LAKE BUCHANAN ASSESSMENT

NUTRIENT LOADNG STUDY AND LAKE MANAGEMENT PLAN

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EXECUTIVE SUMMARY

This study assesses the water quality, hydrology, and nutrient loading of Lake Buchanan and provides potential water quality management alternatives for the Orange County Environmental Protection Division. Lake Buchanan (WBID 3169A3) is located in central Orange County and is part of the Shingle Creek/Kissimmee watershed, which, in turn is in the Okeechobee BMAP area. During the Florida Department of Environmental Protection's (FDEP) Cycle 4 verification period (2008 – 2017), the lake was listed as impaired for biology and was placed on the planning list for chlorophyll-a and nutrients (total phosphorus and total nitrogen). The FDEP's 2020-2022 verified lists indicate the lake is verified as impaired for biology, chlorophyll-a, and nutrients.

A review of the Lake Buchanan water quality data during the verified period from 2015 through 2022 indicates the annual geometric mean (AGM) chlorophyll-*a* concentrations exceeded the numeric nutrient criteria (NNC) in all years with sufficient data except 2018. Insufficient data were available in 2015, 2021, and 2022 to determine whether the NNC condition was exceeded for chlorophyll-*a*. Total nitrogen and total phosphorus AGM concentrations exceeded NNC in 2016, 2017, 2019 and 2020. Total nitrogen and total phosphorus data were insufficient during 2015, 2021, and 2022 to determine whether the NNCs were exceeded. Recent water quality sampling by WSP and EPD (2021 and 2022) indicated the chlorophyll-a, total nitrogen, and total phosphorus AGMs exceeded the NNC. Temperature and dissolved oxygen depth profiles suggest that the lake is experiences anoxic conditions (<2 mg/L) at the sediment-water interface for two thirds of the year but does not appear to be thermally stratified.

Portions of Lake Buchanan have accumulated a significant layer of soft sediments which averaged about 6 feet in thickness, with up to 19.7feet in thickness. The deepest, central portion of the lake contained highly organic sediments (bulk density 0.10 g/cm^3) and was also enriched in phosphorus (4,360 mg/kg TP). Total soft sediment volume in Lake Buchanan is approximately 502,207 yd^3.

WSP conducted a nutrient loading analysis of the Lake Buchanan basin to determine the potential nutrient loading sources. Available geographic information system (GIS) data were evaluated and updated based on field reconnaissance and aerial and topographic information. The Lake Buchanan watershed was divided into 22 sub-basins and each sub-basin was evaluated using land use cover and soil classification information to support water quantity and quality modeling. In addition, WSP deployed two stormwater autosamplers and three seepage meters to support the modeling efforts and provide site-specific empirical pollutant load estimates from both stormwater and groundwater seepage. The results indicated that sediment flux within Lake Buchanan is the largest source of pollutants contributing 592 lb/yr total phosphorus (71%) and 2,360 lb/yr total nitrogen (63%). Surface runoff is the largest source of external loading at 219 lb/yr TP and 1,028 lb/yr TN. Seepage inputs contribute approximately 16 lb/yr total phosphorus and 309 lb/yr total nitrogen. Direct atmospheric loading was a relatively minor pollutant source.

WSP developed three conceptual structural stormwater treatment options in the sub-basins with the highest untreated pollutant loading based on the information provided by this study. Alternative 1 involves construction of a downflow biosorption activated media (BAM) filter to treat sub-basins LB-005, LB-010, and LB-015. Alternative 2 involves construction of a wet detention and downflow BAM filter to treat sub-basins LB-110, LB-115, LB-120, LB-125, and LB-130. Alternative 3 is bioretention area designed to treat sub-basins LB-030, LB-035, LB-040, LB-050, LB-070, and LB-095. Three non-structural alternatives were also identified and described both in terms of pollutant removal and estimated cost per pound of pollutants removed. These alternatives are summarized below and are recommended for further investigation.

Summary of Alternatives

ALTERNATIVE	RANK	TP REMOVED EACH YEAR (LB)	TP REMOVAL COST ($/LB)	TN REMOVED EACH YEAR (LB)	TN REMOVAL COST ($/LB)	TYPE OF REDUCTION
1	4	86	$256	783	$28	Downflow BAM
2	5	205	$327	1,516	$44	Wet Detention and Downflow BAM
3	6	56	$588	193	$201	Bioretention
4	3	13	$77	62	$16	Public Education
5	2	5,450*	$199	---	---	Sediment Inactivation
6	1	2,250	$156	225	$16	Mechanical Harvesting

*Long-term reduction based on high dose and available phosphorus binding capacity of Phoslock® applied

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1.0 INTRODUCTION

1.1 PROJECT DESCRIPTION AND SCOPE OF WORK

WSP USA Environment & Infrastructure Inc. (WSP), formerly known as Wood Environment & Infrastructure Solutions, Inc. (Wood), was contracted by the Orange County Environmental Protection Division (OCEPD) to evaluate the water quality conditions of Lake Buchanan (WBID 3169A3) using Numeric Nutrient Criteria and other relevant limnological assessment methods and to characterize the hydrology and water quality of Lake Buchanan to identify the primary sources of nutrient pollution. Additionally, WSP was contracted by OCEPD to identify potential Best Management Practices (BMPs) designed to mitigate sources of nutrient pollutant loading within the Lake Buchanan watershed and perform a conceptual evaluation of the identified BMPs. This report summarizes the work performed by WSP to complete a hydrological and nutrient loading assessment and lake management plan for Lake Buchanan, including conceptual project recommendations for BMPs, with the ultimate goal of improving water quality in Lake Buchanan.

The scope of work completed by WSP for the Lake Buchanan assessment and management plan is summarized by the following tasks:

- Task 1 Project kick-off meeting between WSP and OCEPD to review the overall project objectives and provide WSP with previous water quality studies and data related to Lake Buchanan.
- Task 2, WSP reviewed the information and data provided by OCEPD and obtained additional water quality data, performed statistical data analyses on all compiled water quality data, and assessed Lake Buchanan water quality based on applicable Numeric Nutrient Criteria (NNC).
- Task 3, WSP and BFA Environmental Consultants (BFA) performed a field reconnaissance to identify and document the major drainage features of the Lake Buchanan watershed.
- Task 4, WSP and BFA used the information obtained from the field reconnaissance and OCEPD to delineate the sub-basins of the Lake Buchanan watershed
- Task 5, WSP and BFA conducted a bathymetric survey of Lake Buchanan with manual soundings of the soft sediment and hard bottom to create a bathymetric map and estimate soft sediment thickness and volume.
- Groundwater seepage, surface water quality, and stormwater quality sampling were conducted by WSP and BFA staff to characterize Lake Buchanan water quality for Task 6 and Task 7.
- Task 8 included estimates of annual runoff inputs to Lake Buchanan from the contributing sub-watershed areas using computer spreadsheet modeling techniques.
- Task 9 included sediment phosphorus fractionation and flux calculations. Intact sediment cores were collected to evaluate the internal sediment nutrient flux within the lake.
- Hydrologic and nutrient budgets were developed by WSP for the Lake Buchanan watershed and reviewed by HMI for Task 10 and Task 11.
- Task 12, WSP utilized BMPTrains to estimate nutrient load reductions and set up a simple BATHTUB water quality model, using inputs developed from previous tasks, to evaluate its potential use to evaluate water quality impacts from proposed nutrient reduction projects. WSP met with OCEPD to present the results of the water quality and hydrologic analyses for Task 13.
- Task 14, various in-lake solutions, and watershed BMPs were identified, evaluated, and ranked based on overall efficacy to reduce nutrients and feasibility of implementation. Conceptual designs, including estimated costs and cost efficiencies, were developed for three structural alternatives.
- Task 15 and Task 16 included preparation of a draft and final report summarizing the work and results of all tasks described in the scope of work.

- All field work performed by WSP conforms to the FDEP's Standard Operating Procedures for Field Activities, DEP-SOP-001/01, dated January 2017, effective April 16, 2018. All laboratory analyses were conducted based on requirements described in Chapter 62-160, FAC.

1.2 BASIN DESCRIPTION AND WATER QUALITY STATUS

Lake Buchanan (WBID 3169A3), located within the Shingle Creek Watershed south of downtown Orlando, is a 47.3-acre lake with a contributing basin of approximately 144.7 acres (**Figure 1-1**). The Lake Buchanan contributing basin is discontiguous because West Holden Avenue directs surface drainage from the road east and west outside of the basin. A single culvert crossing provides the only hydrologic connection from the southern portion of the basin under West Holden Avenue.

The Shingle Creek Watershed is one of the northernmost watersheds of the Kissimmee Basin draining to Lake Okeechobee (**Figure 1-2**). The Lake Buchanan basin is located in a heavily urbanized portion of unincorporated Orange County adjacent to the City of Orlando (**Figure 1-3**). Water elevation within Lake Buchanan is controlled both by a structure on the southwest corner of the lake discharging to a large wetland on the southwest side of the lake and a drainage well located on the north side of the lake. Lake Catherine is located to the northwest of Lake Buchanan and Lake Tyler is located to the southeast. Neither of these lakes has any hydrologic connection to Lake Buchanan. Lake Buchanan has no apparent inflows from other surface waterbodies suggesting that runoff, direct rainfall, and seepage are the primary hydrologic inputs.

Section 303(d) of the Clean Water Act requires the State of Florida to submit lists of surface waterbodies that do not meet applicable water quality standards. These waterbodies are defined as "impaired waters", and Total Maximum Daily Loads (TMDLs) may be established by the Florida Department of Environmental Protection (FDEP) for these waters on a prioritized schedule. Lake Buchanan is located within the Florida Department of Environmental Protection's (FDEP) Kissimmee River Planning Unit and is currently on the FDEP Impaired Waters verified lists for biology, nutrients, and chlorophyll-*a* (Chl-*a*), based on impairment standard exceedances through 2022. In 2011, FDEP adopted new Numeric Nutrient Criteria (NNC) impairment standards, and the new NNC were approved by the United States Environmental Protection Agency in 2012. The applicable NNC standards for Lake Buchanan are listed in **Table 1-1**. A summary of TMDL exceedances indicated by the FDEP's Impaired Waters Run (IWR) 64 data is provided in **Table 1-2**. These data are discussed in more detail in **Section 2.4**.

2.0 PHYSICAL AND CHEMICAL CHARACTERISTICS OF LAKE BUCHANAN

2.1 PHYSICAL DESCRIPTION

The Lake Buchanan basin is located within a highly urbanized portion of Orange County south of downtown Orlando. The basin is dominated by high and medium density residential land uses, as well as a few commercial areas. Few natural land uses are present in the basin, aside from a small area of upland forest south of the lake along Holden Avenue. Historic aerial photography indicates that by 1954, citrus production was present on the east and southeast sides of the lake, but the majority of the basin land use was pasture/ open land with some wetland areas (**Figure 2-1**). By 1969, the construction of residential developments had begun on the south and west sides of the lake and by 1980 additional residential developments had been built east and north of the lake.

The Lake Buchanan basin is relatively flat with most of the southern and northwest portions of the basin with elevations between 95-100 ft North American Vertical Datum of 1988 (NAVD88) as shown in **Figure 2-2**. The northeastern portion of the Lake Buchanan basin increases in elevation up to approximately 105 ft NAVD88.

2.2 BATHYMETRY AND SEDIMENT THICKNESS

Barnes, Ferland & Associates, (BFA) performed a bathymetric and sediment thickness survey of Lake Buchanan on September 8, 2021, and September 18, 2021. BFA performed 100 soundings evenly distributed across the lake (**Appendix A: Topographic Survey**). Average water elevation in the lake was 90.44 ft NAVD 88 between these two dates. Each point was first located using GPS then the depth to the top of the soft sediment layer was measured by recording the depth of a Secchi disk dropped to the bottom. The depth to refusal at each location was measured by pushing a survey rod to refusal. Water depth (to the top of the muck layer) averaged 13.6 feet and had a maximum of 34.6 feet (**Figure 2-3**). Bathymetric contours are shown in **Figure 2-4**. Sediment thickness was determined as the difference between these two measurements. Approximate volume of water within the lake at the time of the survey was 643 ac-ft. The values for soft bottom and hard bottom depths, sediment thickness, and the GPS coordinates for each survey point are shown in **Appendix A**.

Sediment muck thickness averaged 6.0 ft and ranged between 0 and 19.7 feet as shown in **Figure 2-5**. The thickest muck layers were in the deepest area of the lake. Total muck volume in Lake Buchanan is approximately 13.5 million ft^3 (502,207 yd^3).

