen, ortho-phosphorus, total phosphorus, TS, TDS, dissolved oxygen, and ORP were lower in the cistern compared to the filtrate. The use of a cistern design of 5.5" over the green roof area allowed a significant amount of filtrate to be captured. The lower nutrient mass loading from the cistern discharge including nutrients such as ammonia, nitrate + nitrite, total nitrogen, ortho-phosphorus, and total phosphorus was even more significant when compared to the direct filtrate and control roof filtrate mass loading. In conclusion, the filtrate leaving a cistern from overflow compared to that of direct filtrate leaving a green roof without a cistern has less pollutant; and thus emphasizes the advantages of using an adequately designed cistern in green roof design.

Experimental Chambers versus The New American Home and Stormwater Lab

The water quality data from the NAH also shows lower concentrations of pollutants in the cistern compared to the direct filtrate. The stormwater lab cistern water quality had very similar concentrations compared to the cistern water from a comparable chamber except for the total nitrogen concentration, which was higher in the stormwater lab cistern. The higher nitrogen concentration in the stormwater lab cistern may be attributed to the time when the samples were taken and the amount of samples. The samples were taken near the completion of the roof at the end of the growing season in September. The lack of growth on the roof can be correlated to the amount of nitrogen necessary for survival of the plant.

Recommendations

A pollution control layer should be placed beneath the growing media when pollution reduction from the filtrate is a concern. As the ET and filtrate factor had no significant difference when using an 8-inch or a 4-inch media depth and using pollution control or not using the media, either design should be predicted using the CSTORM model. Because of the negligible difference between the hydrology and water quality from gravel and geo-synthetic drainage material, when designing a green roof the choice of geo-synthetic drainage material should be used over gravel when structural support and ease of installation is a concern. Furthermore, in order to reduce pollution to nearby water bodies, minimize the impact of discharge on city sewers, and lower the potable water usage of the building, an adequately designed cistern or other water holding device must be incorporated into the green roof design.

Future Research

Saturation measurements should be taken at different depths from each media depth at different times of the year to determine if one depth becomes completely dry where the other is still saturated through a dry season. This will help determine more efficient irrigation schedules. A study should be performed over several years to determine a trend for the f factor after the green roof has been established. This could also lead to a more water efficient irrigation schedule using less water in the fall. A study should also be done comparing the effectiveness of green roof tray systems versus continuous systems using similar research parameters found in this research.

APPENDIX A: ET AND F FACTOR COMPARISONS

ET Comparisons

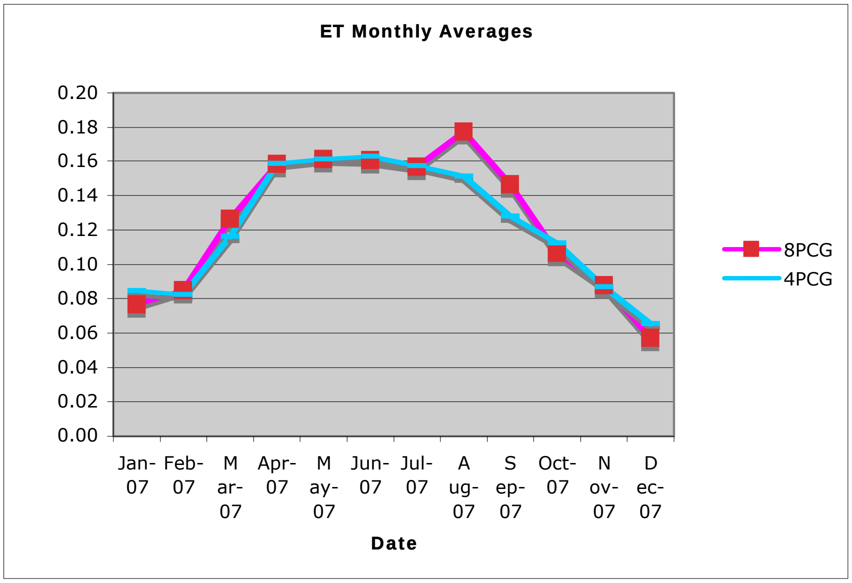


Figure 29: ET Comparison Between 8PCG AND 4PCG

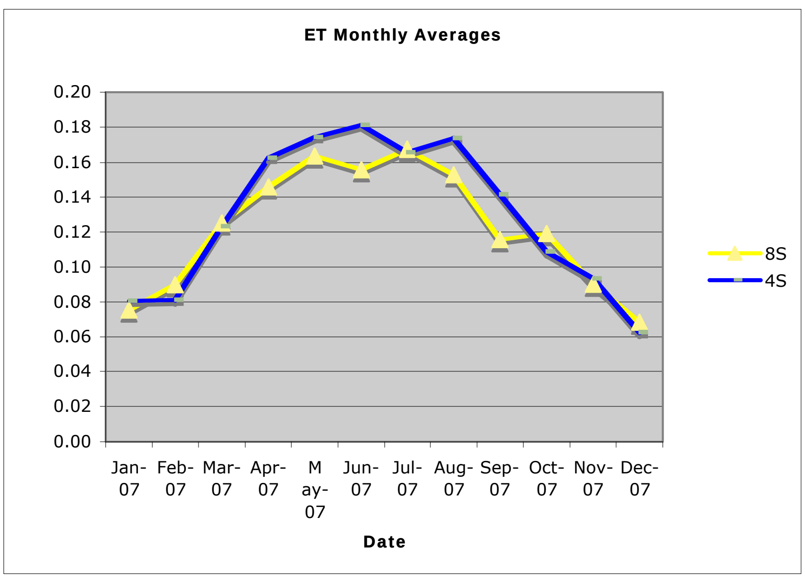


Figure 30: ET Comparison Between 8S AND 4S

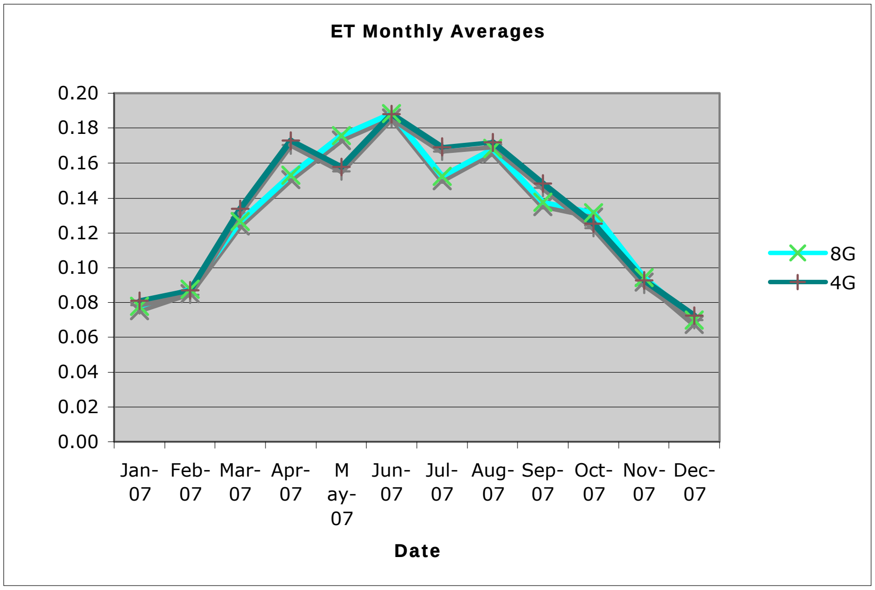


Figure 31: ET Comparison Between 8G AND 4G

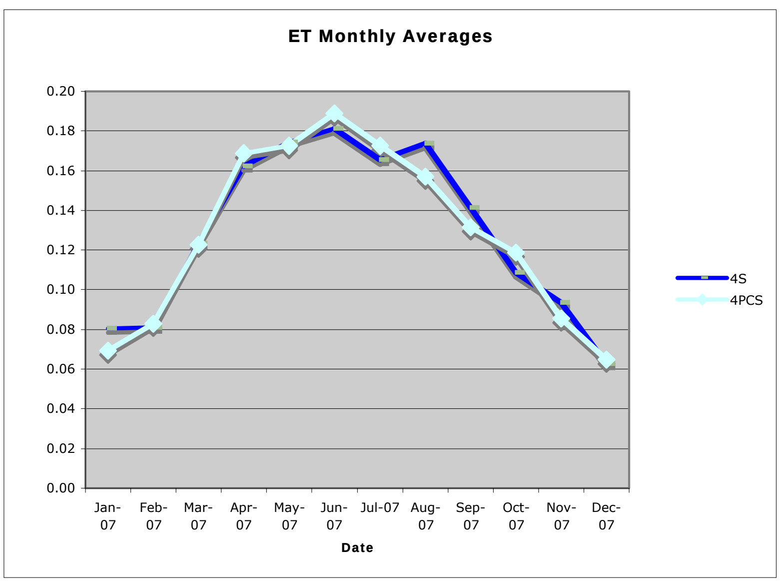


Figure 32: ET Comparison Between 4PCS AND 4S

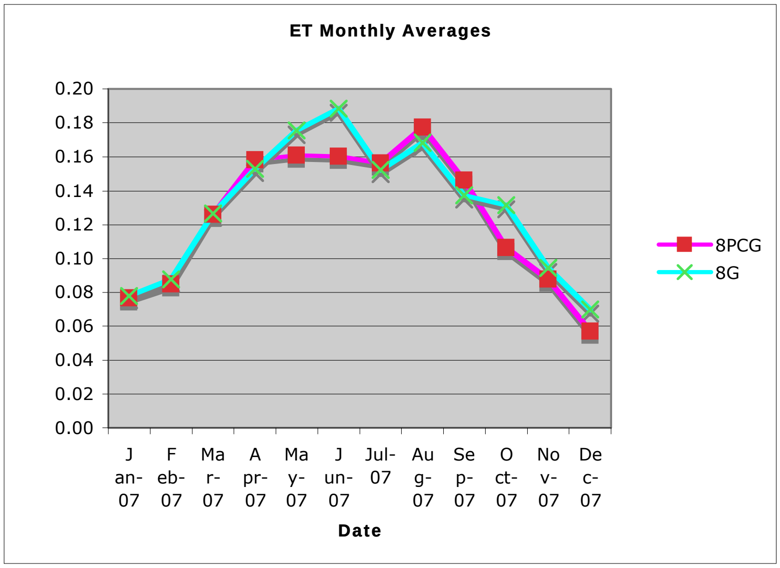


Figure 33: ET Comparison Between 8PCG AND 8G

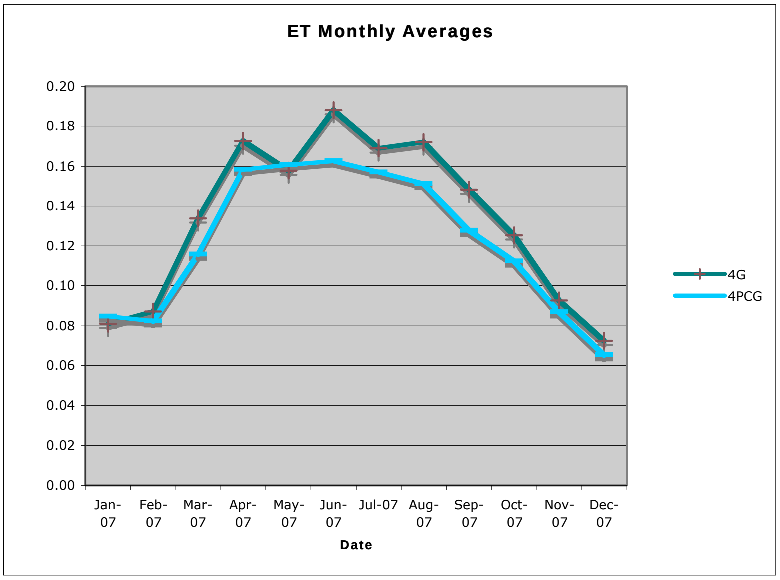


Figure 34: ET Comparison Between 4PCG AND 4G

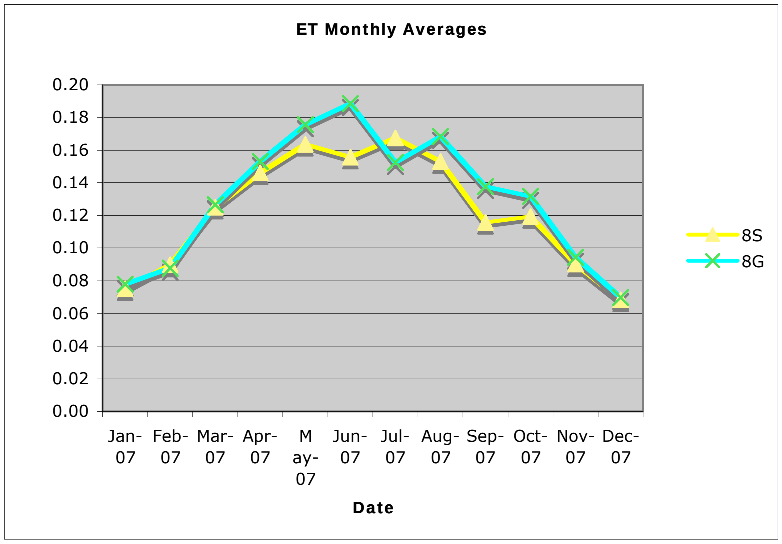


Figure 35: ET Comparison Between 8S AND 8G

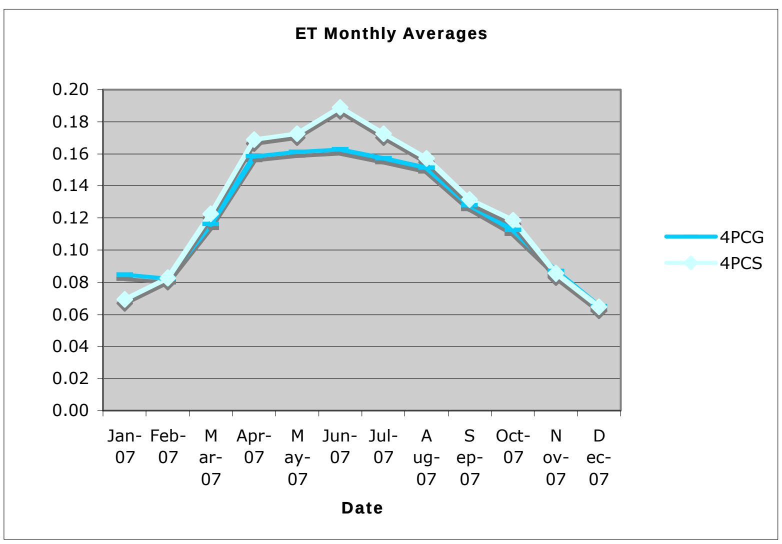


Figure 36: ET Comparison Between 4PCG AND 4PCS

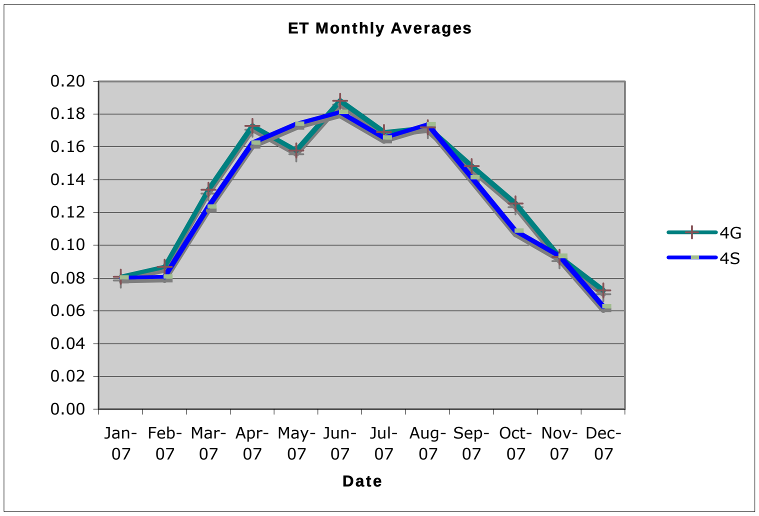


Figure 37: ET Comparison Between 4G AND 4S

f Factor Comparisons

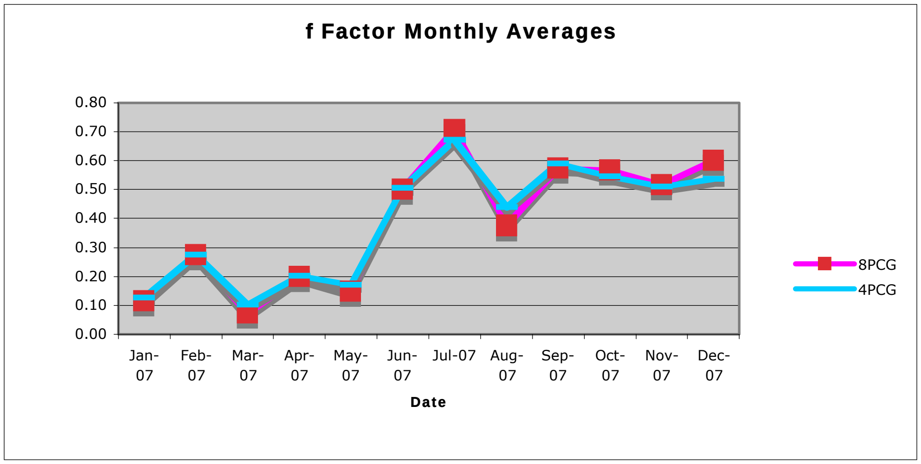


Figure 38: f Factor Comparison Between 8PCG and 4PCG (dimensionless)

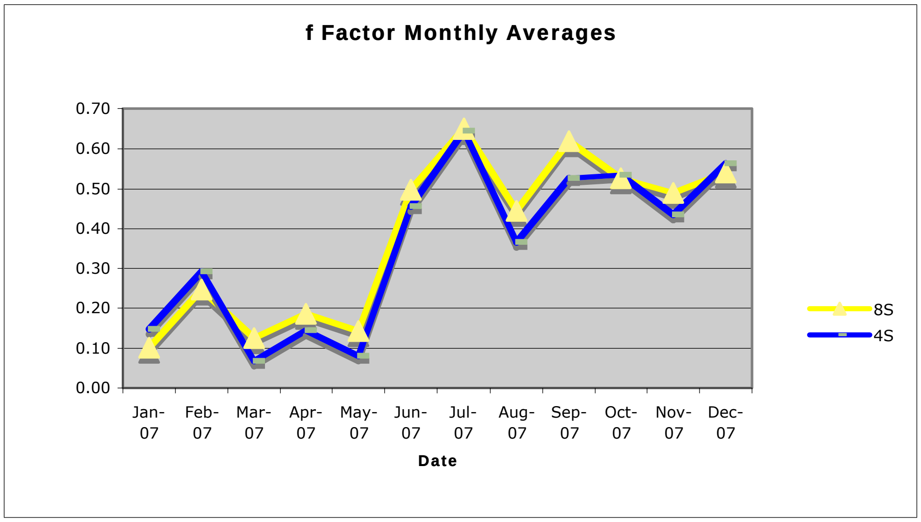


Figure 39: f Factor Comparison Between 8S and 4S (dimensionless)

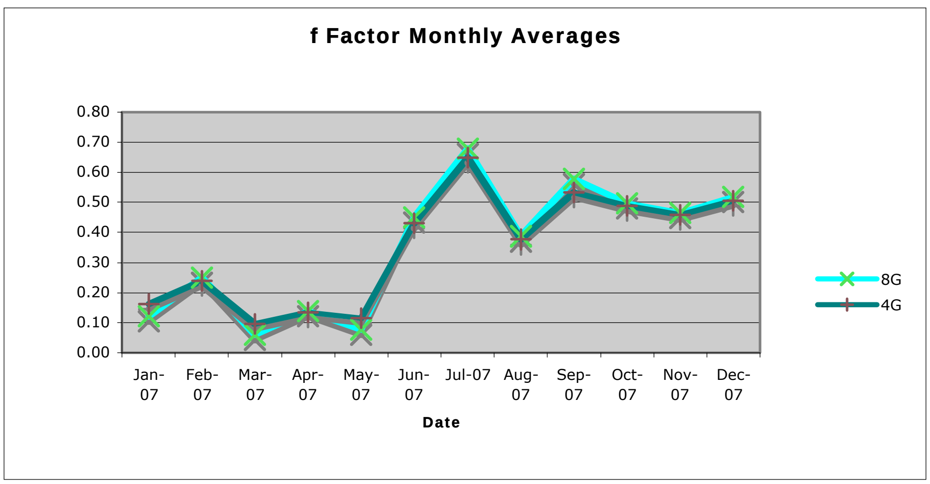


Figure 40: f Factor Comparison Between 8G and 4G (dimensionless)

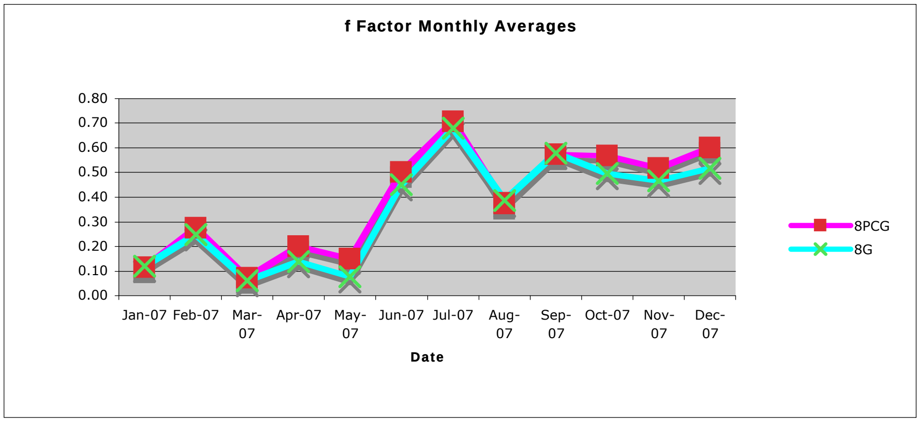


Figure 41: f Factor Comparison Between 8PCG and 8G (dimensionless)

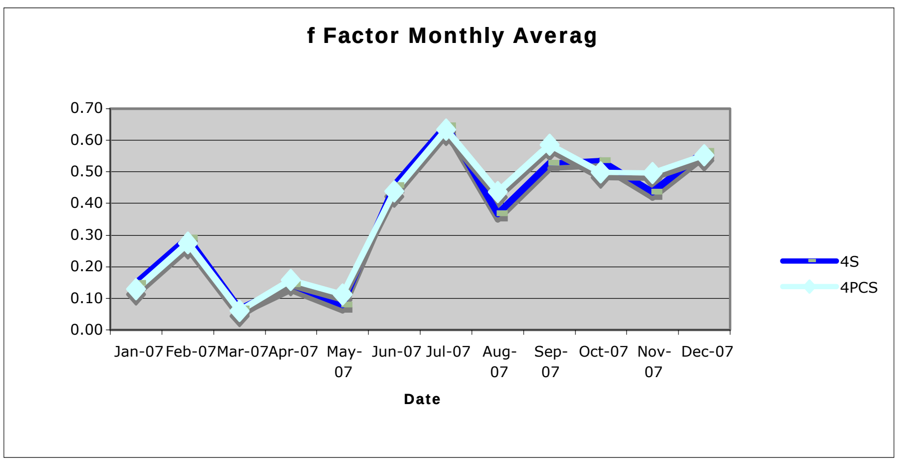


Figure 42: f Factor Comparison Between 4PCS and 4S (dimensionless)

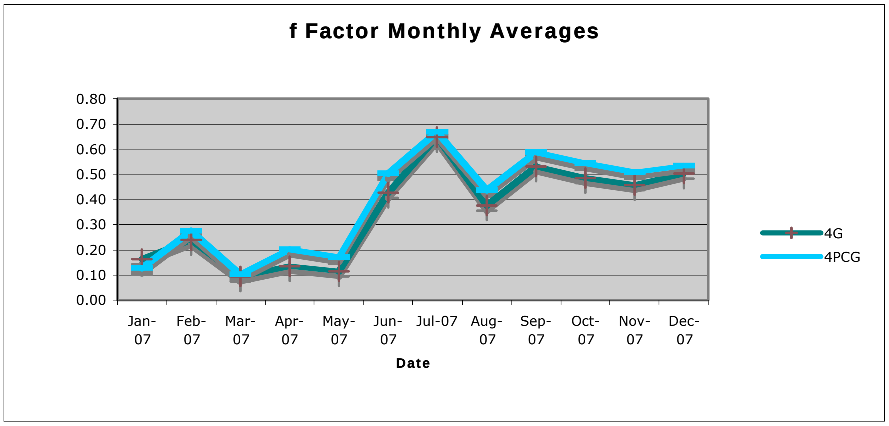


Figure 43: f Factor Comparison Between 4PCG and 4G (dimensionless)

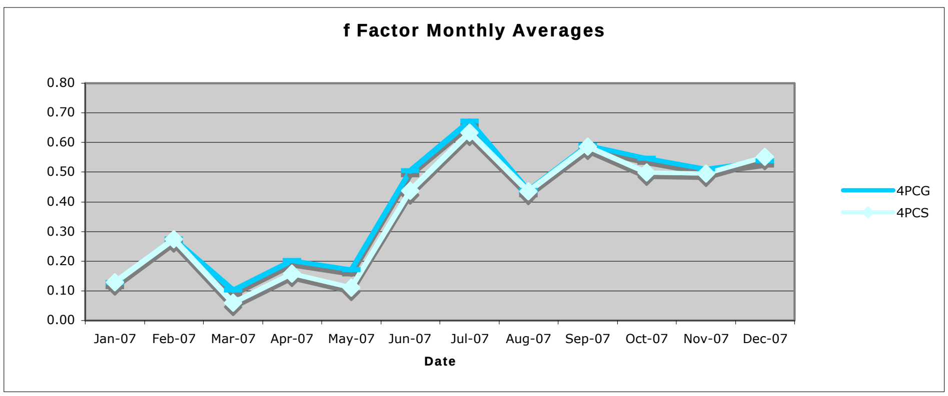


Figure 44: f Factor Comparison Between 4PCS and 4PCG (dimensionless)

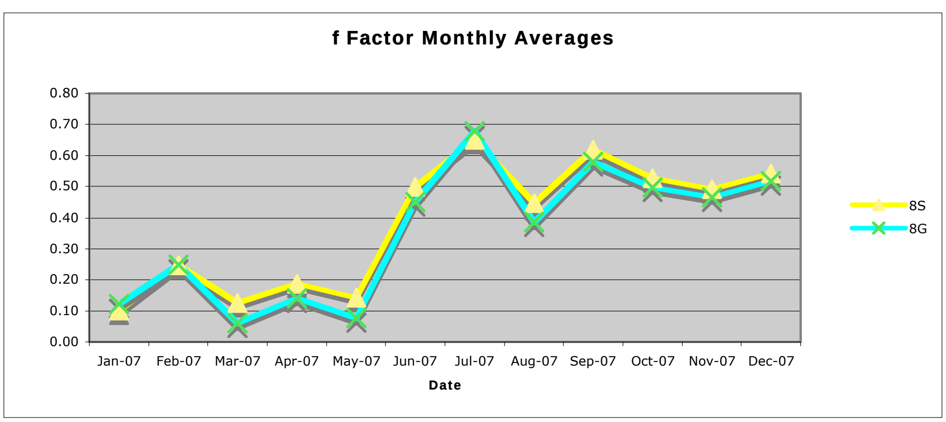


Figure 45: f Factor Comparison Between 8S and 8G (dimensionless)

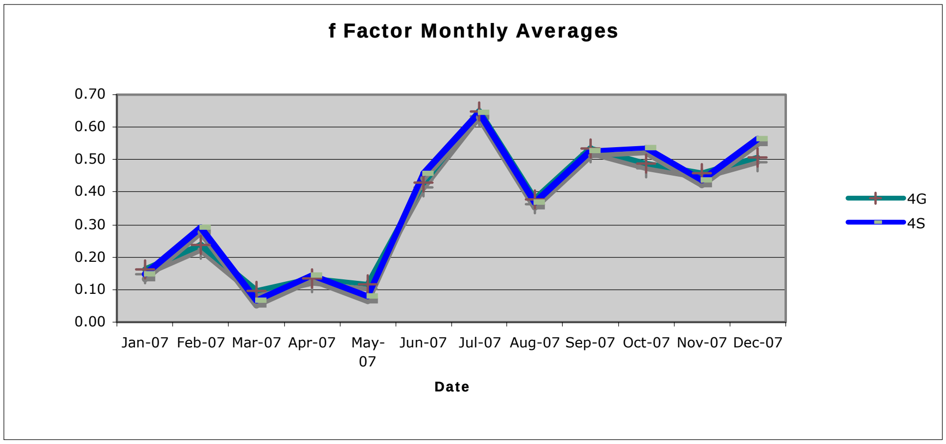


Figure 46: f Factor Comparison Between 4S and 4G (dimensionless)

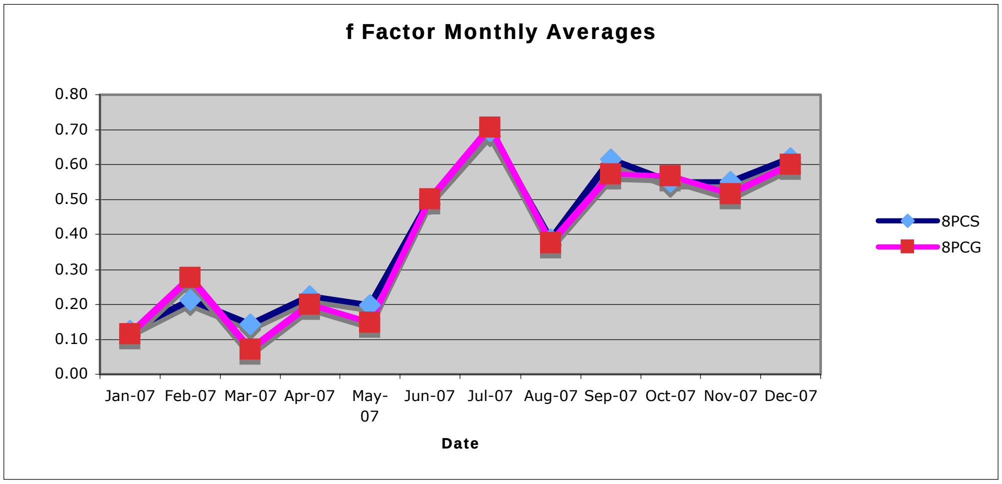


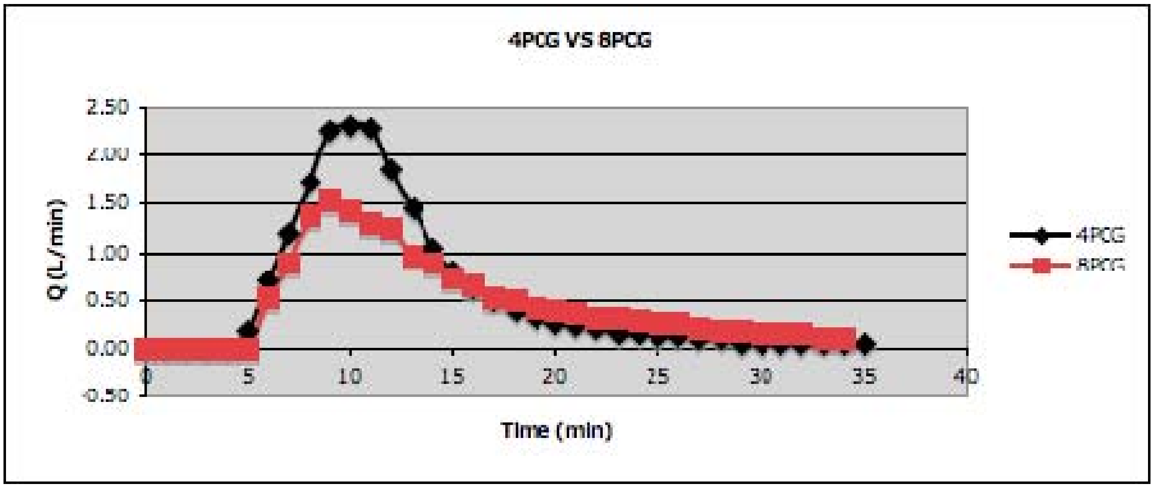
Figure 47: f Factor Comparison Between 8PCS vs. 8PCG (dimensionless)

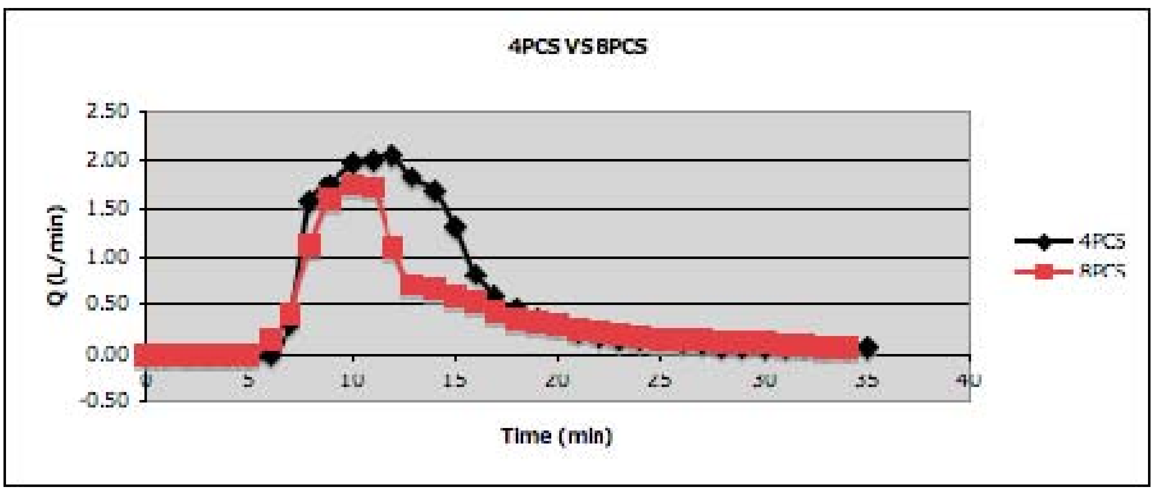
APPENDIX B: HYDROGRAPH AND CUMULATIVE COMPARISONS

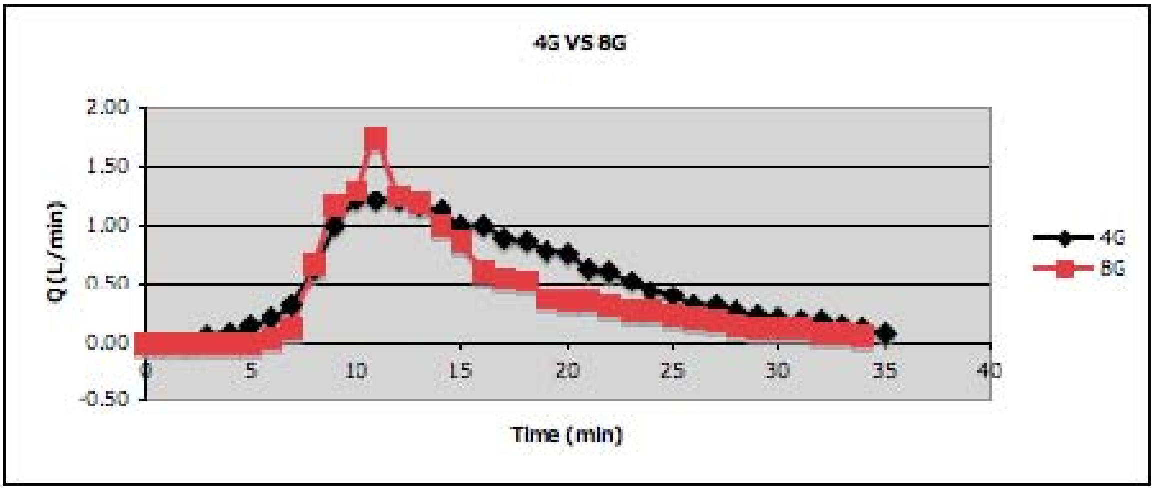
Hydrograph Comparisons

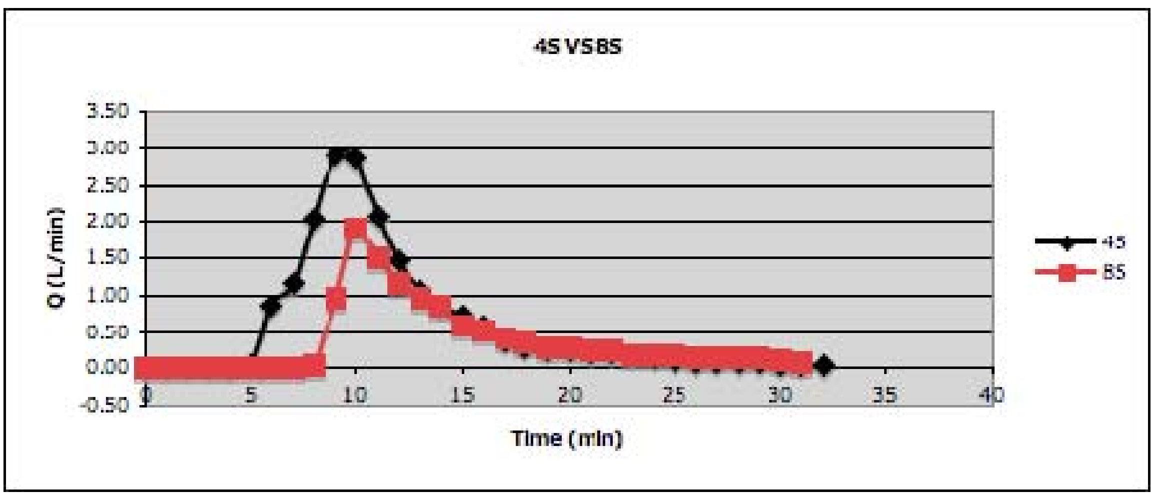
Depth Comparisons

June Hydrographs

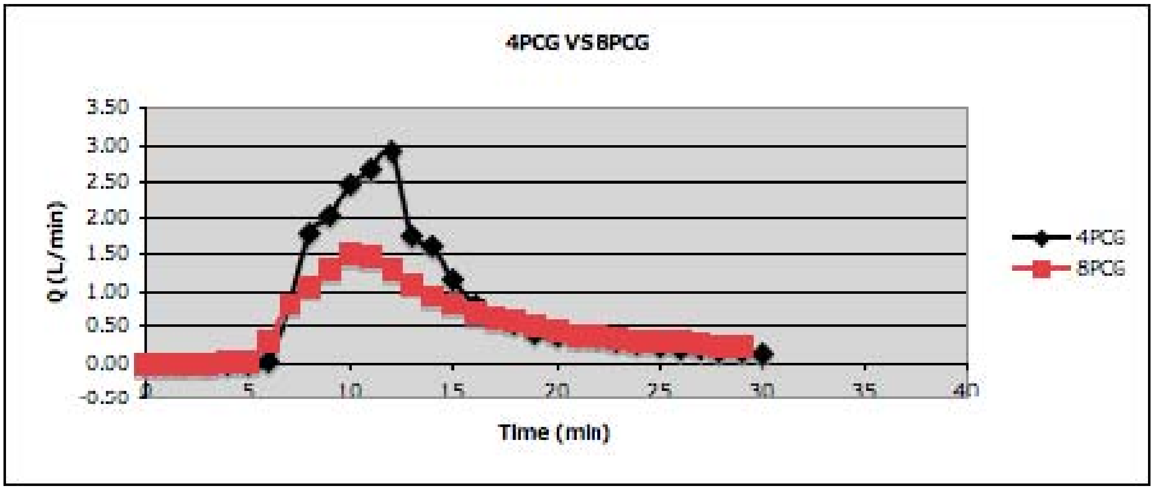


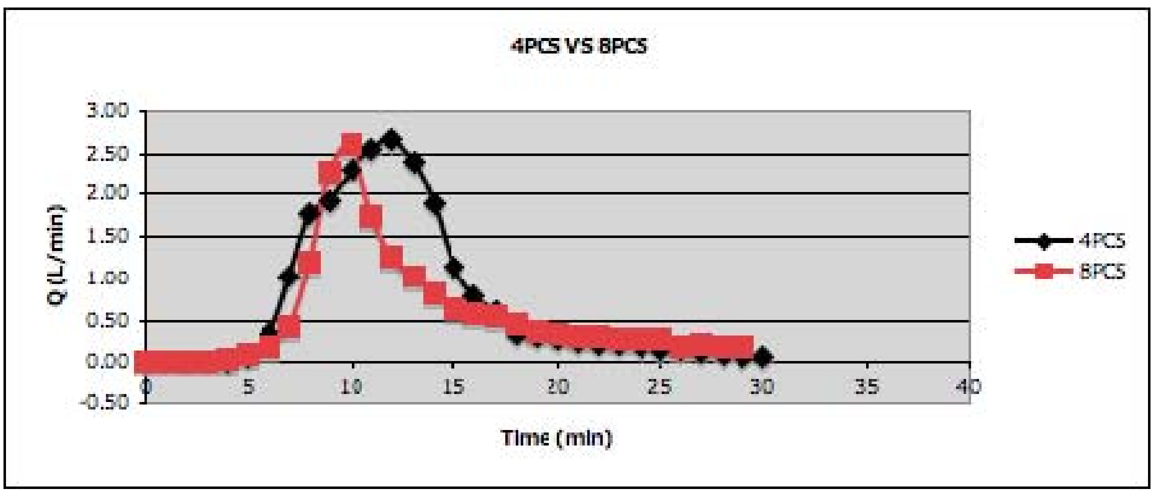


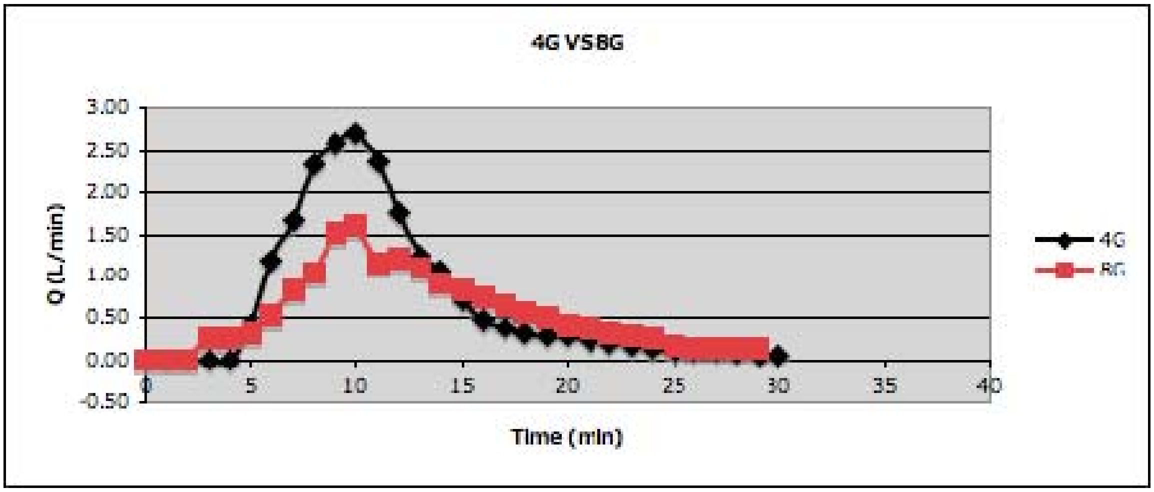


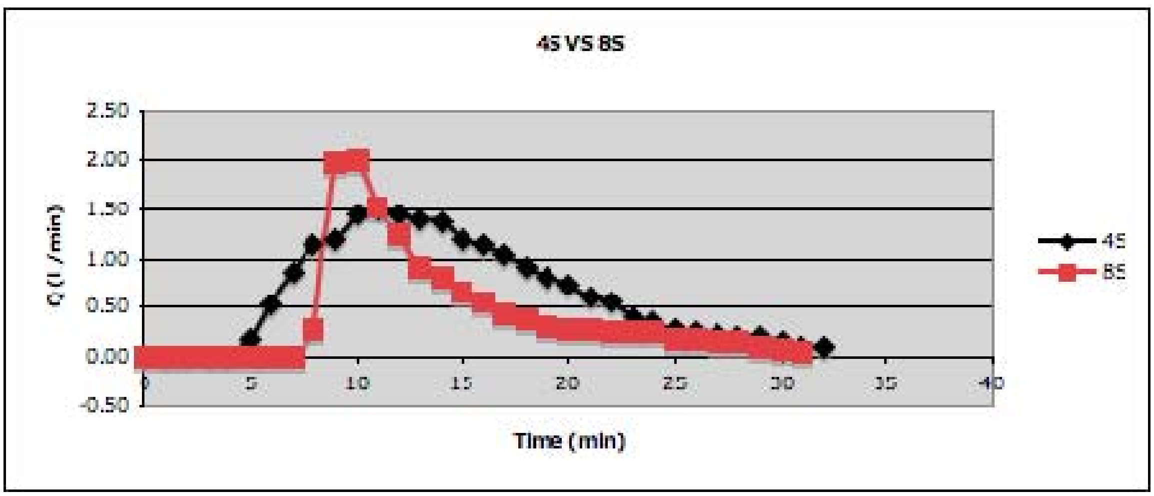


October Hydrographs

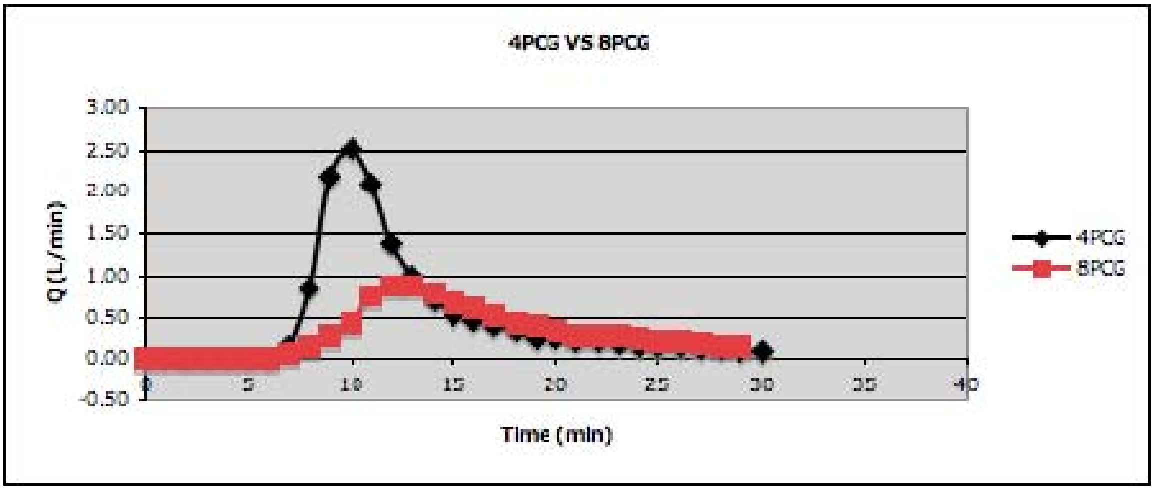

4PCG VS 8PCG
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
-0.50
Q (L/min)
0
5
10
15
20
25
30
35
40
Time (min)
4PCG
8PCG

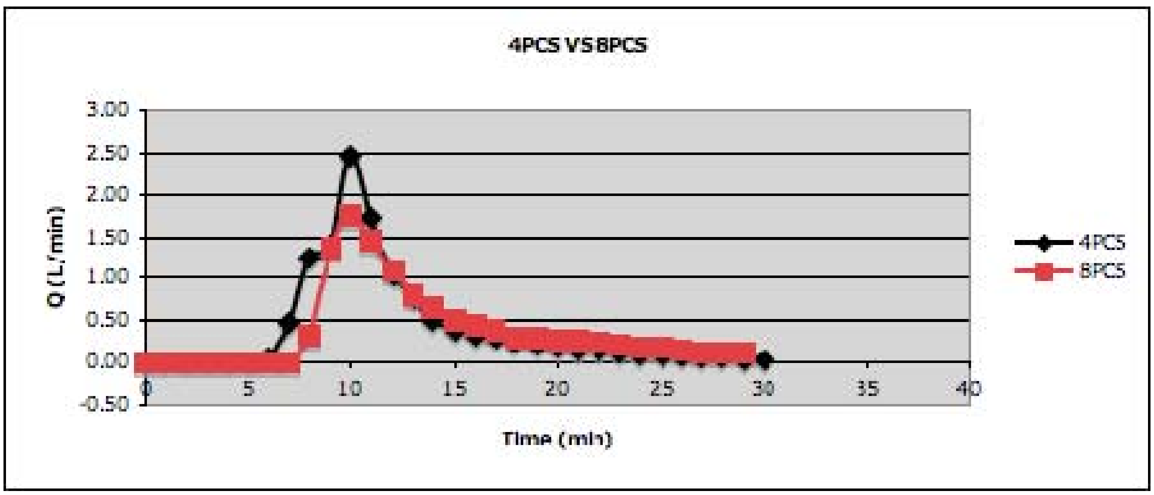

4PCS VS 8PCS
3.00
2.50
2.00
1.50
1.00
0.50
0.00
-0.50
Q (L/min)
0
5
10
15
20
25
30
35
40
Time (min)
4PCS
8PCS

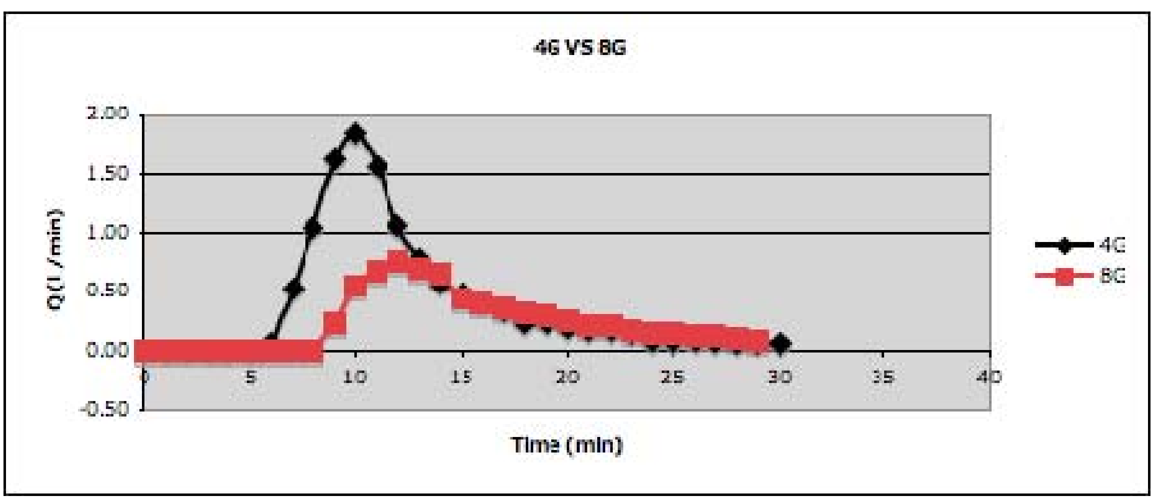


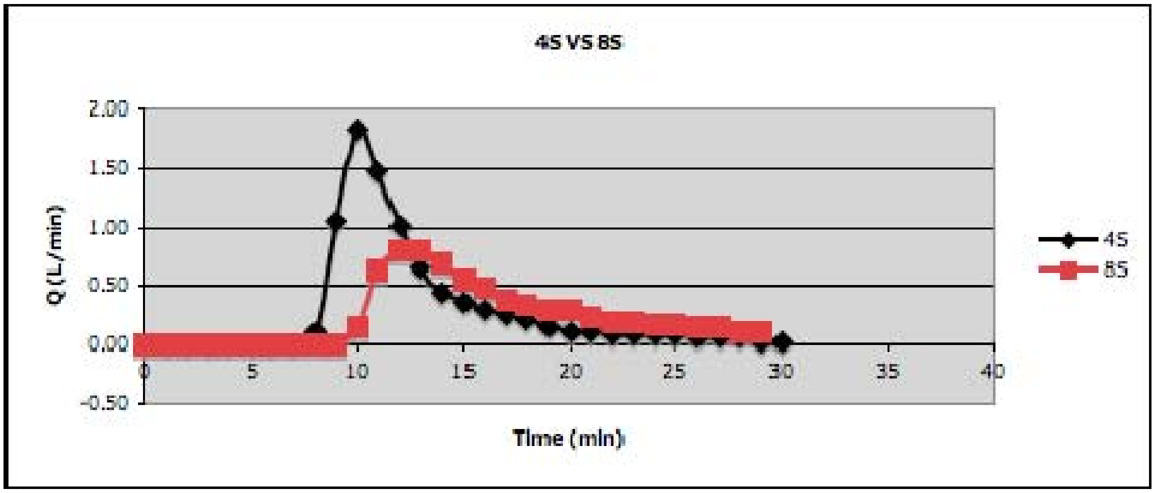


December Hydrographs


4PCG VS 8PCG
Q (L/min)
Time (min)
4PCG
8PCG

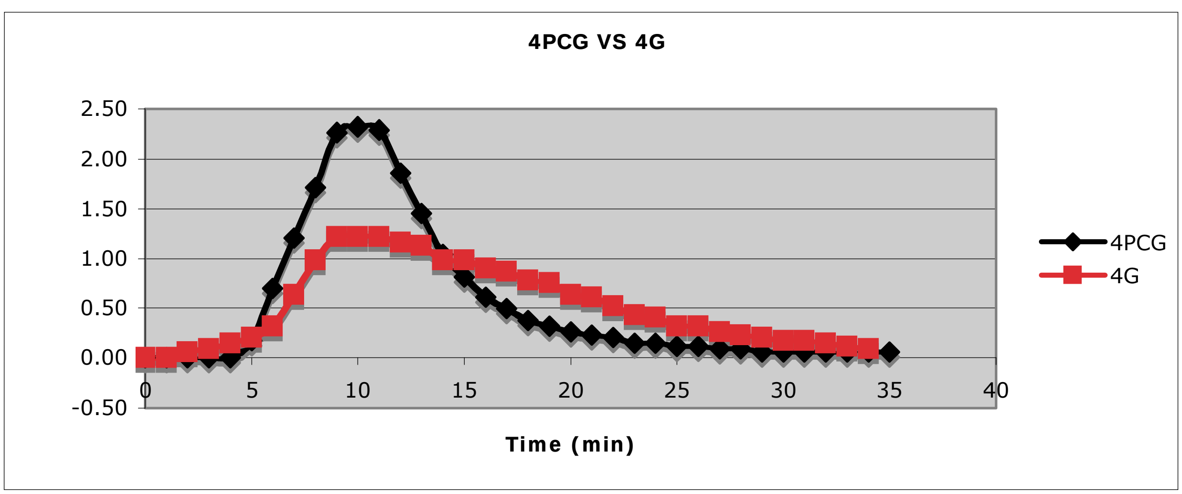

4PCS VS 8PCS
Q (L/min)
Time (min)
4PCS
8PCS

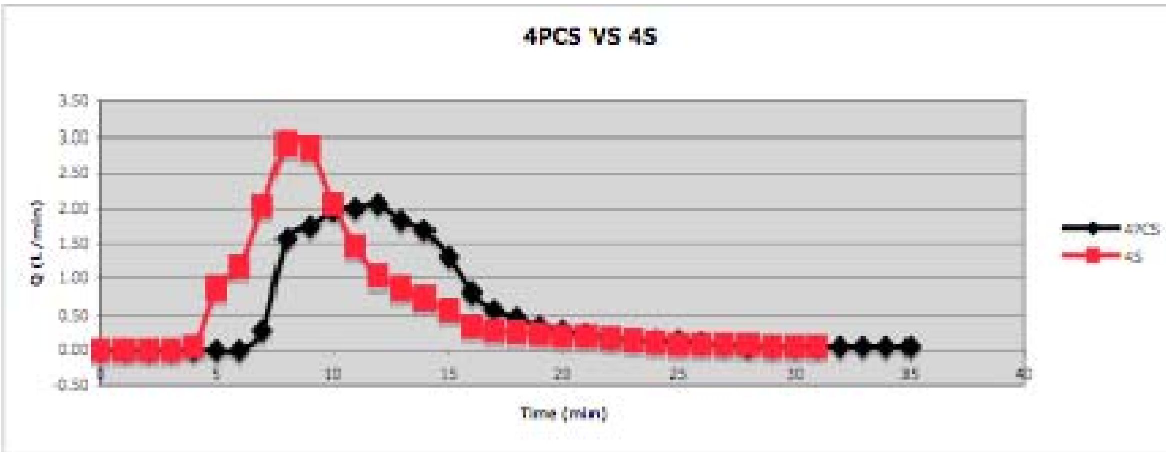

4G VS 8G
Q (L/min)
Time (min)
4G
8G

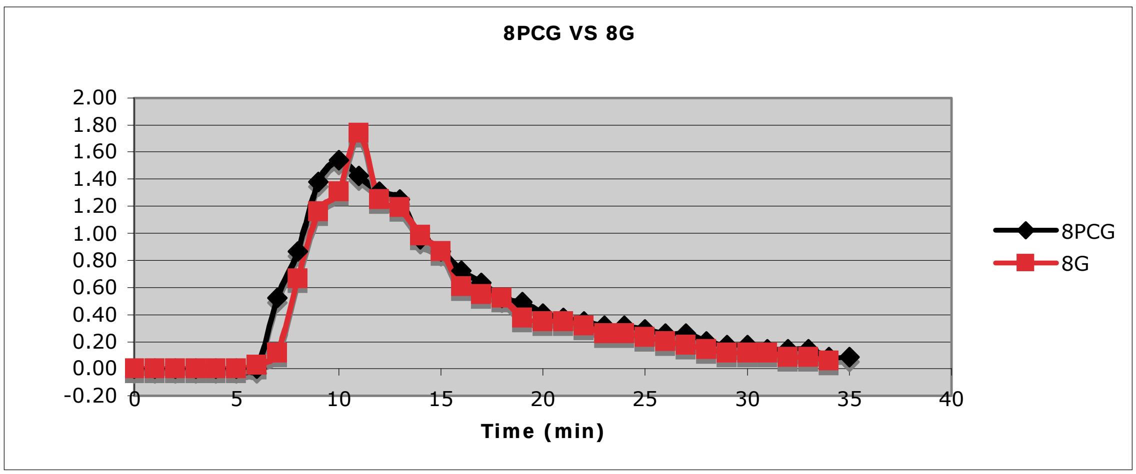


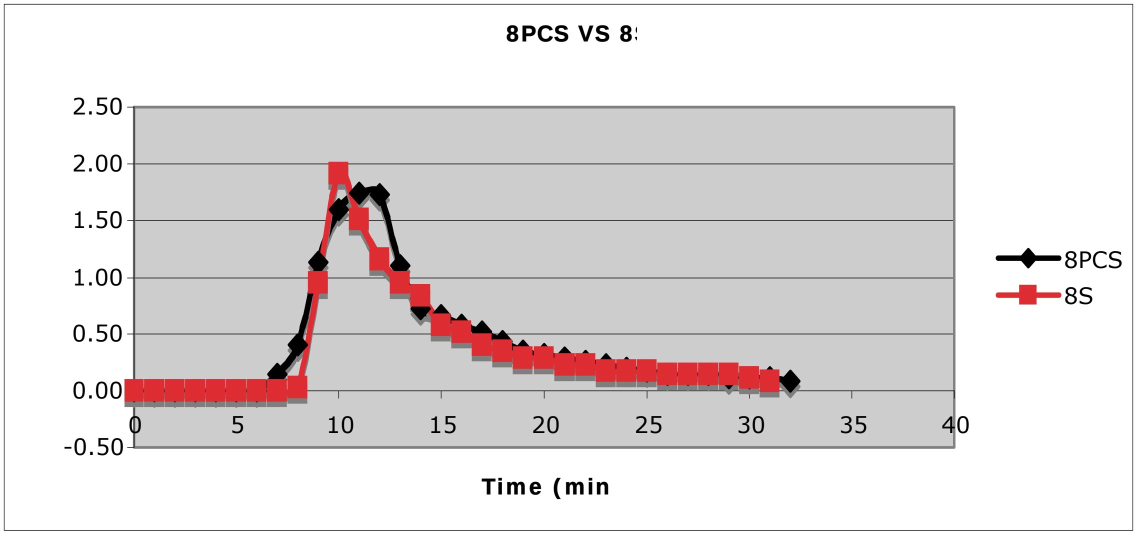
Pollution Control Layer Comparison

June Hydrographs

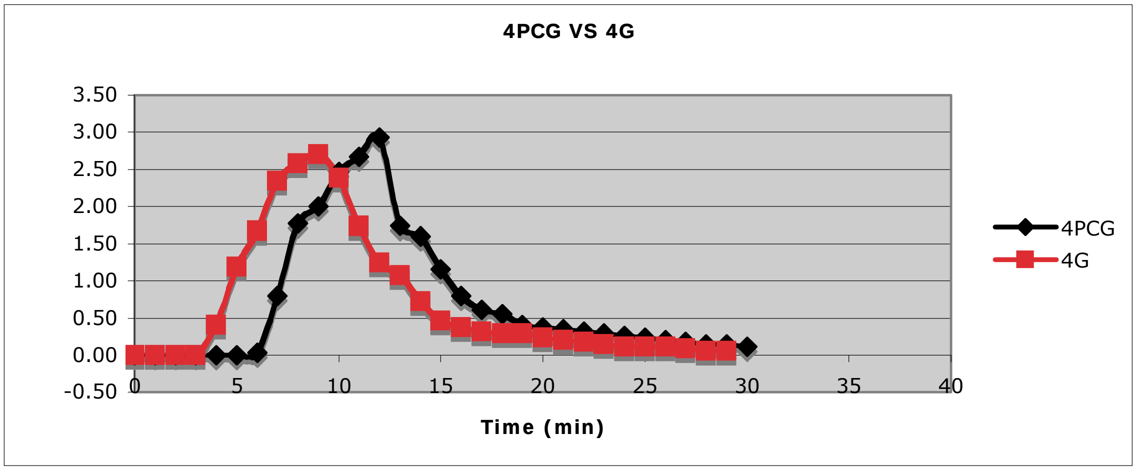


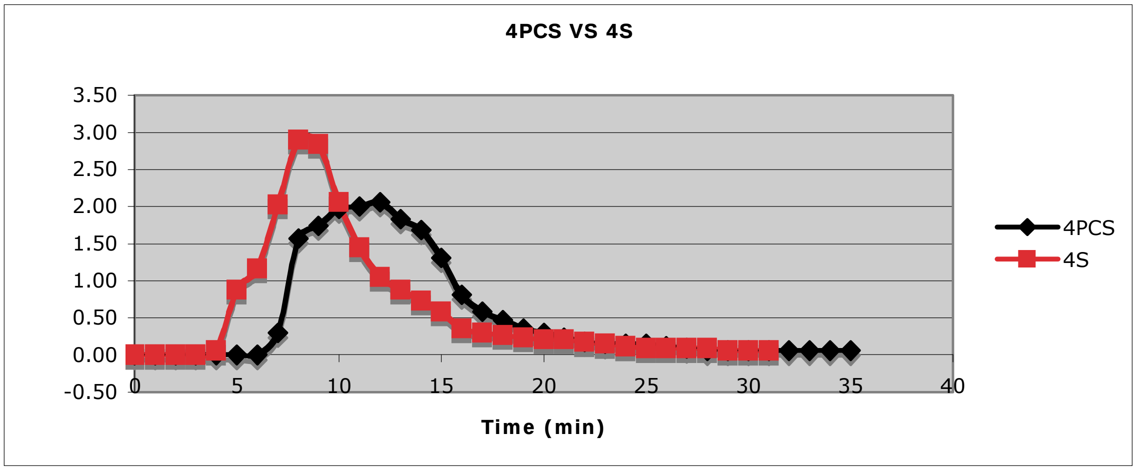

4PCS VS 4S
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
-0.50
Q (L/min)
5
10
15
20
25
30
35
40
Time (min)
4PCS
4S

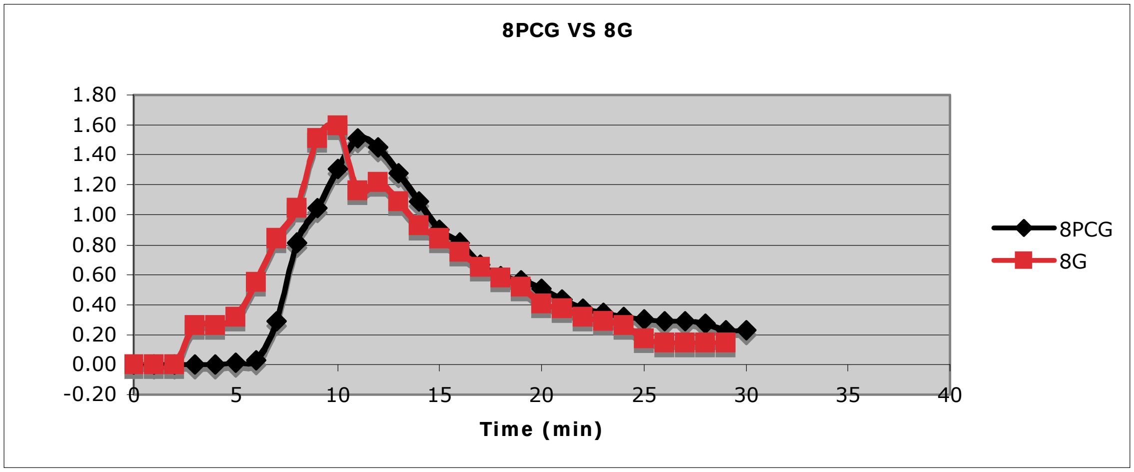

8PCG VS 8G
2.00
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
-0.20
0
5
10
15
20
25
30
35
40
Time (min)
8PCG
8G

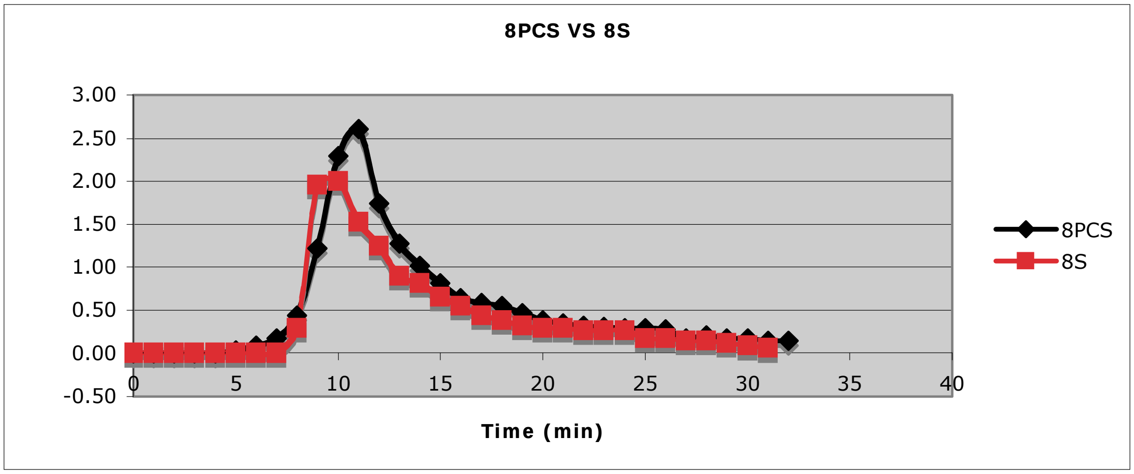


October Hydrographs

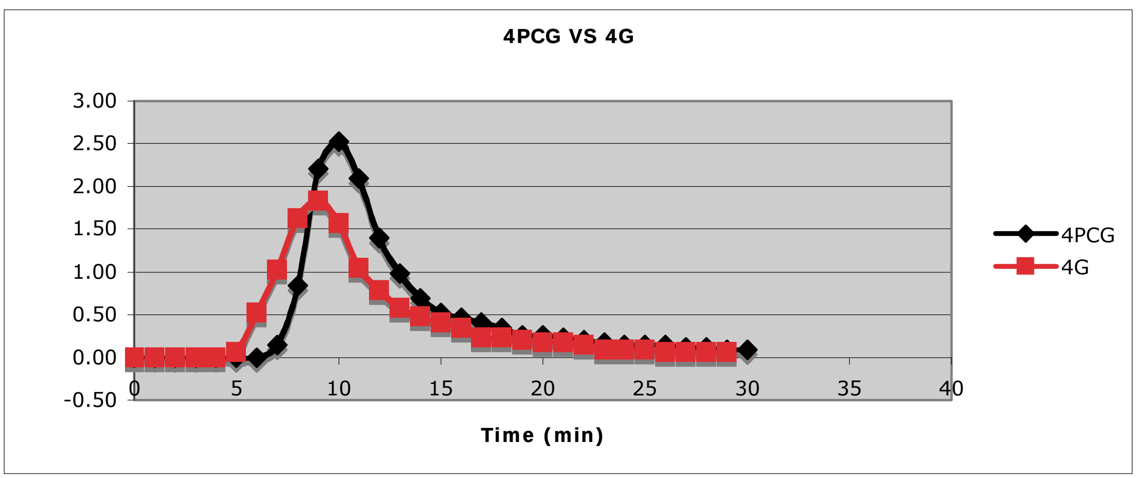


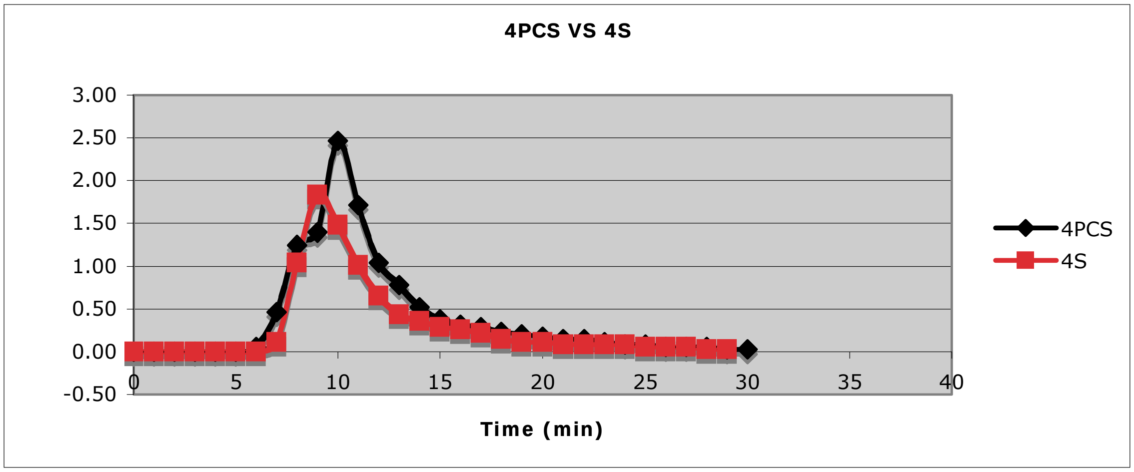

4PCS VS 4S
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
-0.50
0
5
10
15
20
25
30
35
40
Time (min)
4PCS
4S

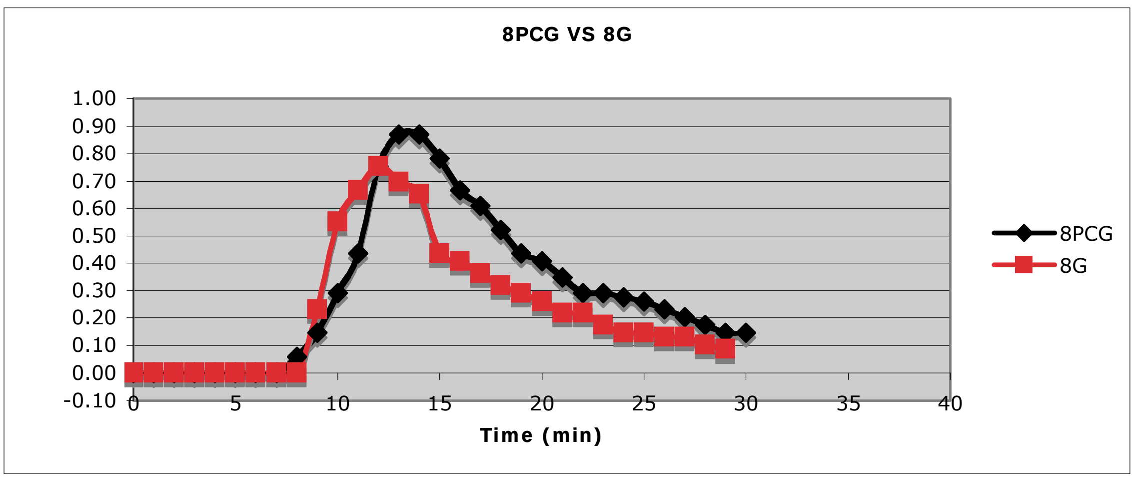

8PCG VS 8G
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
-0.20
0
5
10
15
20
25
30
35
40
Time (min)
8PCG
8G

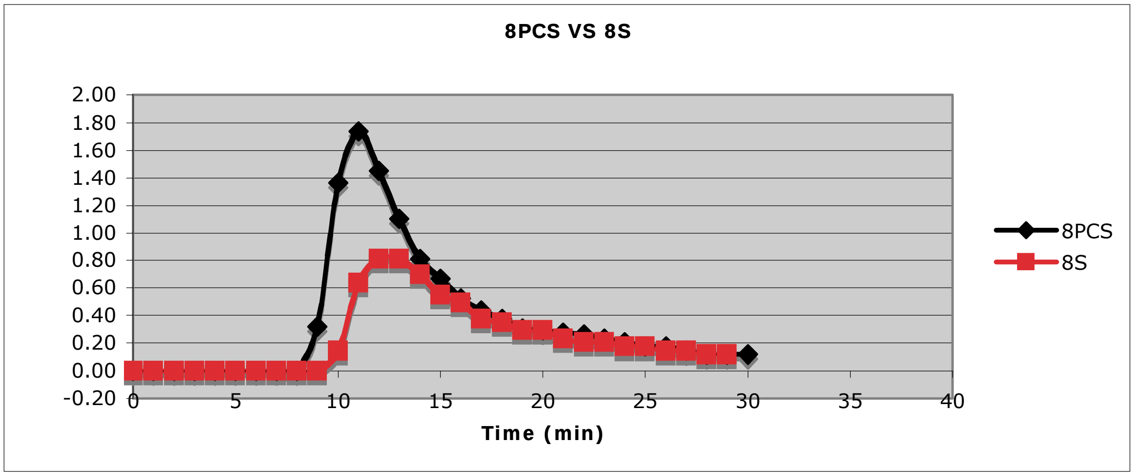


December Hydrographs



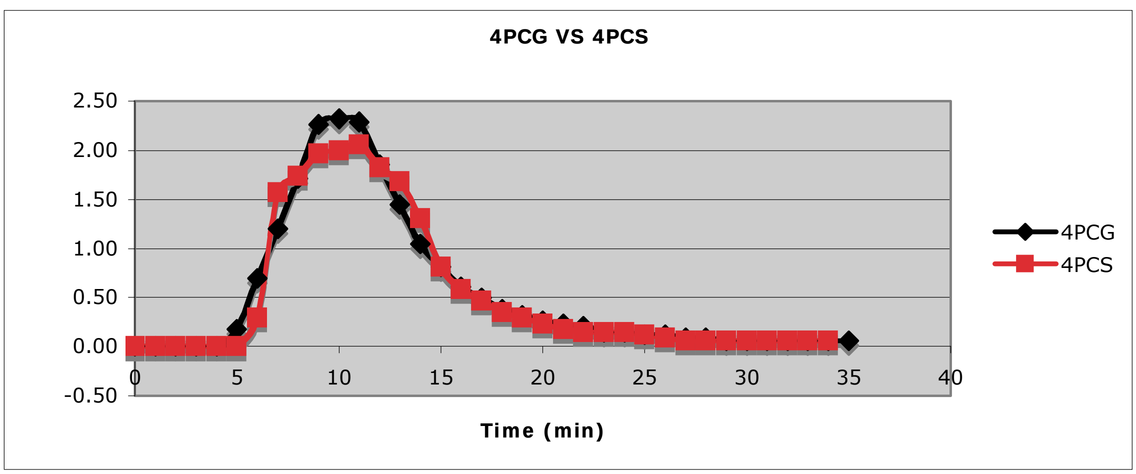

4PCS VS 4S
3.00
2.50
2.00
1.50
1.00
0.50
0.00
-0.50
0
5
10
15
20
25
30
35
40
Time (min)
4PCS
4S

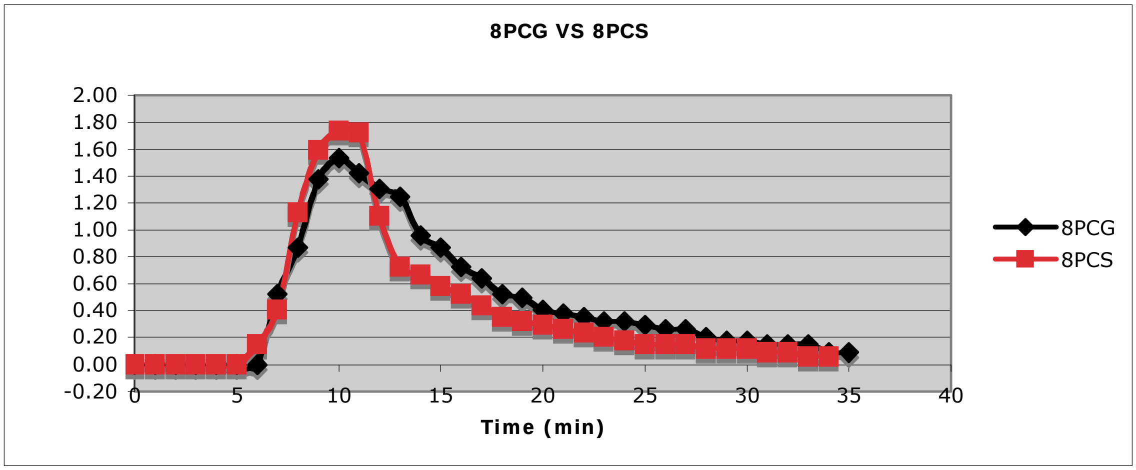

8PCG VS 8G
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
-0.10
0
5
10
15
20
25
30
35
40
Time (min)
8PCG
8G

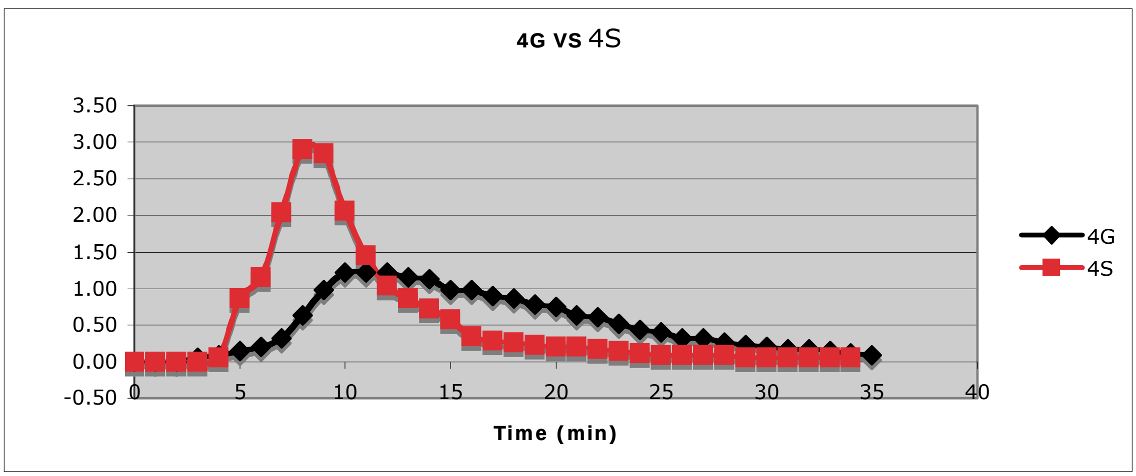


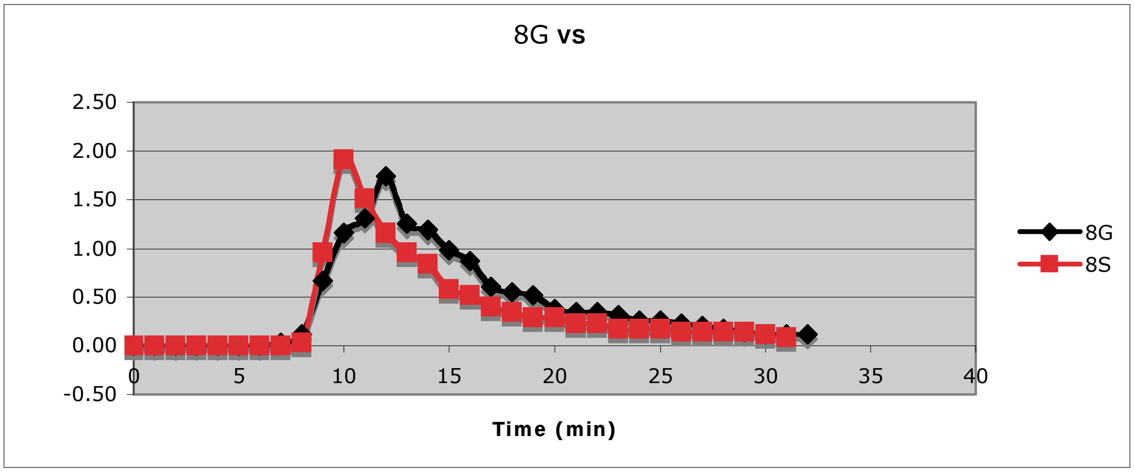
Drainage Layer Comparisons

June Hydrographs

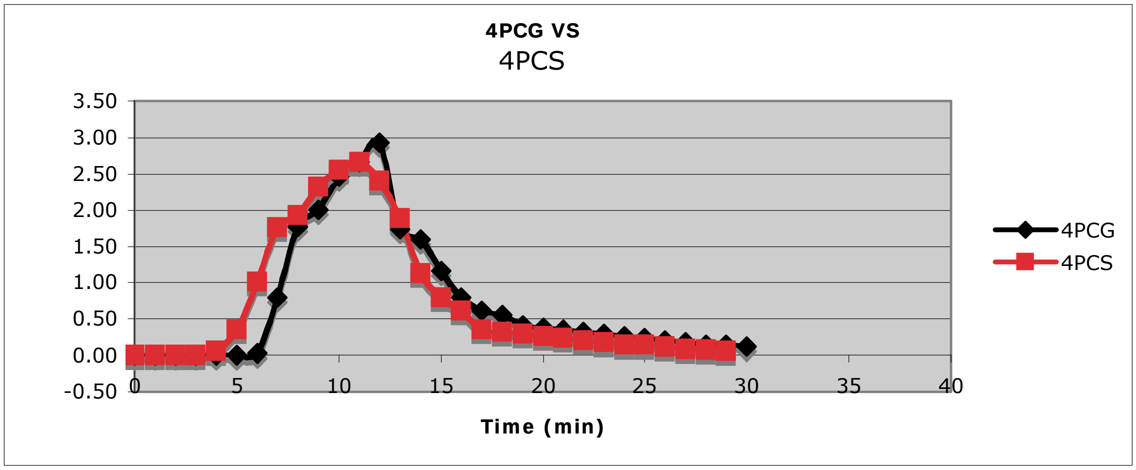


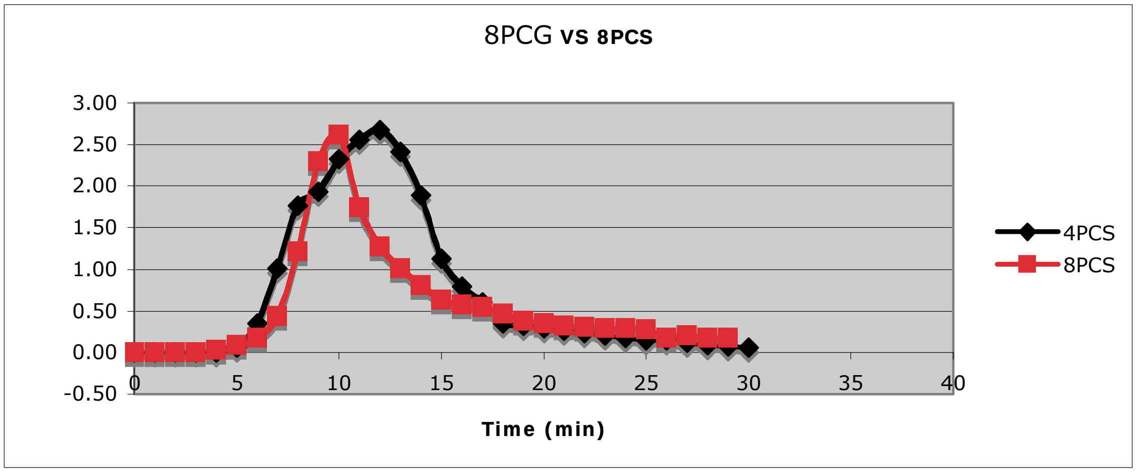

8PCG VS 8PCS
2.00
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
-0.20
0
5
10
15
20
25
30
35
40
Time (min)
8PCG
8PCS

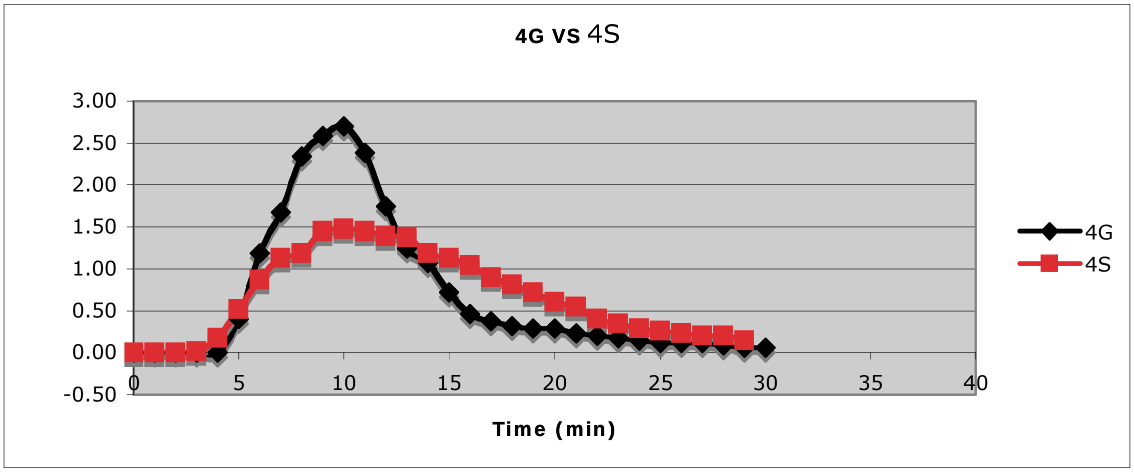

4G VS 4S
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
-0.50
0
5
10
15
20
25
30
35
40
Time (min)
4G
4S

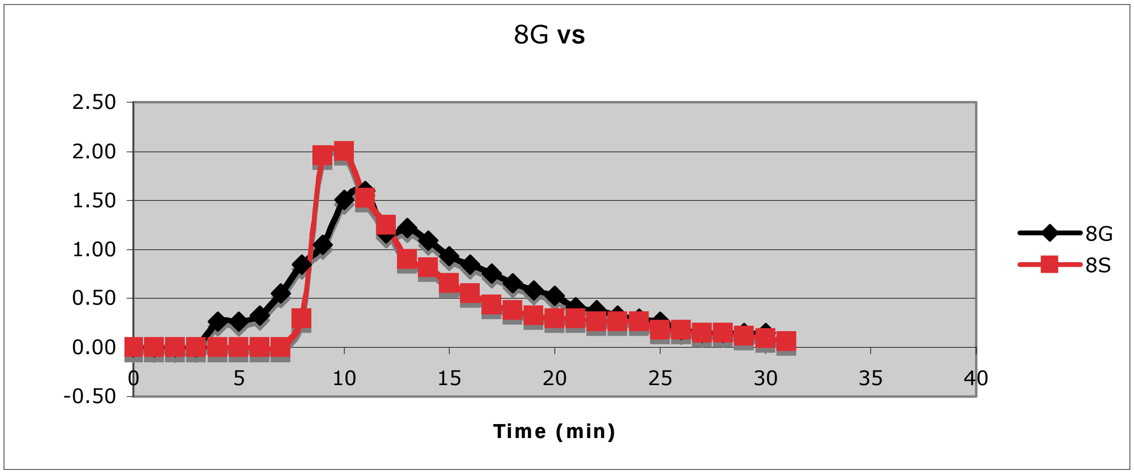


October Hydrographs

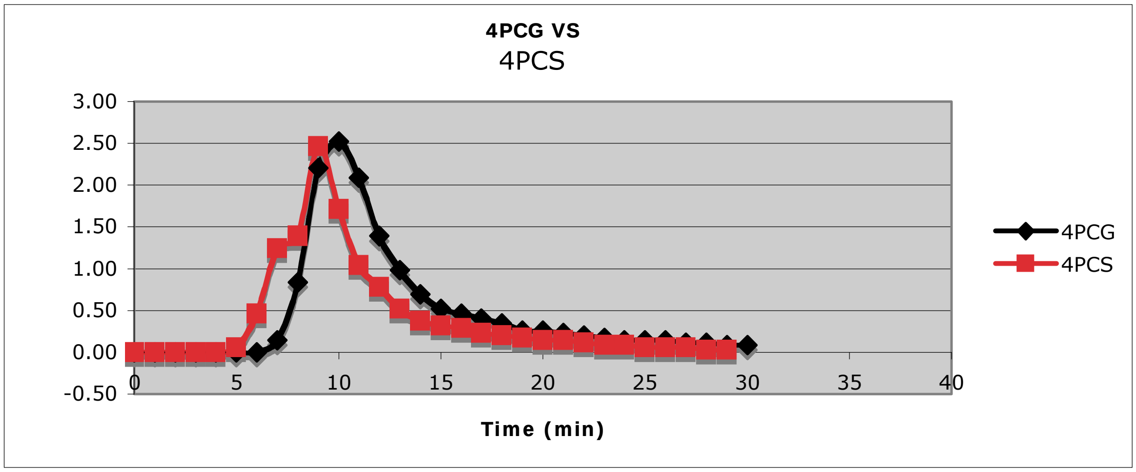


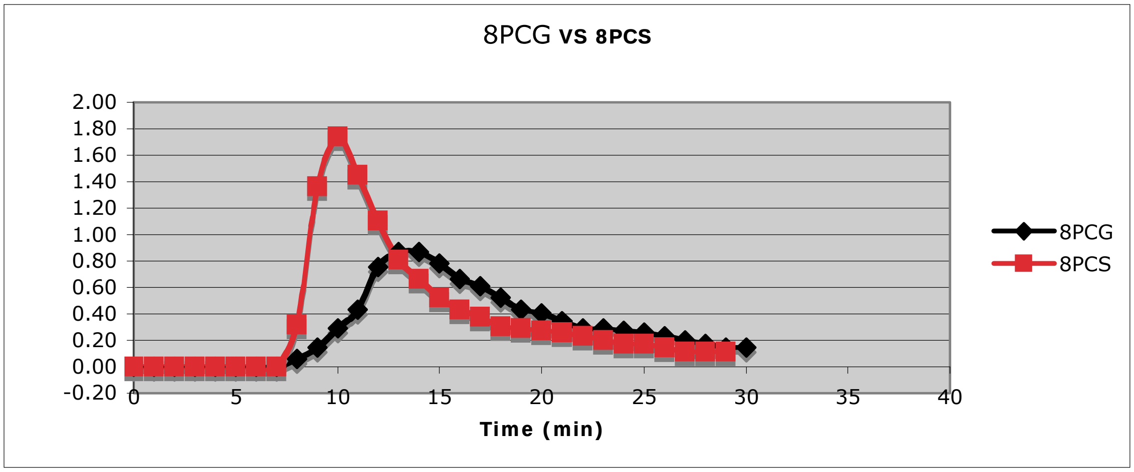

8PCG VS 8PCS
3.00
2.50
2.00
1.50
1.00
0.50
0.00
-0.50
0
5
10
15
20
25
30
35
40
Time (min)
4PCS
8PCS

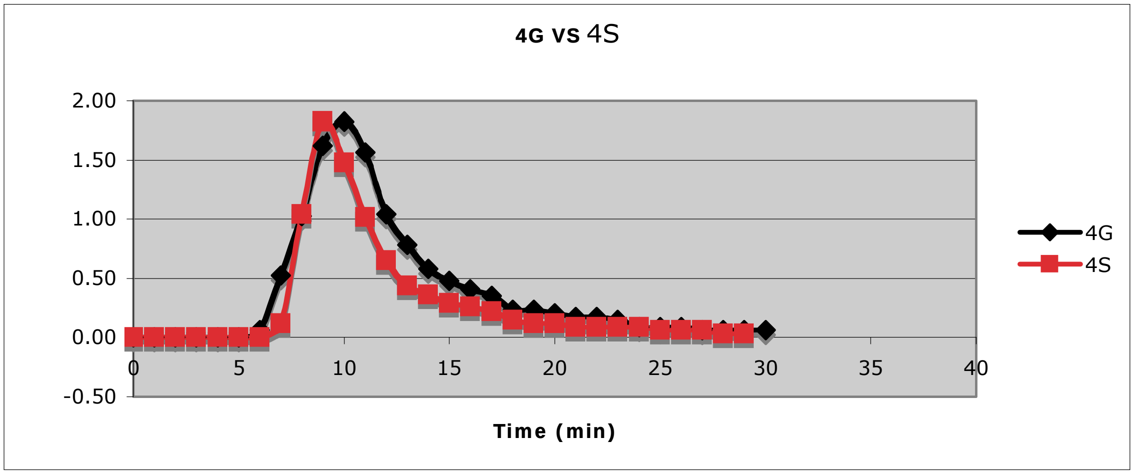

4G VS 4S
3.00
2.50
2.00
1.50
1.00
0.50
0.00
-0.50
0
5
10
15
20
25
30
35
40
Time (min)
4G
4S

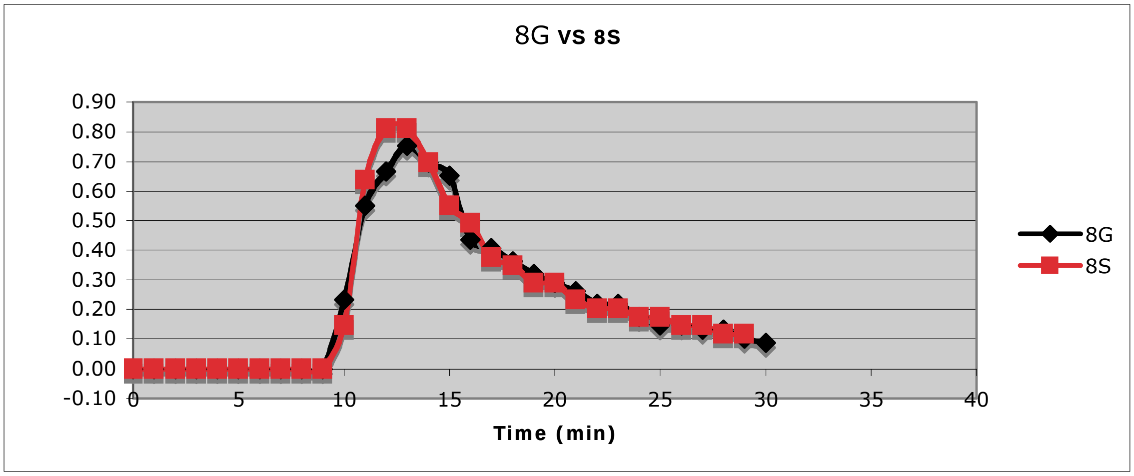


December Hydrographs




8PCG VS 8PCS
2.00
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
-0.20
0
5
10
15
20
25
30
35
40
Time (min)
8PCG
8PCS

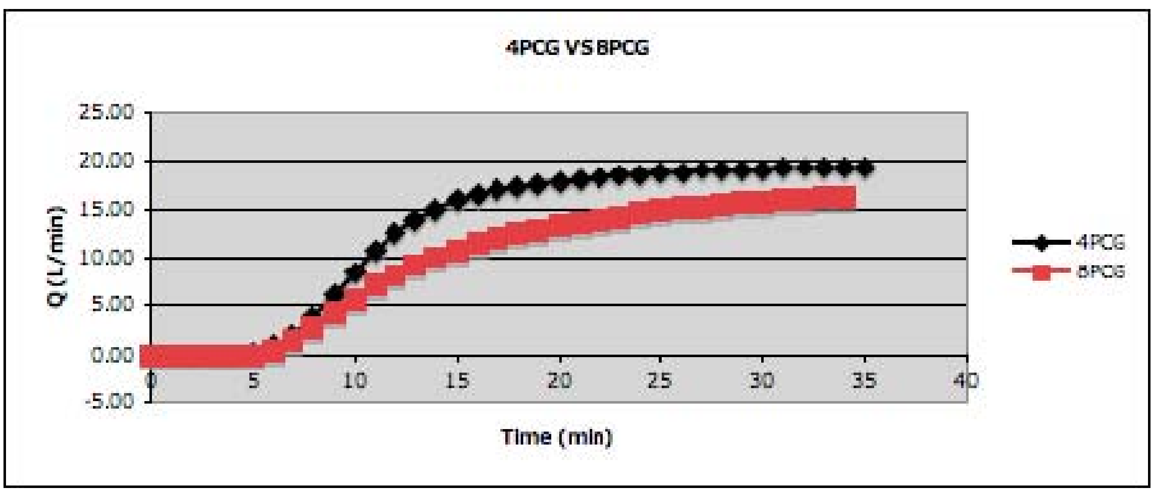

4G VS 4S
2.00
1.50
1.00
0.50
0.00
-0.50
0
5
10
15
20
25
30
35
40
Time (min)
4G
4S

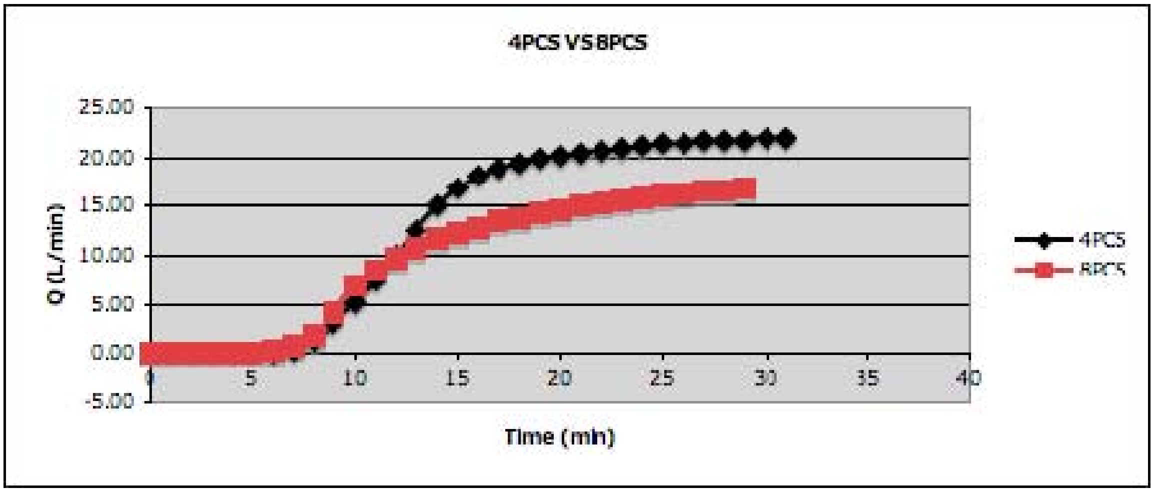


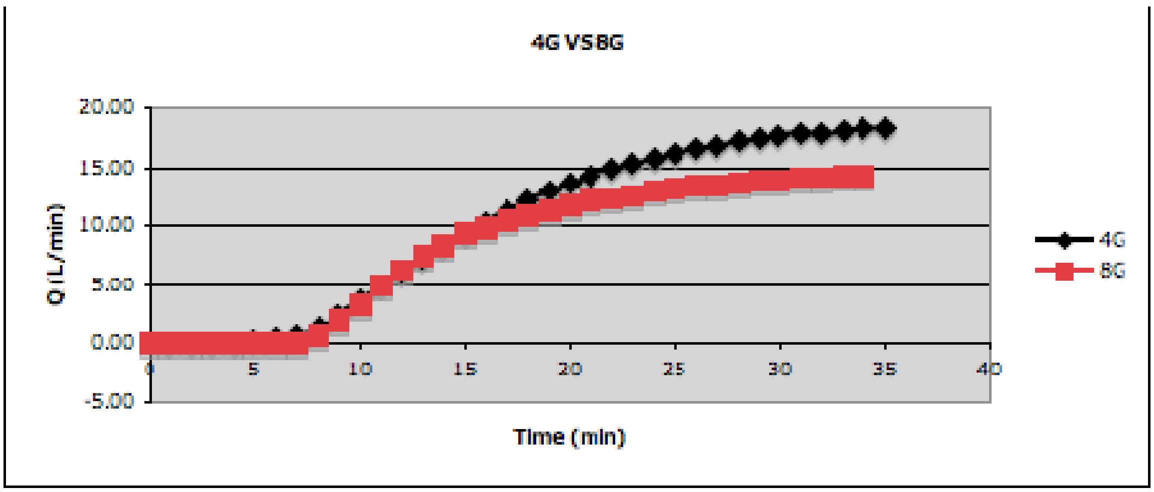
Cumulative Volume Comparisons

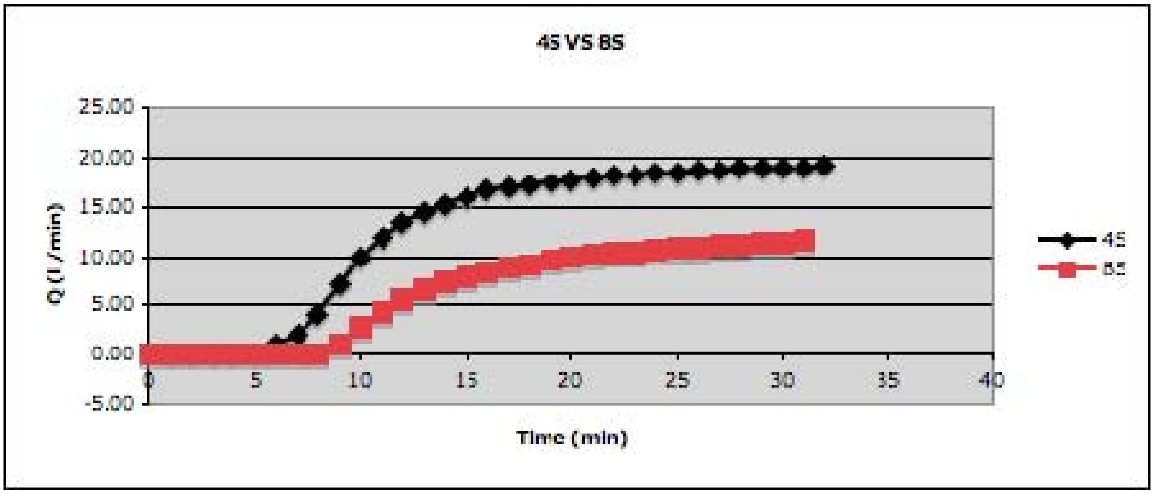
Depth Comparisons

June Cumulative Volume

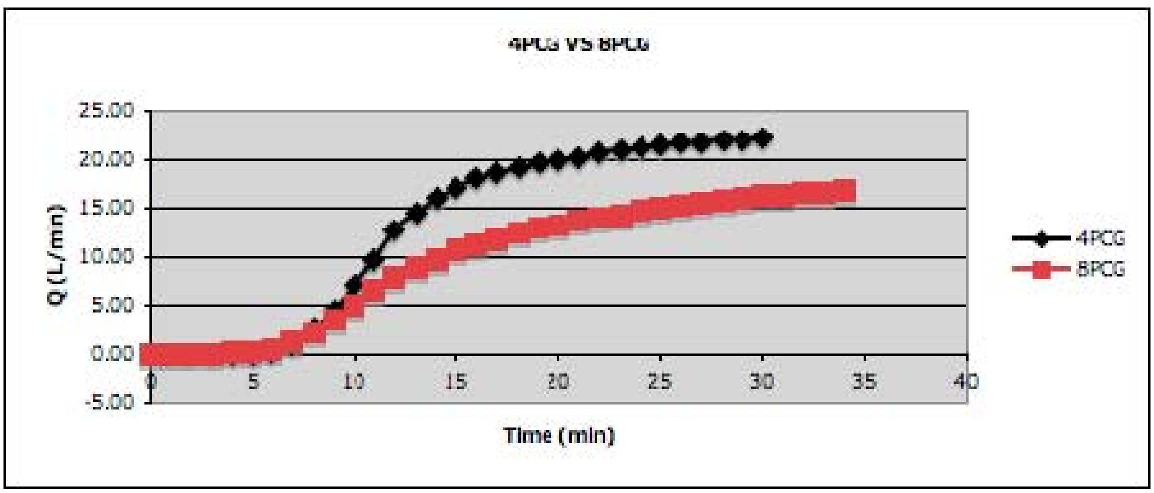


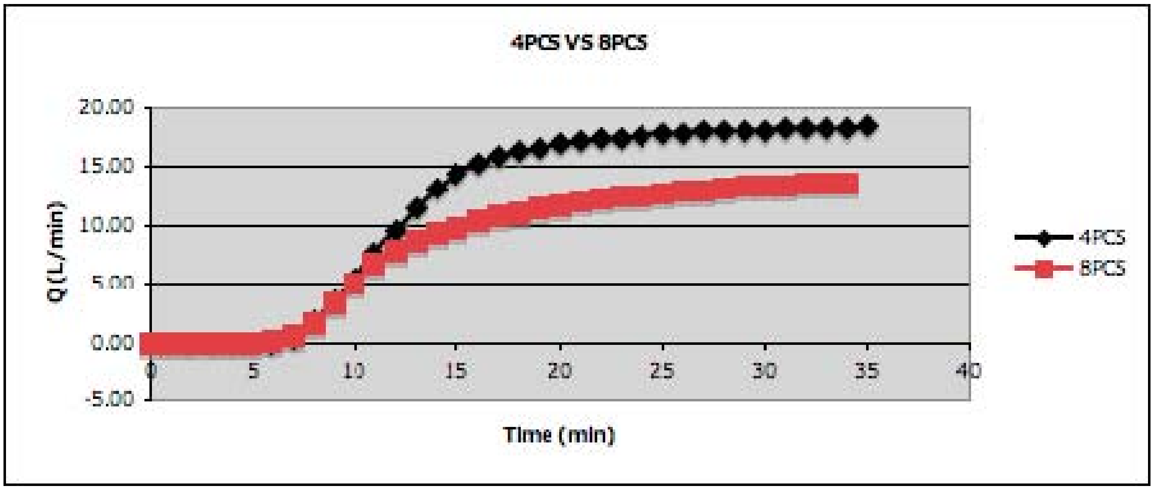

4PCS VS 8PCS
25.00
20.00
15.00
10.00
5.00
0.00
-5.00
Q (L/min)
0
5
10
15
20
25
30
35
40
Time (min)
4PCS
8PCS

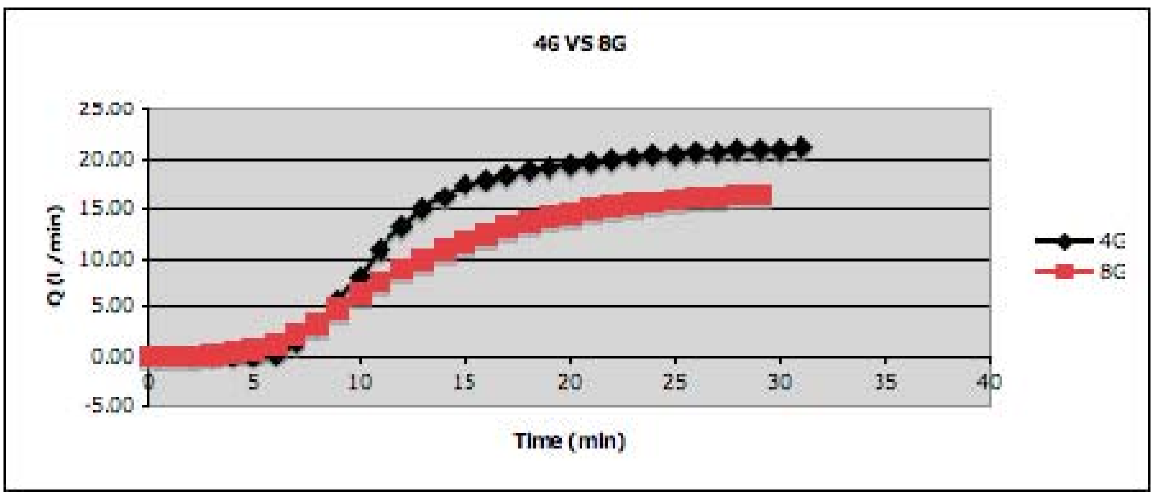

4G VS 8G
20.00
15.00
10.00
5.00
0.00
-5.00
Q (L/min)
0
5
10
15
20
25
30
35
40
Time (min)
4G
8G

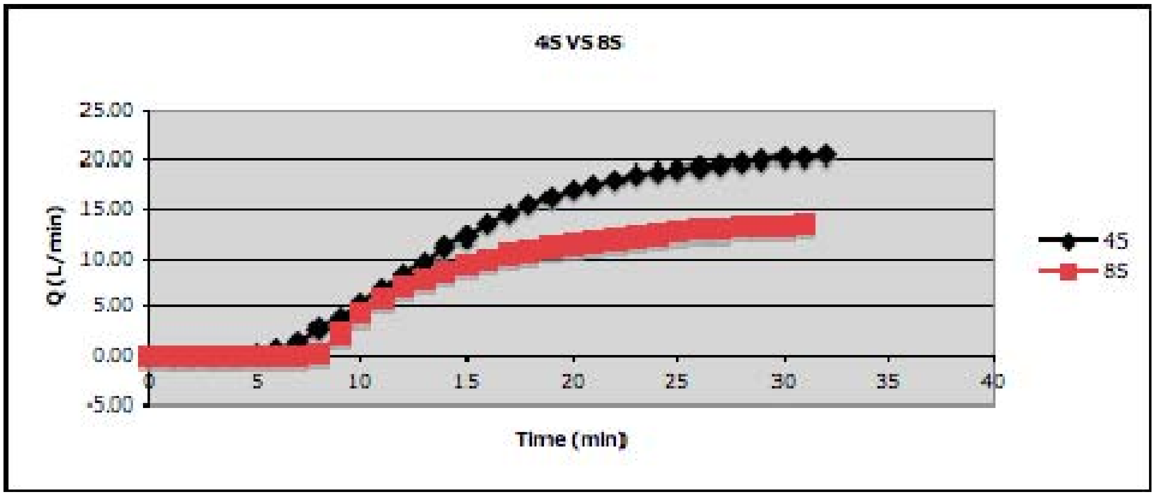


October Cumulative Volume

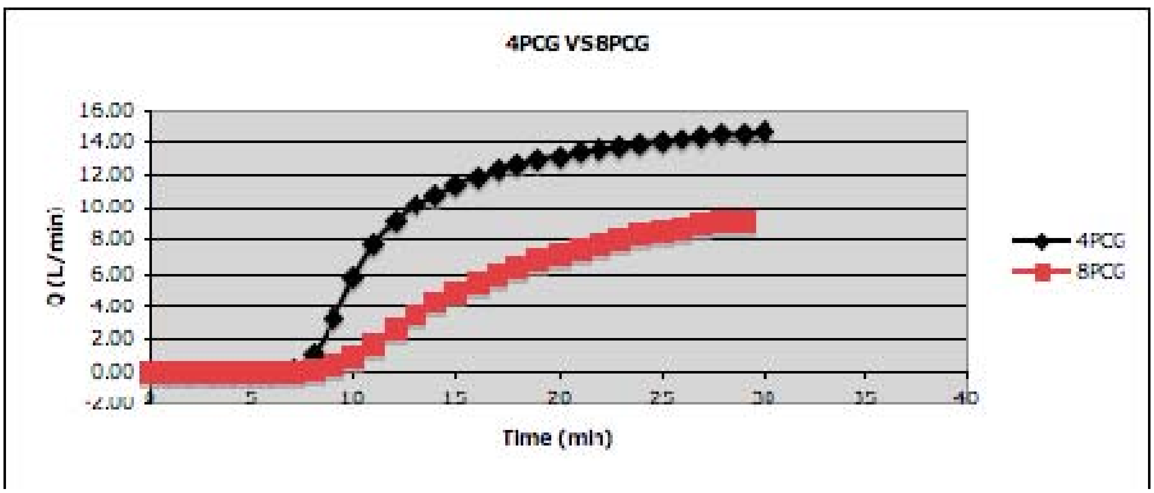


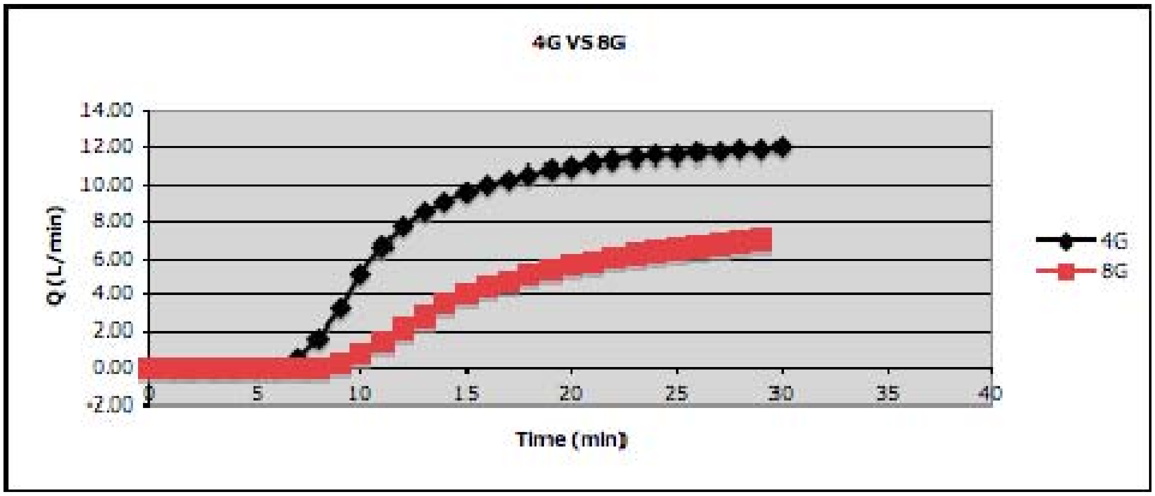

4PCS VS 8PCS
20.00
15.00
10.00
5.00
0.00
-5.00
Q (L/min)
0
5
10
15
20
25
30
35
40
Time (min)
4PCS
8PCS

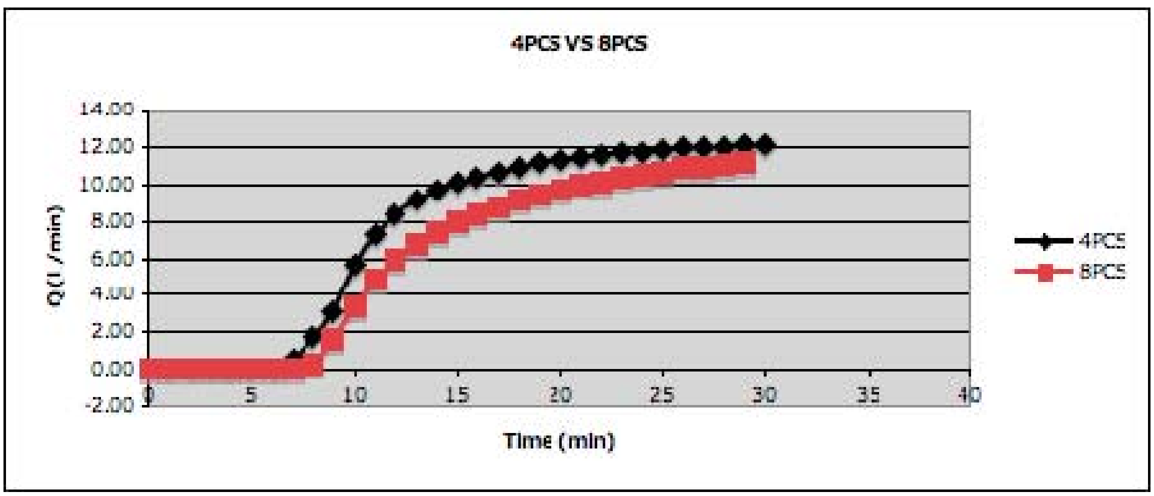

4G VS 8G
25.00
20.00
15.00
10.00
5.00
0.00
-5.00
Q (l /min)
0
5
10
15
20
25
30
35
40
Time (min)
4G
8G

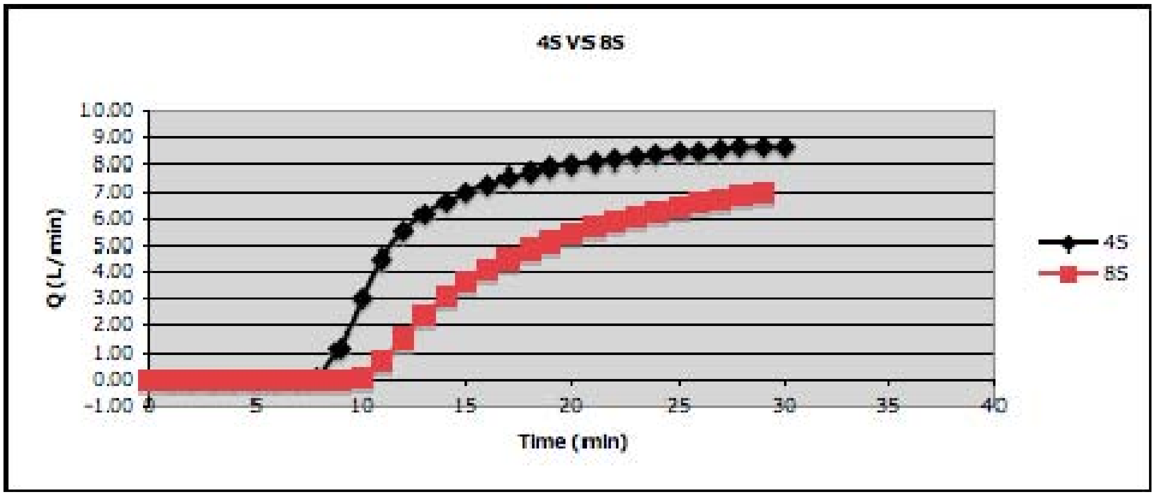


December Cumulative Volume



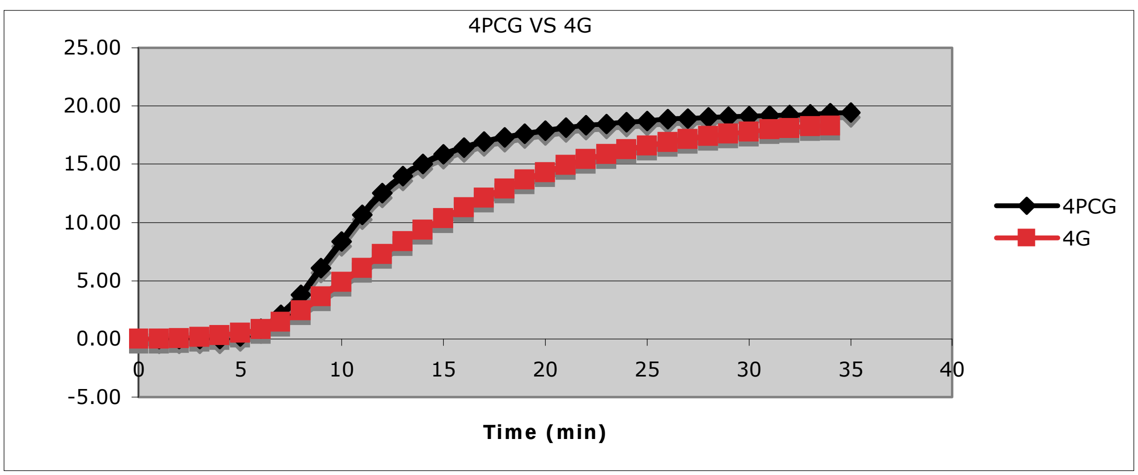

4G VS 8G
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
-2.00
Q (L/min)
0
5
10
15
20
25
30
35
40
Time (min)
4G
8G

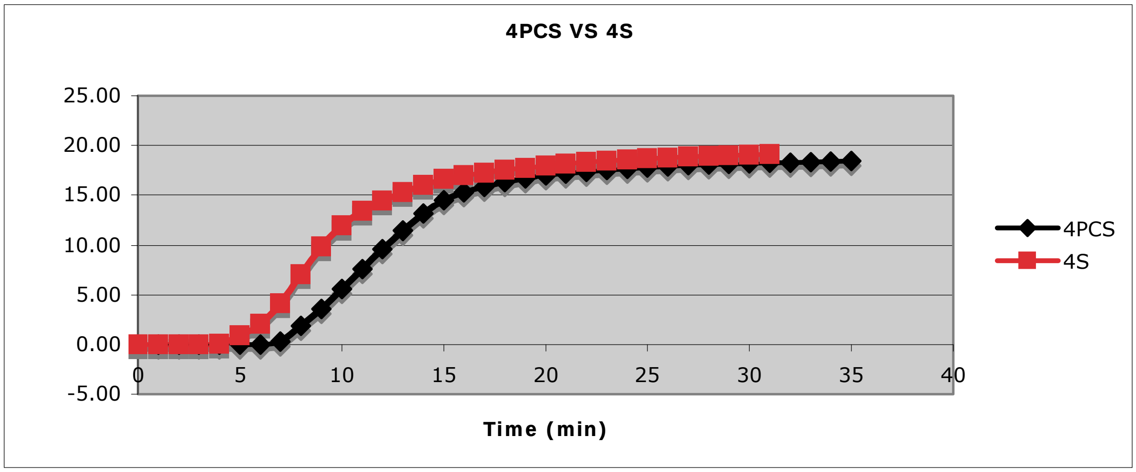

4PCS VS 8PCS
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
-2.00
Q (L/min)
0
5
10
15
20
25
30
35
40
Time (min)
4PCS
8PCS

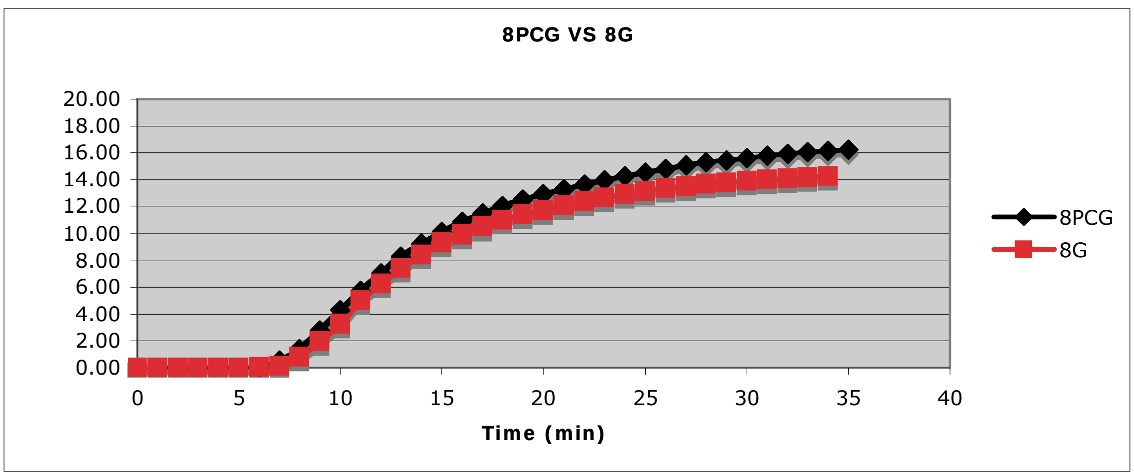


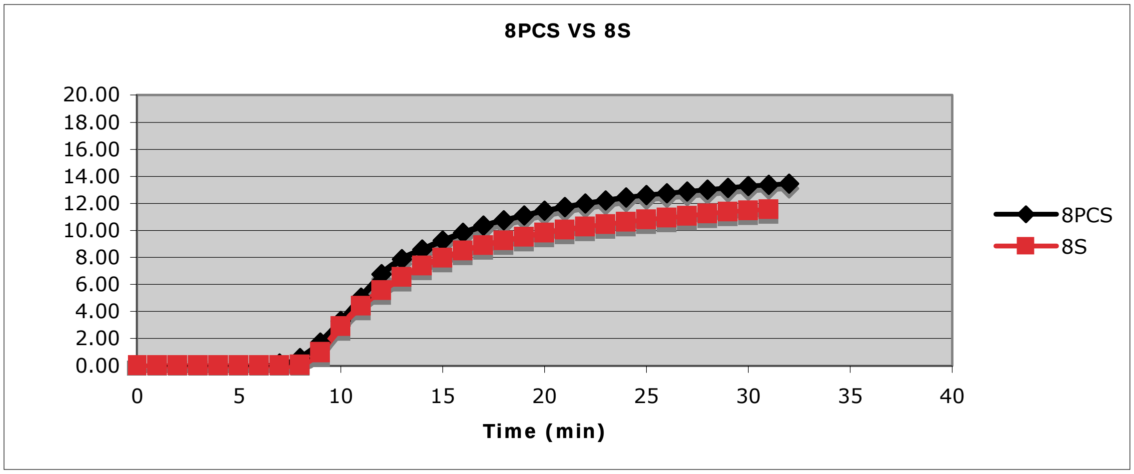
Pollution Control Layer Comparisons

June Cumulative Volume

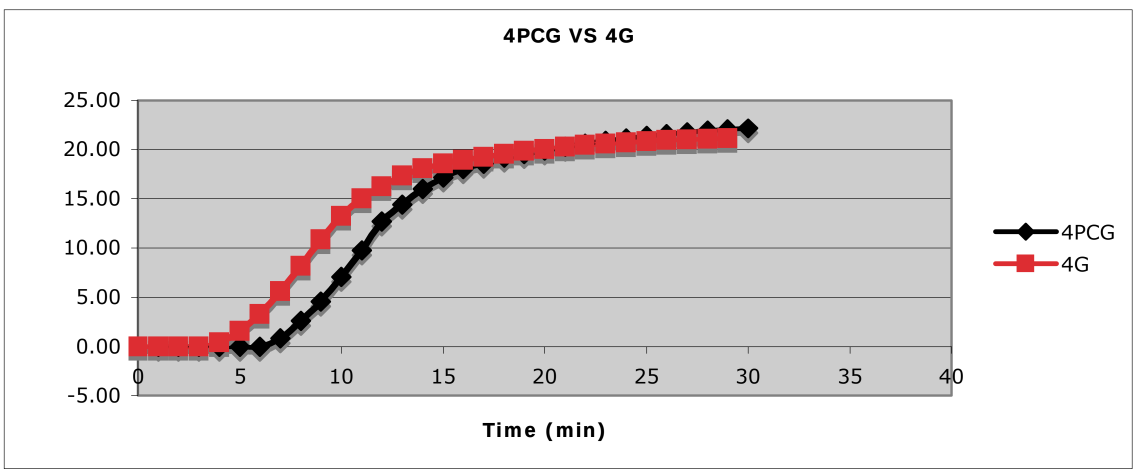


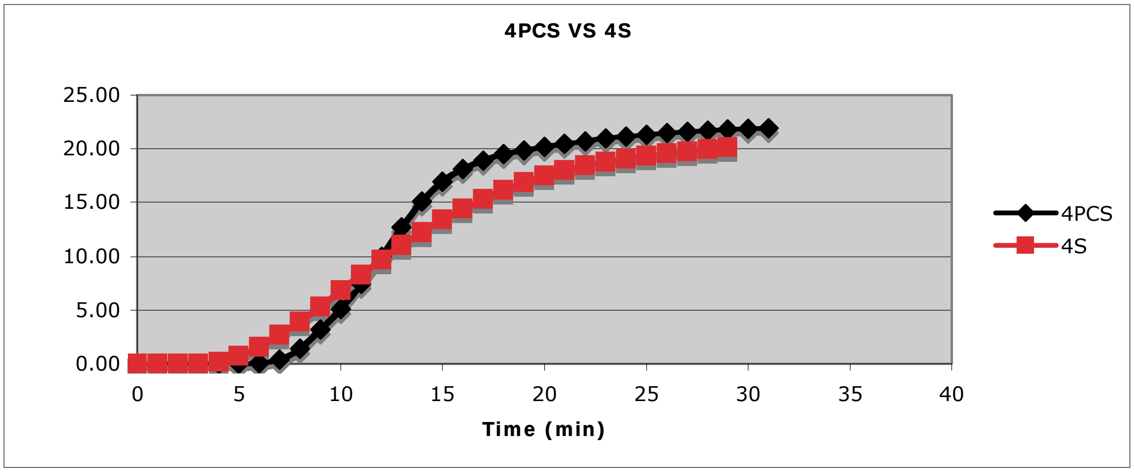

4PCS VS 4S
25.00
20.00
15.00
10.00
5.00
0.00
-5.00
0
5
10
15
20
25
30
35
40
Time (min)
4PCS
4S

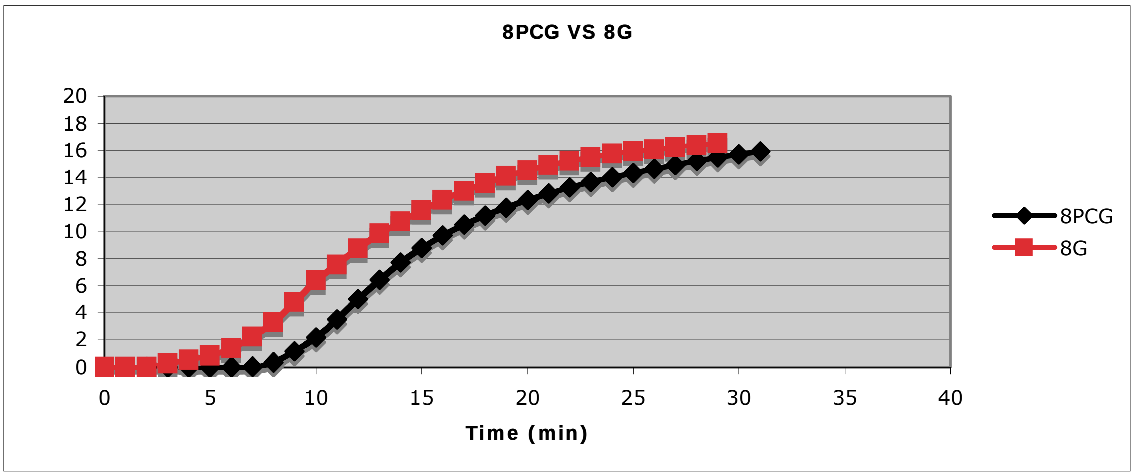

8PCG VS 8G
20.00
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
0
5
10
15
20
25
30
35
40
Time (min)
8PCG
8G

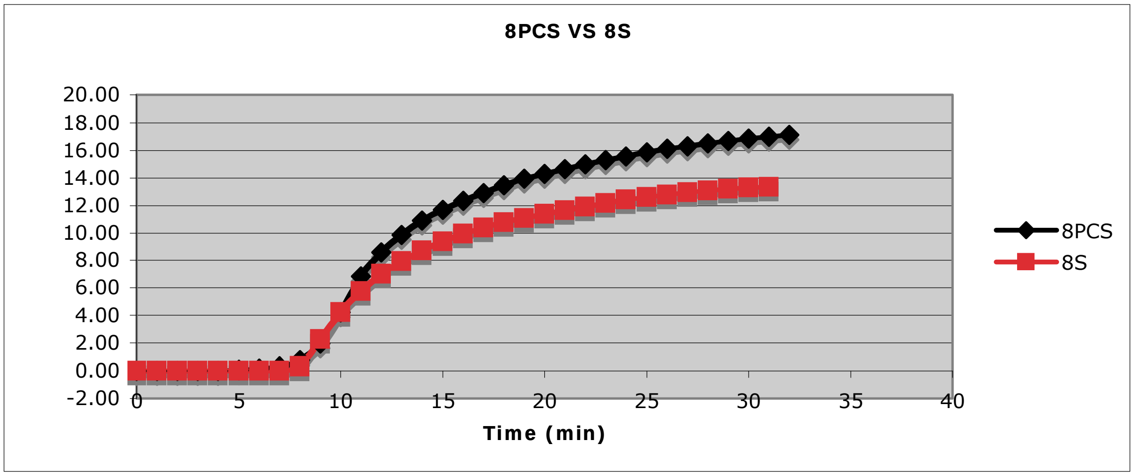


October Cumulative Volume

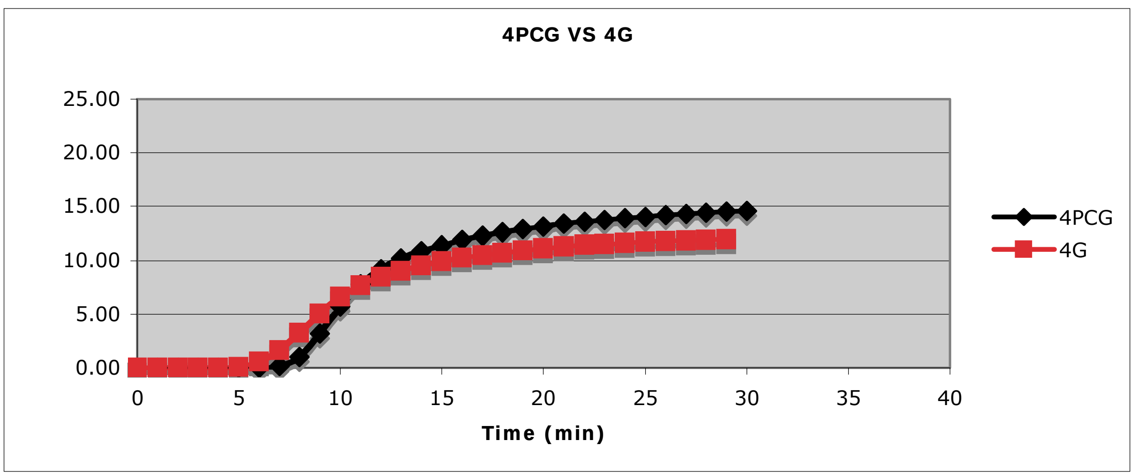


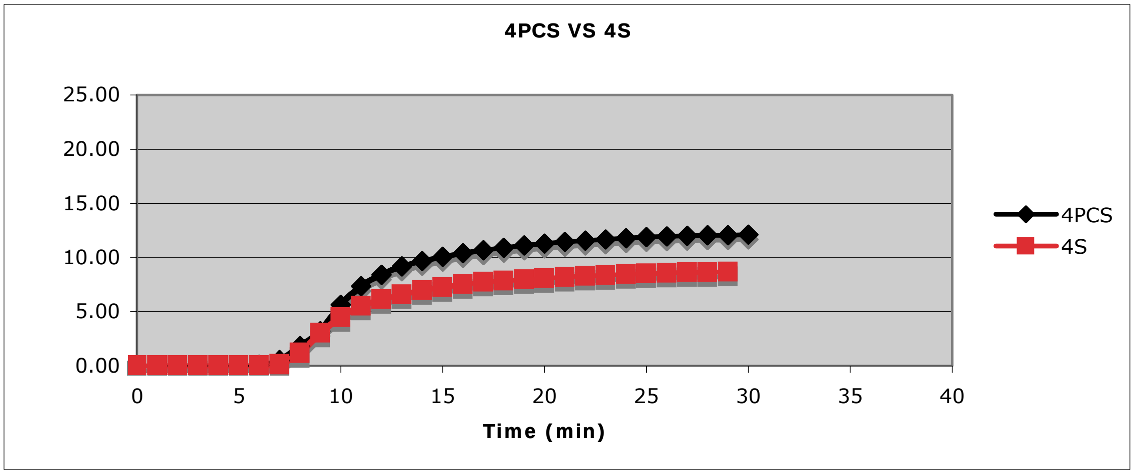

4PCS VS 4S
25.00
20.00
15.00
10.00
5.00
0.00
0
5
10
15
20
25
30
35
40
Time (min)
4PCS
4S

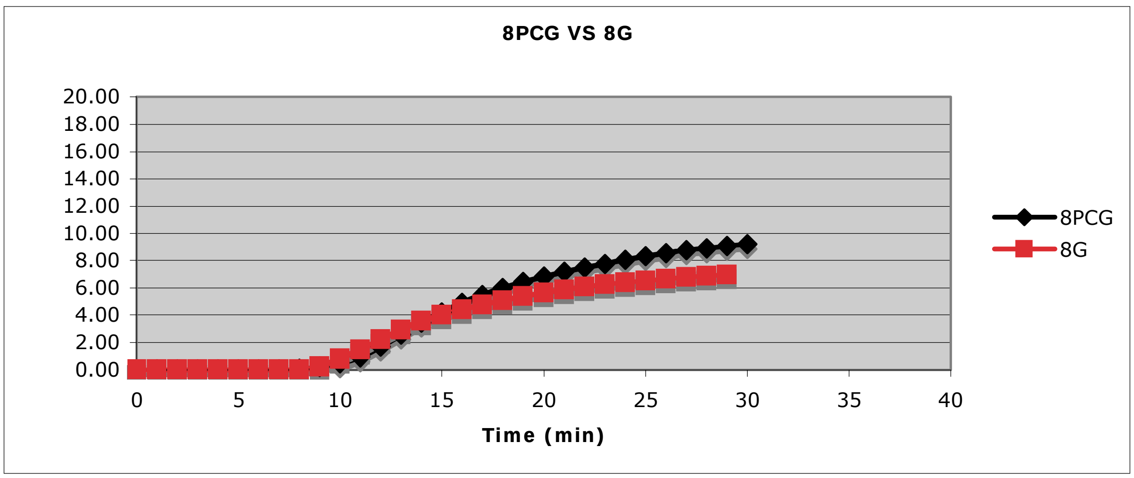

8PCG VS 8G
20
18
16
14
12
10
8
6
4
2
0
0
5
10
15
20
25
30
35
40
Time (min)
8PCG
8G

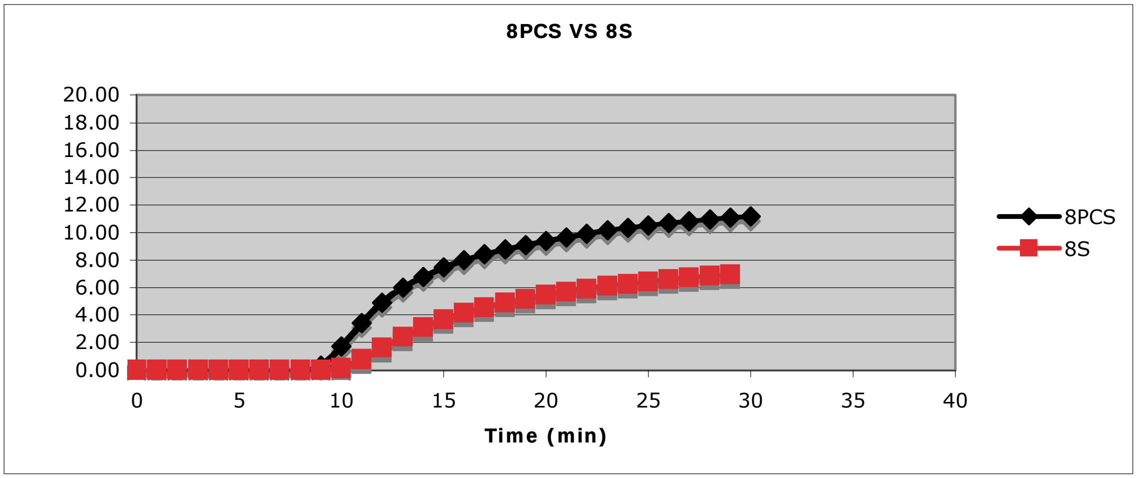


December Cumulative Volume



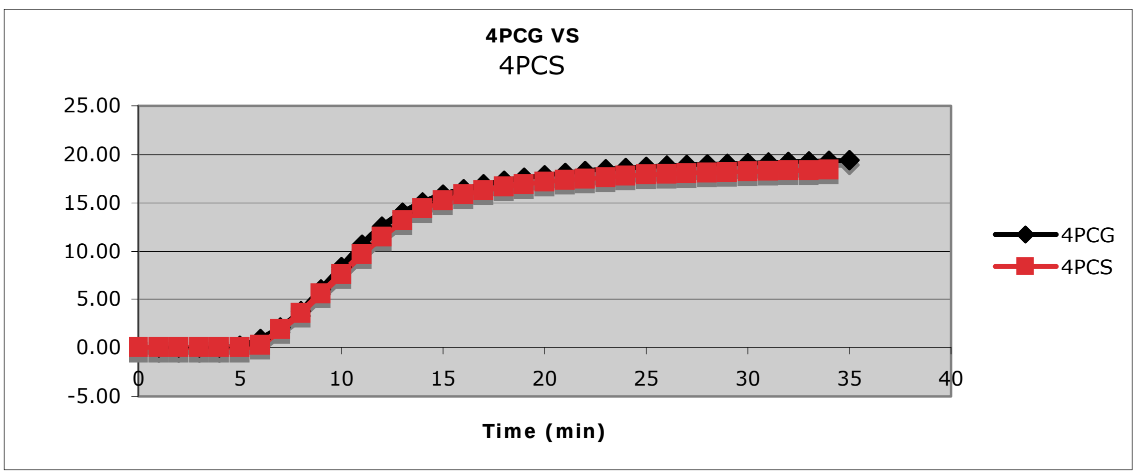

4PCS VS 4S
25.00
20.00
15.00
10.00
5.00
0.00
0
5
10
15
20
25
30
35
40
Time (min)
4PCS
4S

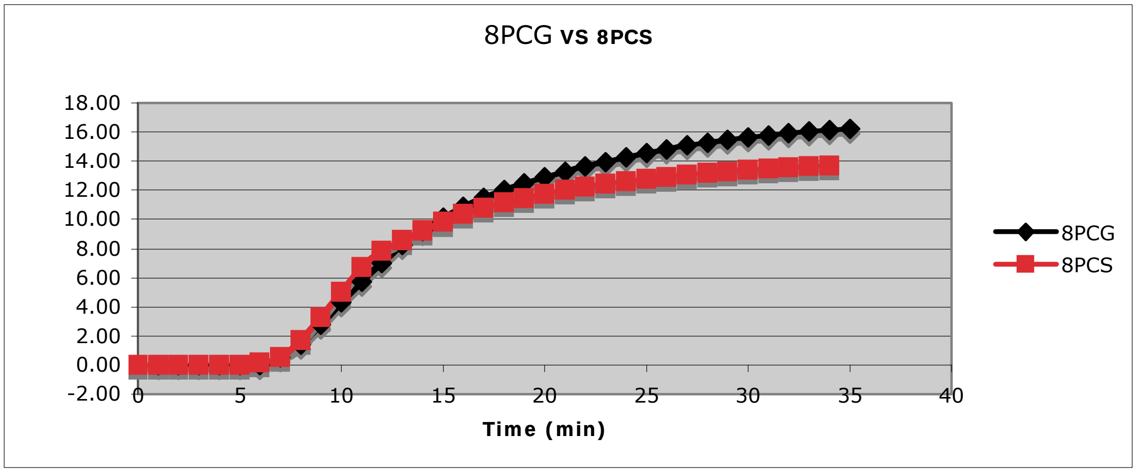

8PCG VS 8G
20.00
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
0
5
10
15
20
25
30
35
40
Time (min)
8PCG
8G

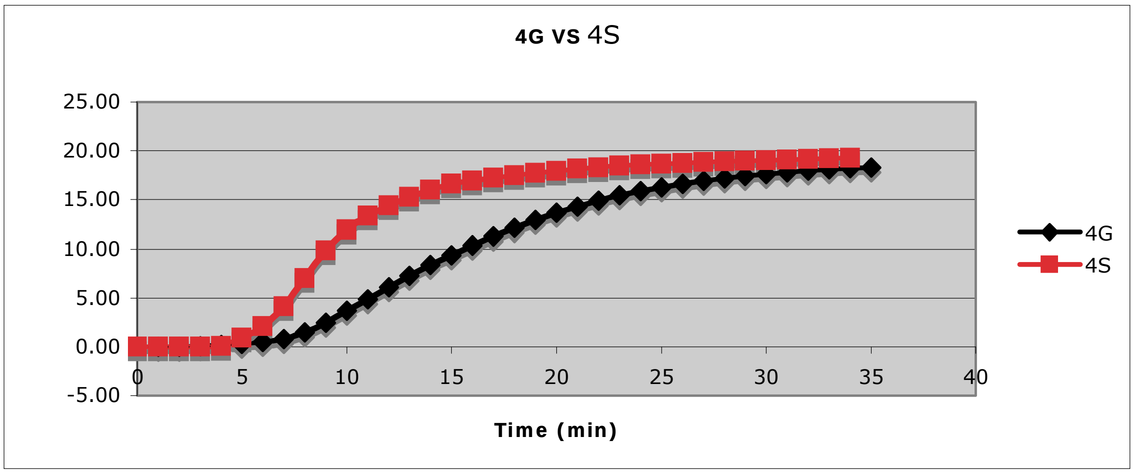


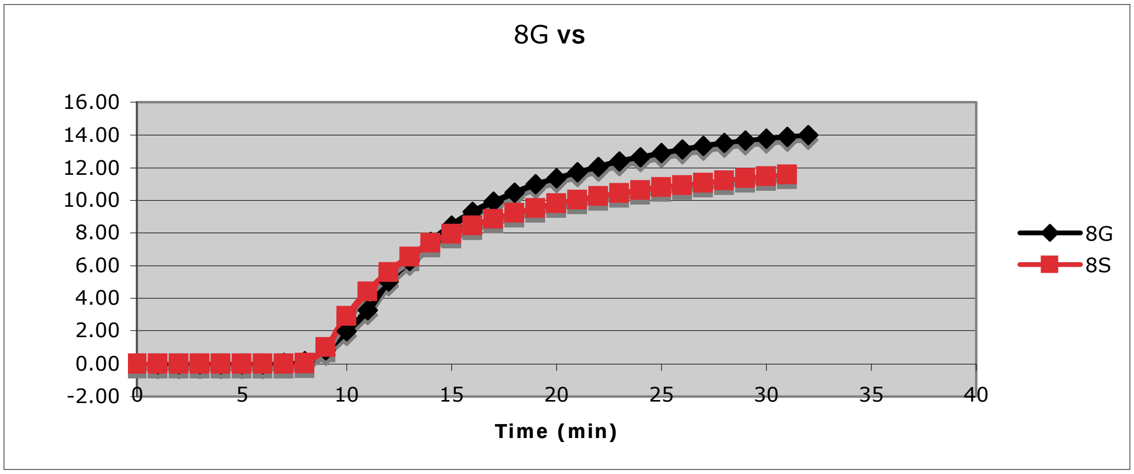
Drainage Layer Comparisons

June Cumulative Volume

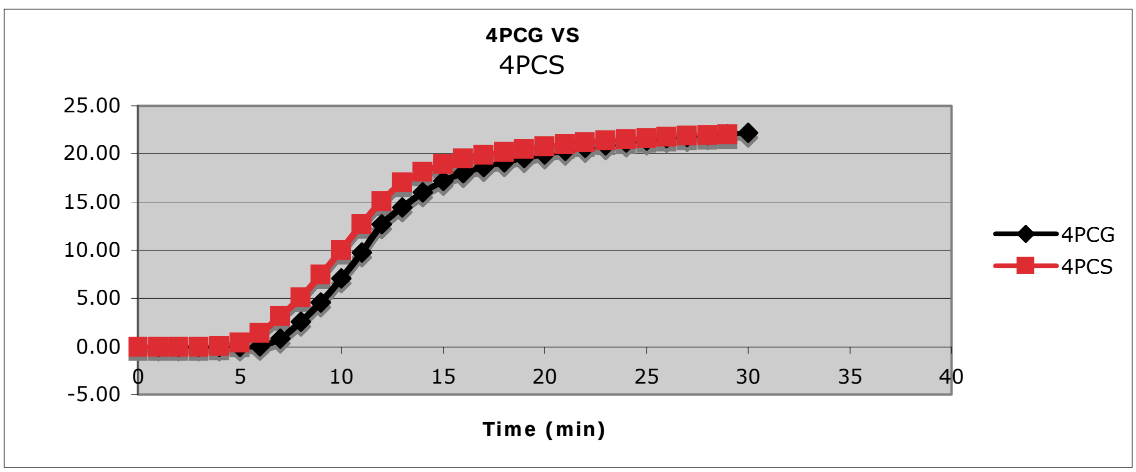


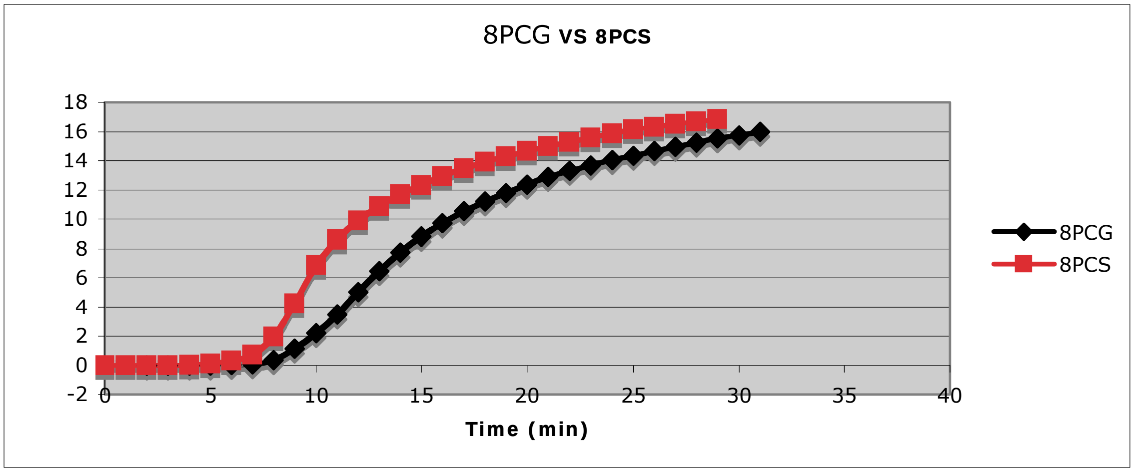

8PCG VS 8PCS
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
-2.00
0
5
10
15
20
25
30
35
40
Time (min)
8PCG
8PCS

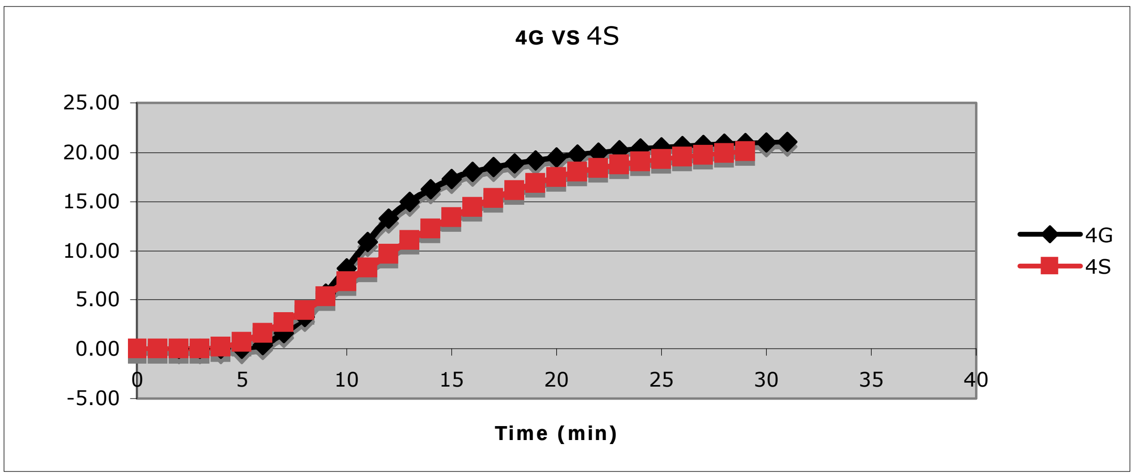

4G VS 4S
25.00
20.00
15.00
10.00
5.00
0.00
-5.00
0
5
10
15
20
25
30
35
40
Time (min)
4G
4S

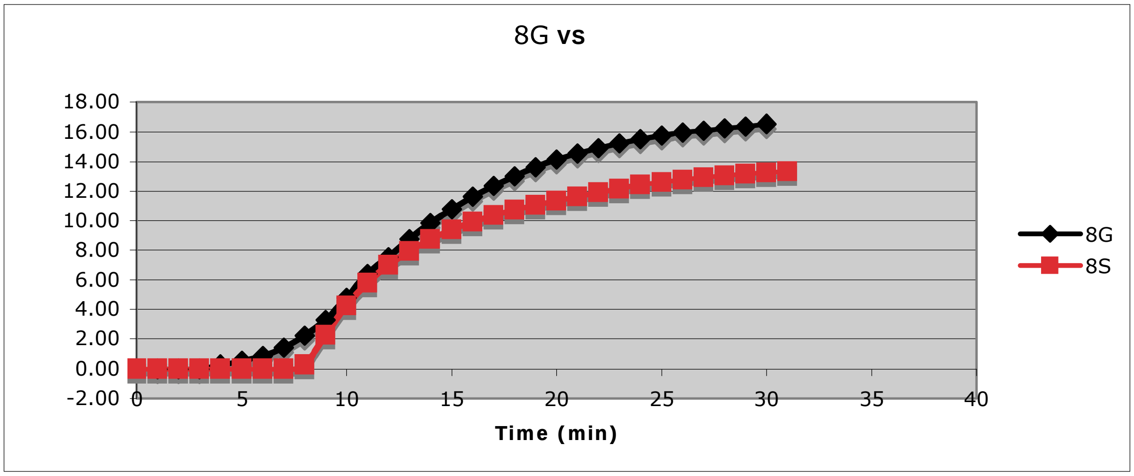


October Cumulative Volume

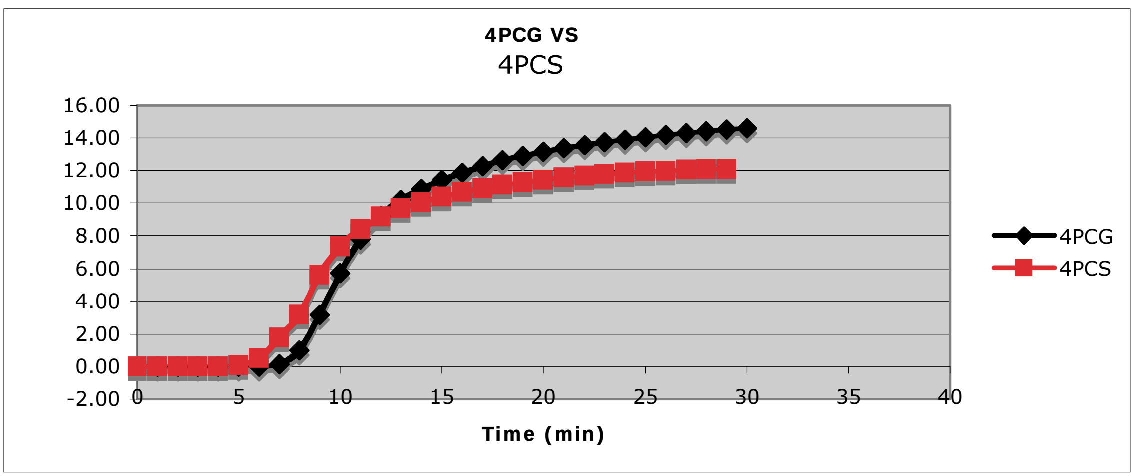


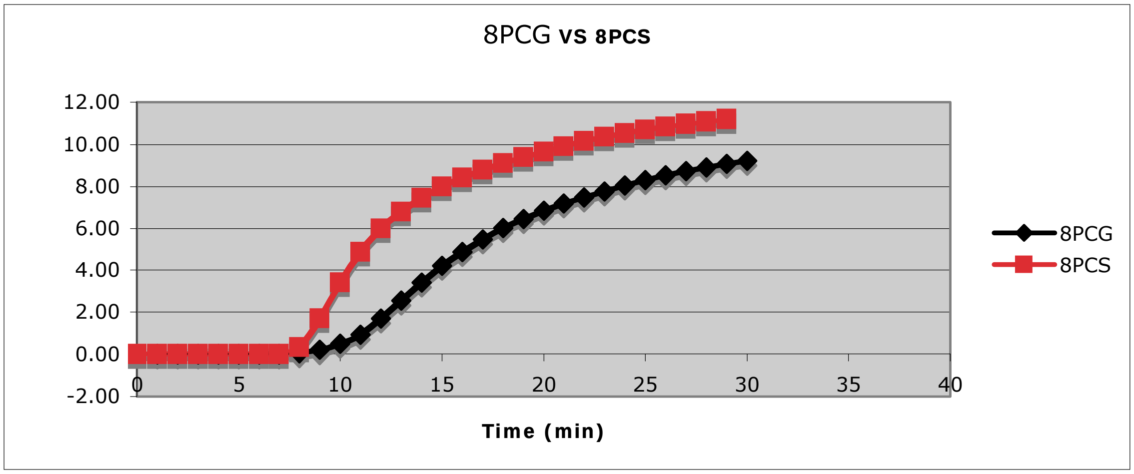

8PCG VS 8PCS
18
16
14
12
10
8
6
4
2
0
-2
0
5
10
15
20
25
30
35
40
Time (min)
8PCG
8PCS

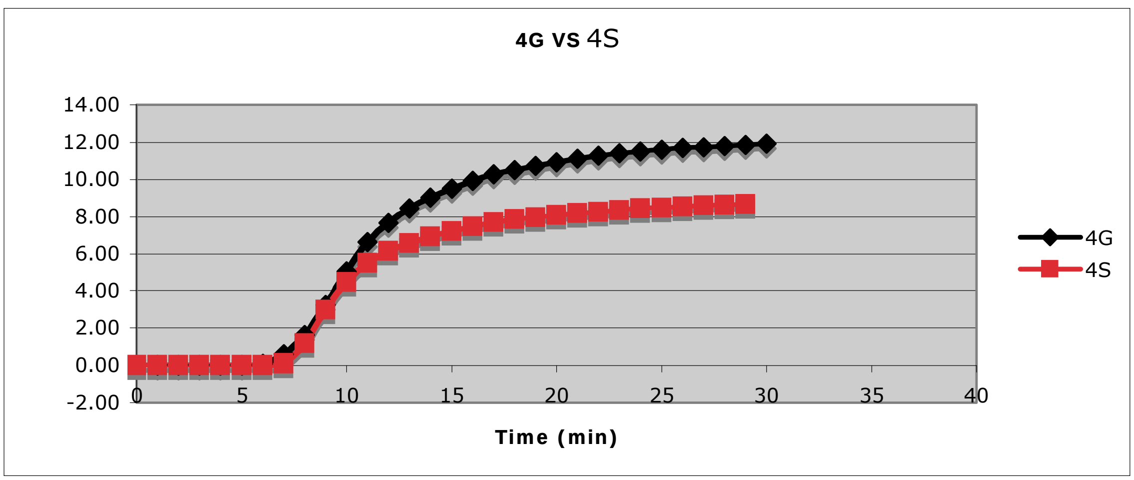

4G VS 4S
25.00
20.00
15.00
10.00
5.00
0.00
-5.00
0
5
10
15
20
25
30
35
40
Time (min)
4G
4S

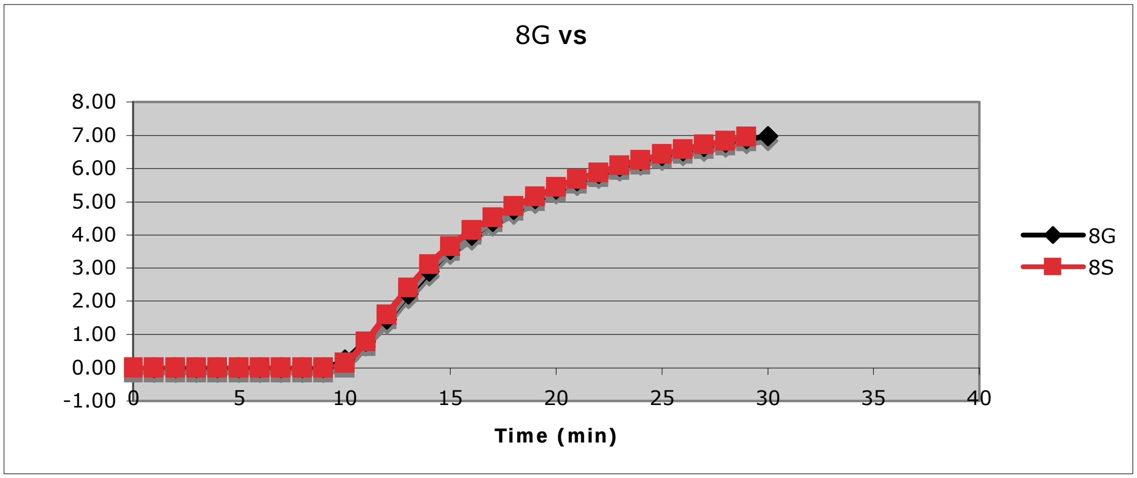


December Cumulative Volume




8PCG vs 8PCS
12.00
10.00
8.00
6.00
4.00
2.00
0.00
-2.00
0
5
10
15
20
25
30
35
40
Time (min)
8PCG
8PCS


4G vs 4S
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
-2.00
0
5
10
15
20
25
30
35
40
Time (min)
4G
4S


8G vs
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
-1.00
0
5
10
15
20
25
30
35
40
Time (min)
8G
8S

APPENDIX C: VOLUME, ET, AND F FACTOR TABLES

Volume Tables

Table 22: Volume of Irrigation, Filtrate, and Overflow

	Irrigation	**Total Filtrate**	**Liters Lost to Overflow**
8PCS (L)	1849	2082	393
8PCG (L)	1839	2051	419
8S (L)	1830	2018	373
8G (L)	1832	1902	317
Average (L)	1837	2013	375
8-inch (in)	47	52	10
4PCS(L)	1817	1955	325
4PCG (L)	1809	2036	401
4S (L)	1805	1942	316
4G (L)	1834	1897	301
Average (L)	1816	1958	336
4-inch (in)	47	51	9
RPD (%)	1	3	11

Table 23: Volume of Precipitation and Control Roof Runoff

	Precipitation	**Control Runoff**
C1 (L)		1623.47
C2 (L)		1616.28
Average (L)	1669	1620
(in)	43	42

ET Table

ET Comparison of all the Chambers										
Date	**8PCS**	**8PCG**	**8S**	**8G**	**C1**	**C2**	**4G**	**4S**	**4PCG**	**4PCS**
1/8/07	-	-	-	-	-	-	-	-	-	-
1/12/07	0.01	0.01	0.01	0.00	0.00	0.00	-	-	-	0.00
1/15/07	0.09	0.09	0.08	0.08	0.00	0.00	0.07	0.09	0.08	0.09
1/19/07	0.07	0.07	0.07	0.07	0.00	0.00	0.07	0.07	0.07	0.07
1/22/07	0.09	0.09	0.08	0.09	0.00	0.00	0.09	0.08	0.09	0.09
1/26/07	0.16	0.16	0.16	0.18	0.00	0.01	0.13	0.12	0.14	0.12
1/29/07	0.04	0.05	0.05	0.04	0.00	0.01	0.05	0.05	0.05	0.05
2/2/07	0.10	0.12	0.11	0.13	0.00	0.02	0.10	0.09	0.10	0.09
2/5/07	-0.01	0.02	0.07	0.00	0.01	0.01	0.03	0.01	0.02	0.02
2/9/07	0.04	0.04	0.04	0.05	0.00	0.00	0.04	0.04	0.04	0.04
2/11/07	0.08	0.12	0.12	0.12	0.00	0.00	0.12	0.12	0.12	0.12
2/16/07	0.13	0.13	0.15	0.16	0.00	0.03	0.15	0.13	0.13	0.13
2/19/07	0.10	0.10	0.09	0.10	0.00	0.00	0.10	0.10	0.10	0.10
2/23/07	0.05	0.06	0.06	0.06	0.00	0.00	0.06	0.06	0.06	0.06
2/26/07	0.09	0.09	0.08	0.09	0.00	0.00	0.09	0.09	0.09	0.09
3/2/07	0.10	0.10	0.10	0.10	0.01	0.01	0.10	0.10	0.10	0.10
3/5/07	0.13	0.13	0.12	0.13	0.00	0.01	0.13	0.13	0.13	0.13
3/9/07	0.06	0.06	0.06	0.06	0.00	0.00	0.06	0.06	0.06	0.06
3/12/07	0.09	0.09	0.08	0.09	0.00	0.00	0.09	0.09	0.09	0.09
3/16/07	0.23	0.26	0.26	0.28	0.00	0.01	0.25	0.25	0.21	0.23
3/19/07	-	-	-	-	0.00	0.00	-	-	-	-
3/23/07	0.10	0.11	0.10	0.12	0.00	0.00	0.12	0.11	0.10	0.11
3/26/07	0.13	0.16	0.13	0.16	0.00	0.00	0.15	0.14	0.14	0.15
3/30/07	0.14	0.24	0.16	0.21	0.00	0.00	0.18	0.11	0.11	0.12
4/2/07	0.16	0.17	0.17	0.17	0.01	0.00	0.17	0.19	0.16	0.18
4/6/07	0.11	0.11	0.11	0.12	0.00	0.00	0.13	0.12	0.12	0.13
4/9/07	0.14	0.15	0.15	0.16	0.00	0.00	0.16	0.16	0.15	0.13
4/13/07	0.14	0.15	0.17	0.17	0.05	0.00	0.18	0.16	0.14	0.18
4/16/07	0.22	0.23	0.24	0.27	0.00	0.01	0.26	0.19	0.24	0.26
4/20/07	-	-	`	`	0.00	0.00	-	-	-	-
4/23/07	0.19	0.20	0.20	0.20	0.00	0.00	0.20	0.20	0.19	0.20
4/27/07	0.10	0.10	0.11	0.12	0.00	0.00	0.12	0.12	0.11	0.12
4/30/07	0.16	0.16	0.16	0.17	0.00	0.00	0.17	0.17	0.16	0.16
5/4/07	0.11	0.11	0.12	0.12	0.00	0.00	0.12	0.12	0.11	0.12
5/7/07	0.32	0.31	0.32	0.32	0.00	0.00	0.23	0.36	0.33	0.34
5/11/07	-	-	-	-	0.00	0.00	-	-	-	-
5/14/07	0.11	0.15	0.17	0.17	0.00	0.00	0.19	0.17	0.15	0.19
5/18/07	0.13	0.17	0.16	0.18	0.00	0.00	0.16	0.16	0.14	0.15
5/22/07	0.11	0.11	0.11	0.13	0.00	0.00	0.11	0.11	0.12	0.11
5/25/07	0.15	0.16	0.15	0.17	0.00	0.00	0.17	0.18	0.15	0.18
5/29/07	0.11	0.12	0.12	0.15	0.00	0.00	0.13	0.13	0.12	0.13
6/1/07	0.17	0.16	0.17	0.16	0.00	0.00	0.17	0.17	0.16	0.17
6/5/07	0.18	0.20	0.02	0.21	0.00	0.00	0.20	0.20	0.18	0.17