2.3 SEDIMENT ASSESSMENT

2.3.1 PHYSICAL CHARACTERISTICS AND PHOSPHORUS FRACTIONATION

An important component of a lake management plan is understanding internal sediment conditions because sediments can be a significant source of internal pollutant loading even after external loading sources are addressed. WSP first evaluated the physical and chemical properties by collecting samples at three different locations in the lake (**Figure 2-6**). Sediment sampling locations were selected based on lake bathymetry and WSP's soft sediment thickness survey, so they were representative of the lake bottom conditions. The potential for sediment phosphorus release was estimated by performing a sequential fractionation procedure.

Sediments were sampled on November 18, 2021, using a piston tube sampler to collect the top 10 cm of the sediments at each location. Sediment samples were immediately extruded into sealed plastic bags and shipped to DB Environmental for physical and chemical analyses including:

- Bulk density
- Moisture content
- Pore water analyses for phosphorus and ammonia
- Total organic carbon
- Phosphorus fractionation

Phosphorus fractionation is a sequential extraction procedure that provides a quantitative estimate of the amount of phosphorus in the sediments, ranging from the most (labile) to the least bioavailable fractions. Different drivers of P release to the water column can be found in **Table 2-1**. Bioavailable phosphorus (BAP) is defined as the sum of labile P [NH_4Cl total soluble phosphorus (TSP)], reductant-soluble P ($NaHCO_3$/$Na_2S_2O_4$ TSP), organic P [NaOH TSP minus NaOH soluble reactive phosphorus (SRP)], and metal-oxide adsorbed P (NaOH SRP) (Meis et al., 2012). The sequential phosphorus extraction method is based on a procedure developed by Hupfer et al. (1995) and Psenner et al. (1998) and later modified by Meis et al. (2012). Sediment phosphorus bioavailability is operationally defined by the extraction sequence, from most to least bio-available:

1. Labile P: Extraction with 1M NH_4Cl to determine loosely adsorbed and porewater P
2. Reductant-soluble P: Extraction with 0.11 M $NaHCO_3$/0.11 M $Na_2S_2O_4$ to determine P mainly bound to Fe-hydroxides or Mn

3. Metal-oxide adsorbed P: Extraction in 1 M NaOH to mobilize P, which is mainly exchangeable against hydroxide ions determined as SRP
4. 4. Organic-P: Organic bound P in the same fraction quantified by subtraction NaOH-SRP from NaOH TSP

Laboratory analytical reports for sediment phosphorus fractionation and additional parameters are provided in Appendix B.

2.3.2 PHYSICAL CHARACTERISTICS AND PHOSPHORUS FRACTIONATION RESULTS

The results for sediment physical and chemical analyses are shown in Tables 2-2A, 2-2B, 2-3 and Figure 2-7. All sediment concentrations are in terms of dry weight (dw). Sediment bulk density was highest at the north side of the lake (Core1) and lowest in the center of the lake (Core2) (Figure 2-7). Similarly, sediment moisture was lowest on the north side of the lake and the highest moisture content was at the center of the lake (Figure 2-7). The various nutrient analytes tested were consistently highest at the center of the lake (Core 2), followed by the southwest side of the lake (Core3) (Figure 2-7).

Approximately 67% of the total phosphorus in these sediments is anticipated to be bioavailable (Table 2-2B). The majority (average: 82%, range: 65% to 95%) of bioavailable phosphorus was in the metal-oxide adsorbed fraction, meaning that phosphorus in this fraction is relatively recalcitrant, and has a medium to high likelihood of release under elevated pH conditions (e.g., reduced carbon dioxide concentration during photosynthetic activity) (Meis et al., 2012). A summary of the sediment fractionation and bulk density results are available in Table 2-3.

2.3.3 SEDIMENT FLUX METHODS AND LOADING CALCULATION

Six intact sediment cores (two cores from each station) approximately 25 cm in length were collected for flux analyses on January 10, 2022, in clear polycarbonate cylinders (7.3 cm diameter, 76 cm long) from the same locations used for the phosphorus speciation analyses (Figure 2-8). Core sample collection depths were 7.6 m for LB-1, 6.3 m for LB-2, and 3.7 m for LB-3. Sampling locations were chosen by examining the sediment characterization and P fractionation data and were intended to be representative of areas of low, medium, and high sediment phosphorus concentrations within the lake. Core photographs are provided in Appendix C-3. At the time of sampling, in-situ physicochemical data were recorded using a YSI ProDSS multimeter along a vertical depth profile at the top, middle, and bottom of the water column. Parameters included water temperature, dissolved oxygen (DO), pH, specific conductivity, and turbidity. Near-bottom ambient lake water was also collected and filtered for use during sediment nutrient flux incubations.

Sediment flux analyses were performed in the WSP Flux Laboratory in accordance with Standard Operating Procedure (SOP) WSP-SFLUX-002 Rev. 9 (Appendix C-1). Sediment cores were prepared and incubated in three sets of two cores, representing aerobic and anoxic conditions. To minimize photosynthetic activity, cores were kept in the dark, and temperatures were controlled in the range of 23 to 27 °C. Water column samples for each core were collected at 0, 24, 48, 96, 168, and 216 hours and analyzed for TP and ammonia in a NELAC certified analytical laboratory (laboratory reports provided in Appendix C-2). Turbidity values were monitored throughout incubation to examine the timing of sediment core equilibrium before conducting flux measurements. DO and pH were also monitored during the study to confirm that appropriate redox conditions were being met throughout the incubation period.

Sediment nutrient flux rates were estimated using the nutrient release rate (NRR) equation and the slopes calculated from the concentration vs. time curve as described in the flux SOP (Appendix C-1). Annual internal nutrient loads were estimated at each station and as spatial averages following the methods described by Ogdahl et al. (2014). Weighted average loads were calculated from average flux rates for all stations based on

the proportion of time the lake bottom was anoxic (between March and October, or approximately 67%) or aerobic (between November and February, or approximately 33%) (see Section 2.5).

2.3.4 SEDIMENT FLUX RESULTS

Sediment cores collected at locations LB-1 and LB-2 appeared to be composed primarily of flocculant dark brown organic sediments, while cores collected at location LB-3 contained a mixture of tan sand and brown organic sediments. Detailed descriptions and photographs of the sediment cores used during flux analyses can be found in Appendix C-3. Table 2-4 provides the range of in-situ water quality data measured across the vertical profiles during the time of sediment core collection. In-situ water quality data measurements were taken at depths ranging from 0.5 to 7.6 m, representing the top, middle, and bottom of the water column (Table 2-4). Overall, water temperatures ranged from 19.6 to 21.1 °C, and the observed pH values ranged from 6.4 to 8.1. Dissolved oxygen values suggested an aerobic environment in the top and middle portions of the water column. The lowest DO values were observed at the bottom portion of the water column at site LB-2. Turbidity measurements collected at the time of sampling ranged from 3.1 to 4.7 NTU and were observed at a water depth of 0.5 meters. Field data from the core sampling event can be found in Appendix C-4.

Figures 2-9 through 2-12 display non-linear TP and ammonia concentration flux curves representing anoxic and aerobic sediment core conditions. As shown in Figures 2-9 and 2-10, sediment cores LB-1 and LB-3, analyzed under both anoxic and aerobic conditions generally had lower TP concentrations throughout most of the incubation period, Sediment core LB-2 displayed an initial peak in TP concentration for both anoxic and aerobic conditions at the 24-hour mark before gradually decreasing to the end of the incubation period. Total phosphorus concentrations gradually increased under aerobic conditions until the 168-hour mark and then declined. Under anoxic conditions, TP increased from 0-24 hours and slowly decreased until the 168-hour mark at which point it began to increase again.

Ammonia flux from the lake sediments represents the dissolved species of nitrogen that is mineralized from organic nitrogen and then released from the sediment into the water column by diffusion through the sediment-water interface. Ammonia is used as a proxy for total nitrogen since it approximates TN flux. As shown in Figure 2-11, ammonia concentrations in sediment cores incubated under anoxic conditions all exhibited initial peaks at the 24-hour mark followed by secondary peaks at the 168-hour mark before decreasing below the detection limit by the end of the 216-hour incubation period. Figure 2-12 indicates sediment cores analyzed under aerobic conditions also exhibited initial ammonia peaks at the 24-hour mark, followed by a gradual decline until it became undetectable at the 168-hour mark. However, unlike the anoxic condition, all aerobic cores exhibited a marked increase in ammonia concentrations between the 168-hour and 216-hour mark for all three cores.

Tables 2-5 provides a summary of anoxic and aerobic gross nutrient flux rates and internal loads for sediment core locations within Lake Buchanan using the NRR method. Sediment cores incubated under aerobic conditions displayed higher overall averages for both TP and ammonia concentrations than sediment cores incubated under anoxic conditions. The flux rates estimated for sediment cores incubated under anoxic conditions for TP ranged from 1.35 to 1.82 mg/m2/d and was 0.00 mg/m2/d for ammonia. Sediment cores incubated under aerobic conditions displayed flux rates for TP that ranged from 6.95 to 10.29 mg/m2/d and from 17.42 to 82.75 mg/m2/d for ammonia.

Spatially averaged flux rates (average of the three cores) were calculated for the aerobic and anoxic rates and the values were applied to the entire surface area of Lake Buchanan (47.3 acres) to estimate representative values for internal loading rates. The average loading rates for sediment cores incubated under anoxic and aerobic conditions for TP were estimated to be 247 and 1,291 lb/yr, respectively. The average loading rates for cores incubated under aerobic and anoxic conditions for ammonia were estimated to be 7,152 and 0 lb/yr, respectively. The annual flux loading to Lake Buchanan was estimated for each method using representative oxygen conditions of 67% anoxic and 33% aerobic as measured in the field and discussed in Section 2.5. The overall weighted average from all sites for TP loading was 592 lb/yr. The overall weighed average from all sites for ammonia loading was 2,360 lb/yr.

2.3.5 SEDIMENT ANALYSIS SUMMARY

Sediment samples collected from locations Core2/LB-2 and Core3/LB-3 had similar TP concentrations (4,370 mg/kg vs. 4,360 mg/kg) and were more than an order of magnitude higher in TP than the core sample collected from Core1/LB-1 (364 mg/kg). The sample collected from Core2/LB-2 contained the greatest amount of organic material and the lowest bulk density and dry weight. Sediments from all three cores had similar anoxic TP flux rates ranging from 1.35 to 1.82 mg/m^2/d, with Core2/LB-2 having the highest flux rate of 1.82 mg/m^2/d. Core1/LB-1 had the second highest TP flux rate of 1.65 mg/m^2/d followed by Core3/LB-3 at 1.35 mg/m^2/d. Interestingly, Core1/LB-1 had the highest aerobic TP flux rate of 10.29 mg/m^2/d followed by Core 2LB-2 at 7.95 mg/m^2/d and Core 3/LB-3 at 6.95 mg/m^2/d. This is primarily because the sample Core3/LB-3 core sample had the highest TP concentration at the end of the core incubation period.

Under anoxic conditions, all cores exhibited a complete transformation of ammonia by the end of the incubation period, presumably to N_2 gas, suggesting denitrification processes were occurring. The aerobic ammonia (interpreted as TN) flux rate was the highest in the Core2/LB-2 sample (82.75 mg/m^2/d) and was more than twice the ammonia (interpreted as TN) flux rate of Core3/LB-3 (39.42 mg/m^2/d). The Core1/LB-1 sample had the lowest ammonia (interpreted as TN) flux rate of 17.42 mg/m^2/d.

2.4 SURFACE WATER QUALITY

2.4.1 LONG-TERM WATER QUALITY EVALUATION METHODOLOGY

WSP obtained water quality data from the Orange County Water Atlas (http://www.orange.wateratlas.usf.edu/), as well as from FDEP's Impaired Waters Rule (IWR) Run 64 database (https://publicfiles.dep.state.fl.us/DEAR/IWR/iwr2021_run61_2021-05-27.zip) and WatershedInformation Network (WIN)(https://prodenv.dep.state.fl.us/DearWin/public/welcomeGeneralPublic?calledBy=GENERALPUBLIC). Because the Orange County Water Atlas data did not include minimum detection limits (MDL) and no FDEP data were included, WSP elected to use the IWR 64 and WIN data to ensure all eligible data were utilized for the analysis. Data collected by both Orange County and the FDEP were used for the analysis. Data were checked for duplicate values and outliers. When samples were at or below the detection limit (e.g., qualified with a "U", meaning the specified component was not detected), ½ the detection limit was used as a reported value. Data with "I" qualifiers were assigned a value equal to the MDL.

The period of record used for determination of long-term geometric means for color and alkalinity included data from January 1998 through January 2022. To evaluate NNC exceedances, annual geometric means (AGM) were calculated for TP, TN, and Chl-*a* data between July 2015 and January 2022. To determine an annual NNC exceedance, the FDEP requires that at least four samples are available and distributed quarterly throughout the year. Insufficient data was available to determine NNC exceedance during 2015, 2021 and 2022. **Table 1-2** provides the annual NNC exceedances for Lake Buchanan between 2015 and 2022. Summary statistics for 2015 – 2022 (or 1999 – 2022 for color and alkalinity) water quality data are provided in **Table 2-6**.

The non-parametric Mann-Kendall test was used to evaluate trends in water quality. This test is widely used to evaluate monotonic trends of environmental data (Helsel, et al., 2006a). The rkt package(https://CRAN.R-project.org/package=rkt) in R (R Core Team, 2018) was used. The R code is derived from the USGS Fortran Code (Helsel et al 2006). Before trend tests were conducted, the data were assessed for serial correlation using the "acf" function in the "stats" package in R (https://stat.ethz.ch/R-manual/R-devel/library/stats/html/00Index.html). The acf function produces a correlogram that indicates if the data are serially correlated. If the data were serially correlated, the "bcpw" function in the "modifiedmk" package (https://www.rdocumentation.org /packages/modifiedmk/versions/1.5.00) was run which provides an adjusted slope (pre-whitened Sen's slope). If data were not serially correlated, the rkt package trend test generates a

test statistic (Tau), a slope, and statistical significance. Statistical significance was declared at the α = 0.05 level. The Seasonal Mann-Kendall Test was used since the Lake Buchanan long-term data set has consistent quarterly data since 2015. Mann-Kendall test results can be found in **Appendix D**.

Trend analyses were completed for color, alkalinity, Chl-*a* (corrected), total phosphorus (TP), orthophosphate (OP), total nitrogen (TN), total Kjeldahl nitrogen (TKN), nitrate+nitrite (NO_x), ammonia (NH_4), Secchi disk depth (SD), and Trophic State Index (TSI). Long term or annual geometric means were calculated to compare to NNC values. Annual TSI were obtained from the FDEP IWR data and evaluated for historical trends. Additionally, TN:TP ratios were evaluated to assess the nutrient most likely to be limiting algal growth in Lake Buchanan.

2.4.2 SAMPLING CONDUCTED BY WSP

WSP collected surface water quality samples from Lake Buchanan beginning March 24, 2021, through February 1, 2022, in the center of the lake (OCEPD's SC3 station) as shown in **Figure 2-13**. Surface water samples were collected at 0.5 m, and analyzed for total Kjeldahl nitrogen (TKN), ammonia (NH_4), TN, TP, OP, Chl-*a*, NO_x, alkalinity, total suspended solids (TSS), turbidity, and color. Field parameters including specific conductance, pH, DO (%), DO (mg/L), and temperature (°C) were measured using a YSI ProDSS multimeter at the time of collection. Summary statistics for laboratory and field parameters during WSP's 2021-2022 monitoring period are provided in **Tables 2-7** and **2-8**. During each sample event, water depth profiles for dissolved oxygen, pH, and temperature were measured every 0.5 m at the SC3 location. Secchi depth measurements were also collected at the same time as sampling. Laboratory reports for analytical data are provided in **Appendix E**.

2.4.3 RESULTS

2.4.3.1 Color

Between 1999 and 2022, color in Lake Buchanan ranged between 5 and 50 with a long-term geometric mean of 24.7 platinum cobalt units (PCU) (**Figure 2-14** and **Table 2-6**) which suggests that Lake Buchanan can be classified as a lake with color less than 40 PCU. Lakes with lower color levels are often more productive and have higher levels of algae and submerged aquatic plants. The Mann-Kendall test indicated no significant trend in color over the 1999 through 2022 period of record (Tau = -0.13, p= 0.4; the data were autocorrelated and pre-whitened for analysis).

During WSP's sampling period, geometric mean color at the Lake Buchanan SC3 station was 27.39 PCU and ranged from 20 to 45 PCU (**Figure 2-15** and **Table 2-7**). Both the period of record geometric mean and WSP sampling period geometric mean are less than 40 PCU.

2.4.3.2 Alkalinity

Alkalinity is a measure of the buffering capacity of the water. Long-term geometric mean alkalinity for Lake Buchanan between 1999 and 2022was 46 mg/L (as $CaCO_3$) and ranged from 27 to 66 mg/L (**Figure 2-16** and **Table 2-6**). The Mann-Kendall Trend Test for values between 2015 and 2021 was not significant (Tau = -0.07, p= 0.78; these data were not autocorrelated).

During the 2021-2022 WSP sampling period, annual geometric mean alkalinity at the Lake Buchanan SC3 station was 33.16 mg/L and ranged between 26 and 49.8 mg/L, which is lower than during the 2015-2021 period (**Figure 2-17** and **Table 2-7**).

2.4.3.3 Chlorophyll-a

Chlorophyll-*a* is the measure of the mass of suspended algae in the water column. From 2015 through 2022, Chl-*a* concentrations ranged from 0.6 to 87.9 µg/L (**Table 2-6**). During the NNC verification period between 2015 and 2022, the annual geometric means exceeded the NNC impairment threshold of 20 µg/L every year except 2018 and when sufficient data were not available in 2015, 2021, and 2022 (**Figure 2-18**). For years 2016,

2017, 2019 and 2020, the minimum numeric values of 0.03 mg/L TP and 1.05 mg/L TN were used as the impairment threshold (**Table 1-1**) because the annual geometric mean Chl-*a* concentration. During 2018 the annual geometric mean Chl-*a* concentration was less than 20 µg/L, so the maximum impairment thresholds of 0.09 mg/L TP and 1.91 mg/L TN were used. There was no evidence of a trend in Chl-*a* concentrations over the 2015 through 2022 evaluation period (Mann-Kendall Tau = 0.02, p= 0.92; the data were autocorrelated and pre-whitened for analysis).

Chlorophyll-*a* data collected by WSP from March 2021 through February 2022 are shown in **Figure 2-19**. The annual geometric mean Chl-*a* concentration at the Lake Buchanan SC3 station during this period was 24.6 µg/L and concentrations ranged from 14 to 74 µg/L **(Table 2-7)**. Two of six samples collected by WSP exceeded the NNC of 20 µg/L, and three samples were at the NNC threshold.

2.4.3.4 Total Phosphorus and Orthophosphate

From 2015 through 2022, TP concentrations in water collected from Lake Buchanan ranged from 0.006 to 0.359 mg/L. (**Figure 2-20** and **Table 2-6**). Annual geometric mean TP concentrations exceeded the NNC limits four of the five years with sufficient data (**Figure 2-20**). Insufficient data were available in 2015, 2021, and 2022 to determine whether the NNC condition was exceeded for TP. The Mann-Kendall Test indicated no significant trends in annual mean TP concentrations during the 2015 through 2021 period of record (Tau = 0.13, p= 0.55; these data were not autocorrelated).

Orthophosphate is defined as the dissolved fraction of phosphorus that is available to algae and plants. Orthophosphate values for Lake Buchanan from 2015 through 2021 were generally below 0.03 mg/L, except for higher concentrations in 2018 and 2020 (**Figure 2-20**). Low OP concentrations suggest that phosphorus in Lake Buchanan is generally rapidly assimilated by suspended algae, and most of the phosphorus is in the particulate form.

Geometric mean TP and OP concentrations during the 2021-2022 sampling performed by WSP were similar to those from the NNC verification period from 2015 through 2022 (**Figure 2-21**). The annual geometric mean TP concentration (0.09 mg/L) at the Lake Buchanan SC3 station exceeded the NNC (0.03 mg/L), and values ranged between 0.04 and 0.20 mg/L.

WSP's 2021-2022 sampling indicated the annual geometric mean OP concentration was 0.01 mg/L at the Lake Buchanan SC3 site, ranging between 0.002 and 0.086 mg/L (**Table 2-7**).

2.4.3.5 *Total Nitrogen, Nitrate-Nitrite, and Total Kjeldahl Nitrogen*

From 2015 through 2022, TN concentrations in Lake Buchanan ranged from 0.58 to 3.29 mg/L with annual geometric means ranging from of 0.87 mg/L to 1.66 mg/L (**Figure 2-22** and **Table 2-6**). Annual geometric mean TN concentrations in the lake exceeded the NNC limits four of the five years with sufficient data. Insufficient data were available in 2015, 2021, and 2022 to determine whether the NNC condition was exceeded for TN. No significant trend in TN concentrations from 2015 through 2021 was evident (Mann-Kendall Test: Tau = 0.02, *p*= 1; the data were not autocorrelated).

NO_x is a combination of all the intermediate forms of nitrogen in the oxidation process and is highly water soluble and easily used by algae. NO_X concentrations were low (below the minimum detection limit) in Lake Buchanan throughout the 2015 to 2021 period of record (**Figure 2-22**).

Total Kjeldahl nitrogen is the combination of ammonia and organic nitrogen and is used as a measure of the organic nitrogen typically from plant and animal matter. Between 2015 and 2021, TKN in Lake Buchanan ranged from 0.57 to 3.23 mg/L (**Table 2-6**). The similarity of TKN and TN concentrations indicates that TN concentrations in Lake Buchanan are primarily driven by TKN. No significant trend in TKN concentrations from 2015 through 2021 was evident (Mann-Kendall Test: Tau = 0.02, *p*= 1; the data were not autocorrelated).

Total nitrogen is calculated as the sum of TKN and NO_x. TN concentrations observed at the Lake Buchanan SC3 station during WSP's 2021-2022 sampling period were similar to the 2015-2021 monitoring period with a geometric mean of 1.39 mg/L and a range from 0.96 to 1.90 mg/L (**Table 2-7** and **Figure 2-23**). The geometric

mean TN concentration of 1.39 mg/L exceeds the NNC threshold of 1.05 mg/L. Nitrate+nitrite concentrations were at or below the detection limit at the Lake Buchanan SC3 station, with the exception of the November 2021 sample (0.11 mg/L) and February 2022 sample (0.31 mg/L).

2.4.3.6 *TN:TP Ratio*

Phosphorus is the macro-nutrient that generally limits primary production in most Florida lakes. Lakes in Florida are classified based on the following ratios:

- TP-limited: TN/TP > 30
- TN and TP co-limited: TN/TP 10 to 30
- TN-limited: TN/TP < 10

The annual geometric mean TN:TP ratio (by mass) for Lake Buchanan during the 2015-2022 period of record averaged 17.6 and ranged between 8.8 and 24.2 (**Figure 2-24**). This suggests that the lake is co-limited by both nitrogen and phosphorus and may occasionally shift to being nitrogen limited. The TN:TP ratio during WSP's 2021 – 2022 sampling period was highly variable ranging from 8.5 to 33.3 (**Figure 2-25**). This indicates that Lake Buchanan is typically TN and TP co-limited but may occasionally shift towards being TN or TP limited depending on hydrologic or other conditions.

2.4.3.7 *Secchi Disk Depth*

Secchi disk depth (SD) is a measure of water clarity. The geometric mean SD for 2015 through 2022 was 1.1 m and ranged from 0.3 to 2.7 m (**Figure 2-26** and **Table 2-6**). This suggests that the lake experiences variable conditions ranging from periodic algal blooms to periods of relatively high clarity. There was no significant trend in SD data (Tau = 0.1, p =0.64). These data were autocorrelated, thus a pre-whitening procedure was employed using the modifiedmk package. The results were similar between the rkt test and the modifiedmk package.

Secchi disk depths at the Buchanan SC3 location during the 2021-2022 study period were similar to the long-term data, with a geometric mean of 0.9 m and a range from 0.5 to 1.3 m (**Figure 2-27** and **Table 2-8**).

2.4.3.8 *Trophic State Index*

The Trophic State Index (TSI) is a lake water quality metric used to classify lake health. The TSI, was developed by the FDEP for Florida lakes, and uses Chl-*a*, TN and TP values to calculate a single numeric metric. It was once used as a metric to determine water quality impairments. The methodology for calculating TSI and impairment assessments prior to 2013 can be found at: http://www.orange.wateratlas.usf.edu/shared/learnmore.asp?toolsection=lm_tsi. Although the TSI is no longer used for impairment determination, it is still a useful metric to describe the general condition of Florida lakes.

Lake Buchanan TSI showed slight variation between 2015 and 2021 with an overall geometric mean of 60.3 and a range between 36 and 79 (**Figure 2-28** and **Table 2-6**). These values suggest that the lake is in the eutrophic classification, and water quality is generally "poor". TSI values greater than 70 generally indicate that the lake is hypereutrophic and is of the poorest water quality.