Date	8PCS	8PCG	8S	8G	C1	C2	4G	4S	4PCG	4PCS
6/8/07	0.22	0.23	0.23	0.26	0.00	0.00	0.27	0.25	0.22	0.24
6/12/07	0.12	0.13	0.17	0.19	0.00	0.01	0.19	0.18	0.15	0.18
6/15/07	0.10	0.13	0.13	0.17	0.00	0.08	0.12	0.12	0.12	0.24
6/19/07	0.09	0.07	0.07	0.07	0.00	0.00	0.11	0.08	0.08	0.08
6/22/07	0.24	0.19	0.19	0.21	0.00	0.01	0.21	0.21	0.18	0.20
6/26/07	0.14	0.14	0.14	0.15	0.00	0.00	0.15	0.15	0.14	0.16
6/29/07	0.24	0.19	0.26	0.28	0.00	0.00	0.28	0.28	0.24	0.27
7/3/07	0.14	0.15	0.16	0.16	0.00	0.01	0.17	0.15	0.14	0.15
7/6/07	0.10	0.08	0.08	0.10	0.03	0.00	0.18	0.09	0.01	0.06
7/10/07	0.11	0.10	0.11	0.13	0.00	0.01	0.09	0.19	0.12	0.11
7/13/07	0.21	0.24	0.26	0.27	0.00	0.01	0.31	0.27	0.25	0.27
7/17/07	0.08	0.12	0.13	0.10	0.00	0.00	0.14	0.19	0.19	0.21
7/20/07	0.23	0.22	0.29	0.22	0.00	0.00	0.22	0.18	0.20	0.24
7/24/07	0.31	0.01	0.32	0.25	0.01	0.01	0.26	0.27	0.34	0.26
7/27/07	0.08	0.43	0.10	0.12	0.01	0.00	0.10	0.10	0.10	0.20
7/31/07	0.05	0.06	0.06	0.02	0.00	0.01	0.06	0.07	0.06	0.06
8/3/07	0.17	0.20	0.11	0.19	0.00	0.01	0.20	0.18	0.17	0.16
8/6/07	0.12	0.12	0.06	0.09	0.00	0.00	0.07	0.08	0.06	0.07
8/10/07	0.12	0.13	0.13	0.13	0.00	0.00	0.14	0.15	0.12	0.13
8/14/07	0.14	0.15	0.14	0.15	0.00	0.00	0.13	0.17	0.14	0.15
8/17/07	0.19	0.23	0.20	0.21	0.02	0.00	0.22	0.19	0.17	0.18
8/21/07	0.13	0.14	0.13	0.14	0.00	0.00	0.15	0.14	0.13	0.12
8/24/07	0.19	0.18	0.20	0.20	0.00	0.00	0.21	0.21	0.19	0.18
8/27/07	0.32	0.28	0.27	0.23	0.02	0.00	0.24	0.27	0.22	0.26
8/30/07	0.16	0.16	0.15	0.17	0.00	0.00	0.19	0.17	0.16	0.16
9/5/07	0.14	0.12	0.14	0.14	0.00	0.01	0.15	0.14	0.12	0.12
9/7/07	0.24	0.23	0.22	0.24	0.00	0.00	0.25	0.25	0.23	0.23
9/10/07	0.16	0.19	0.17	0.16	0.00	0.01	0.13	0.17	0.14	0.15
9/14/07	0.08	0.09	0.09	0.09	0.00	0.00	0.10	0.09	0.09	0.10
9/17/07	0.15	0.17	0.18	0.18	0.00	0.00	0.20	0.18	0.12	0.15
9/21/07	0.12	0.13	0.07	0.08	0.00	0.00	0.12	0.09	0.14	0.09
9/24/07	0.19	0.20	0.02	0.18	0.00	0.02	0.19	0.17	0.13	0.16
9/28/07	0.03	0.03	0.03	0.03	0.00	0.00	0.05	0.04	0.05	0.04
10/1/07	0.16	0.20	0.19	0.18	0.00	0.00	0.19	0.17	0.17	0.18
10/5/07	0.11	0.08	0.12	0.10	0.01	0.00	0.10	0.11	0.08	0.15
10/8/07	0.15	0.07	0.14	0.18	0.01	0.00	0.17	0.11	0.16	0.11
10/12/07	0.04	0.03	0.03	0.04	0.00	0.00	0.04	0.04	0.04	0.04
10/15/07	0.13	0.13	0.15	0.14	0.00	0.00	0.15	0.14	0.13	0.15
10/19/07	0.09	0.08	0.09	0.10	0.00	0.00	0.10	0.09	0.09	0.10
10/22/07	0.16	0.19	0.20	0.21	0.00	0.00	0.20	0.18	0.18	0.17
10/26/07	0.07	0.06	0.05	0.07	0.00	0.00	0.08	0.08	0.06	0.08
10/29/07	0.18	0.12	0.12	0.18	0.01	0.00	0.10	0.07	0.10	0.09
11/2/07	0.08	0.10	0.10	0.13	0.01	0.00	0.10	0.05	0.11	0.08
11/5/07	0.05	0.04	0.05	0.05	0.00	0.00	0.06	0.06	0.05	0.06
11/9/07	0.06	0.07	0.07	0.08	0.00	0.00	0.08	0.07	0.06	0.07
11/12/07	0.12	0.10	0.12	0.12	0.00	0.00	0.12	0.11	0.11	0.12
11/16/07	0.07	0.08	0.08	0.09	0.00	0.00	0.09	0.12	0.07	0.08
11/19/07	0.10	0.11	0.10	0.11	0.00	0.00	0.12	0.16	0.11	0.11
11/23/07	0.04	0.05	0.05	0.06	0.00	0.00	0.07	0.06	0.05	0.05
11/26/07	0.11	0.13	0.12	0.10	0.00	0.01	0.08	0.11	0.11	0.12

Date	8PCS	8PCG	8S	8G	C1	C2	4G	4S	4PCG	4PCS
11/30/07	0.11	0.12	0.11	0.12	0.00	0.01	0.11	0.10	0.10	0.07
12/3/07	0.02	0.02	0.01	0.01	0.00	0.00	0.03	0.02	0.02	0.02
12/7/07	0.05	0.06	0.06	0.06	0.00	0.00	0.06	0.06	0.06	0.04
12/10/07	0.10	0.10	0.10	0.11	0.00	0.00	0.11	0.10	0.10	0.10
12/14/07	0.05	0.06	0.06	0.06	0.00	0.00	0.04	0.05	0.05	0.05
12/17/07	0.11	0.14	0.17	0.18	0.00	0.01	0.21	0.15	0.15	0.16
12/22/07	0.04	0.01	0.04	0.06	0.00	0.00	0.05	0.04	0.04	0.05
12/24/07	0.01	0.01	0.06	0.03	0.00	0.00	0.02	0.03	0.04	0.04
12/28/07	0.04	0.05	0.05	0.05	0.00	0.00	0.05	0.05	0.07	0.05
Average	0.12	0.13	0.13	0.13	0.00	0.00	0.14	0.13	0.12	0.13
s	0.07	0.07	0.07	0.07	0.01	0.01	0.07	0.07	0.06	0.07
s^2	0.004	0.005	0.005	0.004	0.000	0.000	0.004	0.004	0.004	0.004
n	98	98	98	98	101	101	97	97	97	98

f Factor Table

f Factor Comparison of all the Chambers										
Date	8PCS	8PCG	8S	8G	C1	C2	4G	4S	4PCG	4PCS
1/8/07	-	-	-	-	-	-	-	-	-	-
1/12/07	-	-	-	-	0.58	0.96	-	-	-	-
1/15/07	0.00	0.01	0.00	0.06	0.92	-	0.14	0.00	0.02	0.00
1/19/07	0.00	0.00	0.00	0.00	0.77	0.96	0.01	0.00	0.00	0.00
1/22/07	0.00	0.00	0.00	0.00	-	-	0.01	0.09	0.00	0.00
1/26/07	0.53	0.56	0.50	0.47	0.99	0.96	0.62	0.65	0.61	0.64
1/29/07	0.10	0.00	0.00	0.08	0.96	0.89	0.02	0.00	0.00	0.00
2/2/07	0.31	0.24	0.23	0.16	0.98	0.73	0.32	0.37	0.34	0.37
2/5/07	1.07	0.97	0.65	0.99	0.77	0.83	0.73	0.91	0.87	0.80
2/9/07	0.39	0.38	0.40	0.28	-	-	0.33	0.42	0.35	0.40
2/11/07	0.01	0.00	0.00	0.00	-	-	0.00	0.00	0.00	0.00
2/16/07	0.55	0.53	0.51	0.45	1.00	0.86	0.48	0.53	0.55	0.54
2/19/07	0.11	0.09	0.11	0.07	0.95	0.88	0.05	0.06	0.06	0.07
2/23/07	0.12	0.00	0.07	0.05	-	-	0.00	0.04	0.02	0.02
2/26/07	0.00	0.00	0.00	0.00	-	-	0.00	0.00	0.00	0.00
3/2/07	0.00	0.00	0.00	0.00	0.86	0.84	0.00	0.00	0.00	0.00
3/5/07	0.00	0.00	0.00	0.00	0.99	0.73	0.00	0.00	0.00	0.00
3/9/07	0.00	0.00	0.00	0.00	-	-	0.00	0.00	0.00	0.00
3/12/07	0.00	0.00	0.00	0.00	-	-	0.00	0.00	0.00	0.00
3/16/07	0.19	0.11	0.10	0.04	0.99	0.96	0.13	0.14	0.27	0.22
3/19/07	-	-	-	-	-	-	-	-	-	-
3/23/07	0.19	0.16	0.22	0.05	-	-	0.09	0.11	0.21	0.11
3/26/07	0.21	0.07	0.16	0.05	-	-	0.12	0.13	0.18	0.12

Date	8PCS	8PCG	8S	8G	C1	C2	4G	4S	4PCG	4PCS
3/30/07	0.55	0.24	0.52	0.34	-	-	0.42	0.15	0.14	0.05
4/2/07	0.34	0.30	0.30	0.28	0.90	0.97	0.27	0.21	0.31	0.24
4/6/07	0.22	0.16	0.18	0.16	0.88	0.87	0.12	0.13	0.19	0.07
4/9/07	0.13	0.10	0.10	0.02	-	-	0.04	0.04	0.12	0.23
4/13/07	0.38	0.34	0.25	0.26	0.49	1.00	0.23	0.31	0.38	0.23
4/16/07	0.47	0.46	0.45	0.35	0.99	0.98	0.37	0.40	0.43	0.38
4/20/07	-	-	-	-	-	-	-	-	-	-
4/23/07	0.04	0.03	0.00	0.00	1.00	0.90	0.00	0.00	0.03	0.02
4/27/07	0.18	0.17	0.18	0.05	-	-	0.04	0.05	0.13	0.08
4/30/07	0.02	0.03	0.02	0.00	-	-	0.00	0.01	0.03	0.02
5/4/07	0.09	0.08	0.05	0.00	-	-	0.00	0.00	0.09	0.00
5/7/07	0.26	0.26	0.24	0.15	0.98	1.00	0.25	0.16	0.29	0.21
5/11/07	-	-	-	-	-	-	-	-	-	-
5/14/07	0.45	0.11	0.04	0.01	0.96	0.96	0.04	0.00	0.10	0.14
5/18/07	0.27	0.11	0.20	0.04	0.94	0.96	0.15	0.15	0.26	0.19
5/22/07	0.25	0.26	0.29	0.81	0.96	0.96	0.29	0.26	0.20	0.29
5/25/07	0.15	0.16	0.24	0.07	0.90	0.91	0.07	0.05	0.22	0.05
5/29/07	0.09	0.06	0.04	0.01	0.77	0.96	0.02	0.00	0.04	0.01
6/1/07	0.02	0.01	0.01	0.02	-	-	0.00	0.00	0.06	0.01
6/5/07	0.75	0.71	0.76	0.70	0.99	0.99	0.70	0.71	0.74	0.76
6/8/07	0.53	0.47	0.49	0.41	0.99	0.99	0.40	0.45	0.52	0.47
6/12/07	0.71	0.67	0.63	0.57	1.00	0.97	0.56	0.58	0.72	0.61
6/15/07	0.83	0.84	0.83	0.76	1.00	0.88	0.84	0.83	0.81	0.55
6/19/07	0.56	0.63	0.63	0.62	-	-	0.41	0.58	0.51	0.57
6/22/07	0.40	0.48	0.47	0.43	0.98	0.96	0.42	0.42	0.51	0.44
6/26/07	0.38	0.38	0.36	0.31	0.90	0.93	0.31	0.31	0.36	0.28
6/29/07	0.34	0.31	0.29	0.22	0.98	0.97	0.22	0.23	0.33	0.25
7/3/07	0.52	0.49	0.46	0.46	0.98	0.96	0.42	0.49	0.52	0.48
7/6/07	0.91	0.92	0.92	0.88	0.93	1.00	0.79	0.90	0.98	0.93
7/10/07	0.71	0.73	0.72	0.67	0.99	0.95	0.77	0.51	0.68	0.71
7/13/07	0.55	0.50	0.47	0.40	0.99	0.97	0.36	0.45	0.49	0.45
7/17/07	0.93	0.89	0.71	1.00	1.00	1.00	0.87	0.82	0.82	0.68
7/20/07	0.56	0.50	0.37	0.54	0.99	0.98	0.55	0.64	0.58	0.51
7/24/07	0.68	0.99	0.66	0.67	0.98	0.99	0.72	0.72	0.48	0.73
7/27/07	0.80	0.77	0.77	0.73	0.96	1.00	0.77	0.77	0.77	0.54
7/31/07	0.60	0.57	0.59	0.84	1.00	0.96	0.58	0.52	0.54	0.54
8/3/07	0.87	0.84	0.92	0.85	1.00	0.99	0.84	0.86	0.87	0.88
8/6/07	0.35	0.45	0.78	0.64	-	-	0.72	0.68	0.75	0.73
8/10/07	0.33	0.34	0.32	0.30	-	-	0.24	0.22	0.34	0.29
8/14/07	0.28	0.25	0.33	0.28	0.94	0.86	0.37	0.18	0.18	0.28
8/17/07	0.30	0.18	0.30	0.17	-	-	0.13	0.23	0.33	0.29
8/21/07	0.33	0.33	0.30	0.26	-	-	0.22	0.24	0.32	0.35
8/24/07	0.23	0.22	0.19	0.19	-	-	0.15	0.16	0.25	0.28
8/27/07	0.45	0.47	0.56	0.55	0.91	0.99	0.54	0.47	0.59	0.54
8/30/07	0.34	0.29	0.31	0.24	0.95	0.97	0.19	0.25	0.30	0.29
9/5/07	0.66	0.62	0.60	0.57	0.99	0.96	0.55	0.57	0.63	0.62
9/7/07	0.20	0.18	0.16	0.17	0.93	0.88	0.11	0.13	0.20	0.18
9/10/07	0.73	0.62	0.64	0.66	0.99	0.98	0.72	0.64	0.70	0.67
9/14/07	0.51	0.47	0.48	0.49	0.97	0.96	0.41	0.47	0.49	0.44
9/17/07	0.53	0.46	0.46	0.44	0.99	0.97	0.40	0.45	0.50	0.52

Date	**8PCS**	**8PCG**	**8S**	**8G**	**C1**	**C2**	**4G**	**4S**	**4PCG**	**4PCS**
9/21/07	0.85	0.82	0.89	0.87	1.00	1.00	0.82	0.85	0.84	0.85
9/24/07	0.65	0.61	0.97	0.63	1.00	0.94	0.61	0.65	0.64	0.67
9/28/07	0.78	0.81	0.77	0.79	0.64	0.90	0.65	0.73	0.73	0.73
10/1/07	0.36	0.27	0.24	0.27	0.98	1.00	0.23	0.32	0.32	0.28
10/5/07	0.81	0.83	0.78	0.79	0.97	1.00	0.79	0.77	0.82	0.68
10/8/07	0.83	0.93	0.84	0.81	0.97	0.99	0.82	0.88	0.83	0.51
10/12/07	0.73	0.77	0.75	0.67	-	-	0.69	0.69	0.65	0.70
10/15/07	0.21	0.23	0.14	0.15	-	-	0.08	0.16	0.19	0.07
10/19/07	0.29	0.36	0.27	0.22	-	-	0.20	0.26	0.31	0.22
10/22/07	0.37	0.26	0.27	0.22	0.98	0.99	0.23	0.33	0.33	0.36
10/26/07	0.55	0.60	0.59	0.55	0.98	0.98	0.47	0.50	0.57	0.45
10/29/07	0.79	0.84	0.84	0.77	0.98	1.00	0.87	0.91	0.87	0.88
11/2/07	0.75	0.72	0.70	0.62	0.95	0.99	0.70	0.84	0.67	0.77
11/5/07	0.69	0.75	0.70	0.72	-	-	0.63	0.67	0.70	0.65
11/9/07	0.51	0.46	0.40	0.38	-	-	0.34	0.45	0.49	0.40
11/12/07	0.39	0.38	0.33	0.31	-	-	0.26	0.33	0.35	0.27
11/16/07	0.43	0.40	0.37	0.31	-	-	0.32	0.00	0.40	0.35
11/19/07	0.42	0.40	0.38	0.32	-	-	0.31	0.05	0.36	0.32
11/23/07	0.69	0.57	0.59	0.52	-	-	0.46	0.55	0.58	0.57
11/26/07	0.48	0.42	0.41	0.51	0.90	0.83	0.58	0.44	0.45	0.42
11/30/07	0.59	0.54	0.55	0.50	0.99	0.94	0.53	0.58	0.59	0.71
12/3/07	0.93	0.95	0.87	0.93	-	-	0.80	0.88	0.89	0.88
12/7/07	0.61	0.56	0.52	0.49	-	-	0.51	0.55	0.54	0.65
12/10/07	0.48	0.42	0.42	0.35	-	-	0.32	0.42	0.43	0.39
12/14/07	0.24	0.12	0.10	0.09	-	-	0.31	0.14	0.16	0.12
12/17/07	0.76	0.71	0.72	0.66	0.98	0.94	0.59	0.70	0.71	0.69
12/22/07	0.66	0.86	0.57	0.42	0.92	0.97	0.53	0.57	0.57	0.54
12/24/07	0.72	0.73	0.66	0.73	-	-	0.60	0.75	0.68	0.69
12/28/07	0.54	0.47	0.46	0.48	0.98	0.95	0.40	0.50	0.31	0.46
Average	0.43	0.41	0.40	0.38	0.94	0.94	0.36	0.37	0.41	0.38
s	0.275	0.291	0.278	0.291	0.100	0.061	0.272	0.291	0.272	0.271
s^2	0.076	0.085	0.078	0.085	0.010	0.004	0.075	0.085	0.075	0.074
n	97	97	97	97	63	62	97	97	97	97

APPENDIX D: ET AND F FACTOR HYPOTHESIS TESTS

ET Hypothesis Tests

H_{O1}	Pollution Control and Drainage Material are held constant, ET for 8" Depth = ET for 4" Depth
H_{a1}	Pollution Control and Drainage Material are held constant, ET for 8" Depth not equal to ET for 4" Depth
H_{O2}	Depth and Pollution Control is held constant, ET for Plastic Drainage = ET for Gravel Drainage
H_{a2}	Depth and Pollution Control is held constant, ET for Plastic Drainage not equal to ET for Gravel Drainage
H_{O3}	Depth and Drainage Material is held constant, the Pollution Control ET = ET for Non Pollution Control
H_{a3}	Depth and Drainage Material is held constant, the Pollution Control ET not equal to ET for Non Pollution Control
H_{O4}	The Green Roof Chamber's ET is = to the Control Roof ET
H_{a4}	The Green Roof Chamber's ET is not equal to the Control Roof ET

Note: R = Reject H_O & A = Accept H_O

	8PCS	8PCG	8S	8G	C1	C2	4PCS	4PCG	4S	4G
Average	0.12	0.13	0.13	0.13	0.00	0.00	0.13	0.12	0.13	0.14
s	0.065	0.072	0.068	0.068	0.007	0.009	0.066	0.061	0.066	0.065
s^2	0.004	0.005	0.005	0.004	0.000	0.000	0.004	0.004	0.004	0.004
n	98	98	98	98	101	101	98	97	97	97
	Depth Comparison									
z_1	-0.733	0.419	-0.593	-0.095						
H_{O1} (95% CI)	**A**	**A**	**A**	**A**						
H_{O1} (90% CI)	**A**	**A**	**A**	**A**						
	Drainage Comparison									
z_2	-0.484		-0.977				0.673		-0.503	
H_{O1} (95% CI)	**A**		**A**				**A**		**A**	
H_{O1} (90% CI)	**A**		**A**				**A**		**A**	
	PC Comparison									
z_3	-0.260	-0.731					-0.142	-1.347		
H_{O1} (95% CI)	**A**	**A**					**A**	**A**		
H_{O1} (90% CI)	**A**	**A**					**A**	**A**		
	Control Comparison									
z_4	18.293	17.272	17.688	19.378			19.072	19.452	19.287	20.289
H_{O1} (95% CI)	**R**	**R**	**R**	**R**			**R**	**R**	**R**	**R**

H_{O1} (90% CI)	R	R	R	R			R	R	R	R

Filtrate Factor Hypothesis Tests

H_{O1}	Pollution Control and Drainage Material are held constant, f Factor for 8" Depth = f Factor for 4" Depth
H_{a1}	Pollution Control and Drainage Material are held constant, f Factor for 8" Depth not equal to f Factor for 4" Depth
H_{O2}	Depth and Pollution Control is held constant, f Factor for Plastic Drainage = f Factor for Gravel Drainage
H_{a2}	Depth and Pollution Control is held constant, f Factor for Plastic Drainage not equal to f Factor for Gravel Drainage
H_{O3}	Depth and Drainage Material is held constant, the Pollution Control f Factor = f Factor for Non Pollution Control
H_{a3}	Depth and Drainage Material is held constant, the Pollution Control f Factor not equal to f Factor for Non Pollution Control
H_{O4}	The Green Roof Chamber's f Factor is = to the Control Roof f Factor
H_{a4}	The Green Roof Chamber's f Factor is not equal to the Control Roof f Factor

$z_{.05}$ = 1.645 $z_{.025}$ = 1.96

Note: R = Reject H_O & A = Accept H_O

	8PCS	8PCG	8S	8G	C1	C2	4PCS	4PCG	4S	4G
Average	0.43	0.41	0.40	0.38	0.94	0.94	0.38	0.41	0.37	0.36
s	0.275	0.291		0.291	0.10	0.06	0.271	0.272	0.291	0.272
s^2	0.076	0.085	0.078	0.085	0.01	0.004	0.074	0.075	0.085	0.075
n	97	97	97	97	63	62	97	97	97	97
	Depth Comparison									
z_1	1.343	0.021	0.588	0.279						
H_{O1} (95% CI)	A	A	A	A						
H_{O1} (90% CI)	A	A	A	A						
	Drainage Comparison									
z_2	0.582		0.576				-0.72		0.268	
H_{O1} (95% CI)	A		A				A		A	
H_{O1} (90% CI)	A		A				A		A	
	PC Comparison									
z_3	0.779	0.738					0.057	1.054		
H_{O1} (95% CI)	A	A					A	A		
H_{O1} (90% CI)	A	A					A	A		
	Control Comparison									
z_4	-16.5	-16.5	-17.3	-17.4			-18.4	-17.4	-17.5	-18.7
H_{O1} (95% CI)	R	R	R	R			R	R	R	R
H_{O1} (90% CI)	R	R	R	R			R	R	R	R

APPENDIX E: ET AND F FACTOR RAW DATA

Irrigation Master Spreadsheet 8PCS													
Date	Volume of Rain (P) [liters]	Initial Drum Volume (S1B) [liters]	Volume of water added (G) [liters]	Water containers volume (F) [liters]	Water Lost (F) [liters]	Volume of Irrigation (I) [liters]	Post Irrigation Drum Volume (S2B) [liters]	ΣET [liters]	ΣET [in] delta	ET [in/day]	ET (Monthly Average) [in/day]	f Factor	f Factor (Monthly Average)
1/8/07	1.89	77.28	0	89.93	0	0	168.84	-	-	-		-	
1/12/07	0.76	168.84	0	0	0	9.43	160.08	0.76	0.02	0.01		-	
1/15/07	0.38	160.08	0	0	0	9.43	149.72	9.81	0.26	0.09		0	
1/19/07	1.51	149.72	0	0	0	9.43	140.17	10.94	0.29	0.07		0	
1/22/07	0.38	140.17	0	0	0	9.43	130.61	9.81	0.26	0.09		0	
1/26/07	43.05	130.21	0	27.56	0	0	156.49	24.91	0.66	0.16		0.53	
1/29/07	5.29	156.49	0	0.52	0	9.43	146.54	4.76	0.13	0.04	0.08	0.1	0.12
2/2/07	13.22	146.54	0	6.96	0	9.43	144.55	15.68	0.42	0.1		0.31	
2/5/07	4.53	144.55	0	14.94	0	9.43	146.54	-1.25	-0.03	-		-	
2/9/07	0.38	146.54	0	3.86	0	9.43	141.36	5.95	0.16	0.04		0.39	
2/11/07	0	141.36	0	0.06	0	9.43	131.41	9.37	0.25	0.08		0.01	
2/16/07	33.98	131.41	0	24.08	0	9.43	145.34	19.33	0.51	0.13		0.55	
2/19/07	2.64	145.34	0	1.31	0	9.43	135.79	10.77	0.29	0.1		0.11	
2/23/07	0	134.99	0	1.16	0	9.43	127.42	8.27	0.22	0.05		0.12	
2/26/07	0.38	127.42	0	0	0	9.43	117.47	9.81	0.26	0.09	0.08	0	0.21
3/2/07	5.66	117.47	0	0	0	9.43	108.31	15.09	0.4	0.1		0	
3/5/07	4.91	108.71	0	0	0	9.43	97.96	14.34	0.38	0.13		0	
3/9/07	0	97.56	0	0	0	9.43	88.4	9.43	0.25	0.06		0	
3/12/07	0.38	88.4	0	0	0	9.43	78.84	9.81	0.26	0.09		0	
3/16/07	33.98	78.84	0	8.05	0	0	86.81	35.36	0.94	0.23		0.19	
3/19/07	0	86.01	0	0.36	0	18.86	68.09	-0.36	-0.01	0		-	
3/23/07	0.38	67.69	0	3.71	0	18.86	53.36	15.52	0.41	0.1		0.19	
3/26/07	0	53.36	47.87	3.92	0	47.87	54.16	14.94	0.4	0.13		0.21	
3/30/07	0	54.16	0	26.4	0	18.86	61.32	21.47	0.57	0.14	0.11	0.55	0.14

Date	Volume of Rain (P) [liters]	Initial Drum Volume (S1B) [liters]	Volume of water added (G) [liters]	Water containers volume (F) [liters]	Water Lost (F) [liters]	Volume of Irrigation (I) [liters]	Post Irrigation Drum Volume (S2B) [liters]	ΣET [liters]	ΣET [in] delta	ET [in/day]	ET (Monthly Average) [in/day]	f Factor	f Factor (Monthly Average)
4/2/07	7.93	61.72	0	8.99	0	18.86	49.38	17.79	0.47	0.16		0.34	
4/6/07	2.64	49.38	37.71	4.67	0	18.86	71.29	16.83	0.45	0.11		0.22	
4/9/07	0	71.28	0	2.49	0	18.86	53.33	16.36	0.43	0.14		0.13	
4/13/07	15.86	53.36	0	13.27	0	18.86	47.78	21.44	0.57	0.14		0.38	
4/16/07	28.32	47.78	0	22.34	0	0	65.3	24.84	0.66	0.22		0.47	
4/20/07	0	65.3	0	0	0	18.86	47.39	0	0	-		-	
4/23/07	3.78	45.39	0	0.87	0	18.86	27.08	21.68	0.57	0.19		0.04	
4/27/07	0	27.08	37.71	3.48	0	18.86	50.17	15.03	0.4	0.1		0.18	
4/30/07	0	50.17	37.71	0.46	0	18.86	68.49	18.41	0.49	0.16	0.15	0.02	0.22
5/4/07	0	68.49	0	1.74	0	18.86	50.97	17.26	0.46	0.11		0.09	
5/7/07	29.45	50.97	0	12.71	0	0	62.12	36.36	0.96	0.32		0.26	
5/11/07	0	62.12	8.7	0	0	18.86	52.05	0	0	-		-	
5/14/07	0.38	52.08	0	8.7	0	18.86	39.82	12.07	0.32	0.11		0.45	
5/18/07	9.06	44.6	0	7.46	0	18.86	33.77	19.96	0.53	0.13		0.27	
5/22/07	4.53	33.77	18.86	5.8	0	18.86	39.82	17.34	0.46	0.11		0.25	
5/25/07	2.27	39.82	0	3.25	0	18.86	24.29	17.54	0.46	0.15		0.15	
5/29/07	0.38	23.89	37.71	1.74	0	18.86	43.32	16.45	0.44	0.11	0.15	0.09	0.2
6/1/07	0	43.01	37.71	0.36	0	37.71	44.22	18.86	0.5	0.17		0.02	
6/5/07	64.57	44.22	0	76.73	0	18.86	99.14	27.87	0.74	0.18		0.75	
6/8/07	31.72	99.15	0	26.63	0	18.86	105.92	25.09	0.66	0.22		0.53	
6/12/07	46.07	99.14	0	46.42	0	0	145.71	17.59	0.47	0.12		0.71	
6/15/07	80.81	145.71	0	67.3	0	28.29	186.68	11.11	0.29	0.1		0.83	
6/19/07	0	186.68	0	15.96	0	28.29	172.79	13.47	0.36	0.09		0.56	
6/22/07	12.84	178.39	0	16.25	0	28.29	164.06	26.79	0.71	0.24		0.4	
6/26/07	4.53	164.46	0	12.42	0	28.29	147.33	20.87	0.55	0.14		0.38	
6/29/07	12.84	147.3	0	13.78	0	28.29	133	27.55	0.73	0.24	0.17	0.34	0.5

Date	Volume of Rain (P) [liters]	Initial Drum Volume (S1B) [liters]	Volume of water added (G) [liters]	Water containers volume (F) [liters]	Water Lost (F) [liters]	Volume of Irrigation (I) [liters]	Post Irrigation Drum Volume (S2B) [liters]	ΣET [liters]	ΣET [in] delta	ET [in/day]	ET (Monthly Average) [in/day]	f Factor	f Factor (Monthly Average)
7/3/07	15.86	133	0	23.06	0	28.29	127.42	21.85	0.58	0.14		0.52	
7/6/07	67.59	127.82	0	87.03	0	28.29	183.17	10.9	0.29	0.1		0.91	
7/10/07	29.08	183.17	0	40.98	6.16	28.29	191.53	15.95	0.42	0.11		0.71	
7/13/07	26.81	191.93	0	30.46	0	28.29	193.53	23.84	0.63	0.21		0.55	
7/17/07	135.18	193.92	0	151.58	126.48	28.29	191.93	11.89	0.31	0.08		0.93	
7/20/07	26.43	191.14	0	30.46	2.76	28.29	192.73	26.05	0.69	0.23		0.56	
7/24/07	115.17	192.73	0	97.18	72.09	0	218.61	46.27	1.23	0.31		0.68	
7/27/07	48.71	217.68	0	39.16	39.16	0	218.21	9.55	0.25	0.08		0.8	
7/31/07	20.77	218.21	0	12.47	9.14	28.29	192.33	8.29	0.22	0.05	0.15	0.6	0.7
8/3/07	117.81	192.73	0	127.21	95.73	28.29	194.7	18.89	0.5	0.17		0.87	
8/6/07	0	194.72	0	9.86	0	28.29	176.8	18.73	0.5	0.12		0.35	
8/10/07	0	175.61	0	9.28	0	28.29	158.48	17.53	0.46	0.12		0.33	
8/14/07	3.02	158.48	0	8.7	0	28.29	137.78	20.95	0.55	0.14		0.28	
8/17/07	2.64	137.78	0	9.43	0	28.29	119.46	21.77	0.58	0.19		0.3	
8/21/07	0	119.46	0	9.28	0	28.29	99.52	19.92	0.53	0.13		0.33	
8/24/07	0	99.55	0	6.38	0	28.29	79	21.12	0.56	0.19		0.23	
8/27/07	35.87	85.21	0	28.72	0	18.86	93.58	36.44	0.97	0.32		0.45	
8/30/07	7.17	92.78	0	8.85	0	28.29	72.44	18.07	0.48	0.16	0.17	0.34	0.39
9/5/07	31.72	72.47	0	39.6	0	18.86	92.78	20.98	0.56	0.14		0.66	
9/7/07	2.64	92.76	0	4.28	0	28.29	68.81	18.3	0.48	0.24		0.2	
9/10/07	33.98	69.29	0	45.62	0	18.86	93.98	18.47	0.49	0.16		0.73	
9/14/07	7.55	93.58	0	13.56	0	18.86	89.2	12.47	0.33	0.08		0.51	
9/17/07	18.5	87.6	0	19.65	0	18.86	88.8	17.45	0.46	0.15		0.53	
9/21/07	77.03	88.8	0	81.66	0	18.86	147.33	17.76	0.47	0.12		0.85	
9/24/07	37	147.33	0	36.12	0	18.86	161.67	21.46	0.57	0.19		0.65	
9/28/07	1.13	161.67	0	15.67	0	18.86	158.9	4.86	0.13	0.03	0.14	0.78	0.61

Date	Volume of Rain (P) [liters]	Initial Drum Volume (S1B) [liters]	Volume of water added (G) [liters]	Water containers volume (F) [liters]	Water Lost (F) [liters]	Volume of Irrigation (I) [liters]	Post Irrigation Drum Volume (S2B) [liters]	ΣET [liters]	ΣET [in] delta	ET [in/day]	ET (Monthly Average) [in/day]	f Factor	f Factor (Monthly Average)
10/1/07	9.44	158.88	0	10.15	0	18.86	150.52	17.94	0.48	0.16		0.36	
10/5/07	50.98	150.52	0	56.57	0	37.71	167.24	16.08	0.43	0.11		0.81	
10/8/07	65.32	170.43	0	85.58	46.42	18.86	185.56	17.46	0.46	0.15		0.83	
10/12/07	0	185.56	0	13.78	0	18.86	179.99	6.51	0.17	0.04		0.73	
10/15/07	0	180.78	0	3.99	0	18.86	165.25	14.87	0.39	0.13		0.21	
10/19/07	0	165.25	0	5.51	0	18.86	151.71	14.08	0.37	0.09		0.29	
10/22/07	11.33	151.32	0	11.1	0	18.86	142.56	18.64	0.49	0.16		0.37	
10/26/07	4.15	143.35	0	12.76	0	18.86	136.98	11.06	0.29	0.07		0.55	
10/29/07	67.21	136.98	0	68.17	0	18.86	183.49	19.97	0.53	0.18	0.12	0.79	0.55
11/2/07	32.47	183.57	0	38.58	0	18.86	203.88	11.91	0.32	0.08		0.75	
11/5/07	0	202.29	0	13.05	0	18.86	195.91	6.11	0.16	0.05		0.69	
11/9/07	0	195.91	0	9.57	0	18.86	186.36	9.3	0.25	0.06		0.51	
11/12/07	0	186.36	0	7.43	0	18.86	172.02	13.28	0.35	0.12		0.39	
11/16/07	0	172.02	0	8.12	0	18.86	161.67	10.89	0.29	0.07		0.43	
11/19/07	0	162.07	0	7.83	0	18.86	150.52	11.29	0.3	0.1		0.42	
11/23/07	0	150.52	0	13.05	0	18.86	143.35	6.11	0.16	0.04		0.69	
11/26/07	3.78	142.95	0	10.81	0	18.86	134.59	12.28	0.33	0.11		0.48	
11/30/07	17.75	133.8	0	21.47	0	18.86	136.18	16.69	0.44	0.11	0.08	0.59	0.55
12/3/07	0	136.58	0	17.61	0	18.86	134.19	2.13	0.06	0.02		0.93	
12/7/07	0	133.8	0	11.52	0	18.86	126.63	7.71	0.2	0.05		0.61	
12/10/07	0	126.63	0	9.14	0	9.43	124.24	10.89	0.29	0.1		0.48	
12/14/07	0	124.24	0	2.29	0	37.71	86.39	7.84	0.21	0.05		0.24	
12/17/07	20.77	86.39	0	44.39	0	9.43	121.05	12.83	0.34	0.11		0.76	
12/22/07	9.44	120.65	0	12.39	0	9.43	121.82	7.72	0.2	0.04		0.66	
12/24/07	0	121.85	0	6.82	0	9.43	121.85	0.67	0.02	0.01		0.72	
12/28/07	4.91	121.85	0	7.69	0	9.43	120.65	6.37	0.17	0.04	0.05	0.54	0.62

Irrigation Master Spreadsheet 8PCG												
Date	Volume of Rain (P) [liters]	Initial Drum Volume (S1B) [liters]	Volume of water added (G) [liters]	Water containers volume (F) [liters]	Water container volume Removed (F) [liters]	Volume of Irrigation (I) [liters]	Post Irrigation Drum Volume (S2B) [liters]	ΣET [liters]	ΣET [in] delta	ET [in/day]	ET (Monthly Average) [in/day]	f Factor
1/8/07	1.89	77.28	0.00	101.54	0.00	0.00	174.81	-	-	-		-
1/12/07	0.76	168.84	0.00	0.00	0.00	9.43	160.30	0.76	0.02	0.01		-
1/15/07	0.38	160.08	0.00	0.15	0.00	9.43	149.72	9.81	0.26	0.09		0.01
1/19/07	1.51	149.72	0.00	0.00	0.00	9.43	140.17	10.94	0.29	0.07		0.00
1/22/07	0.38	147.33	0.00	0.00	0.00	9.43	135.39	9.81	0.26	0.09		0.00
1/26/07	43.05	135.39	0.00	29.59	0.00	0.00	163.26	24.60	0.65	0.16		0.56
1/29/07	5.29	163.66	0.00	0.00	0.00	9.43	153.71	5.28	0.14	0.05	0.08	0.00
2/2/07	13.22	153.31	0.00	5.42	0.00	9.43	149.72	17.47	0.46	0.12		0.24
2/5/07	4.53	149.72	0.00	13.49	0.00	9.43	151.70	2.41	0.06	0.02		0.97
2/9/07	0.38	151.32	0.00	3.74	0.00	9.43	145.74	6.22	0.16	0.04		0.38
2/11/07	0.00	146.14	0.00	0.00	0.00	9.43	136.15	9.43	0.25	0.12		0.00
2/16/07	33.98	131.41	0.00	23.21	0.00	9.43	145.71	19.92	0.53	0.13		0.53
2/19/07	2.64	145.34	0.00	1.07	0.00	9.43	135.77	10.88	0.29	0.10		0.09
2/23/07	0.00	134.99	0.00	0.00	0.00	9.43	125.83	9.41	0.25	0.06		0.00
2/26/07	0.38	127.42	0.00	0.00	0.00	9.43	116.67	9.84	0.26	0.09	0.09	0.00
3/2/07	5.66	117.47	0.00	0.00	0.00	9.43	107.51	15.08	0.40	0.10		0.00
3/5/07	4.91	108.71	0.00	0.00	0.00	9.43	96.76	14.35	0.38	0.13		0.00
3/9/07	0.00	97.56	0.00	0.00	0.00	9.43	87.60	9.44	0.25	0.06		0.00
3/12/07	0.38	88.40	0.00	0.00	0.00	9.43	78.45	9.81	0.26	0.09		0.00
3/16/07	33.98	78.05	0.00	4.58	0.00	0.00	82.43	39.02	1.03	0.26		0.11
3/19/07	0.00	82.03	0.00	0.00	0.00	18.86	62.12	0.00	0.00	0.00		-

Date	Volume of Rain (P) [liters]	Initial Drum Volume (S1B) [liters]	Volume of water added (G) [liters]	Water containers volume (F) [liters]	Water container volume Removed (F) [liters]	Volume of Irrigation (I) [liters]	Post Irrigation Drum Volume (S2B) [liters]	ΣET [liters]	ΣET [in] delta	ET [in/day]	ET (Monthly Average) [in/day]	f Factor
3/23/07	0.38	59.33	0.00	3.13	0.00	18.86	43.80	16.05	0.43	0.11		0.16
3/26/07	0.00	43.77	47.87	1.36	0.00	47.87	42.21	17.58	0.47	0.16		0.07
3/30/07	0.00	42.18	0.00	11.43	0.00	18.86	34.64	36.29	0.96	0.24	0.13	0.24
4/2/07	7.93	34.66	0.00	8.06	0.00	18.86	23.89	18.98	0.50	0.17		0.30
4/6/07	2.64	23.89	37.71	3.48	0.00	18.86	46.19	17.16	0.45	0.11		0.16
4/9/07	0.00	46.19	0.00	1.94	0.00	18.86	27.08	17.26	0.46	0.15		0.10
4/13/07	15.86	27.08	0.00	11.87	0.00	18.86	19.11	21.97	0.58	0.15		0.34
4/16/07	28.32	19.11	0.00	21.61	0.00	0.00	39.02	26.47	0.70	0.23		0.46
4/20/07	0.00	38.99	0.00	0.00	0.00	18.86	19.91	0.00	0.00	-		-
4/23/07	3.78	19.88	0.00	0.65	0.00	18.86	1.59	22.22	0.59	0.20		0.03
4/27/07	0.00	1.59	37.71	3.25	0.00	18.86	23.49	14.46	0.38	0.10		0.17
4/30/07	0.00	23.51	37.71	0.65	0.00	18.86	42.21	18.21	0.48	0.16	0.16	0.03
5/4/07	0.00	42.18	0.00	1.54	0.00	18.86	24.66	17.26	0.46	0.11		0.08
5/7/07	29.45	24.66	0.00	12.71	0.00	0.00	36.63	35.54	0.94	0.31		0.26
5/11/07	0.00	36.63	0.00	0.00	0.00	18.86	17.52	0.00	0.00	-		-
5/14/07	0.38	17.52	18.86	2.03	0.00	18.86	21.47	16.88	0.45	0.15		0.11
5/18/07	9.06	21.47	18.86	3.13	0.00	18.86	24.66	24.92	0.66	0.17		0.11
5/22/07	4.53	24.69	18.86	6.01	0.00	18.86	29.47	16.18	0.43	0.11		0.26
5/25/07	2.27	29.43	0.00	3.31	0.00	18.86	13.51	17.94	0.48	0.16		0.16
5/29/07	0.38	13.54	37.71	1.23	0.00	18.86	32.24	18.04	0.48	0.12	0.16	0.06
6/1/07	0.00	32.24	37.71	0.22	0.00	37.71	33.45	18.47	0.49	0.16		0.01
6/5/07	64.57	33.45	0.00	72.60	0.00	18.86	84.04	29.79	0.79	0.20		0.71
6/8/07	31.72	84.02	0.00	23.90	0.00	18.86	89.99	26.28	0.70	0.23		0.47

Date	Volume of Rain (P) [liters]	Initial Drum Volume (S1B) [liters]	Volume of water added (G) [liters]	Water containers volume (F) [liters]	Water container volume Removed (F) [liters]	Volume of Irrigation (I) [liters]	Post Irrigation Drum Volume (S2B) [liters]	ΣET [liters]	ΣET [in] delta	ET [in/day]	ET (Monthly Average) [in/day]	f Factor
6/12/07	46.07	84.04	0.00	43.52	0.00	0.00	128.19	19.98	0.53	0.13		0.67
6/15/07	80.81	128.19	0.00	67.62	0.00	28.29	164.82	14.67	0.39	0.13		0.84
6/19/07	0.00	164.82	0.00	17.81	0.00	28.29	153.67	10.73	0.28	0.07		0.63
6/22/07	12.84	153.71	0.00	19.81	0.00	28.29	144.15	22.01	0.58	0.19		0.48
6/26/07	4.53	145.34	0.00	12.56	0.00	28.29	127.82	20.87	0.55	0.14		0.38
6/29/07	12.84	127.82	0.00	12.76	0.00	28.29	113.09	27.98	0.74	0.19	0.16	0.31
7/3/07	15.86	113.09	0.00	21.53	0.00	28.29	105.92	23.04	0.61	0.15		0.49
7/6/07	67.59	106.32	0.00	88.05	0.00	28.29	166.45	8.67	0.23	0.08		0.92
7/10/07	29.08	166.45	0.00	42.14	0.00	28.29	178.00	15.22	0.40	0.10		0.73
7/13/07	26.81	177.60	0.00	27.41	0.00	28.29	178.00	26.82	0.71	0.24		0.50
7/17/07	135.18	178.00	0.00	145.05	95.30	28.29	193.53	18.41	0.49	0.12		0.89
7/20/07	26.43	193.53	0.00	27.56	3.48	28.29	193.53	25.25	0.67	0.22		0.50
7/24/07	115.17	193.13	0.00	142.15	127.65	0.00	211.01	1.30	0.03	0.01		0.99
7/27/07	48.71	210.25	0.00	37.71	37.71	0.00	210.25	48.71	1.29	0.43		0.77
7/31/07	20.77	210.25	0.00	11.84	8.50	28.29	186.76	8.93	0.24	0.06	0.16	0.57
8/3/07	117.81	187.15	0.00	123.29	87.03	28.29	197.51	22.80	0.60	0.20		0.84
8/6/07	0.00	198.30	0.00	12.76	0.00	28.29	184.37	13.95	0.37	0.12		0.45
8/10/07	0.00	188.35	0.00	9.57	0.00	28.29	169.63	19.52	0.52	0.13		0.34
8/14/07	3.02	169.60	0.00	7.69	0.00	28.29	147.33	23.34	0.62	0.15		0.25
8/17/07	2.64	149.33	0.00	5.66	0.00	28.29	127.42	25.75	0.68	0.23		0.18
8/21/07	0.00	127.42	0.00	9.28	0.00	28.29	105.12	20.72	0.55	0.14		0.33
8/24/07	0.00	105.12	0.00	6.24	0.00	28.29	85.69	20.72	0.55	0.18		0.22
8/27/07	35.87	86.41	0.00	30.46	0.00	18.86	98.75	31.90	0.84	0.28		0.47

Date	Volume of Rain (P) [liters]	Initial Drum Volume (S1B) [liters]	Volume of water added (G) [liters]	Water containers volume (F) [liters]	Water container volume Removed (F) [liters]	Volume of Irrigation (I) [liters]	Post Irrigation Drum Volume (S2B) [liters]	ΣET [liters]	ΣET [in] delta	ET [in/day]	ET (Monthly Average) [in/day]	f Factor
8/30/07	7.17	98.75	0.00	7.62	0.00	28.29	77.25	18.07	0.48	0.16	0.18	0.29
9/5/07	31.72	78.05	0.00	36.99	0.00	18.86	95.97	22.97	0.61	0.12		0.62
9/7/07	2.64	95.95	0.00	3.77	0.00	18.86	82.03	17.10	0.45	0.23		0.18
9/10/07	33.98	82.03	0.00	32.72	0.00	18.86	93.44	20.98	0.56	0.19		0.62
9/14/07	7.55	94.77	0.00	12.47	0.00	18.86	88.81	14.06	0.37	0.09		0.47
9/17/07	18.50	88.80	0.00	17.12	0.00	18.86	86.01	19.60	0.52	0.17		0.46
9/21/07	77.03	86.01	0.00	79.05	0.00	18.86	143.35	20.23	0.54	0.13		0.82
9/24/07	37.00	143.35	0.00	33.94	0.00	18.86	156.49	23.21	0.61	0.20		0.61
9/28/07	1.13	157.29	0.00	16.25	0.00	18.86	153.31	4.86	0.13	0.03	0.15	0.81
10/1/07	9.44	154.50	0.00	7.76	0.00	18.86	141.76	22.32	0.59	0.20		0.27
10/5/07	50.98	141.76	0.00	58.02	0.00	37.71	159.66	11.81	0.31	0.08		0.83
10/8/07	65.32	159.68	0.00	95.66	55.12	18.86	182.38	7.38	0.20	0.07		0.93
10/12/07	0.00	182.38	0.00	14.58	0.00	18.86	178.39	4.52	0.12	0.03		0.77
10/15/07	0.00	175.21	0.00	4.29	0.00	18.86	159.66	15.27	0.40	0.13		0.23
10/19/07	0.00	159.68	0.00	6.88	0.00	18.86	148.13	12.09	0.32	0.08		0.36
10/22/07	11.33	148.13	0.00	7.83	0.00	18.86	136.18	21.74	0.58	0.19		0.26
10/26/07	4.15	136.18	0.00	13.78	0.00	18.86	131.01	9.47	0.25	0.06		0.60
10/29/07	67.21	131.41	0.00	72.60	8.70	18.86	177.60	13.47	0.36	0.12	0.11	0.84
11/2/07	32.47	176.80	0.00	37.13	0.00	18.86	194.32	14.70	0.39	0.10		0.72
11/5/07	0.00	194.32	0.00	14.22	0.00	18.86	188.75	4.52	0.12	0.04		0.75
11/9/07	0.00	188.71	0.00	8.70	0.00	18.86	178.01	10.06	0.27	0.07		0.46
11/12/07	0.00	178.00	0.00	7.08	0.00	18.86	164.46	11.78	0.31	0.10		0.38
11/16/07	0.00	164.46	0.00	7.54	0.00	18.86	153.71	11.69	0.31	0.08		0.40
11/19/07	0.00	153.71	0.00	7.54	0.00	18.86	140.96	12.09	0.32	0.11		0.40
11/23/07	0.00	140.96	0.00	10.81	0.00	18.86	133.80	7.71	0.20	0.05		0.57
11/26/07	3.78	133.40	0.00	9.43	0.00	18.86	123.44	14.67	0.39	0.13		0.42

Date	Volume of Rain (P) [liters]	Initial Drum Volume (S1B) [liters]	Volume of water added (G) [liters]	Water containers volume (F) [liters]	Water container volume Removed (F) [liters]	Volume of Irrigation (I) [liters]	Post Irrigation Drum Volume (S2B) [liters]	ΣET [liters]	ΣET [in] delta	ET [in/day]	ET (Monthly Average) [in/day]	f Factor
11/30/07	17.75	124.64	0.00	19.73	0.00	18.86	124.05	17.89	0.47	0.12	0.09	0.54
12/3/07	0.00	123.84	0.00	17.84	0.00	18.86	121.05	1.73	0.05	0.02		0.95
12/7/07	0.00	123.44	0.00	10.50	0.00	18.86	113.09	9.46	0.25	0.06		0.56
12/10/07	0.00	113.09	0.00	7.83	0.00	9.43	109.90	11.69	0.31	0.10		0.42
12/14/07	0.00	109.90	0.00	1.10	0.00	37.71	74.46	8.63	0.23	0.06		0.12
12/17/07	20.77	76.45	0.00	41.34	0.00	9.43	109.90	15.64	0.41	0.14		0.71
12/22/07	9.44	109.90	0.00	16.25	0.00	9.43	117.47	2.62	0.07	0.01		0.86
12/24/07	0.00	106.32	0.00	6.88	0.00	9.43	104.73	1.07	0.03	0.01		0.73
12/28/07	4.91	104.73	0.00	6.67	0.00	9.43	101.94	7.97	0.21	0.05	0.06	0.47

Irrigation Master Spreadsheet 8S

Date	Volume of Rain (P) [liters]	Initial Drum Volume (S1B) [liters]	Volume of water added (G) [liters]	Water containers volume (F) [liters]	Water Lost volume (F) [liters]	Volume of Irrigation (I) [liters]	Post Irrigation Drum Volume (S2B) [liters]	ΣET [liters]	ΣET [in] delta	ET [in/day]	ET (Monthly Average) [in/day]	f Factor
1/8/07	1.89	78.05	0.00	113.58	0.00	0.00	186.36	-	-	-		-
1/12/07	0.76	186.76	0.00	0.00	0.00	9.43	177.60	0.76	0.02	0.01		-
1/15/07	0.38	177.60	0.00	0.00	0.00	9.43	168.04	9.54	0.25	0.08		0.00
1/19/07	1.51	168.04	0.00	0.00	0.00	9.43	158.88	10.27	0.27	0.07		0.00
1/22/07	0.38	158.90	0.00	0.00	0.00	9.43	148.13	9.54	0.25	0.08		0.00
1/26/07	43.05	148.13	0.00	26.11	0.00	0.00	175.21	24.70	0.65	0.16		0.50
1/29/07	5.29	175.21	0.00	0.00	0.00	9.43	165.25	5.29	0.14	0.05	0.08	0.00
2/2/07	13.22	164.85	9.43	4.93	0.00	18.86	160.49	17.18	0.46	0.11		0.23
2/5/07	4.53	160.47	0.00	15.38	0.00	9.43	163.66	8.01	0.21	0.07		0.65
2/9/07	0.38	163.26	0.00	3.86	0.00	9.43	158.09	5.55	0.15	0.04		0.40
2/11/07	0.00	158.09	0.00	0.00	0.00	9.43	148.53	9.16	0.24	0.12		0.00
2/16/07	33.98	149.33	0.00	21.76	0.00	9.43	161.27	22.04	0.58	0.15		0.51
2/19/07	2.64	160.87	0.00	1.28	0.00	9.43	151.32	10.21	0.27	0.09		0.11
2/23/07	0.00	150.92	0.00	0.67	0.00	9.43	142.56	8.36	0.22	0.06		0.07
2/26/07	0.38	142.56	0.00	0.00	0.00	9.43	132.60	9.54	0.25	0.08	0.09	0.00
3/2/07	5.66	132.60	0.00	0.00	0.00	9.43	123.44	14.82	0.39	0.10		0.00
3/5/07	4.91	123.84	0.00	0.00	0.00	9.43	113.09	14.07	0.37	0.12		0.00
3/9/07	0.00	112.69	0.00	0.00	0.00	9.43	104.33	9.16	0.24	0.06		0.00
3/12/07	0.38	104.30	0.00	0.00	0.00	9.43	94.37	8.77	0.23	0.08		0.00
3/16/07	33.98	94.37	0.00	4.50	0.00	0.00	98.75	38.70	1.02	0.26		0.10
3/19/07	0.00	98.75	0.00	0.73	0.00	18.86	80.04	0.00	0.00	-		-

Date	Volume of Rain (P) [liters]	Initial Drum Volume (S1B) [liters]	Volume of water added (G) [liters]	Water containers volume (F) [liters]	Water container volume Removed (F) [liters]	Volume of Irrigation (I) [liters]	Post Irrigation Drum Volume (S2B) [liters]	ΣET [liters]	ΣET [in] delta	ET [in/day]	ET (Monthly Average) [in/day]	f Factor
3/23/07	0.38	80.04	0.00	4.09	0.00	18.86	66.52	14.39	0.38	0.10		0.22
3/26/07	0.00	66.50	47.87	2.90	0.00	47.87	68.89	15.00	0.40	0.13		0.16
3/30/07	0.00	67.30	0.00	24.66	0.00	18.86	73.27	23.69	0.63	0.16	0.13	0.52
4/2/07	7.93	73.27	0.00	7.83	0.00	18.86	59.70	19.80	0.52	0.17		0.30
4/6/07	2.64	59.73	37.71	3.77	0.00	18.86	82.03	16.81	0.45	0.11		0.18
4/9/07	0.00	82.03	0.00	1.91	0.00	18.86	66.07	16.88	0.45	0.15		0.10
4/13/07	15.86	66.10	0.00	8.70	0.00	18.86	56.51	25.45	0.67	0.17		0.25
4/16/07	28.32	56.54	0.00	21.18	0.00	0.00	74.86	27.56	0.73	0.24		0.45
4/20/07	0.00	74.86	0.00	0.00	0.00	18.86	55.75	0.00	0.00	0.00		-
4/23/07	3.78	55.75	34.81	0.00	0.00	18.86	70.47	22.89	0.61	0.20		0.00
4/27/07	0.00	70.48	0.00	3.48	0.00	18.86	55.35	16.17	0.43	0.11		0.18
4/30/07	0.00	55.35	37.71	0.36	0.00	18.86	73.27	17.93	0.47	0.16	0.15	0.02
5/4/07	0.00	73.27	0.00	1.02	0.00	18.86	55.75	18.57	0.49	0.12		0.05
5/7/07	29.45	55.75	0.00	11.69	0.00	0.00	66.90	35.82	0.95	0.32		0.24
5/11/07	0.00	66.90	0.00	0.29	0.00	18.86	46.96	0.00	0.00	-		-
5/14/07	0.38	46.99	18.86	0.90	0.00	18.86	46.96	19.68	0.52	0.17		0.04
5/18/07	9.06	46.96	18.86	5.74	0.00	18.86	52.56	23.59	0.62	0.16		0.20
5/22/07	4.53	52.56	0.00	6.82	0.00	18.86	38.23	17.27	0.46	0.11		0.29
5/25/07	2.27	38.23	0.00	5.22	0.00	18.86	23.51	16.60	0.44	0.15		0.24
5/29/07	0.38	23.49	37.71	0.87	0.00	18.86	38.99	18.20	0.48	0.12	0.16	0.04
6/1/07	0.00	38.99	37.71	0.22	0.00	37.71	39.82	19.62	0.52	0.17		0.01
6/5/07	64.57	39.82	0.00	76.56	0.00	18.86	94.74	27.52	0.73	0.02		0.76
6/8/07	31.72	94.77	0.00	24.59	0.00	18.86	99.55	26.59	0.70	0.23		0.49

Date	Volume of Rain (P) [liters]	Initial Drum Volume (S1B) [liters]	Volume of water added (G) [liters]	Water containers volume (F) [liters]	Water container volume Removed (F) [liters]	Volume of Irrigation (I) [liters]	Post Irrigation Drum Volume (S2B) [liters]	ΣET [liters]	ΣET [in] delta	ET [in/day]	ET (Monthly Average) [in/day]	f Factor
6/12/07	46.07	99.55	0.00	40.67	0.00	0.00	136.98	26.16	0.69	0.17		0.63
6/15/07	80.81	136.98	0.00	67.45	0.00	28.29	174.38	15.12	0.40	0.13		0.83
6/19/07	0.00	174.38	0.00	17.73	0.00	28.29	163.23	10.74	0.28	0.07		0.63
6/22/07	12.84	164.06	0.00	19.29	0.00	28.29	154.50	21.95	0.58	0.19		0.47
6/26/07	4.53	154.50	0.00	11.75	0.00	28.29	135.71	21.34	0.57	0.14		0.36
6/29/07	12.84	135.71	0.00	12.04	0.00	28.29	117.87	29.40	0.78	0.26	0.16	0.29
7/3/07	15.86	117.87	0.00	20.89	0.00	28.29	112.29	23.98	0.64	0.16		0.46
7/6/07	67.59	112.69	0.00	87.03	0.00	28.29	171.23	8.66	0.23	0.08		0.92
7/10/07	29.08	171.23	0.00	40.76	0.00	28.29	182.38	16.73	0.44	0.11		0.72
7/13/07	26.81	182.38	0.00	25.53	0.00	28.29	178.00	30.00	0.79	0.26		0.47
7/17/07	135.18	178.00	0.00	145.05	110.24	28.29	188.35	19.20	0.51	0.13		0.88
7/20/07	26.43	188.35	0.00	20.31	0.00	28.29	181.18	33.20	0.88	0.29		0.37
7/24/07	115.17	181.58	0.00	95.01	54.25	0.00	222.99	48.43	1.28	0.32		0.66
7/27/07	48.71	221.80	0.00	37.42	37.42	0.00	221.78	11.29	0.30	0.10		0.77
7/31/07	20.77	220.60	0.00	12.33	12.33	28.29	191.77	8.45	0.22	0.06	0.17	0.59
8/3/07	117.81	191.77	0.00	134.90	118.94	28.29	179.99	12.14	0.32	0.11		0.92
8/6/07	0.00	179.59	0.00	21.76	0.00	28.29	172.82	6.37	0.17	0.06		0.78
8/10/07	0.00	173.22	0.00	9.14	0.00	28.29	152.91	19.11	0.51	0.13		0.32
8/14/07	3.02	152.91	0.00	10.88	0.00	28.29	133.80	21.66	0.57	0.14		0.33
8/17/07	2.64	134.19	0.00	9.14	0.00	28.29	115.48	22.30	0.59	0.20		0.30
8/21/07	0.00	115.88	0.00	8.06	0.00	28.29	95.19	19.51	0.52	0.13		0.30
8/24/07	0.00	95.17	0.00	5.08	0.00	28.29	72.07	22.68	0.60	0.20		0.19
8/27/07	35.87	72.47	0.00	35.39	0.00	18.86	86.41	30.70	0.81	0.27		0.56

Date	Volume of Rain (P) [liters]	Initial Drum Volume (S1B) [liters]	Volume of water added (G) [liters]	Water containers volume (F) [liters]	Water container volume Removed (F) [liters]	Volume of Irrigation (I) [liters]	Post Irrigation Drum Volume (S2B) [liters]	ΣET [liters]	ΣET [in] delta	ET [in/day]	ET (Monthly Average) [in/day]	f Factor
8/30/07	7.17	86.01	0.00	7.76	0.00	28.29	66.90	16.49	0.44	0.15	0.15	0.31
9/5/07	33.23	65.30	0.00	36.26	0.00	18.86	81.63	25.90	0.69	0.14		0.60
9/7/07	2.64	82.03	0.00	3.19	0.00	18.86	66.90	16.58	0.44	0.22		0.16
9/10/07	33.98	67.69	0.00	34.23	0.00	18.86	81.23	19.65	0.52	0.17		0.64
9/14/07	7.55	81.23	0.00	12.69	0.00	18.86	75.26	13.92	0.37	0.09		0.48
9/17/07	18.50	74.07	0.00	17.00	0.00	18.86	71.68	20.49	0.54	0.18		0.46
9/21/07	77.03	72.07	0.00	85.00	8.70	0.00	148.93	10.35	0.27	0.07		0.89
9/24/07	37.00	130.61	0.00	35.76	0.00	18.86	144.94	2.76	0.07	0.02		0.97
9/28/07	1.13	144.94	0.00	15.52	0.00	18.86	142.95	4.32	0.11	0.03	0.12	0.77
10/1/07	9.44	142.95	0.00	6.53	0.00	18.86	129.02	21.07	0.56	0.19		0.24
10/5/07	50.98	129.81	0.00	55.12	0.00	37.71	146.54	17.45	0.46	0.12		0.78
10/8/07	65.32	145.74	0.00	85.73	26.11	18.86	185.16	15.84	0.42	0.14		0.84
10/12/07	0.00	185.16	0.00	13.49	0.00	18.86	179.99	3.98	0.11	0.03		0.75
10/15/07	0.00	180.38	0.00	2.76	0.00	18.86	163.66	16.72	0.44	0.15		0.14
10/19/07	0.00	163.66	0.00	4.93	0.00	18.86	150.12	13.14	0.35	0.09		0.27
10/22/07	11.33	150.12	0.00	8.01	0.00	18.86	138.57	22.48	0.60	0.20		0.27
10/26/07	4.15	136.58	0.00	13.34	0.00	18.86	132.60	8.14	0.22	0.05		0.59
10/29/07	67.21	133.00	0.00	72.16	8.70	18.86	178.78	13.37	0.35	0.12	0.12	0.84
11/2/07	32.47	178.79	0.00	35.68	0.00	18.86	195.12	15.37	0.41	0.10		0.70
11/5/07	0.00	195.12	0.00	13.63	0.00	18.86	189.54	5.97	0.16	0.05		0.70
11/9/07	0.00	189.54	0.00	7.25	0.00	18.86	177.57	11.18	0.30	0.07		0.40
11/12/07	0.00	177.60	0.00	6.24	0.00	18.86	163.26	13.25	0.35	0.12		0.33
11/16/07	0.00	163.26	0.00	7.11	0.00	18.86	151.32	12.63	0.33	0.08		0.37

Date	Volume of Rain (P) [liters]	Initial Drum Volume (S1B) [liters]	Volume of water added (G) [liters]	Water containers volume (F) [liters]	Water container volume Removed (F) [liters]	Volume of Irrigation (I) [liters]	Post Irrigation Drum Volume (S2B) [liters]	ΣET [liters]	ΣET [in] delta	ET [in/day]	ET (Monthly Average) [in/day]	f Factor
11/19/07	0.00	151.32	0.00	7.11	0.00	18.86	139.77	11.55	0.31	0.10		0.38
11/23/07	0.00	139.37	0.00	10.66	0.00	18.86	130.99	7.57	0.20	0.05		0.59
11/26/07	3.78	131.01	0.00	9.14	0.00	18.86	121.05	13.51	0.36	0.12		0.41
11/30/07	17.75	120.65	0.00	19.58	0.00	18.86	121.45	16.79	0.44	0.11	0.09	0.55
12/3/07	0.00	121.85	0.00	15.96	0.00	18.86	119.46	1.59	0.04	0.01		0.87
12/7/07	0.00	119.46	0.00	9.57	0.00	18.86	110.70	8.76	0.23	0.06		0.52
12/10/07	0.00	110.70	0.00	7.69	0.00	9.43	107.51	10.99	0.29	0.10		0.42
12/14/07	0.00	107.12	0.00	1.02	0.00	37.71	72.87	8.52	0.23	0.06		0.10
12/17/07	20.77	74.86	0.00	40.47	0.00	9.43	101.54	19.57	0.52	0.17		0.72
12/22/07	9.44	101.14	0.00	10.62	0.00	9.43	101.94	7.45	0.20	0.04		0.57
12/24/07	0.00	105.12	0.00	6.79	0.00	9.43	101.94	4.38	0.12	0.06		0.66
12/28/07	4.91	101.94	0.00	6.53	0.00	9.43	98.75	7.70	0.20	0.05	0.07	0.46

Irrigation Master Spreadsheet 8G												
Date	Volume of Rain (P) [liters]	Initial Drum Volume (S1B) [liters]	Volume of water added (G) [liters]	Water containers volume (F) [liters]	Water container volume Removed (F) [liters]	Volume of Irrigation (I) [liters]	Post Irrigation Drum Volume (S2B) [liters]	ΣET [liters]	ΣET [in] delta	ET [in/day]	ET (Monthly Average) [in/day]	f Factor
1/8/07	1.89	70.08	0.00	110.82	0.00	0.00	176.00	-	-	-		-
1/12/07	0.38	176.00	0.00	0.00	0.00	9.43	167.24	0.38	0.01	0.00		-
1/15/07	0.38	166.85	0.00	0.58	0.00	9.43	156.73	9.23	0.24	0.08		0.06
1/19/07	1.13	157.29	0.00	0.00	0.00	9.43	148.13	10.56	0.28	0.07		0.00
1/22/07	0.38	147.73	0.00	0.00	0.00	9.43	136.98	9.81	0.26	0.09		0.00
1/26/07	43.05	137.36	0.00	24.66	0.00	0.00	160.04	27.82	0.74	0.18		0.47
1/29/07	5.29	160.08	0.00	0.41	0.00	9.43	150.52	4.88	0.13	0.04	0.08	0.08
2/2/07	13.22	149.72	0.00	3.71	0.00	9.43	144.55	18.93	0.50	0.13		0.16
2/5/07	4.53	144.55	0.00	13.78	0.00	9.43	146.94	0.18	0.00	0.00		0.99
2/9/07	0.38	146.54	0.00	2.76	0.00	9.43	140.17	7.05	0.19	0.05		0.28
2/11/07	0.00	140.17	0.00	0.00	0.00	9.43	130.61	9.43	0.25	0.12		0.00
2/16/07	33.98	130.21	0.00	19.73	0.00	9.43	140.17	23.69	0.63	0.16		0.45
2/19/07	2.64	140.56	0.00	0.81	0.00	9.43	130.21	11.26	0.30	0.10		0.07
2/23/07	0.00	129.81	0.00	0.44	0.00	9.43	121.45	8.99	0.24	0.06		0.05
2/26/07	0.38	121.05	0.00	0.00	0.00	9.43	111.50	9.81	0.26	0.09	0.09	0.00
3/2/07	5.66	111.50	0.00	0.00	0.00	9.43	102.74	15.09	0.40	0.10		0.00
3/5/07	4.91	102.74	0.00	0.00	0.00	9.43	91.98	14.34	0.38	0.13		0.00
3/9/07	0.00	91.98	0.00	0.00	0.00	9.43	83.22	9.43	0.25	0.06		0.00
3/12/07	0.38	83.22	0.00	0.00	0.00	9.43	73.91	9.81	0.26	0.09		0.00
3/16/07	33.98	74.07	0.00	1.77	0.00	0.00	75.66	41.64	1.10	0.28		0.04
3/19/07	0.00	75.26	0.00	0.00	0.00	18.86	56.54	0.00	0.00	0.00		-

Date	Volume of Rain (P) [liters]	Initial Drum Volume (S1B) [liters]	Volume of water added (G) [liters]	Water containers volume (F) [liters]	Water container volume Removed (F) [liters]	Volume of Irrigation (I) [liters]	Post Irrigation Drum Volume (S2B) [liters]	ΣET [liters]	ΣET [in] delta	ET [in/day]	ET (Monthly Average) [in/day]	f Factor
3/23/07	0.38	56.15	0.00	1.02	0.00	18.86	39.42	18.22	0.48	0.12		0.05
3/26/07	0.00	39.02	47.87	1.02	0.00	47.87	37.03	17.84	0.47	0.16		0.05
3/30/07	0.00	37.03	0.00	16.19	0.00	18.86	34.64	31.68	0.84	0.21	0.13	0.34
4/2/07	7.93	34.64	0.00	7.40	0.00	18.86	20.39	19.39	0.51	0.17		0.28
4/6/07	2.64	19.51	37.71	3.34	0.00	18.86	42.18	18.16	0.48	0.12		0.16
4/9/07	0.00	42.21	0.00	0.38	0.00	18.86	22.70	18.48	0.49	0.16		0.02
4/13/07	15.86	22.30	0.00	8.99	0.00	18.86	12.74	25.72	0.68	0.17		0.26
4/16/07	28.32	12.74	0.00	16.68	0.00	0.00	27.08	30.50	0.81	0.27		0.35
4/20/07	0.00	27.08	0.00	0.00	0.00	18.86	7.45	0.00	0.00	0.00		-
4/23/07	3.78	7.96	37.71	0.00	0.00	18.86	27.08	22.63	0.60	0.20		0.00
4/27/07	0.00	27.08	37.71	1.02	0.00	18.86	9.96	17.84	0.47	0.12		0.05
4/30/07	0.00	9.16	37.71	0.00	0.00	18.86	27.87	18.86	0.50	0.17	0.15	0.00
5/4/07	0.00	27.87	0.00	0.00	0.00	18.86	9.56	18.86	0.50	0.12		0.00
5/7/07	29.45	9.56	8.70	12.18	0.00	0.00	31.86	36.13	0.96	0.32		0.25
5/11/07	0.00	31.86	0.00	0.00	0.00	18.86	12.74	0.00	0.00	-		-
5/14/07	0.38	12.36	29.01	0.26	0.00	18.86	23.89	18.97	0.50	0.17		0.01
5/18/07	9.06	23.89	18.86	0.99	0.00	18.86	25.48	26.93	0.71	0.18		0.04
5/22/07	4.53	25.48	18.86	3.92	0.00	18.86	25.48	19.47	0.52	0.13		0.17
5/25/07	2.27	25.48	0.00	1.42	0.00	21.76	6.77	19.70	0.52	0.17		0.07
5/29/07	0.38	6.77	37.71	0.17	0.00	18.86	25.48	21.96	0.58	0.15	0.18	0.01
6/1/07	0.00	25.48	37.71	0.36	0.00	37.71	25.87	18.49	0.49	0.16		0.02
6/5/07	64.57	25.87	0.00	71.22	0.00	18.86	76.45	31.06	0.82	0.21		0.70
6/8/07	31.72	76.45	0.00	20.89	0.00	18.86	78.84	29.69	0.79	0.26		0.41

Date	Volume of Rain (P) [liters]	Initial Drum Volume (S1B) [liters]	Volume of water added (G) [liters]	Water containers volume (F) [liters]	Water container volume Removed (F) [liters]	Volume of Irrigation (I) [liters]	Post Irrigation Drum Volume (S2B) [liters]	ΣET [liters]	ΣET [in] delta	ET [in/day]	ET (Monthly Average) [in/day]	f Factor
6/12/07	46.07	80.44	0.00	36.76	0.00	0.00	112.26	28.17	0.75	0.19		0.57
6/15/07	80.81	112.26	0.00	61.50	0.00	28.29	148.13	19.30	0.51	0.17		0.76
6/19/07	0.00	148.13	0.00	17.41	0.00	28.29	136.98	10.88	0.29	0.07		0.62
6/22/07	12.84	136.98	0.00	17.87	0.00	28.29	125.83	23.25	0.62	0.21		0.43
6/26/07	4.53	126.63	0.00	10.30	0.00	28.29	107.12	22.52	0.60	0.15		0.31
6/29/07	12.84	107.91	0.00	9.21	0.00	28.29	87.60	31.91	0.85	0.28	0.19	0.22
7/3/07	15.86	87.60	0.00	20.31	0.00	28.29	80.04	23.84	0.63	0.16		0.46
7/6/07	67.59	80.04	0.00	83.98	0.00	28.29	136.18	11.89	0.31	0.10		0.88
7/10/07	29.08	136.18	0.00	38.29	0.00	23.21	150.12	19.07	0.50	0.13		0.67
7/13/07	26.81	150.12	0.00	19.87	0.00	28.29	142.97	30.15	0.80	0.27		0.40
7/17/07	135.18	142.97	0.00	151.72	93.85	28.29	168.84	11.74	0.31	0.10		0.93
7/20/07	26.43	168.84	0.00	29.74	0.00	28.29	171.23	24.98	0.66	0.22		0.54
7/24/07	115.17	170.83	0.00	95.73	58.02	0.00	208.27	47.72	1.26	0.25		0.67
7/27/07	48.71	208.27	0.00	35.39	35.39	0.00	208.66	13.32	0.35	0.12		0.73
7/31/07	20.77	208.66	0.00	17.41	18.42	28.29	178.39	3.36	0.09	0.02	0.15	0.84
8/3/07	117.81	178.79	0.00	124.74	84.13	28.29	192.35	21.35	0.57	0.19		0.85
8/6/07	0.00	192.33	0.00	17.99	0.00	28.29	182.34	10.30	0.27	0.09		0.64
8/10/07	0.00	182.38	0.00	8.41	0.00	28.29	162.47	19.87	0.53	0.13		0.30
8/14/07	3.02	162.47	0.00	8.70	0.00	28.29	141.76	22.60	0.60	0.15		0.28
8/17/07	0.00	141.76	0.00	4.93	0.00	28.29	119.46	23.35	0.62	0.21		0.17
8/21/07	0.00	119.46	0.00	7.25	0.00	28.29	97.96	21.03	0.56	0.14		0.26
8/24/07	0.00	97.93	0.00	5.29	0.00	23.21	80.44	22.99	0.61	0.20		0.19
8/27/07	35.87	80.44	0.00	32.71	5.80	18.86	87.21	26.37	0.70	0.23		0.55

Date	Volume of Rain (P) [liters]	Initial Drum Volume (S1B) [liters]	Volume of water added (G) [liters]	Water containers volume (F) [liters]	Water container volume Removed (F) [liters]	Volume of Irrigation (I) [liters]	Post Irrigation Drum Volume (S2B) [liters]	ΣET [liters]	ΣET [in] delta	ET [in/day]	ET (Monthly Average) [in/day]	f Factor
8/30/07	7.17	87.21	0.00	6.24	0.00	28.29	66.07	19.79	0.52	0.17	0.17	0.24
9/5/07	33.23	66.10	0.00	35.32	0.00	18.86	80.83	26.19	0.69	0.14		0.57
9/7/07	2.64	80.83	0.00	3.63	0.00	18.86	66.50	17.87	0.47	0.24		0.17
9/10/07	33.98	66.50	0.00	34.81	0.00	18.86	79.64	18.03	0.48	0.16		0.66
9/14/07	7.55	79.64	0.00	13.05	0.00	18.86	74.07	13.35	0.35	0.09		0.49
9/17/07	18.50	73.27	0.00	16.54	0.00	18.86	69.69	20.82	0.55	0.18		0.44
9/21/07	77.03	70.08	0.00	83.26	8.12	18.86	126.63	12.63	0.33	0.08		0.87
9/24/07	37.00	126.63	0.00	35.25	0.00	18.86	140.56	20.61	0.55	0.18		0.63
9/28/07	1.13	140.56	0.00	15.81	0.00	18.86	136.98	4.18	0.11	0.03	0.14	0.79
10/1/07	9.44	137.78	0.00	7.54	0.00	18.86	125.03	20.75	0.55	0.18		0.27
10/5/07	50.98	123.44	0.00	55.41	0.00	37.71	142.56	14.42	0.38	0.10		0.79
10/8/07	65.32	142.52	0.00	83.04	17.77	18.86	185.96	20.00	0.53	0.18		0.81
10/12/07	0.00	185.96	0.00	12.62	0.00	18.86	178.79	6.24	0.17	0.04		0.67
10/15/07	0.00	179.99	0.00	2.90	0.00	18.86	162.47	15.96	0.42	0.14		0.15
10/19/07	0.00	162.47	0.00	4.21	0.00	18.86	147.73	14.65	0.39	0.10		0.22
10/22/07	11.33	147.73	0.00	6.79	0.00	18.86	134.19	23.40	0.62	0.21		0.22
10/26/07	4.15	134.59	0.00	12.76	0.00	18.86	129.02	10.25	0.27	0.07		0.55
10/29/07	67.21	128.22	0.00	66.22	0.00	18.86	175.21	19.85	0.53	0.18	0.13	0.77
11/2/07	32.47	176.40	0.00	31.62	0.00	18.86	190.34	19.71	0.52	0.13		0.62
11/5/07	0.00	190.74	0.00	13.63	0.00	18.86	183.97	5.22	0.14	0.05		0.72
11/9/07	0.00	183.94	0.00	7.25	0.00	18.86	172.79	11.60	0.31	0.08		0.38
11/12/07	0.00	172.82	0.00	5.77	0.00	18.86	158.09	13.08	0.35	0.12		0.31
11/16/07	0.00	158.09	0.00	5.80	0.00	18.86	145.74	13.05	0.35	0.09		0.31

Date	Volume of Rain (P) [liters]	Initial Drum Volume (S1B) [liters]	Volume of water added (G) [liters]	Water containers volume (F) [liters]	Water container volume Removed (F) [liters]	Volume of Irrigation (I) [liters]	Post Irrigation Drum Volume (S2B) [liters]	ΣET [liters]	ΣET [in] delta	ET [in/day]	ET (Monthly Average) [in/day]	f Factor
11/19/07	0.00	145.74	0.00	5.95	0.00	18.86	132.20	12.91	0.34	0.11		0.32
11/23/07	0.00	132.20	0.00	9.72	0.00	18.86	123.44	9.14	0.24	0.06		0.52
11/26/07	3.78	123.44	0.00	11.60	0.00	18.86	115.08	11.03	0.29	0.10		0.51
11/30/07	17.75	114.68	0.00	18.19	0.00	18.86	114.28	18.41	0.49	0.12	0.09	0.50
12/3/07	0.00	114.28	0.00	17.55	0.00	18.86	111.50	1.31	0.03	0.01		0.93
12/7/07	0.00	111.50	0.00	9.28	0.00	18.86	102.34	9.57	0.25	0.06		0.49
12/10/07	0.00	102.34	0.00	6.53	0.00	9.43	97.96	12.33	0.33	0.11		0.35
12/14/07	0.00	97.56	0.00	0.84	0.00	37.71	62.12	8.59	0.23	0.06		0.09
12/17/07	20.77	62.12	0.00	38.58	0.00	9.43	89.20	19.90	0.53	0.18		0.66
12/22/07	9.44	89.20	0.00	7.83	0.00	9.43	87.60	11.04	0.29	0.06		0.42
12/24/07	0.00	92.78	0.00	6.85	0.00	9.43	89.60	2.58	0.07	0.03		0.73
12/28/07	4.91	89.60	0.00	6.82	0.00	9.43	86.65	7.52	0.20	0.05	0.07	0.48

Irrigation Master Spreadsheet 4PCS													
Date	Volume of Rain (P) [liters]	Initial Drum Volume (S1B) [liters]	Volume of water added (G) [liters]	Water containers volume (F) [liters]	Water Lost volume (F) [liters]	Volume of Irrigation (I) [liters]	Post Irrigation Drum Volume (S2B) [liters]	ΣET [liters]	ΣET [in] delta	ET [in/day]	ET (Monthly Average) [in/day]	f Factor	f Factor (Monthly Average)
1/8/07	1.89	91.19	0.00	117.93	0.00	0.00	203.08	-	-	-		-	
1/12/07	0.38	203.08	0.00	0.00	0.00	9.43	193.53	0.38	0.01	0.00		-	
1/15/07	0.38	193.53	0.00	0.00	0.00	9.43	183.17	9.81	0.26	0.09		0.00	
1/19/07	1.13	182.77	0.00	0.00	0.00	9.43	174.01	10.56	0.28	0.07		0.00	
1/22/07	0.38	173.62	0.00	0.00	0.00	9.43	163.26	9.81	0.26	0.09		0.00	
1/26/07	43.05	163.66	0.00	33.80	0.00	0.00	195.53	18.68	0.49	0.12		0.64	
1/29/07	5.29	195.52	0.00	0.00	0.00	9.43	184.37	5.29	0.14	0.05	0.07	0.00	0.13
2/2/07	13.22	184.37	0.00	8.41	0.00	9.43	183.17	14.23	0.38	0.09		0.37	
2/5/07	4.53	183.17	0.00	11.14	0.00	9.43	181.98	2.82	0.07	0.02		0.80	
2/9/07	0.38	181.58	0.00	3.89	0.00	9.43	176.40	5.92	0.16	0.04		0.40	
2/11/07	0.00	176.00	0.00	0.00	0.00	9.43	165.65	9.43	0.25	0.12		0.00	
2/16/07	33.98	165.65	0.00	23.35	0.00	9.43	178.79	20.06	0.53	0.13		0.54	
2/19/07	2.64	178.79	0.00	0.84	0.00	9.43	169.63	11.23	0.30	0.10		0.07	
2/23/07	0.00	169.24	0.00	0.23	0.00	9.43	160.08	9.20	0.24	0.06		0.02	
2/26/07	0.38	160.08	0.00	0.00	0.00	9.43	149.33	9.81	0.26	0.09	0.08	0.00	0.27
3/2/07	5.66	149.72	0.00	0.00	0.00	9.43	140.56	15.09	0.40	0.10		0.00	
3/5/07	4.91	140.56	0.00	0.00	0.00	9.43	131.01	14.34	0.38	0.13		0.00	
3/9/07	0.00	130.61	0.00	0.00	0.00	9.43	121.85	9.43	0.25	0.06		0.00	
3/12/07	0.38	121.85	0.00	0.00	0.00	9.43	112.69	9.81	0.26	0.09		0.00	
3/16/07	33.98	112.69	0.00	9.34	0.00	0.00	121.45	34.07	0.90	0.23		0.22	
3/19/07	0.00	120.65	0.00	0.00	0.00	18.86	101.14	0.00	0.00	-		-	

Date	Volume of Rain (P) [liters]	Initial Drum Volume (S1B) [liters]	Volume of water added (G) [liters]	Water containers volume (F) [liters]	Water Lost volume (F) [liters]	Volume of Irrigation (I) [liters]	Post Irrigation Drum Volume (S2B) [liters]	ΣET [liters]	ΣET [in] delta	ET [in/day]	ET (Monthly Average) [in/day]	f Factor	f Factor (Monthly Average)
3/23/07	0.38	101.14	0.00	2.03	0.00	18.86	85.21	17.20	0.46	0.11		0.11	
3/26/07	0.00	85.21	0.00	2.18	0.00	18.86	67.66	16.68	0.44	0.15		0.12	
3/30/07	0.00	67.69	0.00	0.87	0.00	18.86	50.59	17.99	0.48	0.12	0.12	0.05	0.06
4/2/07	7.93	50.57	0.00	6.45	0.00	18.86	37.43	20.33	0.54	0.18		0.24	
4/6/07	2.64	37.43	37.71	1.45	0.00	18.86	56.94	20.05	0.53	0.13		0.07	
4/9/07	0.00	56.94	0.00	4.35	0.00	18.86	43.01	14.51	0.38	0.13		0.23	
4/13/07	15.86	43.01	0.00	8.01	0.00	18.86	32.65	26.71	0.71	0.18		0.23	
4/16/07	28.32	32.65	0.00	17.84	0.00	0.00	47.78	29.34	0.78	0.26		0.38	
4/20/07	0.00	47.78	0.00	0.00	0.00	18.86	28.67	0.00	0.00	-		-	
4/23/07	3.78	28.67	34.81	0.51	0.00	18.86	45.39	22.13	0.59	0.20		0.02	
4/27/07	0.00	45.39	37.71	1.45	0.00	18.86	28.67	17.41	0.46	0.12		0.08	
4/30/07	0.00	28.67	34.81	0.29	0.00	18.86	45.39	18.57	0.49	0.16	0.17	0.02	0.16
5/4/07	0.00	45.39	0.00	0.00	0.00	18.86	27.87	18.86	0.50	0.12		0.00	
5/7/07	29.45	27.84	0.00	10.15	0.00	0.00	34.21	38.16	1.01	0.34		0.21	
5/11/07	0.00	34.21	0.00	0.00	0.00	24.66	9.56	0.00	0.00	-		-	
5/14/07	0.38	9.56	26.11	3.48	0.00	18.86	19.11	21.56	0.57	0.19		0.14	
5/18/07	9.06	19.11	18.86	5.22	0.00	18.86	25.48	22.70	0.60	0.15		0.19	
5/22/07	4.53	25.48	21.76	6.76	0.00	18.86	34.25	16.63	0.44	0.11		0.29	
5/25/07	2.27	34.25	0.00	0.96	0.00	18.86	15.53	20.16	0.53	0.18		0.05	
5/29/07	0.38	15.53	37.71	0.15	0.00	18.86	32.65	19.09	0.51	0.13	0.17	0.01	0.11
6/1/07	0.00	32.62	37.71	0.15	0.00	37.71	33.07	18.71	0.50	0.17		0.01	
6/5/07	64.57	33.07	0.00	77.25	0.00	18.86	89.96	25.03	0.66	0.17		0.76	
6/8/07	31.72	89.99	0.00	23.64	0.00	23.21	89.96	26.93	0.71	0.24		0.47	