2.5 DEPTH PROFILES

Lake depth profile data were collected at the SC3 location (Lat 28.496111, Long -81.405833) during the 2021 – 2022 monitoring period by measuring temperature, specific conductance, pH, and dissolved oxygen from the surface to the bottom of the lake. Depth profiles provide information about the degree of stratification in a lake. Thermal stratification can result in warmer, less dense water above a deep stagnant layer of colder water with comparatively low dissolved oxygen. Anoxic (low oxygen) conditions can accelerate internal release of sediment nutrients and reduce available habitat for aquatic organisms. Knowledge of the temporal and spatial extent of stratification can provide valuable information to OCEPD with respect to future management efforts.

WSP recorded six temperature and dissolved oxygen depth profiles concurrently with water quality sampling efforts at SC3. Temperature and dissolved oxygen were recorded every 0.5 m, starting at 0.5 m in depth and continuing to about 0.5 m off the bottom.

Temperature and dissolved oxygen depth profile results for Lake Buchanan are shown in Figures 2-29 and 2-30. These profiles indicate that the lake was not thermally stratified but exhibited a rapid decrease in DO with depth during four of the six sampling events between March 2021 and February 2022. Anoxic conditions (<2.0 mg/L) typically occurred at 4.5-5.0 m in depth between March and October although anoxic conditions occurred at 3.5 m during the June sampling event. This suggests sediments within the lake experience approximately eight months of anoxic conditions and four months of aerobic conditions through the year. Depth profile data for each sampling event are provided in Appendix F.

2.6 WATER QUALITY SUMMARY

Lake Buchanan water quality is currently on the FDEP Impaired Waters verified lists for biology, TN, TP, and Chl-*a*, and WSP's review of the water quality data from 2015 through 2021 support the impairment listing. Water quality conditions did not appear to change monotonically, and Mann-Kendall trend tests were not significant suggesting that there has been no degradation or improvement in water quality conditions over this time period. Chl-*a* and SD data vary widely suggesting that suspended algae is normally present and supported by anecdotal observations, but bloom conditions vary in intensity and duration. Table 1-2 summarizes the NNC exceedances during the 2015-2022 period for Chl-*a*, TN, and TP.

WSP's Chl-*a* data from March 2021 through February 2022 indicate higher concentrations than data from the 2015-2022 period with an annual geometric mean of 24.62 µg/L. Chl-*a* concentrations between 2015 and 2022 were consistently above the NNC threshold, except for 2018 when the annual geometric mean was 9.4 µg/L (Figure 2-18). WSP's TN and TP data from March 2021 through February 2022 also indicate higher concentrations than data from the 2015-2022 period with annual geometric means of 1.39 mg/L and 0.09 mg/L, respectively. Both TN and TP exceeded the NNC thresholds in four out of five years with sufficient data during the 2015-2022 evaluation period. WSP data suggest the TN and TP NNC thresholds were both exceeded during the March 2021 through February 2022 monitoring period.

WSP's dissolved oxygen depth profiles suggest that deeper portions of Lake Buchanan exhibit anoxic conditions from spring through fall (Figure 2-30). It is unclear whether this is a natural condition, but nutrient inputs to the lake, aquatic herbicide treatments, and persistent algal blooms likely play a role in reducing the oxygen concentration near the bottom of the lake.

3.0 DRAINAGE BASIN CHARACTERISTICS

3.1 BASIN DELINEATIONS

WSP delineated the Lake Buchanan basin and sub-basins using land elevation contours, existing storm water drainage conveyance systems, permitting records, and field observations. ESRI ArcView was used to generate contour maps displaying elevation changes with color gradients. Contour maps and aerial photographs were used to determine maximum elevations and topographic physical features (e.g., roadways, railways, etc.). These were then used to delineate the watershed boundaries.

The Lake Buchanan basin covers 144.7 acres, exclusive of Lake Buchanan (Figure 1-3). Using the methodology above, WSP delineated 22 sub-basins ranging from 0.95 to 15.0 acres in size (Figure 3-1, Table 3-1).

Sub-basin delineations, stormwater conveyances and stormwater outfall locations for the Lake Buchanan basin were field verified by Barnes, Ferland and Associates, Inc. (BFA) personnel. Major stormwater outfall locations

and drainage systems were identified by BFA within each sub-basin and are shown in **Figure 3-2**. Copies of the field notes, pictures, and field waypoint locations are provided in **Appendix G**.

3.2 LAND USE

Land use information for the Lake Buchanan sub-basins was obtained from the SFWMD 2017-2019 Land Use Cover Characteristics. Sub-basin land use cover was compiled in a Geographic Information System (GIS) for further analysis. A total of seven land use categories were identified within the basin (**Table 3-2**). The dominant land use in the Lake Buchanan sub-basins is high density residential, covering 89.9% of the basin (**Figure 3-3, Table 3-2**). Other notable land use categories include upland mixed forests (3.7%) and lakes and reservoirs (4.8%).

3.3 SOIL CHARACTERISTICS

Information on soil types within the Lake Buchanan watershed was obtained from the Natural Resources Conservation Service (NRCS) Soil Survey Geographic database for Orange County, Florida (2012). Soil information was extracted in the form of Hydrologic Soil Groups (HSG) which classify soil types with respect to runoff-producing characteristics. Using this system, soils are classified into five (5) groups for evaluation and modeling purposes. The chief consideration in each of the soil group types is inherent capacity of bare soil to permit infiltration. A summary of the characteristics of each hydrologic soil group is presented below.

Group A: Soils having low runoff potential and high infiltration rates even when thoroughly saturated. They consist primarily of deep, well to excessively drained sands or gravels and have a high rate of water transmission.

Group B: Soils having moderate infiltration rates when thoroughly saturated and consist primarily of moderately deep to deep, moderately well to well drained soils with moderately fine to moderately coarse textures. These soils have a moderate rate of water transmission.

Group C: Soils having low infiltration rates when thoroughly saturated and consist primarily of soils with a layer that impedes downward movement of water and soils with moderately fine to fine texture. These soils have a low rate of water transmission.

Group D: Soils having high runoff potential: These soils have low infiltration rates when thoroughly saturated and consist primarily of clay soils with high swelling potential, soils with a permanent high-water table, soils with a clay pan or clay layer at or near the surface and shallow soils over nearly impervious material. These soils have a very low rate of water transmission.

Dual Hydrologic Soil Groups (Group X/D): Soils located in areas where the water table is within 60 cm of the surface: In their saturated state, these soils still have a hydraulic conductivity that may be favorable for water transmission. If these soils can be adequately drained, they are assigned a dual hydrologic soil group (A/D, B/D, and C/D). The first letter applies to the drained condition and the second to the undrained condition.

Group W/U: Soils are categorized as wetland(hydric) or urban, in which case, 100% imperviousness is assumed.

A map of the HSGs within the Lake Buchanan watershed is provided in **Figure 3-4** and reported in **Table 3-3**. The majority (65.4%) of the basin is covered by soils in the A/D HSG.

The soil coverage within the basin is ranked from highest to lowest below:

- A/D (65.4%)
- A (15.3%)
- W/U (10.4%)
- B/D (8.9%)

4.0 HYDROLOGIC BUDGET

4.1 HYDROLOGIC CHARACTERISTICS

A hydrologic budget was developed for the Lake Buchanan watershed including inputs from direct precipitation, stormwater runoff, and groundwater seepage and hydrologic losses including evaporation, groundwater recharge, and surface outflows. The hydrologic budget is used as an input for development of a nutrient budget and water quality model as well as estimation of hydraulic residence time within the lake. A discussion of identified hydrologic inputs and losses for Lake Buchanan is provided in the following sections.

4.2 HYDROLOGIC INPUTS

4.2.1 PRECIPITATION

Annual rainfall for the Lake Buchanan watershed was estimated using SFWMD's Doppler-estimated NexRad Grid 10112707 to provide 15-minute rainfall data for the local area between 2002 and 2021. **Figure 4-1** depicts the average annual rainfall between 2002 and 2021. Annual rainfall data from this period are provided in **Table 4-1**. Average annual rainfall between 2002 and 2021 for the Lake Buchanan basin was estimated to be 51.04 inches.

Annual direct precipitation to Lake Buchanan was calculated by multiplying the average annual rainfall by the lake surface area of 47.3 acres. Direct precipitation is estimated to have contributed an average 201.2 ac-ft annually to Lake Buchanan. Lake Buchanan surface area is not included in the stormwater runoff model discussed below since runoff and pollutant loading from this portion of the basin are estimated directly.

4.2.2 STORMWATER RUNOFF

The area contributing stormwater runoff to Lake Buchanan is roughly three times the size of the lake but is highly urbanized suggesting that stormwater runoff may represent a moderate portion of the hydrologic budget. The annual runoff volume was estimated for each sub-basin within the contributing area using annual rainfall and local runoff characteristics. Local runoff characteristics include annual rainfall depth, sub-basin area, non-Directly Connected Impervious Area Curve Number (NDCIA CN), which is a function of land use and HSG, percent Directly Connected Impervious Area (DCIA), and runoff coefficient.

4.2.2.1 Runoff Curve Number Calculation

Hydrologic characteristics of the drainage sub-basin areas were first developed for utilization in the stormwater runoff model. In order to estimate the runoff volume from each of the sub-basins, basin-specific hydrologic characteristics were estimated using land use and hydrologic soils data for the sub-basin watersheds. Land use information from 2017-2019 was provided by SFWMD (**Table 3-2** and **Figure 3-3**). Soils data from 2010 were obtained from the NRCS Soil Survey Geographic Database for Orange County, FL, 2010 (**Figure 3-4 and Table 3-3**). Land uses are assumed to have a specific range of DCIA ranging from 0 – 100% as shown in **Appendix H: Table 1-1**. Next, both land use classification and HSG soil data are used to determine the appropriate NDCIA CN as provided in **Appendix H: Table 1-1**. This table was adapted from the "Urban Hydrology for Small Watersheds-TR-55 document (USDA 1986).

4.2.2.2 Spreadsheet Runoff Model

The % DCIA and NDCIA CN identified above are used to determine a runoff coefficient 'c' for each combination of land use and HSG soil type (**Appendix H: Table 1-2**). The runoff coefficient assigned to each discrete area

within the basin is then used with an annual precipitation estimate to estimate the total runoff volume. Values in Appendix H: Table 1-2 were obtained from FDEP's Draft Stormwater Quality Applicant's Handbook, Design Requirements for Stormwater Treatment Systems in Florida (2010) using Orange County's designated meteorological Zone 2.

Stormwater runoff modeling was conducted to estimate the annual stormwater runoff associated with each drainage sub basin. Stormwater runoff modeling was accomplished using a Microsoft Excel spreadsheet named "Pollutant Loadings Assessment (PLA) Tool" developed in-house by WSP. It is based on design criteria that were developed by FDEP and the Water Management Districts during production of the draft guidance documents conceived during statewide stormwater regulation efforts. The model utilizes the modified U.S. Environmental Protection Agency's (EPA) Simple Method (Schueler, 1987).

For this investigation, the Simple Method calculation of runoff volume was modified in accordance with the methodology developed by FDEP and the Water Management Districts when Florida was considering a statewide stormwater rule for calculating annual runoff as follows:

$$Q = 0.083*c*i*A$$

Where:

Q = Runoff Volume (ac-ft/yr)
c = Runoff coefficient determined based on Florida Meteorological Zones as classified in the draft Stormwater Quality Applicant's Handbook, March 2010.
i = Annual rainfall depth (in)
0.083 = Conversion factor (inches to feet)
A = Area (ac)

Lake Buchanan and the associated stormwater treatment ponds are assumed to be at brim-full condition for modeling purposes and additional volume attenuation is not applied.

4.2.2.3 Lake Buchanan Runoff Characterization

Annual runoff calculations for the Lake Buchanan basin indicate stormwater runoff is the primary component of the hydrologic budget. This is consistent with the relatively small but highly developed contributing area. Annual stormwater runoff volume from Lake Buchanan basin is approximately 235.0 ac-ft/yr or 1.2 times the direct rainfall contribution to the lake. Table 4-2 summarizes the estimated stormwater runoff from each sub-basin. Thirteen of the twenty sub-basins contribute less than 5% of the total runoff contribution. Sub-Basins LB-130 and LB-110 have no on-site stormwater treatment and generate the largest amount of stormwater runoff at 11.3% and 10.8%, respectively.

4.2.3 GROUNDWATER SEEPAGE

Seepage meters provide a means of direct groundwater discharge measurement and sample collection for nutrient concentrations to calculate loading. The seepage meter consists of an open-bottom chamber driven into the lake bottom. A collection bag prefilled with a small amount of distilled water is attached to the top of the meter after the chamber has been installed. The amount of groundwater contribution (or loss) is determined by measuring the change in volume of water in the bag. This method has been successfully used for decades, having been first developed in 1944 (Israelson and Reeve, 1944). Improvements to this method were made by Lee (1977), and this method is still currently used in lake studies. A diagram of a typical seepage meter is presented in Figure 4-2.