Date	Volume of Rain (P) [liters]	Initial Drum Volume (S1B) [liters]	Volume of water added (G) [liters]	Water containers volume (F) [liters]	Water Lost volume (F) [liters]	Volume of Irrigation (I) [liters]	Post Irrigation Drum Volume (S2B) [liters]	ΣET [liters]	ΣET [in] delta	ET [in/day]	ET (Monthly Average) [in/day]	f Factor	f Factor (Monthly Average)
6/12/07	46.07	89.96	0.00	42.06	0.00	0.00	131.82	27.21	0.72	0.18		0.61	
6/15/07	80.81	131.82	0.00	44.76	4.35	28.29	144.94	36.04	0.95	0.24		0.55	
6/19/07	0.00	144.94	0.00	15.98	0.00	28.29	130.61	12.30	0.33	0.08		0.57	
6/22/07	12.84	130.61	0.00	17.97	0.00	28.29	121.45	23.15	0.61	0.20		0.44	
6/26/07	4.53	121.45	0.00	9.23	0.00	28.29	101.94	23.59	0.62	0.16		0.28	
6/29/07	12.84	101.94	0.00	10.47	0.00	28.29	84.42	30.65	0.81	0.27	0.19	0.25	0.44
7/3/07	15.86	84.42	0.00	21.40	0.00	26.11	78.05	22.75	0.60	0.15		0.48	
7/6/07	67.59	78.05	0.00	87.03	0.00	28.29	136.98	6.67	0.18	0.06		0.93	
7/10/07	29.08	136.98	0.00	40.61	0.00	28.29	146.54	16.75	0.44	0.11		0.71	
7/13/07	26.81	146.54	0.00	24.66	0.00	28.29	144.94	30.44	0.81	0.27		0.45	
7/17/07	135.18	144.94	0.00	132.00	101.54	28.29	148.13	31.47	0.83	0.21		0.81	
7/20/07	26.43	150.52	0.00	27.85	0.00	28.29	152.11	26.87	0.71	0.24		0.51	
7/24/07	115.17	152.11	0.00	104.44	46.42	0.00	208.66	39.02	1.03	0.26		0.73	
7/27/07	48.71	208.26	0.00	26.54	26.54	0.00	208.26	22.17	0.59	0.20		0.54	
7/31/07	20.77	209.06	0.00	11.17	12.18	28.29	179.60	9.60	0.25	0.06	0.17	0.54	0.63
8/3/07	117.81	179.59	0.00	128.08	88.48	28.29	190.34	18.02	0.48	0.16		0.88	
8/6/07	0.00	190.34	0.00	20.60	0.00	28.29	182.38	7.69	0.20	0.07		0.73	
8/10/07	0.00	182.38	0.00	8.12	0.00	28.29	162.47	20.16	0.53	0.13		0.29	
8/14/07	3.02	162.47	0.00	8.70	0.00	28.29	140.96	22.60	0.60	0.15		0.28	
8/17/07	0.00	140.96	0.00	8.12	0.00	28.29	121.44	20.16	0.53	0.18		0.29	
8/21/07	0.00	121.45	0.00	10.01	0.00	28.29	101.94	18.28	0.48	0.12		0.35	
8/24/07	0.00	101.54	0.00	7.83	0.00	28.29	81.63	20.45	0.54	0.18		0.28	
8/27/07	35.87	80.44	0.00	34.52	0.00	18.86	93.58	29.63	0.78	0.26		0.54	

Date	Volume of Rain (P) [liters]	Initial Drum Volume (S1B) [liters]	Volume of water added (G) [liters]	Water containers volume (F) [liters]	Water Lost volume (F) [liters]	Volume of Irrigation (I) [liters]	Post Irrigation Drum Volume (S2B) [liters]	ΣET [liters]	ΣET [in] delta	ET [in/day]	ET (Monthly Average) [in/day]	f Factor	f Factor (Monthly Average)
8/30/07	7.17	93.18	0.00	7.54	0.00	28.29	74.86	18.49	0.49	0.16	0.16	0.29	0.44
9/5/07	33.23	74.86	0.00	38.44	0.00	18.86	91.98	23.08	0.61	0.12		0.62	
9/7/07	2.64	91.98	0.00	3.77	0.00	18.86	77.66	17.73	0.47	0.23		0.18	
9/10/07	33.98	77.65	0.00	35.39	0.00	18.86	92.38	17.45	0.46	0.15		0.67	
9/14/07	7.55	93.18	0.00	11.60	0.00	17.41	85.61	14.80	0.39	0.10		0.44	
9/17/07	18.50	85.61	0.00	18.77	0.00	18.86	83.62	17.14	0.45	0.15		0.52	
9/21/07	77.03	83.62	0.00	81.63	0.00	18.86	143.73	14.25	0.38	0.09		0.85	
9/24/07	37.00	143.75	0.00	37.51	0.00	18.86	159.68	18.35	0.49	0.16		0.67	
9/28/07	1.13	160.08	0.00	14.51	0.00	18.86	156.09	5.48	0.15	0.04	0.13	0.73	0.59
10/1/07	9.44	156.09	0.00	7.83	0.00	18.86	144.15	20.46	0.54	0.18		0.28	
10/5/07	50.98	144.15	0.00	47.29	0.00	37.71	154.90	22.55	0.60	0.15		0.68	
10/8/07	65.32	154.90	0.00	87.03	36.26	18.86	184.76	16.01	0.42	0.11		0.84	
10/12/07	0.00	184.76	0.00	13.20	0.00	18.86	179.59	5.66	0.15	0.04		0.70	
10/15/07	0.00	178.79	0.00	1.36	0.00	18.86	159.68	17.49	0.46	0.15		0.07	
10/19/07	0.00	162.86	0.00	4.06	0.00	18.86	147.33	14.80	0.39	0.10		0.22	
10/22/07	11.33	146.94	0.00	10.91	0.00	18.86	138.57	19.28	0.51	0.17		0.36	
10/26/07	4.15	136.98	0.00	10.44	0.00	18.86	130.21	12.57	0.33	0.08		0.45	
10/29/07	67.21	130.61	0.00	76.01	8.70	18.86	179.19	10.06	0.27	0.09	0.12	0.88	0.50
11/2/07	32.47	179.99	0.00	39.45	0.00	18.86	200.29	11.88	0.31	0.08		0.77	
11/5/07	0.00	200.29	0.00	12.18	0.00	18.86	191.53	6.67	0.18	0.06		0.65	
11/9/07	0.00	191.52	0.00	7.54	0.00	18.86	179.60	11.31	0.30	0.07		0.40	
11/12/07	0.00	179.59	0.00	5.13	0.00	18.86	164.06	13.72	0.36	0.12		0.27	
11/16/07	0.00	164.06	0.00	6.67	0.00	18.86	151.71	12.18	0.32	0.08		0.35	
11/19/07	0.00	152.51	0.00	6.09	0.00	18.86	138.57	12.76	0.34	0.11		0.32	
11/23/07	0.00	138.57	0.00	10.73	0.00	18.86	130.21	8.12	0.22	0.05		0.57	
11/26/07	3.78	130.21	0.00	9.43	0.00	18.86	120.65	13.20	0.35	0.12		0.42	

Date	Volume of Rain (P) [liters]	Initial Drum Volume (S1B) [liters]	Volume of water added (G) [liters]	Water containers volume (F) [liters]	Water Lost volume (F) [liters]	Volume of Irrigation (I) [liters]	Post Irrigation Drum Volume (S2B) [liters]	ΣET [liters]	ΣET [in] delta	ET [in/day]	ET (Monthly Average) [in/day]	f Factor	f Factor (Monthly Average)
11/30/07	17.75	119.46	0.00	25.82	4.35	18.86	121.45	10.78	0.29	0.07	0.09	0.71	0.50
12/3/07	0.00	121.05	0.00	16.54	0.00	18.86	119.46	2.32	0.06	0.02		0.88	
12/7/07	0.00	115.08	0.00	12.18	0.00	18.86	108.31	6.67	0.18	0.04		0.65	
12/10/07	0.00	108.31	0.00	7.31	0.00	9.43	105.92	11.55	0.31	0.10		0.39	
12/14/07	0.00	105.92	0.00	1.16	0.00	37.71	70.08	8.27	0.22	0.05		0.12	
12/17/07	20.77	70.08	0.00	40.32	0.00	9.43	100.54	18.16	0.48	0.16		0.69	
12/22/07	9.44	100.52	0.00	10.15	0.00	9.43	99.55	8.71	0.23	0.05		0.54	
12/24/07	0.00	103.13	0.00	6.53	0.00	9.43	100.35	2.90	0.08	0.04		0.69	
12/28/07	4.91	100.35	0.00	6.53	0.00	9.43	95.57	7.81	0.21	0.05	0.06	0.46	0.55

Irrigation Master Spreadsheet 4PCG													
Date	Volume of Rain (P) [liters]	Initial Drum Volume (S1B) [liters]	Volume of water added (G) [liters]	Water containers volume (F) [liters]	Water Lost volume (F) [liters]	Volume of Irrigation (I) [liters]	Post Irrigation Drum Volume (S2B) [liters]	ΣET [liters]	ΣET [in] delta	ET [in/day]	ET (Monthly Average) [in/day]	f Factor	f Factor (Monthly Average)
1/8/07	1.89	85.61	0.00	116.62	0.00	0.00	201.09	-	-	-		-	
1/12/07	0.38	201.49	0.00	0.00	0.00	9.43	191.93	0.38	0.01	-		-	
1/15/07	0.38	191.93	0.00	0.22	0.00	9.43	182.38	9.59	0.25	0.08		0.02	
1/19/07	1.13	181.98	0.00	0.00	0.00	9.43	172.82	10.56	0.28	0.07		0.00	
1/22/07	0.38	173.22	0.00	0.00	0.00	9.43	162.86	9.81	0.26	0.09		0.00	
1/26/07	43.05	163.26	0.00	32.06	0.00	0.00	193.53	20.42	0.54	0.14		0.61	
1/29/07	5.29	193.13	0.00	0.00	0.00	9.43	182.77	5.29	0.14	0.05	0.08	0.00	0.13
2/2/07	13.22	182.77	0.00	7.75	0.00	9.43	181.58	14.90	0.39	0.10		0.34	
2/5/07	4.53	181.58	0.00	12.16	0.00	9.43	182.38	1.80	0.05	0.02		0.87	
2/9/07	0.38	181.98	0.00	3.45	0.00	9.43	176.00	6.35	0.17	0.04		0.35	
2/11/07	0.00	176.00	0.00	0.00	0.00	9.43	165.25	9.43	0.25	0.12		0.00	
2/16/07	33.98	165.65	0.00	23.79	0.00	9.43	179.19	19.62	0.52	0.13		0.55	
2/19/07	2.64	178.79	0.00	0.73	0.00	9.43	168.84	11.35	0.30	0.10		0.06	
2/23/07	0.00	168.84	0.00	0.23	0.00	9.43	160.08	9.20	0.24	0.06		0.02	
2/26/07	0.38	160.08	0.00	0.00	0.00	9.43	149.33	9.81	0.26	0.09	0.08	0.00	0.27
3/2/07	5.66	148.93	0.00	0.00	0.00	9.43	140.17	15.09	0.40	0.10		0.00	
3/5/07	4.91	140.17	0.00	0.00	0.00	9.43	130.21	14.34	0.38	0.13		0.00	
3/9/07	0.00	130.21	0.00	0.00	0.00	9.43	121.05	9.43	0.25	0.06		0.00	
3/12/07	0.38	121.05	0.00	0.00	0.00	9.43	111.50	9.81	0.26	0.09		0.00	
3/16/07	33.98	111.50	0.00	11.82	0.00	0.00	121.45	31.59	0.84	0.21		0.27	
3/19/07	0.00	122.25	0.00	0.00	0.00	18.86	102.74	0.00	0.00	-		-	

Date	Volume of Rain (P) [liters]	Initial Drum Volume (S1B) [liters]	Volume of water added (G) [liters]	Water containers volume (F) [liters]	Water Lost volume (F) [liters]	Volume of Irrigation (I) [liters]	Post Irrigation Drum Volume (S2B) [liters]	ΣET [liters]	ΣET [in] delta	ET [in/day]	ET (Monthly Average) [in/day]	f Factor	f Factor (Monthly Average)
3/23/07	0.38	102.34	0.00	4.06	0.00	18.86	88.40	15.17	0.40	0.10		0.21	
3/26/07	0.00	88.40	0.00	3.48	0.00	18.86	72.06	15.38	0.41	0.14		0.18	
3/30/07	0.00	72.07	0.00	2.70	0.00	18.86	56.54	16.16	0.43	0.11	0.12	0.14	0.10
4/2/07	7.93	56.54	0.00	8.38	0.00	18.86	44.60	18.40	0.49	0.16		0.31	
4/6/07	2.64	44.60	37.71	4.00	0.00	18.86	66.10	17.50	0.46	0.12		0.19	
4/9/07	0.00	65.70	0.00	2.23	0.00	18.86	49.38	16.62	0.44	0.15		0.12	
4/13/07	15.86	49.38	0.00	13.05	0.00	18.86	43.80	21.66	0.57	0.14		0.38	
4/16/07	28.32	43.80	0.00	20.45	0.00	0.00	62.12	26.72	0.71	0.24		0.43	
4/20/07	0.00	62.12	0.00	0.00	0.00	18.86	43.01	0.00	0.00	-		-	
4/23/07	3.78	43.01	34.81	0.73	0.00	18.86	56.54	21.91	0.58	0.19		0.03	
4/27/07	0.00	56.15	0.00	2.47	0.00	18.86	39.82	16.39	0.43	0.11		0.13	
4/30/07	0.00	39.82	37.71	0.55	0.00	18.86	57.34	18.31	0.48	0.16	0.16	0.03	0.20
5/4/07	0.00	57.34	0.00	1.74	0.00	23.21	36.63	17.12	0.45	0.11		0.09	
5/7/07	29.45	36.63	0.00	15.06	0.00	0.00	52.56	37.60	1.00	0.33		0.29	
5/11/07	0.00	52.56	0.00	0.00	0.00	18.86	33.45	0.00	0.00	-		-	
5/14/07	0.38	33.45	18.86	2.00	0.00	18.86	33.45	17.23	0.46	0.15		0.10	
5/18/07	9.06	33.45	18.86	7.14	0.00	18.86	40.62	20.78	0.55	0.14		0.26	
5/22/07	4.53	40.62	18.86	4.64	0.00	18.86	44.60	18.75	0.50	0.12		0.20	
5/25/07	2.27	44.60	0.00	4.67	0.00	18.86	30.79	16.45	0.44	0.15		0.22	
5/29/07	0.38	30.79	37.71	0.73	0.00	18.86	48.18	18.51	0.49	0.12	0.16	0.04	0.17
6/1/07	0.00	48.17	37.71	1.16	0.00	37.71	50.59	17.70	0.47	0.16		0.06	
6/5/07	64.57	50.59	0.00	75.43	0.00	18.86	104.30	26.86	0.71	0.18		0.74	
6/8/07	31.72	104.33	0.00	26.17	0.00	18.86	110.70	24.41	0.65	0.22		0.52	

Date	Volume of Rain (P) [liters]	Initial Drum Volume (S1B) [liters]	Volume of water added (G) [liters]	Water containers volume (F) [liters]	Water Lost volume (F) [liters]	Volume of Irrigation (I) [liters]	Post Irrigation Drum Volume (S2B) [liters]	ΣET [liters]	ΣET [in] delta	ET [in/day]	ET (Monthly Average) [in/day]	f Factor	f Factor (Monthly Average)
6/12/07	46.07	110.70	0.00	41.80	0.00	0.00	150.49	23.12	0.61	0.15		0.64	
6/15/07	80.81	150.49	0.00	66.72	0.00	26.11	190.75	14.08	0.37	0.12		0.83	
6/19/07	0.00	190.75	0.00	14.51	0.00	28.29	174.38	11.60	0.31	0.08		0.56	
6/22/07	12.84	174.38	0.00	20.86	0.00	28.29	166.45	20.27	0.54	0.18		0.51	
6/26/07	4.53	166.45	0.00	11.75	0.00	28.29	149.09	21.07	0.56	0.14		0.36	
6/29/07	12.84	149.09	0.00	13.69	0.00	28.29	134.59	27.43	0.73	0.24	0.16	0.33	0.50
7/3/07	15.86	134.59	0.00	22.86	0.00	28.29	129.02	21.28	0.56	0.14		0.52	
7/6/07	67.59	129.02	0.00	94.28	5.80	28.29	189.54	1.59	0.04	0.01		0.98	
7/10/07	29.08	189.54	0.00	39.22	0.00	28.29	194.32	18.14	0.48	0.12		0.68	
7/13/07	26.81	193.53	0.00	26.92	0.00	28.29	194.72	28.17	0.75	0.25		0.49	
7/17/07	135.18	194.72	0.00	134.17	110.96	28.29	187.95	29.29	0.78	0.19		0.82	
7/20/07	26.43	187.95	0.00	31.91	0.00	28.29	191.14	22.81	0.60	0.20		0.58	
7/24/07	115.17	191.14	0.00	92.83	72.53	0.00	209.85	50.62	1.34	0.34		0.65	
7/27/07	48.71	209.85	0.00	37.71	37.71	0.00	209.87	11.00	0.29	0.10		0.77	
7/31/07	20.77	209.85	0.00	11.17	12.18	28.29	181.18	9.60	0.25	0.06	0.16	0.54	0.67
8/3/07	117.81	179.99	0.00	127.07	104.44	28.29	176.42	19.03	0.50	0.17		0.87	
8/6/07	0.00	176.40	0.00	21.18	0.00	28.29	168.84	7.11	0.19	0.06		0.75	
8/10/07	0.00	168.84	0.00	9.57	0.00	23.21	156.09	18.71	0.50	0.12		0.34	
8/14/07	3.02	156.09	0.00	4.79	0.00	28.29	129.97	21.44	0.57	0.14		0.18	
8/17/07	0.00	129.97	0.00	9.36	0.00	28.29	113.47	18.93	0.50	0.17		0.33	
8/21/07	0.00	113.49	0.00	9.14	0.00	28.29	93.98	19.15	0.51	0.13		0.32	
8/24/07	0.00	93.98	0.00	7.18	0.00	26.11	75.24	21.10	0.56	0.19		0.25	
8/27/07	35.87	75.26	0.00	36.70	0.00	18.86	89.99	25.28	0.67	0.22		0.59	

Date	Volume of Rain (P) [liters]	Initial Drum Volume (S1B) [liters]	Volume of water added (G) [liters]	Water containers volume (F) [liters]	Water Lost volume (F) [liters]	Volume of Irrigation (I) [liters]	Post Irrigation Drum Volume (S2B) [liters]	ΣET [liters]	ΣET [in] delta	ET [in/day]	ET (Monthly Average) [in/day]	f Factor	f Factor (Monthly Average)
8/30/07	7.17	89.20	0.00	7.69	0.00	28.29	70.48	18.34	0.49	0.16	0.15	0.30	0.44
9/5/07	33.23	70.08	0.00	38.82	0.00	18.86	88.40	22.70	0.60	0.12		0.63	
9/7/07	2.64	88.00	0.00	4.28	0.00	18.86	74.07	17.22	0.46	0.23		0.20	
9/10/07	33.98	74.86	0.00	36.84	0.00	18.86	90.39	16.00	0.42	0.14		0.70	
9/14/07	7.55	89.99	0.00	12.91	0.00	18.86	83.22	13.50	0.36	0.09		0.49	
9/17/07	18.50	83.62	0.00	18.57	0.00	18.86	82.03	18.79	0.50	0.12		0.50	
9/21/07	77.03	83.22	0.00	80.29	4.35	18.86	141.76	15.60	0.41	0.14		0.84	
9/24/07	37.00	140.96	0.00	35.74	0.00	18.86	156.49	20.12	0.53	0.13		0.64	
9/28/07	1.13	156.89	0.00	14.51	0.00	18.86	152.91	5.48	0.15	0.05	0.13	0.73	0.59
10/1/07	9.44	152.51	0.00	9.14	0.00	18.86	142.16	19.16	0.51	0.17		0.32	
10/5/07	50.98	141.76	0.00	57.15	0.00	37.71	163.68	12.68	0.34	0.08		0.82	
10/8/07	65.32	163.66	0.00	85.36	36.26	18.86	191.14	17.68	0.47	0.16		0.83	
10/12/07	0.00	191.14	0.00	12.33	0.00	18.86	185.16	6.53	0.17	0.04		0.65	
10/15/07	0.00	185.16	0.00	3.66	0.00	18.86	170.03	15.20	0.40	0.13		0.19	
10/19/07	0.00	170.03	0.00	5.80	0.00	18.86	157.29	13.05	0.35	0.09		0.31	
10/22/07	11.33	157.69	0.00	10.10	0.00	18.86	146.54	20.09	0.53	0.18		0.33	
10/26/07	4.15	148.13	0.00	13.20	0.00	18.86	140.93	9.81	0.26	0.06		0.57	
10/29/07	67.21	140.96	0.00	75.14	4.35	18.86	191.14	10.93	0.29	0.10	0.11	0.87	0.55
11/2/07	32.47	191.14	0.00	34.23	12.47	18.86	193.53	17.10	0.45	0.11		0.67	
11/5/07	0.00	193.92	0.00	13.20	0.00	18.86	185.56	5.66	0.15	0.05		0.70	
11/9/07	0.00	185.53	0.00	9.28	0.00	18.86	175.59	9.57	0.25	0.06		0.49	
11/12/07	0.00	175.61	0.00	6.53	0.00	18.86	161.27	12.33	0.33	0.11		0.35	
11/16/07	0.00	161.67	0.00	7.54	0.00	18.86	149.72	11.31	0.30	0.07		0.40	

Date	Volume of Rain (P) [liters]	Initial Drum Volume (S1B) [liters]	Volume of water added (G) [liters]	Water containers volume (F) [liters]	Water Lost volume (F) [liters]	Volume of Irrigation (I) [liters]	Post Irrigation Drum Volume (S2B) [liters]	ΣET [liters]	ΣET [in] delta	ET [in/day]	ET (Monthly Average) [in/day]	f Factor	f Factor (Monthly Average)
11/19/07	0.00	149.72	0.00	6.82	0.00	18.86	136.58	12.04	0.32	0.11		0.36	
11/23/07	0.00	136.58	0.00	10.88	0.00	18.86	127.82	7.98	0.21	0.05		0.58	
11/26/07	3.78	127.81	0.00	10.08	0.00	18.86	119.46	12.55	0.33	0.11		0.45	
11/30/07	17.75	118.66	0.00	21.47	0.00	18.86	121.44	15.14	0.40	0.10	0.09	0.59	0.51
12/3/07	0.00	121.45	0.00	16.83	0.00	18.86	119.06	2.03	0.05	0.02		0.89	
12/7/07	0.00	118.27	0.00	10.15	0.00	18.86	108.31	8.70	0.23	0.06		0.54	
12/10/07	0.00	109.90	0.00	8.04	0.00	9.43	106.72	10.82	0.29	0.10		0.43	
12/14/07	0.00	107.12	0.00	1.48	0.00	37.71	72.47	7.95	0.21	0.05		0.16	
12/17/07	20.77	74.07	0.00	41.48	4.35	9.43	101.54	17.00	0.45	0.15		0.71	
12/22/07	9.44	101.54	0.00	10.73	0.00	9.43	101.94	8.13	0.22	0.04		0.57	
12/24/07	0.00	105.12	0.00	6.41	0.00	9.43	101.94	3.02	0.08	0.04		0.68	
12/28/07	4.91	101.94	0.00	4.50	0.00	13.05	92.78	9.84	0.26	0.07	0.07	0.31	0.54

Irrigation Master Spreadsheet 4S

Date	Volume of Rain (P) [liters]	Initial Drum Volume (S1B) [liters]	Volume of water added (G) [liters]	Water containers volume (F) [liters]	Water Lost volume (F) [liters]	Volume of Irrigation (I) [liters]	Post Irrigation Drum Volume (S2B) [liters]	ΣET [liters]	ΣET [in] delta	ET [in/day]	ET (Monthly Average) [in/day]	f Factor	f Factor (Monthly Average)
1/8/07	1.89	91.19	0.00	115.61	0.00	0.00	202.68	-	-	-		-	
1/12/07	0.38	202.68	0.00	0.00	0.00	9.43	193.53	0.38	0.01	-		-	
1/15/07	0.38	193.13	0.00	0.00	0.00	9.43	182.38	9.81	0.26	0.09		0.00	
1/19/07	1.13	182.34	0.00	0.00	0.00	9.43	172.79	10.56	0.28	0.07		0.00	
1/22/07	0.38	172.82	0.00	0.87	0.00	9.43	163.23	8.94	0.24	0.08		0.09	
1/26/07	43.05	163.26	0.00	34.29	0.00	0.00	195.52	18.18	0.48	0.12		0.65	
1/29/07	5.29	195.52	0.00	0.00	0.00	9.43	183.97	5.29	0.14	0.05	0.08	0.00	0.15
2/2/07	13.22	183.97	0.00	8.33	0.00	9.43	182.77	14.32	0.38	0.09		0.37	
2/5/07	4.53	182.77	0.00	12.76	0.00	9.43	182.77	1.20	0.03	0.01		0.91	
2/9/07	0.38	182.38	0.00	4.15	0.00	9.43	177.20	5.66	0.15	0.04		0.42	
2/11/07	0.00	177.60	0.00	0.00	0.00	9.43	166.42	9.43	0.25	0.12		0.00	
2/16/07	33.98	166.45	0.00	23.21	0.00	9.43	179.59	20.20	0.54	0.13		0.53	
2/19/07	2.64	180.38	0.00	0.67	0.00	9.43	170.03	11.40	0.30	0.10		0.06	
2/23/07	0.00	169.63	0.00	0.41	0.00	9.43	160.87	9.02	0.24	0.06		0.04	
2/26/07	0.38	160.87	0.00	0.00	0.00	9.43	149.72	9.81	0.26	0.09	0.08	0.00	0.29
3/2/07	5.66	149.72	0.00	0.00	0.00	9.43	140.96	15.09	0.40	0.10		0.00	
3/5/07	4.91	140.96	0.00	0.00	0.00	9.43	130.61	14.34	0.38	0.13		0.00	
3/9/07	0.00	131.01	0.00	0.00	0.00	9.43	121.85	9.43	0.25	0.06		0.00	
3/12/07	0.38	121.85	0.00	0.00	0.00	9.43	112.29	9.81	0.26	0.09		0.00	
3/16/07	33.98	112.29	0.00	5.98	0.00	0.00	117.48	37.44	0.99	0.25		0.14	
3/19/07	0.00	117.47	0.00	0.00	0.00	18.86	97.56	0.00	0.00	-		-	

Date	Volume of Rain (P) [liters]	Initial Drum Volume (S1B) [liters]	Volume of water added (G) [liters]	Water containers volume (F) [liters]	Water Lost volume (F) [liters]	Volume of Irrigation (I) [liters]	Post Irrigation Drum Volume (S2B) [liters]	ΣET [liters]	ΣET [in] delta	ET [in/day]	ET (Monthly Average) [in/day]	f Factor	f Factor (Monthly Average)
3/23/07	0.38	97.56	0.00	2.18	0.00	18.86	81.63	17.06	0.45	0.11		0.11	
3/26/07	0.00	81.63	0.00	2.44	0.00	18.86	62.92	16.42	0.43	0.14		0.13	
3/30/07	0.00	62.92	0.00	2.90	0.00	18.86	47.39	15.96	0.42	0.11	0.12	0.15	0.07
4/2/07	7.93	46.99	0.00	5.66	0.00	18.86	31.86	21.13	0.56	0.19		0.21	
4/6/07	2.64	32.25	33.36	2.76	0.00	18.86	49.38	18.74	0.50	0.12		0.13	
4/9/07	0.00	48.58	0.00	0.81	0.00	18.86	29.87	18.04	0.48	0.16		0.04	
4/13/07	15.86	29.88	0.00	10.76	0.00	18.86	22.30	23.95	0.63	0.16		0.31	
4/16/07	28.32	22.30	0.00	18.86	0.00	0.00	36.63	28.32	0.75	0.19		0.40	
4/20/07	0.00	36.63	0.00	0.00	0.00	18.86	18.48	0.00	0.00	-		-	
4/23/07	3.78	18.48	34.81	0.00	0.00	18.86	35.04	22.63	0.60	0.20		0.00	
4/27/07	0.00	35.04	0.00	0.99	0.00	18.86	17.12	17.87	0.47	0.12		0.05	
4/30/07	0.00	16.33	37.71	0.15	0.00	18.86	33.45	18.71	0.50	0.17	0.16	0.01	0.14
5/4/07	0.00	33.45	0.00	0.00	0.00	18.86	15.29	18.86	0.50	0.12		0.00	
5/7/07	29.45	19.11	0.00	7.69	0.00	0.00	25.48	40.62	1.08	0.36		0.16	
5/11/07	0.00	25.48	18.86	0.00	0.00	18.86	24.91	0.00	0.00	-		-	
5/14/07	0.38	24.91	18.86	0.09	0.00	18.86	24.91	19.15	0.51	0.17		0.00	
5/18/07	9.06	20.71	18.86	4.32	0.00	18.86	25.48	23.60	0.62	0.16		0.15	
5/22/07	4.53	24.69	21.76	6.03	0.00	18.86	32.62	17.35	0.46	0.11		0.26	
5/25/07	2.27	32.62	0.00	1.10	0.00	18.86	14.34	20.02	0.53	0.18		0.05	
5/29/07	0.38	14.34	37.71	0.00	0.00	18.86	31.03	19.23	0.51	0.13	0.17	0.00	0.08
6/1/07	0.00	31.03	37.71	0.00	0.00	37.71	32.24	18.86	0.50	0.17		0.00	
6/5/07	64.57	32.24	0.00	72.53	0.00	18.86	82.83	29.76	0.79	0.20		0.71	
6/8/07	31.72	82.83	0.00	22.57	0.00	18.86	86.01	28.01	0.74	0.25		0.45	

Date	Volume of Rain (P) [liters]	Initial Drum Volume (S1B) [liters]	Volume of water added (G) [liters]	Water containers volume (F) [liters]	Water Lost volume (F) [liters]	Volume of Irrigation (I) [liters]	Post Irrigation Drum Volume (S2B) [liters]	ΣET [liters]	ΣET [in] delta	ET [in/day]	ET (Monthly Average) [in/day]	f Factor	f Factor (Monthly Average)
6/12/07	46.07	86.01	0.00	37.68	0.00	0.00	121.05	27.24	0.72	0.18		0.58	
6/15/07	80.81	121.05	0.00	67.09	0.00	28.29	158.07	13.72	0.36	0.12		0.83	
6/19/07	0.00	158.07	0.00	16.36	0.00	28.29	144.12	11.92	0.32	0.08		0.58	
6/22/07	12.84	144.15	0.00	17.17	0.00	28.29	133.80	23.95	0.63	0.21		0.42	
6/26/07	4.53	133.80	0.00	10.18	0.00	28.29	114.68	22.63	0.60	0.15		0.31	
6/29/07	12.84	113.09	0.00	9.63	0.00	28.29	94.77	31.49	0.83	0.28	0.18	0.23	0.46
7/3/07	15.86	94.77	0.00	21.61	0.00	28.29	88.80	22.53	0.60	0.15		0.49	
7/6/07	67.59	88.80	0.00	86.16	0.00	28.29	146.54	9.71	0.26	0.09		0.90	
7/10/07	29.08	144.94	0.00	29.01	0.00	28.29	144.15	28.35	0.75	0.19		0.51	
7/13/07	26.81	144.15	0.00	24.66	0.00	28.29	141.36	30.44	0.81	0.27		0.45	
7/17/07	135.18	140.96	0.00	134.17	58.02	28.29	187.95	29.29	0.78	0.19		0.82	
7/20/07	26.43	150.92	0.00	34.81	4.35	28.29	152.91	19.90	0.53	0.18		0.64	
7/24/07	115.17	152.91	0.00	103.28	75.43	0.00	211.05	40.18	1.06	0.27		0.72	
7/27/07	48.71	211.05	0.00	37.71	37.71	0.00	211.05	11.00	0.29	0.10		0.77	
7/31/07	20.77	210.65	0.00	10.73	11.75	28.29	181.18	10.03	0.27	0.07	0.17	0.52	0.65
8/3/07	117.81	181.20	0.00	126.19	89.93	28.29	189.54	19.90	0.53	0.18		0.86	
8/6/07	0.00	189.54	0.00	19.15	0.00	28.29	179.19	9.14	0.24	0.08		0.68	
8/10/07	0.00	180.78	0.00	6.24	0.00	28.29	158.88	22.05	0.58	0.15		0.22	
8/14/07	3.02	158.90	0.00	5.66	0.00	28.29	134.59	25.65	0.68	0.17		0.18	
8/17/07	0.00	134.99	0.00	6.38	0.00	28.29	113.89	21.90	0.58	0.19		0.23	
8/21/07	0.00	114.28	0.00	6.89	0.00	28.29	92.00	21.40	0.57	0.14		0.24	
8/24/07	0.00	91.98	0.00	4.64	0.00	23.21	74.07	23.64	0.63	0.21		0.16	
8/27/07	35.87	74.07	0.00	27.99	0.00	18.86	80.83	31.09	0.82	0.27		0.47	

Date	Volume of Rain (P) [liters]	Initial Drum Volume (S1B) [liters]	Volume of water added (G) [liters]	Water containers volume (F) [liters]	Water Lost volume (F) [liters]	Volume of Irrigation (I) [liters]	Post Irrigation Drum Volume (S2B) [liters]	ΣET [liters]	ΣET [in] delta	ET [in/day]	ET (Monthly Average) [in/day]	f Factor	f Factor (Monthly Average)
8/30/07	7.17	80.44	0.00	6.53	0.00	28.29	59.73	19.50	0.52	0.17	0.17	0.25	0.37
9/5/07	33.23	59.73	0.00	35.07	0.00	18.86	74.46	26.44	0.70	0.14		0.57	
9/7/07	2.64	74.86	0.00	2.76	0.00	18.86	59.73	18.74	0.50	0.25		0.13	
9/10/07	33.98	59.73	0.00	33.94	0.00	18.86	73.65	18.90	0.50	0.17		0.64	
9/14/07	7.55	73.67	0.00	12.40	0.00	18.86	67.28	14.01	0.37	0.09		0.47	
9/17/07	18.50	67.30	0.00	16.83	0.00	18.86	64.51	20.53	0.54	0.18		0.45	
9/21/07	77.03	65.30	0.00	81.95	7.25	18.86	121.45	13.93	0.37	0.09		0.85	
9/24/07	37.00	121.45	0.00	36.12	0.00	18.86	136.98	19.74	0.52	0.17		0.65	
9/28/07	1.13	136.58	0.00	14.58	0.00	18.86	132.20	5.41	0.14	0.04	0.14	0.73	0.53
10/1/07	9.44	132.20	0.00	8.92	0.00	18.86	121.45	19.38	0.51	0.17		0.32	
10/5/07	50.98	121.45	0.00	53.67	0.00	37.71	138.18	16.16	0.43	0.11		0.77	
10/8/07	65.32	138.18	0.00	91.09	21.47	18.86	187.15	11.95	0.32	0.11		0.88	
10/12/07	0.00	187.15	0.00	12.98	0.00	18.86	181.58	5.87	0.16	0.04		0.69	
10/15/07	0.00	181.18	0.00	2.96	0.00	18.86	165.25	15.90	0.42	0.14		0.16	
10/19/07	0.00	165.25	0.00	4.93	0.00	18.86	151.32	13.92	0.37	0.09		0.26	
10/22/07	11.33	150.92	0.00	9.86	0.00	18.86	140.96	20.32	0.54	0.18		0.33	
10/26/07	4.15	142.95	0.00	11.60	0.00	18.86	134.59	11.41	0.30	0.08		0.50	
10/29/07	67.21	134.19	0.00	78.33	8.70	18.86	183.49	7.74	0.21	0.07	0.11	0.91	0.54
11/2/07	32.47	183.17	0.00	43.23	5.80	18.86	202.29	8.10	0.21	0.05		0.84	
11/5/07	0.00	202.29	0.00	12.55	0.00	18.86	194.32	6.31	0.17	0.06		0.67	
11/9/07	0.00	194.32	0.00	8.41	0.00	18.86	183.17	10.44	0.28	0.07		0.45	
11/12/07	0.00	183.17	18.86	6.24	0.00	18.86	187.15	12.62	0.33	0.11		0.33	
11/16/07	0.00	187.15	0.00	0.00	0.00	18.86	168.84	18.86	0.50	0.12		0.00	

Date	Volume of Rain (P) [liters]	Initial Drum Volume (S1B) [liters]	Volume of water added (G) [liters]	Water containers volume (F) [liters]	Water Lost volume (F) [liters]	Volume of Irrigation (I) [liters]	Post Irrigation Drum Volume (S2B) [liters]	ΣET [liters]	ΣET [in] delta	ET [in/day]	ET (Monthly Average) [in/day]	f Factor	f Factor (Monthly Average)
11/19/07	0.00	168.84	0.00	1.02	0.00	18.86	149.72	17.84	0.47	0.16		0.05	
11/23/07	0.00	149.72	0.00	10.44	0.00	18.86	140.96	8.41	0.22	0.06		0.55	
11/26/07	3.78	140.96	0.00	9.94	0.00	18.86	131.41	12.70	0.34	0.11		0.44	
11/30/07	17.75	131.01	0.00	21.38	0.00	18.86	133.80	15.22	0.40	0.10	0.09	0.58	0.44
12/3/07	0.00	133.80	0.00	16.54	0.00	18.86	130.21	2.32	0.06	0.02		0.88	
12/7/07	0.00	130.61	0.00	10.30	0.00	18.86	121.05	8.56	0.23	0.06		0.55	
12/10/07	0.00	123.04	0.00	7.98	0.00	9.43	119.06	10.88	0.29	0.10		0.42	
12/14/07	0.00	118.27	0.00	1.33	0.00	37.71	82.83	8.09	0.21	0.05		0.14	
12/17/07	20.77	83.22	0.00	41.19	0.00	9.43	112.29	17.29	0.46	0.15		0.70	
12/22/07	9.44	112.29	0.00	10.73	0.00	9.43	113.09	8.13	0.22	0.04		0.57	
12/24/07	0.00	116.27	0.00	7.11	0.00	9.43	113.09	2.32	0.06	0.03		0.75	
12/28/07	4.91	113.09	0.00	7.11	0.00	9.43	110.70	7.23	0.19	0.05	0.06	0.50	0.56

Irrigation Master Spreadsheet 4G

Date	Volume of Rain (P) [liters]	Initial Drum Volume (S1B) [liters]	Volume of water added (G) [liters]	Water containers volume (F) [liters]	Water Lost volume (F) [liters]	Volume of Irrigation (I) [liters]	Post Irrigation Drum Volume (S2B) [liters]	ΣET [liters]	ΣET [in] delta	ET [in/day]	ET (Monthly Average) [in/day]	f Factor	f Factor (Monthly Average)
1/8/07	1.89	84.02	0.00	104.18	0.00	0.00	180.37	-	-	-		-	
1/12/07	0.38	180.38	0.00	0.00	0.00	9.43	171.23	0.38	0.01	-		-	
1/15/07	0.38	170.83	0.00	1.38	0.00	9.43	162.47	8.43	0.22	0.07		0.14	
1/19/07	1.13	162.86	0.00	0.15	0.00	9.43	153.71	10.42	0.28	0.07		0.01	
1/22/07	0.38	153.31	0.00	0.15	0.00	9.43	144.15	9.66	0.26	0.09		0.01	
1/26/07	43.05	143.75	0.00	32.75	0.00	0.00	174.41	19.72	0.52	0.13		0.62	
1/29/07	5.29	174.41	0.00	0.12	0.00	9.43	164.06	5.17	0.14	0.05	0.08	0.02	0.16
2/2/07	13.22	164.06	0.00	7.34	0.00	9.43	162.07	15.30	0.41	0.10		0.32	
2/5/07	4.53	162.07	0.00	10.15	0.00	9.43	160.87	3.81	0.10	0.03		0.73	
2/9/07	0.38	160.47	0.00	3.25	0.00	9.43	155.30	6.56	0.17	0.04		0.33	
2/11/07	0.00	154.90	0.00	0.00	0.00	9.43	143.75	9.43	0.25	0.12		0.00	
2/16/07	33.98	144.15	0.00	20.66	0.00	9.43	154.90	22.76	0.60	0.15		0.48	
2/19/07	2.64	154.90	0.00	0.58	0.00	9.43	145.34	11.49	0.30	0.10		0.05	
2/23/07	0.00	144.94	0.00	0.03	0.00	9.43	136.18	9.40	0.25	0.06		0.00	
2/26/07	0.38	136.18	0.00	0.00	0.00	9.43	125.03	9.81	0.26	0.09	0.09	0.00	0.24
3/2/07	5.66	125.03	0.00	0.00	0.00	9.43	116.27	15.09	0.40	0.10		0.00	
3/5/07	4.91	116.27	0.00	0.00	0.00	9.43	106.72	14.34	0.38	0.13		0.00	
3/9/07	0.00	106.32	0.00	0.00	0.00	9.43	97.16	9.43	0.25	0.06		0.00	
3/12/07	0.38	97.16	0.00	0.00	0.00	9.43	87.60	9.81	0.26	0.09		0.00	
3/16/07	33.98	87.60	0.00	5.73	0.00	0.00	93.18	37.68	1.00	0.25		0.13	
3/19/07	0.00	92.78	0.00	0.00	0.00	18.86	72.87	0.00	0.00	-		-	

Date	Volume of Rain (P) [liters]	Initial Drum Volume (S1B) [liters]	Volume of water added (G) [liters]	Water containers volume (F) [liters]	Water Lost volume (F) [liters]	Volume of Irrigation (I) [liters]	Post Irrigation Drum Volume (S2B) [liters]	ΣET [liters]	ΣET [in] delta	ET [in/day]	ET (Monthly Average) [in/day]	f Factor	f Factor (Monthly Average)
3/23/07	0.38	72.07	0.00	1.74	0.00	18.86	56.15	17.49	0.46	0.12		0.09	
3/26/07	0.00	56.13	47.87	2.29	0.00	47.87	56.54	16.56	0.44	0.15		0.12	
3/30/07	0.00	56.54	0.00	20.02	0.00	18.86	57.34	27.85	0.74	0.18	0.13	0.42	0.10
4/2/07	7.93	56.94	0.00	7.18	0.00	18.86	43.80	19.61	0.52	0.17		0.27	
4/6/07	2.64	43.40	37.71	2.61	0.00	18.86	64.11	18.89	0.50	0.13		0.12	
4/9/07	0.00	63.71	0.00	0.84	0.00	18.86	45.00	18.02	0.48	0.16		0.04	
4/13/07	15.86	46.99	0.00	7.83	0.00	18.86	35.04	26.88	0.71	0.18		0.23	
4/16/07	28.32	35.04	0.00	17.62	0.00	0.00	50.97	29.55	0.78	0.26		0.37	
4/20/07	0.00	50.97	0.00	0.00	0.00	18.86	31.86	0.00	0.00	-		-	
4/23/07	3.78	31.06	37.71	0.03	0.00	18.86	49.38	22.60	0.60	0.20		0.00	
4/27/07	0.00	49.38	0.00	0.81	0.00	18.86	30.66	18.04	0.48	0.12		0.04	
4/30/07	0.00	31.46	37.71	0.00	0.00	18.86	46.99	18.86	0.50	0.17	0.17	0.00	0.13
5/4/07	0.00	46.99	0.00	0.00	0.00	15.96	28.67	18.86	0.50	0.12		0.00	
5/7/07	29.45	28.67	0.00	11.17	0.00	0.00	37.27	34.24	0.91	0.23		0.25	
5/11/07	0.00	37.27	0.00	0.00	0.00	21.76	15.93	0.00	0.00	-		-	
5/14/07	0.38	15.93	18.86	0.81	0.00	18.86	15.13	21.32	0.56	0.19		0.04	
5/18/07	9.06	15.13	18.86	4.15	0.00	18.86	19.11	23.77	0.63	0.16		0.15	
5/22/07	4.53	19.11	18.86	6.80	0.00	18.86	22.30	16.58	0.44	0.11		0.29	
5/25/07	2.27	22.30	0.00	1.57	0.00	18.86	5.18	19.56	0.52	0.17		0.07	
5/29/07	0.38	5.18	37.71	0.29	0.00	18.86	22.70	18.94	0.50	0.13	0.16	0.02	0.12
6/1/07	0.00	22.68	37.71	0.00	0.00	37.71	23.89	18.86	0.50	0.17		0.00	
6/5/07	64.57	23.89	0.00	72.03	0.00	18.86	77.66	30.25	0.80	0.20		0.70	
6/8/07	31.72	77.65	0.00	20.45	0.00	18.86	78.84	30.12	0.80	0.27		0.40	

Date	Volume of Rain (P) [liters]	Initial Drum Volume (S1B) [liters]	Volume of water added (G) [liters]	Water containers volume (F) [liters]	Water Lost volume (F) [liters]	Volume of Irrigation (I) [liters]	Post Irrigation Drum Volume (S2B) [liters]	ΣET [liters]	ΣET [in] delta	ET [in/day]	ET (Monthly Average) [in/day]	f Factor	f Factor (Monthly Average)
6/12/07	46.07	77.66	0.00	36.52	0.00	0.00	110.67	28.40	0.75	0.19		0.56	
6/15/07	80.81	110.67	0.00	67.52	0.00	28.29	152.08	13.28	0.35	0.12		0.84	
6/19/07	0.00	152.08	0.00	11.60	0.00	28.29	133.41	16.68	0.44	0.11		0.41	
6/22/07	12.84	133.40	0.00	17.38	0.00	28.29	122.65	23.75	0.63	0.21		0.42	
6/26/07	4.53	121.45	0.00	10.04	0.00	28.29	101.54	22.78	0.60	0.15		0.31	
6/29/07	12.84	104.33	0.00	8.92	0.00	28.29	84.42	32.20	0.85	0.28	0.19	0.22	0.43
7/3/07	15.86	84.42	0.00	18.57	0.00	28.29	74.07	25.58	0.68	0.17		0.42	
7/6/07	67.59	74.07	0.00	75.43	0.00	28.29	121.05	20.45	0.54	0.18		0.79	
7/10/07	29.08	121.05	0.00	44.39	0.00	28.29	135.77	12.97	0.34	0.09		0.77	
7/13/07	26.81	135.79	0.00	19.73	0.00	28.29	127.82	35.37	0.94	0.31		0.36	
7/17/07	135.18	127.82	0.00	142.15	95.30	28.29	145.74	21.32	0.56	0.14		0.87	
7/20/07	26.43	145.74	0.00	30.17	0.00	28.29	147.33	24.55	0.65	0.22		0.55	
7/24/07	115.17	147.33	0.00	103.86	49.32	0.00	202.68	39.60	1.05	0.26		0.72	
7/27/07	48.71	202.68	0.00	37.71	23.21	0.00	216.62	11.00	0.29	0.10		0.77	
7/31/07	20.77	216.62	0.00	12.04	12.04	28.29	186.36	8.73	0.23	0.06	0.17	0.58	0.65
8/3/07	117.81	186.36	0.00	123.29	102.99	28.29	177.60	22.80	0.60	0.20		0.84	
8/6/07	0.00	177.60	0.00	20.31	0.00	28.29	171.23	7.98	0.21	0.07		0.72	
8/10/07	0.00	171.23	0.00	6.67	0.00	28.29	150.12	21.61	0.57	0.14		0.24	
8/14/07	3.02	150.11	0.00	11.60	0.00	28.29	130.99	19.70	0.52	0.13		0.37	
8/17/07	0.00	131.01	0.00	3.70	0.00	28.29	106.32	24.59	0.65	0.22		0.13	
8/21/07	0.00	105.92	0.00	6.09	0.00	28.29	83.62	22.19	0.59	0.15		0.22	
8/24/07	0.00	83.22	0.00	4.28	0.00	23.21	64.91	24.01	0.64	0.21		0.15	
8/27/07	35.87	65.30	0.00	31.77	5.22	18.86	71.68	27.31	0.72	0.24		0.54	

Date	Volume of Rain (P) [liters]	Initial Drum Volume (S1B) [liters]	Volume of water added (G) [liters]	Water containers volume (F) [liters]	Water Lost volume (F) [liters]	Volume of Irrigation (I) [liters]	Post Irrigation Drum Volume (S2B) [liters]	ΣET [liters]	ΣET [in] delta	ET [in/day]	ET (Monthly Average) [in/day]	f Factor	f Factor (Monthly Average)
8/30/07	7.17	70.88	0.00	5.00	0.00	28.29	48.58	21.03	0.56	0.19	0.17	0.19	0.38
9/5/07	33.23	48.98	0.00	33.97	0.00	18.86	62.52	27.54	0.73	0.15		0.55	
9/7/07	2.64	62.12	0.00	2.32	0.00	18.86	46.57	19.18	0.51	0.25		0.11	
9/10/07	33.98	46.59	0.00	38.08	5.80	18.86	59.70	14.76	0.39	0.13		0.72	
9/14/07	7.55	59.73	0.00	10.81	0.00	18.86	51.73	15.60	0.41	0.10		0.41	
9/17/07	18.50	51.77	0.00	14.88	0.00	18.86	46.99	22.48	0.60	0.20		0.40	
9/21/07	77.03	46.99	0.00	78.33	4.35	18.86	103.53	17.56	0.47	0.12		0.82	
9/24/07	37.00	103.53	0.00	34.09	0.00	18.86	117.07	21.77	0.58	0.19		0.61	
9/28/07	1.13	117.07	0.00	13.05	0.00	18.86	112.69	6.93	0.18	0.05	0.15	0.65	0.53
10/1/07	9.44	112.69	0.00	6.53	0.00	18.86	99.15	21.77	0.58	0.19		0.23	
10/5/07	50.98	99.55	0.00	55.41	0.00	37.71	117.47	14.42	0.38	0.10		0.79	
10/8/07	65.32	115.08	0.00	83.98	0.00	18.86	178.00	19.05	0.50	0.17		0.82	
10/12/07	0.00	178.00	0.00	13.05	0.00	18.86	172.02	5.80	0.15	0.04		0.69	
10/15/07	0.00	172.02	0.00	1.60	0.00	18.86	153.71	17.26	0.46	0.15		0.08	
10/19/07	0.00	153.71	0.00	3.70	0.00	18.86	139.37	15.16	0.40	0.10		0.20	
10/22/07	11.33	139.77	0.00	6.96	0.00	18.86	126.63	23.22	0.61	0.20		0.23	
10/26/07	4.15	126.63	0.00	10.73	0.00	18.86	119.06	12.28	0.33	0.08		0.47	
10/29/07	67.21	119.06	0.00	75.28	8.70	18.86	165.65	10.79	0.29	0.10	0.13	0.87	0.49
11/2/07	32.47	166.05	0.00	36.12	0.00	18.86	182.38	15.21	0.40	0.10		0.70	
11/5/07	0.00	182.38	0.00	11.89	0.00	18.86	174.57	6.96	0.18	0.06		0.63	
11/9/07	0.00	174.57	0.00	6.38	0.00	18.86	162.07	12.47	0.33	0.08		0.34	
11/12/07	0.00	162.07	0.00	4.82	0.00	18.86	146.94	14.04	0.37	0.12		0.26	
11/16/07	0.00	146.54	0.00	5.95	0.00	18.86	133.80	12.91	0.34	0.09		0.32	
11/19/07	0.00	133.40	0.00	5.80	0.00	18.86	119.46	13.05	0.35	0.12		0.31	
11/23/07	0.00	119.46	0.00	8.70	0.00	18.86	108.71	10.15	0.27	0.07		0.46	
11/26/07	3.78	109.11	0.00	13.05	0.00	18.86	101.54	9.58	0.25	0.08		0.58	

Date	Volume of Rain (P) [liters]	Initial Drum Volume (S1B) [liters]	Volume of water added (G) [liters]	Water containers volume (F) [liters]	Water Lost volume (F) [liters]	Volume of Irrigation (I) [liters]	Post Irrigation Drum Volume (S2B) [liters]	ΣET [liters]	ΣET [in] delta	ET [in/day]	ET (Monthly Average) [in/day]	f Factor	f Factor (Monthly Average)
11/30/07	17.75	101.54	0.00	19.44	0.00	18.86	101.94	17.17	0.45	0.11	0.09	0.53	0.46
12/3/07	0.00	101.94	0.00	15.00	0.00	18.86	97.16	3.86	0.10	0.03		0.80	
12/7/07	0.00	97.96	0.00	9.57	0.00	18.86	88.40	9.28	0.25	0.06		0.51	
12/10/07	0.00	88.40	0.00	5.95	0.00	9.43	83.22	12.91	0.34	0.11		0.32	
12/14/07	0.00	83.22	0.00	2.90	0.00	37.71	49.38	6.53	0.17	0.04		0.31	
12/17/07	20.77	49.38	0.00	34.23	0.00	9.43	71.68	24.25	0.64	0.21		0.59	
12/22/07	9.44	71.68	0.00	9.92	0.00	9.43	71.68	8.95	0.24	0.05		0.53	
12/24/07	0.00	75.66	0.00	5.66	0.00	9.43	72.47	3.77	0.10	0.02		0.60	
12/28/07	4.91	72.47	0.00	5.80	0.00	9.43	67.69	8.54	0.23	0.05	0.07	0.40	0.51

Irrigation Master Spreadsheet C1

Date	Volume of Rain (P) [liters]	Water containers volume (F) [liters]	ΣET [liters]	ET [in/day]	ET (Monthly Average) [in/day]	f Factor	f Factor (Monthly Average)
1/9/11	1.89	0.00	1.89	-		-	
1/13/11	0.76	0.44	0.32	0.00		0.58	
1/16/11	0.38	0.35	0.03	0.00		0.92	
1/20/11	1.51	1.16	0.35	0.00		0.77	
1/23/11	0.38	0.00	0.38	0.00		-	
1/27/11	43.05	42.79	0.26	0.00		0.99	
1/30/11	5.29	5.08	0.21	0.00	0.00	0.96	0.84
2/3/11	13.22	12.91	0.31	0.00		0.98	
2/6/11	4.53	3.48	1.05	0.01		0.77	
2/10/11	0.38	0.00	0.38	0.00		-	
2/12/11	0.00	0.00	0.00	0.00		-	
2/17/11	33.98	33.98	0.01	0.00		1.00	
2/20/11	2.64	2.52	0.12	0.00		0.95	
2/24/11	0.00	0.06	-0.06	0.00		-	
2/27/11	0.38	0.00	0.38	0.00	0.00	-	0.92
3/3/11	5.66	4.84	0.82	0.01		0.86	
3/6/11	4.91	4.87	0.04	0.00		0.99	
3/10/11	0.00	0.00	0.00	0.00		-	
3/13/11	0.38	0.12	0.26	0.00		-	
3/17/11	33.98	33.65	0.33	0.00		0.99	
3/20/11	0.00	0.00	0.00	0.00		-	
3/24/11	0.38	0.12	0.26	0.00		-	
3/27/11	0.00	0.00	0.00	0.00		-	

Date	Volume of Rain (P) [liters]	Water containers volume (F) [liters]	ΣET [liters]	ET [in/day]	ET (Monthly Average) [in/day]	f Factor	f Factor (Monthly Average)
3/31/11	0.00	0.00	0.00	0.00	0.00	-	0.95
4/3/11	7.93	7.11	0.82	0.01		0.90	
4/7/11	2.64	2.32	0.32	0.00		0.88	
4/10/11	0.00	0.00	0.00	0.00		-	
4/14/11	15.86	7.83	8.03	0.05		0.49	
4/17/11	28.32	28.14	0.18	0.00		0.99	
420/2007	0.00	0.00	0.00	0.00		-	
423/2007	3.78	3.77	0.00	0.00		1.00	
4/28/11	0.00	0.00	0.00	0.00		-	
5/1/11	0.00	0.00	0.00	0.00	0.01	-	0.85
5/5/11	0.00	0.00	0.00	0.00		-	
5/8/11	29.45	28.89	0.56	0.00		0.98	
5/12/11	0.00		0.00	0.00		-	
5/15/11	0.38	0.36	0.01	0.00		0.96	
5/19/11	9.06	8.56	0.50	0.00		0.94	
5/23/11	4.53	4.35	0.18	0.00		0.96	
5/26/11	2.27	2.03	0.23	0.00		0.90	
5/30/11	0.38	0.29	0.09	0.00	0.00	0.77	0.92
6/2/11	0.00	0.00	0.00	0.00		-	
6/6/11	64.57	64.04	0.53	0.00		0.99	
6/9/11	31.72	31.40	0.31	0.00		0.99	
6/13/11	46.07	45.98	0.09	0.00		1.00	
6/16/11	80.81	80.79	0.01	0.00		1.00	
6/20/11	0.00	0.00	0.00	0.00		-	
6/23/11	12.84	12.62	0.22	0.00		0.98	
6/27/11	4.53	4.09	0.44	0.00		0.90	
6/30/11	12.84	12.62	0.22	0.00	0.00	0.98	0.98

Date	Volume of Rain (P) [liters]	Water containers volume (F) [liters]	ΣET [liters]	ET [in/day]	ET (Monthly Average) [in/day]	f Factor	f Factor (Monthly Average)
7/4/11	15.86	15.52	0.34	0.00		0.98	
7/7/11	67.59	63.01	4.58	0.03		0.93	
7/11/11	29.08	28.87	0.21	0.00		0.99	
7/14/11	26.81	26.46	0.35	0.00		0.99	
7/18/11	135.18	135.04	0.14	0.00		1.00	
7/21/11	26.43	26.25	0.18	0.00		0.99	
7/25/11	115.17	113.14	2.03	0.01		0.98	
7/28/11	48.71	46.71	2.00	0.01		0.96	
8/1/11	20.77	20.74	0.03	0.00	0.01	1.00	0.98
8/3/11	117.81	117.78	0.03	0.00		1.00	
8/7/11	0.00	0.00	0.00	0.00		-	
8/11/11	0.00	0.00	0.00	0.00		-	
8/15/11	3.02	2.84	0.18	0.00		0.94	
8/18/11	2.64	0.00	2.64	0.02		-	
8/22/11	0.00	0.00	0.00	0.00		-	
8/25/11	0.00	0.00	0.00	0.00		-	
8/28/11	35.87	32.64	3.24	0.02		0.91	
8/31/11	7.17	6.82	0.36	0.00	0.00	0.95	0.95
9/6/11	31.72	31.39	0.33	0.00		0.99	
9/8/11	2.64	2.47	0.18	0.00		0.93	
9/11/11	33.98	33.80	0.19	0.00		0.99	
9/15/11	7.55	7.33	0.23	0.00		0.97	
9/18/11	18.50	18.28	0.23	0.00		0.99	
9/21/07	77.03	76.73	0.30	0.00		1.00	
9/24/07	37.00	36.84	0.16	0.00		1.00	
9/28/07	1.13	0.72	0.41	0.00	0.00	0.64	0.94
10/1/07	9.44	9.28	0.16	0.00		0.98	

Date	Volume of Rain (P) [liters]	Water containers volume (F) [liters]	ΣET [liters]	ET [in/day]	ET (Monthly Average) [in/day]	f Factor	f Factor (Monthly Average)
10/5/07	50.98	49.32	1.66	0.01		0.97	
10/8/07	65.32	63.61	1.72	0.01		0.97	
10/12/07	0.00	0.00	0.00	0.00		-	
10/15/07	0.00	0.00	0.00	0.00		-	
10/19/07	0.00	0.00	0.00	0.00		-	
10/22/07	11.33	11.05	0.28	0.00		0.98	
10/26/07	4.15	4.06	0.09	0.00		0.98	
10/29/07	67.21	65.64	1.58	0.01	0.00	0.98	0.98
11/2/07	32.47	30.75	1.72	0.01		0.95	
11/5/07	0.0	0.00	0.00	0.00		-	
11/9/07	0.0	0.00	0.00	0.00		-	
11/12/07	0.0	0.00	0.00	0.00		-	
11/16/07	0.0	0.00	0.00	0.00		-	
11/19/07	0.0	0.00	0.00	0.00		-	
11/23/07	0.0	0.00	0.00	0.00		-	
11/26/07	3.78	3.41	0.37	0.00		0.90	
11/30/07	17.75	17.55	0.20	0.00	0.00	0.99	0.95
12/3/07	0.00	0.00	0.00	0.00		-	
12/7/07	0.00	0.00	0.00	0.00		-	
12/10/07	0.00	0.00	0.00	0.00		-	
12/14/07	0.00	0.00	0.00	0.00		-	
12/17/07	20.77	20.37	0.40	0.00		0.98	
12/22/07	9.44	8.70	0.74	0.00		0.92	
12/24/07	0.00	0.00	0.00	0.00		-	
12/28/07	4.91	4.79	0.12	0.00	0.00	0.98	0.96

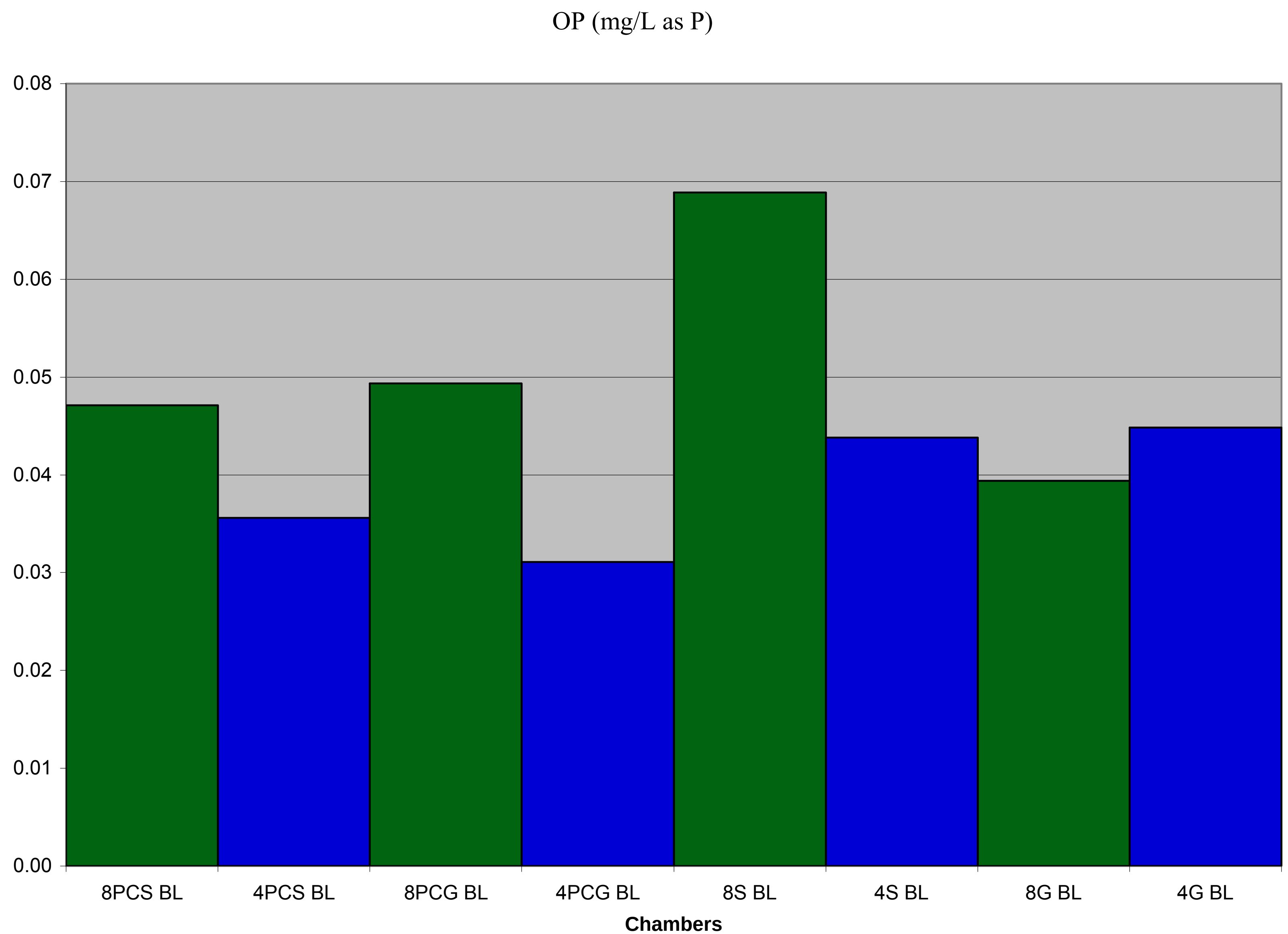
Irrigation Master Spreadsheet C2							
Date	Volume of Rain (P) [liters]	Water containers volume (F) [liters]	ΣET [liters]	ET [in/day]	ET (Monthly Average) [in/day]	f Factor	f Factor (Monthly Average)
1/9/11	1.89	0.00	1.89	-		-	
1/13/11	0.38	0.36	0.01	0.00		0.96	
1/16/11	0.38	0.00	0.38	0.00		-	
1/20/11	1.13	1.09	0.04	0.00		0.96	
1/23/11	0.38	0.07	0.31	0.00		-	
1/27/11	43.05	41.34	1.71	0.01		0.96	
1/30/11	5.29	4.71	0.57	0.01	0.00	0.89	0.94
2/3/11	13.22	9.63	3.58	0.02		0.73	
2/6/11	4.53	3.77	0.76	0.01		0.83	
2/10/11	0.38	0.09	0.29	0.00		-	
2/12/11	0.00	0.00	0.00	0.00		-	
2/17/11	33.98	29.30	4.68	0.03		0.86	
2/20/11	2.64	2.32	0.32	0.00		0.88	
2/24/11	0.00	0.00	0.00	0.00		-	
2/27/11	0.38	0.00	0.38	0.00	0.01	-	0.83
3/3/11	5.66	4.76	0.91	0.01		0.84	
3/6/11	4.91	3.60	1.31	0.01		0.73	
3/10/11	0.00	0.00	0.00	0.00		-	
3/13/11	0.38	0.06	0.32	0.00		-	
3/17/11	33.98	32.75	1.23	0.01		0.96	
3/20/11	0.00	0.00	0.00	0.00		-	

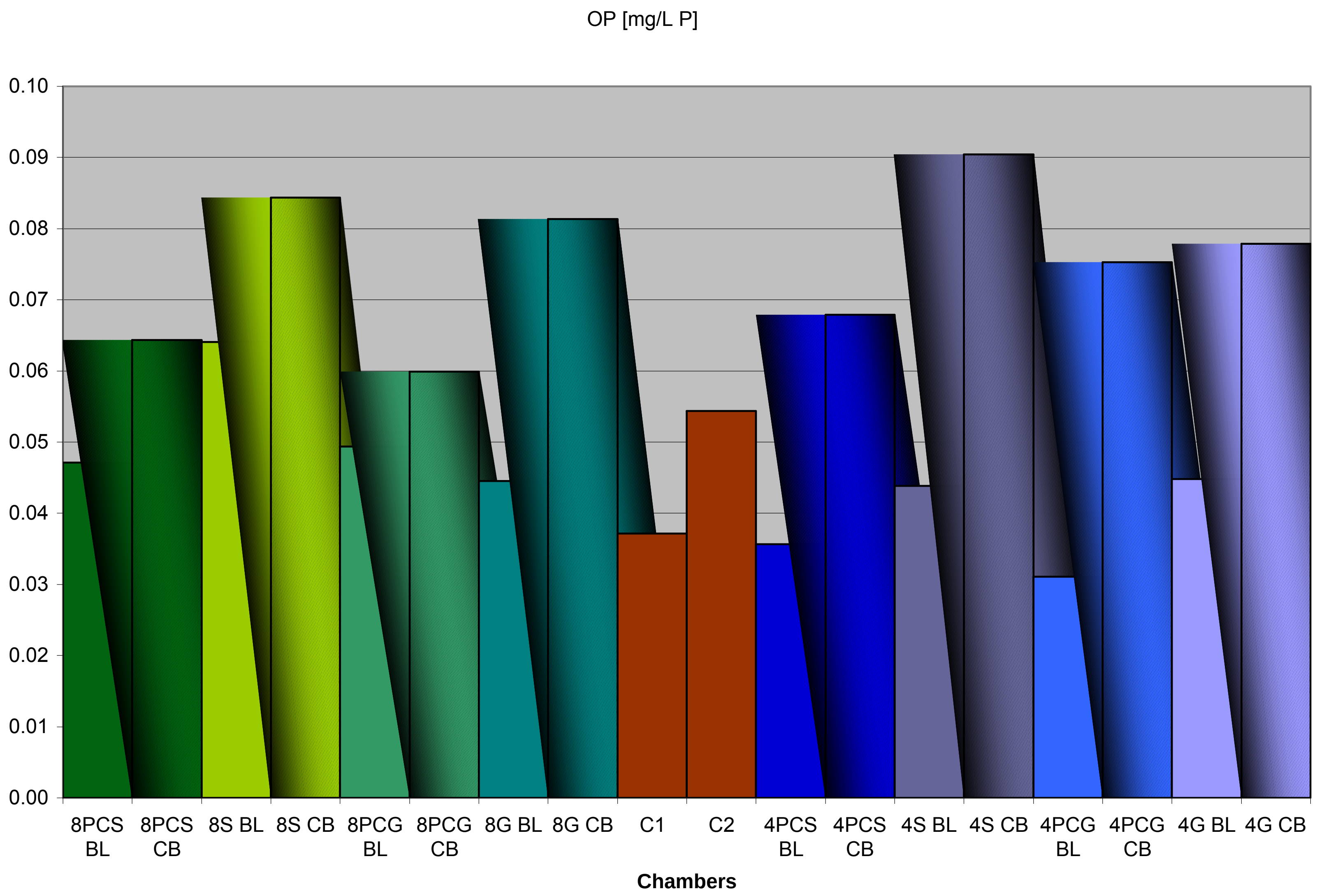
Date	Volume of Rain (P) [liters]	Water containers volume (F) [liters]	ΣET [liters]	ET [in/day]	ET (Monthly Average) [in/day]	f Factor	f Factor (Monthly Average)
3/24/11	0.38	0.07	0.31	0.00		-	
3/27/11	0.00	0.00	0.00	0.00		-	
3/31/11	0.00	0.00	0.00	0.00	0.00	-	0.85
4/3/11	7.93	7.69	0.24	0.00		0.97	
4/7/11	2.64	2.29	0.35	0.00		0.87	
4/10/11	0.00	0.00	0.00	0.00		-	
4/14/11	15.86	15.78	0.08	0.00		1.00	
4/17/11	28.32	27.70	0.62	0.01		0.98	
420/2007	0.00	0.00	0.00	0.00		-	
423/2007	3.78	3.41	0.37	0.00		0.90	
4/28/11	0.00	0.00	0.00	0.00		-	
5/1/11	0.00	0.00	0.00	0.00	0.00	-	0.94
5/5/11	0.00	0.00	0.00	0.00		-	
5/8/11	29.45	29.33	0.12	0.00		1.00	
5/12/11	0.00	0.00	0.00	0.00		-	
5/15/11	0.38	0.36	0.01	0.00		0.96	
5/19/11	9.06	8.70	0.36	0.00		0.96	
5/23/11	4.53	4.35	0.18	0.00		0.96	
5/26/11	2.27	2.06	0.21	0.00		0.91	
5/30/11	0.38	0.36	0.01	0.00	0.00	0.96	0.96
6/2/11	0.00	0.00	0.00	0.00		-	
6/6/11	64.57	64.23	0.34	0.00		0.99	
6/9/11	31.72	31.33	0.39	0.00		0.99	
6/13/11	46.07	44.68	1.39	0.01		0.97	
6/16/11	80.81	71.34	9.47	0.08		0.88	
6/20/11	0.00	0.00	0.00	0.00		-	
6/23/11	12.84	12.27	0.57	0.01		0.96	

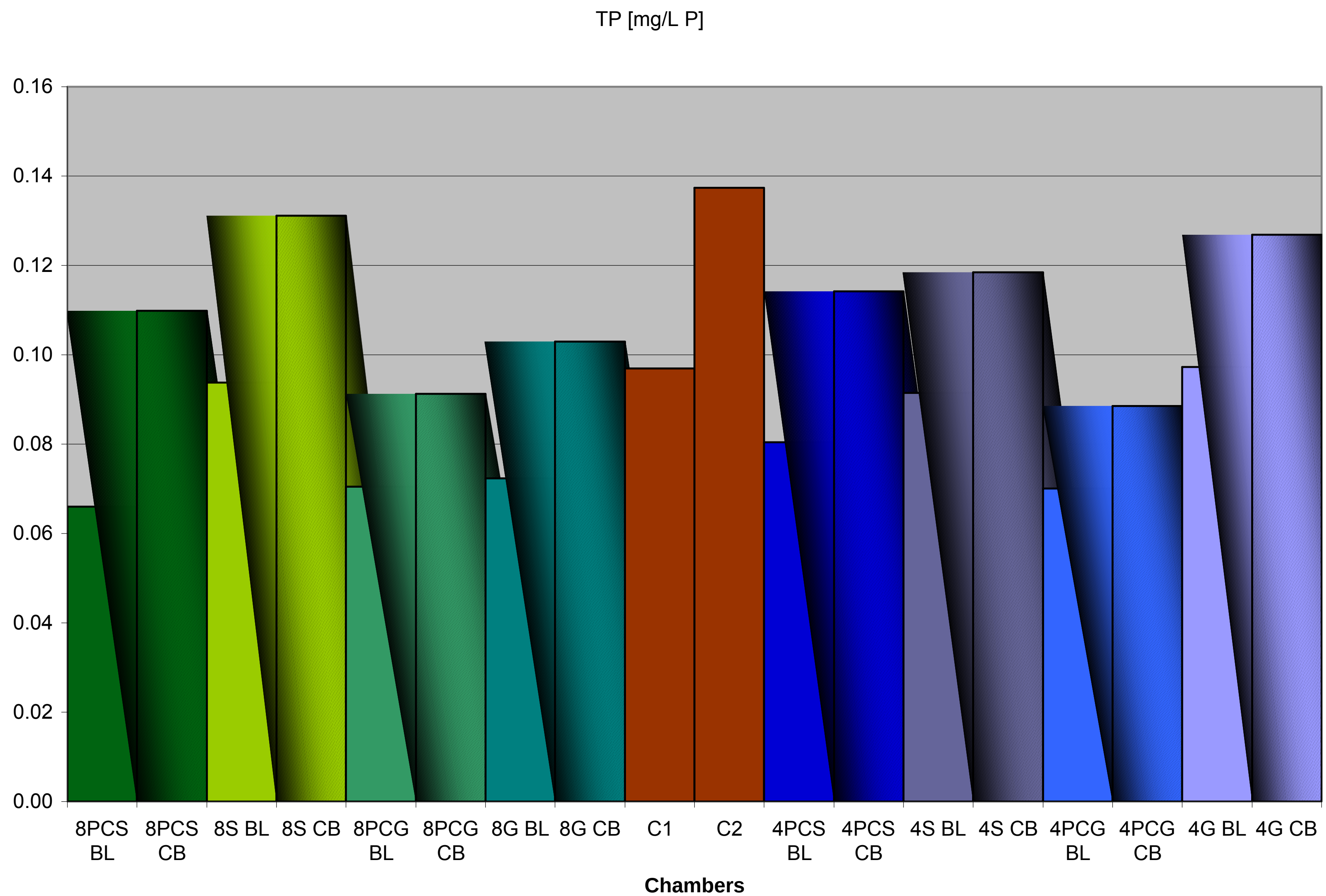
Date	Volume of Rain (P) [liters]	Water containers volume (F) [liters]	ΣET [liters]	ET [in/day]	ET (Monthly Average) [in/day]	f Factor	f Factor (Monthly Average)
6/27/11	4.53	4.21	0.32	0.00		0.93	
6/30/11	12.84	12.47	0.36	0.00	0.01	0.97	0.96
7/4/11	15.86	15.17	0.69	0.01		0.96	
7/7/11	67.59	67.54	0.05	0.00		1.00	
7/11/11	29.08	27.56	1.52	0.01		0.95	
7/14/11	26.81	26.05	0.76	0.01		0.97	
7/18/11	135.18	134.69	0.49	0.00		1.00	
7/20/11	26.43	25.96	0.47	0.00		0.98	
7/25/11	115.17	114.16	1.01	0.01		0.99	
7/28/11	48.71	48.59	0.12	0.00		1.00	
8/1/11	20.77	19.87	0.90	0.01	0.01	0.96	0.98
8/3/11	117.81	117.06	0.75	0.01		0.99	
8/7/11	0.00	0.00	0.00	0.00		-	
8/11/11	0.00	0.00	0.00	0.00		-	
8/15/11	3.02	2.61	0.41	0.00		0.86	
8/18/11	0.00	0.00	0.00	0.00		-	
8/22/11	0.00	0.00	0.00	0.00		-	
8/25/11	0.00	0.00	0.00	0.00		-	
8/28/11	35.87	35.39	0.48	0.00		0.99	
8/31/11	7.17	6.96	0.21	0.00	0.00	0.97	0.94
9/6/11	33.23	31.91	1.32	0.01		0.96	
9/8/11	2.64	2.32	0.32	0.00		0.88	
9/11/11	33.98	33.36	0.62	0.01		0.98	
9/15/11	7.55	7.25	0.30	0.00		0.96	
9/18/11	18.50	17.99	0.52	0.00		0.97	
9/21/07	77.03	76.88	0.15	0.00		1.00	
9/24/07	37.00	34.81	2.19	0.02		0.94	

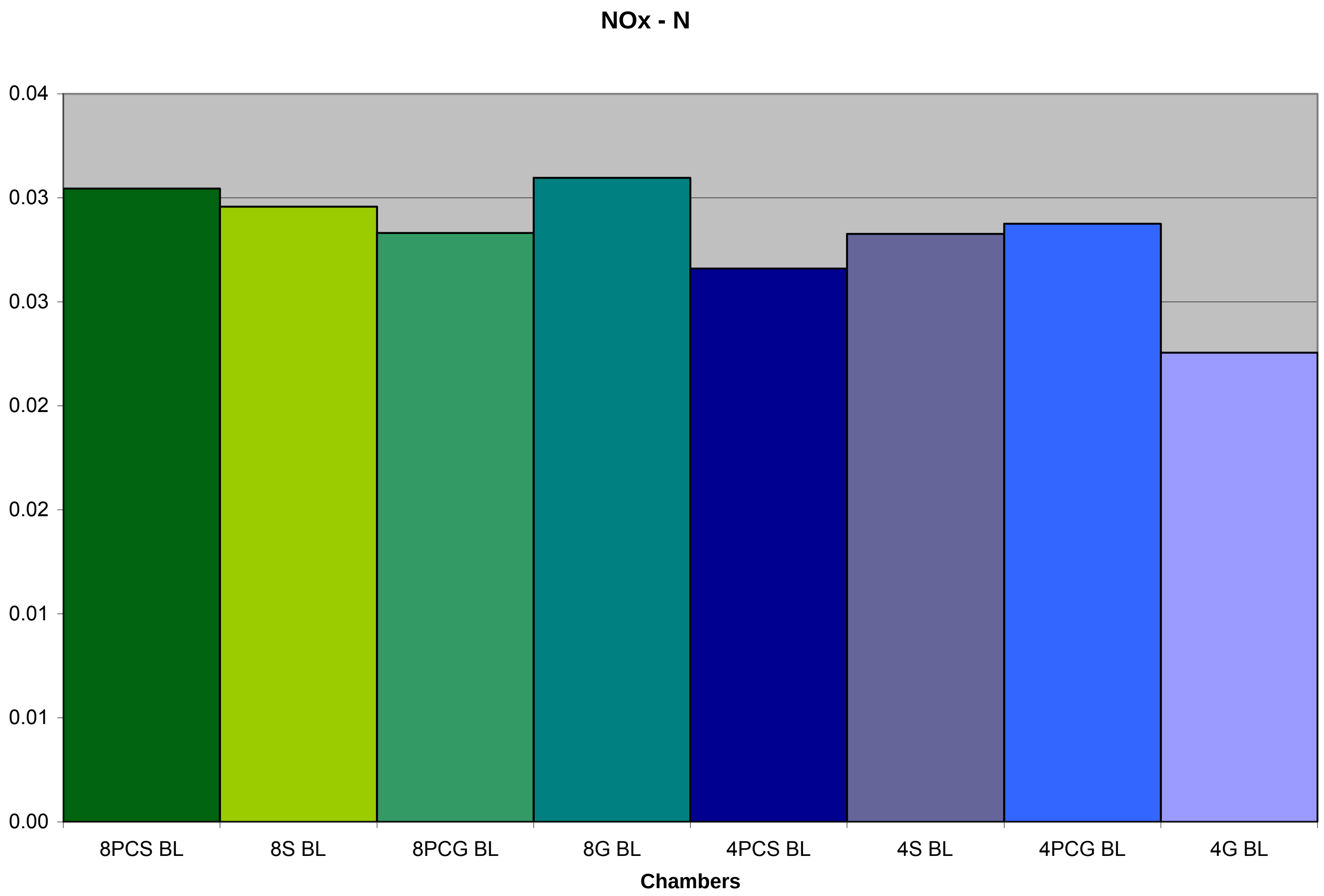
Date	Volume of Rain (P) [liters]	Water containers volume (F) [liters]	ΣET [liters]	ET [in/day]	ET (Monthly Average) [in/day]	f Factor	f Factor (Monthly Average)
9/28/07	1.13	1.02	0.12	0.00	0.01	0.90	0.95
10/1/07	9.44	9.43	0.01	0.00		1.00	
10/5/07	50.98	50.77	0.21	0.00		1.00	
10/8/07	65.32	64.77	0.56	0.00		0.99	
10/12/07	0.00	0.00	0.00	0.00		-	
10/15/07	0.00	0.00	0.00	0.00		-	
10/19/07	0.00	0.00	0.00	0.00		-	
10/22/07	11.33	11.23	0.10	0.00		0.99	
10/26/07	4.15	4.06	0.09	0.00		0.98	
10/29/07	67.21	67.16	0.05	0.00	0.00	1.00	0.99
11/2/07	32.47	32.20	0.27	0.00		0.99	
11/5/07	0	0.00	0.00	0.00		-	
11/9/07	0	0.00	0.00	0.00		-	
11/12/07	0	0.00	0.00	0.00		-	
11/16/07	0	0.00	0.00	0.00		-	
11/19/07	0	0.00	0.00	0.00		-	
11/23/07	0	0.00	0.00	0.00		-	
11/26/07	3.77	3.12	0.66	0.01		0.83	
11/30/07	17.74	16.68	1.07	0.01	0.00	0.94	0.92
12/3/07	0	0.00	0.00	0.00		-	
12/7/07	0	0.00	0.00	0.00		-	
12/10/07	0	0.00	0.00	0.00		-	
12/14/07	0	0.00	0.00	0.00		-	
12/17/07	20.76	19.44	1.33	0.01		0.94	
12/22/07	9.44	9.14	0.30	0.00		0.97	
12/24/07	0	0.00	0.00	0.00		-	
12/28/07	4.90	4.64	0.27	0.00	0.00	0.95	0.95

APPENDIX F: WATER QUALITY COMPARISONS

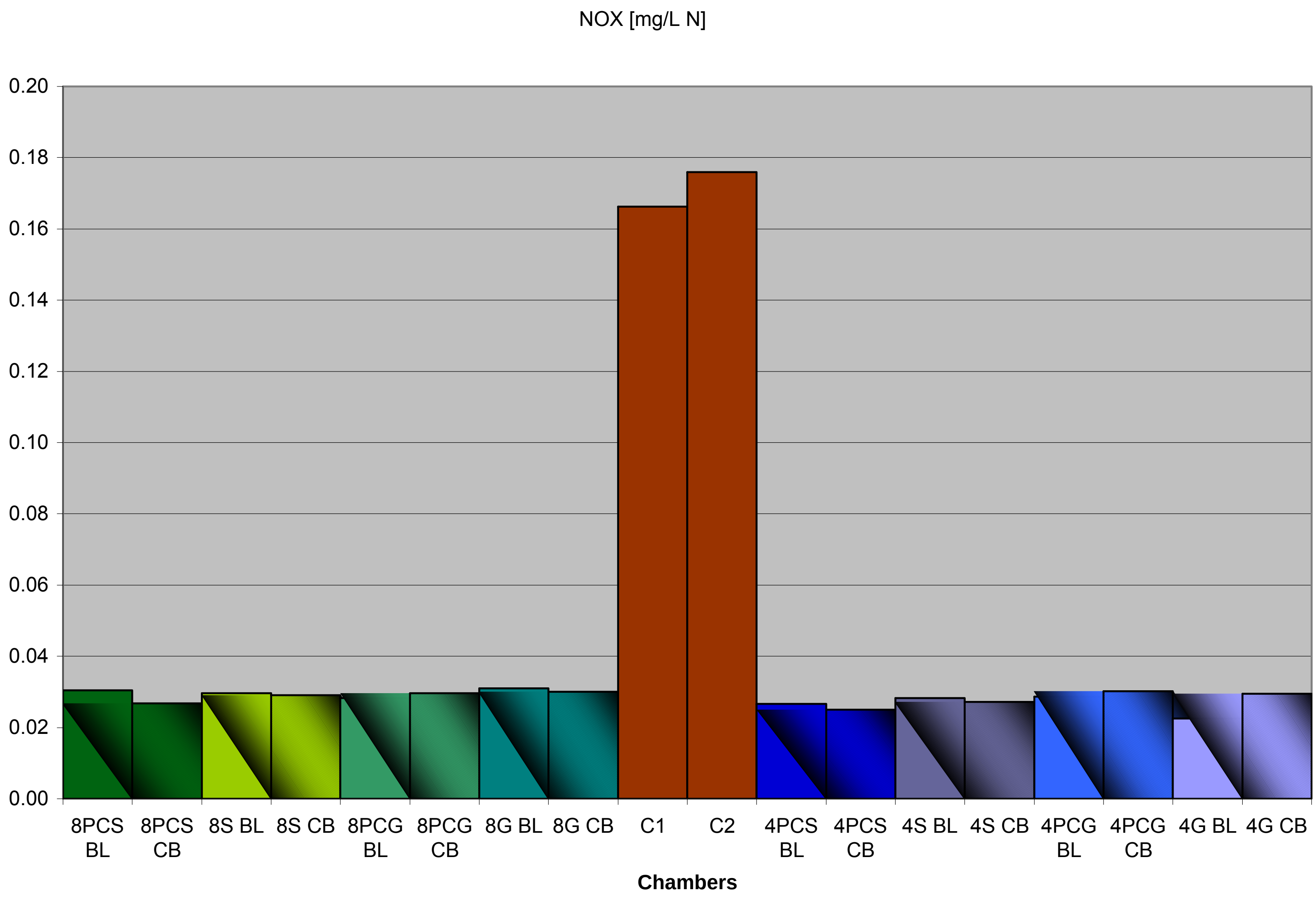

OP (mg/L as P)
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
8PCS BL
4PCS BL
8PCG BL
4PCG BL
8S BL
4S BL
8G BL
4G BL
Chambers


OP [mg/L P]
0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
8PCS BL
8PCS CB
8S BL
8S CB
8PCG BL
8PCG CB
8G BL
8G CB
C1
C2
4PCS BL
4PCS CB
4S BL
4S CB
4PCG BL
4PCG CB
4G BL
4G CB
Chambers

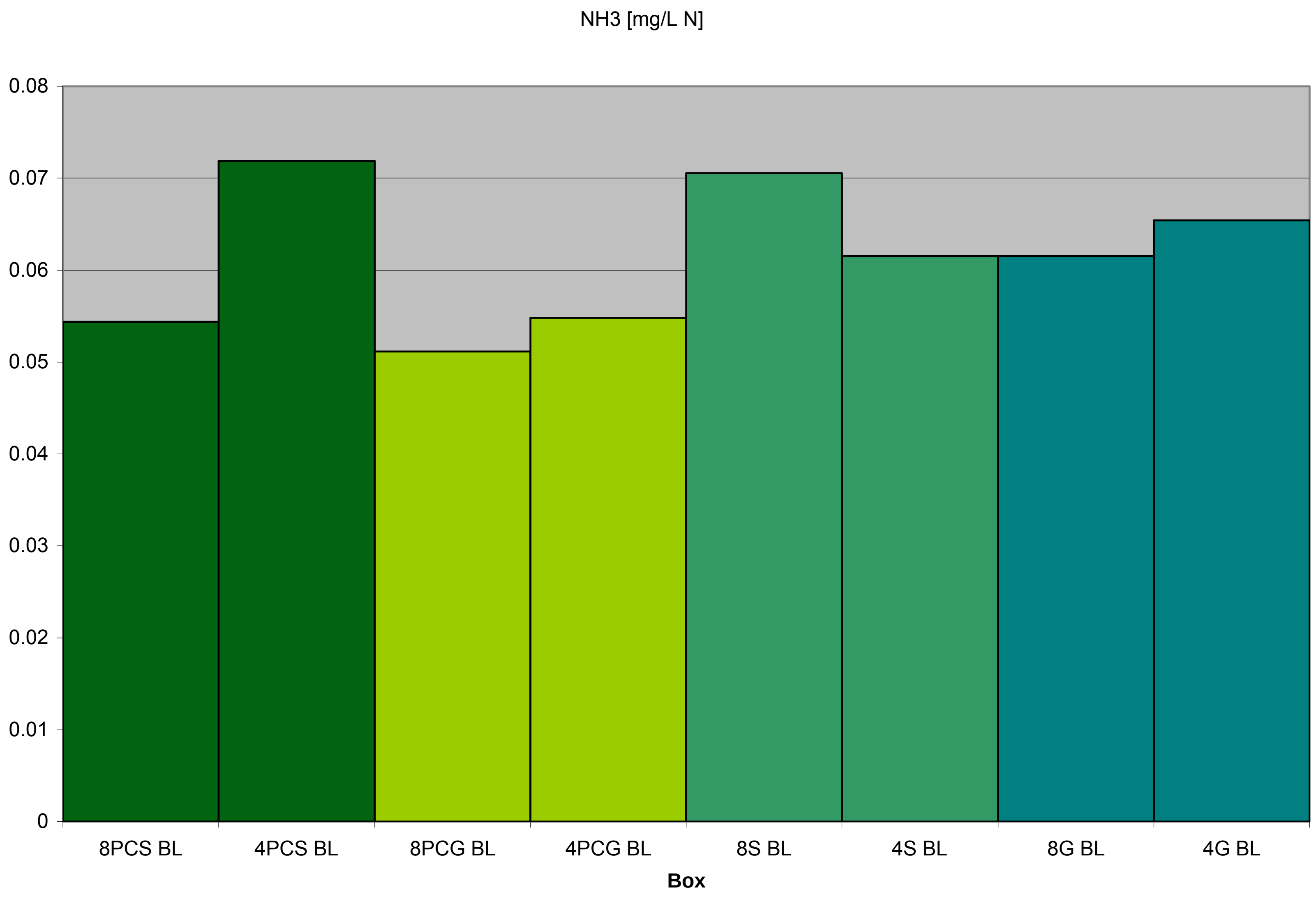

TP [mg/L P]
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
8PCS BL
8PCS CB
8S BL
8S CB
8PCG BL
8PCG CB
8G BL
8G CB
C1
C2
4PCS BL
4PCS CB
4S BL
4S CB
4PCG BL
4PCG CB
4G BL
4G CB
Chambers

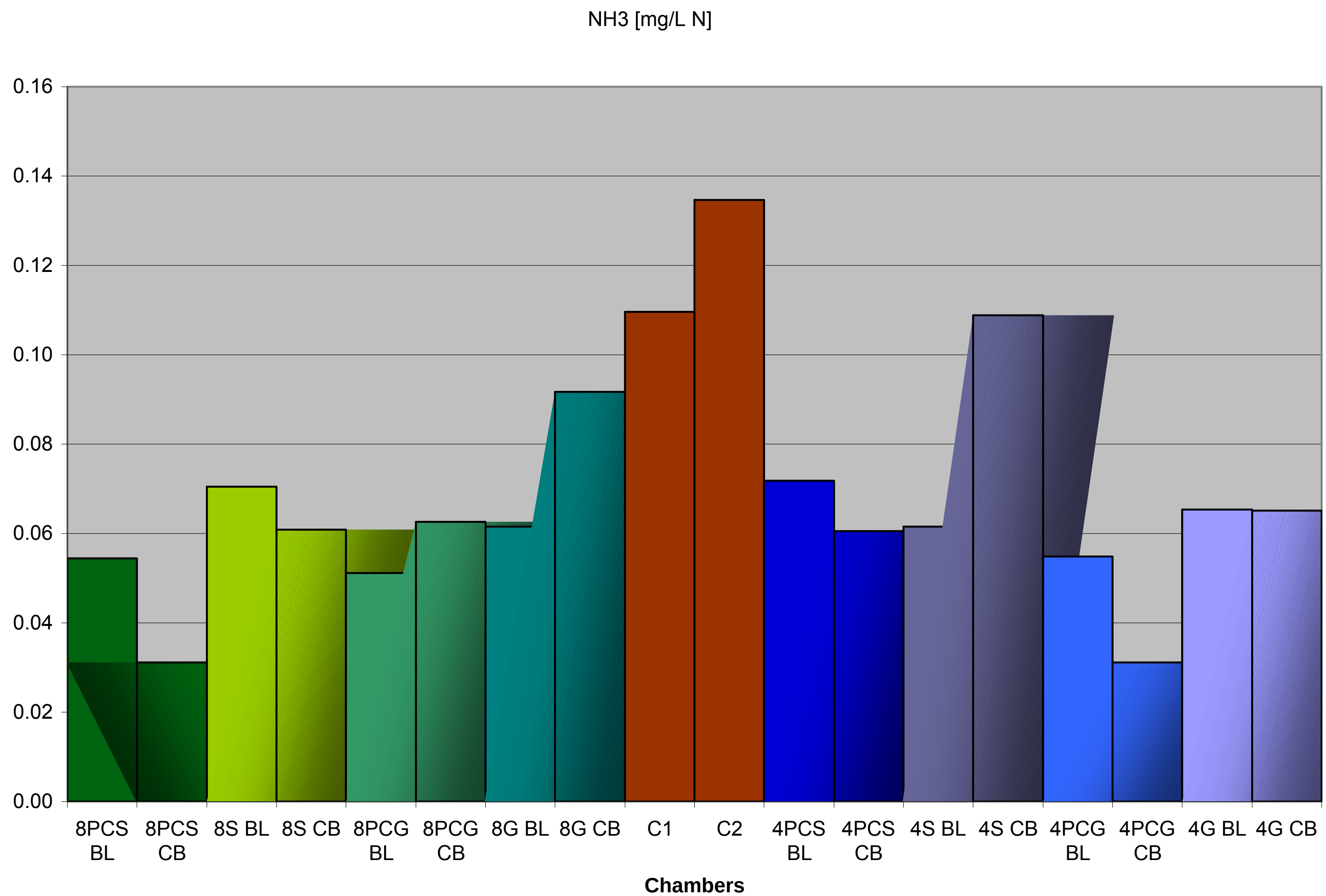


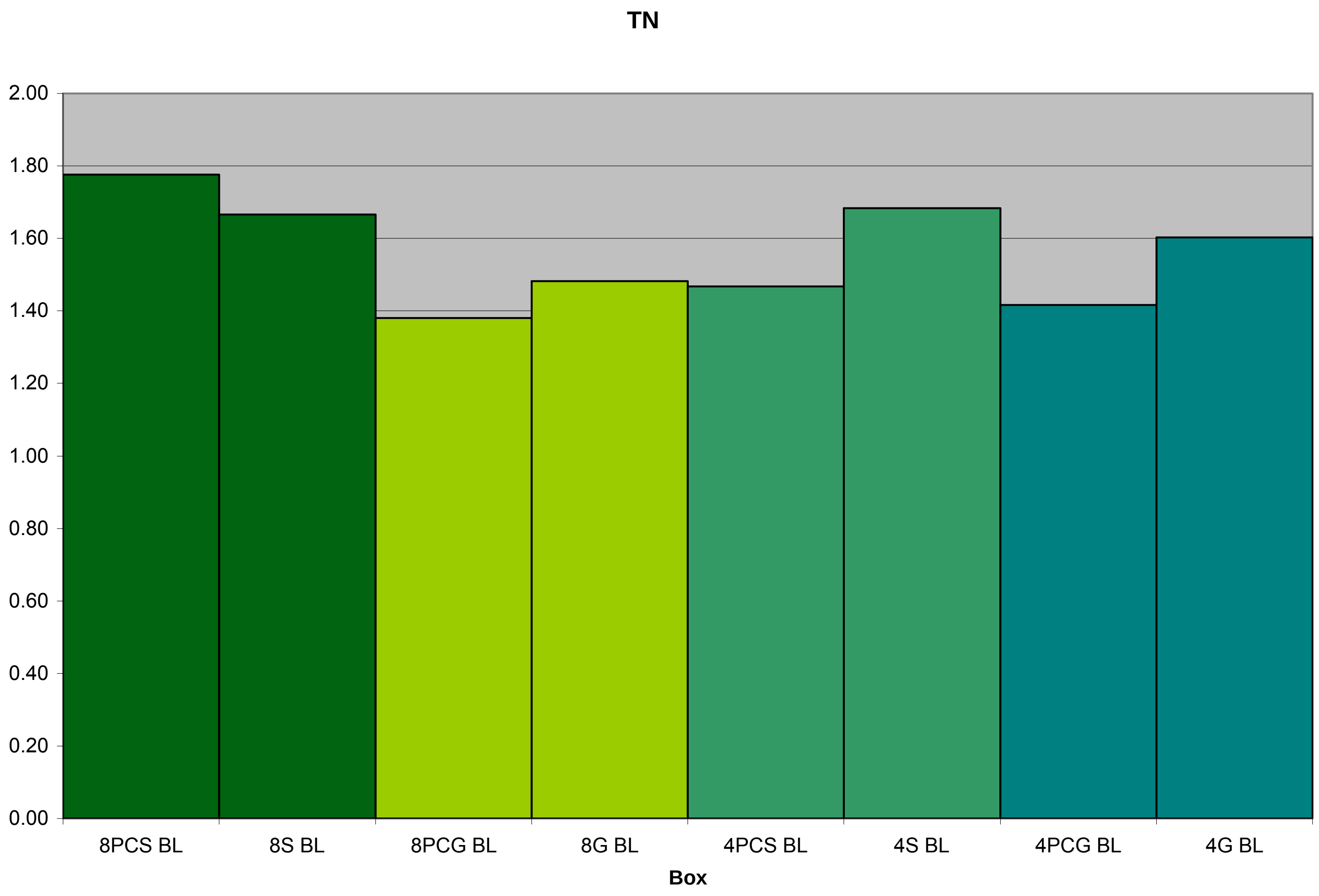
NOx - N
0.04
0.03
0.03
0.02
0.02
0.01
0.01
0.00
8PCS BL
8S BL
8PCG BL
8G BL
4PCS BL
4S BL
4PCG BL
4G BL
Chambers

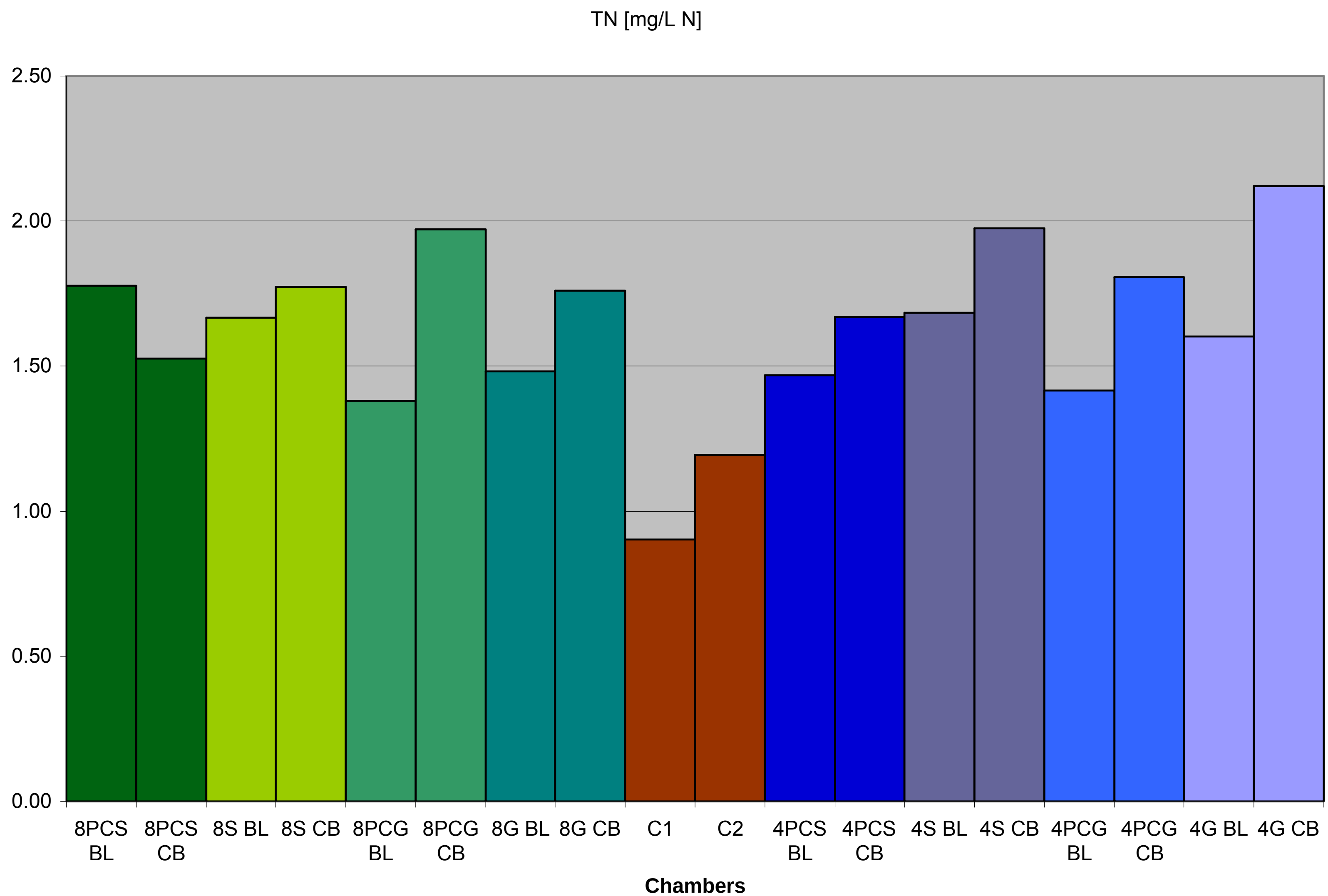


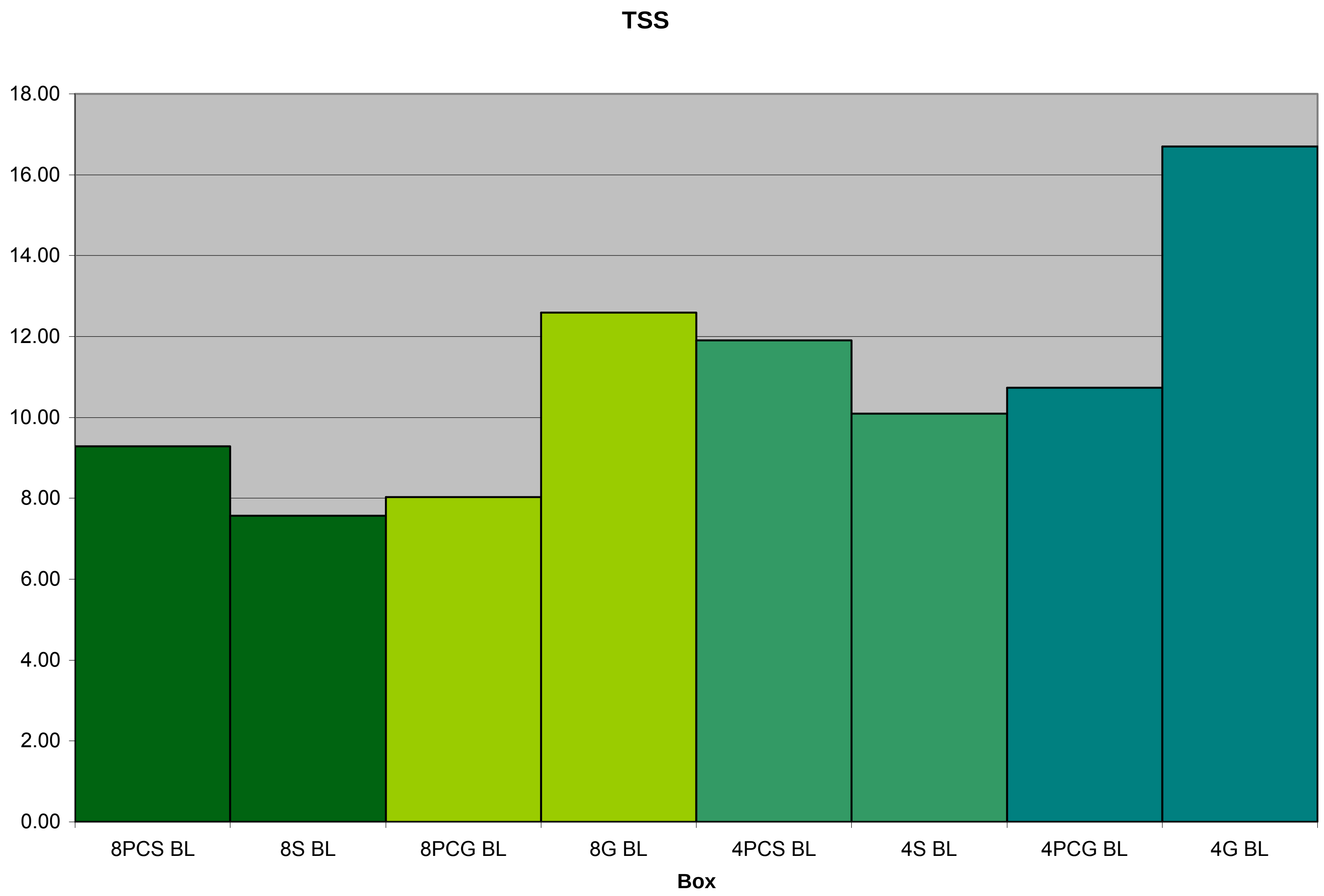
NOX [mg/L N]
0.20
0.18
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
8PCS BL
8PCS CB
8S BL
8S CB
8PCG BL
8PCG CB
8G BL
8G CB
C1
C2
4PCS BL
4PCS CB
4S BL
4S CB
4PCG BL
4PCG CB
4G BL
4G CB
Chambers

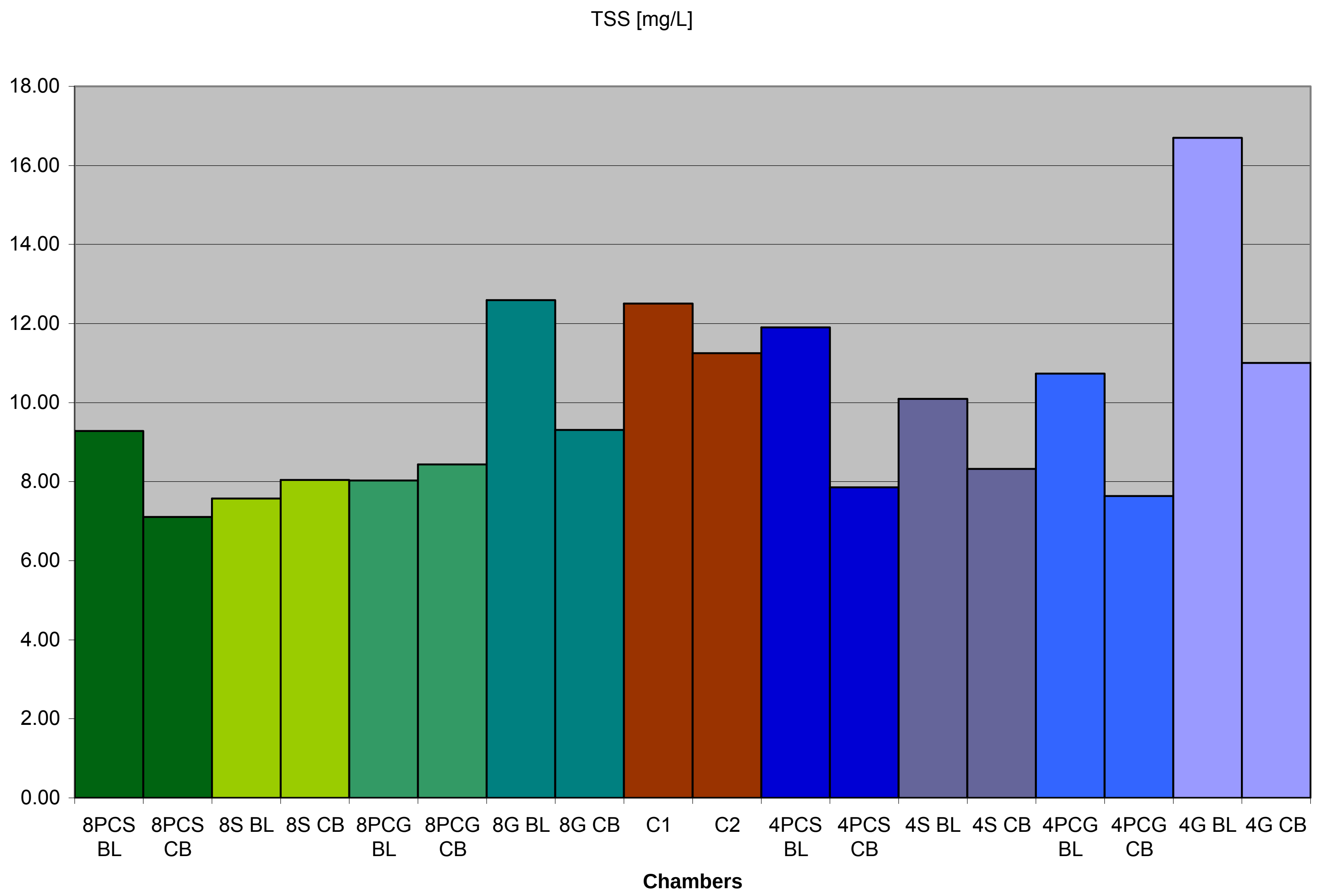

NH3 [mg/L N]
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
8PCS BL
4PCS BL
8PCG BL
4PCG BL
8S BL
4S BL
8G BL
4G BL
Box

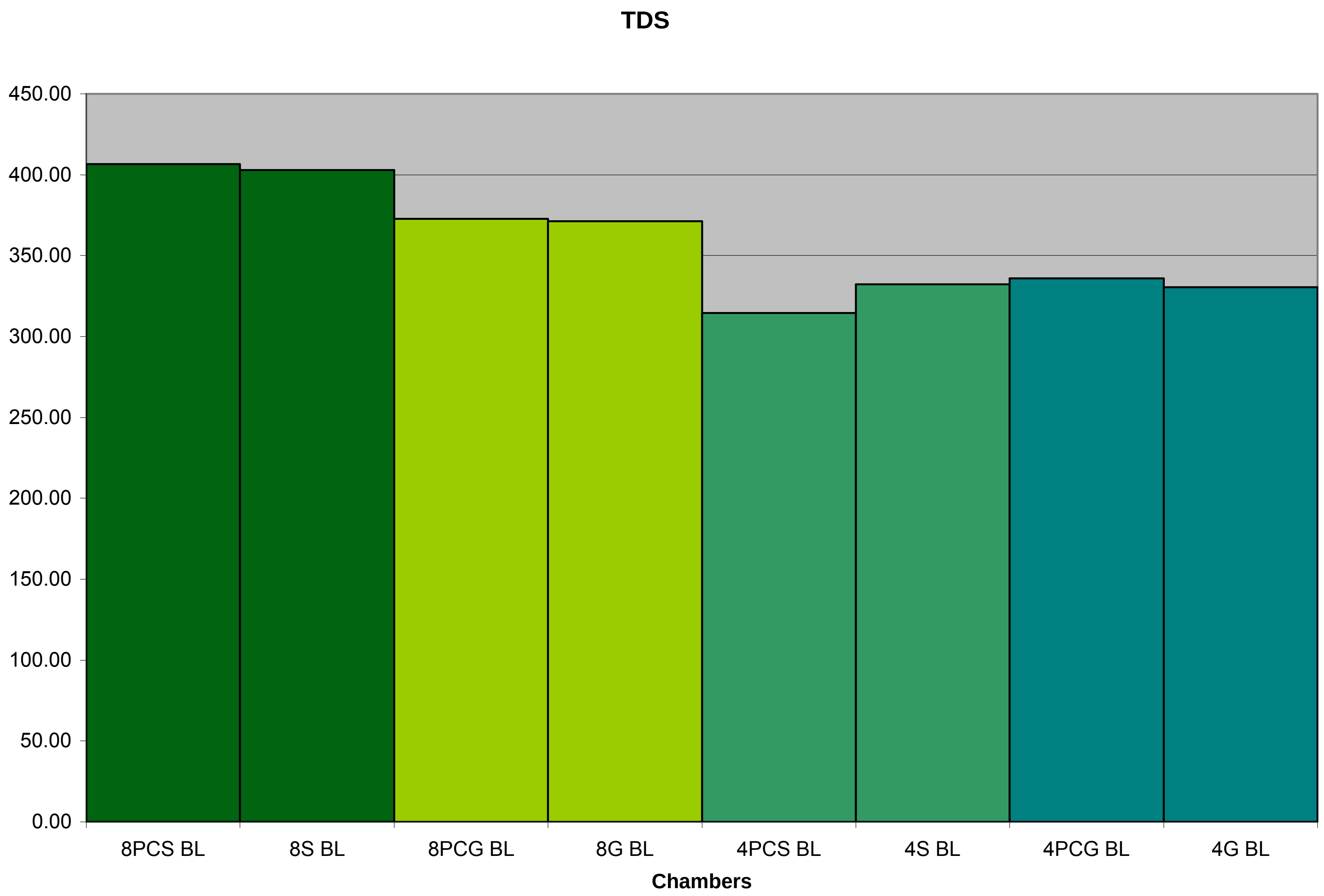

NH3 [mg/L N]
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
8PCS BL
8PCS CB
8S BL
8S CB
8PCG BL
8PCG CB
8G BL
8G CB
C1
C2
4PCS BL
4PCS CB
4S BL
4S CB
4PCG BL
4PCG CB
4G BL
4G CB
Chambers

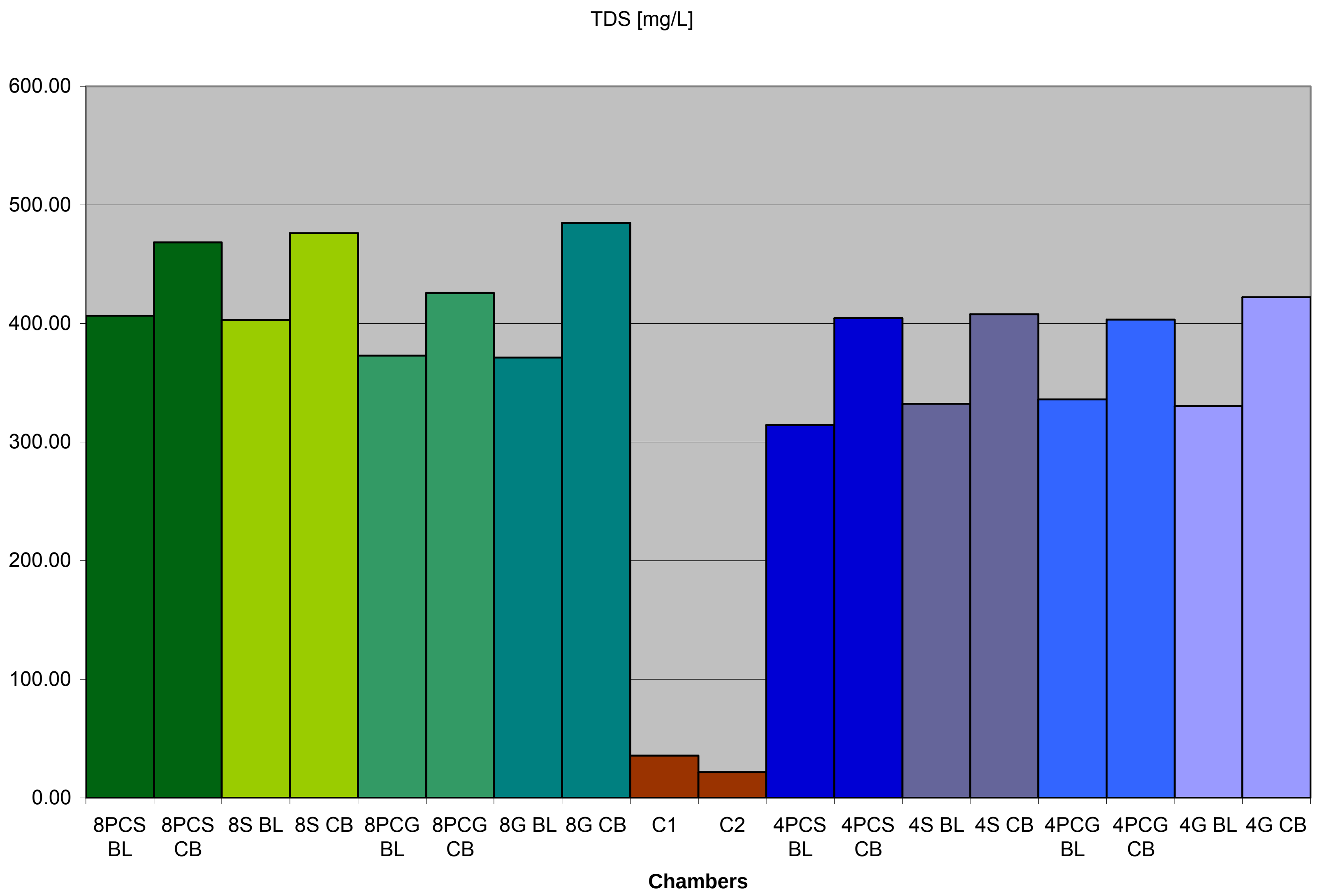

TN
2.00
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
8PCS BL
8S BL
8PCG BL
8G BL
4PCS BL
4S BL
4PCG BL
4G BL
Box

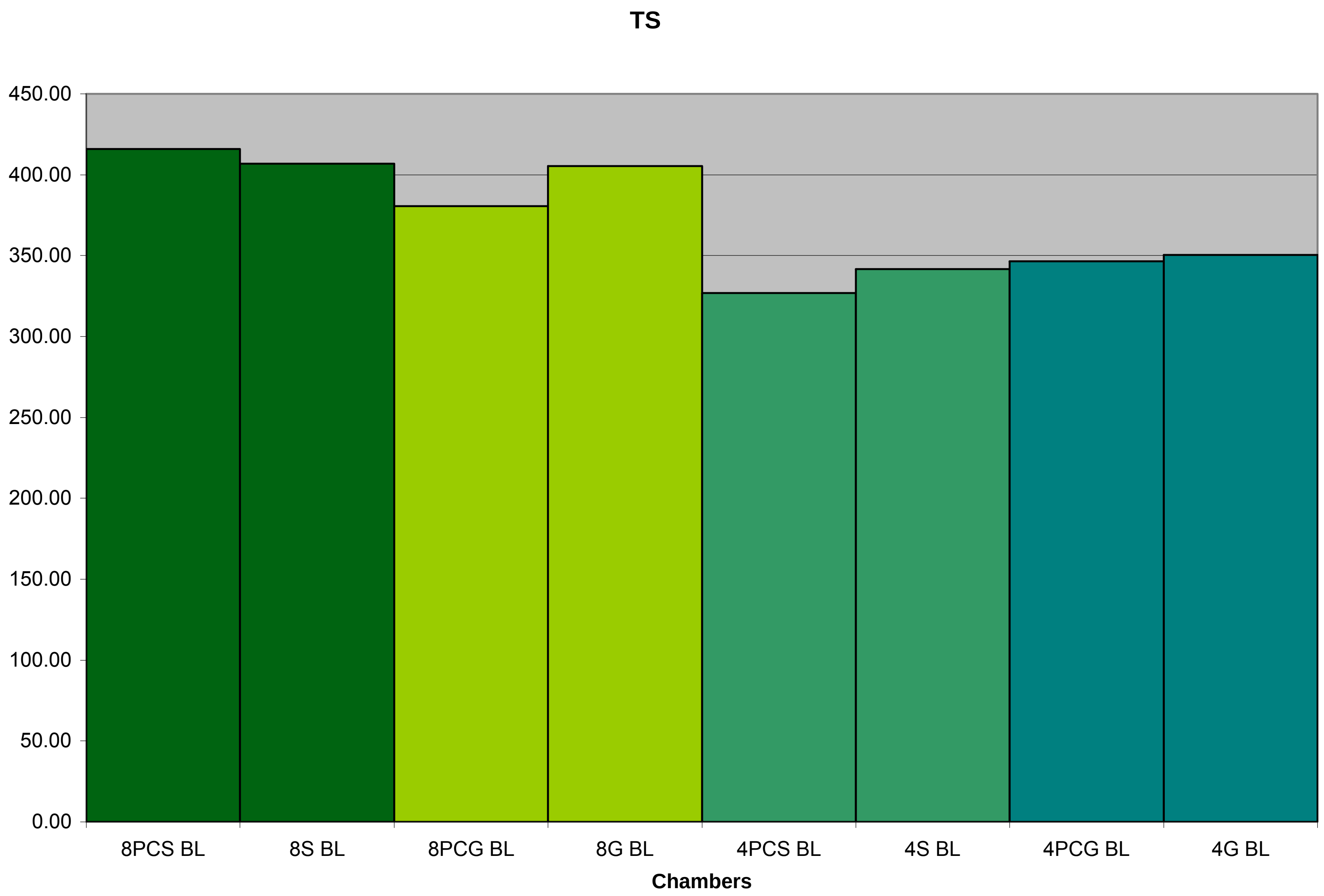

TN [mg/L N]
2.50
2.00
1.50
1.00
0.50
0.00
8PCS BL
8PCS CB
8S BL
8S CB
8PCG BL
8PCG CB
8G BL
8G CB
C1
C2
4PCS BL
4PCS CB
4S BL
4S CB
4PCG BL
4PCG CB
4G BL
4G CB
Chambers

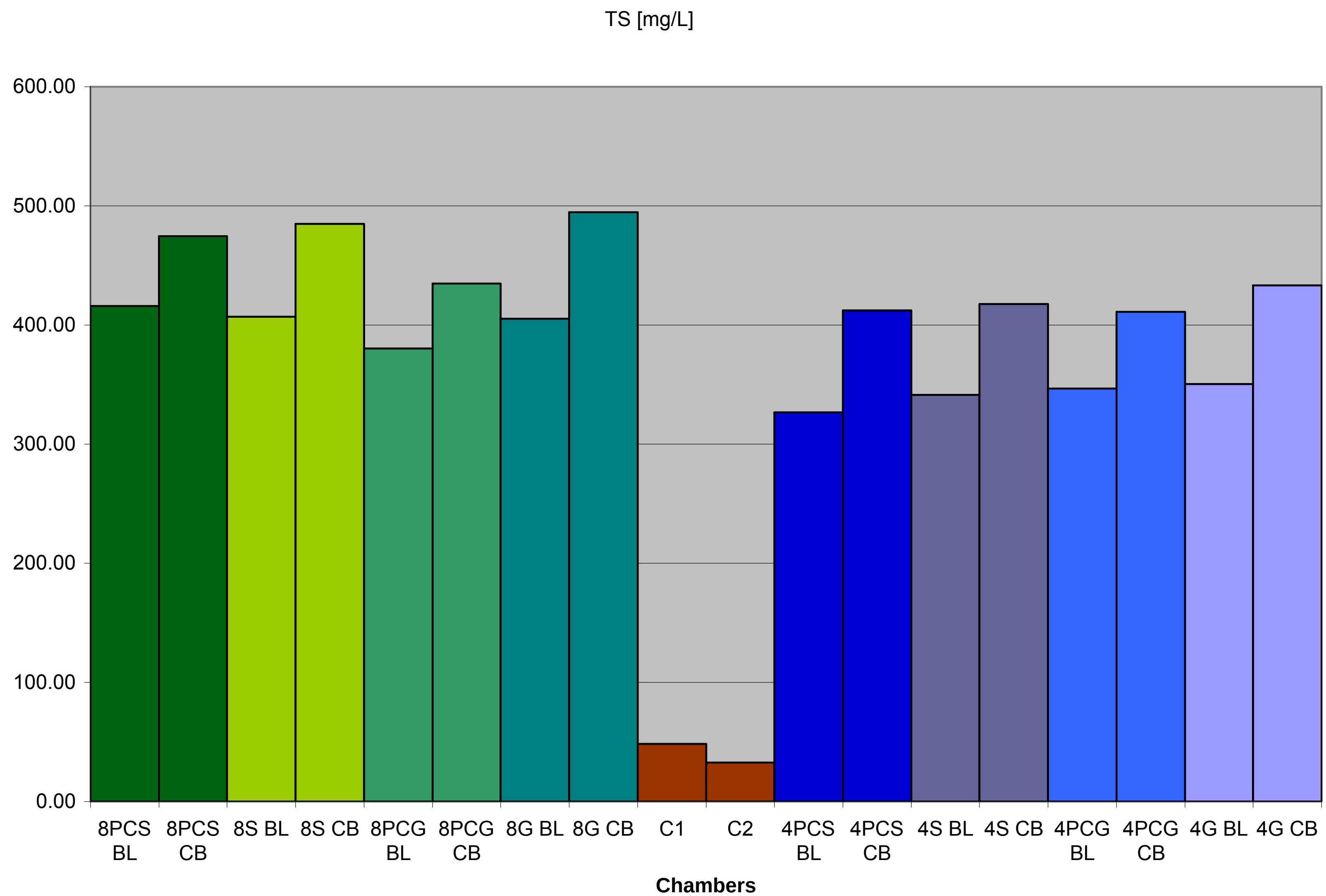

TSS
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
8PCS BL
8S BL
8PCG BL
8G BL
4PCS BL
4S BL
4PCG BL
4G BL
Box

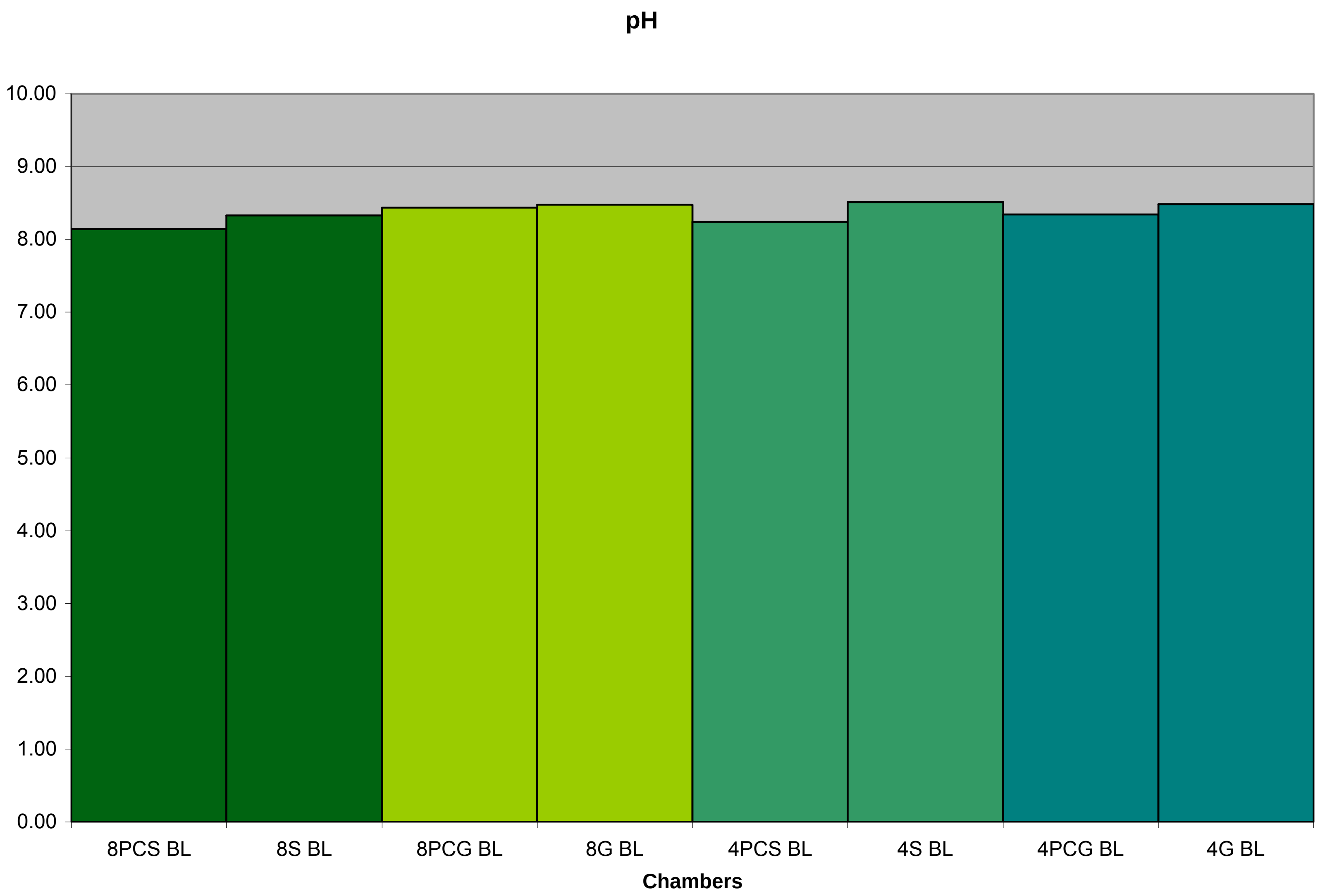

TSS [mg/L]
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
8PCS BL
8PCS CB
8S BL
8S CB
8PCG BL
8PCG CB
8G BL
8G CB
C1
C2
4PCS BL
4PCS CB
4S BL
4S CB
4PCG BL
4PCG CB
4G BL
4G CB
Chambers


TDS
450.00
400.00
350.00
300.00
250.00
200.00
150.00
100.00
50.00
0.00
8PCS BL
8S BL
8PCG BL
8G BL
4PCS BL
4S BL
4PCG BL
4G BL
Chambers


TDS [mg/L]
600.00
500.00
400.00
300.00
200.00
100.00
0.00
8PCS BL
8PCS CB
8S BL
8S CB
8PCG BL
8PCG CB
8G BL
8G CB
C1
C2
4PCS BL
4PCS CB
4S BL
4S CB
4PCG BL
4PCG CB
4G BL
4G CB
Chambers


TS
450.00
400.00
350.00
300.00
250.00
200.00
150.00
100.00
50.00
0.00
8PCS BL
8S BL
8PCG BL
8G BL
4PCS BL
4S BL
4PCG BL
4G BL
Chambers


TS [mg/L]
600.00
500.00
400.00
300.00
200.00
100.00
0.00
8PCS BL
8PCS CB
8S BL
8S CB
8PCG BL
8PCG CB
8G BL
8G CB
C1
C2
4PCS BL
4PCS CB
4S BL
4S CB
4PCG BL
4PCG CB
4G BL
4G CB
Chambers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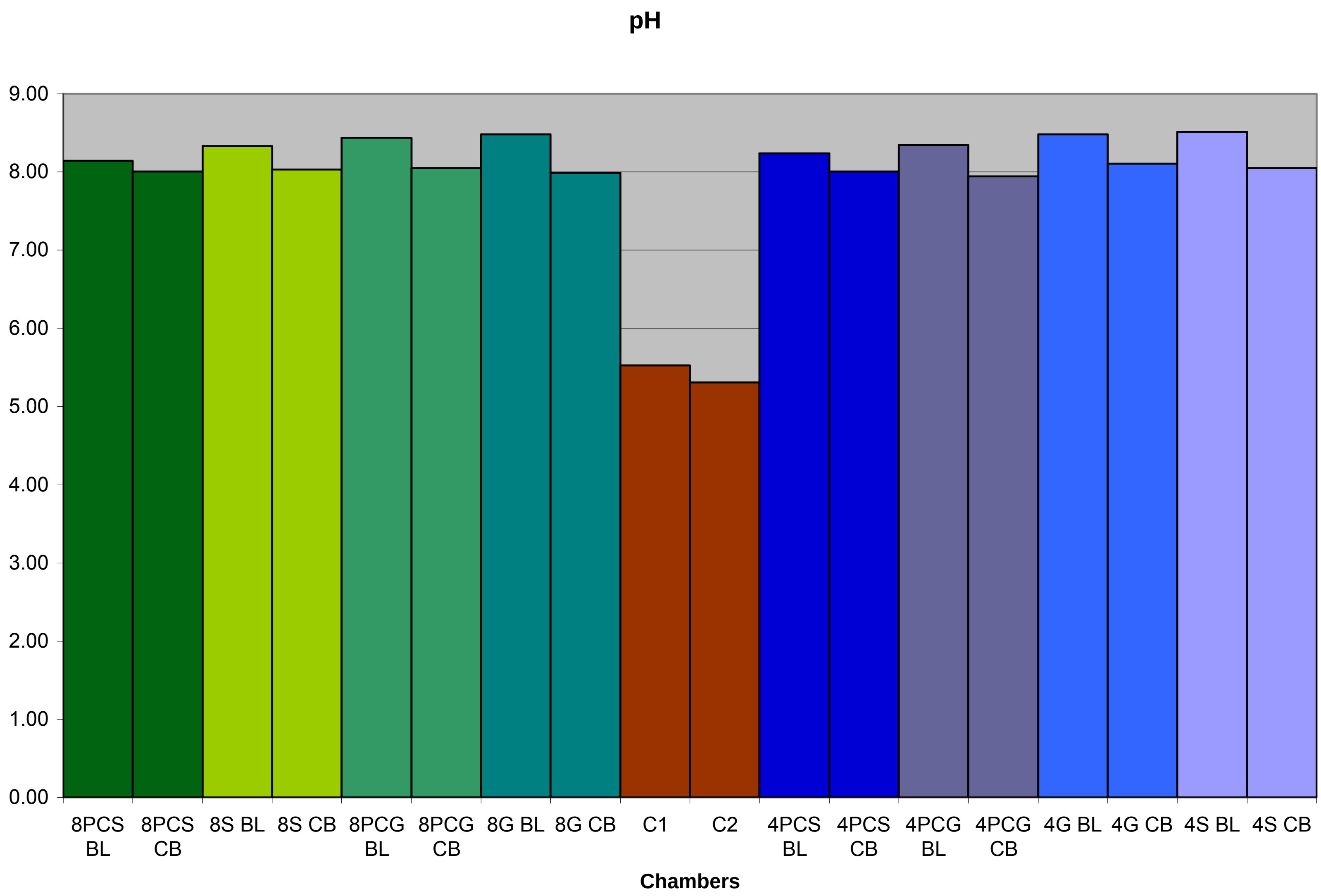
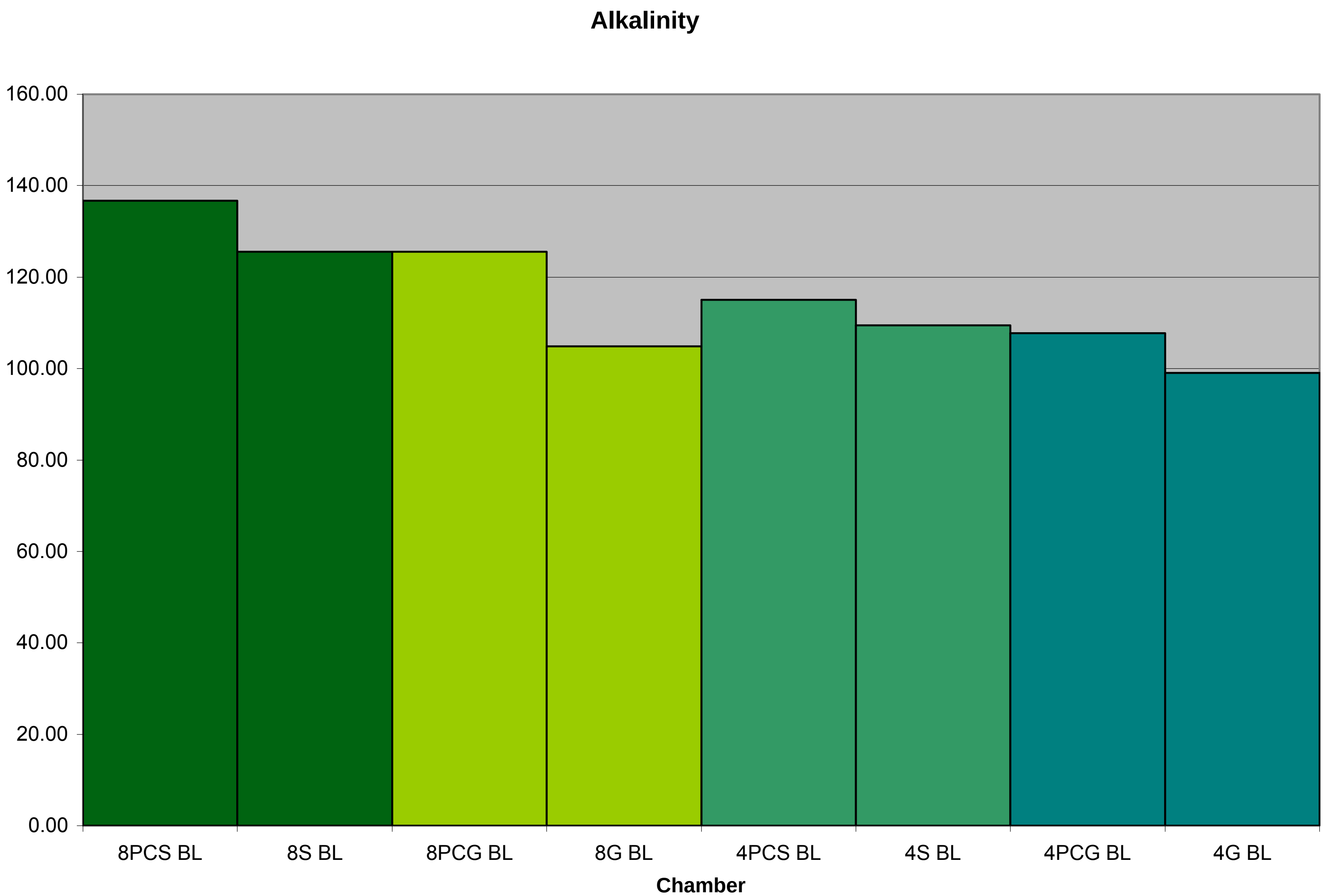
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
8PCS BL
8S BL
8PCG BL
8G BL
4PCS BL
4S BL
4PCG BL
4G BL
Chambers


pH
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
8PCS BL
8PCS CB
8S BL
8S CB
8PCG BL
8PCG CB
8G BL
8G CB
C1
C2
4PCS BL
4PCS CB
4PCG BL
4PCG CB
4G BL
4G CB
4S BL
4S CB
Chambers


Alkalinity
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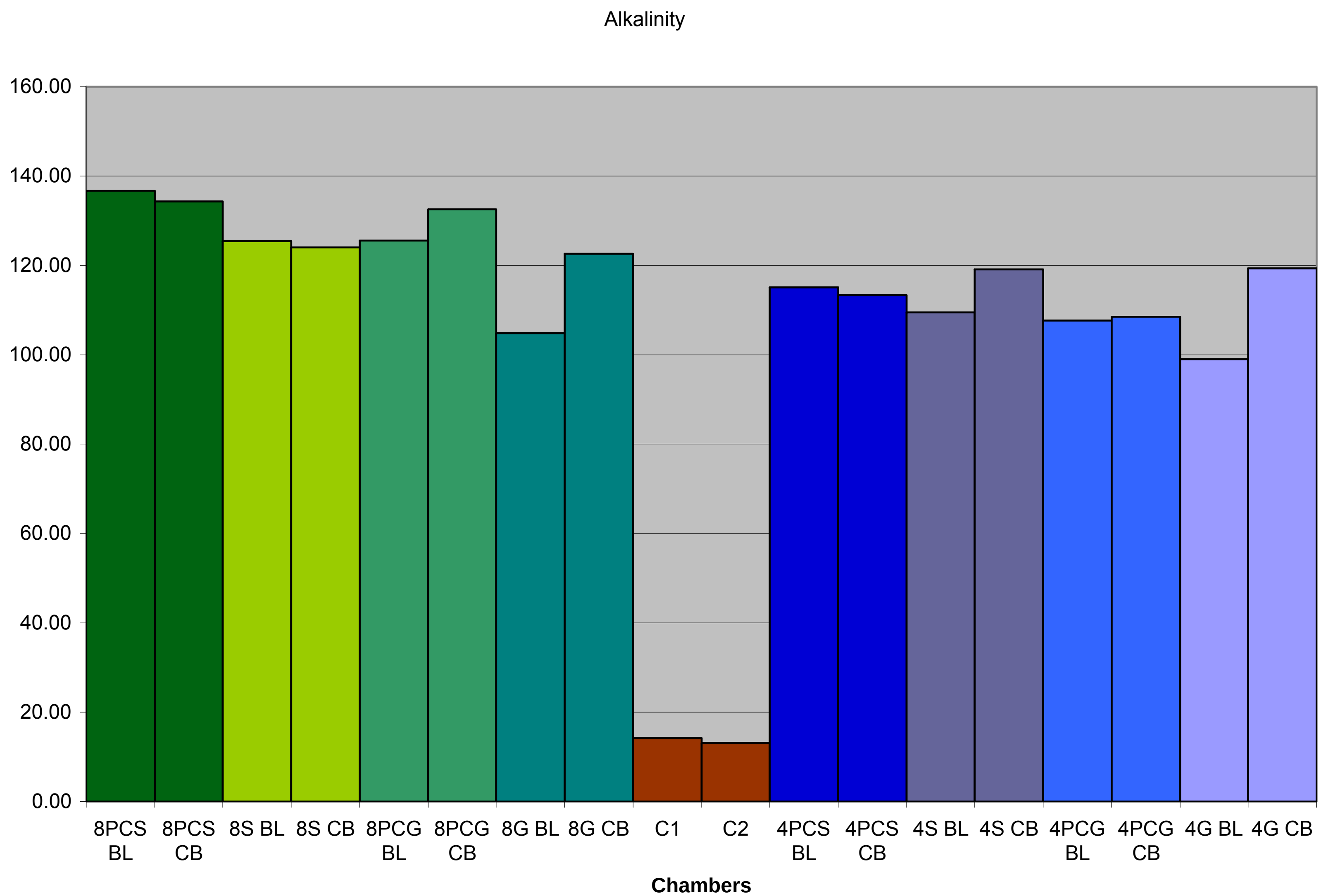
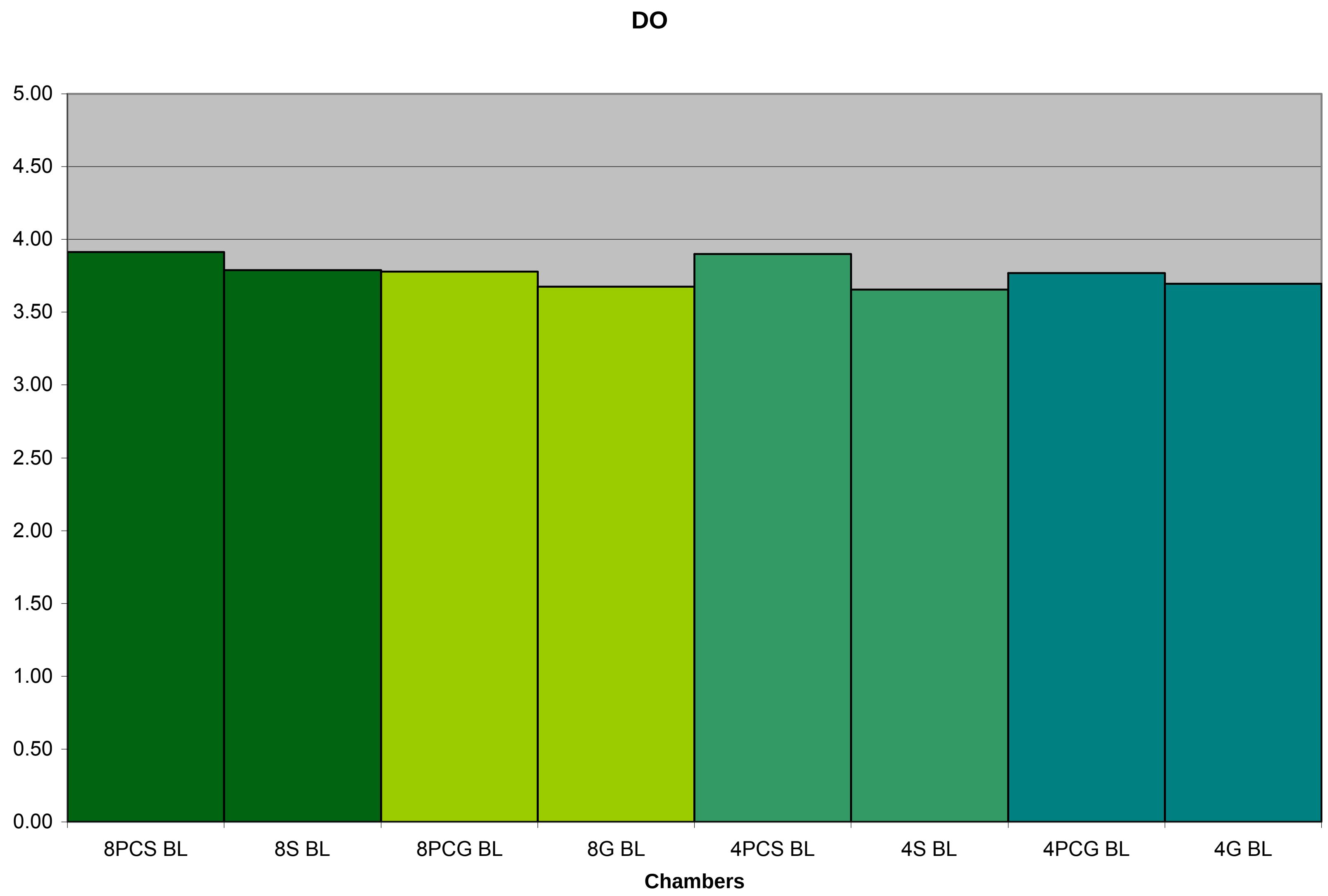
120.00
100.00
80.00
60.00
40.00
20.00
0.00
8PCS BL
8S BL
8PCG BL
8G BL
4PCS BL
4S BL
4PCG BL
4G BL
Chamber


Alkalinity
160.00
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
8PCS BL
8PCS CB
8S BL
8S CB
8PCG BL
8PCG CB
8G BL
8G CB
C1
C2
4PCS BL
4PCS CB
4S BL
4S CB
4PCG BL
4PCG CB
4G BL
4G CB
Chambers


DO
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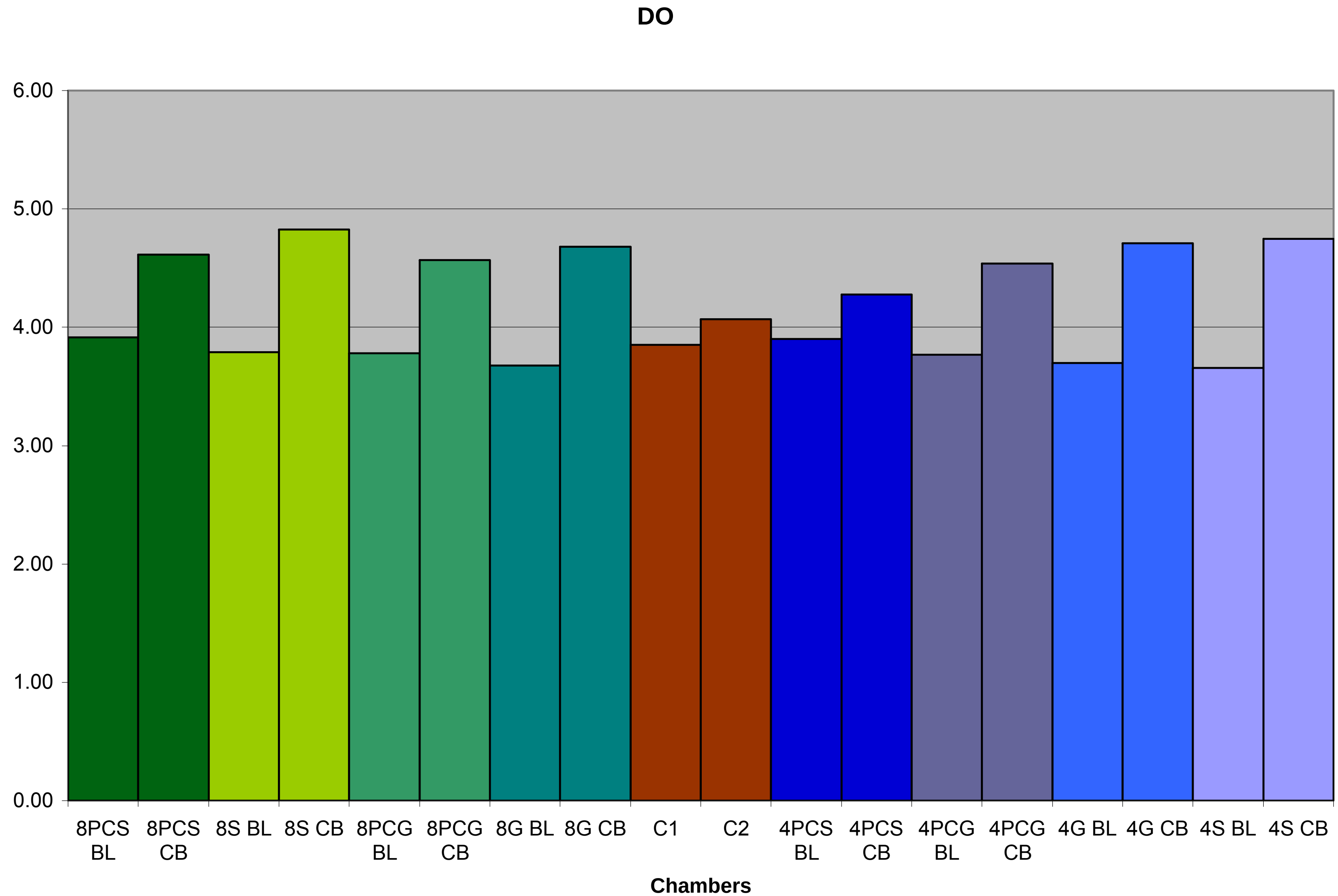
4.50
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
8PCS BL
8S BL
8PCG BL
8G BL
4PCS BL
4S BL
4PCG BL
4G BL
Chambers


DO
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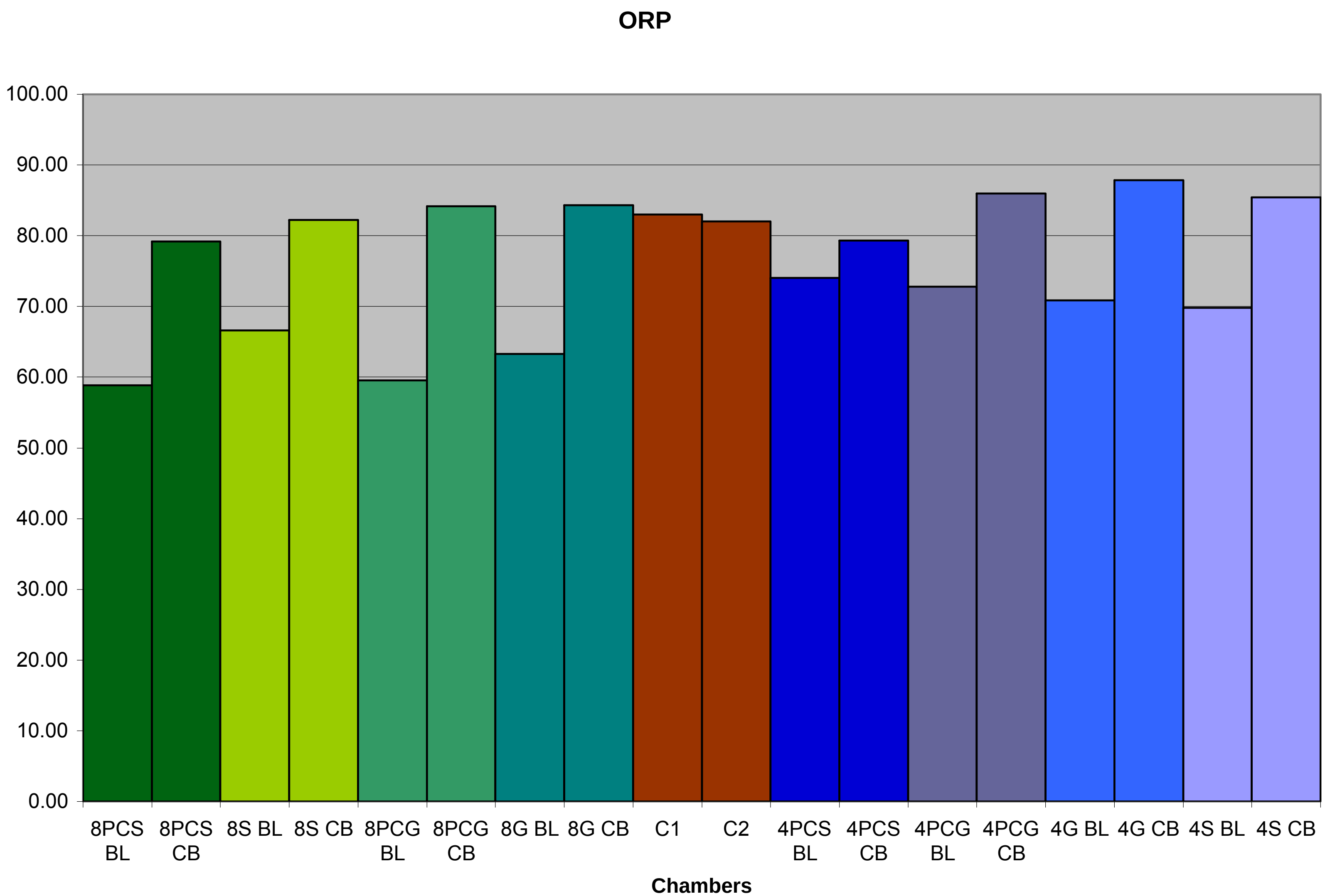
4.00
3.00
2.00
1.00
0.00
8PCS BL
8PCS CB
8S BL
8S CB
8PCG BL
8PCG CB
8G BL
8G CB
C1
C2
4PCS BL
4PCS CB
4PCG BL
4PCG CB
4G BL
4G CB
4S BL
4S CB
Chambers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80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
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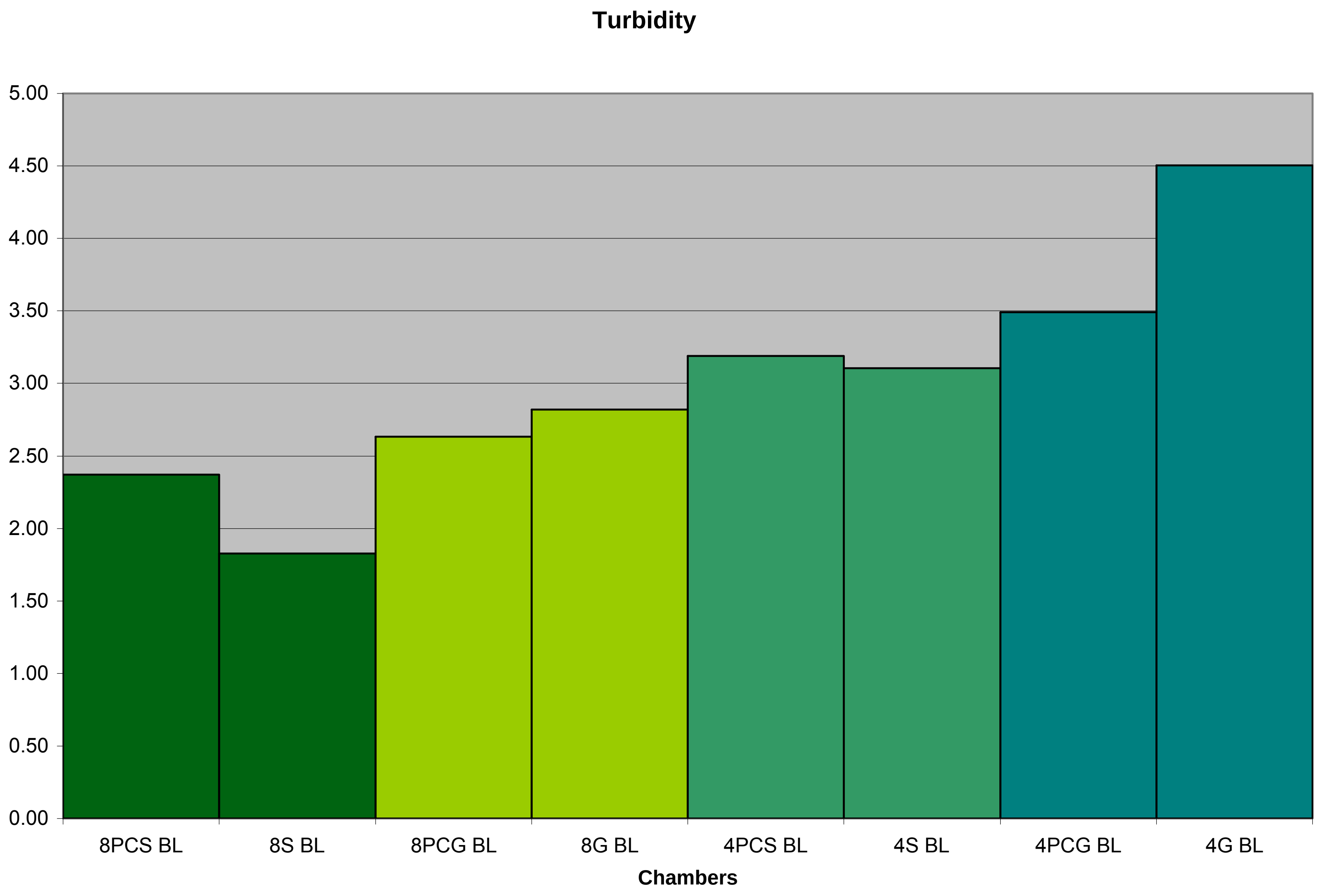
8PCS CB
8S BL
8S CB
8PCG BL
8PCG CB
8G BL
8G CB
C1
C2
4PCS BL
4PCS CB
4PCG BL
4PCG CB
4G BL
4G CB
4S BL
4S CB
Chambers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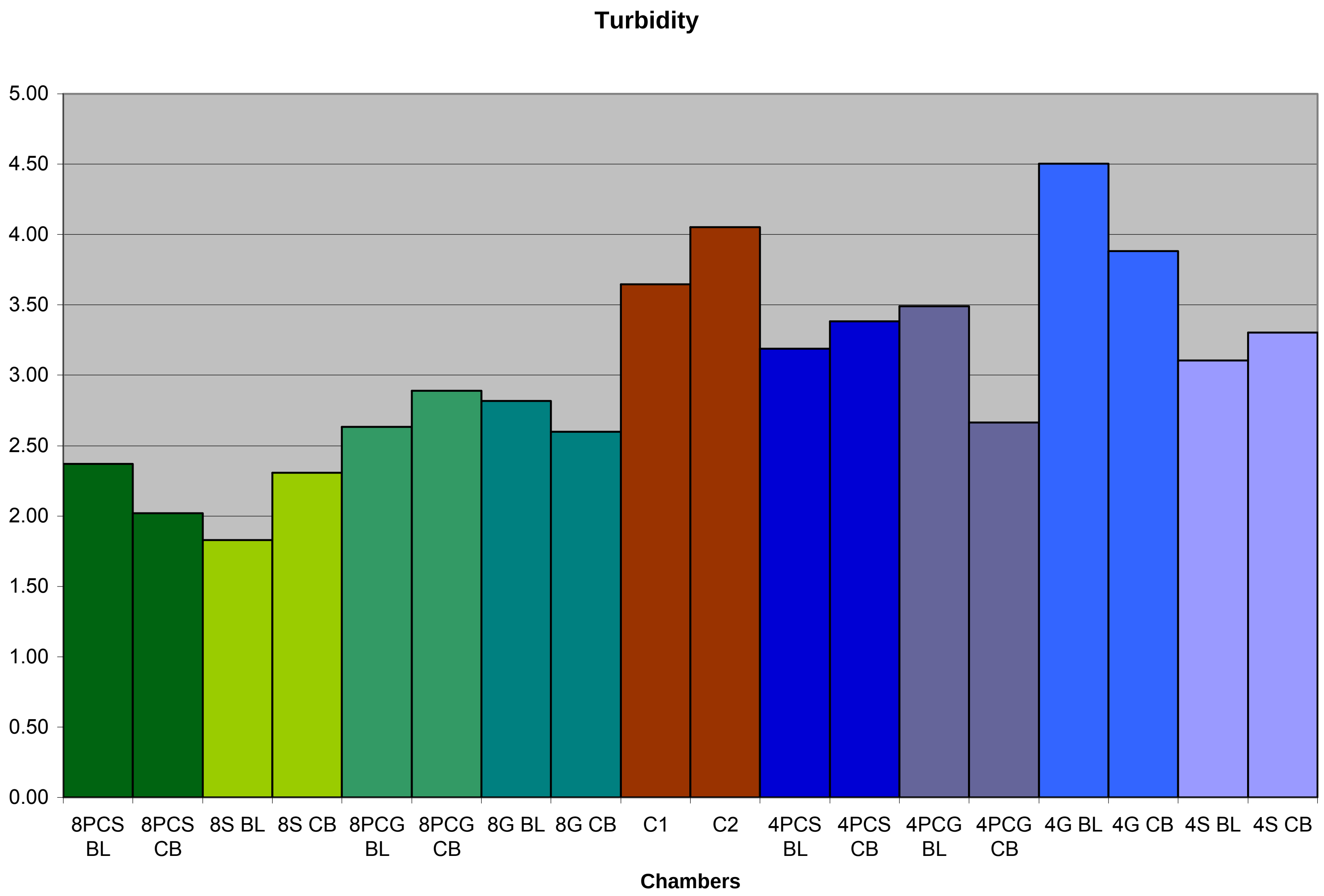
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
8PCS BL
8S BL
8PCG BL
8G BL
4PCS BL
4S BL
4PCG BL
4G BL
Chambers


Turbidity
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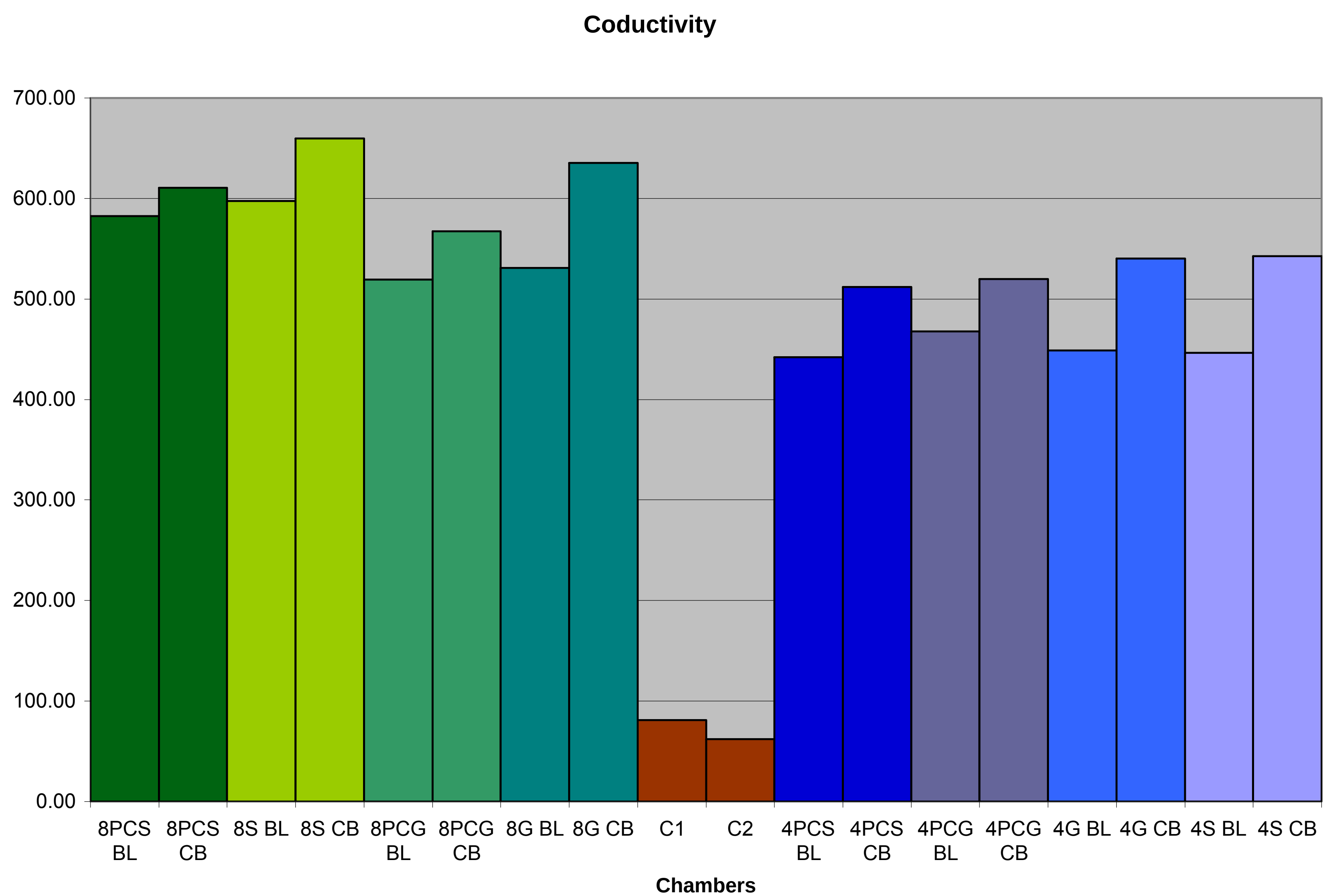
4.50
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
8PCS BL
8PCS CB
8S BL
8S CB
8PCG BL
8PCG CB
8G BL
8G CB
C1
C2
4PCS BL
4PCS CB
4PCG BL
4PCG CB
4G BL
4G CB
4S BL
4S CB
Chambers


Coductivity
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500.00
400.00
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200.00
100.00
0.00
8PCS BL
8PCS CB
8S BL
8S CB
8PCG BL
8PCG CB
8G BL
8G CB
C1
C2
4PCS BL
4PCS CB
4PCG BL
4PCG CB
4G BL
4G CB
4S BL
4S CB
Chambers

APPENDIX G: WATER QUALITY HYPOTHESIS TESTS

OP Hypothesis Tests

H_{O1} When PC layer and Drainage Layer are held constant, The OP for 4" depth = OP for 8" depth
H_{a1} When PC layer and Drainage Layer are held constant, The OP for 4" depth not equal OP for 8" depth
H_{O2} When the PC and Depths are held constant, OP for Gravel Drainage = OP for Plastic Drainage
H_{a2} When the PC and Depths are held constant, OP for Gravel Drainage not equal OP for Plastic Drainage
H_{O3} When the Drainage Layer and Depths is held constant, OP for Layer with Black & Gold = OP for Layer Without Black and Gold
H_{a3} When the Drainage Layer and Depths is held constant, OP for Layer with Black & Gold not equal OP for Layer Without Black and Gold
H_{O4} OP for a Box with PC Layer = OP for a control box
H_{a4} OP for a Box with PC Layer not equal OP for a control box
H_{O5} OP for a Box without PC Layer = OP for a control box
H_{a5} OP for a Box without PC Layer not equal OP for a control box
H_{O6} When PC layer, Drainage Layer, and depth are held constant, The OP for the barrel = OP for Filtrate
H_{a6} When PC layer, Drainage Layer, and depth are held constant, The OP for the barrel not equal OP for Filtrate

z_α = 1.645 $-z_\alpha$ = -1.645

Note: R = Reject H_O & A = Accept H_O

	8PCS	8PCS CB	8S	8S CB	8PCG	8PCG CB	8G	8G CB	C1	C Average	C2	4PCS	4PCS CB	4S	4S CB	4PCG	4PCG CB	4G	4G CB
Average	0.047	0.064	0.064	0.084	0.049	0.060	0.045	0.081	0.037	0.046	0.054	0.036	0.068	0.044	0.090	0.031	0.075	0.045	0.078
Stand. Dev.	0.0247	0.0289	0.0556	0.0759	0.0267	0.0381	0.0342	0.0661	0.0397	0.0475	0.0553	0.0207	0.0485	0.04	0.08	0.0217	0.0625	0.03	0.06
Var	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
n	39	28	39	30	41	26	41	27	22	22.5	23	39	30	39.00	29.00	41	30	39.00	29.00
Depth Comparison																			
H_{O1} (95% CI)	R	A	A	A	R	A	A	A											
H_{O1} (90% CI)	R	A	R	A	R	A	A	A											
s1^2/s2^2	0.70	2.81	0.45	1.07	0.66	2.69	0.60	0.76											
sp1^2	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00											
v	76	56	76	57	80	54	78	54											
$t_{0.025}$ (95% CI)	1.96	2.0032	1.96	2.0025	1.96	2.0049	1.96	2.0049											
$t_{0.05}$ (90% CI)	1.645	1.673	1.645	1.672	1.645	1.674	1.645	1.674											
t_1		-0.334	-	-0.302	-	-1.093	-	0.210											
z1	2.221		1.889		3.404		-0.037												
Drainage Comparison																			
H_{O2} (95% CI)	A	A	A	A								A	A	A	A				
H_{O2} (90% CI)	A	A	R	A								A	A	A	A				
s1^2/s2^2	1.16	0.58	0.38	0.76								1.10	0.60	0.51	0.54				
sp1^2	0.00	0.00	0.00	0.01								0.00	0.00	0.00	0.00				
v	78	52	78	55								78	58	76	56				
$t_{0.025}$ (95% CI)	1.96	1.96	1.96	1.96								1.96	1.96	1.96	1.96				
$t_{0.05}$ (90% CI)	1.645	1.645	1.645	1.645								1.645	1.645	1.645	1.645				
t_2	-	-	-	-								-	-	-	-				
z2	-0.394	0.481	1.876	0.158								0.958	-0.513	-0.136	0.691				