4.2.3.1 Groundwater Seepage Collection Methods

Seepage meters were constructed using modified 55-gallon steel drums with a diameter of 23 inches. Each meter covered an area of 2.89 ft^2 (0.26 m^2). A 0.75-inch threaded elbow tubing connector was inserted into the top of the drum and sealed with Teflon tape to ensure that it was watertight. Commercial-grade non-kink hose with a 0.75-inch inner diameter was inserted onto the elbow using a hose clamp. The end of the hose was

connected to a PVC ball valve and a coupling with a compression fitting that was used to attach a 3mm thick 35 gallon (132 liters) heavy-duty polyethylene bag.

The volume of groundwater seepage entering Lake Buchanan was measured directly using three seepage meters. Seepage meters were placed at the northeast (LBSM1), west (LBSM2) and southeast (LBSM3) edges of the lake and installed in approximately four feet of water depth (**Figure 4-3**). Locations were selected to be approximately equidistant around the lake to provide a representative estimate of overall groundwater movement.

Meters were installed 8 to 10 inches into the sediment. This resulted in 4-5 inches of water between the sediments and the top of the meter. Meters were tilted slightly during installation so that the open end was partially elevated, allowing for the escape of any gasses collected in the container prior to sampling. The tubing attached to each meter was left open during installation to allow for equalization as the meter was pushed into the sediment. Prior to attaching the collection bag, seepage meters were kept open for one month for equilibration. After equilibration, 2 liters of distilled water were added to the bag, immediately prior to installation. Pre-filling each bag prior to installation allowed for the measurement of a potential negative movement of water out of the meter. Ionic diffusion from the sediment is assumed to compensate for any dilution that would occur by the initial introduction of this distilled water. Air within the collection bag was removed by partially submerging the bag with the ball valve above water. Once all the air was evacuated, the ball valve was closed and submerged for connection to the tubing/meter. Once this connection was made the ball valve was opened, allowing for water exchange between the meter and collection bag. A floating buoy was attached to each meter to mark its location.

At the time of collection, the PVC ball valve was closed. Once closed, the bag was detached, and the total water volume collected was measured using a bucket and/or a graduated cylinder. A total of 18 seepage samples (six events with three locations normally sampled for each event) were collected from Lake Buchanan every other month between June 2021 and March 2022. Samples from LBSM3 could not be recovered on 8/2/2021 because the collection bag was damaged, and samples from LBSM1 could not be recovered on 8/2/2021 due to water hyacinth overgrowth and were instead recovered on 8/26/21.

Seepage rates for individual meters were determined by dividing the net volume collected from each meter by the cross-sectional area of each meter.

4.2.3.2 Groundwater Seepage Volume Data

Summary data for each seepage meter are provided in **Tables 4-3** and **4-4**. Seepage rates averaged 620 mL/m^2-day and ranged from 33 to 2,972 mL/m^2-day. Seepage rates for Lake Buchanan are consistent with seepage rates for lakes with similar surrounding topographic conditions (n=111 measurements, average of 700 mL/m^2-day, range from -200 to 12,300 mL/m^2-day). The seepage area for Lake Buchanan was estimated to be 18.3 acres using the 10-ft depth contour. Using the average seepage rate of 620 mL/m^2-day over the 18.3-acre seepage face within the lake, the total annual seepage contribution to Lake Buchanan was estimated to be 13.8 ac-ft/yr. Portions of the lake deeper than 10 feet were assumed to have no seepage contribution.

4.3 HYDROLOGIC LOSSES

4.3.1 EVAPORATION

Evaporative loss was not directly measured in this study. WSP utilized an estimate of 47.33 in/year based on results from a pan evaporation study conducted on the Butler Chain of Lakes (ERD, 2007). The pan evaporation station in the study was located about eight miles from Lake Buchanan. This evaporation rate is similar to long-term evaporation rates previously measured in Central Florida (i.e., Lichtler *et al,* 1976). Using the estimate of 47.33 in/yr, and a lake area of 47.3 acres, the total evaporative loss from Lake Buchanan is estimated to be 186.6 ac-ft/yr.

4.3.2 GROUNDWATER RECHARGE

Groundwater recharge through seepage within the Lake Buchanan basin is expected to be between 4 to 8 in/yr as shown in Figure 4-4. The maximum hydrologic loss of 8 inches per year attributed to recharge from the 47.3-acre lake bottom is anticipated to be 31.5 ac-ft/yr.

4.3.3 SURFACE OUTFLOW

Surface outflow, or discharge, is assumed to be the difference between total hydrologic inputs and outputs (evaporation and groundwater recharge) and includes both surface discharges to the southwest and discharges to the drain well on the north side of the lake. Based on the hydrologic model, net surface outflow from Lake Buchanan is approximately 231.7 ac-ft/yr.

4.4 HYDROLOGIC BUDGET SUMMARY

Annual hydrologic inputs to Lake Buchanan total 449.8 ac-ft and include direct precipitation, stormwater runoff, and groundwater seepage (Table 4-5A). Stormwater runoff contributes approximately 52% of the hydrologic inputs. Direct precipitation contributes about 45%. Estimated contribution from groundwater seepage is 3% which is consistent with the relatively flat topography and lack of stormwater treatment within the watershed.

Discharge represents approximately 52% of the hydrologic outputs from Lake Buchanan with evaporative loses of about 42% (**Table 4-5B**). Groundwater recharge through seepage represents about 7% of Lake Buchanan's hydrologic loses.

4.4.1 LAKE HYDROLOGIC RESIDENCE TIME

Total volume within Lake Buchanan at the time of the bathymetric survey was estimated to be 643 ac-ft. Hydrologic residence time is estimated as the lake volume divided by the sum of annual hydrologic inputs (457 ac-ft). Lake Buchanan has a moderate hydrologic residence time of 1.4 years. For comparison, lakes in the Upper Ocklawaha River Basin downstream of Lake Apopka range from 0.16 to 4.45 years with two of six lakes reporting greater than 1.4 years (Fulton, 1995).

5.0 NUTRIENT BUDGET

5.1 NUTRIENT INPUTS

A nutrient budget was developed for Lake Buchanan utilizing the hydrologic budget described in Section 4 with literature-based and site-specific water quality data. External nutrient inputs include atmospheric deposition, stormwater runoff, groundwater seepage. Internal nutrient loading, occurring as loading flux as discussed in Section 2.3.4, is estimated to contribute 2,360 lb TN and 592 lb TP annually to Lake Buchanan. External nutrient inputs to the lake are evaluated in the following sections.

5.1.1 ATMOSPHERIC DEPOSITION

Literature values were utilized to estimate direct wet and dry atmospheric loading of nitrogen and phosphorus. Badruzzaman et al. (2012) summarized the atmospheric deposition of TN and TP into Florida waters indicating that nitrogen deposition may range from 195 to 208 mg TN/m^2-yr, while phosphorus was typically 7.5 mg TP/m^2-yr. Thus, using the area of the lake (47.3 acres, or 191,417.3 m^2) and the average TN-loading estimate (201

mg TN/m^2-yr), TN and TP atmospheric contribution to Lake Buchanan are estimated to be 42.9 and 1.6 lb/yr, respectively.

5.1.2 STORMWATER RUNOFF

Stormwater runoff volume was obtained from the hydrologic budget previously described in **Section 4**. Hydrologic inputs from stormwater runoff from each sub-basin were estimated from the hydrologic model described in **Section 4.2.2.2**.

5.1.2.1 Literature Based EMCs

Literature-based event mean concentrations (EMC) (**Appendix H: Table 1-3**) for specific land uses were applied to surface runoff volumes to estimate total annual mass pollutant loading. EMCs were developed using land use specific pollutant concentrations obtained from past monitoring activities conducted throughout the State of Florida and were derived from several sources as noted in the documentation. EMCs included in this modeling analysis included TN, TP, and total suspended solids (TSS). Literature values were used for all Sub-Basins except LB-015 and LB-050 which were based on stormwater quality monitoring.

Appendix H: Table 1-3 lists the EMCs used to estimate pollutant loads for non-monitored contribution areas based on land use. The site specific or composite EMCs used for each basin are shown in **Table 5-1**. Based on guidance from the 2020 BMP Trains User Manual, no EMCs were utilized, and no loading was assigned to surface waters, other than Lake Buchanan, which is evaluated separately, because these land uses are assumed to have no net runoff contribution as a result of evapotranspiration.

5.1.2.2 Stormwater Quality Monitoring

Site-specific EMCs were evaluated by calculating the average concentrations for stormwater samples collected from outfalls draining urbanized portions of the basin on the north and southeast sides of the lake. Site-specific EMCs improve the accuracy of the loading model and are especially important in areas where literature-based EMCs may not suffice.

Beginning in July 2021, WSP installed rain gauges and autosampler units at two locations shown in **Figure 5-1**. The autosampler placed at the BuchananDW location (**Figure 5-2**) sampled from the pond overflow structure providing treatment for Sub-Basin LB-015. This pond also treats overflows from stormwater ponds associated with Sub-Basins LB-005 and LB-010**.** The autosampler placed at the Buchanan Palemetto location (**Figure 5-3**) sampled from an 18-inch pipe providing drainage for Sub-Basin LB-050**.** The drainage areas were selected for monitoring based on the relative basin size, current stormwater treatment level, and ability to differentiate specific portions of the basin for potential stormwater Best Management Practices (BMPs).

Six storm events were sampled from September 2021 through March 2022. Each autosampler was equipped with a tipping bucket rain gauge programmed to trigger the autosampler after a rainfall event exceeded 0.2 inches within a 2-hour period and no antecedent rainfall for at least 72 hours. Once triggered, flow-weighted samples were collected using a pacing interval that provided sufficient sample volume. Samples were composited for each sampling event. Samples were analyzed for ammonia, NO_x, TKN, TP, OP, total alkalinity, TSS, and turbidity. Total nitrogen was calculated as the sum of TKN and NO_x.

Each autosampler was equipped with a pressure transducer which continuously recorded water elevation at the location of the sample intake. The relative change in water elevation measured by the pressure transducer was used to determine the appropriate flow weighting for each sample aliquot collected following a qualifying rain event.

The laboratory reports for stormwater quality are provided in **Appendix I**. Mean values for water chemistry data for each station are provided in **Table 5-2**.

5.1.2.3 Stormwater Quality Monitoring Results

Mean TP and TN pollutant concentrations were highest at the Buchanan Palmetto location and lowest at the Buchanan DW autosampler location. Stormwater quality data suggests the stormwater pond upstream of the Buchanan DW location is providing effective treatment for the events that were monitored. Pollutant concentrations measured at the Buchanan Palmetto location are similar to literature-based concentrations for the respective land use.

Literature-based composite EMCs and site-specific EMCs for upstream sub-basins adjacent to each stormwater monitoring station are provided in Table 5-1. These EMCs were used in conjunction with runoff estimates from each sub-basin to provide pollutant mass loading estimates as discussed in Section 5.1.2.4.

Mean TP concentration in stormwater from both autosampler locations during the sampling period was 0.270 mg/L, compared to the mean TP concentration of 0.110 mg/L for Lake Buchanan during the 2021-2022 monitoring period. On average, OP represented 59.3% of the TP concentration in stormwater during the 2021-2022 monitoring period. During the same period, the percentage of OP in Lake Buchanan surface water samples averaged 18.2% suggesting that OP entering the lakes is consumed rapidly by suspended algae.

Mean TN concentration in stormwater from both autosampler locations during the sampling period was 1.46 mg/L compared to the mean TN concentration of 1.44 mg/L for Lake Buchanan during the 2021-2022 monitoring period. Mean nitrate + nitrite concentration for Lake Buchanan surface water was 0.08 mg/L compared to 0.23 mg/L in stormwater samples collected in 2020-2021. Mean ammonia concentration was 0.17 mg/L in stormwater and was 0.11 mg/L in Lake Buchanan surface water during 2020-2021.

5.1.2.4 Surface Runoff Loading Estimate Model

The Lake Buchanan watershed pollutant loading model was developed based on regional land use and soils information as well as the site-specific EMC data obtained from direct stormwater sampling. Modeled and measured TN, TP, and TSS values were combined with modeled runoff to develop annual nutrient budgets for the lake. WSP utilized BMP Trains in conjunction with the spreadsheet model to incorporate the impacts of treatment BMPs in series. The results of the nutrient budget and pollutant loading model were used to make specific recommendations for BMPs within the watershed. An estimate of anticipated water quality improvements with implemented BMP recommendations was also performed.