	8PCS	8PCS CB	8S	8S CB	8PCG	8PCG CB	8G	8G CB	C1	C Average	C2	4PCS	4PCS CB	4S	4S CB	4PCG	4PCG CB	4G	4G CB
Average	0.047	0.064	0.064	0.084	0.049	0.060	0.045	0.081	0.037	0.046	0.054	0.036	0.068	0.044	0.090	0.031	0.075	0.045	0.078
Stand. Dev.	0.0247	0.02893	0.0556	0.0759	0.0267	0.038092	0.0342	0.0661	0.0397	0.04749	0.0553	0.0207	0.04852	0.04	0.08	0.0217	0.06248	0.03	0.06
Var	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
n	39	28	39	30	41	26	41	27	22	22.5	23	39	30	39.00	29.00	41	30	39.00	29.00
PC Comparison																			
H_{O3} (95% CI)	A	A			A	A						A	A			R	A		
H_{O3} (90% CI)	R	A			A	A						A	A			R	A		
s1^2/s2^2	5.06	6.88			1.65	3.01						3.21	2.63			0.67	0.85		
sp1^2	0.00	0.00			0.00	0.00						0.00	0.00			0.00	0.00		
v	76	56			80	51						76	57			78	57		
$t_{0.025}$ (95% CI)	1.96	2.0032			1.96	2.0076						1.96	2.0025			1.96	2.0025		
$t_{0.05}$ (90% CI)	1.645	1.673			1.645	1.675						1.645	1.672			1.645	1.672		
t3		-1.307				-1.442							-1.329				-0.166		
z3	-1.739				0.709							-1.203				-2.527			
PC vs Control																			
H_{O4} (95% CI)	A	A			A	A						A	A			A	A		
H_{O4} (90% CI)	A	R			A	A						A	A			A	R		
s1^2/s2^2	3.79	2.77			3.26	1.60						5.39	0.98			3.30	0.70		
sp1^2	0.00	0.00			0.00	0.00						0.00	0.00			0.00	0.00		
v	60	49			62	47						60	51			29	50		
$t_{0.025}$ (95% CI)	2.021	2.021			1.9996	2.0129						2.001	2.0086			2.0452	2.0096		
$t_{0.05}$ (90% CI)	1.684	1.684			1.670	1.679						1.671	1.676			1.699	1.677		
t4	0.144	1.698			0.385	1.140						-1.148	1.640			-1.675	1.863		
NPC vs Control																			
H_{O5} (95% CI)			A	R			A	R						A	R			A	R
H_{O5} (90% CI)			A	R			A	R						A	R			A	R
s1^2/s2^2			0.75	0.40			1.98	0.53						1.68	0.37			3.30	0.70
sp1^2			0.00	0.00			0.00	0.00						0.00	0.00			0.00	0.00
v			60	51			62	48						60	50			60	50
$t_{0.025}$ (95% CI)			2.001	2.0086			1.9996	2.0117						2.001	2.0096			2.001	2.0096
$t_{0.05}$ (90% CI)			1.671	1.676			1.670	1.678						1.671	1.677			1.671	1.677
t5			1.302	2.110			-0.116	2.127						-0.177	2.367			-0.100	2.129
Cistern vs Filtrate																			
H_{O6} (95% CI)	R		A		A		R					R		R		R		R	
H_{O6} (90% CI)	R		A		A		R					R		R		R		R	
s1^2/s2^2	0.73		0.54		0.49		0.27					0.18		0.22		0.12		0.21	
sp1^2	0.00		0.00		0.00		0.00					0.00		0.00		0.00		0.00	
v	65		67		65		66					67		66		69		66	
$t_{0.025}$ (95% CI)	1.9971		1.996		1.9971		1.9966					1.996		1.9966		1.9949		1.9966	
$t_{0.05}$ (90% CI)	1.669		1.668		1.669		1.668					1.668		1.668		1.667		1.668	
t6	-2.621		-1.281		-1.330		-3.013					-3.737		-3.250		-4.206		-3.167	

TP Hypothesis Tests

H_{O1} When PC layer and Drainage Layer are held constant, The TP for 4" depth = TP for 8" depth
H_{a1} When PC layer and Drainage Layer are held constant, The TP for 4" depth not equal TP for 8" depth
H_{O2} When the PC and Depths are held constant, TP for Gravel Drainage = TP for Plastic Drainage
H_{a2} When the PC and Depths are held constant, TP for Gravel Drainage not equal TP for Plastic Drainage
H_{O3} When the Drainage Layer and Depths is held constant, TP for Layer with PC = TP for Layer Without Black and Gold
H_{a3} When the Drainage Layer and Depths is held constant, TP for Layer with PC not equal TP for Layer Without Black and Gold
H_{O4} TP for a Box with PC Layer = TP for a control box
H_{a4} TP for a Box with PC Layer not equal TP for a control box
H_{O5} TP for a Box without PC Layer = TP for a control box
H_{a5} TP for a Box without PC Layer not equal TP for a control box
H_{O6} When PC layer, Drainage Layer, and depth are held constant, The TP for the barrel = TP for Filtrate
H_{a6} When PC layer, Drainage Layer, and depth are held constant, The TP for the barrel not equal TP for Filtrate

z_α = 1.645 $-z_\alpha$ = -1.645

Note: R = Reject H_O & A = Accept H_O

	8PCS	8PCS CB	8S	8S CB	8PCG	8PCG CB	8G	8G CB	C1	C Average	C2	4PCS	4PCS CB	4S	4S CB	4PCG	4PCG CB	4G	4G CB
Average	0.066	0.110	0.094	0.131	0.070	0.091	0.072	0.103	0.097	0.117	0.137	0.080	0.114	0.092	0.119	0.070	0.089	0.097	0.127
s	0.0304	0.0592	0.0674	0.0769	0.0456	0.0406	0.0478	0.0593	0.067	0.0941	0.1212	0.0447	0.0851	0.07	0.08	0.036	0.0477	0.06	0.07
Var	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.01	0.01	0.01	0.00	0.00	0.00	0.00
n	39	32	37	30	38	27	37	25	24	24.5	25	38	31	39.00	30.00	40	27	38.00	30.00
Depth Comparison																			
H_{O1} (95% CI	A	A	A	A	A	A	R	A											
H_{O1} (90% CI	R	A	A	A	A	A	R	A											
s1^2/s2^2	2.16	2.07	1.14	0.98	0.62	1.38	1.38	1.26											
sp1^2	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00											
v	75	61	74	58	76	52	73	53											
$t_{0.025}$ (95% CI)	1.96	1.9996	1.96	2.0017	1.96	2.0066	1.96	2.0057											
$t_{0.05}$ (90% CI)	1.645	1.670	1.645	1.672	1.645	1.675	1.645	1.674											
t_1		-0.236	-	0.639	-	0.232	-	-1.395											
z1	-1.653		0.144		0.049		-2.065												
Drainage Comparison																			
H_{O2} (95% CI	A	A	A	A								A	A	A	A				
H_{O2} (90% CI	A	A	A	A								A	A	A	A				
s1^2/s2^2	2.25	2.13	0.50	0.59								0.65	3.18	0.61	0.76				
sp1^2	0.00	0.00	0.00	0.00								0.00	0.00	0.00	0.01				
v	75	57	72	53								76	56	75	58				
$t_{0.025}$ (95% CI)	1.96	1.96	1.96	1.96								1.96	1.96	1.96	1.96				
$t_{0.05}$ (90% CI)	1.645	1.645	1.645	1.645								1.645	1.645	1.645	1.645				
t_2	-	-	-	-								-	-	-	-				
z2	-0.506	1.418	1.580	1.535								1.130	1.439	-0.388	-0.451				

	8PCS	8PCS CB	8S	8S CB	8PCG	8PCG CB	8G	8G CB	C1	C Average	C2	4PCS	4PCS CB	4S	4S CB	4PCG	4PCG CB	4G	4G CB
Average	0.07	0.109817	0.09	0.13	0.07	0.09	0.07	0.10	0.097	0.117148	0.1373	0.08	0.11	0.09	0.12	0.07	0.09	0.10	0.13
s	0.0304	0.059223	0.0674	0.0769	0.0456	0.04057	0.0478	0.0593	0.067	0.094091	0.1212	0.0447	0.08511	0.07	0.08	0.036	0.0477	0.06	0.07
Var	0.0009	0.003507	0.0045	0.0059	0.00	0.00165	0.00	0.0035	0.0045	0.009586	0.0147	0.002	0.00724	0.01	0.01	0.0013	0.002275	0.00	0.00
n	39	32	37	30	38	27	37	25	24	24.5	25	38	31	39.00	30.00	40	27	38.00	30.00
PC Comparison																			
H_{O3} (95% CI)	R	A			A	A						A	A			R	R		
H_{O3} (90% CI)	R	A			A	A						A	A			R	R		
s1^2/s2^2	4.91	1.69			1.10	2.14						2.60	0.80			0.41	1.94		
sp1^2	0.00	0.00			0.00	0.00						0.00	0.01			0.00	0.00		
v	74	60			73	50						75	59			76	55		
$t_{0.025}$ (95% CI)	1.96	2.0003			1.96	2.0086						1.96	2.001			1.96	2.004		
$t_{0.05}$ (90% CI)	1.645	1.671			1.645	1.676						1.645	1.671			1.645	1.673		
t3		-1.228				-0.832							-0.210				-2.478		
z3	-2.300				-0.176							-0.815				-2.532			
PC vs Control																			
H_{O4} (95% CI)	R	A			R	R						R	A			R	A		
H_{O4} (90% CI)	R	A			R	R						R	A			R	A		
s1^2/s2^2	0.00	0.00			0.00	0.00						0.00	0.00			0.00	0.00		
sp1^2	0.00	0.00			0.00	0.00						0.00	0.01			0.00	0.00		
v	37	30			36	25						36	29			29	28		
$t_{0.025}$ (95% CI)	2.025667	2.042			2.0281	2.0595						2.0281	2.0452			2.0452	2.0484		
$t_{0.05}$ (90% CI)	1.687	1.697			1.688	1.708						1.688	1.699			1.699	1.701		
t4	-6.439	-0.454			-3.900	-2.240						-3.130	-0.128			-3.225	-1.519		
NPC vs Control																			
H_{O5} (95% CI)			A	A			R	A						A	A			A	A
H_{O5} (90% CI)			A	A			R	A						A	A			A	A
s1^2/s2^2			0.00	0.00			0.00	0.00						0.00	0.00			0.00	0.00
sp1^2			0.00	0.01			0.00	0.00						0.01	0.01			0.00	0.00
v			35	28			35	23						37	28			36	28
$t_{0.025}$ (95% CI)			2.0301	2.0484			2.0301	2.0687						2.0262	2.0484			2.0281	2.0484
$t_{0.05}$ (90% CI)			1.690	1.701			1.690	1.714						1.687	1.701			1.688	1.701
t5			-1.311	0.657			-3.548	-0.825						-1.362	0.065			-1.350	0.527
Cistern vs Filtrate																			
H_{O6} (95% CI)	R		R		A		R					R		A		A		A	
H_{O6} (90% CI)	R		R		R		R					R		A		R		R	
s1^2/s2^2	0.26		0.77		1.26		0.65					0.28		0.89		0.57		0.72	
sp1^2	0.00		0.01		0.00		0.00					0.00		0.01		0.00		0.00	
v	69		65		63		60					67		67		65		66	
$t_{0.025}$ (95% CI)	1.9949		1.9971		1.9983		2.0003					1.996		1.996		1.9971		1.9966	
$t_{0.05}$ (90% CI)	1.667		1.669		1.669		1.671					1.668		1.668		1.669		1.668	
t6	-4.024		-2.117		-1.899		-2.241					-2.115		-1.504		-1.808		-1.992	

NOx Hypothesis Tests

H_{O1}	When PC layer and Drainage Layer are held constant, The NOx for 4" depth = NOx for 8" depth
H_{a1}	When PC layer and Drainage Layer are held constant, The NOx for 4" depth not equal NOx for 8" depth
H_{O2}	When the PC and Depths are held constant, NOx for Gravel Drainage = NOx for Plastic Drainage
H_{a2}	When the PC and Depths are held constant, NOx for Gravel Drainage not equal NOx for Plastic Drainage
H_{O3}	When the Drainage Layer and Depths is held constant, NOx for Layer with Black & Gold = NOx for Layer Without Black and Gold
H_{a3}	When the Drainage Layer and Depths is held constant, NOx for Layer with Black & Gold not equal NOx for Layer Without Black and Gold
H_{O4}	NOx for a Box with PC Layer = NOx for a control box
H_{a4}	NOx for a Box with PC Layer not equal NOx for a control box
H_{O5}	NOx for a Box without PC Layer = NOx for a control box
H_{a5}	NOx for a Box without PC Layer not equal NOx for a control box
H_{O6}	When PC layer, Drainage Layer, and depth are held constant, The NOx for the barrel = NOx for Filtrate
H_{a6}	When PC layer, Drainage Layer, and depth are held constant, The NOx for the barrel not equal NOx for Filtrate

z_{α} = 1.645 $-z_{\alpha}$ = -1.645

Note: R = Reject H_O & A = Accept H_O

	8PCS	8PCS CB	8S	8S CB	8PCG	8PCG CB	8G	8G CB	C1	C Average	C2	4PCS	4PCS CB	4S	4S CB	4PCG	4PCG CB	4G	4G CB
Average	0.030	0.027	0.030	0.029	0.028	0.030	0.031	0.030	0.166	0.171	0.176	0.027	0.025	0.028	0.027	0.029	0.030	0.023	0.030
Stand. Dev.	0.012862	0.01542	0.0147	0.0193	0.01449	0.01782	0.0256	0.02	0.2139	0.2135	0.2131	0.01247	0.01382	0.02	0.02	0.0168	0.02091	0.02	0.02
Var	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.05	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
n	35	24	34	26	34	21	36	20	21	20.5	20	33	25	36.00	25.00	37	26	34.00	24.00
Depth Comparison																			
H_{O1} (95% CI)	A	A	A	A	A	A	A	A											
H_{O1} (90% CI)	A	A	A	A	A	A	R	A											
s1^2/s2^2	0.94	0.80	1.11	1.04	1.34	1.38	0.39	0.79											
sp1^2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00											
v	66	47	68	49	69	45	68	42											
CI)	1.96	2.0117	1.96	2.0096	1.96	2.0141	1.96	2.0181											
$t_{0.05}$ (90% CI)	1.645	1.678	1.645	1.677	1.645	1.679	1.645	1.682											
t_1		0.434		0.368		-0.095		0.082											
z1	1.249		0.366		-0.118		1.659												
Drainage Comparison																			
H_{O2} (95% CI)	A	A	A	A								A	A	A	A				
H_{O2} (90% CI)	A	A	A	A								A	A	A	A				
s1^2/s2^2	1.27	0.75	3.02	1.08								1.82	0.44	1.06	0.82				
sp1^2	0.00	0.00	0.00	0.00								0.00	0.00	0.00	0.00				
v	67	43	68	44								68	49	68	47				
CI)	1.96	1.96	1.96	1.96								1.96	1.96	1.96	1.96				
$t_{0.05}$ (90% CI)	1.645	1.645	1.645	1.645								1.645	1.645	1.645	1.645				
t_2																			
z2	0.647	-0.580	-0.279	-0.151								-0.609	-1.065	1.514	-0.453				

	8PCS	8PCS CB	8S	8S CB	8PCG	8PCG CB	8G	8G CB	C1	C Average	C2	4PCS	4PCS CB	4S	4S CB	4PCG	4PCG CB	4G	4G CB
Average	0.030	0.027	0.030	0.029	0.028	0.030	0.031	0.030	0.166	0.171	0.176	0.027	0.025	0.028	0.027	0.029	0.030	0.023	0.030
Stand. Dev.	0.012862	0.01542	0.0147	0.0193	0.01449	0.01782	0.0256	0.02	0.2139	0.21351	0.2131	0.01247	0.01382	0.02	0.02	0.0168	0.02091	0.02	0.02
Var	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.05	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
n	35	24	34	26	34	21	36	20	21	20.5	20	33	25	36	25	37	26	34	24
PC Comparison																			
H_{O3} (95% CI)	A	A			A	A						A	A			A	A		
H_{O3} (90% CI)	A	A			A	A						A	A			A	A		
s1^2/s2^2	1.31	1.57			3.12	1.26						1.55	2.03			1.10	0.72		
sp1^2	0.00	0.00			0.00	0.00						0.00	0.00			0.00	0.00		
v	67	48			68	39						67	48			69	48		
CI)	1.96	1.96			1.96	1.96						1.96	1.96			1.96	1.96		
$t_{0.05}$ (90% CI)	1.645	1.645			1.645	1.645						1.645	1.645			1.645	1.645		
t3																			
z3	0.257	-0.477			-0.540	-0.055						-0.491	-0.447			1.590	0.126		
PC vs Control																			
H_{O4} (95% CI)	R	R			R	R						R	R			R	R		
H_{O4} (90% CI)	R	R			R	R						R	R			R	R		
s1^2/s2^2	275.55	191.63			217.08	143.53						293.31	238.76			178.31	143.89		
sp1^2	0.02	0.04			0.02	0.05						0.02	0.04			0.02	0.04		
v	54	43			53	40						52	44			29	43		
CI)	2.0057	2.0181			2.0066	2.0227						2.0076	2.0167			2.0452	2.0181		
$t_{0.05}$ (90% CI)	1.674	1.682			1.675	1.685						1.675	1.681			1.699	1.682		
t4	-3.912	-2.380			-3.910	-2.099						-3.901	-2.489			-4.063	-2.463		
NPC vs Control																			
H_{O5} (95% CI)			R	R			R	R						R	R			R	R
H_{O5} (90% CI)			R	R			R	R						R	R			R	R
s1^2/s2^2			209.83	122.30			69.53	113.74						189.13	117.52			178.31	143.89
sp1^2			0.02	0.02			0.02	0.02						0.02	0.02			0.02	0.02
v			53	45			55	39						55	44			53	43
CI)			2.0066	2.0154			2.0049	2.0244						2.0049	2.0167			2.0066	2.0181
$t_{0.05}$ (90% CI)			1.675	1.680			1.674	1.686						1.674	1.681			1.675	1.682
t5			-3.875	-3.384			-3.916	-2.942						-4.024	-3.363			-4.064	-3.242
Cistern vs Filtrate																			
H_{O6} (95% CI)	A		A		A		A					A		A		A		A	
H_{O6} (90% CI)	A		A		A		A					A		A		A		A	
s1^2/s2^2	0.70		0.58		0.66		1.64					0.81		0.62		0.65		0.81	
sp1^2	0.00		0.00		0.00		0.00					0.00		0.00		0.00		0.00	
v	57		58		53		54					56		59		61		56	
CI)	2.0025		2.0017		2.0057		2.0049					2.0032		2.001		1.9996		2.0032	
$t_{0.05}$ (90% CI)	1.672		1.672		1.674		1.674					1.673		1.671		1.670		1.673	
t6	0.985		0.100		-0.318		0.142					0.468		0.250		-0.316		-1.568	

NH3 Hypothesis Tests

H_{O1} When PC layer and Drainage Layer are held constant, The NH3 for 4" depth = NH3 for 8" depth
H_{a1} When PC layer and Drainage Layer are held constant, The NH3 for 4" depth not equal NH3 for 8" depth
H_{O2} When the PC and Depths are held constant, NH3 for Gravel Drainage = NH3 for Plastic Drainage
H_{a2} When the PC and Depths are held constant, NH3 for Gravel Drainage not 3qual NH4 for Plastic Drainage
H_{O3} When the Drainage Layer and Depths is held constant, NH3 for Layer with Black & Gold = NH3 for Layer Without Black and Gold
H_{a3} When the Drainage Layer and Depths is held constant, NH3 for Layer with Black & Gold not equal NH3 for Layer Without Black and Gold
H_{O4} NH3 for a Box with PC Layer = NH3 for a control box
H_{a4} NH3 for a Box with PC Layer not equal NH3 for a control box
H_{O5} NH3 for a Box without PC Layer = NH3 for a control box
H_{a5} NH3 for a Box without PC Layer not equal NH3 for a control box
H_{O6} When PC layer, Drainage Layer, and depth are held constant, The NH3 for the barrel = NH4 for Filtrate
H_{a6} When PC layer, Drainage Layer, and depth are held constant, The NH3 for the barrel not equal NH4 for Filtrate

z_a = 1.645 $-z_a$ = -1.645

Note: R = Reject H_O & A = Accept H_O

	8PCS	8PCS CB	8S	8S CB	8PCG	8PCG CB	8G	8G CB	C1	$C_{Average}$	C2	4PCS	4PCS CB	4S	4S CB	4PCG	4PCG CB	4G	4G CB
Average	0.054	0.031	0.071	0.061	0.051	0.063	0.062	0.092	0.110	0.122	0.135	0.072	0.061	0.061	0.109	0.055	0.031	0.065	0.065
Stand. Dev.	0.057	0.016	0.066	0.061	0.065	0.080	0.055	0.115	0.107	0.108	0.110	0.080	0.073	0.081	0.156	0.063	0.035	0.081	0.076
Var	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.00	0.00	0.01	0.01
n	23	17	22	18	24	14	22	20	12	12.5	13	21	18	21.00	18.00	22	16	24.00	16.00
Depth Comparison																			
H_{O1} (95% CI	A	A	A	A	A	A	A	A											
H_{O1} (90% CI	A	A	A	A	A	A	A	A											
s1^2/s2^2	1.94	20.70	1.50	6.63	0.94	0.20	2.18	0.43											
sp1^2	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.01											
v	42	33	41	34	44	28	44	34											
$t_{0.025}$ (95% CI)	2.021	2.035	2.021	2.033	2.021	2.048	2.021	2.033											
$t_{0.05}$ (90% CI)	1.684	1.693	1.684	1.691	1.684	1.701	1.684	1.691											
t_1	-0.839	-1.611	0.402	-1.215	-0.192	1.429	-0.190	0.795											
Drainage Comparison																			
H_{O2} (95% CI	A	A	A	A								A	A	A	A				
H_{O2} (90% CI	A	A	A	A								A	A	A	A				
s1^2/s2^2	1.30	0.04	0.68	3.59								0.63	4.30	0.99	0.23				
sp1^2	0.00	0.00	0.00	0.01								0.01	0.00	0.01	0.02				
v	45	29	42	36								41	32	43	32				
$t_{0.025}$ (95% CI)	2.021	2.045	2.021	2.028								2.021	2.037	2.021	2.037				
$t_{0.05}$ (90% CI)	1.684	1.699	1.684	1.688								1.684	1.694	1.684	1.694				
t_2	0.179	-1.592	0.493	-1.018								0.778	1.457	-0.162	1.016				

	8PCS	8PCS CB	8S	8S CB	8PCG	8PCG CB	8G	8G CB	C1	C Averag e	C2	4PCS	4PCS CB	4S	4S CB	4PCG	4PCG CB	4G	4G CB
Average	0.054	0.031	0.071	0.061	0.051	0.063	0.062	0.092	0.110	0.122	0.135	0.072	0.061	0.061	0.109	0.055	0.031	0.065	0.065
Stand. Dev.	0.057	0.016	0.066	0.061	0.065	0.080	0.055	0.115	0.107	0.108	0.110	0.080	0.073	0.081	0.156	0.063	0.035	0.081	0.076
Var	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.00	0.00	0.01	0.01
n	23	17	22	18	24	14	22	20	12	12.5	13	21	18	21	18	22	16	24	16
PC Comparison																			
H_{O3} (95% CI	A	A			A	A						A	A			A	A		
H_{O3} (90% CI	A	R			A	A						A	A			A	A		
s1^2/s2^2	1.33	14.15			0.70	2.07						1.03	4.53			0.61	4.57		
sp1^2	0.00	0.00			0.00	0.01						0.01	0.01			0.01	0.00		
v	43	33			44	32						40	34			44	30		
$t_{0.025}$ (95% CI)	2.021	2.035			2.021	2.037						2.021	2.033			2.021	2.042		
$t_{0.05}$ (90% CI)	1.684	1.693			1.684	1.694						1.684	1.691			1.684	1.697		
t3	-0.877911	-1.951			-0.582	-0.817						0.4172	-1.188			-0.494	-1.631		
PC vs Control																			
H_{O4} (95% CI	R	R			R	A						A	A			R	R		
H_{O4} (90% CI	R	R			R	A						A	R			R	R		
s1^2/s2^2	3.58	45.10			2.76	1.84						1.84	2.18			1.81	2.05		
sp1^2	0.01	0.01			0.01	0.01						0.01	0.01			0.01	0.01		
v	34	28			35	25						32	29			29	27		
$t_{0.025}$ (95% CI)	2.035	2.052			2.033	2.064						2.040	2.048			2.045	2.056		
$t_{0.05}$ (90% CI)	1.693	1.703			1.691	1.711						1.696	1.701			1.699	1.706		
t4	-2.451	-3.430			-2.475	-1.619						-1.541	-1.875			-2.316	-3.163		
NPC vs Control																			
H_{O5} (95% CI)			A	A			R	A						A	A			A	A
H_{O5} (90% CI)			A	R			R	A						A	A			A	A
s1^2/s2^2			2.69	3.19			3.95	0.89						1.79	0.48			1.81	2.05
sp1^2			0.01	0.01			0.01	0.01						0.01	0.02			0.01	0.01
v			33	29			33	31						32	29			35	27
$t_{0.025}$ (95% CI)			2.037	2.048			2.037	2.042						2.040	2.048			2.033	2.056
$t_{0.05}$ (90% CI)			1.694	1.701			1.694	1.697						1.696	1.701			1.691	1.706
t5			-1.367	-1.997			-2.194	-0.748						-1.434	-0.258			-1.430	-1.651
Cistern vs Filtrate																			
H_{O6} (95% CI	A		A		A		A					A		A		A		A	
H_{O6} (90% CI	A		A		A		A					A		A		A		A	
s1^2/s2^2	12.58		1.18		0.67		0.22					1.18		0.27		3.18		1.13	
sp1^2	0.00		0.00		0.01		0.01					0.01		0.01		0.00		0.01	
v	38		38		36		40					37		37		36		38	
$t_{0.025}$ (95% CI)	2.023		2.023		2.028		2.021					2.026		2.026		2.028		2.023	
$t_{0.05}$ (90% CI)	1.685		1.685		1.688		1.684					1.687		1.687		1.688		1.685	
t6	1.621		0.479		-0.482		-1.105					0.458		-1.214		1.352		0.009	

TN Hypothesis Tests

H_{O1} When PC layer and Drainage Layer are held constant, The TN for 4" depth = TN for 8" depth
H_{a1} When PC layer and Drainage Layer are held constant, The TN for 4" depth not equal TN for 8" depth
H_{O2} When the PC and Depths are held constant, TN for Gravel Drainage = TN for Plastic Drainage
H_{a2} When the PC and Depths are held constant, TN for Gravel Drainage not equal TN for Plastic Drainage
H_{O3} When the Drainage Layer and Depths is held constant, TN for Layer with Black & Gold = TN for Layer Without Black and Gold
H_{a3} When the Drainage Layer and Depths is held constant, TN for Layer with Black & Gold not equal TN for Layer Without Black and Gold
H_{O4} TN for a Box with PC Layer = TN for a control box
H_{a4} TN for a Box with PC Layer not equal TN for a control box
H_{O5} TN for a Box without PC Layer = TN for a control box
H_{a5} TN for a Box without PC Layer not equal TN for a control box
H_{O6} When PC layer, Drainage Layer, and depth are held constant, The TN for the barrel = TN for Filtrate
H_{a6} When PC layer, Drainage Layer, and depth are held constant, The TN for the barrel not equal TN for Filtrate

Note: R = Reject H_O & A = Accept H_O

	8PCS	8PCS CB	8S	8S CB	8PCG	8PCG CB	8G	8G CB	C1	$C_{Average}$	C2	4PCS	4PCS CB	4S	4S CB	4PCG	4PCG CB	4G	4G CB
Average	1.776	1.526	1.666	1.774	1.380	1.972	1.482	1.760	0.903	1.049	1.195	1.468	1.670	1.683	1.975	1.416	1.808	1.603	2.120
Stand. Dev.	0.639	0.659	0.556	0.613	0.817	1.625	0.595	0.909	0.743	0.780	0.818	0.644	0.611	0.804	0.735	0.478	0.542	0.497	0.913
Var	0.41	0.43	0.31	0.38	0.67	2.64	0.35	0.83	0.55	0.61	0.67	0.41	0.37	0.65	0.54	0.23	0.29	0.25	0.83
n	20	16	16	16	19	16	19	19	16	15	14	20	17	19.00	18.00	18	15	19.00	18.00
Depth Comparison																			
H_{O1} (95% CI)	A	A	A	A	A	A	A	A											
H_{O1} (90% CI)	A	A	A	A	A	A	A	A											
s1^2/s2^2	0.99	0.86	0.48	1.44	2.92	8.98	1.43	1.01											
sp1^2	0.41	0.40	0.49	0.46	0.45	1.51	0.30	0.83											
v	38	31	33	32	35	29	36	35											
$t_{0.025}$ (95% CI)	2.023	2.040	2.035	2.037	2.030	2.045	2.028	2.030											
$t_{0.05}$ (90% CI)	1.685	1.696	1.693	1.694	1.690	1.699	1.688	1.690											
t_1	1.520	-0.653	-0.071	-0.871	-0.165	0.372	-0.678	-1.201											
Drainage Comparison																			
H_{O2} (95% CI)	A	A	A	A								A	A	A	A				
H_{O2} (90% CI)	R	A	A	A								A	A	A	A				
s1^2/s2^2	1.63	0.16	1.15	2.20								1.81	1.27	2.61	1.54				
sp1^2	0.53	1.54	0.33	0.62								0.33	0.34	0.45	0.69				
v	37	30	33	33								36	30	36	34				
$t_{0.025}$ (95% CI)	2.026	2.042	2.035	2.035								2.028	2.042	2.028	2.033				
$t_{0.05}$ (90% CI)	1.687	1.697	1.693	1.693								1.688	1.697	1.688	1.691				
t_2	1.693	-1.016	0.938	0.051								0.280	-0.668	0.369	-0.524				

	8PCS	8PCS CB	8S	8S CB	8PCG	8PCG CB	8G	8G CB	C1	C Average	C2	4PCS	4PCS CB	4S	4S CB	4PCG	4PCG CB	4G	4G CB
Average	1.776	1.526	1.666	1.774	1.380	1.972	1.482	1.760	0.903	1.049	1.195	1.468	1.670	1.683	1.975	1.416	1.808	1.603	2.120
Stand. Dev.	0.639	0.659	0.556	0.613	0.817	1.625	0.595	0.909	0.743	0.780	0.818	0.644	0.611	0.804	0.735	0.478	0.542	0.497	0.913
Var	0.41	0.43	0.31	0.38	0.67	2.64	0.35	0.83	0.55	0.61	0.67	0.41	0.37	0.65	0.54	0.23	0.29	0.25	0.83
n	20	16	16	16	19	16	19	19	16	15	14	20	17	19	18	18	15	19	18
PC Comparison																			
H_{O3} (95% CI)	A	A			A	A						A	A			A	A		
H_{O3} (90% CI)	A	A			A	A						A	A			A	A		
s1^2/s2^2	0.76	0.86			0.53	0.31						1.56	1.44			0.92	2.83		
sp1^2	0.36	0.40			0.51	1.65						0.53	0.46			0.24	0.59		
v	34	30			36	33						37	33			35	24		
$t_{0.025}$ (95% CI)	2.033	2.042			2.028	2.035						2.026	2.035			2.030	2.064		
$t_{0.05}$ (90% CI)	1.691	1.697			1.688	1.693						1.687	1.693			1.690	1.711		
t3	0.544318	-1.102			-0.442	0.485						-0.924309	-1.330			-1.165	-1.217		
PC vs Control																			
H_{O4} (95% CI)	R	A			A	A						A	R			A	R		
H_{O4} (90% CI)	R	R			A	R						R	R			A	R		
s1^2/s2^2	1.49	1.41			0.92	0.23						1.47	1.63			2.67	2.08		
sp1^2	0.49	0.52			0.64	1.66						0.50	0.48			0.40	0.45		
v	33	29			32	29						33	30			31	28		
$t_{0.025}$ (95% CI)	2.035	2.045			2.037	2.045						2.035	2.042			2.040	2.048		
$t_{0.05}$ (90% CI)	1.693	1.699			1.694	1.699						1.693	1.697			1.696	1.701		
t4	3.031	1.843			1.197	1.993						1.740	2.522			1.659	3.091		
NPC vs Control																			
H_{O5} (95% CI)			A	A			A	A						A	R			A	R
H_{O5} (90% CI)			R	R			A	A						A	R			A	R
s1^2/s2^2			1.98	1.63			1.72	0.74						0.95	1.13			2.47	0.73
sp1^2			1.02	1.17			1.21	1.98						1.55	1.36			1.00	1.75
v			29	29			32	32						32	31			32	31
$t_{0.025}$ (95% CI)			2.045	2.045			2.037	2.037						2.037	2.040			2.037	2.039666667
$t_{0.05}$ (90% CI)			1.699	1.699			1.694	1.694						1.694	1.696			1.694	1.696
t5			1.702	1.867			1.141	1.462						1.474	2.270			1.605	2.319
Cistern vs Filtrate																			
H_{O6} (95% CI)	A		A		A		A					A		A		R		R	
H_{O6} (90% CI)	A		A		A		A					A		A		R		R	
s1^2/s2^2	0.94		0.82		0.25		0.43					0.90		0.84		1.29		3.37	
sp1^2	0.42		0.34		1.56		0.59					0.40		0.59		0.26		0.53	
v	34		30		33		36					35		35		31		22	25.96197
$t_{0.025}$ (95% CI)	2.033		2.042		2.035		2.028					2.030		2.030		2.040		2.074	
$t_{0.05}$ (90% CI)	1.691		1.697		1.693		1.688					1.690		1.690		1.696		1.717	
t6	1.151		-0.521		-1.394		-1.115					-0.975		-1.153		-2.205		-2.124	

TSS Hypothesis Tests

H_{O1} When PC layer and Drainage Layer are held constant, The TSS for 4" depth = TSS for 8" depth
H_{a1} When PC layer and Drainage Layer are held constant, The TSS for 4" depth not equal TSS for 8" depth
H_{O2} When the PC and Depths are held constant, TSS for Gravel Drainage = TSS for Plastic Drainage
H_{a2} When the PC and Depths are held constant, TSS for Gravel Drainage not equal TSS for Plastic Drainage
H_{O3} When the Drainage Layer and Depths is held constant, TSS for Layer with Black & Gold = TSS for Layer Without Black and Gold
H_{a3} When the Drainage Layer and Depths is held constant, TSS for Layer with Black & Gold not equal TSS for Layer Without Black and Gold
H_{O4} TSS for a Box with PC Layer = TSS for a control box
H_{a4} TSS for a Box with PC Layer not equal TSS for a control box
H_{O5} TSS for a Box without PC Layer = TSS for a control box
H_{a5} TSS for a Box without PC Layer not equal TSS for a control box
H_{O6} When PC layer, Drainage Layer, and depth are held constant, The TSS for the barrel = TSS for Filtrate
H_{a6} When PC layer, Drainage Layer, and depth are held constant, The TSS for the barrel not equal TSS for Filtrate

α = 0.05 z_α = 1.645 $-z_\alpha$ = -1.645

Note: R = Reject H_O & A = Accept H_O

	8PCS	8PCS CB	8S	8S CB	8PCG	8PCG CB	8G	8G CB	C1	$C_{Average}$	C2	4PCS	4PCS CB	4S	4S CB	4PCG	4PCG CB	4G	4G CB
Average	9.288	7.111	7.575	8.042	8.031	8.440	12.593	9.302	12.500	11.873	11.246	11.906	7.861	10.098	8.320	10.730	7.639	16.698	11.000
s	9.9189	4.663475	5.6135	8.72573	9.1131	8.852814	13.9607	10.875	15.273	12.8521	10.431	10.98671	8.1839	7.64	9.74	9.8591	8.5572	15.96	13.01
Var	98.39	21.75	31.51	76.14	83.05	78.37	194.90	118.28	233.26	171.04	108.81	120.71	66.98	58.40	94.94	97.20	73.23	254.60	169.30
n	36	22	33	25	34	23	32	22	20	20.5	21	34	25	31.00	25.00	36	25	34.00	25.00
Depth Comparison																			
H_{O1} (95% CI	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**											
H_{O1} (90% CI	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**											
s1^2/s2^2	1.23	3.08	1.85	1.25	1.17	0.93	1.31	1.43											
sp1^2	109.22	45.87	44.52	85.54	90.33	75.69	225.68	145.49											
v	68	45	62	48	68	46	64	45											
$t_{0.025}$ (95% CI)	1.960	2.014	1.960	2.011	1.960	2.013	1.960	2.014											
$t_{0.05}$ (90% CI)	1.645	1.679	1.645	1.677	1.645	1.679	1.645	1.679											
t_1		-0.379	-	-0.106	-	0.319	-	-0.482											
z1	-1.044		-1.497		-1.190		-1.114												
Drainage Comparison																			
H_{O2} (95% CI	**A**	**A**	**A**	**A**								**A**	**A**	**R**	**A**				
H_{O2} (90% CI	**A**	**A**	**R**	**A**								**A**	**A**	**R**	**A**				
s1^2/s2^2	0.84	0.28	6.19	1.55								0.81	0.91	4.36	1.78				
sp1^2	90.94	50.72	111.91	95.80								108.61	70.10	161.17	132.12				
v	68	43	63	45								68	48	63	48				
$t_{0.025}$ (95% CI)	1.96	1.96	1.96	1.96								1.96	1.96	1.96	1.96				
$t_{0.05}$ (90% CI)	1.645	1.645	1.645	1.645								1.645	1.645	1.645	1.645				
t_2	-	-	-	-								-	-	-	-				
z2	0.552	-0.634	-1.890	-0.434								0.470	0.094	-2.156	-0.824				

	8PCS	8PCS CB	8S	8S CB	8PCG	8PCG CB	8G	8G CB	C1	C Average	C2	4PCS	4PCS CB	4S	4S CB	4PCG	4PCG CB	4G	4G CB
Average	9.288	7.111	7.575	8.042	8.031	8.440	12.593	9.302	12.500	11.873	11.246	11.906	7.861	10.098	8.320	10.730	7.639	16.698	11.000
s	9.9189	4.663475	5.6135	8.72573	9.1131	8.852814	13.9607	10.875	15.273	12.8521	10.431	10.98671	8.1839	7.64	9.74	9.8591	8.5572	15.96	13.01
Var	98.39	21.75	31.51	76.14	83.05	78.37	194.90	118.28	233.26	171.04	108.81	120.71	66.98	58.40	94.94	97.20	73.23	254.60	169.30
n	36	22	33	25	34	23	32	22	20	20.5	21	34	25	31	25	36	25	34	25
PC Comparison																			
H_{O3} (95% CI	A	A			A	A						A	A			A	A		
H_{O3} (90% CI	A	A			A	A						A	A			R	A		
s1^2/s2^2	0.32	3.50			2.35	1.51						0.48	1.42			0.38	2.31		
sp1^2	66.45	50.76			137.23	97.86						91.04	80.96			173.59	121.27		
v	67	45			64	43						63	48			68	48		
$t_{0.025}$ (95% CI)	1.960	2.014			1.960	2.017						1.960	2.011			1.960	2.011		
$t_{0.05}$ (90% CI)	1.645	1.679			1.645	1.681						1.645	1.677			1.645	1.677		
t3		-0.447				-0.292							-0.180				-1.079		
z3	0.892				-1.562							0.776				-1.870			
PC vs Control																			
H_{O4} (95% CI	A	R			A	A						A	A			A	A		
H_{O4} (90% CI	A	R			A	A						A	A			A	A		
s1^2/s2^2	1.74	7.86			2.06	2.18						1.42	2.55			0.67	1.01		
sp1^2	101.28	22.84			85.64	82.10						124.48	69.89			262.56	176.67		
v	55	41			53	42						53	44			29	44		
$t_{0.025}$ (95% CI)	2.021	2.021			2.007	2.020						2.007	2.017			2.045	2.017		
$t_{0.05}$ (90% CI)	1.684	1.684			1.675	1.683						1.675	1.681			1.699	1.681		
t4	-0.928	-3.246			-1.485	-1.247						0.011	-1.611			-0.255	-1.069		
NPC vs Control																			
H_{O5} (95% CI)			A	A			A	A						A	A			A	A
H_{O5} (90% CI)			A	A			A	A						A	A			A	A
s1^2/s2^2			5.43	2.25			0.88	1.45						2.93	1.80			0.67	1.01
sp1^2			140.12	118.68			312.57	143.68						175.43	129.05			366.78	170.08
v			52	44			51	41						50	44			53	44
$t_{0.025}$ (95% CI)			2.008	2.017			2.009	2.021						2.010	2.017			2.007	2.017
$t_{0.05}$ (90% CI)			1.675	1.681			1.676	1.684						1.677	1.681			1.675	1.681
t5			-1.291	-1.180			0.144	-0.699						-0.471	-1.050			0.901	-0.225
Cistern vs Filtrate																			
H_{O6} (95% CI	A		A		A		A					A		A		A		A	
H_{O6} (90% CI	A		A		A		A					A		A		A		A	
s1^2/s2^2	4.52		0.41		1.06		1.65					1.80		0.62		1.33		1.50	
sp1^2	69.65		50.64		81.18		163.96					98.08		74.64		87.45		218.69	
v	56		56		55		52					57		54		59		57	
$t_{0.025}$ (95% CI)	2.003		2.003		2.004		2.007					2.003		2.005		2.001		2.003	
$t_{0.05}$ (90% CI)	1.673		1.673		1.673		1.675					1.672		1.674		1.671		1.672	
t6	0.964		-0.247		-0.168		0.928					1.550		0.766		1.270		1.462	

TDS Hypothesis Tests

H_{O1}	When PC layer and Drainage Layer are held constant, The TDS for 4" depth = TDS for 8" depth
H_{a1}	When PC layer and Drainage Layer are held constant, The TDS for 4" depth not equal TDS for 8" depth
H_{O2}	When the PC and Depths are held constant, TDS for Gravel Drainage = TDS for Plastic Drainage
H_{a2}	When the PC and Depths are held constant, TDS for Gravel Drainage not equal TDS for Plastic Drainage
H_{O3}	When the Drainage Layer and Depths is held constant, TDS for Layer with Black & Gold = TDS for Layer Without Black and Gold
H_{a3}	When the Drainage Layer and Depths is held constant, TDS for Layer with Black & Gold not equal TDS for Layer Without Black and Gold
H_{O4}	TDS for a Box with PC Layer = TDS for a control box
H_{a4}	TDS for a Box with PC Layer not equal TDS for a control box
H_{O5}	TDS for a Box without PC Layer = TDS for a control box
H_{a5}	TDS for a Box without PC Layer not equal TDS for a control box
H_{O6}	When PC layer, Drainage Layer, and depth are held constant, The TDS for the barrel = TDS for Filtrate
H_{a6}	When PC layer, Drainage Layer, and depth are held constant, The TDS for the barrel not equal TDS for Filtrate

α = 0.05 z_α = 1.645 $-z_\alpha$ = -1.645

Note: R = Reject H_O & A = Accept H_O

	8PCS	8PCS CB	8S	8S CB	8PCG	8PCG CB	8G	8G CB	C1	$C_{Average}$	C2	4PCS	4PCS CB	4S	4S CB	4PCG	4PCG CB	4G	4G CB
Average	407	468	403	476	373	426	371	485	36	29	22	314	404	332	408	336	403	330	422
s	69	80	114	84	83	74	114	143	20	20	19	75	111	95	91	67	114	84	93
Var	4726	6419	12987	7123	6863	5455	13079	20523	419	382	345	5673	12222	8995	8285	4486	13094	7002	8638
n	36	25	34	24	36	23	36	22	20	20.5	21	36	25	34.00	23.00	36	25	35.00	25.00
Depth Comparison																			
H_{O1} (95% CI	R	R	R	R	R	A	A	A											
H_{O1} (90% CI	R	R	R	R	R	A	R	R											
s1^2/s2^2	1.20	1.90	1.44	1.16	1.53	2.40	1.87	2.38											
sp1^2	5200	9321	10991	7691	5674	9441	10084	14184											
v	70	48	66	45	70	46	69	45											
$t_{0.025}$ (95% CI)	1.960	2.011	1.960	2.014	1.960	2.013	1.960	2.014											
$t_{0.05}$ (90% CI)	1.645	1.677	1.645	1.679	1.645	1.679	1.645	1.679											
t_1		2.339	-	2.678	-	0.801	-	1.796											
z1	5.427		2.773		2.084		1.715												
Drainage Comparison																			
H_{O2} (95% CI	A	A	A	A								A	A	A	A				
H_{O2} (90% CI	R	R	A	A								A	A	A	A				
s1^2/s2^2	1.45	1.18	1.01	2.88								0.79	0.93	0.78	1.04				
sp1^2	5795	5958	13034	13518								5080	12658	7984	8469				
v	70	46	68	44								70	48	67	46				
$t_{0.025}$ (95% CI)	1.96	1.96	1.96	1.96								1.96	1.96	1.96	1.96				
$t_{0.05}$ (90% CI)	1.645	1.645	1.645	1.645								1.645	1.645	1.645	1.645				
t_2	-	-	-	-								-	-	-	-				
z2	1.883	1.907	1.162	-0.245								-1.277	0.031	0.088	-0.550				

	8PCS	8PCS CB	8S	8S CB	8PCG	8PCG CB	8G	8G CB	C1	C Averag	C2	4PCS	4PCS CB	4S	4S CB	4PCG	4PCG CB	4G	4G CB
Average	407	468	403	476	373	426	371	485	36	29	22	314	404	332	408	336	403	330	422
s	69	80	114	84	83	74	114	143	20	20	19	75	111	95	91	67	114	84	93
Var	4726	6419	12987	7123	6863	5455	13079	20523	419	382	345	5673	12222	8995	8285	4486	13094	7002	8638
n	36	25	34	24	36	23	36	22	20	20.5	21	36	25	34.00	23.00	36	25	35.00	25.00
PC Comparison																			
H_{O3} (95% CI	A	A			A	A						A	A			A	A		
H_{O3} (90% CI	A	A			A	R						A	A			A	A		
s1^2/s2^2	2.75	1.11			1.91	3.76						1.59	0.68			0.64	0.66		
sp1^2	8735.30	6763.47			9970.73	12813.82						7285.44	10339.25			5725.56	10866.29		
v	68	47			70	43						68	46			69	48		
$t_{0.025}$ (95% CI)	1.96	2.0117			1.96	2.0167						1.96	2.0129			1.96	2.0106		
$t_{0.05}$ (90% CI)	1.645	1.678			1.645	1.681						1.645	1.679			1.645	1.677		
t3		-0.339				-1.746							-0.113				-0.642		
z3	0.167				0.072							-0.873				0.300			
PC vs Control																			
H_{O4} (95% CI	R	R			R	R						R	R			R	R		
H_{O4} (90% CI	R	R			R	R						R	R			R	R		
s1^2/s2^2	0.08	0.06			0.06	0.07						0.07	0.03			0.05	0.04		
sp1^2	4865.22	6698.36			7064.74	5714.80						5839.98	12753.29			7213.70	9013.72		
v	55	44			55	42						55	44			29	44		
$t_{0.025}$ (95% CI)	2.021	2.021			2.0049	2.0195						2.0049	2.0167			2.0452	2.0167		
$t_{0.05}$ (90% CI)	1.684	1.684			1.674	1.683						1.674	1.681			1.699	1.681		
t4	19.585	18.027			14.800	17.299						13.513	11.166			13.072	13.246		
NPC vs Control																			
H_{O5} (95% CI)			R	R			R	R						R	R			R	R
H_{O5} (90% CI)			R	R			R	R						R	R			R	R
s1^2/s2^2			0.03	0.05			0.03	0.02						0.04	0.05			0.05	0.04
sp1^2			13626.19	4030.03			13682.51	10825.65						9509.55	4571.93			7439.61	4937.26
v			53	43			55	41						53	42			54	44
$t_{0.025}$ (95% CI)			2.0066	2.0181			2.0049	2.0211						2.0066	2.0195			2.0057	2.0167
$t_{0.05}$ (90% CI)			1.675	1.682			1.674	1.684						1.675	1.683			1.674	1.681
t5			11.464	23.443			10.582	14.282						11.137	18.455			12.580	18.802
Cistern vs Filtrate																			
H_{O6} (95% CI	R		R		R		R					R		R		R		R	
H_{O6} (90% CI	R		R		R		R					R		R		R		R	
s1^2/s2^2	0.74		1.82		1.26		0.64					0.46		1.09		0.34		0.81	
sp1^2	5414.91		10578.64		6319.51		15870.24					8337.03		8711.46		7987.76		7678.75	
v	59		56		57		56					59		55		59		58	
$t_{0.025}$ (95% CI)	2.001		2.0032		2.0025		2.0032					2.001		2.004		2.001		2.0017	
$t_{0.05}$ (90% CI)	1.671		1.673		1.672		1.673					1.671		1.673		1.671		1.672	
t6	-3.217		-2.676		-2.499		-3.335					-3.785		-2.990		-2.902		-4.003	

pH Hypothesis Tests

H_{O1} When PC layer and Drainage Layer are held constant, The pH for 4" depth = pH for 8" depth
H_{a1} When PC layer and Drainage Layer are held constant, The pH for 4" depth not equal pH for 8" depth
H_{O2} When the PC and Depths are held constant, pH for Gravel Drainage = pH for Plastic Drainage
H_{a2} When the PC and Depths are held constant, pH for Gravel Drainage not equal pH for Plastic Drainage
H_{O3} When the Drainage Layer and Depths is held constant, pH for Layer with Black & Gold = pH for Layer Without Black and Gold
H_{a3} When the Drainage Layer and Depths is held constant, pH for Layer with Black & Gold not equal pH for Layer Without Black and Gold
H_{O4} pH for a Box with PC Layer = pH for a control box
H_{a4} pH for a Box with PC Layer not equal pH for a control box
H_{O5} pH for a Box without PC Layer = pH for a control box
H_{a5} pH for a Box without PC Layer not equal pH for a control box
H_{O6} When PC layer, Drainage Layer, and depth are held constant, The pH for the barrel = pH for Filtrate
H_{a6} When PC layer, Drainage Layer, and depth are held constant, The pH for the barrel not equal pH for Filtrate

z_α = 1.645 $-z_\alpha$ = -1.645

Note: R = Reject H_O & A = Accept H_O

	8PCS	8PCS CB	8S	8S CB	8PCG	8PCG CB	8G	8G CB	C1	$C_{Average}$	C2	4PCS	4PCS CB	4S	4S CB	4PCG	4PCG CB	4G	4G CB
Average	8.14	8.01	8.33	8.03	8.44	8.05	8.48	7.99	5.53	5.42	5.31	8.24	8.01	8.51	8.05	8.34	7.95	8.48	8.10
s	0.59	0.32	0.38	0.40	0.44	0.32	0.54	0.42	0.88	0.84	0.79	0.43	0.39	0.57	0.45	0.52	0.34	0.51	0.41
Var	0.34	0.11	0.14	0.16	0.20	0.10	0.29	0.18	0.78	0.70	0.63	0.19	0.15	0.32	0.20	0.27	0.12	0.26	0.17
n	38	28	39	27	39	25	38	26	22	21.5	21	39	27	38.00	26.00	39	26	39.00	27.00
Depth Comparison																			
H_{O1} (95% CI)	A	A	A	A	A	A	A	A											
H_{O1} (90% CI)	A	A	A	A	A	A	A	A											
s1^2/s2^2	0.55	1.44	2.22	1.28	1.38	1.16	0.90	0.93											
sp1^2	0	0	0	0	0	0	0	0											
v	75	53	75	51	76	49	75	51											
$t_{0.025}$ (95% CI)	1.960	2.006	1.960	2.008	1.960	2.010	1.960	2.008											
$t_{0.05}$ (90% CI)	1.645	1.674	1.645	1.675	1.645	1.677	1.645	1.675											
t_1		0.008	-	-0.196	-	1.103	-	-0.991											
z1	-0.834		-1.613		0.837		-0.020												
Drainage Comparison																			
H_{O2} (95% CI)	R	A	A	A								A	A	A	A				
H_{O2} (90% CI)	R	A	A	A								A	A	A	A				
s1^2/s2^2	0.57	1.05	2.01	1.15								1.44	1.30	0.81	0.83				
sp1^2	0	0	0	0								0	0	0	0				
v	75	51	75	51								76	51	75	51				
$t_{0.025}$ (95% CI)	1.96	2.0076	1.96	2.0076								1.96	1.96	1.96	1.96				
$t_{0.05}$ (90% CI)	1.645	1.675	1.645	1.675								1.645	1.645	1.645	1.645				
t_2	-	-0.481284	-	0.343209								-	0.5818	-	-0.443				
z2	-2.475		-1.384									-0.959		0.227					

	8PCS	8PCS CB	8S	8S CB	8PCG	8PCG CB	8G	8G CB	C1	C Average	C2	4PCS	4PCS CB	4S	4S CB	4PCG	4PCG CB	4G	4G CB
Average	8.14	8.01	8.33	8.03	8.44	8.05	8.48	7.99	5.53	5.42	5.31	8.24	8.01	8.51	8.05	8.34	7.95	8.48	8.10
s	0.59	0.32	0.38	0.40	0.44	0.32	0.54	0.42	0.88	0.84	0.79	0.43	0.39	0.57	0.45	0.52	0.34	0.51	0.41
Var	0.34	0.11	0.14	0.16	0.20	0.10	0.29	0.18	0.78	0.70	0.63	0.19	0.15	0.32	0.20	0.27	0.12	0.26	0.17
n	38	28	39	27	39	25	38	26	22	21.5	21	39	27	38.00	26.00	39	26	39.00	27.00
PC Comparison																			
$_{O3}$ (95% C	A	A			A	A						R	A			A	A		
$_{O3}$ (90% C	R	A			A	A						R	A			A	A		
s1^2/s2^2	0.42	1.49			1.48	1.80						1.71	1.32			1.03	1.43		
sp1^2	0.24	0.13			0.24	0.14						0.25	0.18			0.27	0.14		
v	75	53			75	49						75	51			76	51		
$t_{0.025}$ (95% CI	1.96	2.0057			1.96	2.0096						1.96	2.0076			1.96	2.0076		
$t_{0.05}$ (90% CI)	1.645	1.674			1.645	1.677						1.645	1.675			1.645	1.675		
t3		-0.247				0.543							-0.412				-1.527		
z3	-1.692				-0.399							-2.349				-1.189			
PC vs Control																			
$_{O4}$ (95% C	R	R			R	R						R	R			R	R		
$_{O4}$ (90% C	R	R			R	R						R	R			R	R		
s1^2/s2^2	2.05	6.68			3.59	7.00						3.74	4.62			2.61	6.02		
sp1^2	0.47	0.36			0.37	0.38						0.37	0.39			0.42	0.38		
v	37	27			38	24						38	26			29	26		
$t_{0.025}$ (95% CI	2.028	2.056			2.0262	2.0687						2.0262	2.0595			2.0452	2.0595		
$t_{0.05}$ (90% CI)	1.688	1.706			1.687	1.714						1.687	1.708			1.699	1.708		
t4	14.699	14.974			12.499	11.786						12.296	11.483			11.638	11.600		
NPC vs Control																			
$_{O5}$ (95% CI)			R	R			R	R						R	R			R	R
$_{O5}$ (90% CI)			R	R			R	R						R	R			R	R
s1^2/s2^2			37.62	34.54			18.70	30.06						16.91	27.03			20.76	32.42
sp1^2			0.12	0.12			0.27	0.15						0.30	0.17			0.24	0.13
v			38	26			37	25						37	25			38	26
$t_{0.025}$ (95% CI)			2.0262	2.0595			2.0281	2.0639						2.0281	2.0639			2.0262	2.0595
$t_{0.05}$ (90% CI)			1.687	1.708			1.688	1.711						1.688	1.711			1.687	1.708
t5			21.413	20.572			14.677	18.840						13.947	17.783			15.538	19.948
Cistern vs Filtrate																			
$_{O6}$ (95% C	A		R		R		R					R		R		R		R	
$_{O6}$ (90% C	A		R		R		R					R		R		R		R	
s1^2/s2^2	3.26		0.92		1.95		1.61					1.24		1.60		2.31		1.56	
sp1^2	0.24		0.15		0.16		0.25					0.17		0.27		0.21		0.22	
v	64		64		62		62					64		62		63		64	
$t_{0.025}$ (95% CI	1.9977		1.9977		1.999		1.999					1.9977		1.999		1.9983		1.9977	
$t_{0.05}$ (90% CI)	1.669		1.669		1.670		1.670					1.669		1.670		1.669		1.669	
t6	1.109		3.129		3.789		3.874					2.255		3.447		3.434		3.195	

Alkalinity Hypothesis Tests

H_{O1} When PC layer and Drainage Layer are held constant, The alkalinity for 4" depth = alkalinity for 8" depth
H_{a1} When PC layer and Drainage Layer are held constant, The alkalinity for 4" depth not equal alkalinity for 8" depth
H_{O2} When the PC and Depths are held constant, alkalinity for Gravel Drainage = alkalinity for Plastic Drainage
H_{a2} When the PC and Depths are held constant, alkalinity for Gravel Drainage not equal alkalinity for Plastic Drainage
H_{O3} When the Drainage Layer and Depths is held constant, alkalinity for Layer with Black & Gold = alkalinity for Layer Without Black and Gold
H_{a3} When the Drainage Layer and Depths is held constant, alkalinity for Layer with Black & Gold not equal alkalinity for Layer Without Black and Gold
H_{O4} alkalinity for a Box with PC Layer = alkalinity for a control box
H_{a4} alkalinity for a Box with PC Layer not equal alkalinity for a control box
H_{O5} alkalinity for a Box without PC Layer = alkalinity for a control box
H_{a5} alkalinity for a Box without PC Layer not equal alkalinity for a control box
H_{O6} When PC layer, Drainage Layer, and depth are held constant, The alkalinity for the barrel = alkalinity for Filtrate
H_{a6} When PC layer, Drainage Layer, and depth are held constant, The alkalinity for the barrel not equal alkalinity for Filtrate

α = 0.05 z_α = 1.645 $-z_\alpha$ = -1.645

Note: R = Reject H_O & A = Accept H_O

	8PCS	8PCS CB	8S	8S CB	8PCG	8PCG CB	8G	8G CB	C1	C Average	C2	4PCS	4PCS CB	4S	4S CB	4PCG	4PCG CB	4G	4G CB
Average	137	134	126	124	126	133	105	123	14	14	13	115	113	109	119	108	109	99	119
s	27	28	31	21	36	33	29	28	25	25	25	25	22	28	27	23	20	31	24
Var	716.65	811.93	934.71	434.65	1311.03	1121.83	845.27	773.89	629.14	632.17	635.20	624.00	470.91	783.71	741.75	522.22	396.42	991.80	559.46
n	38	28	38	27	39	25	38	26	22	22	22	39	27	38.00	27.00	38	26	38.00	27.00
Depth Comparison																			
H_{O1} (95% C	R	R	R	A	R	R	A	A											
H_{O1} (90% C	R	R	R	A	R	R	A	A											
s1^2/s2^2	0.87	0.58	0.84	1.71	0.40	0.35	1.17	0.72											
sp1^2	669.71	644.64	859.21	588.20	921.88	751.72	918.53	664.57											
v	75	53	74	52	75	49	74	51											
$t_{0.025}$(95% CI)	1.960	2.006	1.960	2.007	1.960	2.010	1.960	2.008											
$t_{0.05}$(90% CI)	1.645	1.674	1.645	1.675	1.645	1.677	1.645	1.675											
t_1		3.077	-	0.741	-	3.133	-	0.462											
z1	3.677		2.381		2.601		0.839												
Drainage Comparison																			
H_{O2} (95% C	A	A	R	A								A	A	A	A				
H_{O2} (90% C	A	A	R	A								A	A	A	A				
s1^2/s2^2	1.83	0.72	0.90	1.78								0.84	1.19	1.27	0.75				
sp1^2	1017.80	957.77	889.99	600.94								573.79	434.39	887.76	650.60				
v	75	51	74	51								75	51	74	52				
$t_{0.025}$(95% CI)	1.96	1.96	1.96	1.96								1.96	1.96	1.96	1.96				
$t_{0.05}$(90% CI)	1.645	1.645	1.645	1.645								1.645	1.645	1.645	1.645				
t_2	-	-	-	-								-	-	-	-				
z2	1.540	0.206	3.016	0.211								1.347	0.832	1.530	-0.027				

	8PCS	8PCS CB	8S	8S CB	8PCG	8PCG CB	8G	8G CB	C1	C Averag	C2	4PCS	4PCS CB	4S	4S CB	4PCG	4PCG CB	4G	4G CB
Average	136.75	134.37	125.50	124.04	125.59	132.60	104.86	122.61	14.18	13.67	13.16	115.04	113.30	109.49	119.15	107.69	108.54	99.03	119.33
s	26.77	28.49	30.57	20.85	36.21	33.49	29.07	27.82	25.08	25.14	25.20	24.98	21.70	27.99	27.24	22.85	19.91	31.49	23.65
Var	716.65	811.93	934.71	434.65	1311.03	1121.83	845.27	773.89	629.14	632.17	635.20	624.00	470.91	783.71	741.75	522.22	396.42	991.80	559.46
n	38	28	38	27	39	25	38	26	22	22	22	39	27	38.00	27.00	38	26	38.00	27.00
PC Comparison																			
H_{O3} (95% CI	A	A			R	A						A	A			A	A		
H_{O3} (90% CI	R	A			R	A						A	A			A	R		
s1^2/s2^2	1.30	0.54			0.64	0.69						1.26	1.58			0.53	1.41		
sp1^2	825.68	626.85			1081.25	944.31						702.79	606.33			757.01	479.54		
v	74	53			75	49						75	52			74	51		
$t_{0.025}$ (95% CI)	1.96	2.0057			1.96	2.0096						1.96	2.0066			1.96	2.0076		
$t_{0.05}$ (90% CI)	1.645	1.674			1.645	1.677						1.645	1.675			1.645	1.675		
t3		1.530				1.161							-0.873				-1.794		
z3	1.707				2.774							0.918				1.373			
PC vs Control																			
H_{O4} (95% CI	R	R			R	R						R	R			R	R		
H_{O4} (90% CI	R	R			R	R						R	R			R	R		
s1^2/s2^2	0.88	0.78			0.48	0.56						1.01	1.34			0.64	1.13		
sp1^2	736.56	843.16			1346.46	1170.61						640.87	489.75			1019.35	581.84		
v	58	48			59	45						59	47			29	47		
$t_{0.025}$ (95% CI)	2.021	2.021			2.001	2.0141						2.001	2.0117			2.0452	2.0117		
$t_{0.05}$ (90% CI)	1.684	1.684			1.671	1.679						1.671	1.678			1.699	1.678		
t4	16.928	14.590			11.439	11.891						15.018	15.674			10.992	13.576		
NPC vs Control																			
H_{O5} (95% CI)			R	R			R	R						R	R			R	R
H_{O5} (90% CI)			R	R			R	R						R	R			R	R
s1^2/s2^2			0.68	1.45			0.75	0.82						0.81	0.85			0.64	1.13
sp1^2			1329.44	522.91			1237.51	709.19						1174.25	692.79			1388.12	591.95
v			58	47			58	46						58	47			58	47
$t_{0.025}$ (95% CI)			2.0017	2.0117			2.0017	2.0129						2.0017	2.0117			2.0017	2.0117
$t_{0.05}$ (90% CI)			1.672	1.678			1.672	1.679						1.672	1.678			1.672	1.678
t5			11.448	16.804			9.676	14.121						10.437	13.952			8.552	15.121
Cistern vs Filtrate																			
H_{O6} (95% CI	A		A		A		R					A		A		A		R	
H_{O6} (90% CI	A		A		A		R					A		A		A		R	
s1^2/s2^2	0.88		2.15		1.17		1.09					1.33		1.06		1.32		1.77	
sp1^2	756.85		728.34		1237.79		816.48					561.81		766.39		471.49		813.37	
v	64		63		62		62					64		63		62		63	
$t_{0.025}$ (95% CI)	1.9977		1.9983		1.999		1.999					1.9977		1.9983		1.999		1.9983	
$t_{0.05}$ (90% CI)	1.669		1.669		1.670		1.670					1.669		1.669		1.670		1.669	
t6	0.347		0.215		-0.777		-2.440					0.294		-1.386		-0.153		-2.829	

DO Hypothesis Tests

H_{O1}	When PC layer and Drainage Layer are held constant, The DO for 4" depth = DO for 8" depth
H_{a1}	When PC layer and Drainage Layer are held constant, The DO for 4" depth not equal DO for 8" depth
H_{O2}	When the PC and Depths are held constant, DO for Gravel Drainage = DO for Plastic Drainage
H_{a2}	When the PC and Depths are held constant, DO for Gravel Drainage not equal DO for Plastic Drainage
H_{O3}	When the Drainage Layer and Depths is held constant, DO for Layer with Black & Gold = DO for Layer Without Black and Gold
H_{a3}	When the Drainage Layer and Depths is held constant, DO for Layer with Black & Gold not equal DO for Layer Without Black and Gold
H_{O4}	DO for a Box with PC Layer = DO for a control box
H_{a4}	DO for a Box with PC Layer not equal DO for a control box
H_{O5}	DO for a Box without PC Layer = DO for a control box
H_{a5}	DO for a Box without PC Layer not equal DO for a control box
H_{O6}	When PC layer, Drainage Layer, and depth are held constant, The DO for the barrel = DO for Filtrate
H_{a6}	When PC layer, Drainage Layer, and depth are held constant, The DO for the barrel not equal DO for Filtrate

$\alpha =$ 0.05 $z_\alpha =$ 1.645 $-z_\alpha =$ -1.645

Note: R = Reject H_0 & A = Accept H_0

	8PCS	8PCS CB	8S	8S CB	8PCG	8PCG CB	8G	8G CB	C1	C Average	C2	4PCS	4PCS CB	4S	4S CB	4PCG	4PCG CB	4G	4G CB
Average	3.91	4.61	3.79	4.83	3.78	4.57	3.68	4.68	3.85	3.96	4.07	3.90	4.28	3.66	4.75	3.77	4.54	3.70	4.71
Stand. Dev.	1.35	1.33	0.93	1.22	0.95	1.05	1.02	1.08	0.75	1.02	1.28	1.43	0.95	1.24	1.15	1.44	1.07	1.45	1.49
Var	1.81	1.77	0.87	1.48	0.90	1.10	1.04	1.17	0.56	1.10	1.65	2.05	0.90	1.54	1.32	2.07	1.13	2.09	2.23
n	36	23	35	24	35	24	35	24	14	14.5	15	36	23	35.00	24.00	36	25	36.00	25.00
Depth Comparison																			
H_{O1} (95% CI)	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**											
H_{O1} (90% CI)	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**											
s1^2/s2^2	1.13	0.51	1.77	0.89	2.30	1.03	2.01	1.90											
sp1^2	1.93	1.33	1.20	1.40	1.49	1.12	1.57	1.71											
v	70	44	68	46	69	47	69	47											
$t_{0.025}$ (95% CI)	1.960	2.015	1.960	2.013	1.960	2.012	1.960	2.012											
$t_{0.05}$ (90% CI)	1.645	1.680	1.645	1.679	1.645	1.678	1.645	1.678											
t_1		0.988	-	0.229	-	0.106	-	-0.080											
z1	0.042		0.501		0.039		-0.072												
Drainage Comparison																			
H_{O2} (95% CI)	**A**	**A**	**A**	**A**								**A**	**A**	**A**	**A**				
H_{O2} (90% CI)	**A**	**A**	**A**	**A**								**A**	**A**	**A**	**A**				
s1^2/s2^2	0.50	1.61	1.20	0.79								1.01	0.79	1.36	1.69				
sp1^2	1.36	1.42	0.95	1.32								2.06	1.02	1.82	1.78				
v	69	45	68	46								70	46	69	47				
$t_{0.025}$ (95% CI)	1.96	1.96	1.96	1.96								1.96	1.96	1.96	1.96				
$t_{0.05}$ (90% CI)	1.645	1.645	1.645	1.645								1.645	1.645	1.645	1.645				
t_2	-	-	-	-								-	-	-	-				
z2	0.490	0.126	0.480	0.445								0.391	-0.895	-0.127	0.104				

	8PCS	8PCS CB	8S	8S CB	8PCG	8PCG CB	8G	8G CB	C1	C Average	C2	4PCS	4PCS CB	4S	4S CB	4PCG	4PCG CB	4G	4G CB
Average	3.91	4.61	3.79	4.83	3.78	4.57	3.68	4.68	3.85	3.96	4.07	3.90	4.28	3.66	4.75	3.77	4.54	3.70	4.71
Stand. Dev.	1.35	1.33	0.93	1.22	0.95	1.05	1.02	1.08	0.75	1.02	1.28	1.43	0.95	1.24	1.15	1.44	1.07	1.45	1.49
Var	1.81	1.77	0.87	1.48	0.90	1.10	1.04	1.17	0.56	1.10	1.65	2.05	0.90	1.54	1.32	2.07	1.13	2.09	2.23
n	36	23	35	24	35	24	35	24	14	14.5	15	36	23	35.00	24.00	36	25	36.00	25.00
PC Comparison																			
H_{O3} (95% CI)	A	A			A	A						A	A			A	A		
H_{O3} (90% CI)	A	A			A	A						A	A			A	A		
s1^2/s2^2	0.48	0.84			1.15	1.07						0.75	1.46			0.99	1.96		
sp1^2	1.35	1.62			0.97	1.13						1.80	1.11			2.08	1.68		
v	69	45			68	46						69	45			70	48		
$t_{0.025}$ (95% CI)	1.96	2.0141			1.96	2.0129						1.96	2.0141			1.96	2.0106		
$t_{0.05}$ (90% CI)	1.645	1.679			1.645	1.679						1.645	1.679			1.645	1.677		
t3		-0.572				-0.354							-1.528				-0.466		
z3	0.460				0.437							0.766				0.208			
PC vs Control																			
H_{O4} (95% CI)	A	A			A	A						A	A			A	A		
H_{O4} (90% CI)	A	A			A	R						A	A			A	A		
s1^2/s2^2	0.61	0.62			1.22	1.01						0.54	1.22			0.53	0.50		
sp1^2	1.86	1.85			0.93	1.15						2.11	0.94			2.15	2.32		
v	49	36			48	37						49	36			29	38		
$t_{0.025}$ (95% CI)	2.021	2.03033333			2.0117	2.0281						2.0106	2.0301			2.0452	2.0262		
$t_{0.05}$ (90% CI)	1.684	1.690			1.678	1.688						1.677	1.690			1.699	1.687		
t4	-0.105	1.437			-0.597	1.716						-0.129	0.979			-0.418	1.151		
NPC vs Control																			
H_{O5} (95% CI)			A	R			A	A						A	R			A	A
H_{O5} (90% CI)			A	R			A	R						A	R			A	A
s1^2/s2^2			1.27	0.75			1.06	0.94						0.72	0.84			0.53	0.50
sp1^2			1.35	1.34			1.52	1.15						2.04	1.24			2.59	1.82
v			48	37			48	37						48	37			49	38
$t_{0.025}$ (95% CI)			2.0117	2.0281			2.0117	2.0281						2.0117	2.0281			2.0106	2.0262
$t_{0.05}$ (90% CI)			1.678	1.688			1.678	1.688						1.678	1.688			1.677	1.687
t5			-0.470	2.255			-0.733	2.022						-0.677	2.133			-0.522	1.683
Cistern vs Filtrate																			
H_{O6} (95% CI)	A		R		R		R					A		R		R		R	
H_{O6} (90% CI)	R		R		R		R					A		R		R		R	
s1^2/s2^2	1.03		0.59		0.82		0.89					2.28		1.17		1.83		0.94	
sp1^2	1.79		1.11		0.98		1.09					1.61		1.45		1.69		2.14	
v	57		57		57		57					57		57		59		59	
$t_{0.025}$ (95% CI)	2.0025		2.0025		2.0025		2.0025					2.0025		2.0025		2.001		2.001	
$t_{0.05}$ (90% CI)	1.672		1.672		1.672		1.672					1.672		1.672		1.671		1.671	
t6	-1.958		-3.712		-3.014		-3.618					-1.114		-3.420		-2.275		-2.652	

ORP Hypothesis Tests

H_{O1} When PC layer and Drainage Layer are held constant, The ORP for 4" depth = ORP for 8" depth
H_{a1} When PC layer and Drainage Layer are held constant, The ORP for 4" depth not equal ORP for 8" depth
H_{O2} When the PC and Depths are held constant, ORP for Gravel Drainage = ORP for Plastic Drainage
H_{a2} When the PC and Depths are held constant, ORP for Gravel Drainage not equal ORP for Plastic Drainage
H_{O3} When the Drainage Layer and Depths is held constant, ORP for Layer with Black & Gold = ORP for Layer Without Black and Gold
H_{a3} When the Drainage Layer and Depths is held constant, ORP for Layer with Black & Gold not equal ORP for Layer Without Black and Gold
H_{O4} ORP for a Box with PC Layer = ORP for a control box
H_{a4} ORP for a Box with PC Layer not equal ORP for a control box
H_{O5} ORP for a Box without PC Layer = ORP for a control box
H_{a5} ORP for a Box without PC Layer not equal ORP for a control box
H_{O6} When PC layer, Drainage Layer, and depth are held constant, The ORP for the barrel = ORP for Filtrate
H_{a6} When PC layer, Drainage Layer, and depth are held constant, The ORP for the barrel not equal ORP for Filtrate

α = 0.05 z_a = 1.645 $-z_a$ = -1.645

Note: R = Reject H_O & A = Accept H_O

	8PCS	8PCS CB	8S	8S CB	8PCG	8PCG CB	8G	8G CB	C1	C Average	C2	4PCS	4PCS CB	4S	4S CB	4PCG	4PCG CB	4G	4G CB
Average	59	79	67	82	60	84	63	84	83	83	82	74	79	70	85	73	86	71	88
Stand. Dev.	33	28	26	26	29	27	23	25	7	6	6	23	29	24	26	24	24	26	26
Var	1066	785	701	681	865	721	552	634	50	41	32	549	812	568	659	568	554	651	701
n	29	10	29	10	29	10	28	10	2	2	2	29	10	28.00	9.00	29	10	29.00	9.00
Depth Comparison																			
H_{O1} (95% CI)	**R**	**A**	**A**	**A**	**A**	**A**	**A**	**A**											
H_{O1} (90% CI)	**R**	**A**	**A**	**A**	**R**	**A**	**A**	**A**											
s1^2/s2^2	1.94	1.03	1.23	1.03	1.52	1.30	1.18	1.10											
sp1^2	807.52	798.76	635.87	670.58	716.70	637.42	602.17	665.47											
v	56	18	55	17	56	18	55	17											
$t_{0.025}$ (95% CI)	2.003	2.101	2.004	2.110	2.003	2.101	2.004	2.110											
$t_{0.05}$ (90% CI)	1.673	1.734	1.673	1.740	1.673	1.734	1.673	1.740											
t_1	-2.038	-0.008	-0.479	-0.273	-1.888	-0.159	-1.160	-0.303											
Drainage Comparison																			
H_{O2} (95% CI)	**A**	**A**	**A**	**A**								**A**	**A**	**A**	**A**				
H_{O2} (90% CI)	**A**	**A**	**A**	**A**								**A**	**A**	**A**	**A**				
s1^2/s2^2	1.23	1.09	1.27	1.07								1.03	1.47	1.14	1.06				
sp1^2	965.65	753.07	627.84	657.76								558.57	683.12	610.21	679.57				
v	56	18	55	18								56	18	55	16				
$t_{0.025}$ (95% CI)	2.003	1.960	1.960	1.960								1.960	1.960	1.960	1.960				
$t_{0.05}$ (90% CI)	1.673	1.645	1.645	1.645								1.645	1.645	1.645	1.645				
t_2	-0.085	-0.407	0.497	-0.183								0.200	-0.573	-0.159	-0.199				

	8PCS	8PCS CB	8S	8S CB	8PCG	8PCG CB	8G	8G CB	C1	C Averag	C2	4PCS	4PCS CB	4S	4S CB	4PCG	4PCG CB	4G	4G CB
Average	59	79	67	82	60	84	63	84	83	83	82	74	79	70	85	73	86	71	88
Stand. Dev.	33	28	26	26	29	27	23	25	7	6	6	23	29	24	26	24	24	26	26
Var	1066	785	701	681	865	721	552	634	50	41	32	549	812	568	659	568	554	651	701
n	29	10	29	10	29	10	28	10	2	2	2	29	10	28.00	9.00	29	10	29.00	9.00
PC Comparison																			
H_{O3} (95% CI)	A	A			A	A						A	A			A	A		
H_{O3} (90% CI)	A	A			A	A						A	A			A	A		
s1^2/s2^2	0.66	0.87			0.64	0.88						1.03	0.81			0.87	1.27		
sp1^2	883.40	733.18			711.59	677.65						558.62	740.02			609.24	622.88		
v	56	18			55	18						55	17			56	17		
$t_{0.025}$ (95% CI)	2.0032	2.1009			2.004	2.1009						2.004	2.1098			2.0032	2.1098		
$t_{0.05}$ (90% CI)	1.673	1.734			1.673	1.734						1.673	1.740			1.673	1.740		
t3	-0.994	-0.248			-0.533	-0.009						0.6783	-0.492			0.3032	-0.165		
PC vs Control																			
H_{O4} (95% CI)	A	A			A	A						A	A			A	A		
H_{O4} (90% CI)	A	A			A	A						A	A			A	A		
s1^2/s2^2	0.04	0.05			0.05	0.06						0.07	0.05			0.06	0.06		
sp1^2	1105.31	883.20			897.52	811.20						569.55	914.01			674.65	800.70		
v	29	10			29	10						29	10			29	9		
$t_{0.025}$ (95% CI)	2.045	2.228			2.0452	2.2281						2.0452	2.2281			2.0452	2.2622		
$t_{0.05}$ (90% CI)	1.699	1.812			1.699	1.813						1.699	1.813			1.699	1.833		
t4	-0.973	-0.143			-1.048	0.077						-0.483	-0.137			-0.509	0.160		
NPC vs Control																			
H_{O5} (95% CI)			A	A			A	A						A	A			A	A
H_{O5} (90% CI)			A	A			A	A						A	A			A	A
s1^2/s2^2			0.06	0.06			0.07	0.06						0.07	0.06			0.06	0.06
sp1^2			728.44	617.26			574.81	574.91						591.81	589.91			676.16	627.32
v			29	10			28	10						28	9			29	9
$t_{0.025}$ (95% CI)			2.0452	2.2281			2.0484	2.2281						2.0484	2.2622			2.0452	2.2622
$t_{0.05}$ (90% CI)			1.699	1.813			1.701	1.813						1.701	1.833			1.699	1.833
t5			-0.805	-0.016			-1.093	0.097						-0.712	0.155			-0.612	0.275
Cistern vs Filtrate																			
H_{O6} (95% CI)	A		A		R		R					A		A		A		A	
H_{O6} (90% CI)	R		A		R		R					A		A		A		R	
s1^2/s2^2	1.36		1.03		1.20		0.87					0.68		0.86		1.03		0.93	
sp1^2	997.54		696.17		830.35		572.56					613.24		588.98		564.49		661.68	
v	37		37		37		36					37		35		37		36	
$t_{0.025}$ (95% CI)	2.0262		2.0262		2.0262		2.0281					2.0262		2.0301		2.0262		2.0281	
$t_{0.05}$ (90% CI)	1.687		1.687		1.687		1.688					1.687		1.690		1.687		1.688	
t6	-1.756		-1.610		-2.333		-2.380					-0.576		-1.680		-1.512		-1.735	

Turbidity Hypothesis Tests

H_{O1} When PC layer and Drainage Layer are held constant, The TURBIDITY for 4" depth = TURBIDITY for 8" depth
H_{a1} When PC layer and Drainage Layer are held constant, The TURBIDITY for 4" depth not equal TURBIDITY for 8" depth
H_{O2} When the PC and Depths are held constant, TURBIDITY for Gravel Drainage = TURBIDITY for Plastic Drainage
H_{a2} When the PC and Depths are held constant, TURBIDITY for Gravel Drainage not equal TURBIDITY for Plastic Drainage
H_{O3} When the Drainage Layer and Depths is held constant, TURBIDITY for Layer with Black & Gold = TURBIDITY for Layer Without Black and Gold
H_{a3} When the Drainage Layer and Depths is held constant, TURBIDITY for Layer with Black & Gold not equal TURBIDITY for Layer Without Black and Gold
H_{O4} TURBIDITY for a Box with PC Layer = TURBIDITY for a control box
H_{a4} TURBIDITY for a Box with PC Layer not equal TURBIDITY for a control box
H_{O5} TURBIDITY for a Box without PC Layer = TURBIDITY for a control box
H_{a5} TURBIDITY for a Box without PC Layer not equal TURBIDITY for a control box
H_{O6} When PC layer, Drainage Layer, and depth are held constant, The TURBIDITY for the barrel = TURBIDITY for Filtrate
H_{a6} When PC layer, Drainage Layer, and depth are held constant, The TURBIDITY for the barrel not equal TURBIDITY for Filtrate

α = 0.05 z_a = 1.645 $-z_a$ = -1.645

Note: R = Reject H_0 & A = Accept H_0

	8PCS	8PCS CB	8S	8S CB	8PCG	8PCG CB	8G	8G CB	C1	C Average	C2	4PCS	4PCS CB	4S	4S CB	4PCG	4PCG CB	4G	4G CB
Average	2.37	2.02	1.83	2.31	2.63	2.89	2.82	2.60	3.65	3.85	4.05	3.19	3.38	3.11	3.30	3.49	2.66	4.50	3.88
Stand. Dev.	0.94	0.92	0.86	1.09	2.26	2.02	2.42	1.87	3.15	3.61	4.08	2.43	2.65	2.30	2.34	2.30	1.32	3.57	2.49
Var	0.88	0.84	0.74	1.18	5.11	4.07	5.88	3.50	9.90	13.28	16.66	5.91	7.01	5.31	5.46	5.29	1.75	12.74	6.19
n	37	23	31	22	36	23	32	21	20	19	18	34	25	31.00	25.00	34	23	35.00	25.00
Depth Comparison																			
H_{O1} (95% C	A	R	R	A	A	A	R	A											
H_{O1} (90% C	R	R	R	R	A	A	R	R											
s1^2/s2^2	6.70	8.31	7.19	4.63	1.03	0.43	2.17	1.77											
sp1^2	3.28	4.06	3.02	3.46	5.20	2.91	9.47	4.97											
v	69	46	60	45	68	44	65	44											
$t_{0.025}$(95% CI)	1.960	2.013	1.960	2.014	1.960	2.015	1.960	2.015											
$t_{0.05}$ (90% CI)	1.645	1.679	1.645	1.679	1.645	1.680	1.645	1.680											
t_1		-2.341	-	-1.834	-	0.450	-	-1.948											
z1	-1.844		-2.892		-1.571		-2.277												
Drainage Comparison																			
H_{O2} (95% C	A	A	R	A								A	A	A	A				
H_{O2} (90% C	A	R	R	A								A	A	R	A				
s1^2/s2^2	5.80	0.21	7.96	2.97								0.90	4.01	2.40	1.13				
sp1^2	2.97	2.46	3.35	2.31								5.60	4.50	9.26	5.83				
v	71	44	61	41								66	46	64	48				
$t_{0.025}$(95% CI)	1.96	1.96	1.96	1.96								1.96	1.96	1.96	1.96				
$t_{0.05}$ (90% CI)	1.645	1.645	1.645	1.645								1.645	1.645	1.645	1.645				
t_2	-	-	-	-								-	-	-	-				
z2	-0.644	-1.884	-2.173	-0.620								-0.522	1.205	-1.910	-0.849				

	8PCS	8PCS CB	8S	8S CB	8PCG	8PCG CB	8G	8G CB	C1	C Averag	C2	4PCS	4PCS CB	4S	4S CB	4PCG	4PCG CB	4G	4G CB
Average	2	2	2	2	3	3	3	3	4	4	4	3	3	3	3	3	3	5	4
Stand. Dev	1	1	1	1	2	2	2	2	3	4	4	2	3	2	2	2	1	4	2
Var	1	1	1	1	5	4	6	4	10	13	17	6	7	5	5	5	2	13	6
n	37	23	31	22	36	23	32	21	20	19	18	34	25	31.00	25.00	34	23	35.00	25.00
PC Comparison																			
H_{O3} (95% CI	R	A			A	A						A	A			A	R		
H_{O3} (90% CI	R	A			A	A						A	A			A	R		
s1^2/s2^2	0.84	1.40			1.15	0.86						0.90	0.78			0.41	3.54		
sp1^2	0.82	1.01			5.47	3.80						5.62	6.24			9.07	4.07		
v	66	43			66	42						63	48			67	46		
$t_{0.025}$ (95% CI)	1.96	2.0167			1.96	2.0181						1.96	2.0106			1.96	2.0129		
$t_{0.05}$ (90% CI)	1.645	1.681			1.645	1.682						1.645	1.677			1.645	1.679		
t3		-0.958				0.498							0.112				-2.093		
z3	2.483				-0.325							0.143				-1.406			
PC vs Control																			
H_{O4} (95% CI	R	R			A	A						A	A			A	A		
H_{O4} (90% CI	R	R			R	A						A	A			A	A		
s1^2/s2^2	15.06	15.73			2.60	3.26						2.25	1.89			1.04	2.14		
sp1^2	0.91	0.88			5.26	4.27						6.09	7.32			13.13	6.46		
v	54	40			53	40						51	42			29	42		
$t_{0.025}$ (95% CI)	2.021	2.021			2.0057	2.0211						2.0076	2.0181			2.0452	2.0181		
$t_{0.05}$ (90% CI)	1.684	1.684			1.674	1.684						1.675	1.682			1.699	1.682		
t4	-5.498	-6.275			-1.869	-1.497						-0.932	-0.565			-0.346	-1.503		
NPC vs Control																			
H_{O5} (95% CI)			R	A			A	A						A	A			A	A
H_{O5} (90% CI)			R	R			A	A						A	A			A	A
s1^2/s2^2			17.99	11.26			2.26	3.79						2.50	2.43			1.04	2.14
sp1^2			9.01	6.76			14.04	8.14						13.74	8.81			20.37	9.23
v			48	39			49	38						48	42			52	42
$t_{0.025}$ (95% CI)			2.0106	2.0227			2.0096	2.0244						2.0106	2.0181			2.0066	2.0181
$t_{0.05}$ (90% CI)			1.677	1.685			1.677	1.686						1.677	1.682			1.675	1.682
t5			-2.310	-1.894			-0.949	-1.385						-0.688	-0.603			0.509	0.038
Cistern vs Filtrate																			
H_{O6} (95% CI	A		A		A		A					A		A		A		A	
H_{O6} (90% CI	A		R		A		A					A		A		A		A	
s1^2/s2^2	1.04		0.63		1.26		1.68					0.84		0.97		3.03		2.06	
sp1^2	0.87		0.92		4.71		4.95					6.37		5.38		3.87		10.03	
v	58		51		57		51					57		54		55		58	
$t_{0.025}$ (95% CI)	2.0017		2.0076		2.0025		2.0076					2.0025		2.0049		2.004		2.0017	
$t_{0.05}$ (90% CI)	1.672		1.675		1.672		1.675					1.672		1.674		1.673		1.672	
t6	1.420		-1.786		-0.444		0.354					-0.290		-0.317		1.555		0.748	

Conductivity Hypothesis Tests

H_{O1} When PC layer and Drainage Layer are held constant, The CONDUCTIVITY for 4" depth = CONDUCTIVITY for 8" depth
H_{a1} When PC layer and Drainage Layer are held constant, The CONDUCTIVITY for 4" depth not equal CONDUCTIVITY for 8" depth
H_{O2} When the PC and Depths are held constant, CONDUCTIVITY for Gravel Drainage = CONDUCTIVITY for Plastic Drainage
H_{a2} When the PC and Depths are held constant, CONDUCTIVITY for Gravel Drainage not equal CONDUCTIVITY for Plastic Drainage
H_{O3} When the Drainage Layer and Depths is held constant, CONDUCTIVITY for Layer with Black & Gold = CONDUCTIVITY for Layer Without Black and Gold
H_{a3} When the Drainage Layer and Depths is held constant, CONDUCTIVITY for Layer with Black & Gold not equal CONDUCTIVITY for Layer Without Black and Gold
H_{O4} CONDUCTIVITY for a Box with PC Layer = CONDUCTIVITY for a control box
H_{a4} CONDUCTIVITY for a Box with PC Layer not equal CONDUCTIVITY for a control box
H_{O5} CONDUCTIVITY for a Box without PC Layer = CONDUCTIVITY for a control box
H_{a5} CONDUCTIVITY for a Box without PC Layer not equal CONDUCTIVITY for a control box
H_{O6} When PC layer, Drainage Layer, and depth are held constant, The CONDUCTIVITY for the barrel = CONDUCTIVITY for Filtrate
H_{a6} When PC layer, Drainage Layer, and depth are held constant, The CONDUCTIVITY for the barrel not equal CONDUCTIVITY for Filtrate

α = 0.05 z_α = 1.645 $-z_\alpha$ = -1.645

Note: R = Reject H_0 & A = Accept H_0

	8PCS	8PCS CB	8S	8S CB	8PCG	8PCG CB	8G	8G CB	C1	C Average	C2	4PCS	4PCS CB	4S	4S CB	4PCG	4PCG CB	4G	4G CB
Average	583	611	597	660	519	567	531	635	32	33	34	442	512	447	543	468	520	449	540
Stand. Dev.	79	125	95	154	91	114	137	152	19	23	27	75	167	94	143	63	154	83	142
Var	6201	15738	9048	23667	8255	12907	18800	23147	377	551	724	5560	27946	8855	20308	3921	23813	6858	20055
n	33	23	32	23	32	23	31	23	16	16.5	17	32	23	32.00	23.00	32	23	32.00	24.00
Depth Comparison																			
H_{O1} (95% CI)	R	R	R	R	R	A	R	R											
H_{O1} (90% CI)	R	R	R	R	R	A	R	R											
s1^2/s2^2	0.90	1.78	0.98	0.86	0.47	1.85	0.36	0.87											
sp1^2	5886	21842	8952	21987	6088	18360	12731	21567											
v	63	44	62	44	62	44	61	45											
$t_{0.025}$(95% CI)	1.960	2.015	1.960	2.015	1.960	2.015	1.960	2.014											
$t_{0.05}$ (90% CI)	1.645	1.680	1.645	1.680	1.645	1.680	1.645	1.679											
t_1		2.263	-	2.677	-	1.189	-	2.224											
z1	7.391		6.372		2.632		2.874												
Drainage Comparison																			
H_{O2} (95% CI)	R	A	R	A								A	A	A	A				
H_{O2} (90% CI)	R	A	R	A								A	A	A	A				
s1^2/s2^2	1.33	1.22	2.08	0.98								0.71	1.17	0.77	0.99				
sp1^2	7212	14322	13844	23407								4740	25879	7857	20179				
v	63	44	61	44								62	44	62	45				
$t_{0.025}$(95% CI)	1.96	1.96	1.96	1.96								1.96	1.96	1.96	1.96				
$t_{0.05}$ (90% CI)	1.645	1.645	1.645	1.645								1.645	1.645	1.645	1.645				
t_2	-	-	-	-								-	-	-	-				
z2	3.006	1.228	2.218	0.538								-1.495	-0.164	-0.101	0.060				

	8PCS	8PCS CB	8S	8S CB	8PCG	8PCG CB	8G	8G CB	C1	C Average	C2	4PCS	4PCS CB	4S	4S CB	4PCG	4PCG CB	4G	4G CB
Average	583	611	597	660	519	567	531	635	32	33	34	442	512	447	543	468	520	449	540
Stand. Dev.	79	125	95	154	91	114	137	152	19	23	27	75	167	94	143	63	154	83	142
Var	6201	15738	9048	23667	8255	12907	18800	23147	377	551	724	5560	27946	8855	20308	3921	23813	6858	20055
n	33	23	32	23	32	23	31	23	16	16.5	17	32	23	32.00	23.00	32	23	32.00	24.00
PC Comparison																			
H_{O3} (95% CI)	A	A			A	A						A	A			A	A		
H_{O3} (90% CI)	A	A			A	R						A	A			A	A		
s1^2/s2^2	1.46	1.50			2.28	1.79						1.59	0.73			0.57	0.84		
sp1^2	7602.09	19702.59			13440.83	18026.79						7207.32	24126.61			5389.68	21892.53		
v	63	44			61	44						62	44			62	45		
$t_{0.025}$ (95% CI)	1.96	2.0154			1.96	2.0154						1.96	2.0154			1.96	2.0141		
$t_{0.05}$ (90% CI)	1.645	1.680			1.645	1.680						1.645	1.680			1.645	1.679		
t3		-1.183				-1.720							-0.667				-0.470		
z3	-0.678				-0.410							-0.215				1.032			
PC vs Control																			
H_{O4} (95% CI)	R	R			R	R						R	R			R	R		
H_{O4} (90% CI)	R	R			R	R						R	R			R	R		
s1^2/s2^2	0.09	0.03			0.07	0.04						0.10	0.02			0.08	0.03		
sp1^2	6401.36	16487.23			8529.91	13521.25						5744.88	29276.44			7087.04	20967.08		
v	48	38			47	38						47	38			29	39		
$t_{0.025}$ (95% CI)	2.021	2.025666667			2.0129	2.0262						2.0129	2.0262			2.0452	2.0244		
$t_{0.05}$ (90% CI)	1.684	1.687			1.679	1.687						1.679	1.687			1.699	1.686		
t4	22.778	13.945			17.362	14.243						17.801	8.678			17.035	10.420		
NPC vs Control																			
H_{O5} (95% CI)			R	R			R	R						R	R			R	R
H_{O5} (90% CI)			R	R			R	R						R	R			R	R
s1^2/s2^2			0.06	0.02			0.03	0.02						0.06	0.03			0.08	0.03
sp1^2			9634.21	14112.50			19742.41	13807.17						9434.80	12141.39			7371.60	12202.92
v			47	38			46	38						47	38			47	39
$t_{0.025}$ (95% CI)			2.0129	2.0262			2.0141	2.0262						2.0129	2.0262			2.0129	2.0244
$t_{0.05}$ (90% CI)			1.679	1.687			1.679	1.687						1.679	1.687			1.679	1.686
t5			18.966	16.350			11.632	15.890						14.045	14.334			15.976	14.354
Cistern vs Filtrate																			
H_{O6} (95% CI)	A		A		A		R					R		R		A		R	
H_{O6} (90% CI)	A		R		R		R					R		R		R		R	
s1^2/s2^2	0.39		0.38		0.64		0.81					0.20		0.44		0.16		0.34	
sp1^2	10086.56		15116.45		10185.73		20638.95					14851.92		13608.92		12178.05		12479.39	
v	54		53		53		52					53		53		53		54	
$t_{0.025}$ (95% CI)	2.0049		2.0057		2.0057		2.0066					2.0057		2.0057		2.0057		2.0049	
$t_{0.05}$ (90% CI)	1.674		1.674		1.674		1.675					1.674		1.674		1.674		1.674	
t6	-1.033		-1.858		-1.751		-2.639					-2.105		-3.013		-1.729		-3.029	

TS Hypothesis Tests

H_{O1}	When PC layer and Drainage Layer are held constant, The TS for 4" depth = TS for 8" depth
H_{a1}	When PC layer and Drainage Layer are held constant, The TS for 4" depth not equal TS for 8" depth
H_{O2}	When the PC and Depths are held constant, TS for Gravel Drainage = TS for Plastic Drainage
H_{a2}	When the PC and Depths are held constant, TS for Gravel Drainage not equal TS for Plastic Drainage
H_{O3}	When the Drainage Layer and Depths is held constant, TS for Layer with Black & Gold = TS for Layer Without Black and Gold
H_{a3}	When the Drainage Layer and Depths is held constant, TS for Layer with Black & Gold not equal TS for Layer Without Black and Gold
H_{O4}	TS for a Box with PC Layer = TS for a control box
H_{a4}	TS for a Box with PC Layer not equal TS for a control box
H_{O5}	TS for a Box without PC Layer = TS for a control box
H_{a5}	TS for a Box without PC Layer not equal TS for a control box
H_{O6}	When PC layer, Drainage Layer, and depth are held constant, The TS for the barrel = TS for Filtrate
H_{a6}	When PC layer, Drainage Layer, and depth are held constant, The TS for the barrel not equal TS for Filtrate

α = 0.05 z_α = 1.645 $-z_\alpha$ = -1.645

Note: R = Reject H_O & A = Accept H_O

	8PCS	8PCS CB	8S	8S CB	8PCG	8PCG CB	8G	8G CB	C1	C Average	C2	4PCS	4PCS CB	4S	4S CB	4PCG	4PCG CB	4G	4G CB
Average	416	475	407	485	380	435	405	494	48	41	33	327	412	342	418	347	411	350	433
s	70	78	120	84	83	74	100	147	24	23	22	79	113	95	94	69	116	84	100
Var	4907	6111	14440	7009	6900	5409	9916	21497	599	544	490	6263	12736	9019	8906	4792	13385	7028	9997
n	36	25	31	24	36	23	32	22	20	20.5	21	35	25	34.00	22.00	36	25	34.00	25.00
Depth Comparison																			
H_{O1} (95% CI	**R**	**R**	**R**	**R**	**A**	**A**	**R**	**A**											
H_{O1} (90% CI	**R**	**R**	**R**	**R**	**R**	**A**	**R**	**R**											
s1^2/s2^2	1.28	2.08	0.62	1.27	0.69	2.47	0.71	0.47											
sp1^2	5575.12	9423.78	11600.05	7914.06	5846.19	9570.26	8426.63	15363.72											
v	69	48	63	44	70	46	64	45											
$t_{0.025}$ (95% CI)	1.96	2.0106	1.96	2.0154	1.96	2.0129	1.96	2.0141											
$t_{0.05}$ (90% CI)	1.645	1.677	1.645	1.680	1.645	1.679	1.645	1.679											
t_1		2.267	-	2.552	-	0.846	-	1.688											
z1	5.019		2.419		1.877		2.417												
Drainage Comparison																			
H_{O2} (95% CI	**R**	**A**	**A**	**A**								**A**	**A**	**A**	**A**				
H_{O2} (90% CI	**R**	**R**	**A**	**A**								**A**	**A**	**A**	**A**				
s1^2/s2^2	1.41	1.13	0.69	3.07								0.77	0.95	0.78	1.12				
sp1^2	5903.55	5775.38	12140.58	13923.57								5516.93	13060.54	8023.21	9487.76				
v	70	46	61	44								69	48	66	45				
$t_{0.025}$ (95% CI)	1.96	1.96	1.96	1.96								1.96	1.96	1.96	1.96				
$t_{0.05}$ (90% CI)	1.645	1.645	1.645	1.645								1.645	1.645	1.645	1.645				
t_2	-	-	-	-								-	-	-	-				
z2	1.961	1.806	0.063	-0.276								-1.119	0.038	-0.402	-0.553				

	8PCS	8PCS CB	8S	8S CB	8PCG	8PCG CB	8G	8G CB	C1	C Averag	C2	4PCS	4PCS CB	4S	4S CB	4PCG	4PCG CB	4G	4G CB
Average	416	475	407	485	380	435	405	494	48	41	33	327	412	342	418	347	411	350	433
s	70	78	120	84	83	74	100	147	24	23	22	79	113	95	94	69	116	84	100
Var	4907	6111	14440	7009	6900	5409	9916	21497	599	544	490	6263	12736	9019	8906	4792	13385	7028	9997
n	36	25	31	24	36	23	32	22	20	20.5	21	35	25	34.00	22.00	36	25	34.00	25.00
PC Comparison																			
H_{O3} (95% CI	A	A			A	A						A	A			A	A		
H_{O3} (90% CI	A	A			A	R						A	A			A	A		
s1^2/s2^2	2.94	1.15			1.44	3.97						1.44	0.70			0.68	0.75		
sp1^2	9306.56	6550.51			8316.63	13265.82						7620.30	10948.59			5877.06	11691.01		
v	65	47			66	43						67	45			68	48	44.762	
$t_{0.025}$ (95% CI)	1.96	2.0117			1.96	2.0167						1.96	2.0141			1.96	2.0106		
$t_{0.05}$ (90% CI)	1.645	1.678			1.645	1.681						1.645	1.679			1.645	1.677		
t3		-0.438				-1.734							-0.176				-0.728		
z3	0.368				-1.105							-0.697				-0.197			
PC vs Control																			
H_{O4} (95% CI	R	R			R	R						R	R			R	R		
H_{O4} (90% CI	R	R			R	R						R	R			R	R		
s1^2/s2^2	0.00	0.00			0.00	0.00						0.00	0.00			0.00	0.00		
sp1^2	3345.88	3615.75			4626.10	3123.05						4178.64	7270.82			3272.20	7628.73		
v	578	567			578	565						577	567		40.88	29	567		
$t_{0.025}$ (95% CI)	2.021	2.021			1.984	1.984						1.984	1.984			2.0452	1.984		
$t_{0.05}$ (90% CI)	1.684	1.684			1.660	1.660						1.660	1.660			1.699	1.660		
t4	23.455	24.220			18.060	23.234						15.923	14.630			19.336	14.236		
NPC vs Control																			
H_{O5} (95% CI)			R	R			R	R						R	R			R	R
H_{O5} (90% CI)			R	R			R	R						R	R			R	R
s1^2/s2^2			0.00	0.00			0.00	0.00						0.00	0.00			0.00	0.00
sp1^2			8965.67	4042.66			6297.01	11408.60						5870.98	4879.75			4619.61	5759.61
v			573	566			574	564						576	564		39.27023	576	567
$t_{0.025}$ (95% CI)			1.984	1.984			1.984	1.984						1.984	1.984			1.984	1.984
$t_{0.05}$ (90% CI)			1.660	1.660			1.660	1.660						1.660	1.660			1.660	1.660
t5			13.592	23.224			16.243	13.844						14.047	17.585			16.294	17.369
Cistern vs Filtrate																			
H_{O6} (95% CI	R		R		R		R					R		R		R		R	
H_{O6} (90% CI	R		R		R		R					R		R		R		R	
s1^2/s2^2	0.80		2.06		1.28		0.46					0.49		1.01		0.36		0.70	
sp1^2	5396.80		11214.89		6324.65		14592.75					8941.62		8974.68		8287.47		8278.04	
v	59		53		57		52					58		54		59		57	
$t_{0.025}$ (95% CI)	2.001		2.0057		2.0025		2.0066					2.0017		2.0049		2.001		2.0025	
$t_{0.05}$ (90% CI)	1.671		1.674		1.672		1.675					1.672		1.674		1.671		1.672	
t6	-3.062		-2.699		-2.568		-2.669					-3.450		-2.937		-2.719		-3.466	

APPENDIX H: WATER QUALITY RAW DATA

Water Quality Master Spreadsheet C1

Date	OP [mg/ L P]	TP [mg/ L P]	NOX [mg/ L N]	NH3 [mg/L N]	TN [mg/L N]	Turbidity [NTU]	TSS [mg/ L]	TDS [mg/ L]	TS [mg/ L]	Alkalinity [mg/L as CaCO3]	pH	Conduc -tivity [umhos / cm]	DO	ORP
1/12/07												-		
1/15/07												-		
1/23/07												-		
1/26/07	0	0.2			-	8.73				2	6.23	14		
2/5/07	0.01	0.03			-	5.74	5	10	15	2	6.27	25		
2/12/07														
2/19/07														
2/26/07														
3/5/07		0.12	0.17		0.170		17	68	85	6	6.31			
3/12/07														
3/19/07														
3/26/07														
4/2/07	0.04	0.18	0.13		1.13	8.25	18	58	76	4	6.3	71		
4/9/07			0.15		0.15									
4/16/07		0.04	0.15	0.13	0.730	1.73	15	36	51	6	6.33	13	6.2	
4/30/07														
5/4/07	0.04	0.14	0.10		0.86	5.96	52	2	54	3	5.19	-	4	
5/14/07	0.15					11.9	14	50	64	5	5.3	-		
5/21/07	0.05	0.08				4.11				0	4.05	73	3.4	
5/29/07	-					-	-					-		

Date	OP [mg/ L P]	TP [mg/ L P]	NOX [mg/ L N]	NH3 [mg/L N]	TN [mg/L N]	Turbidity [NTU]	TSS [mg/ L]	TDS [mg/ L]	TS [mg/ L]	Alkalinity [mg/L as CaCO3]	pH	Conduc -tivity [umhos / cm]	DO	ORP
6/5/07	0.03	0.06	0.041	0.39		0.95	7	6	13	2	5.20	34	3.9	
6/12/07	0.01	0.05	0.255			1.52	-	-	-	0	3.85	19		
6/19/07	-												3.1	
6/26/07	-	0.11				3.81	23	46	69	0	4.60	34		
7/3/07	0.01	0.23		0.073		1.72	0.5	38	39	0	4.78	20	3.7	
7/10/07	0.113	0.19	0.187	0.125		0.421								
7/11/07	0.01	0.03	0.196	0.019	0.51	1.3	6	16	22	0	3.8	21	3.5	
7/17/07	0.02	0.02	0.161	0.066		1.17	8	36	44	0	5.50			
7/24/07		0.01	0.067	0.063	0.3		4	24	28				3.8	
7/31/07	0.02	0.031		0.014		1.27				0	5.78	15.7	3.1	
8/6/07														
8/14/07	0.08	0.197	0.646	0.111	2.71	2.71	5	72	77	23	5.85	61	-	
8/14/07	0.081		0.881	0.231										
8/21/07	-	-		-	-								-	
8/27/07		0.10			2.22	5.69	16	50.00	66	59	6.21	30	-	
9/5/07	0.03		-		1.71		1.00	18.00	19				3.80	
9/10/07	0.01		0.05		0.82		4.00	28.00	32	63	6.11	30	-	
9/10/07	0.00	0.02	0.02	0.03	0.19									
9/17/07	0.03	0.06			0.80		3.00	66.00	69	20	5.05	22	3.70	
9/24/07	0	0.11				1.72	0	28	28	15	6.54		4.2	
10/1/07	0.01	0.16					53	34	87				3.9	
10/8/07		0.08	0.019		1.08	0.98	0	30	30	8	5.63		3.6	

Date	OP [mg/ L P]	TP [mg/ L P]	NOX [mg/ L N]	NH3 [mg/L N]	TN [mg/L N]	Turbidity [NTU]	TSS [mg/ L]	TDS [mg/ L]	TS [mg/ L]	Alkalinity [mg/L as CaCO3]	pH	Conduc-tivity [umhos / cm]	DO	ORP
10/15/07		-	0.041											
10/22/07	0.073	0.091	0.153	,127	0.741									
10/29/07		-	0.007	-										
11/5/07		-	0.048	-	-									
11/12/07		-	-											
11/19/07		-	-	-										
11/26/07		-		-										
12/3/07		-												
12/11/07		-	-	-	-									
12/19/07			0.02	0.067	0.32	3.25				94	6.75			
12/22/07												23.2	4.5	88
12/28/07														78
Average	0.04	0.10	0.17	0.11	0.90	3.65	12.50	35.80	48.30	14.18	5.53	32.25	3.85	83.00
Stand. Dev.	0.04	0.07	0.21	0.11	0.74	3.15	15.27	20.48	24.47	25.08	0.88	19.43	0.75	7.07
Varence	0.00	0.00	0.05	0.01	0.55	9.90	233	419	599	629	0.78	377	0.56	50.00
n	22	24	21	12	16	20	20	20	20	22	22	16	14	2
Mass Out	60	157	270	178	1465		20293	58120	78413	0				
Median	0.025	0.0855	0.13	0.07	0.7705	2.22	6.25	35	47.5	3.7	5.705	25.3	3.75	-

Water Quality Master Spreadsheet C2

Date	OP [mg/L P]	TP [mg/L P]	NOX [mg/L N]	NH3 [mg/L N]	TN [mg/L N]	Turbidity [NTU]	TSS [mg/L]	TDS [mg/L]	TS [mg/L]	Alkalinity [mg/L as CaCO3]	pH	Conduct-ivity [umhos/cm]	DO	ORP
1/12/07												-		
1/15/07												-		
1/23/07												-		
1/26/07	0.01	0.07			-	5.74				4	6.15	12		
2/5/07	0.01	0.08			-	-	8	11	20	5	6	40		
2/12/07														
2/19/07														
2/26/07														
3/5/07	-	0.15	0.240		-	-	16	50	66	8	6.08	6		
3/19/07														
3/26/07														
4/2/07	0.09	0.23	0.210		1.61	8.32	15	34	49	6	6.33	71		
4/9/07														
4/16/07	-	0.05	0.200	0.12	1.03	2.92	18	48	66	0		12	7.8	
4/30/07														
5/4/07	0.05	0.17	0.150		3.33	4.44	26	0	26	2	5.66	-	3.7	
5/14/07	0.14	0.48	-		-	15.4	24	18	42	4	5.24	-		
5/21/07	0.04	-			-	6.22	1	0	1	0	3.78	113	4.3	
5/29/07	-				-							-		
6/5/07	0.04	0.06	0.045	0.4		1.11	23	2	25	0	4.81	23	3	
6/12/07	0.04	0.07	0.260			1.61	-	-	-	0	3.89	20		
6/19/07	-												3.3	
6/26/07	0.04	0.11				1.72	3	4	7	0	5.11			
7/3/07	0.07	0.16		0.010		1.87	3.5	38	41	0	6.07	21	3.4	
7/10/07	0.126	0.27	0.244	0.106	0.47									

Date	OP [mg/L P]	TP [mg/L P]	NOX [mg/L N]	NH3 [mg/L N]	TN [mg/L N]	Turbidity [NTU]	TSS [mg/L]	TDS [mg/L]	TS [mg/L]	Alkalinity [mg/L as CaCO3	pH	Conduct-ivity [umhos/cm]	DO	ORP
7/11/07	0.01	0.04	0.221	0.027		1.09	9.5	30	39	0	4.02	51	3	
7/17/07	0.03	0.03	0.160	0.130		0.89	7	0	7	0	4.80			
7/24/07		0.01	0.056	0.126	1.01		13	6	19			32	3.6	
7/31/07	0.04	0.174		0.116		1.41				0	5.34	12.2	3.7	
8/6/07														
8/14/07	0.17	0.342	0.58	0.262	2.18	2.22	9	56	64.5	22	6.05	56		
8/14/07	0.199		0.867	0.243										
8/21/07	-			-	-	-				-	-		-	
8/27/07		0.13			1.82	11.8	38.00	36.00	74	36	5.33	22.00	-	
9/5/07	0.04	0.39	-		1.02		0.00	10.00	10				3.50	
9/10/07	0.01	-	0.05		0.85		1.00	18.00	19	69.00	5.12	24.00	-	
9/10/07	0.01	0.03	0.00	0.02	0.12									
9/17/07	0.01	0.03			1.15		4.00	48.00	52	18.00	4.91	21.00	3.30	
9/24/07	0	0.09				1.87	0	20	20	9	5.28		4.4	
10/1/07	0.01	0.13					18	8	26				4.2	
10/8/07		0.06	0.02		0.76	1.33	0	16	16	7	4.98		3.7	
10/15/07		-	0.015			-				-	-			
10/22/07	0.069	0.088	0.138	0.126	0.728									
10/29/07		-	0.015	-										
11/5/07		-	0.031	-	-	-				-	-			
12/19/07			0.017	0.061	0.65	2.96				100	6.58			
12/22/07												40	6.1	86
12/28/07														78
Aver.	0.05	0.14	0.18	0.13	1.19	4.05	11.25	21.59	32	13.16	5.31	33.90	4.07	82
Stand	0.06	0.12	0.21	0.11	0.82	4.08	10.43	18.58	22	25.20	0.79	26.91	1.28	5.6
Var	0.00	0.01	0.05	0.01	0.67	16.66	109	345	490	635	0.63	724	1.65	32
n	23	25	20	13	14	18	21	21	21	22	21	17	15	2

Water Quality Master Spreadsheet 8PCS BL														
Date	OP [mg/L P]	TP [mg/L P]	NOX [mg/L N]	NH3 [mg/L N]	TN [mg/L N]	Turbidity [NTU]	TSS [mg/L]	TDS [mg/L]	TS [mg/L]	Alkalinity [mg/L as CaCO3]	pH	Conductivity [umhos/cm]	DO	ORP
1/12/07	-				-	2.98	13	492	505	142	8.32	705	3.4	
1/15/07	-		0.020			4.67	7	388	395	140	8.09	594	4.6	
1/23/07	0.06	0.14	0.040		2.450	3.23	0	364	364	142	8.54	587	4.9	
1/26/07	0.06	0.12			-	3.37	-	-	-	140	8.54	570	6.5	
2/5/07	0.07	0.08	0.027		-	3.81	0	383	383	144	8.42	598	5.1	
2/12/07	0.07	0.09	0.019	0.17	1.27	3.35	38	504	542	136	8.43	596	4.4	
2/19/07	0.06	0.09	0.039		-	3.41	-	-	-	146	8.58	590	8.5	
2/26/07	0.03	0.07	0.030		-	1.83	12	352	364	164	8.44	594	3.8	
3/5/07	0.02	0.07	0.010		-	3.77	23	410	433	142	8.44	-	6.1	
3/12/07	0.00	0.03	0.002	0.099	1.165	1.60	2	450	452	134	8.72	559		
3/19/07	0.03	0.07	0.030		2.930	2.36	5	410	415	140	8.85	564	4.7	89
3/26/07	0.08				-	1.93	-	-	-	136	8.55	-	5.4	45
4/2/07	0.09	0.09	0.040		-	2.95	3	430	433	139	8.27	632	3.8	61
4/9/07	0.05	0.08	0.030		-	2.42	5	374	379	147	8.06	604	3.1	40
4/16/07	0.07	0.10	0.020	0	1.670	3.36	37	486	523	140	7.83	676	3.7	57
4/30/07	0.04	-	0.040	0.04	2.640	3.61	17	382	399	153	8.13	632		75
5/4/07	0.06	0.12	0.020	0.02		3.82	30	322	352	147	8.6	-	3.4	48
5/14/07	0.03	0.10				4.57	7	400	407	102	8.19	-	3.5	30
5/21/07	0.06	0.07	0.030			1.83	12	312	324	152	8.02	515	4.8	40
5/29/07	0.05	0.06	0.059			-	10	318	328	-	-	595	3.1	151
6/5/07	0.04	0.07	0.042	0.20		1.09	10	162	172	70	6.08	400	4.1	65
6/12/07	0.06	0.06	0.038	0.13		2.03	2	460	462	138	8.18	837		41
6/19/07	0.06	0.06				2.35	0	390	390	120	7.5	598	2.9	39

Date	OP [mg/L P]	TP [mg/L P]	NOX [mg/L N]	NH3 [mg/L N]	TN [mg/L N]	Turbidity [NTU]	TSS [mg/L]	TDS [mg/L]	TS [mg/L]	Alkalinity [mg/L as CaCO3]	pH	Conductivity [umhos/cm]	DO	ORP
6/26/07	0.03	0.07				1.78	0	372	372	104	7.53	601		50
7/3/07	0.05	0.05		0.055		1.9	11	468	479	127	7.77	613	3.6	37
7/10/07	0.01	0.05	0.047	0.124	1.28									
7/11/07	0.03	0.04	0.052	0.058	1.18	1.64	16	320	336	138	7.05	634	2.4	
7/17/07	0.04	0.04	0.041	0.036		0.96	10	502	512	258	7.71		2.7	17
7/24/07		0.03		0.036	0.77	1.61	9	442	451	133	7.41		2.7	11
7/31/07	0.04	0.033				1.34				137	7.92	561	2.07	53
8/6/07														
8/14/07	0.05	0.08	0.03	0.005	0.61	1.12	0	396	396			543	2.6	
8/14/07	0.004		0.012	0.031										
8/21/07	0.07	0.088		0.006	2.14	1.09				123	7.68	552	2.4	
8/27/07		0.03			1.74	2.54	6	458	464	127	7.51	603		
9/5/07	0.11		0.042		1.54		4	488	492				2.5	
9/10/07	0.09		0.039		2.53		6	454	460	134	8.55	644	-	
9/10/07	0.003	0.03	0.0025	0.045	1.94									
9/17/07	0.03	0.03			2.01		4	470	474	109	9.11	641	3.8	
9/24/07	0.03	0.1				1.55	9	464	473	127	8.39	620	3.3	
10/1/07	0.04	0.1					0	418	418				4.1	
10/8/07		0.07	0.022		2.05	2	0	424	424	134	8.4		2.5	
10/15/07	0.05	0.02	0.024			2.25	7	402	409	130	8.58	534	3.9	23
10/22/07	0.022	0.033	0.018	0.039	1.563									56
10/29/07			0.035	0.020										
11/5/07	0.05	0.05	0.028	0.004	2.54	2.36	13	444	457	130	8.82	450	4.4	41
11/12/07			0.026											61
11/17/07														50
11/19/07	0.02	0.02	0.04	0.019		1.69				152.0	8.44	439.0	3.60	32.00

Date	OP [mg/L P]	TP [mg/L P]	NOX [mg/L N]	NH3 [mg/L N]	TN [mg/L N]	Turbidity [NTU]	TSS [mg/L]	TDS [mg/L]	TS [mg/L]	Alkalinity [mg/L as CaCO3]	pH	Conductivity [umhos/cm]	DO	ORP
11/26/07				0.006										
12/3/07														
12/11/07	0.02	0.03	0.03	0.108	1.51		9.00	396	405					125
12/19/07			0.032	0.000		2.46				128	7.87			127
12/22/07												478	4.7	77
12/24/07														85
12/28/07														81
Average	0.05	0.07	0.03	0.054	1.78	2.37	9.29	406.67	415.95	136.75	8.14	582.55	3.91	58.86
Stand. Dev.	0.02	0.03	0.01	0.057	0.64	0.94	9.92	68.75	70.05	26.77	0.59	78.75	1.35	32.65
Varence	0.00	0.00	0.00	0.00	0.41	0.88	98.39	4726	4907	717	0	6201	1.81	1065
n	39	39	35	23	20	37	36	36	36	38	38	33	36	29
Mass Out	19	26	12	21	698	0	3649	159768	163417	0	0			
Median	0.05	0.07	0.03	0.036	1.705	2.35	6.835	410	416.5	137.5	8.29	595	3.7	49

Water Quality Master Spreadsheet 8PCG BL														
Date	OP [mg/L P]	TP [mg/L P]	NOX [mg/L N]	NH3 [mg/L N]	TN [mg/L N]	Turbidity [NTU]	TSS [mg/L]	TDS [mg/L]	TS [mg/L]	Alkalinity [mg/L as CaCO3]	pH	Conduct-ivity [umhos/cm]	DO	ORP
1/12/07					-		23	464	487	148	7.56	651	3.2	
1/15/07			0.030		-	6.06	7	296	303	137	8.87	569	3.4	
1/23/07	0.08	0.14	0.040		-	4.98	0	312	312	138	8.65	519	5	
1/26/07	0.05	0.13	0.060		-	8.29			-	138	8.69	531	5.4	
2/5/07	0.08	0.09	0.038		-	8.21	20	340	360	140	8.64	533	5.7	
2/12/07	0.04	0.10	0.028		-	7.65		332	332	138	8.54	568	4.2	
2/19/07	0.05	0.10	0.012		-	3.41			-	138	8.8		5.8	
2/26/07	0.03	0.10	0.030	0.11	1.52	6.18	0	375	375	136	8.67	565	4.3	
3/5/07	0.03	0.16	0.020		3.52	7.87	33	392	425	138	8.76		4.4	
3/12/07	0.00		0.007	0.11	1.20	1.90	10	393	403	125	8.92	520		
3/19/07	0.03	0.07	0.030		-	1.93	15	368	383	130	9.1	536	3.8	103
3/26/07	0.06	0.20			0.60	2.12			-	124	9.05		4.9	30
4/2/07	0.11	0.07	0.040		-	1.68	13	340	353	120	8.98	525	4.1	75
4/9/07	0.08	0.05	0.030	0.02	1.49	1.70	7	282	289	120	8.64	470	3.2	34
4/16/07	0.07	0.09	0.010	0.02	-	2.06		544	544	130	8	755	4.8	54
4/30/07	0.04	-	0.040	0.01	-	1.73	12	290	302	96	8.18	483		80
5/4//07/	0.05	0.13	0.020		-	4.05	37	316	353	205	8.39		3.1	26
5/14/07	0.05	0.15			-	1.43	0	302	302	22	8.48		2.8	30
5/21/07	0.06	0.06	0.030		0.14	0.66	12	198	210	76	8.72	331	4.7	20
5/29/07	0.04	0.03	0.047	0.20		-	0	366	366	-	-	363	4.3	103

Date	OP [mg/L P]	TP [mg/L P]	NOX [mg/L N]	NH3 [mg/L N]	TN [mg/L N]	Turbidity [NTU	TSS [mg/L]	TDS [mg/L]	TS [mg/L]	Alk. [mg/L as CaCO3]	pH	Conduct-ivity [umhos /cm]	DO	ORP
6/5/07	0.05	0.05	0.040	0.12		1.02	2	132	134	82	7.65	287	3.4	40
6/12/07	0.06	0.06	0.039			0.95	2	418	420	108	7.79	654		72
6/19/07	0.06	0.06				1.48	8	290	298	106	7.86	566	2.6	48
6/26/07	0.03	0.03				1.02	0	330	330	132	7.93	577		56
7/3/07	0.04	0.04		0.004		1.58	4	440	444	117	8.01	556	3.7	43
7/10/07	0.01	0.06	0.007	0.114	1.276									
7/11/07	0.04	0.04	0.037	0.001	0.79	2.48	16	476	492	176	7.49	615	3.2	
7/17/07	0.03	0.03	0.056	0.021		1.08	15	450	465	260	8.02		2.7	33
7/24/07		0.02	0.002	0.024	0.68	1.19	5	422	427	134	7.8		2.8	23
7/31/07	0.02	0.024		0.001		1.9				126	8.16	542	1.9	39
8/14/07	0.03	0.054		0.001	0.84	1.87	6	358	364	125	7.98	497	3.3	
8/14/07	0.015	-	0.016	0.031										
8/21/07	0.08	0.097		0.003	2.04	1.09				119	8.04	494	3.6	
8/27/07					1.74	1.83	9	410	419	114	8.13	537		
9/5/07	0.11		0.043		1.06		0	376	376				3.2	
9/10/07	0.1		0.04		1.64		3	428	431	110	9.11	562	-	
9/10/07	0.002	0.029	0.0026	0.021	1.398									
9/17/07	0.08	0.03			2.36		12	526	538	131	9	566	3	
9/24/07	0.07	0.09				1.58	0	438	438	119	9	572	3.1	
10/1/07	0.04	0.1					0	380	380				3.4	
10/8/07		0.07	0.022		2.28	1.21	0	430	430	126	8.64		2.6	
10/15/07	0.06	0.01	0.016			1.14	3	362	365	132	8.82	491	4	74

Date	OP [mg/L P]	TP [mg/L P]	NOX [mg/L N]	NH3 [mg/L N]	TN [mg/L N]	Turbidity [NTU]	TSS [mg/L]	TDS [mg/L]	TS [mg/L]	Alkalinity [mg/L as CaCO3]	pH	Conduct-ivity [umhos/cm]	DO	ORP
10/22/07	0.017	0.024		0.046	1.511									57
10/29/07			0.023	0.245										
11/5/07	0.05	0.01	0.028	0.014		1.36	9	436	445	88	8.91	432	3.7	38
11/12/07			0.03											51.00
11/17/07														51.00
11/19/07	0.05	0.02		0.019		2.12				110.00	8.72	421.00	4.00	46.00
11/26/07				0.012										
12/3/07														
12/11/07	0.03	0.04	0.025	0.033	0.13		5	426	431					123
12/19/07			0.028	0.050		1.41				118	8.56			124
12/22/07												503	4.1	74
12/24/07														92
12/28/07														88
Aver	0.05	0.07	0.03	0.051	1.38	2.63	8.03	372	380	125.59	8.44	519.07	3.8	60
Stand. Dev.	0.03	0.05	0.01	0.065	0.82	2.26	9.11	82.84	83.07	36.21	0.44	90.86	0.95	29.42
Vare	0.00	0.00	0.00	0.00	0.67	5.11	83	6863	6900	1311	0.20	8255	0.9	865
n	41	38	34	24	19	36	34	36	36	39	39	32	35	29
Mass Out	21	30	12	21	579									
Med.	0.05	0.062	0.029	0.021	1.398	1.78	6.335	375.5	378	126	8.61	536.1	3.6	49.5

Water Quality Master Spreadsheet 8S BL														
Date	OP [mg/ L P]	TP [mg/ L P]	NOX [mg/ L N]	NH3 [mg/ L N]	TN [mg/ L N]	Turbidity [NTU]	TSS [mg/L]	TDS [mg/L]	TS [mg/L]	Alkalinity [mg/L as CaCO3]	pH	Conduc [umhos/ cm]	DO	ORP
1/12/07					-		30	580	610	140	7.86	844	2.9	
1/15/07			0.06		-		10	476	486	148	7.88	663	3.3	
1/23/07	0.18	0.18	0.02		-	4.02	3	388	391	150	8.16	632	3.6	
1/26/07	0.18	0.22	0.05		-	2.01			-	148	8.33	659	5	
2/5/07	0.2	0.18	0.02		2.6	1.97	3	419	422	150	8.24	665	4.9	
2/12/07	0.16	0.22	0.022		-	1.54		450	-	150	8.15	682	3.8	
2/19/07	0.20	0.20	0.013		-	1.59			-	150	8.39		5.2	
2/26/07	0.09	0.26	0.020	0.01	1.87		22	435	457	154	8.35	647	4	
3/5/07	0.10		0.010					468		148	8.17		3.9	
3/19/07	0.00	0.11		0.14	1.238	2.5	7	476	483	146	8.28	617		
3/12/07	0.10	0.17	0.050		-	3.85	15	336	351	156	8.57	663	3.7	93
3/26/07	0.13				0.89				-	150	8.57		4.3	52
4/2/07	0.07	0.19	0.040		-		10	442	452	146	8.79	646	4.3	72
4/9/07	0.04	0.13	0.020	0.02	1.53	3.39	10	346	356	130	8.89	601	5	41
4/16/07	0.03	0.14	0.030			3.27		398	-	112	8.95	616	5.2	59
4/30/07	0.02	-		0.02		1.46	12	358	370	107	8.53	593		87
5/4/07	0.03	0.05	0.030			1.5	10	-	-	90	7.53		3.7	53
5/14/07	0.02	0.05				1.68	7	296	303	66	8.47		3	38
5/21/07	0.03	0.04	0.020			1.17	13	166	179	84	8.57	429	4.8	37
5/29/07	0.03	0.06	0.050	0.21		-	3	314	317	-	-	535	4.5	107

Date	OP [mg/ L P]	TP [mg/ L P]	NOX [mg/ L N]	NH3 [mg/ L N]	TN [mg/ L N]	Turbidity [NTU]	TSS [mg/L]	TDS [mg/L]	TS [mg/L]	Alkalinity [mg/L as CaCO3]	pH	Conduc [umhos/ cm]	DO	ORP
6/5/07	0.04	0.05	0.039	0.17		1.26	0	64	64	132	7.82	322	3.5	51
6/12/07	0.05	0.06	0.039			1.05	0	-	-	116	7.76	751		69
6/19/07	0.05	0.06				1.47	0	100	100	100	8.32	689	2.2	62
6/26/07	0.00	0.03				0.74	0	434	434	110	8.03	655		61
7/3/07	0.05	0.05		0.062		1.28	7	496	503	118	7.44	612	4	52
7/10/07			0.008	0.125	1.52									
7/11/07	0.03	0.05	0.031	0.027	1.00	1.33	3	546	549	192	7.8	742	3.1	
7/17/07	0.04	0.04	0.039	0.001		0.74	12	514.00	526		8.31		4.9	40
7/24/07		0.03	0.06	0.009	2.00	1.1	13	474	487	208	8.26		2.8	35
7/31/07	0.03	0.034		0.000		1.62				137	8.68	594	3.6	40
8/6/07														
8/14/07	0.04	0.034	0.031	0.015	0.69	1.04	3	358	361	98	8.46	543	3.1	
8/14/07	0.005		0.012	0.062										
8/21/07	0.05	0.091		0.013	1.34	1.55				87	8.57	532	3.4	
8/27/07		0.04			2.3		4	434	438	91	8.33	605		
9/5/07	0.11	0.11	0.043		1.61		3	436	439				2.6	
9/10/07	0.11		0.04		2.53		0	468	468	96	9	641	-	
9/10/07														
9/17/07	0.03	0.03			1.96		8	526	534	90	9	645	2.8	
9/24/07	0.04	0.11				1.28	14	466	480	108	8.08	658	1.8	
10/1/07	0.05	0.14					8	468	476				2.8	
10/8/07		0.09	0.022		1.86	1.15	6	498	504	120	8.26		2.4	
10/15/07	0.04	0.04	0.021			2.49	14	390	404	114	8.5	551	4	91

Date	OP [mg/ L P]	TP [mg/ L P]	NOX [mg/ L N]	NH3 [mg/ L N]	TN [mg/ L N]	Turbidity [NTU]	TSS [mg/L]	TDS [mg/L]	TS [mg/L]	Alkalinity [mg/L as CaCO3]	pH	Conduc [umhos/ cm]	DO	ORP
10/22/07	0.021	0.022	0.01	0.149		1.746								58
10/29/07			0.034	0.154										
11/5/07	0.03	0.03	0.02	0.082		2.66	15	458	473	110	8.6	463	5	52
11/12/07			0.019											53
11/17/07														50
11/19/07	0.03	0.09	0.066	0.165		2.32				114	8.02	440	4.1	44
11/26/07				0.046										
12/3/07														
12/11/07	0.04	0.04	0.03	0.041	1.72		10.00	470.00	480					125
12/19/07			0.02	0.032		1.92				140.00	8.05			125
12/22/07												490	5.70	97
12/24/07														97
12/28/07														91
Average	0.06	0.094	0.03	0.071	1.67	1.83	7.58	402.89	406.94	125.50	8.33	597	3.79	66.62
Stand. Dev.	0.06	0.07	0.01	0.066	0.56	0.86	5.61	113.96	120.16	30.57	0.38	95.12	0.93	26.5
Varence	0.00	0.00	0.00	0.00	0.31	0.74	31.51	12987	14440	935	0	9048	1	701
n	39	37	34	22	16	31	33	34	31	38	39	32	35	29
Mass Out	24	35	11	26	621	0	2823	150130	151640	0	0	0	0	0
Median	0.04	0.06	0.028	0.044	1.67	1.55	8	439	452	125	8.32	632	3.7	53

Water Quality Master Spreadsheet 8PCG BL														
Date	OP [mg/L P]	TP [mg/L P]	NOX [mg/L N]	NH3 [mg/L N]	TN [mg/L N]	Turbidity [NTU]	TSS [mg/L]	TDS [mg/L]	TS [mg/L]	Alkalinity [mg/L as CaCO3]	pH	Conduc [umhos/ cm]	DO	ORP
1/12/07					-		23	464	487	148	7.56	651	3.2	
1/15/07			0.030		-	6.06	7	296	303	137	8.87	569	3.4	
1/23/07	0.08	0.14	0.040		-	4.98	0	312	312	138	8.65	519	5	
1/26/07	0.05	0.13	0.060		-	8.29			-	138	8.69	531	5.4	
2/5/07	0.08	0.09	0.038		-	8.21	20	340	360	140	8.64	533	5.7	
2/12/07	0.04	0.10	0.028		-	7.65		332	332	138	8.54	568	4.2	
2/19/07	0.05	0.10	0.012		-	3.41			-	138	8.8		5.8	
2/26/07	0.03	0.10	0.030	0.11	1.52	6.18	0	375	375	136	8.67	565	4.3	
3/5/07	0.03	0.16	0.020		3.52	7.87	33	392	425	138	8.76		4.4	
3/19/07	0.00		0.007	0.11	1.20	1.90	10	393	403	125	8.92	520		
3/12/07	0.03	0.07	0.030		-	1.93	15	368	383	130	9.1	536	3.8	103
3/26/07	0.06	0.20			0.60	2.12			-	124	9.05		4.9	30
4/2/07	0.11	0.07	0.040		-	1.68	13	340	353	120	8.98	525	4.1	75
4/9/07	0.08	0.05	0.030	0.02	1.49	1.70	7	282	289	120	8.64	470	3.2	34
4/16/07	0.07	0.09	0.010	0.02	-	2.06		544	544	130	8	755	4.8	54
4/30/07	0.04	-	0.040	0.01	-	1.73	12	290	302	96	8.18	483		80
5/4/07	0.05	0.13	0.020		-	4.05	37	316	353	205	8.39		3.1	26
5/14/07	0.05	0.15			-	1.43	0	302	302	22	8.48		2.8	30
5/21/07	0.06	0.06	0.030		0.14	0.66	12	198	210	76	8.72	331	4.7	20
5/29/07	0.04	0.03	0.047	0.20		-	0	366	366	-	-	363	4.3	103

Date	OP [mg/L P]	TP [mg/L P]	NOX [mg/L N]	NH3 [mg/L N]	TN [mg/L N]	Turbidity [NTU]	TSS [mg/L]	TDS [mg/L]	TS [mg/L]	Alkalinity [mg/L as CaCO3]	pH	Conduc [umhos/ cm]	DO	ORP
6/5/07	0.05	0.05	0.040	0.12		1.02	2	132	134	82	7.65	287	3.4	40
6/12/07	0.06	0.06	0.039			0.95	2	418	420	108	7.79	654		72
6/19/07	0.06	0.06				1.48	8	290	298	106	7.86	566	2.6	48
6/26/07	0.03	0.03				1.02	0	330	330	132	7.93	577		56
7/3/07	0.04	0.04		0.004		1.58	4	440	444	117	8.01	556	3.7	43
7/10/07	0.01	0.06	0.007	0.114	1.276									
7/11/07	0.04	0.04	0.037	0.001	0.79	2.48	16	476	492	176	7.49	615	3.2	
7/17/07	0.03	0.03	0.056	0.021		1.08	15	450	465	260	8.02		2.7	33
7/24/07		0.02	0.002	0.024	0.68	1.19	5	422	427	134	7.8		2.8	23
7/31/07	0.02	0.024		0.001		1.9				126	8.16	542	1.9	39
8/6/07		-												
8/14/07	0.03	0.054		0.001	0.84	1.87	6	358	364	125	7.98	497	3.3	
8/14/07	0.015	-	0.016	0.031										
8/21/07	0.08	0.097		0.003	2.04	1.09				119	8.04	494	3.6	
8/27/07					1.74	1.83	9	410	419	114	8.13	537		
9/5/07	0.11		0.043		1.06		0	376	376				3.2	
9/10/07	0.1		0.04		1.64		3	428	431	110	9.11	562	-	
9/10/07	0.002	0.029	0.0026	0.021	1.398									
9/17/07	0.08	0.03			2.36		12	526	538	131	9	566	3	
9/24/07	0.07	0.09				1.58	0	438	438	119	9	572	3.1	
10/1/07	0.04	0.1					0	380	380				3.4	
10/8/07		0.07	0.022		2.28	1.21	0	430	430	126	8.64		2.6	
10/15/07	0.06	0.01	0.016			1.14	3	362	365	132	8.82	491	4	74

Date	OP [mg/L P]	TP [mg/L P]	NOX [mg/L N]	NH3 [mg/L N]	TN [mg/L N]	Turbidity [NTU]	TSS [mg/L]	TDS [mg/L]	TS [mg/L]	Alkalinity [mg/L as CaCO3]	pH	Conduc [umhos/ cm]	DO	ORP
10/22/07	0.017	0.024		0.046	1.511									57
10/29/07			0.023	0.245										
11/5/07	0.05	0.01	0.028	0.014		1.36	9	436	445	88	8.91	432	3.7	38
11/12/07			0.03											51
11/17/07														51
11/19/07	0.05	0.02		0.019		2.12				110.00	8.72	421	4.00	46
11/26/07				0.012										
12/3/07														
12/11/07	0.03	0.04	0.025	0.033	0.13		5	426	431					123
12/19/07			0.028	0.050		1.41				118	8.56			124
12/22/07												503	4.1	74
12/24/07														92
12/28/07														88
Average	0.05	0.07	0.03	0.051	1.38	2.63	8.03	372.88	380.44	125.59	8.44	519.07	3.78	59.55
Stand. Dev.	0.03	0.05	0.01	0.065	0.82	2.26	9.11	82.84	83.07	36.21	0.44	90.86	0.95	29.42
Varence	0.00	0.00	0.00	0.00	0.67	5.11	83	6863	6900	1311	0.20	8255	0.90	865
n	41	38	34	24	19	36	34	36	36	39	39	32	35	29
Mass Out	21	30	12	21	579		3369	156398	159569	0				
Median	0.05	0.062	0.029	0.021	1.398	1.78	6.335	375.5	378	126	8.61	536.1	3.6	49.5

Water Quality Master Spreadsheet 8S BL														
Date	OP [mg/ L P]	TP [mg/ L P]	NOX [mg/ L N]	NH3 [mg/L N]	TN [mg/ L N]	Turbidity [NTU]	TSS [mg/L]	TDS [mg/L]	TS [mg/L]	Alkalinity [mg/L as CaCO3]	pH	Conduc[umhos/ cm]	DO	ORP
1/12/07					-		30	580	610	140	7.86	844	2.9	
1/15/07			0.06		-		10	476	486	148	7.88	663	3.3	
1/23/07	0.18	0.18	0.02		-	4.02	3	388	391	150	8.16	632	3.6	
1/26/07	0.18	0.22	0.05		-	2.01			-	148	8.33	659	5	
2/5/07	0.2	0.18	0.02		2.6	1.97	3	419	422	150	8.24	665	4.9	
2/12/07	0.16	0.22	0.022		-	1.54		450	-	150	8.15	682	3.8	
2/19/07	0.20	0.20	0.013		-	1.59			-	150	8.39		5.2	
2/26/07	0.09	0.26	0.020	0.01	1.87		22	435	457	154	8.35	647	4	
3/5/07	0.10		0.010					468		148	8.17		3.9	
3/19/07	0.00	0.11		0.14	1.238	2.5	7	476	483	146	8.28	617		
3/12/07	0.10	0.17	0.050		-	3.85	15	336	351	156	8.57	663	3.7	93
3/26/07	0.13				0.89				-	150	8.57		4.3	52
4/2/07	0.07	0.19	0.040		-		10	442	452	146	8.79	646	4.3	72
4/9/07	0.04	0.13	0.020	0.02	1.53	3.39	10	346	356	130	8.89	601	5	41
4/16/07	0.03	0.14	0.030			3.27		398	-	112	8.95	616	5.2	59
4/30/07	0.02	-		0.02		1.46	12	358	370	107	8.53	593		87
5/4/07	0.03	0.05	0.030			1.5	10	-	-	90	7.53		3.7	53
5/14/07	0.02	0.05				1.68	7	296	303	66	8.47		3	38
5/21/07	0.03	0.04	0.020			1.17	13	166	179	84	8.57	429	4.8	37
5/29/07	0.03	0.06	0.050	0.21		-	3	314	317	-	-	535	4.5	107
6/5/07	0.04	0.05	0.039	0.17		1.26	0	64	64	132	7.82	322	3.5	51
6/12/07	0.05	0.06	0.039			1.05	0	-	-	116	7.76	751		69
6/19/07	0.05	0.06				1.47	0	100	100	100	8.32	689	2.2	62
6/26/07	0.00	0.03				0.74	0	434	434	110	8.03	655		61
7/3/07	0.05	0.05		0.062		1.28	7	496	503	118	7.44	612	4	52

Date	OP [mg/ L P]	TP [mg/ L P]	NOX [mg/ L N]	NH3 [mg/L N]	TN [mg/ L N]	Turbidity [NTU]	TSS [mg/L]	TDS [mg/L]	TS [mg/L]	Alkalinity [mg/L as CaCO3]	pH	Conduc[umhos/ cm]	DO	ORP
7/10/07			0.008	0.125	1.52									
7/11/07	0.03	0.05	0.031	0.027	1.00	1.33	3	546	549	192	7.8	742	3.1	
7/17/07	0.04	0.04	0.039	0.001		0.74	12	514.00	526		8.31		4.9	40
7/24/07		0.03	0.06	0.009	2.00	1.1	13	474	487	208	8.26		2.8	35
7/31/07	0.03	0.034		0.000		1.62				137	8.68	594	3.6	40
8/6/07														
8/14/07	0.04	0.034	0.031	0.015	0.69	1.04	3	358	361	98	8.46	543	3.1	
8/14/07	0.005		0.012	0.062										
8/21/07	0.05	0.091		0.013	1.34	1.55				87	8.57	532	3.4	
8/27/07		0.04			2.3		4	434	438	91	8.33	605		
9/5/07	0.11	0.11	0.043		1.61		3	436	439				2.6	
9/10/07	0.11		0.04		2.53		0	468	468	96	9	641	-	
9/10/07														
9/17/07	0.03	0.03			1.96		8	526	534	90	9	645	2.8	
9/24/07	0.04	0.11				1.28	14	466	480	108	8.08	658	1.8	
10/1/07	0.05	0.14					8	468	476				2.8	
10/8/07		0.09	0.022		1.86	1.15	6	498	504	120	8.26		2.4	
10/15/07	0.04	0.04	0.021			2.49	14	390	404	114	8.5	551	4	91
10/22/07	0.021	0.022	0.01	0.149		1.746								58
10/29/07			0.034	0.154										
11/5/07	0.03	0.03	0.02	0.082		2.66	15	458	473	110	8.6	463	5	52
11/12/07			0.019											53
11/17/07														50
11/19/07	0.03	0.09	0.066	0.165		2.32				114	8.02	440	4.1	44
11/26/07				0.046										
12/3/07														
12/11/07	0.04	0.04	0.03	0.041	1.72		10.00	470.00	480					125
12/19/07			0.02	0.032		1.92				140.00	8.05			125.

Date	OP [mg/L P]	TP [mg/L P]	NOX [mg/L N]	NH3 [mg/L N]	TN [mg/L N]	Turbidity [NTU]	TSS [mg/L]	TDS [mg/L]	TS [mg/L]	Alkalinity [mg/L as CaCO3]	pH	Conduc[umhos/cm]	DO	ORP
12/22/07												490.	5.70	97.
12/24/07														97.
12/28/07														91
Average	0.06	0.094	0.03	0.071	1.67	1.83	7.58	402.89	406.94	125.50	8.33	597.27	3.79	66.6
Stand. Dev.	0.06	0.07	0.01	0.066	0.56	0.86	5.61	113.96	120.16	30.57	0.38	95.12	0.93	26.4
Varence	0.00	0.00	0.00	0.00	0.31	0.74	31.51	12987	14440	935	0	9048	1	701
n	39	37	34	22	16	31	33	34	31	38	39	32	35	29
Mass Out	24	35	11	26	621	0	2823	150130	151640	0	0	0	0	0
Median	0.04	0.06	0.028	0.0435	1.665	1.55	8	439	452	125	8.32	632	3.7	53

Water Quality Master Spreadsheet 8G BL														
Date	OP [mg/L P]	TP [mg/L P]	NOX [mg/L N]	NH3 [mg/L N]	TN [mg/L N]	Turbidity [NTU]	TSS [mg/L]	TDS [mg/L]	TS [mg/L]	Alkalinity [mg/L as CaCO3]	pH	Conduc [umhos/cm]	DO	ORP
1/12/07					-		20	488	508	146	7.6	700	2.9	
1/15/07			0.020		1.13		40	344	384	134	8.18	571	4.6	
1/23/07	0.04	0.10	0.030		-	3.07	2	340	342	132	8.59	549	4.2	
1/26/07	0.04	0.11	0.020		-	3.28			-	134	8.54	605	4.9	
2/5/07	0.02	0.20	0.075		-	2.88	0	348	348	134	8.39	554	4.6	
2/12/07	0.05	0.13	0.030		-	9.82	55	330	385	130	8.49	592	4.2	
2/19/07	0.09	0.14	0.022		-	2.86			-	132	8.71		5.9	
2/26/07	0.02	0.14	0.070		-	9.77	17	382	399	128	8.79	581	4.2	
3/5/07	0.00		0.020				38	386	424	124	8.83		4.3	
3/19/07	0.04	0.07	0.030		0.64	2.07	23	442	465	94	9.37	524	3.6	75
3/12/07	0.01	0.05	0.00	0.09	1.13	2.60	4.00	354	358	101.00	9.02	510.00		
3/26/07	0.06	0.06			-	2.29			-	69	9.52		5.1	65
4/2/07	0.11		0.020		-	2.29	2	338	340	73	9.22	516	3.8	71
4/9/07	0.08	0.08	0.010	0.02	1.12	1.87	5	274	279	80	8.88	451	3.4	62
4/16/07	0.02		0.040		-		-	346	-	58	9.16	815	4.6	55
4/30/07	0.05		0.110	0.02				166	-	36	9.54	300		76
5/4/07	0.07	0.19	0.020			8.06	-	178	-	123	7.99		4.1	59
5/14/07	0.02	0.12				5.42	50	158	208	70	8.52		3.2	35
5/21/07	0.05	0.05	0.030		0.25	0.85	10	282	292	64	8.92	246	4.9	24
5/29/07	0.03		0.047	0.20		-	-	152	-	-	-	323	5	-
6/5/07	0.06	0.05	0.039	0.16		1.86	0	108	108	58	8.48	210	3	50

Date	OP [mg/L P]	TP [mg/L P]	NOX [mg/L N]	NH3 [mg/L N]	TN [mg/L N]	Turbidity [NTU]	TSS [mg/L]	TDS [mg/L]	TS [mg/L]	Alkalinity [mg/L as CaCO3]	pH	Conduc [umhos/cm]	DO	ORP
6/12/07	0.04	0.05	0.042			1.11	23	458	481	96	7.92	686		63
6/19/07	0.07	0.07				1.31	0	390	390	114	8.31	600	2.9	65
6/26/07	0.03	0.03				1.1	11	400	411	92	7.89	607		61
7/3/07	0.04	0.04		0.096		1.25	2	454	456	96	8.4	634	3.6	49
7/10/07	0.007	0.04	0.016	0.121	1.4									
7/11/07	0.03	0.04	0.089	0.001	1.96	1.4	11	502	513	124	7.04	684	2.9	-
7/17/07	0.04	0.04	0.038	0.034		1.34	15	510	525	184	8.45		3.2	43
7/24/07		0.03	0	0.035	1.71	1.12	5	418	423	119	8.15		3	40
7/31/07	0.03	0.036		0.000		1.34				101	8.5	538	2.7	39
8/6/07														
8/14/07	0.04	0.03	0.071	0.015	0.72	0.74	6	324	330				2.5	
8/14/07	0.005		0.004	0.036										
8/21/07	0.07	0.107		0.030	2.37	1.38				103	8.44	477	2.8	
8/27/07		0.03			1.78	6.02	6	376	382	86	7.36	478		
9/5/07	0.01	0.09	0.044		2.05		5	386	391			463	1.6	
9/10/07	0.15				1.74		5	468	473	118	8.09	652	-	
9/10/07	0.003	0.019	0.003	0.048	1.492									
9/17/07	0.06	0.06			2.51		9	534	543	108	8.06	673	1.9	
9/24/07	0.07	0.12				1.25	23	558	581	116	8.13	672	2.5	
10/1/07	0.03	0.12					1	462	463				3.5	
10/8/07		0.1	0.013		1.77	3.37	10	452	462	104	8.44		2.6	
10/15/07	0.06	0.03	0.01			2.8	14	416	430	116	8.3	541	4.1	78
10/22/07	0.007	0.021	0.003	0.142	1.413									58

Date	OP [mg/L P]	TP [mg/L P]	NOX [mg/L N]	NH3 [mg/L N]	TN [mg/L N]	Turbidity [NTU]	TSS [mg/L]	TDS [mg/L]	TS [mg/L]	Alkalinity [mg/L as CaCO3]	pH	Conduc [umhos/cm]	DO	ORP
10/29/07			0.03	0.075										
11/5/07	0.14	0.02	0.03	0.092	1.64	2.82	19.00	466.00	485	138.00	8.25	492.00	5.20	54.00
11/12/07			0.03											50.00
11/17/07														48.00
11/19/07	0.02	0.04	0.02	0.024		1.82				98.00	8.62	432.00	3.30	42.00
11/26/07				0.051										
12/3/07														
12/11/07	0.02	0.03	0.015	0.021	0.98		7	462	469					120
12/19/07			0.011	0.038		1.04				122	7.97			124
12/22/07												455	5.4	81
12/24/07														94
12/28/07														92
Average	0.045	0.07	0.03	0.062	1.48	2.82	12.59	371	405	104.86	8.48	531.12	3.68	63
Stand. Dev.	0.03	0.05	0.03	0.055	0.60	2.42	13.96	114	99	29.07	0.54	137.11	1.02	23
Varence	0.00	0.00	0.00	0.003	0.35	5.88	195	13079	9916	845	0.29	18800	1.04	552
n	41	37	36	22	19	32	32	36	32	38	38	31	35	28
Mass Out	14	23	10	19	470		3991	117640	128421	0				
Median	0.04	0.053	0.026	0.037	1.49	1.97	9.5	386	416.9	111	8.445	549	3.6	58

Water Quality Master Spreadsheet 4PCS BL														
Date	OP [mg/L P]	TP [mg/L P]	NOX [mg/L N]	NH3 [mg/L N]	TN [mg/L N]	Turbidity [NTU]	TSS [mg/L]	TDS [mg/L]	TS [mg/L]	Alkalinity [mg/L as CaCO3]	pH	Conduc [umhos/cm]	DO	ORP
1/12/07					-		13	324	337	132	7.79	457.65	3.9	
1/15/07			0.02		2.805	6.02	2	222	224	126	8.20	400.43	4.8	
1/23/07	0.03	0.14	0.02		-	2.96	3	224	227	128	8.59	400.43	6.1	
1/26/07	0.02	0.10	0.04		-	6.06	-	-	-	128	8.49	446	6.9	
2/5/07	0.07	0.13	0.02		-	3.65	3	253	256	132	8.42	432	4.3	
2/12/07	0.04	0.14	0.02	0.200	0.99	4.64	40	318	358	130	8.42	429	4.1	
2/19/07	0.06	0.12	0.01		-	3.36	-	-	-	128	8.61		8.1	
2/26/07	0.04	0.15	0.020		1.61	10.2	12	269	281	106	8.65	433	4.4	
3/5/07	0	0.18	0.020		-		35	282	317	128	8.55		6	
3/19/07	0.012	0.09	0.002	0.091	0.91	2.9	11	299	310	120	8.60	411		
3/12/07	0.04	0.11			0.36	3.46	22	292	314	130	8.76	436	3.1	92
3/26/07	0.07	0.09			1.56	3.36	-	-	-	124	8.72		4.3	60
4/2/07	0.08	0.08	0.040		-	2.88	5	294	299	121	8.85	439	4	82
4/9/07	0.01	0.08	0.030	0.030	1.35	2.59	8	260	268	124	8.60	452	4.2	90
4/16/07	0.04	0.08	0.030			2.58	43	370	413	114	8.35	486	5.1	52
4/30/07	0.05	-	0.020	0.020		-		286		104	7.73	473		119
5/4/07	0.05	0.06	0.040		1.70	10.30	7	190	197	112	8.25		4	60
5/14/07	0.04	0.14				6.17		292	292	70	7.9		2.9	46
5/21/07	0.06	0.06	0.030			1.19	15	222	237	94	8.27	389	4.3	79
5/29/07	0.03	0.04	0.048	0.213		-	7	176	183	-	-	355	4.9	99
6/5/07	0.05	0.05	0.036	0.250		1.03	0	120	120	64	7.99	241	4.2	70
6/12/07	0.03	0.06	0.036			0.92	5	396	401	112	8.09	619		71
6/19/07	0.05	0.05				1.26	0	364	364	100	8.29	512	3	71
6/26/07	0.01	0.05				1.61	0	334	334	104	8.03	490		65
7/3/07	0.06	0.06		0.065		1.7	3	374	377	99	7.95	530	3.4	63
7/10/07	0.002	0.06	0.008	0.143	1.38									

Date	OP [mg/L P]	TP [mg/L P]	NOX [mg/L N]	NH3 [mg/L N]	TN [mg/L N]	Turbidity [NTU]	TSS [mg/L]	TDS [mg/L]	TS [mg/L]	Alkalinity [mg/L as CaCO3]	pH	Conduc [umhos/cm]	DO	ORP
7/11/07	0.02	0.06	0.029	0.024	0.83	1.6	14	430	444	120	6.75	588	2.5	
7/17/07	0.04	0.04	0.033	0.040		1.3	6	410	416	185	8.02		2.6	59
7/24/07		0.02	0.005	0.040	2.28	1.44	5	352	357	196	7.81		2.4	50
7/31/07	0.04	0.046		0.000		2.25				126	8.3	414	3.5	39
8/6/07														
8/14/07	0.04	0.026	0.043	0.030	0.5	0.77	6	242	248	96.00	8.32	364	2.4	
8/14/07	0.006		0.016	0.035										
8/21/07	0.05			0.020	1.86	2.38				86	7.98	392	2.7	
8/27/07		0.02			1.23	1.86	3	292	295	89	7.99	422		
9/5/07	0.02	0.16	0.045		1.16		6	344	350				2.6	
9/10/07	0		0.047		2.39		12	354	366	92	8	480	-	
9/17/07	0	0.04			1.66		10	440	450	104	8	530	1.5	
9/24/07	0.03	0.11				1.7	21	392	413	117	8.02	508	2	
10/1/07	0.03	0.15					8	382	390				2.6	
10/8/07		0.13	0.011		2.74	8.1	12	402	414	94	7.19		2.7	
10/15/07	0.05	0.05	0.017			3.28	20	326	346	106	8.81	448	3.9	77
10/22/07														60
10/29/07			0.036	0.000										
11/5/07	0.05	0.03	0.028	0.003	2.27	2.88	21	354	375	124	8.52	348	4.6	58
11/12/07			0.028											61
11/17/07														49
11/19/07	0.03	0.03		0.024		1.88				124	8.63	385	4.3	45
11/26/07				0.036										
12/3/07														
12/11/07	0.04	0.04	0.02	0.210	1.11		18.00	356.00	374					122.00
12/19/07			0.02	0.034		3.02				126.00	8.22			122.00
12/22/07												408.00	5.00	92.00

Date	OP [mg/L P]	TP [mg/L P]	NOX [mg/L N]	NH3 [mg/L N]	TN [mg/L N]	Turbidity [NTU]	TSS [mg/L]	TDS [mg/L]	TS [mg/L]	Alkalinity [mg/L as CaCO3]	pH	Conduc [umhos/cm]	DO	ORP
12/24/07														96.00
12/28/07														99.00
Average	0.04	0.08	0.03	0.072	1.47	3.19	11.91	314.43	326.84	115.04	8.24	441.99	3.90	74.07
Stand. Dev.	0.02	0.04	0.01	0.080	0.64	2.43	10.99	75.32	79.14	24.98	0.43	74.56	1.43	23.44
Variance	0.00	0.00	0.00	0.006	0.41	5.91	121	5673	6263	624	0.19	5559.56	2.05	549.21
n	39	38	33	21	20	34	34	36	35	39	39	32	36	29
Mass Out	12	26	9	23	477		3871	102232	106266	0				
Median	0.04	0.060	0.028	0.035	1.47	2.735	8	321	337	120	8.27	435.5	4	64

Water Quality Master Spreadsheet 4PCG BL

Date	OP [mg/L P]	TP [mg/L P]	NOX [mg/L N]	NH3 [mg/L N]	TN [mg/L N]	Turbidity [NTU]	TSS [mg/L]	TDS [mg/L]	TS [mg/L]	Alkalinity [mg/L as CaCO3]	pH	Conduc [umhos / cm]	DO	ORP
1/12/07					-		10	332	342	150	8.35	490	3.4	
1/15/07			0.020		-	5.71	7	256	263	116	8.57	440	5.4	
1/23/07	0.02	0.14	0.060		-	-	10	280	290	116	8.34	400	5.6	
1/26/07	0.01	0.09	0.010		-	2.79	-	-	-	122	8.78	394	6.3	
2/5/07	0.07	0.05	0.044		-	3.66	0	244	244	118	8.79	433	5.5	
2/12/07	0.02	0.11	0.018	0.05	1.30	9.25	39	394	433	122	9.04	440	4.5	
2/19/07	0.05	0.13	0.055		-	5.45		-	-	116	9.19		8.5	
2/26/07	0.03	0.15	0.030		1.68	7.85	15	270	285	113	8.82	475	3.3	
3/5/07	0.00	0.15	0.010		-	8.2	8	296	304	116	8.86		3.6	
3/19/07	0.00	0.09	0.002	0.097	1.05	3.2	7	312	319	106	8.66	416		
3/12/07	0.02	0.11	0.030		1.19	3.64	23	318	341	120	9.63	434	3.3	96
3/26/07	0.06	0.10			1.45	4.62		-	-	100	9.14		5	62
4/2/07	0.08	0.08	0.020		-	3.76	0	280	280	92	9.03	453	4	82
4/9/07	0.06	0.06	0.040	0.01	-	2.4	13	292	305	100	8.71	475	3.6	76
4/16/07	0.05	0.07	0.040			2.63	28	390	418	88	8.45	529	5	46
4/30/07	0.01	0.06	0.020	0		1.39	13	320	333	78	8.67	510		109
5/4/07	0.04	0.10	0.030			1.67	10	246	256	86	8.09		2.8	59
5/14/07	0.02	0.07				7.62	10	372	382	56	8.09		2.5	47
5/21/07	0.05	0.07	0.030			1.42	13	288	301	88	8.67	438	4	77
5/29/07	0.03	0.04	0.047	0.20		-	5	290	295	-	-	486	4.6	105
6/5/07	0.04	0.06	0.044	0.22		1.38	0	170	170	74	8.52	319	3.4	79
6/12/07	0.01	0.05	0.036			1.68	13	376	389	94	8.29	583		70
6/19/07	0.04	0.04				1.55	0	336	336	86	8.27	494	3	69
6/26/07	0.00	0.03				0.93	15	268	283	104	7.69	504		64
7/3/07	0.03	0.04		0.045		1.9	7	356	363	90	8	500	3.6	60
7/10/07	0.00	0.03	0.007	0.124	1.14									
7/11/07	0.03	0.05	0.003	0.000	0.51	1.58	18	388	406	170	7.66	520	3.2	

Date	OP [mg/L P]	TP [mg/L P]	NOX [mg/L N]	NH3 [mg/L N]	TN [mg/L N]	Turbidity [NTU]	TSS [mg/L]	TDS [mg/L]	TS [mg/L]	Alkalinity [mg/L as CaCO3]	pH	Conduc [umhos / cm]	DO	ORP
7/17/07	0.04	0.05	0.011	0.033		1.85	5	382	387	177	8.05		2.3	53
7/24/07		0.04	0.058	0.034	-	2.65	15	336	351	104	7.59		2.3	48
7/31/07	0.02	0.066		0.003		4.5					8.15	447	5.6	39
8/6/07														
8/14/07	0.03	0.062	0.03	0.014	0.8	4.27	4	302	306	103.00	8.05	424	1.5	
8/14/07	0.005		0.01	0.079										
8/21/07	0.06			0.058	2.04	3.14				113	7.53	485	2.2	
8/27/07		0.06			2.5		37	372	409	140	7.48	519		
9/5/07	0.03		0.042		1.88		2	428	430	108	8.14		2	
9/10/07	0.07		0.048		1.81		0	416	416	112	7.99	566	-	
9/10/07	0.003	0.037	0.018	0.040	1.656									
9/17/07	0.04	0.04			1.6		6	528	534			561	2.6	
9/24/07	0.03	0.11				1.9	6	400	406	100	8.02	572	2.6	
10/1/07	0.04	0.11					1	364	365				2.4	
10/8/07		0.1	0.019		0.89	8.21	2	364	366	112	8.03		2.9	
10/15/07	0.06	0.04	0.017			2.56	13	290	303	118	8.16	421	3.6	80
10/22/07	0.01	0.02	0.03	0.127	1.40									60
10/29/07			0.03											
11/5/07	0.03	0.03	0.02	0.001	1.24	2.67	20.00	376.00	396	108.00	8.24	368.00	4.10	56
11/12/07			0.02											56
11/17/07														50
11/19/07	0	0.03	0.067	0.023		2.53				117	8.34	417	4.1	43
11/26/07				0.002										
12/3/07														
12/11/07	0.03	0.03	0.023	0.018	1.35		6	376	382					125
12/19/07			0.025	0.026		2.32				110	7.56			124
12/22/07												448	4.6	85
12/24/07														95
12/28/07														97

Date	OP [mg/L P]	TP [mg/L P]	NOX [mg/L N]	NH3 [mg/L N]	TN [mg/L N]	Turbidity [NTU]	TSS [mg/L]	TDS [mg/L]	TS [mg/L]	Alkalinity [mg/L as CaCO3]	pH	Conduc [umhos / cm]	DO	ORP
Average	0.03	0.07	0.03	0.055	1.42	3.49	10.73	335.88	346.61	107.69	8.34	467.72	3.77	72.8
Stand. Dev.	0.02	0.04	0.02	0.063	0.48	2.30	9.86	66.98	69.22	22.85	0.52	62.62	1.44	23.83
Varence	0.00	0.00	0.00	0.004	0.23	5.29	97	4486	4792	522	0.27	3920.92	2.07	567.93
n	41	40	37	22	18	34	36	36	36	38	39	32	36	29
Mass Out	12	28	12	22	567		4300	134590	138889	0				
Median	0.03	0.06	0.025	0.033	1.376	2.66	9	334	341.5	109	8.29	475.1	3.6	63

Water Quality Master Spreadsheet 4S BL

Date	OP [mg/L P]	TP [mg/L P]	NOX [mg/L N]	NH3 [mg/L N]	TN [mg/L N]	Turbidity [NTU]	TSS [mg/L]	TDS [mg/L]	TS [mg/L]	Alkalinity [mg/L as CaCO3]	pH	Conduc [umhos/ cm]	DO	ORP
1/12/07					-		30	380	410	146	7.61	560	3.4	
1/15/07			0.02		1.71		0	316	316	138	8.08	485	4.3	
1/23/07		0.25	0.02		-	6.89	0	260	260	142	8.2	487	5.16	
1/26/07	0.15	0.24	0.010		-	3.84				143	8.4	519	5.1	
2/5/07	0.14	0.18	0.026		-	5.51	15	270	285	126	8.09	436	5.3	
2/12/07	0.11	0.21	0.033		1.46	9.69	23	494	517	142	8.45	493	4.5	
2/19/07	0.05	0.15	0.014		-	2.93			-	138	8.77		6.6	
2/26/07	0.04	0.22	0.020		2.02		23	282	305	122	8.82	458	4.3	
3/5/07	0.00	0.26	0.010		-			330	330	110	9.97		4.4	
3/19/07	0.00	0.05	0.007	0.094	0.94	2.00	4	276	280	87	8.94	284		
3/12/07	0.02	0.08	0.030		1.08	3.04	12	274	286	78	9.52	396	4.1	92
3/26/07	0.06	0.07			-	4.08			-	71	9.52		5	58
4/2/07	0.12	0.10	0.020		-	6.33	15	242	257	70	9.23	398	4	75
4/9/07	0.03	0.10	0.020	0.01	1.75	6.97	22	258	280	84	9.17	419	3.2	60
4/16/07	0.06		0.040			5.02		388	388	74	9	497	4.4	49
4/30/07	0.01	0.13		0.01		6.21		260	260	76	8.92	410		95
5/4/07	0.09	0.19	0.030			5.17	12	454	466	90	7.53		3.2	46
5/14/07	-	-				-	-	-	-	-	-		-	-
5/21/07	0.04	0.02	0.040			0.57	22	202	224	156	8.13	334	4.7	44
5/29/07	0.01	0.05	0.046	0.25		-	15	168	183	-	-	327	4.1	99
6/5/07	0.06	0.08	0.039	0.27		2.28	0	80	80	68	8.39	229	3.4	61
6/12/07	0.02	0.06	0.037			1.10	27	358	385	100	8.05	615		71
6/19/07	0.09	0.09				1.30	-	-	-	104	8.23	521	3	67
6/26/07	0.03	0.03				1.08	0	282	282	161	8.34	504		63
7/3/07	0.03	0.03		0.138		1.43	9	398	407	110	8.2	494	3.5	52
7/10/07	0.00	0.04	0.008	0.135	1.24									
7/11/07	0.03	0.03	0.063	0.019	1.15	1.89	13	404	417	93	8.27	540	2.9	

Date	OP [mg/L P]	TP [mg/L P]	NOX [mg/L N]	NH3 [mg/L N]	TN [mg/L N]	Turbidity [NTU]	TSS [mg/L]	TDS [mg/L]	TS [mg/L]	Alkalinity [mg/L as CaCO3]	pH	Conduc [umhos/ cm]	DO	ORP
7/17/07	0.04	0.04	0.017	0.003		0.77	4	402	406	171	8.71		3	52
7/24/07		0.02	0.044	0.011	-	0.98	6	336	342	140	7.69		2.8	46
7/31/07	0.02	0.025		0		1.42				95	8.91	394	3.7	44
8/6/07														
8/14/07	0.05	0.024	0.03	0.022	0.5	0.93	6	274	280	94	9.02	354	2.3	
8/14/07	0.007		0.009	0.031										
8/21/07	0.05	0.117		0.034	1.05	1.51				84	7.97	356	2.2	
8/27/07		0.02			1.59		8	322	330	84	7.97	439		
9/5/07	0.03		0.046		1.78		3	392	395				1.2	
9/10/07	0.02		0.041		2.98		8	394	402	126	8	563	-	
9/10/07	0.004	0.085	0.01		2.658									
9/17/07	0.05	0.05			3.76		6	528	534	126	8	600	1.1	
9/24/07	0.03	0.11				1.43	4	444	448	132	8.02	565	1.6	
10/1/07	0.03	0.14					0	386	386				1.9	
10/8/07		0.11	0.02		1.86	1.75	5	402	407	121	8.24		3.6	
10/15/07	0.06	0.04	0.036			3.27	12	336	348	114	8.8	551	4.4	78
10/22/07	0.014	0.023	0.025	0.038	1.457									60
10/29/07			0.028	0.150										
11/5/07	0.06	0.04	0.043	0.019	2.01	3.01	11	358	369	98	8.67	375	4.5	56
11/12/07			0.072											52
11/17/07														48
11/19/07	0.02	0.03	0.02	0.005		2.03				94.00	8.63	398.00	3.50	49.00
11/26/07				0.005										
12/3/07														
12/11/07	0.03	0.03	0.022	0.023	1.01		9	382	391					122
12/19/07			0.011	0.024		1.87				118	7.67			122
12/22/07												442	4	102
12/24/07														95

Date	OP [mg/L P]	TP [mg/L P]	NOX [mg/L N]	NH3 [mg/L N]	TN [mg/L N]	Turbidity [NTU]	TSS [mg/L]	TDS [mg/L]	TS [mg/L]	Alkalinity [mg/L as CaCO3]	pH	Conduc [umhos/ cm]	DO	ORP
12/28/07														97
Average	0.04	0.092	0.03	0.061	1.68	3.11	10.10	332.37	341.53	109.49	8.51	446.55	3.66	69. 82
Stand. Dev.	0.04	0.07	0.02	0.081	0.80	2.30	7.64	94.84	94.97	27.99	0.57	94.10	1.24	23. 84
Varence	0.00	0.01	0.00	0.007	0.65	5.31	58	8995	9019	784	0.32	8855.07	1.54	568 .37
n	39	39	36	21	19	31	31	34	34	38	38	32	35	28
Mass Out	14	29	9	19	532		3189	104981	107871	0				
Median	0.03	0.07	0.0255	0.023	1.59	2.03	9	336	345	110	8.36 5	458.1	3.65	60