A total of 1,027 lbs. TN, 219 lbs. TP, and 32,957 lbs. TSS were estimated to be generated annually from the twenty-two sub-basins (Table 5-3). The sub-basins that produced the greatest volume generally produced the highest pollutant loading. Sub-Basins LB-110 and LB-130 had the highest TN, TP, and TSS loading percentages within the watershed as shown below:

	LB-110	LB-130
• TN	12.36%	13.47%
• TP	14.38%	15.88%
• TSS	15.98%	17.11%

Figures 5-4A and 5-4B show the TN and TP loading contribution from each sub-basin with the highest loading shown in red and the lowest loading shown in green.

5.1.3 GROUNDWATER SEEPAGE CONTRIBUTION

Water samples were collected from each seepage meter for water quality analyses approximately every two months from locations shown in Figure 4-3. Seepage samples were analyzed for ammonia, NO_x, TKN, TP, and OP and standard field parameters including temperature, DO, specific conductance, pH and ORP. Seepage water quality laboratory reports are provided in Appendix J. Summary seepage data are provided Table 5-4. Loading from groundwater seepage was calculated using the average estimated annual seepage volume to Lake Buchanan and average nutrient concentrations listed in Table 5-4.

Water quality field parameters were measured in seepage water and compared to conditions within the surrounding water column as a quality control check to verify the seepage meter was functioning properly. As indicated in **Table 5-4**, samples were not collected when bags were damaged or when seepage meters were found unseated. The average dissolved oxygen concentration was approximately 53% lower in the seepage meters than the average dissolved oxygen concentration at Lake Buchanan surface water. In addition, average specific conductance in seepage meters was approximately 30% higher than the average specific conductance in Lake Buchanan surface water. Low dissolved oxygen and high specific conductance in seepage water are typical of groundwater sources and suggest the seepage meters were functioning properly.

Lake Buchanan seepage samples generally exhibited nutrient concentrations that were higher than lake concentrations, averaging 1.6 and 9.8 mg/L for TP and TN, respectively (**Figures 5-5** and **5-6**). The average seepage meter TP concentration was 13 times higher than the average TP concentration in Lake Buchanan surface water. The average seepage meter TN concentration was and about 7 times higher than the average TN concentration measured in Lake Buchanan surface water.

Water samples collected from seepage meter LBSM3 on the south end of the lake exhibited the highest TP concentration averaging 3.6 mg/L with the majority of TP in the bioavailable OP form (**Table 5-4**). Seepage meter LBSM2 had the highest average TN concentration of 14.7 mg/L although LBSM3 was similar at 15.5 mg/L. Nitrate + nitrite concentrations of up to 29 mg/L were collected from seepage meter LBSM2 and a similar maximum nitrate + nitrite concentration of 25 mg/L was also observed in samples collected from seepage meter LBSM2. Ammonia-N and TKN concentrations (**Figures 5-7** and **5-8**) were also high in samples collected from the LBSM3 seepage meter, averaging 13.3 mg/L and 14.6 mg/L respectively.

Groundwater seepage loading was estimated by combining flows and concentrations from the seepage meters. TP and TN estimated groundwater seepage loading rate was 0.26 and 4.9 mg/m^2-day, respectively (**Table 5-4**). The 18-3-ac seepage area within Lake Buchanan contributes approximately 15.4 lb/yr TP and 293.0 lbs/yr for TN, respectively.

5.1.4 ANALYSES OF NITROGEN AND OXYGEN STABLE ISOTOPES IN SEEPAGE SAMPLES

Isotopic signatures of nitrate ($\delta^{15}N$ and $\delta^{18}O$) can be used to identify potential sources of nitrate (Kendall 1998). Ratios of $\delta^{15}N$ and $\delta^{18}O$ in groundwater can indicate nitrogen sources including synthetic fertilizer, mineralized fertilizer, soil organic nitrogen, manure and/or wastewater (including septic waste). However, there are limitations to these identifications, especially in areas with differing ages of the sources, depth to groundwater, and in areas with a mixture of nitrogen sources (Xue et al., 2009; Canion et al., 2020).

Stable isotopes of nitrate were measured in water samples collected from Lake Buchanan seepage meters. Seventeen samples were collected between November 22, 2021and October 11, 2022. No sample was collected from LBSM1 on March 24, 2022, due to a damaged collection bag. Stable isotope analyses were completed by Beta Analytics Laboratory (**Appendix K**). Beta Analytics Laboratory requires nitrate concentrations of at least 0.08 mg/L for stable isotope analyses. All but the sample from LBSM2 contained sufficient nitrate for the stable isotope analyses. **Table 5-5** provides the stable isotope data for each seepage meter.

A biplot of $\delta^{15}N$ and $\delta^{18}O$ stable isotope ratios from Lake Buchanan seepage samples is provided in **Figure 5-9**. The ratio of $\delta^{15}N$ stable isotopes in Lake Buchanan seepage meters fell within both the ammonia/urea fertilizer and manure/wastewater bounding boxes ranging from -8.73 ‰ to 5.05 ‰ (average 2.48 ‰). Stable isotope ratios for $\delta^{18}O$ in Lake Buchanan seepage water ranged from -37.6 ‰ to 12.6 ‰ (average -15.83 ‰) and generally fell below the typical bounding box values reported for $\delta^{18}O$ by Canion et al. (2020). The reason for this is unclear but may be a result of biogeochemical processes occurring as seepage water moves up through the sediment. In most other studies, including Canion et al, (2020), samples were collected from groundwater wells. Given the wide range of $\delta^{15}N$ and $\delta^{18}O$ stable isotope ratios and lack of agreement with literature-based

bounding boxes, seepage samples collected from Lake Buchanan do not appear to provide a suitable means of identifying discrete sources of nitrate.

5.1.5 BATHTUB MODEL RESULTS

Loading model inputs to Lake Buchanan were entered into the United States Army Corps of Engineers BATHTUB model (https://dots.el.erdc.dren.mil/elmodels/emiinfo.html) using first order decay rate equations to estimate the water quality response. Only external loadings were entered during the first model run to evaluate the water quality response from these inputs separately. Considering only external inputs, Lake Buchanan would be expected to have a TN concentration of 0.476 mg/L, a TP concentration of 0.032 mg/L and a Chl-*a* concentration of 12 µg/L. The predicted TN and TP concentrations are considerably lower than the 2015-2022 range of annual geometric means with sufficient data for TN (0.87 – 1.66 mg/L), TP (0.067 – 0.188 mg/L). The predicted Chl-*a* concentration is within the range, of observed annual geometric mean Chl-*a* concentrations (9.4-39.9 µg/L) (Table 1-2). Once the model was calibrated to include the internal TN and TP loading determined by flux, the modeled concentrations match actual TN, TP, and Chl-*a* concentrations more closely using calibration factors of 6 and 3 for TN and TP, respectively.

5.1.6 SUMMARY OF ANNUAL POLLUTANT LOADS BY SOURCE

External and internal pollutant loading estimates to Lake Buchanan are presented in Table 5-6. External TP load to Lake Buchanan is estimated to be 237 lb/yr with surface runoff contributing 92.4%. External TN load to Lake Buchanan is estimated to be 1,379 lb/yr with surface runoff contributing 74.5%. TSS load to Lake Buchanan is estimated to be 32,957 lb/yr with surface runoff contributing 100.0% of the TSS load.

Flux study results indicate internal loading is the major source of TP and TN to Lake Buchanan contributing 592 lb/yr TP and 2,360 lb/yr TN. Internal TP loading from sediment flux is approximately 2.7 times the TP loading contributed by stormwater while TN loading from sediment flux loading is approximately 2.3 times the TN from stormwater loading.

Lake Buchanan exports approximately 71 lbs of TP, 934 lbs of TN, and 3,392 lbs of TSS downstream or to the drain well annually based on mean TN and TP concentrations observed during WSP's 2021 through 2022 sampling period, and estimated discharge of 239 ac-ft/yr. This suggests that Lake Buchanan is acting as a sink for TP. Total nitrogen mass export is slightly less than TN mass inputs for stormwater suggesting that the lake is retaining more nitrogen than it receives although the difference is marginal.

6.0 WATER QUALITY IMPROVEMENT ALTERNATIVES

Internal loading appears to be the greatest source of nutrient loading to Lake Buchanan. Some of this internal loading is likely to be attributed to long-term herbicide application programs on the lake which are intended to treat water hyacinths which routinely cover large portions of the lake. Internal loading could be significantly reduced by chemical inactivation of sediment phosphorus, dredging, re-assessment of the herbicide application program, or a combination of all three options.

Addressing internal loading within Lake Buchanan may provide near-term water quality improvements but lack of sufficient stormwater treatment within the basin will continue to introduce nutrient loads and cause ongoing water quality impairments within the lake if not addressed concurrently.

Treatment of stormwater presents a significant potential for load reduction and water quality improvement through strategic implementation of structural BMPs. Treatment of both internal and external pollutant loading is recommended to address the current water quality impairment status. Both structural stormwater and non-structural BMP alternatives within Lake Buchanan and the surrounding basin are evaluated below.

WSP utilized the information provided during reconnaissance activities and combined this with a desk-top procedure to identify potential sites for stormwater BMPs. WSP began by evaluating sub-basins with higher

pollutant loadings. Next, using aerial imagery, areas with favorable hydrologic settings were identified. Once potential sites were selected, information from the Orange County Property Appraiser's website was utilized to determine the property owners and parcel information. Three treatment alternatives were identified and are discussed in order of priority in the following sections. Pollutant loadings were estimated using the procedures discussed in Sections 4 and 5.

Estimated costs and the associated annual pollutant load reductions (rounded to the nearest integer) were estimated using BMPTRAINS. Design (engineering and surveying) and permitting costs are subject to vary depending on existing infrastructure (i.e., if substantial conflicts arise, pipes need replacement, design/installation of non-standard control structures, curbing/pavement replacement, etc.) and other permitting and construction issues. When necessary, additional costs for operation and maintenance were estimated. Future modeling will need to be conducted to determine pipe size sufficiency and prevent upstream flooding impacts.

6.1 STRUCTURAL ALTERNATIVES

6.1.1 ALTERNATIVE 1 – SUB-BASIN LB-015: BAM DOWNFLOW FILTRATION WITH LAKE WATER REMEDIATION

Alternative 1 is a downflow linear BAM filter with a continuous recirculation/lake filtration stream that will provide additional treatment for Sub-Basins LB-005, LB-010 and LB-015 (Figure 6-1). Currently, runoff from Sub-Basin LB-015 enters the existing stormwater pond located south of East Texas Avenue. The pond also receives overflows from existing BMPs within LB-005 and LB-010. Field reports and information from Orange County indicate the pond is normally wet with signs of scouring downstream of the control structure. Based on autosampler data from the control structure, the pond appears to be providing treatment that is typical of wet retention ponds. Elevated nutrient concentrations within Lake Buchanan provide the opportunity to implement an efficient offline lake treatment system while simultaneously providing suitable conditions for enhanced biological stormwater treatment.

6.1.1.1 Description

BMP Alternative 1 involves installation of a downflow BAM filtration system with a continuous recirculation/lake filtration stream on the east side of the existing Orange County stormwater pond shown in Figure 6-1. For conceptual purposes, the recirculating system is assumed to operate 100% of the time. However, the recirculating system will not operate while the pond is treating stormwater runoff. The actual operating time for the recirculating system will be evaluated as part of a subsequent feasibility study. The recommended downflow BAM filtration system includes excavation and removal of existing soils and replacement with media and a flow distribution system to move water into and out of the media without the need for an expensive prefabricated concrete structure. This configuration is commercially available and additional information regarding this design is provided in Appendix L. A downflow filter is recommended to prolong the life of the system, encourage media bed saturation, retain sloughed biofilms, and reduce maintenance.

Iron-filings-based green environmental media (IFGEM) is recommended for use in this application because of its enhanced nitrogen removing abilities compared to various Bold & Gold mixes (Appendix M). Approximately 10,000 ft^3 of media will be required to provide the necessary two feet of bed thickness and required permeability for the 1-inch design storm event, or 2.3 ac-ft of discharge from Sub-Basins LB-005, LB-010, and LB-015. The recommended contact time (the time it takes for water to travel through the media) for this media is 288 minutes. The appropriate contact time is regulated by an orifice in the underdrain system.