Water Quality Master Spreadsheet 4G BL														
Date	OP [mg/L P]	TP [mg/L P]	NOX [mg/L N]	NH3 [mg/L N]	TN [mg/L N]	Turbidity [NTU]	TSS [mg/L]	TDS [mg/L]	TS [mg/L]	Alkalinity [mg/L as CaCO3]	pH	Conduc [umhos/cm]	DO	ORP
1/12/07					-		20	-	-	148	7.64	546	2.9	
1/15/07			0.02		-	13.80	20	276	296	130	8.18	481	4.2	
1/23/07		0.174	0.01		-	5.35	13	272	285	130	8.5	479	4	
1/26/07	0.1	0.22	0.02		-	8.25			-	129	8.63	472	6.6	
2/5/07	0.10	0.20	0.016		-	3.4	0	252	252	130	8.69	472	5.7	
2/12/07	0.07	0.13	0.036	0.03	0.82	9.7	53	375	428	118	8.88	479	5.6	
2/19/07	0.03	0.14	0.013		-	6.1			-	106	9.17		7.6	
2/26/07	0.08	0.23	0.040	0.29	1.46	13.6	33	265	298	76	9.19	418	5.7	
3/5/07	0.00	0.18	0.010		-	14.9	38	264	302	66	9.18		4.9	
3/19/07	0.00	0.07		0.09	1.093	3.6	9	270	279	55	9.4	362		
3/12/07	0.04	0.11	0.020		0.96	4.0	22	274	296	58	9.41	392	4.2	66
3/26/07	0.08	0.14			-	5.9			-	58	9.13		4.1	64
4/2/07	0.10	0.12	0.020		-	5.1	10	282	292	80	8.68	464	2.8	73
4/9/07	0.04	0.20	0.010	0.01	-		35	270	305	86	8.87	446	3.5	61
4/16/07	0.05	0.13	0.020			6.3	67	346	413	76	9.02	490	5.9	80
4/30/07	0.03	0.10	0.030	0.00		6.6	43	278	321	66	8.68	429		96
5/4/07	0.07	0.07	0.030			3.5	-	182	182	65	8.66		3.1	46
5/14/07	0.03	0.10				12.2	20	290	310	60	8.36		3	41
5/21/07	0.05	0.05	0.020			1.4	12	226	238	86	8.43	362	4.5	114
5/29/07	0.04		0.048	0.25		-		212	-	-	-	387	3.6	116
6/5/07	0.05	0.08	0.050	0.22		1.3	0	140	140	92	7.44	266	2.8	55
6/12/07	0.05	0.07	0.044			1.5	1	364	364	120	7.64	632		71
6/19/07	0.07	0.08				2.8	2	290	292	94	8.51	522	2.8	63
6/26/07	0.02	0.05				2.8	2	322	324	82	8.03	583		61
7/3/07	0.04	0.09		0.100	1.4	3.24	19	402	421	122	7.7	571	3.6	53
7/10/07			0.01	0.090	1.28									
7/11/07	0.02	0.07	0.001	0.008	1.5	2.47	12	442	454		7.79	416	2.7	

Date	OP [mg/L P]	TP [mg/L P]	NOX [mg/L N]	NH3 [mg/L N]	TN [mg/L N]	Turbidity [NTU]	TSS [mg/L]	TDS [mg/L]	TS [mg/L]	Alkalinity [mg/L as CaCO3]	pH	Conduc [umhos/cm]	DO	ORP
7/17/07	0.05	0.06	0.002	0.001		1.67	17	440	457	218	8.04		2.4	52
7/24/07		0.05	0	0.009	1.48	0.98	15	368	383	140	7.69		2.4	46
7/31/07	0.03	0.055		0.000		2.75				112	8.32	298	1.6	37
8/6/07														
8/14/07	0.04	0.044		0.022	1.14	1.42	4	370	374	91	8.63	383	2.5	
8/14/07	0.012		0.058	0.02										
8/21/07	0.04			0.088	2.04	2.6				73	8.12	386	1.8	
8/27/07		0.05			1.74	6.19	15	388	403	103	7.71	463		
9/5/07	0.05		0.048		2.08		11	418	429				2.4	
9/10/07	0.07		0.04		1.64		13	400	413	96	9	536	-	
9/10/07	0.005	0.067	0.0025	0.073	2.481									
9/17/07	0.06	0.06			2.36		8	520	528	96	8	563	2.3	
9/24/07	0.02	0.13				3.24	8	442	450	118	8.33	530	2.2	
10/1/07	0.03	0.12					0	378	378				2.5	
10/8/07		0.09	0.011		1.36	1.29	13	398	411	111	8.16		2.8	
10/15/07	0.04	0.03	0.008			2.28	3	360	363	120	8.74	429	3.7	68
10/22/07	0.009	0.016	0.026	0.067	1.507									61
10/29/07			0.01	0.046										
11/5/07	0.07	0.05	0.028	0.066	2.55	2.84	19	368	387	110	8.64	388	4.1	54
11/12/07			-											51
11/17/07														49
11/19/07	0.04	0.03	0.037	0.026		1.59				104	8.42	410	3.7	46
11/26/07				0.000										
12/3/07														
12/11/07	0.02	0.04	0.01	0.038	1.57		19.00	368.00	387					124.00
12/19/07			0.014	0.024		2.42				118	8.23			122
12/22/07												437	4.6	95

Date	OP [mg/L P]	TP [mg/L P]	NOX [mg/L N]	NH3 [mg/L N]	TN [mg/L N]	Turbidity [NTU]	TSS [mg/L]	TDS [mg/L]	TS [mg/L]	Alkalinity [mg/L as CaCO3]	pH	Conduc [umhos/cm]	DO	ORP
12/24/07														94
12/28/07														96
Average	0.04	0.10	0.02	0.065	1.60	4.50	16.70	330.47	350.25	99.03	8.48	448.79	3.70	70.86
Stand. Dev.	0.03	0.06	0.02	0.081	0.50	3.57	15.96	83.68	83.83	31.49	0.51	82.82	1.45	25.51
Varence	0.00	0.00	0.00	0.01	0.25	12.74	255	7002	7028	992	0.26	6858.43	2.09	650.55
n	39	38	34	24	19	35	34	35	34	38	39	32	36	29
Mass Out	13	29	7	20	482		5023	99418	105369	0				
Median	0.04	0.078	0.02	0.032	1.5	3.24	13.165	346	363.75	99.5	8.5	463	3.5	61

Water Quality Master Spreadsheet 8PCS CB

Date	OP [mg/L P]	TP [mg/L P]	NOX [mg/L N]	NH3 [mg/L N]	TN [mg/L N]	Turbidity [NTU]	TSS [mg/L]	TDS [mg/L]	TS [mg/L]	Alkalinity [mg/L as CaCO3]	pH	Cond, [umhos/cm]	DO	ORP
1/12/07		0.21				2.98	0	328	328	150	7.95	520	3	
1/15/07							-	-	-			-	-	
1/23/07							-	-	-			-	-	
1/26/07		0.22	0.030	0.06		3.37	-	-	-	146	8.12	589	-	
2/5/07	0.11	0.12	0.023			3.81	7	376	383	130	7.98	576	6.4	
2/12/07														
2/19/07														
2/26/07														
3/5/07														
3/19/07														
3/26/07	0.09	0.20					-	-	-	158	8.23		5.3	
4/2/07	0.13	0.13	0.050				5	546	551	154	8.19	761	4.6	
4/9/07														
4/16/07	0.07	0.15	0.020			2.72		548	548	128	7.88	778	6.2	
4/30/07														
5/4/07	0.12	0.14			0.48	3.71	7	496	503	105	7.96	-	4.1	
5/14/07														
5/21/07	0.06	0.11	0.040			2.45		574	574	152	8.02	847	4.7	
5/29/07														
6/5/07	0.05	0.07	0.036			1.45	8	446	454	148	7.93	829	3.8	
6/12/07	0.08	0.10	0.038			3.35	13	432	445	102	7.92	604		
6/19/07	0.05	0.11				3.1	13	430	443	122	7.83	619	3.5	
6/26/07	0.07	0.07				1.77	0	432	432	126	7.71	678		

Date	OP [mg/L P]	TP [mg/L P]	NOX [mg/L N]	NH3 [mg/L N]	TN [mg/L N]	Turbidity [NTU]	TSS [mg/L]	TDS [mg/L]	TS [mg/L]	Alkalinity [mg/L as CaCO3]	pH	Cond, [umhos/cm]	DO	ORP
7/3/07	0.06	0.06		0.039		1.29	9	512	521	135	8	693	4.2	
7/10/07	0.04	0.112	0.007		1.4									
7/11/07	0.06	0.06	0.041	0.021	1.15	1.74	15	472	487	173	7.22	591	5.2	
7/17/07	0.08	0.08	-	0.012		1.89	10	345	355	124	7.75		3.9	
7/24/07		0.04	0.007	0.017	1.24	1.95	5	346	351	242	7.59		3.3	
7/31/07	0.05	0.076		0.013		0.98				133	8.6	336	3.6	
8/6/07														
8/14/07	0.05	0.055	0.069	0.038	0.72	1.2	14	462	476	114	8.33	546		
8/14/07	0.026		0.021	0.022										
8/21/07	0.04	0.24		0.015	2.37	1				111	7.74	552	4.3	
8/27/07		0.16			2.93			592	592	119	7.27	629		
9/5/07	0.03	0.15	0.042		1.54		2	570	572	126	8.43		3	
9/10/07	0.13		0.04		1.98		7	486	493	122	8.29	655	-	
9/10/07	0.038	0.23	0.0025	0.028	1.917									
9/17/07	0.07	0.05			2.41		2	620	622			657	3.3	
9/24/07		0.14				1.29	3	412	415	106	8.22	488	4	
10/1/07	0.06	0.13					0	442	442				-	
10/8/07		0.15	0.013		1.59	1.13	4	352	356	124	8.15		3.6	
10/15/07	0.06	0.1	0.016			1.37	8	436	444	166	8.25	544	4.7	86
10/22/07	0.022	0.039	0.014	0.049	1.517									
10/29/07			0.019	0.024										
11/5/07	0.06	0.03	0.028	0.016	1.22	1.51	13	384	397	124	8.41	415	7.8	63
11/12/07			0.028											58
11/17/07														50

Date	OP [mg/L P]	TP [mg/L P]	NOX [mg/L N]	NH3 [mg/L N]	TN [mg/L N]	Turbidity [NTU]	TSS [mg/L]	TDS [mg/L]	TS [mg/L]	Alkalinity [mg/L as CaCO3]	pH	Cond, [umhos/cm]	DO	ORP
11/19/07	0.05	0.03	0.02	0.028		1.97				130.00	8.09	558	4.40	60
11/26/07				0.036										
12/3/07														
12/11/07	0.05	0.05	0.02	0.054	0.90		4.00	528.00	532					125
12/19/07			0.018	0.058	1.05	1.38				108	8.05			127
12/22/07												490	7.6	82
12/24/07														87
12/28/07														54
Average	0.06	0.11	0.03	0.031	1.53	2.02	7.11	468.29	474.51	134.37	8.01	610.73	4.61	79
Stand. Dev.	0.03	0.06	0.02	0.016	0.66	0.92	4.66	80.12	78.18	28.49	0.32	125.45	1.33	28
Varence	0.00	0.00	0.00	0.00	0.43	0.84	22	6419	6111	812	0.11	15738	1.77	785
n	28	32	24	17	16	23	22	25	25	28	28	23	23	10
Mass Out	134	229	56	65	3178		14808	975124	988081	0				
Median	0.06	0.111	0.022	0.028	1.458	1.77	6.67	446	454	127	8.01	598	4.15	63

Water Quality Master Spreadsheet 8PCG CB														
Date	OP [mg/ L P]	TP [mg/ L P]	NOX [mg/ L N]	NH3 [mg/ L N]	TN [mg/ L N]	Turbidity [NTU]	TSS [mg/L]	TDS [mg/L]	TS [mg/L]	Alkalinity [mg/L as CaCO3]	pH	Cond. [umhos/ cm]	DO	ORP
1/12/07							27	284	311			494	4.6	
1/15/07												-		
1/23/07												-		
1/26/07	0.12	0.17	0.060			6.71	-	-	-	150	8.15	570		
2/5/07	0.16	0.15	0.020			5.94	2	336	344	130	8.19	538	6.6	
2/12/07														
2/19/07														
2/26/07														
3/5/07														
3/19/07														
3/26/07	0.09	0.16				6.93	-	-	-	166	8.17		5.2	
4/2/07	0.13	0.13	0.060			7.38	3	474	484	154	8.21	697	4.5	
4/9/07														
4/16/07	0.10	0.10	0.020			5.36	30	396	426	102	8.4	545	5.6	
4/30/07														
5/4/07	0.07	0.11	0.020		1.51	2.97	25	434	459	118	7.98		4.8	
5/14/07					0.00									
5/21/07	0.07	0.11	0.050		2.03	2.16	10	548	558	152	7.94	809	5.4	
5/29/07														
6/5/07	0.10	0.12	0.052	0.20		2.00	0	456	456	132	7.82	773	3.7	
6/12/07	0.07	0.08	0.039			2.37	25	444	469	90	7.41	647		
6/19/07	0.05	0.09				2.25	0	428	428	120	8.27	580	3.2	
6/26/07	0.04	0.05				1.41	0	444	444	130	7.8	655		
7/3/07	0.05	0.07		0.030		1.61				148	7.65	540	3.9	
7/10/07	0.01	0.06	0.009	0.221	1.142									
7/11/07	0.05	0.05	0.048	0.036	2.28	1.56	16	426	442	136	8.09	500	3.4	

Date	OP [mg/ L P]	TP [mg/ L P]	NOX [mg/ L N]	NH3 [mg/ L N]	TN [mg/ L N]	Turbidity [NTU]	TSS [mg/L]	TDS [mg/L]	TS [mg/L]	Alkalinity [mg/L as CaCO3]	pH	Cond. [umhos/ cm]	DO	ORP
7/17/07	0.05	0.05	-	0.010		2.48	9	278	287	111	7.6		4.1	
7/24/07		0.03	0.041	0.016	1.2	1.48	5	350	355	264	7.74		3.5	
7/31/07	0.05	0.062		0.003		1.1				141	8.44	302	4.3	
8/6/07														
8/14/07	0.05	0.156	0.028	0.017	1.91	2.38	6	370	376	101	8.59	475		
8/14/07	0.007		0.019	0.047										
8/21/07	0.02			0.047	2.52	1.61				97	7.74	494	4.9	
8/27/07		0.07			1.94	2.58	10	494	504	120	7.58	629		
9/5/07		0.11	0.04		1.85		3	512	515				4.2	
9/10/07	0.02		0.043		1.81		3	474	477	122	8.45	620	-	
9/10/07	0.007	0.074	0.011	0.025	2.051									
9/17/07	0.04	0.04			2.01		1	572	573	121	8	630	3.6	
9/24/07		0.13				1.61	13	338	351	120	8.22	465	4.5	
10/1/07	0.05	0.11					8	442	450				3.9	
10/8/07		0.08	0.008		1.82	2.33	2	316	318	136	8.35		3.4	
10/15/07	0.07	0.07	0.021			1.04	1	412	413	144	8.15	529	4.2	83
10/22/07	0.039		0.007	0.204	7.804									
10/29/07			0.009	0.004										
11/5/07	0.04	0.03	0.019	0.019	1.8	1.22	14	426	440	110	7.91	420	6.7	65
11/12/07			0.02											52
11/19/07	0.03	0.04		0.005		1.56				122.00	8.19	562	4.90	56
11/26/07				0.024										59
12/3/07														
12/11/07	0.04	0.05	0.013	0.099	0.15		7	524	531					124
12/19/07														
12/19/07			0.014	0.024	1.66	1.09				110	8.17			127
12/22/07												503	6.6	95

Date	OP [mg/ L P]	TP [mg/ L P]	NOX [mg/ L N]	NH3 [mg/ L N]	TN [mg/ L N]	Turbidity [NTU]	TSS [mg/L]	TDS [mg/L]	TS [mg/L]	Alkalinity [mg/L as CaCO3]	pH	Cond. [umhos/ cm]	DO	ORP
12/24/07														95
12/28/07														86
Average	0.06	0.09	0.03	0.063	1.97	2.89	8	426	435	133	8.05	567.38	4.57	84
Stand. Dev.	0.04	0.04	0.02	0.080	1.63	2.02	9	74	74	33	0.32	113.61	1.05	26.85
Varence	0.00	0.00	0.00	0.01	2.64	4.07	78	5455	5409	1122	0.10	12906.65	1.10	721.07
n	26	27	21	14	16	23	23	23	23	25	25	23	24	10
Mass Out	123	187	61	129	4045		17312	873675	892229	0				
Median	0.05	0.08	0.021	0.027	1.88	2.25	6	428	442	130	8.15	545	4.25	74

Water Quality Master Spreadsheet 8S CB

Date	OP [mg/L P]	TP [mg/L P]	NOX [mg/L N]	NH3 [mg/L N]	TN [mg/L N]	Turbidity [NTU]	TSS [mg/L]	TDS [mg/L]	TS [mg/L]	Alkalinity [mg/L as CaCO3]	pH	Cond. [umhos/cm]	DO	ORP
1/12/07							37	308	345			528	2.9	
1/15/07									-			-		
1/23/07									-			-		
1/26/07	0.27	0.21	0.010						-	158	8.2	641		
2/5/07	0.28	0.21	0.080			3.64	0	394	394	132	8.1	590	5.3	
2/12/07														
2/19/07														
2/26/07														
3/5/07														
3/19/07														
3/26/07	0.14	0.26							-	168	8.29		4.8	
4/2/07	0.17	0.20	0.020		2.12	4.32	5	608	613	162	8.34	851	6.8	
4/9/07														
4/16/07	0.14	0.17	0.020			3.31	35	544	579	116	7.95	753	5.3	
4/30/07														
5/4/07	0.24	0.35	0.030			4.39	16	522	538	125	8.07		4.8	
5/14/07														
5/21/07	0.14	0.15	0.040			1.14	8	552	560	148	7.93	976	5.3	
5/29/07														
6/5/07	0.14	0.15	0.050	0.22		1.41	0	-	-	132	7.90	940	3	
6/12/07	0.03	0.09	0.044			2.59	2	446	448	102	7.63	693		
6/19/07	0.07	0.19				1.72	0	452	452	128	7.83	678	4.6	
6/26/07	0.05	0.11					0	504	504	122	7.86	774		
7/3/07	0.07	0.10		0.070		1.16	3	564	567	118	7.44	785	3.5	

Date	OP [mg/L P]	TP [mg/L P]	NOX [mg/L N]	NH3 [mg/L N]	TN [mg/L N]	Turbidity [NTU]	TSS [mg/L]	TDS [mg/L]	TS [mg/L]	Alkalinity [mg/L as CaCO3]	pH	Cond. [umhos/cm]	DO	ORP
7/10/07	0.08	0.19	0.009	0.146	1.36									
7/11/07	0.03	0.05	0.000	0.015	1.15	0.94	15	518	533	162	8	660	3.9	
7/17/07	0.06	0.06	0.039	0.023		2.82	14	352	366	103	7.34		4.6	
7/24/07		0.06	0.049	0.02	1.48	1.63	10	316	326	148	7.55		5.1	
7/31/07	0.06	0.062		0.013		1.83				119	8.61	343	5	
8/6/07														
8/14/07	0.05	0.174	0.056	0.015	1.14	2.79	25	316	341	105	8.97	544		
8/14/07	0.005		0.012	0.062										
8/21/07	0.02	0.207		0.016	2.85	1.79				97	7.75	532	5.6	
8/27/07		0.07			2.38	3.37	5	558	563	110	7.89	719		
9/5/07	0.05	0.08	0.041		1.64		1	546	547				3.2	
9/10/07	0.05		0.041		1.47		2	536	538	102	7.88	675	-	
9/10/07	0.01		0.0025	0.033	1.921									
9/17/07	0.07	0.07			1.76		7	538	545	104	8.42	693	3.4	
9/24/07	0.06	0.1				1.16	2	424	426	104	8.33	558	6.1	
10/1/07	0.03	0.16					9	490	499				5.4	
10/8/07		0.08	0.011		1.49	1.36	1	380	381	122	8.27		3.5	
10/15/07	0.05	0.06	0.01			1.34	10	434	444	114	8.2	581	2.9	83
10/22/07	0.006	0.023	0.025	0.106	1.332									
10/29/07			0.024	0.019										
11/5/07	0.05	0.05	0.03	0.090	3.11	1.66	16	414	430	114	8.45	424	6.9	68
11/12/07			0.04											51
11/19/07	0.02	0.07	0.04	0.015		2.92				124	8.36	615	5	59
11/26/07				0.146										60
12/3/07														
12/11/07	0.09	0.18	0.02	0.023	1.05		7.00	546.00	553					126

Date	OP [mg/L P]	TP [mg/L P]	NOX [mg/L N]	NH3 [mg/L N]	TN [mg/L N]	Turbidity [NTU]	TSS [mg/L]	TDS [mg/L]	TS [mg/L]	Alkalinity [mg/L as CaCO3]	pH	Cond .[um hos/ cm]	DO	ORP
12/19/07														76
12/22/07			0.02	0.063	2.13	3.45				110.00	7.25			126
12/24/07												490	7.00	84
12/28/07														89
Average	0.08	0.13	0.03	0.06	1.77	2.31	8.04	476.26	484.65	124.04	8.03	659.71	4.83	82
Stand. Dev.	0.08	0.08	0.02	0.061	0.61	1.09	8.73	84.40	83.72	20.85	0.40	154	1.22	26.
Varence	0.01	0.01	0.00	0.00	0.38	1.18	76	7123	7009	435	0.16	23667.37	1.48	681
n	30	30	26	18	16	22	25	24	24	27	27	23	24	10
Mass Out	170	265	59	123	3579		16226	960949	977880	0				
Median	0.06	0.1	0.03	0.023	1.565	1.79	6	490	499	121	8.035	667.5	4.8	63.5

Water Quality Master Spreadsheet 8G CB														
Date	OP [mg/L P]	TP [mg/L P]	NOX [mg/L N]	NH3 [mg/L N]	TN [mg/L N]	Turbidity [NTU]	TSS [mg/L]	TDS [mg/L]	TS [mg/L]	Alkalinity [mg/L as CaCO3]	pH	Cond. [umhos/cm]	DO	ORP
1/12/07							23	272	295			480.95	3.5	
1/15/07												-		
1/23/07												-		
1/26/07	0.25	0.23	0.020		-	7.85				142	8.11	596		
2/5/07	0.23	0.09	0.006		-	3.65	0	348	352	118	8.17	554	5.4	
2/12/07														
2/19/07														
2/26/07														
3/5/07														
3/19/07														
3/26/07	0.10	0.26			-				-	138	8.21		4.4	
4/2/07	0.18	0.13	0.030		0.75	3.45	0	294	297	145	8.23	819	5.2	
4/9/07					0.00									
4/16/07	0.09	0.08	0.030		1.83	1.88	35	558	593	98	7.85	815	4.9	
4/30/07					1.80									
5/4/07	0.17		0.030	0.16	2.19	5.36	27	930	957	118	7.79		4.2	
5/14/07					0.00									
5/21/07	0.05	0.09	0.050	0.14	3.43	3.66	3	690	693	144	8.15	797	5	
5/29/07														
6/5/07	0.17	0.18	0.043	0.20		1.82	-	-	-	118	7.08	1003	3.2	
6/12/07	0.13	0.16	0.043			2.77	15	458	473	110	7.23	761		

Date	OP [mg/L P]	TP [mg/L P]	NOX [mg/L N]	NH3 [mg/L N]	TN [mg/L N]	Turbidity [NTU]	TSS [mg/L]	TDS [mg/L]	TS [mg/L]	Alkalinity [mg/L as CaCO3]	pH	Cond. [umhos/ cm]	DO	ORP
6/19/07	0.07	0.07				0.96	2	386	388	138	7.91	608	3	
6/26/07	0.05	0.05				0.87	7	466	473	118	8.36	700		
7/3/07	0.06	0.07		0.097		1.39	3	578	581	94	7.38	744	3.7	
7/10/07	0.02	0.07	0.017	0.350	1.61									
7/11/07	0.05	0.05	0.063	0.008	1.89	1.1	12	510	522	137	8.15	660	5.8	
7/17/07	0.10	0.11	0.023	0.079		2.02	19	344	363	112	7.52		4.5	
7/24/07		0.05	0.043	0.075	2.8	1.19	5	322	327	220	7.86		5.4	
7/31/07	0.03	0.035		0.01		1.1				109	8.8	328	6.8	
8/6/07														
8/14/07	0.03	0.08	0.078	0.005	0.95	6.22	21	444	465	83	8.71	527		
8/14/07	0.004		0.009	0.057										
8/21/07	0.05			0.003	2.23	2.08				79	7.79	478	3.9	
8/27/07		0.09			2.54	2.5	2	530	532	114	7.68	577		
9/5/07	0.05	0.07	0.039		1.33		1	530	531				3.8	
9/10/07	0.03		0.04		1.54		2	500	502	120	8	657	-	
9/10/07	0.038		0.0025	0.033	1.963									
9/17/07	0.1	0.09			2.91		5	616	621	123	8.34	706	3.1	
9/24/07	0.04	0.14				1.39	7	442	449	-	-	530	4.8	
10/1/07	0.05	0.15					0	424	424				5.6	
10/8/07		0.15	0.008		2.32	1.36	0	374	374	122	8.27		3.4	
10/15/07	0.04	0.06	0.013			1.93	30	438	468	120	8.16	560	4.2	83
10/22/07	0.012	0.023	0.013	0.42	1.364									

Date	OP [mg/L P]	TP [mg/L P]	NOX [mg/L N]	NH3 [mg/L N]	TN [mg/L N]	Turbidity [NTU]	TSS [mg/L]	TDS [mg/L]	TS [mg/L]	Alkalinity [mg/L as CaCO3]	pH	Cond. [umhos/ cm]	DO	ORP
10/29/07			0.03	0.013										
11/5/07	0.07	0.07	0.01	0.009	2.79	2.20	5.00	438	443	82.00	8.26	467.	6.20	73
11/12/07			0.01											53
11/19/07	0.05	0.05		0.009		1.27				88.00	7.79	637	4.60	60
11/26/07				0.04										58
12/3/07														
12/11/07	0.03	0.07	0.012	0.053	1.24		4	602	606					121
12/19/07			0.016	0.077	2.19					110	7.75			126
12/22/07												455	6.5	80
12/24/07														96
12/28/07														93
Average	0.08	0.10	0.03	0.092	1.76	2.60	9	485	494	123	7.99	635.46	4.68	84
Stand. Dev.	0.07	0.06	0.02	0.115	0.91	1.87	11	143	147	28	0.42	152.14	1.08	25
Varence	0.00	0.00	0.00	0.01	0.83	3.50	118	20523	21497	774	0.18	23147	1.17	634
n	27	25	20	20	19	21	22	22	22	26	26	23	24	10
Mass Out	155	196	57	174	3347		17689	922024	940355	0				
Median	0.05	0.09	0.03	0.055	1.83	1.93	5	451	470	118	8.11	633	4.4	83

Water Quality Master Spreadsheet 4PCS CB														
Date	OP [mg/L P]	TP [mg/L P]	NOX [mg/L N]	NH3 [mg/L N]	TN [mg/L N]	Turbidity [NTU]	TSS [mg/L]	TDS [mg/L]	TS [mg/L]	Alkalinity [mg/L as CaCO3]	pH	Cond. [umhos/cm]	DO	ORP
1/12/07							23	240	263			382	3.8	
1/15/07									-			-		
1/23/07									-			-		
1/26/07	0.14	0.14	0.01			5.43			-	128	8.08	458		
2/5/07	0.08	0.09	0.035	0.20	1.19	4.24	0	266	266	116	8.28	425	5.3	
2/12/07									-					
2/19/07									-					
3/5/07									-					
3/19/07									-					
3/26/07	0.10	0.28				10.5			-	158	8.27		4.4	
4/2/07	0.10	0.28	0.02		2.19	8.15	5	516	521	137	8.14	716	4.5	
4/9/07									-					
4/16/07	0.16	0.15	0.03			4.29	24	544	568	116	7.84	708	5.7	
4/30/07									-					
5/4/07	0.06	0.32	0.04		3.00	10.30	12	494	506	82	7.07	-	3.4	
5/14/07									-					
5/21/07	0.20	0.32	0.03			2.89	23	656	679	144	7.79	978	3.9	
5/29/07									-					
6/5/07	0.13	0.13	0.038	0.25		1.66	7	436	443	126	7.36	693	2.9	
6/12/07	0.05	0.13	0.041			4.92	22	342	364	86	7.38	490		
6/19/07	0.10	0.10				3.33	0	306	306	90	8.06	440	3.2	
6/26/07	0.03	0.07				2.13	3	400	403	120	8.67	622		
7/3/07	0.05	0.07		-		1.62	2	512	514	118	7.78	659	4.1	
7/10/07	0.1	0.19	0.008	0.01	1.21									
7/11/07	0.06	0.06		0.018	1.22	1.71	18	360	378	131	8.2	428	5.7	
7/17/07	0.09	0.09	0.003	0.039		2.15	14	264	278	104	7.73		5	59

Date	OP [mg/L P]	TP [mg/L P]	NOX [mg/L N]	NH3 [mg/L N]	TN [mg/L N]	Turbidity [NTU]	TSS [mg/L]	TDS [mg/L]	TS [mg/L]	Alkalinity [mg/L as CaCO3]	pH	Cond. [umhos/cm]	DO	ORP
7/24/07		0.05	0.006	0.039	1.53	2.7	18	236	254	160	7.82		4.1	
7/31/07	0.04	0.033		0.003		2.34				126	8.3	256	3.5	
8/6/07														
8/14/07	0.04	0.052	0.027	0.037	0.99	1.17	0	354	354	88.00	8.83	409		
8/14/07	0.007		0.02	0.026										
8/21/07	0.02	0.089		0.007	-	0.98				82	8.03	363	3.8	
8/27/07		0.14			2.54	1.51	0	456	456	114	7.53	541		
9/5/07	0.05	0.03	0.041		1.95		0	464	464				3.4	
9/10/07	0.07		0.04		1.57		0	416	416	96	8	594	-	
9/10/07	0.008	0.008	0.003	0.033	1.86									
9/17/07	0.04	0.06			2.61		5	514	519	87	8	556	3.7	
9/24/07	0.13	0.13				1.62	3	300	303	114	8.05	374	3.1	
10/1/07	0.01	0.16					0	338	338				4.7	
10/8/07		0.1	0.018		1.17	1.82	2	254	256	124	8.15		3.7	
10/15/07	0.03	0.06	0.018			2.67	9	406	415	103	8.16	396	4.4	79
10/22/07	0.019	0.024	0.011	0.177	1.70									
10/29/07			0.043	0.016										
11/5/07	0.06	0.03	0.017	0.003	1.45	2.69	9	332	341	94	8.02	297	-	70
11/12/07			0.014											56
11/19/07	0.03	0.06	0.043	0.039		1.80				107	7.99	411	5.2	49
11/26/07				0.036										45
12/11/07	0.03	0.09	0.03	0.108	0.88		13.00	540	553					122
12/19/07			0.04	0.049	1.33	1.96				108.00	7.82			122
12/22/07												453.00	6.40	94
12/24/07														97
Average	0.07	0.11	0.02	0.061	1.67	3.38	7.86	404	412	113.30	8.01	512.11	4.28	79
Stand.	0.05	0.09	0.01	0.073	0.61	2.65	8.18	110.55	112.85	21.70	0.39	167.17	0.95	29

Date	OP [mg/ L P]	TP [mg/ L P]	NOX [mg/L N]	NH3 [mg/ L N]	TN [mg/ L N]	Turbidity [NTU]	TSS [mg/ L]	TDS [mg/ L]	TS [mg/ L]	Alkalinity [mg/L as CaCO3]	pH	Cond. [umhos/ cm]	DO	ORP
Varence	0.00	0.01	0.00	0.005	0.37	7.01	67	12222	12736	471	0.15	27946	0.90	812
n	30	31	25	18	17	25	25	25	25	27	27	23	23	10
Mass Out	133	223	49	118	3266		15371	790789	806160	0				
Median	0.055	0.09	0.027	0.037	1.53	2.34	5	400	403.33	114	8.05	449	4	64.5

Water Quality Master Spreadsheet 4PCG CB														
Date	OP [mg/L P]	TP [mg/L P]	NOX [mg/L N]	NH3 [mg/L N]	TN [mg/L N]	Turbidity [NTU]	TSS [mg/L]	TDS [mg/L]	TS [mg/L]	Alkalinity [mg/L as CaCO3]	pH	Cond. [umhos/ cm]	DO	ORP
1/12/07							38	252	290			400	3.5	
1/15/07												-		
1/23/07												-		
1/26/07	0.20	0.20	0.050			6.56			-	116	7.08	491		
2/5/07	0.16	0.15	0.046			4.17	0	298	298	102	7.93	433	5.4	
2/12/07														
2/19/07														
2/26/07														
3/5/07														
3/19/07														
3/26/07	0.08	0.20							-	136	8.33		3.9	
4/2/07	0.20	0.11	0.020			4.88	0	570	570	151	8.24	749	4.4	
4/9/07														
4/16/07	0.16	0.08	0.020			2.96	38	498	536	92	7.58	665	6.1	
4/30/07														
5/4/07	0.06	0.06	0.030		2.31	3.63	0	572	572	92	7.84		4.6	
5/14/07														
5/21/07	0.07	0.09	0.020			1.40	13	616	629	112	8.05	922	4.9	
5/29/07														
6/5/07	0.05	0.09	0.044			1.62	7	436	443	112	7.77	756	3.4	
6/12/07	0.07	0.09	0.047			4.22	8	354	362	78	7.58	492		
6/19/07	0.05	0.06				2.06	0	290	290	84	8.12	429	3.4	

Date	OP [mg/L P]	TP [mg/L P]	NOX [mg/L N]	NH3 [mg/L N]	TN [mg/L N]	Turbidity [NTU]	TSS [mg/L]	TDS [mg/L]	TS [mg/L]	Alkalinity [mg/L as CaCO3]	pH	Cond. [umhos/ cm]	DO	ORP
6/26/07	0.02	0.04				1.06	10	370	380	98	8.43	586		
7/3/07	0.05	0.12		-		1.45	6	478	484	104	7.61	603	3.9	
7/10/07	0.25		0.012	0.125										
7/11/07	0.06	0.06	0.080	0.009	2.32	1.51	4	332	336	112	8.05	440	2.9	
7/17/07	0.04	0.05	0.036	0.001		2.46	12	228	240	80	7.54		5	
7/24/07		0.03	0.013	0.009	1.2	2.12	5	204	209	157	7.58		4.4	
7/31/07	0.03	0.06		0.003		2.46				116	8.15	249	5.6	
8/6/07														80
8/14/07	0.07	0.11	0.081	0.071	1.14	2.61	1	380	381	110	8.23	489	6.8	
8/14/07	0.01		0.019	0.041										
8/21/07	0.06			0.005	1.62	2.28				116	7.92	443	3.8	
8/27/07		0.09			2.58	3.45	0	490	490	108	7.49	602		
9/5/07	0.06		0.041		2.43		8	464	472				3.8	
9/10/07	0.16		0.044		1.78		2	428	430	110	8.16	540	-	
9/10/07	0.01	0.16	0.003	0.026	1.824									
9/17/07	0.08				2.76		7	554	561	106	8.32	555	3.4	
9/24/07	0.04	0.10					14	268	282			401	3.9	
10/1/07	0.03	0.12					2	354	356				4.5	
10/8/07		0.10	0.014		1.59	2.40	2	292	294	104	8.24		3.9	
10/15/07	0.08	0.09	0.012			2.25	9	338	347	126	7.9	365	3.7	68
10/22/07	0.01	0.02	0.01	0.091	1.58									
10/29/07			0.02	0.011										
11/5/07	0.05	0.03	0.02	0.005	1.24	2.21	20.00	376.00	396	72.00	8.05	340.00	5.80	70

Date	OP [mg/L P]	TP [mg/L P]	NOX [mg/L N]	NH3 [mg/L N]	TN [mg/L N]	Turbidity [NTU]	TSS [mg/L]	TDS [mg/L]	TS [mg/L]	Alkalinity [mg/L as CaCO3]	pH	Cond. [umhos/ cm]	DO	ORP
11/12/07			0.02											57
11/19/07	0.02	0.04	0.057	0.017		1.06				114	7.92	488	4.7	59
11/26/07				0.027										
12/3/07														
12/11/07	0.03	0.04	0.017	0.031	1.2		15	492	507					122
12/17/07														91
12/19/07			0.013	0.026	1.54	2.45				114	8.5			122
12/22/07												399	6.7	95
12/24/07														96
Average	0.08	0.09	0.03	0.031	1.81	2.66	7.64	403.42	411.06	108.54	7.95	519.87	4.54	86.00
Stand. Dev.	0.06	0.05	0.02	0.035	0.54	1.32	8.56	114.43	115.69	19.91	0.34	154.31	1.07	23.53
Varence	0.00	0.00	0.000	0.001	0.29	1.75	73	13094	13385	396	0.12	23813	1.13	553.78
n	30.00	27.00	26.00	16.00	15.00	23.00	25.00	25.00	25.00	26.00	26.00	23.00	25.00	10.00
Mass Out	153	180	62	63	3681		15554	821439	836993	0				
Median	0.055	0.087	0.02	0.0215	1.62	2.28	6.67	380	396	110	8.05	492	4.15	75

Water Quality Master Spreadsheet 4S CB

Date	OP [mg/ L P]	TP [mg/ L P]	NOX [mg/ L N]	NH3 [mg/ L N]	TN [mg/ L N]	Turbidity [NTU]	TSS [mg/L]	TDS [mg/L]	TS [mg/L]	Alkalinity [mg/L as CaCO3]	pH	Cond [umh os/cm]	DO	ORP
1/12/07							33	248	281			402	3.6	
1/15/07												-		
1/23/07												-		
1/26/07	0.29	0.27	0.010			7.54				152	8.12	522		
2/5/07	0.31	0.18	0.040		0.98	6.12	2	272	274	126	8.09	436	5.8	
2/12/07														
2/19/07														
2/26/07														
3/5/07														
3/19/07														
3/26/07	0.08	0.23				8.01				116	8.05		6.3	
4/2/07	0.13	0.12	0.020			3.6	0	516	516	112	8.22	719	4.4	
4/9/07														
4/16/07	0.09	0.12	0.020		2.3	4.56	38	506	544	94	7.97	629	5.8	
4/30/07														
5/4/07	0.15	0.19	0.060		1.61	4.80	12	416	428	75	6.86		4.1	
5/14/07													-	
5/21/07	0.12	0.12	0.060			1.65	10	576	586	156	8.13	918	5.2	
5/29/07											-			
6/5/07	0.13	0.19	0.053	0.24		3.22	2	446	448	132		740	3.7	
6/12/07	0.09	0.15	0.048			5.94	27	358	385	84	7.2	525		
6/19/07	0.06	0.07				2.04	0	-	-	102	8.32	473	3.5	
6/26/07	0.05	0.05				1.16	0	364	364	98	8.33	553		
7/3/07	0.05	0.07		0.016		1.01	17	488	505	110	7.47	614	3.6	
7/10/07	0.12	0.29	0.010	0.500	2.06									
7/11/07	0.08	0.08	0.000	0.034	1.54	1.49	21	394	415	134	8.24	572	4.7	

Date	OP [mg/L P]	TP [mg/L P]	NOX [mg/L N]	NH3 [mg/L N]	TN [mg/L N]	Turbidity [NTU]	TSS [mg/L]	TDS [mg/L]	TS [mg/L]	Alkalinity [mg/L as CaCO3]	pH	Cond [umhos/cm]	DO	ORP
7/17/07	0.07	0.07	0.048	0.029		2.53	11	306	317	108	7.71		6.5	
7/24/07		0.04	0.002	0.011	1.34	1.62	13	222	235	196	7.84		4.6	
7/31/07	0.04	0.06		0.004		1.54				138	8.61	294	3.9	
8/6/07		-												
8/14/07	0.03	0.06	0.029	0.207	1.87	7.44	0	464	464	86.00	9.04	426		
8/14/07	0.01		0.01	0.036										
8/21/07	0.06	0.08		0.000	2.8	1.56				100	8.07	356	4.2	
8/27/07		0.09			1.59	2.38	12	452	464	83	7.67	603		
9/5/07	0.27	0.27	0.042		2.98		3	392					4.3	
9/10/07			0.040		1.98		5	440	445	112	8.53	595	-	
9/10/07	0.01		0.003	0.034	1.918									
9/17/07	0.06	0.05			3.06		0	552	552	119	8.57	613	3.3	
9/24/07	0.08	0.13				1.01	4	344	348	109	8.26	450	3.4	
10/1/07	0.06	0.13					4	-	-				5	
10/8/07		0.10	0.011		3.06	1.22	0	294	294	124	8.34		3.6	
10/15/07	0.08	0.04	0.022			1.16	13	384	397	141	7.93	468	4.5	80
10/22/07	0.01	0.03	0.007	0.055	1.427									
10/29/07			0.020	0.005										
11/5/07	0.05	0.03	0.033	0.011	2.67	1.91	7	352	359	116	7.88	330	7.3	69
11/12/07			-											53
11/19/07	0.02	0.18	0.06	0.217		6.53				160.00	7.87	593.00	4.90	55.00
11/26/07				0.467										
12/3/07														
12/11/07	0.03	0.04	0.016	0.029	0.44		0	432	432					123
12/17/07														76
12/19/07			0.011	0.065	1.93	2.56				134	8.05			121
12/22/07												508	6.6	97

Date	OP [mg/ L P]	TP [mg/ L P]	NOX [mg/ L N]	NH3 [mg/ L N]	TN [mg/ L N]	Turbidity [NTU]	TSS [mg/L]	TDS [mg/L]	TS [mg/L]	Alkalinity [mg/L as CaCO3]	pH	Cond [umh os/cm]	DO	ORP
12/28/07														95
Averag e	0.09	0.12	0.03	0.109	1.98	3.30	8.32	407.73	417.65	119.15	8.05	542.6 5	4.75	85.44
Stand. Dev.	0.08	0.08	0.02	0.156	0.73	2.34	9.74	91.02	94.37	27.24	0.45	142.5 0	1.15	25.66
Varence	0.01	0.01	0.00	0.02	0.54	5.46	95	8285	8906	742	0.20	2030 7.52	1.32	658.5 3
n	29	30	25	18	18	25	25	23	22	27	26	23	24	9
Mass Out	176	230	53	211	3835		16153	791608	810875	0				
Median	0.07	0.095	0.02	0.033	1.924	2.38	5	394	421	116	8.08	539	4.4	76

Water Quality Master Spreadsheet 4G CB														
Date	OP [mg/L P]	TP [mg/L P]	NOX [mg/L N]	NH3 [mg/L N]	TN [mg/L N]	Turbidity [NTU]	TSS [mg/L]	TDS [mg/L]	TS [mg/L]	Alkalinity [mg/L as CaCO3]	pH	Cond. [umhos/ cm]	DO	ORP
1/12/07							23	212	235			427	3.6	
1/15/07												-		
1/23/07												-		
1/26/07	0.19	0.20	0.020			5.65			-	144	8.11	486		
2/5/07	0.24	0.24	0.042			7.82	0	274	274	114	8.01	472	6.8	
2/12/07														
2/19/07														
2/26/07														
3/5/07														
3/19/07														
3/26/07	0.12	0.27				11.3			-	126	8.37		8.3	
4/2/07	0.10	0.13	0.030		2.33	7.21	13	472	485	132	8.47	743	6.1	
4/9/07														
4/16/07	0.06	0.11	0.050		1.65	3.97	32	500	532	96	8.09	490	5.6	
4/30/07														
5/4/07	0.14	0.24	0.030		1.86	5.92	55	582	637	104	7.63		4.6	
5/14/07														
5/21/07	0.04	0.12	0.040			3.74	27	584	611	126	8.36	876	5.6	
5/29/07														
6/5/07	0.12	0.16	0.051	0.26		1.7	2	472	474	140	7.77	750	4.2	
6/12/07	0.10	0.14	0.044			4.18	27	416	443	98	7.62	610	2.9	
6/19/07	0.10	0.25				2.65	5	398	403	128	7.7	525	2	
6/26/07	0.03	0.08				2.09	0	412	412	124	8.33	617		
7/3/07	0.03	0.09				1.9	3	534	537	98	7.61	696	3.9	
7/10/07	0.09	0.18	0.009	0.062	1.27									
7/11/07	0.05	0.13	0.045	0.055	1.89	1.41	17	452	469	162	7.67	540	3.8	

Date	OP [mg/L P]	TP [mg/L P]	NOX [mg/L N]	NH3 [mg/L N]	TN [mg/L N]	Turbidity [NTU]	TSS [mg/L]	TDS [mg/L]	TS [mg/L]	Alkalinity [mg/L as CaCO3]	pH	Cond [umhos/ cm]	DO	ORP
7/17/07	0.11	0.11	0.066	0.006		2.01	7	302	309	197	7.56		3.9	
7/24/07		0.05	0.017	0.013	1.95	3.2	13	266	279	107	7.85	320	4.5	
7/31/07	0.03	0.035		0		1.51				109	8.84	247	3.6	
8/6/07		-												
8/14/07	0.06	0.113	0.026	0.091	4.2	7.02	8	408	416	98	9.13	488		
8/21/07	0.05	0.163		0.015	4.54	5.94				98	7.64	582	4.3	
8/27/07		0.09			1.9	2.99	6	450	456	103	7.59	577		
9/5/07	0.19	0.19	0.041		2.43		2	426	428				3.9	
9/10/07	0.06		0.041		2.05	-	0	464	464	104.00	8.46	567	-	
9/10/07	0.007		0.0025	0.041	2.149									
9/17/07	0.04	0.05			2.16		6	524	530	98	8.20	575	3.3	
9/24/07	0.1	0.1				1.9	2	276	278	105	8.39	413	4.3	
10/1/07	0.06	0.14					6	370	376				4.9	
10/8/07		0.086	0.01		1.49	1.37	0	288	288	105	8.32		3.7	
10/15/07	0.04	0.08	0.018			3.69	17	386	403	140	8.29	523	4.3	81
10/22/07	0.012	0.02	0.009	0.216	1.533									
10/29/07		-	0.013	0.030										
11/5/07	0.05	0.05	0.018	0.017	1.33	3.25	9	396	405	142	8.41	363	6.7	70
11/12/07		-	-											50
11/19/07	0.02	0.13	0.058	0.045		2.65				114	8.24	463	4.3	54
11/26/07		-		0.132										
12/3/07		-												
12/11/07	0.02	0.06	0.02	0.029	1.01		8.00	484.00	492					122
12/19/07		-	0.013	0.031	2.42	2.02				110	8.17			123
12/22/07												500	7.5	99
12/24/07														95
12/28/07														97
Average	0.08	0.13	0.03	0.065	2.12	3.88	11.00	422.33	433.33	119.33	8.10	540.16	4.71	87

Date	OP [mg/L P]	TP [mg/L P]	NOX [mg/L N]	NH3 [mg/L N]	TN [mg/L N]	Turbidity [NTU]	TSS [mg/L]	TDS [mg/L]	TS [mg/L]	Alkalinity [mg/L as CaCO3]	pH	Cond [umhos/ cm]	DO	ORP
Stand. Dev.	0.06	0.07	0.02	0.076	0.91	2.49	13.01	92.94	99.99	23.65	0.41	141.62	1.49	26.4 7
Varence	0.00	0.00	0.00	0.01	0.83	6.19	169	8638	9997	559	0.17	20055	2.23	701
n	29	30	24	16	18	25	25	25	25	27	27	24	25	9
Mass Out	148	241	56	124	4023		20871	801337	822208	0				
Median	0.06	0.116	0.028	0.036	1.925	3.2	7	416	428	110	8.17	525	4.3	75.5

APPENDIX I: MEDIA ANALYSIS TABLES

Table 24: Chemical Properties of Expanded Clay Growing Media

Type of Media	Units	Fresh Expanded Clay Growing Media	After 1yr Expanded Clay Growing Media	% Increase or Decrease
pH		6.5	7.5	15
Organic Content	mass %	2.2	1.9	-14
P P2O5	mg/L	29.7	27.7	-7
Postassium K2O	mg/L	107.4	39.3	-63
Magnesium	mg/L	60.6	29.3	-52
Nitrate & Ammonia	mg/L	6.1	9.7	59

Table 25: Melich 3 Analysis for Expanded Clay Growing Media

Type of Media	Units	Fresh Expanded Clay Growing Media	After 1yr Expanded Clay Growing Media	% Increase or Decrease
Phosphorus (as P)	mg/kg	16.14	23.92	48
Phosphorus (as P2O5)	mg/kg	36.96	54.78	48
Potassium (as K)	mg/kg	86.14	50.12	-42
Potassium (as K2O)	mg/kg	103.36	60.15	-42
Calcium	mg/kg	1126.47	1528.78	36
Magnesium	mg/kg	169.03	126.24	-25

Table 26: Saturated Media Extract Test For Expanded Clay Media

Type of Media	Units	Fresh Expanded Clay Growing Media	After 1yr Expanded Clay Growing Media	% Increase or Decrease
pH		6.72	7.69	14
Soluble Salts	mmhos/cm	0.6	0.4	-33
Nitrate-N	mg/L	0.53	1.84	247
Phosphorus (P)	mg/L	1.9	1.03	-46
Potassium (K)	mg/L	15.32	4.81	-69
Calcium	mg/L	91.58	157.39	72
Magnesium	mg/L	23.56	12.9	-45
Boron	mg/L	0.42	0.05	-88
Copper	mg/L	0.37	0.3	-19
Iron	mg/L	17.19	8.23	-52
Manganese	mg/L	8.25	1.76	-79
Sodium	mg/L	32.69	6.4	-80
Zinc	mg/L	0.38	0.81	113
Ammonia-N	mg/L	0.48	0.11	-77

Table 27: Calcium Carbonate Equivalent of Expanded Clay Growing Media

Type of Media	Units	Fresh Expanded Clay Growing Media	After 1yr Expanded Clay Growing Media	% Increase or Decrease
Solids	%	86.49	71.36	-17
CCE (Dry)	%	1.44	1.41	-2
CCE (Wet)	%	1.25	1	-20

Table 28: Physical Properties of Tire Crumb Growing Media

Type of Media	Units	Fresh Tire Crumb Growing Media	After 1yr Tire Crumb Growing Media	% Increase or Decrease
Paticle Size $\leq$ 0.05mm	mass %	9.9	9.2	-7
Bulk Density (Dry)	lb/ft3	34.1	30.4	-11
Bulk Density (Wet)	lb/ft3	59.72	70.99	19
Moisture	mass %	13.9	26.8	93
Pore Volume	Vol. %	61.4	67.6	10
Max Water Holding Capacity	Vol. %	42.1	65.2	55
Water Permeability	in/hr	120	77.04	-36

Table 29: Chemical Properties of Tire Crumb Growing Media

Type of Media	Units	Fresh Tire Crumb Growing Media	After 1yr Tire Crumb Growing Media	% Increase or Decrease
pH		5.3	7	32
Organic Content	mass %	36.8	105	185
P P2O5	mg/L	13.5	41.7	209
Postassium K2O	mg/L	85.2	40.5	-52
Magnesium	mg/L	67	55.3	-17
Nitrate & Ammonia	mg/L	5.7	6.6	16

Table 30: Melich 3 Analysis for Tire Crumb Growing Media

Type of Media	Units	Fresh Tire Crumb Growing Media	After 1yr Tire Crumb Growing Media	% Increase or Decrease
Phosphorus (as P)	mg/kg	8.74	45.85	425
Phosphorus (as P2O5)	mg/kg	20.02	105	424
Potassium (as K)	mg/kg	66.88	79.09	18
Potassium (as K2O)	mg/kg	80.26	94.91	18
Calcium	mg/kg	698.8	3041.15	335
Magnesium	mg/kg	179.34	260.81	45

Table 31: Saturated Media Extract Test For Tire Crumb Media

Type of Media	Units	Fresh Tire Crumb Growing Media	After 1yr Tire Crumb Growing Media	% Increase or Decrease
pH		5.14	7.03	37
Soluble Salts	mmhos/cm	0.49	0.48	-2
Nitrate-N	mg/L	0.31	1.65	432
Phosphorus (P)	mg/L	1.85	1.27	-31
Potassium (K)	mg/L	12.82	9.54	-26
Calcium	mg/L	45.48	83.94	85
Magnesium	mg/L	20.23	17.74	-12
Boron	mg/L	0.35	0.07	-80
Copper	mg/L	0.41	0.67	63
Iron	mg/L	17.88	1.09	-94
Manganese	mg/L	5.48	0.04	-99
Sodium	mg/L	30.04	6.28	-79
Zinc	mg/L	21.77	164.72	657
Ammonia-N	mg/L	1.76	0.1	-94

Table 32: Calcium Carbonate Equivalent For Tire Crumb Growing Media

Type of Media	Units	Fresh Tire Crumb Growing Media	After 1yr Tire Crumb Growing Media	% Increase or Decrease
Solids	%	86.15	73.2	-15
CCE (Dry)	%	1.31	3.42	161
CCE (Wet)	%	1.13	2.5	121

Table 33: Physical Properities For Growing Media

Type of Media	Units	Growing Media	After 1yr Growing Media	% Increase or Decrease
Paticle Size ≤ 0.05mm	mass %	12	10.1	-16
Bulk Density (Dry)	lb/ft3	38.2	38.54	1
Bulk Density (Wet)	lb/ft3	77.8	77.62	0
Moisture	mass %	34.9	33.7	-3
Pore Volume	Vol. %	66.9	70.6	6
Max Water Holding Capacity	Vol. %	64.9	64.6	0
Water Permeability	in/hr	18.18	27.6	52

Table 34: Chemical Properties of Growing Media

Type of Media	Units	Growing Media	After 1yr Growing Media	% Increase or Decrease
pH		7.5	7.5	0
Organic Content	mass %	8.8	8.6	-2
P P2O5	mg/L	29.7	44.5	50
Postassium K2O	mg/L	129.5	119.5	-8
Magnesium	mg/L	61.1	48.1	-21
Nitrate & Ammonia	mg/L	11.4	4.4	-61

Table 35: Melich 3 Analysis for Growing Media

Type of Media	Units	Growing Media	After 1yr Growing Media	% Increase or Decrease
Phosphorus (as P)	mg/kg	34.77	27.4	-21
Phosphorus (as P2O5)	mg/kg	79.62	62.74	-21
Potassium (as K)	mg/kg	235.27	166.85	-29
Potassium (as K2O)	mg/kg	282.33	200.22	-29
Calcium	mg/kg	2575.39	3012.64	17
Magnesium	mg/kg	323.42	333.1	3

Table 36: Saturated Media Extract Test For Growing Media

Type of Media	Units	Growing Media	After 1yr Growing Media	% Increase or Decrease
pH		7.81	7.89	1
Soluble Salts	mmhos/cm	1	0.68	-32
Nitrate-N	mg/L	1.2	0.29	-76
Phosphorus (P)	mg/L	1.85	0.66	-64
Potassium (K)	mg/L	56.95	19.61	-66
Calcium	mg/L	264.18	192.08	-27
Magnesium	mg/L	44.71	22.07	-51
Boron	mg/L	0.3	0.17	-43
Copper	mg/L	0.6	0.98	63
Iron	mg/L	12.72	13.43	6
Manganese	mg/L	4	4.85	21
Sodium	mg/L	34.19	21.97	-36
Zinc	mg/L	2.22	5.22	135
Ammonia-N	mg/L	0.48	0.1	-79

Table 37: Calcium Carbonate Equivalent For Growing Media

Type of Media	Units	Growing Media	After 1yr Growing Media	% Increase or Decrease
Solids	%	65.12	66.29	2
CCE (Dry)	%	2.74	2.98	9
CCE (Wet)	%	1.79	1.98	11

Table 38: Physical Properties for the Pollution Control Media

Type of Media	Units	Pollution Control Media	After 1yr Pollution Control Media	% Increase or Decrease
Paticle Size ≤ 0.05mm	mass %	10.7	10.5	-2
Bulk Density (Dry)	lb/ft3	34.87	33.8	-3
Bulk Density (Wet)	lb/ft3	61.35	60.23	-2
Moisture	mass %	21.8	31.1	43
Pore Volume	Vol. %	62.4	65.8	5
Max Water Holding Capacity	Vol. %	44.1	21.1	-52
Water Permeability	in/hr	227.04	228.42	1

Table 39: Chemical Properties for the Pollution Control Media

Type of Media	Units	Pollution Control Media	After 1yr Pollution Control Media	% Increase or Decrease
pH		7.2	7.1	-1
Organic Content	mass %	37	37.8	2
P P2O5	mg/L	16.7	11.6	-31
Postassium K2O	mg/L	39.1	33.2	-15
Magnesium	mg/L	18.1	15.4	-15
Nitrate & Ammonia	mg/L	11.8	3.6	-69

Table 40: Melich 3 Analysis for Pollution Control Media

Type of Media	Units	Pollution Control Media	After 1yr Pollution Control Media	% Increase or Decrease
Phosphorus (as P)	mg/kg	12.95	11.98	-7
Phosphorus (as P2O5)	mg/kg	29.67	27.43	-8
Potassium (as K)	mg/kg	84.1	66.55	-21
Potassium (as K2O)	mg/kg	100.92	79.86	-21
Calcium	mg/kg	1422.1	1465.11	3
Magnesium	mg/kg	112.57	124.51	11

Table 41: Saturated Media Extract Test For Pollution Control Media

Type of Media	Units	Pollution Control Media	After 1yr Pollution Control Media	% Increase or Decrease
pH		7.71	7.5	-3
Soluble Salts	mmhos/cm	0.74	0.59	-20
Nitrate-N	mg/L	1.32	0.21	-84
Phosphorus (P)	mg/L	0.53	0.38	-28
Potassium (K)	mg/L	20.71	8.57	-59
Calcium	mg/L	204.55	162.39	-21
Magnesium	mg/L	18.25	12.78	-30
Boron	mg/L	0.3	0.08	-73
Copper	mg/L	0.27	0.83	207
Iron	mg/L	6.04	6.1	1
Manganese	mg/L	2.46	0.41	-83
Sodium	mg/L	12.95	13.26	2
Zinc	mg/L	45.34	58.52	29
Ammonia-N	mg/L	2.21	0.11	-95

Table 42: Calcium Carbonate Equivalent For Pollution Control Media

Type of Media	Units	Pollution Control Media	After 1yr Pollution Control Media	% Increase or Decrease
Solids	%	78.19	68.94	-12
CCE (Dry)	%	1.73	1.35	-22
CCE (Wet)	%	1.35	0.93	-31

APPENDIX J: PROCEDURES

Irrigation SOP

- Use permanent ink for all hand written records

- Record the names of all who are present, the date and time of irrigation

- Look at the rain gages by the chambers and the weather station receiver in the stormwater lab to determine the amount of rain that has fallen in the last twenty four hours and record the quantity.

o Empty rain gages onto nearby grass and replace after use

o Determine if irrigation is needed

 If more than .5 in. than the regular irrigation chambers DO NOT get irrigated

 If more than 1 in. than all the chambers DO NOT get irrigated

- Measure and record the height of water in each drum

o Insert the metal yard stick and record a depth in inches

- Look at the Tupperware water holding containers and the drums to determine if any water needs to be let out or added

- Measure and record the amount of water added or removed via the graduated cylinder for each drum

o Just record the total inches

- Measure and record the height of water in each drum

o Insert the metal yard stick and record a depth in inches

- Remove any water in the clear Tupperware water holding containers to the respective

55

gallon drum carefully measuring the amount via the graduated cylinder

o Just record the total inches

- Measure and record the height of water in each drum

o Insert the metal yard stick and record a depth in inches

- Irrigate each chamber with water from its respective drum making sure to measure and use the appropriate amount of water

o The inches provided on the field spreadsheet is inches of the graduated cylinder

- Measure and record the height of water in each drum

o Insert the metal yard stick and record a depth in inches

- Organize data for entry into the master spreadsheet

Nitrate + Nitrite Procedures

1. Select “HACH PROGRAM” “2515 N, Nitrate , LR, 0.5mg/L”

2. zero with DI water and clean 25 mL sample cell

3. Select “Options”

4. Press “view conc.” until screen reads “view abs.”

5. Select “view abs.”

6. Select “exit”

7. Measure out 30 mL of sample in volumetric flask

8. Add contents of Nitraver 6 packet

9. Start timer 1 (3:00 min) and shake.

10. Start timer 2 – wait two minutes

11. Take out 25 mL and put in another container

12. Add contents of Nitraver 3 packet to the 25 mL sample

13. (Start timer 3) Shake for 30 seconds

14. (Start timer 4) Wait 15 minutes

15. Measure ABS on spectrophotometer

16. Compare to std. curve plotted using known concentrations of Nitrate

Solids Procedures

1. Wash and clean crucibles for both suspended and dissolved solids

2. Place filters in suspended solids crucibles and rinse with DI water

a. Use filtration vacuum to remove all the water

3. Place all crucibles in drying oven for at least 4 hours

4. Remove crucibles from oven and let cool in desiccator

5. Weigh each crucible and record the weight

6. Place crucibles back in desiccator for at least one hour

7. Remove crucibles and reweigh

a. If weight is different by more than 5% then dry for another hour, cool, and reweigh

8. Vacuum filter the required volume of water using the suspended solids crucibles

9. Collect the 25 mL of filtrate in the dissolved solids crucible

10. Place the suspended solids crucibles in the drying oven at 105$_o$C for at least fourhours

a. Repeat steps 4 – 7a

11. Place the dissolved solids crucibles in the drying oven at 165$_o$C for at least four hours

a. Repeat steps 4 – 7a

12. The suspended and dissolved solids are calculated using the difference between the final and initial weight divided by the sample volume

pH and Alkalinity Procedure

Calibration of pH meter

Mix buffer solutions:

1. Take 25 mL of pH 4 buffer solution and dilute to 100 mL with DI water
2. Take 4 mL of pH 7 buffer solution and dilute to 100 mL with DI water
3. Take 10 mL of pH 10 buffer solution and dilute to 100 mL with DI water

Calibrate:

1. Remove electrode storage container from electrode
2. Turn on pH meter by touching screen
3. Touch “channel 1”
4. Touch “pH”
5. Touch “standardize”
6. Place electrode in 50 mL of each buffer solution to standardize

Testing

pH:

1. Take 50 mL of each sample
2. Rinse the electrode with DI water
3. Place electrode in sample and record pH
4. Rinse the electrode with DI water and repeat until all samples are complete

Alkalinity:

1. Take 50 mL of each sample
2. Place pH electrode in sample
3. Titrate each sample with 0.02N H_2SO_4 to a pH of 4.5
4. Record volume of H_2SO_4
5. Alkalinity measured in total Alkalinity titrated to reach pH = 4.5

Turbidity Procedure

Calibration:

1. Obtain Gelex standard vials labeled (1-10), (1-100), and (1-1000)
2. Wipe vial with felt wipe
3. Insert vial into machine (diamond forward)
4. Push read and record turbidity (to .00) in notebook

Testing:

1. Fill empty vial with each sample
2. Wipe vial with felt wipe
3. Insert vial into machine (diamond forward)
4. Push read and record turbidity (to 0.00)

Ortho-Phosphorus Procedure

Equipment and Supplies:

1. Spectrophotometer
2. 1 mL epindorph
3. 10 mL Vile
4. Hach Phosh 3 powder pillow
5. Phosphorus Solution
6. Five 100 mL volumetric flasks
7. Filtration device and 0.45um membrane filters

Filtration:

1. Filter 30 mL of each collected sample
2. For quality assurance

a. Filter 60 mL for duplicate samples
b. Filter 100 mL for spiked samples

Prepare Standards for Calibration Curve:

1. Prepare 0.1, 0.5, 1.0, 1.5, and 2 mg/L standards using the 100mL volumetric flasks

Testing:

1. Select Hach program 3025 on the spectrophotmeter
2. Zero the spectrophotmeter by measuring 10 mL of DI water in the 10 mL sample cell
3. Pour 10 mL of the filtered sample into the 10 mL sample cell (pour up to marked line of 10 mL)
4. Empty the powder pillow into the vile and cover with parafilm
5. Shake until most of the powder is dissolved
6. Let it sit for 2 min (start the timer on the spectrophotometer)
7. Measure in the spectrophotometer as absorbance
8. In put readings into excel spreadsheet and compare to standard curve

Total Phosphorus Procedure

Equipment and Supplies:

1. Spectrophotometer
2. 200 mL cylinders
3. 1 mL epindorph
4. Autoclave
5. pH probe
6. Seven 100 mL volumetric flasks

Reagents:

1. Concentrated Sulfuric Acid
2. 10 N Sodium Hydroxide
3. Phosphate standard solution
4. Ammonium Persulfate

Test:

1. Create the standard solution for the calibration curve (Blank, 0.5 mg/L, 1 mg/L, 1.5
2. mg/L, 2 mg/L)
3. Measure 75 mL of sample and place into 200 mL cylinder (Except for Spikes)
4. Spikes add 110 mL of sample to cylinder
5. Lower pH to below 2 using 1 mL Sulfuric acid solution (3:10)
6. Add 2 g of crystal Ammonium Persulfate
7. Place cylinders into autoclave, cover with aluminum foil and run autoclave for 45
8. minutes
9. Remove cylinders and let sit until room temperature
10. Raise the pH to above 10 using the 10N Sodium Hydroxide (1:2)
11. Make spikes
    1. Add 0.1 mL of 1000 ppm Phosphate standard to a 100 mL volumetric flask
    2. Pour sample up to 100 mL mark
12. Pour 10 mL into the ICP test tubes and label accordingly

Follow ICP protocol

ICP Protocol

Sample Prep:

1. Lable 15 mL test tubes.
2. All samples need to be 2% HNO_3 by volume. Refrigerate for 12 hours after acid addition before running on ICP.

ICP running:

1. Power on computer.
2. Open WinLab32.
3. Turn on gases. Nitrogen should be greater than 100 psi. Gas tanks should have greater than 200 psi built up. Check gas level in tank is not empty.
4. In WinLab32, go to analysis → autosampler. In the plasma window the Nebulizer should be set to 0.50 and the RF Power set to 1500. Click Apply. Click the On button. ICP will not start unless the door to the plasma is shut.
5. Let machine warm up for 30 min before running.
6. To set up methods, click File → Open → Method. On the periodic table, use the preferred wavelength. Go to Settings. Select the Time to be Auto, the Delay to be 60 sec, and 3 replicates. (F1 gives help on all menus)
7. For Calibration, define standards and location. Enter the units and concentration values for your standards. For the blank, use 2% acid solution as your first standard. Equations should be Linear.
8. To enter samples, click Sample Info → Batch ID. Enter the sample ID. Right click to use column fill. The right click and column fill the location, starting with location 9 (or location of first sample). Click File → Save As → Sample File Info.
9. Wait for ICP to initialize optics.
10. The analyze samples, in Auto Analysis window, go to Results Data → Save. Under Analyze click Analyze All.
11. The Calibration should have results with RSD<1.
12. To see data click Examine → Data → Data Set
13. If emergency switch is tripped click Emergency Switch → System → Reset Emergency Plasma Off → OK (turn button on) → On (on Plasma Control)
14. To retrieve results, go to WinLab32-offline. Click File → Open → Method then Reproc → Data Set → Select Results
15. To shut down, turn plasma button to off. Go to Analysis→ Auto Sampler Up.

ICP Maintenance:

1. The black tube takes sample to machine. Change once a week. The red tube is the return. Change every few weeks. Release the clips between runs so tubing doesn't sit stretched.
2. To clean the injector and the torch, let sit in 2% acid solution overnight. After reinstalling the view must be realigned. To do so, click Tools → Spectrophotometer Control. Align the view with the Mn solutions. Click Analysis → Auto Sampler → Go To: Location "X" where the Mn solution is located. Click OK on the Radial (plasma) when using the 10 ppm Mn solution and for Axial use the 1 ppm Mn solution. Between aligning the Radial and Axial views put Autosampler in Wash location (2% HNO_3) by Shift+F10.

Ammonia

1. Select the test.
2. Prepared Sample: Fill a sample cell to the 10- mL mark with sample.
3. Blank Preparation: Fill a second sample cell to the 10-mL mark with deionized water.
4. Add the contents of one Ammonia Salicylate Powder Pillow to each cell.
5. Insert the stopper or cap the cell and shake to dissolve.
6. Start the instrument timer. A three-minute reaction period will begin.
7. When the timer expires, add the contents of one Ammonia Cyanurate Reagent Powder Pillow to each cell.
8. Stopper or cap and shake to dissolve.
9. Start the instrument timer. A 15-minute reaction period will begin. A green color will develop if ammonia-nitrogen
10. When the timer expires, wipe the blank and insert it into the cell holder
11. ZERO the instrument. The display will show: 0.00mg/L NH3–N.
12. Wipe the sample and insert it into the cell holder. READ the results in mg/L NH3–N.

Total Nitrogen

1. Turn on the DRB200 Reactor and heat to 105°C.
2. Using a funnel, add the contents of one Total Nitrogen Persulfate Reagent Powder Pillow to each of two Total Nitrogen Hydroxide Digestion Reagent vials. Wipe off any reagent that may get on the lid or the tube threads.
3. *Note: One reagent blank is sufficient for each set of samples.*
4. Prepared Sample: Add 2 mL of sample to one vial.
5. Blank Preparation: Add 2mL of the deionized water included in the kit to a second vial. Use only water that is free of all nitrogen-containing species as a substitute for the provided deionized water.
6. Cap both vials. Shake vigorously for at least 30seconds to mix. The persulfate reagent may not dissolve completely after shaking. This will not affect accuracy.
7. Insert the vials in the reactor and close the lid. Heat for exactly 30 minutes.
8. Using finger cots, immediately remove the hot vials from the reactor. Cool the vials to room temperature.
9. Select the test. Insert an adapter if required (see *Instrument- specific information*).
10. Remove the caps from the digested vials and add the contents of one Total Nitrogen (TN) Reagent A Powder Pillow to each vial. 350 N, Total LR TNT Stored Programs Start
11. Cap the tubes and shake for 15 seconds. 10. Start the instrument timer. A three-minute reaction period will begin.
12. After the timer expires, remove the caps from the vials and add one TN Reagent B Powder Pillow to each vial.
13. Cap the tubes and shake for 15 seconds. The reagent will not completely dissolve. This will not affect accuracy. The solution will begin to turn yellow.
14. Start the instrument timer. A two-minute reaction period will begin.
15. After the timer expires, remove the caps from two TN Reagent C vials and add 2 mL of digested, treated sample to one vial. Add 2 mL of digested, treated reagent blank to the second TN Reagent Cvial.
16. Cap the vials and invert ten times to mix. Use slow, deliberate inversions for

complete recovery. The tubes will be warm to the touch.

17. Start the instrument timer. A five-minute reaction period will begin. The yellow color will intensify.
18. Wipe the reagent blank and insert it into the 16-mm round cell holder.
19. ZERO the instrument. The display will show: 0.0 mg/L N
20. Wipe the reagent vial and insert it into the 16- mm round cell holder.
21. *Note: Multiple samples may be read after zeroing on one reagent blank.*
22. READ the results in mg/L N.

APPENDIX K: WATER QUALITY ASSURANCE AND QUALITY CONTROL

pH QAQC Data			
Date	pH	Dup. pH	RPD [%]
1/23/07	8.59	8.65	1%
1/23/07	8.53	8.59	1%
2/12/07	8.78	9.04	3%
2/12/07	8.43	8.45	0%
3/19/07	9.19	9.63	5%
3/19/07	9.4	9.41	0%
4/16/07	8.56	7.83	9%
4/16/07	8.71	9.16	5%
5/14/07	8.23	7.07	15%
5/14/07	6.92	8.25	18%
6/5/07	7.93	7.75	2%
6/5/07	7.82	7.65	2%
7/3/07	7.62	7.78	2%
7/3/07	7.74	7.65	1%
7/31/07	8.33	8.44	1%
7/31/07	8.69	8.8	1%
8/21/07	8.06	8.04	0%
8/21/07	8.46	8.44	0%
9/10/07	5.36	5.12	5%
9/10/07	8.41	8.4	0%
10/8/07	8.25	8.15	1%
10/8/07	8.38	8.45	1%
11/5/07	8.45	8.6	2%
11/5/07	8.45	8.45	0%
11/19/07	8.57	8.67	1%
11/19/07	7.92	8.09	2%
12/11/07	8.22	8.17	1%
12/11/07	7.92	8.05	2%

Conductivity QAQC Data			
Date	Conc. [mg/L as $CaCO_3$]	Dup. Conc. [mg/L as $CaCO_3$]	RPD [%]
1/26/07	592	585	1%
2/12/07	481	479	15%
2/26/07	435	434	0%
2/26/07	457	458	0%
3/19/07	387	396	2%
3/19/07	438	430	2%
4/9/07	457	446	2%
4/16/07	724	778	7%
4/16/07	641	630	2%
5/21/07	849	848	0%
5/21/07	809	811	0%
5/29/07	534	530	1%
5/29/07	486	493	1%
6/5/07	829	794	4%
6/5/07	773	749	3%
6/26/07	607	612	1%
6/26/07	610	601	1%
7/3/07	540	652	19%
7/3/07	674	659	2%
7/31/07	297	296	0%
7/31/07	326	336	3%
12/11/07	463	540	15%
12/11/07	484	490	1%

Alkalinity QAQC Data			
Date	Conc. [mg/L as $CaCO_3$]	Dup. Conc. [mg/L as $CaCO_3$]	RPD [%]
1/23/07	138	140	1%
1/23/07	132	132	0%
2/12/07	122	118	3%
2/12/07	142	142	0%
3/19/07	120	108	11%
3/19/07	58	58	0%
4/16/07	140	142	1%
4/16/07	90	94	4%
5/14/07	82	92	11%
5/14/07	112	86	26%
6/5/07	148	142	4%
6/5/07	132	128	3%
7/3/07	110	118	7%
7/3/07	124	148	18%
7/31/07	138	141	2%
7/31/07	116	109	6%
8/21/07	117	119	2%
8/21/07	82	103	23%
9/10/07	102	96	6%
9/10/07	46	69	40%
10/8/07	126	124	2%
10/8/07	124	110	12%
11/5/07	110	120	9%
11/5/07	114	120	5%
11/19/07	114	118	3%
11/19/07	116	88	27%
12/11/07	88	110	22%
12/11/07	130	108	18%

Turbidity QAQC Data			
Date	NTU	Dup. NTU	RPD [%]
1/23/07	8.29	10.1	20%
1/23/07	7.17	3.07	80%
2/12/07	9.25	16.2	55%
2/12/07	9.39	9.98	6%
3/19/07	4.15	3.64	13%
3/19/07	4.08	3.98	2%
3/26/07	11.4	9.79	15%
3/26/07	11.6	12.9	11%
4/16/07	2.93	3.00	2%
4/16/07	4.77	4.27	11%
5/14/07	10.3	10.2	1%
5/14/07	3.82	2.25	52%
6/5/07	1.45	1.65	13%
6/5/07	1.86	2.00	7%
7/3/07	1.62	1.66	2%
7/3/07	1.90	1.95	3%
7/31/07	0.98	1.83	60%
7/31/07	1.83	1.83	0%
8/21/07	1.38	2.08	40%
8/21/07	1.55	1.79	14%
10/8/07	1.13	1.33	16%
10/8/07	1.15	1.04	10%
12/11/07	1.27	1.09	15%
12/11/07	1.57	1.38	13%

TDS QAQC Data			
Date	Conc. [mg/L]	Dup. Conc. [mg/L]	RPD [%]
1/12/07	252	252	0%
1/12/07	348	316	10%
2/5/07	413	425	3%
2/5/07	262	270	3%
3/5/07	468	460	2%
3/5/07	392	380	3%
4/16/07	548	542	1%
4/16/07	504	506	0%
5/14/07	250	292	15%
5/14/07	196	166	17%
6/12/07	0	6	200%
6/12/07	416	404	3%
7/11/07	360	362	1%
7/11/07	332	330	1%
7/17/07	342	348	2%
8/14/07	242	264	9%
8/14/07	222	274	21%
9/5/07	570	512	11%
9/5/07	402	428	6%
10/1/07	442	406	8%
10/1/07	354	378	7%
10/15/07	362	393	8%
10/15/07	350	365	4%
11/5/07	337	345	2%
11/5/07	365	408	11%
12/11/07	528	532	1%
12/11/07	524	514	2%

TSS QAQC Data			
Date	Conc. [mg/L]	Dup. Conc. [mg/L]	RPD [%]
1/12/07	37	40	8%
1/12/07	10	10	0%
2/5/07	2	3	66%
2/5/07	0	0	0%
3/5/07	32	33	3%
3/5/07	33	32	3%
4/16/07	37	38	3%
4/16/07	43	38	12%
5/14/07	2	6	100%
5/14/07	57	68	18%
6/12/07	27	15	57%
6/12/07	5	7	33%
7/11/07	18	0	200%
7/11/07	4	2	67%
7/17/07	10	11	10%
8/14/07	3	6	67%
8/14/07	6	3	67%
9/5/07	3	5	50%
9/5/07	5	3	50%
10/1/07	13	2	147%
10/1/07	3	17	140%
10/15/07	22	17	26%
10/15/07	50	63	23%
11/5/07	70	27	89%
11/5/07	8	10	22%
12/11/07	4	9	77%
12/11/07	7	1	150%

TN QAQC Data						
Date	Conc. [mg N/L]	Dup. Conc. [mg N/L]	RPD [%]	Conc. [mg N/L]	Spike Conc. [mg N/L]	% Recovery
1/15/07	1.43	0.9	45%	0.6	2.56	99%
1/15/07	1.59	2.13	29%	1.43	2.5	53%
1/15/07	1.22	1.27	4%	1.11	2.93	91%
1/15/07	0.63	1.22	64%	0.26	2.18	96%
2/12/07	0.79	0.74	7%	0.28	1.71	71%
7/24/07	2.52	3.74	39%	-	-	-
7/24/07	1.71	1.43	18%	-	-	-
8/21/07	2.04	2.42	17%	2.14	2.56	85%
8/21/07	1.34	2.28	52%	-	-	-
8/27/07	1.94	2.22	13%	1.9	4	140%
9/5/07	2.05	2.43	17%	1.16	3.04	94%
10/15/07	1.86	1.82	2%	2.28	3.89	81%
10/15/07	1.59	1.72	8%	1.72	2.79	53%
11/5/07	2.26	2.54	12%	2.38	3.85	74%
11/5/07	0.88	2.14	83%	1.64	3.88	112%
12/11/07	0.9	0.82	9%	0.13	1.93	90%
12/11/07	-	-	-	0.9	2.12	61%
12/19/07	0.29	0.32	10%	0.65	2.15	75%
12/19/07	1.2	0.64	61%	0.96	2.82	93%

Ammonia QAQC Data						
Date	Conc. [mg N/L]	Dup. Conc. [mg N/L]	RPD [%]	Conc. [mg N/L]	Spike Conc. [mg N/L]	% Recovery
5/21/07	-	-	-	0.25	0.36	113%
5/29/07	0.21	0.2	5%	0.21	0.3	91%
6/5/07	0.22	0.21	5%	0.12	0.24	124%
6/5/07	0.17	0.18	6%	0.13	0.23	99%
6/13/07	0.18	0.18	0%	0	0.098	141%
6/15/07	0.057	0.056	2%	0.13	0.36	233%
6/19/07	0.039	0.048	21%	0	0.082	109%
6/19/07	0	0	0%	0	0.07	93%
7/3/07	0	0.03	200%	0.09	0.34	100%
7/3/07	0.01	0.02	67%	0.01	0.21	80%
7/11/07	-	-	-	0.01	0.06	120%
7/17/07	0.011	0.012	9%	0.01	0.108	108%
7/24/07	0.016	0.017	6%	0.01	0.11	104%
7/31/07	-	-	-	0	0.084	84%
8/6/07	-	-	-	0.021	0.096	75%
8/14/07	0.08	0.013	144%	0.022	0.192	85%
8/14/07	-	-	-	0.013	0.194	93%
8/21/07	<.01	<.01	0%	0.03	0.233	102%
8/21/07	0.017	0.08	130%	0.006	0.203	99%
11/26/07	0.028	0.03	7%	0.154	0.3	98%
11/26/07	<.01	<.01	0%	-	-	-

Nitrate + Nitrite QAQC Data						
Date	Conc. [mg N/L]	Dup. Conc. [mg N/L]	RPD [%]	Conc. [mg N/L]	Spike Conc. [mg N/L]	% Recovery
2/5/07	0.023	0.02	14%	-	-	-
2/19/07	0.026	0.023	12%	-	-	-
2/26/07	-	-	-	0.037	0.11	73%
3/5/07	0.012	0.013	8%	0.017	0.07	108%
3/5/07	0.018	0.019	5%	-	-	-
3/19/07	0.039	0.03	26%	0.086	0.142	111%
4/2/07	0.017	0.022	26%	0.207	0.288	81%
4/2/07	0.023	0.03	26%	-	-	-
4/9/07	0.032	0.039	20%	0.02	0.064	88%
4/9/07	0.02	0.019	5%	0.027	0.062	68%
4/16/07	-	-	-	0.017	0.063	93%
4/16/07	-	-	-	0.025	0.061	73%
5/4/07	0.028	0.032	13%	-	-	-
5/21/07	0.038	0.045	17%	-	-	-
5/21/07	0.041	0.038	8%	-	-	-
5/29/07	0.029	0.027	7%	-	-	-
5/29/07	0.034	0.037	8%	-	-	-
6/5/07	0.045	0.043	5%	0.035	0.12	85%
6/5/07	0.041	0.041	0%	-	-	-
6/13/07	0.233	0.244	5%	0.249	0.391	142%
6/15/07	0.051	0.048	6%	-	-	-
7/3/07	-	-	-	0.029	0.13	100%
7/11/07	0.014	0.012	15%	0.063	0.141	78%
7/11/07	-	-	-	0.221	0.328	107%
7/17/07	0.04	0.02	67%	-	-	-
7/24/07	0.058	0.049	17%	0.056	0.144	88%
10/15/07	0.042	0.033	24%	-	-	-
10/15/07	0.037	0.027	31%	0.027	0.323	99%
11/12/07	0.059	0.059	0%	0.028	0.13	103%
11/12/07	0.023	0.022	4%	0.044	0.155	111%
12/19/07	0.017	0.013	27%	0.006	0.16	52%

Total Phosphorus QAQC Data

Date	Conc. [mg P/L]	Dup. Conc. [mg P/L]	RPD [%]	Conc. [mg P/L]	Spike Conc. [mg P/L]	% Recovery
1/26/07	0.34	0.36	6%	0.16	0.89	224%
1/26/07	0.15	0.22	38%	0.61	0.93	98%
2/5/07	0.22	0.28	24%	0.08	0.36	85%
2/5/07	0.17	0.15	13%	0.52	0.91	119%
2/26/07	0.19	0.19	0%	0.13	0.26	84%
2/26/07	0.13	0.13	0%	0.2	0.32	74%
3/26/07	0.26	0.26	0%	0.06	0.21	89%
3/26/07	-	-	-	0.063	0.207	89%
4/16/07	0.122	0.125	2%	0.348	0.481	82%
4/16/07	0.12	0.147	20%	0.097	0.246	91%
5/14/07	0.107	0.104	3%	0.1	0.26	97%
5/14/07	0.14	0.14	0%	0.07	0.23	95%
6/5/07	0.68	0.87	25%	0.07	0.19	73%
6/5/07	0.13	0.11	17%	0.045	0.19	88%
7/24/07	0.03	0.04	29%	0.03	0.18	94%
7/24/07	0.04	0.04	0%	0.01	0.17	99%
8/21/07	0.097	0.091	6%	0.088	0.214	77%
8/21/07	0.079	0.097	20%	0.107	0.246	85%
10/15/07	0.06	0.06	0%	0.04	0.14	123%
10/15/07	-	-	-	0.03	0.13	124%
11/5/07	0.03	0.03	0%	0.03	0.09	77%
11/5/07	0.02	0.02	0%	0.03	0.12	105%
11/19/07	0.18	0.18	0%	0.04	0.1	85%
11/19/07	0.13	0.12	8%	-	-	-
12/11/07	0.04	0.04	0%	0.03	0.11	96%
12/11/07	0.03	0.03	0%	0.04	0.11	94%

Ortho-Phosphorus QAQC Data						
Date	Conc. [mg P/L]	Dup. Conc. [mg P/L]	RPD [%]	Conc. [mg P/L]	Spike Conc. [mg P/L]	% Recovery
1/23/07	0.07	0.08	13%	0.07	0.35	84%
1/26/07	0.15	0.16	6%	0.02	0.36	103%
2/12/07	0.06	0.05	18%	0.06	0.21	90%
2/12/07	0.17	0.19	11%	0.12	0.26	84%
3/5/07	0.1	0.1	0%	0.02	0.19	104%
3/5/07	0.03	0.02	40%	0	0.2	118%
4/9/07	0.05	0.02	86%	0.08	0.21	78%
4/9/07	0.01	0.02	67%	0.04	0.2	97%
5/14/07	0.04	0.04	0%	0.02	0.21	119%
5/14/07	0.12	0.13	8%	0.03	0.19	94%
6/5/07	0.11	0.1	10%	0.04	0.22	108%
6/5/07	0.05	0.06	18%	0.05	0.23	109%
7/11/07	0.04	0.06	40%	0.02	0.21	115%
7/11/07	0.09	0.08	12%	0.03	0.19	102%
8/21/07	0.07	0.08	13%	0.07	0.13	78%
8/21/07	0.06	0.05	18%	0.04	0.14	94%
9/5/07	0.04	0.05	22%	0.02	0.09	91%
9/5/07	0.04	0.03	29%	0.03	0.13	112%
10/15/07	0.04	0.05	22%	0.06	0.12	81%
11/5/07	0.07	0.06	15%	0.03	0.12	105%
11/5/07	0.04	0.05	22%	-	-	-
12/11/07	0.28	0.25	11%	0.1	0.03	94%

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