Stormwater will continue to flow to and receive its current level of design treatment through the existing wet retention pond. The existing bleed down orifice will be plugged and replaced with a floating skimmer to provide constant head and maximize treatment efficiency. The skimmer will be located at the south end of the pond

and leads to a collection sump for distribution through a manifold system into the BAM filter. Additionally, a floating skimmer draws water from the top of the water column, where solids settling has already occurred; thus, using a floating skimmer decreases the particulate loading to the BAM filter and minimizes potential filter clogging and reduced permeability issues. Treated water will leave the downflow BAM filter through a discharge structure at the same or similar elevation as the current bleed down orifice. The sump will function to receive both gravity flows and pumped flows from Lake Buchanan. A centrifugal pump will continuously recirculate lake water through the downflow media filter and will be deactivated by a float switch in the sump when stormwater is flowing into the BAM filter

It is anticipated that the recirculation system will provide a flow rate capable of achieving the required 288-minute contact time. Flow rate can be decreased if desired to achieve higher removal efficiencies, although the volume treated will then decrease (Hood, 2019).

The recirculation stream provides multiple benefits. One of the mechanisms by which BAM downflow filters achieve nitrogen removal is by the biological processes of nitrification and denitrification. If a BAM filter is allowed to desiccate or is not supplied with sufficient nutrients, the microbial biofilm will cease to function leading to reduced nutrient removal during storm events. For example, wastewater trickling filters have shown nutrient removal efficiency deterioration after just 1-2 hours without flow (Metcalf & Eddy, 2003).

Another advantage of recirculation pertains to the capture of sloughed biofilm. The microbes that compose the biofilm bio-assimilate soluble reactive phosphorus (SRP) into biomass. As the biofilm becomes thicker, portions will slough off, thus releasing organic phosphorus. Downflow filters are better at retaining sloughed biofilms than upflow filters since the media does not expand or channelize resulting in release of trapped particulates. However, downflow filters may need occasional maintenance (discing) to ensure proper infiltration.

A third, and quantifiable, advantage of including a recirculation stream is that even when there is no stormwater entering into the system from rain events, the downflow BAM filtration system is operating and continuously removing nutrients from Lake Buchanan. The relatively high nutrient concentrations present in Lake Buchanan will improve the overall nutrient removal efficiency of the filter. The design makes use of existing space to contain the media within the pond's maintenance berm which would require periodic maintenance.

6.1.1.2 Efficiency

The existing wet retention pond currently discharges loadings of 148.2 lb/yr of TN and 10.2 lb/yr of TP to Lake Buchanan. A BAM downflow filter will be installed on the east side of the existing wet retention pond; thus, the runoff will travel in series through two BMPs. Because the pond receives both untreated stormwater from Sub-Basin LB-015 and treated discharge from Sub-Basins LB-005 and LB-010, TP and TN removal efficiencies for the existing configuration were estimated using BMP TRAINS. Based on BMP TRAINS, a downflow filter, utilizing a IFGEM media can be expected to remove 69% of the TN and 82% of the TP that remain in the stormwater after it has passed through a pond, given a 20 in/hr hydraulic loading rate. Appendix M contains an excerpt from the BMP Trains manual with information regarding type BAM removal efficiencies for different BMP systems and removal efficiency calculations for BMPs in series.

Additionally, the BAM downflow filter system will include a continuous recirculation stream that draws water from Lake Buchanan, enabling it to remove nutrients from Lake Buchanan during dry periods. The proposed BAM downflow filter could potentially remove up to 8.4 lb/yr TP from Sub-Basin LB-015 stormwater inflows and an additional 77.5 lb/yr from the recirculating system (Table 6-1). The proposed BAM downflow filter would also have the potential to remove up to 102.5 lb/yr TN with an additional TP load reduction of 680.6 lb/yr from the recirculating system (Table 6-2). Including both stormwater and recirculation treatment, the proposed BAM downflow filter could remove 86 lb/yr of TP and 783 lb/yr of TN.

6.1.1.3 Cost

The estimated conceptual cost including design, construction, operation, and maintenance for this alternative assuming a 25-year life cycle and a safety factor of 2 is approximately $550,407, which translates to $22,016 in annualized cost. Based on the previously stated efficiencies and load reduction for the proposed treatment

condition, this alternative would cost approximately $256/lb TP or $28/lb TN for additional nutrient removal beyond the existing condition over the 25-year life of the project; note that each of these costs is independent and are determined by dividing the cost of the entire project by the mass of the specific nutrient removed. **Table 6-3** summarizes the cost estimate for **Alternative 1**.

6.1.2 ALTERNATIVE 2 – SUB-BASIN LB-115 WET POND AND BAM TREATMENT ENHANCEMENT

Alternative 2 proposes construction of two wet ponds on the east and west sides of LB-115 to capture untreated stormwater from Sub-Basins LB-110 and LB-130 as shown in **Figure 6-2**. In addition, a downflow BAM filter at the center of the parcel is proposed to treat stormwater pond outflows from Sub-Basin LB-120, LB-110, and LB-130 as well as upstream treated outflows from LB-115 and LB-125. The downflow BAM filter will be similar in design as the downflow filter proposed as part of **Alternative 1** and will have a similar recirculating function to remove nutrients from Lake Buchanan.

Stormwater runoff is currently conveyed from all sub-basins south of Holden Avenue through LB-115, under Holden Avenue, and north to Lake Buchanan. Sub-Basins LB-110 and LB-130 have no existing stormwater treatment. The quality and function of the subject parcel through which all drainage from sub-basins south of West Holden Ave. is unknown but it is likely impacted by channel incising and short-circuiting although the parcel currently appears to support a mixed hardwood tree canopy as evidenced by aerial imagery and land use classification. Acquisition of the parcel would allow the County to identify areas that may be suitable for construction of the wet treatment ponds and downflow BAM filter using the interior of the parcel, while protecting the existing tree canopy around the property perimeter which currently provides a buffer along Lake Holden Avenue and the adjacent apartment complex.

6.1.2.1 Description

Each wet pond proposed for construction would be require approximately 1.9 acres of surface area and 2.1 ac-ft of volume to provide 14 days of treatment. The **Alternative 2** downflow BAM filter would be designed similar to what is described in **Alternative 1** but within a smaller surface area of 10,318 ft^2 with 20,636 ft^3 of media volume. Discharge from the proposed wet detention ponds would enter the downflow filter through an overflow weir structure. The recirculating pump would also operate as with **Alternative 1** and will be controlled by a float switch that monitors water stage at the inflow structure (or upstream outflow structure). The recirculation pump would be powered down when inflow from Sub-Basin LB-120 is detected.

6.1.2.2 Efficiency

Sub-Basins LB-110 and LB-130 currently discharge untreated stormwater to Lake Buchanan that contributes 66.3 lb/yr TP and 265.4 lb/yr TN (**Tables 6-4** and **6-5**). The proposed wet detention BMP would provide reduction of 42.4 lb/yr TP and 93.5 lb/yr TN. In addition to the wet detention BMPs, a BAM downflow filter will be installed to provide further treatment of all sub-basins south of Lake Holden Avenue including LB-110, LB-115, LB-120, LB-125, LB-130, and LB-135. Based on BMP TRAINS, a downflow filter utilizing a IFGEM BAM with an organic component, can be expected to remove 90% of the TN and TP that remain in the stormwater after it has passed through a pond, given a 20 in/hr hydraulic loading rate. An additional 3.0 lb/yr TP and 19.4 lb/yr TN load removal could be achieved by the downflow BAM filter. **Appendix M** contains an excerpt from the BMP Trains manual with information regarding type BAM removal efficiencies for different BMP systems and removal efficiency calculations for BMPs in series.

Additionally, the BAM downflow filter system will include a continuous recirculation stream that draws water from Lake Buchanan, enabling it to remove nutrients from Lake Buchanan during dry periods. For conceptual purposes, the recirculating system is assumed to operate 100% of the time. However, the recirculating system will not operate while the pond is treating stormwater runoff. The actual operating time for the recirculating system will be evaluated as part of a subsequent feasibility study. The proposed BAM downflow filter could potentially remove an additional 159.8 lb/yr TP and 1,402.7 lb/yr TN from Lake Buchanan (**Tables 6-4** and **6-**

5). Including both stormwater and recirculation treatment, the combined wet detention and recirculating BAM downflow filter could remove a combined 205.3 lb/yr of TP and 1,516.0 lb/yr of TN Because the volume of water treated by the recirculating component, this BMP could provide significant nutrient reductions that are the equivalent of 94% of the total TP stormwater load and 150% of the total TN stormwater load to Lake Buchanan. The amount of mass load removal provided by the recirculating system will depend on the concentration of TN and TP within Lake Buchanan.

6.1.2.3 Cost

The estimated conceptual cost, not considering land acquisition, potential wetland mitigation, inflation or interest, (including design, construction, operation, and maintenance) for this alternative assuming a 25-year life span and a safety factor of 2 is approximately $1,679,168, which translates to $67,166 in annualized cost. Based on the previously stated efficiencies and load reduction for the proposed treatment condition, this alternative would cost approximately $327/lb TP or $44/lb TN for additional nutrient removal beyond the existing condition over the 25-year life of the project; note that each of these costs is independent and are determined by dividing the cost of the entire project by the mass of the specific nutrient removed. Table 6-6 summarizes the cost estimate for Alternative 2.

6.1.3 ALTERNATIVE 3 – STORMWATER BIOSWALES

Alternative 3 involves capturing and treating the runoff from all of the sub-basins along the eastern side of Lake Buchanan including LB-030, LB-035, LB-040, LB-050, LB-070, and LB-095 as shown in Figure 6-3. Alternative 3 makes use of the available space between the normal high-water elevation of Lake Buchanan (91.54 ft NAVD 88) and the edge of pavement to construct a bioswale similar to what is shown in Appendix N. Similar BMPs, typically backyard swales, are sometimes implemented for new residential developments and are designed to be protective of water quality. Since there are almost no current BMP treatments along the east shore of Lake Buchanan and there is no available space within the properties, this option could provide a substantial reduction to the 66.2 lb/yr TP and 268.4 lb/yr TN that are currently discharged from these sub-basins directly to Lake Buchanan.

6.1.3.1 Description

Alternative 3 involves construction of bioswales approximately 1.4 acres along the east side of Lake Buchanan. A bioswale is a modified conveyance channel designed to intercept and treat stormwater by incorporating the use of BAM and/or vegetation to retain nutrients. Bioswales can be designed to blend with the existing landscape and, once complete, could be an amenity to the adjacent properties. Construction of bioswales in developed areas surrounding waterbodies is often difficult because of multiple property owners and challenges with obtaining the necessary drainage easements. Given the benefits of increased water quality and the limited number of adjacent property owners on the east side of Lake Buchanan, the ability to implement a public-private partnership for construction of Alternative 3 may be more feasible. Furthermore, the diffuse nature of the sub-basins and number of outfalls along the east side of Lake Buchanan makes other types of pipe end treatments (e.g., baffle boxes) inefficient.

6.1.3.2 Efficiency

Bioswales are designed to collect and treat surface water runoff effectively and efficiently within a limited space, especially along rights-of-way and riparian areas. While the specific reduction efficiency of a bioswale depends on the available volume and type of media or vegetation planted, an overall 72% reduction of TN and 85% of TP is assumed for simplicity. The combined loading from Sub-Basins LB-030, LB-035, LB-040, LB-050, and LB-070 is 66.2 lb/yr TP and 268.4 lb/yr TN. Bioswales could reduce approximately 56.3 lb/yr TP and 193.2 lb/yr TN.

6.1.3.3 Cost

Using the average construction cost for a bioswale of approximately $58 per linear foot reported by Terrascope (https://terrascope2024.mit.edu/?page_id=657) and an average width of 12.5 ft or $4.64 per ft^2, the Lake Buchanan bioswale would cost approximately $283,000. The cost of potential easements is not included. Annual maintenance costs of an additional $4.84 per linear foot over the 25-year life cycle would also be required for a total of $590,325. The approximate overall cost for bioswale construction and maintenance would be $973,325 or $38,933 per year over 25 years. This equates to annual load reduction efficiencies of $588/lb TP and $201/lb TN.

6.2 NON-STRUCTURAL ALTERNATIVES

6.2.1 ALTERNATIVE 4 – PUBLIC EDUCATION

OCEPD is actively participating in public education throughout the county and should work to focus specifically on the Lake Buchanan basin. It is anticipated that Orange County will already qualify for the standard 6% load reduction for the basic county-wide public education requirements established by FDEP. However, community outreach and education are recommended specifically for the Lake Buchanan basin as it is the external source of nutrients and pollutants. Often, residents, lawn maintenance companies, and other individuals are unaware of the potentially deleterious impact their particular actions or habits have on local waterbodies. The primary remedy is to implement a well-conceived public education program that persuades citizens that they have a valuable role in the maintenance of the water quality within their community and teaches practices to minimize or eliminate the sources of pollution. The program should be creative, convey a consistent message, and be sustainable. In addition, the education program could be supplemented with an incentive program to encourage and facilitate community members in implementing site specific solutions to non-point source pollution and water quality problems. A summary of the steps Orange County has already taken to address loading to Lake Buchanan and other waterbodies is provided below along with recommendations for site-specific actions which the County could take.

Orange County recently implemented Fertilizer Management Ordinance No. 2022-03 which supersedes the prior fertilizer ordinance and places additional restrictions on the application of fertilizer throughout the County.

The most significant changes from the previous ordinance are as follows

- No application of any nitrogen or phosphorus containing fertilizers between June 1 and September 30.
- No fertilizer application is permitted within 25 feet of an adjacent waterbody or wetland.
- Any nitrogen applied as a fertilizer must be at least 65% slow release and a maximum of three pounds of nitrogen can be applied per 1,000 square feet per year.

The following requirements remain in place as with previous versions of the ordinance:

- No fertilizer shall be used unless labeled in accordance with state law.
- Only fertilizers with zero phosphorus are permitted unless a soil analysis test performed by a laboratory using UF/IFAS approved methodology demonstrates phosphorus deficiency.
- Broadcast spreaders must be equipped with a shield.
- No fertilizer, grass clippings, or vegetative material shall be deposited onto any impervious surface, public right-of-way, public property, stormwater drain, ditch, conveyance, or water body.

The ordinance is available through the following link:

http://orangecountyfl.net/Portals/0/Library/Environment/docs/ORA20220211_Ordinance2022_03_0-CERT.pdf

Orange County has also created a website to inform the public of the ordinance and a variety of efforts that can be implemented by individual homeowners available at the following link:

http://orangecountyfl.net/Environment/FertilizeResponsibly.aspx#.YsxoKHbMLb0

The focus is primarily on reducing nitrogen loading in response to the 2016 Springs and Aquifer Protection Act, but the ordinance also prohibits the application of fertilizers containing phosphorus on residential property unless a phosphorus deficiency is proven. Retailers are required to post a notice of the fertilizer ordinance during summer months which increases awareness. Some areas within the Lake Buchanan basin are agricultural and exempt from the new ordinance. Therefore, the managers of the agricultural areas should be directed to the agricultural BMP enrollment program.

In addition to the measures prescribed in the ordinance, a wide range of BMPs are available as guidelines for homeowners and others involved in turf grass maintenance. BMP information is available from:

The Florida Yards & Neighborhoods (FYN) program, an educational outreach program of UF/IFAS Extension (https://sfyl.ifas.ufl.edu/miami-dade/natural-resources/florida-yards-and-neighborhoods-fyn/); the FYN Handbook (FYN, 2003); and FDEP's Non-Point Source Management website and specifically the Florida Green Industries: BMPs for Protection of Water Resources in Florida developed jointly by the Florida Green Industries, FDEP, Florida Department of Agriculture and Consumer Services (FDACS), Florida's Department of Community Affairs (DCA), water management districts, and UF (Florida Green Industries, 2002) https://www.sfwmd.gov/sites/default/files/documents/fl_green_bmp.pdf.

Information for professional lawn care service providers is also available from diverse sources including industry associations such as the Florida Turfgrass Association (https://www.ftga.org/default.aspx).

The primary sources of guidance used by most residential fertilizer users are package labels; advice by family, friends and neighbors; and information from retail sources of the product (see Israel and Knox, 2001). More effective public education programs should be implemented to increase citizens' understanding of the FYN Program, residential turfgrass BMPs, and their importance to Florida's environment.

Both rain sensors and soil moisture sensors, if used properly, can facilitate irrigation management, conserve water, and prevent excessive chemical leaching by overriding automatic operation of a sprinkler system. Furthermore, Florida is the only state in the nation with an overall rain sensor statute. Beginning in 1991, this statute applies to all new automatic sprinkler systems: "Any person who purchases and installs an automatic lawn sprinkler system after May 1, 1991, shall install, and must maintain and operate a rain sensor device or switch that will override the irrigation cycle of the sprinkler system when adequate rainfall has occurred" (Florida Statute 373.662). This requirement was intended to conserve water. However, avoiding overwatering clearly will have additional benefits in preventing nutrient runoff and leaching to groundwater. Consequently, enhancements of the state and/or County's approach to encouraging sensor-controlled irrigation may be warranted. One potential enhancement could be the provision of funds for operation of a program to install and maintain sensor-controlled irrigation systems. For example, water supply utilities could administer a program to install and maintain sensor-controlled irrigation systems, targeting large users of irrigation water, regardless of the applicability of the rain sensor statute to that user. Based on industry experience with such systems, providing for routine maintenance would be an important part of such a program.

An estimate of the potential benefit of more widespread adoption of residential turf grass BMPs was developed in a similar study performed by WSP (previously MACTEC, 2007) for the SJRWMD. Specifically, it was assumed that use of turf grass BMPs would eliminate specific practices (excess watering, excess fertilization, and/or exclusive use of "fast-release" fertilizer formulations) that were studied by Morton, et al. (1988) and Snyder, et al. (1984). MACTEC (2007) concluded that effective implementation of turf grass BMPs could achieve a 33% reduction in groundwater loadings of TN from residential land uses. Although not specifically addressed by MACTEC (2007), their methodology suggests a similar reduction in stormwater loadings of TN.

Information regarding proper servicing and routine septic system maintenance should also be included as part of the public education program. The Lake Buchanan watershed is predominantly serviced by central sewer

systems, but there are several parcels with septic systems (Figure 6-4). Conversion of these adjacent septic systems to central sewer is possible but would likely be cost prohibitive for the resulting pollutant load reduction.

6.2.1.1 Efficiency

Homeowner education is achieved through mass advertising using primarily social media, television commercials, and signage. The cost for these broad-reaching public awareness campaigns is distributed over the entire county and is minimal in any one basin. However, success of these advertising campaigns is difficult to measure on a large scale, and a more targeted approach for this specific basin is recommended. The effort to identify and work with homeowners immediately adjacent to Lake Buchanan, and should focus on minimizing fertilizer application, particularly near the shoreline; importance of maintaining riparian vegetation; promoting shoreline plantings; and proper septic system maintenance.

6.2.1.2 Cost

Orange County has already implemented a comprehensive countywide public outreach program and it is not anticipated that additional effort would be required to qualify for the maximum of 6% runoff loading reduction of 13 lb TP and 62 lb TN. However, a targeted outreach campaign specific to the Lake Buchanan basin would likely be more effective than the comprehensive countywide program and could be accomplished for approximately $1,000 per year, or $77 per lb of TP and $16 per lb of TN. Public education can easily be incorporated into the lake management plan provided sufficient staffing resources are available.

6.2.2 ALTERNATIVE 5 – SEDIMENT NUTRIENT INACTIVATION ALTERNATIVE

Sediment nutrient inactivation may be a suitable option for expediting and enhancing water quality improvement within Lake Buchanan. Phosphorus fractionation and flux analysis indicates the presence of significant sources of phosphorus in some areas of the lake bottom. Inactivation of potentially bioavailable phosphorus by chemical application using a combination of Phoslock® and liquid aluminum sulfate (alum) can be used in conjunction provide an economic solution to increase water transparency and reduce sediment nutrient flux. Lake Buchanan consistently has poor clarity so one or more water column alum treatments is likely to be necessary. Phoslock® has had the most extensive use within Florida but is just one of several lanthanum-based products available for sediment nutrient inactivation.

6.2.2.1 Description

Combining alum treatment for water column treatment with Phoslock® for sediment nutrient inactivation has several advantages over traditional alum applications or use of Phoslock® alone. Phoslock® is a proprietary product utilizing elemental lanthanum to selectively bind free phosphate ions. Phoslock® is not a flocculent like alum but selectively binds with phosphate to prevent sediment release and subsequent biological uptake. Phoslock® is the recommended in Lake Buchanan because it will have little effect on pH, unlike alum, and Phoslock®, has no precautionary environmental concerns, and does not remove beneficial zooplankton from the water column.

6.2.2.2 Efficiency

Internal load reduction occurs when BAP is liberated from the sediments and is subsequently bound by lanthanum prior to diffusing into the water column. Phoslock® used in this type of application is broadcast over the lake surface but can be targeted to settle within the deepest areas that have the greatest ability to release phosphorus. The lanthanum mass applied would be available for phosphate inactivation at a 1:1 ratio.

6.2.2.3 Cost

Sediment inactivation cost for the Phoslock® application is estimated based on targeting a 5 - acre portion of the lake bottom with the highest BAP mass. Phoslock® would be applied to inactivate approximately 5,450 pounds of phosphorus that could otherwise be released into the water column.

Using a cost proposal from SePro for a combined alum/Phoslock® treatment on a similar lake in 2021, WSP estimates treatment costs to be $1,084,522 with a TP removal (inactivation) cost of approximately $200 per pound. It should be noted that longevity of chemical inactivation projects is generally limited by continuing sources of external pollutant input and the retention time of water within the lake. It is recommended that OCEPD proceed with control of external loading sources in conjunction with this immediate but temporary means of improving water quality. It should also be noted that FDEP does not claim sovereign submerged lands ownership of the bottom of Lake Buchanan. Application of chemicals designed to inactivate sediment phosphorus (e.g., alum or Phoslock®) will require a 404 Dredge and Fill Application and an Individual ERP from the FDEP.

6.2.3 ALTERNATIVE 6 – AQUATIC PLANT HARVESTING

Aquatic plant harvesting is recommended in lieu of future aquatic herbicide application because dead and decaying aquatic vegetation may be a significant source of internal loading to Lake Buchanan. Aquatic harvesters are designed to float on top of the water and use conveyor systems to remove vegetation such as water hyacinth and hydrilla. The primary advantage of aquatic plant harvesters over herbicides is complete removal of plant material from the subject waterbody which results in a net reduction of nutrient and sediment load. Challenges to aquatic harvesting include expense, access, duration, and disposal. While mechanical harvesting is considerably more expensive than aquatic herbicide application, there may still be a considerable cost advantage over other BMPs (e.g., dredging) which may be required to restore water quality in a lake impacted by anthropogenic eutrophication and sedimentation.

6.2.3.1 Description

Mechanical harvesting on Lake Buchanan could be accomplished by launching the harvester using the existing access ramp on the southeast side of the lake. The harvester could be unloaded to Orange County's stormwater pond on the north side of the lake and either hauled off to another site for drying or temporarily placed on the adjacent property for drying. The mechanical harvester would be deployed as needed once 25% of the surface area of the lake becomes covered with hyacinths.

6.2.3.2 Efficiency

Efficiency of harvesting is dependent on the mass removal of aquatic vegetation and the associated nutrient composition. Based on findings from Heard and Winterton (2000), hyacinths grown in water quality conditions similar to Lake Buchanan are comprised of approximately 3% TN and 0.3% TP by dry weight. The approximate hyacinth biomass harvested per acre is 150 tons with approximately 7.5 tons of dry weight (Sperry et al., 2010). Harvesting just five acres (37.5 dry tons) of hyacinth from Lake Buchanan could result in removal of 2,250 lb TN and 225 lb TP from Lake Buchanan.

6.2.3.3 Cost

The cost of mechanical plant harvesting typically depends on the project size, type, and density of vegetation. It is anticipated that harvesting costs for five acres of hyacinth removal on Lake Buchanan would be approximately $30,000. Onsite disposal of dry material (incorporation into existing soils) is anticipated to cost an additional $5,000. Total load removal costs would be $16/lb TN and $156/lb TP.

6.3 SUMMARY OF ALTERNATIVES

Table 6-7 provides a summary of the pollutant removal costs associated with structural and non-structural alternatives for Lake Buchanan.

7.0 RESULTS AND CONCLUSIONS

The Lake Buchanan watershed was largely developed prior to the implementation of stormwater regulations. Lack of existing stormwater treatment provides opportunities for BMP retrofits, but relatively little undeveloped land exists within the basin.

During the 2015 through 2022 evaluation period, Chl-*a*, TN and TP concentrations exceeded the NNC four out of five years with sufficient data which resulted in Lake Buchanan being listed as impaired by the FDEP. The majority of external nutrient loading appears to be from stormwater runoff although some concentrated sources of nitrate are entering the lake from seepage sources as well. Internal loading from sediments also appears to be a significant source of loading and could be addressed through sediment inactivation technology and mechanical harvesting of excessive floating vegetation. Reducing loading from external sources will prolong the benefits of an internal load reduction project.

Based on the results of the pollutant load modeling, WSP developed conceptual stormwater treatment options in the sub-basins with the highest pollutant loading. Three structural alternatives and four non-structural alternatives were proposed and described both in terms of pollutant removal and estimated cost per pound of pollutants removed. Project alternatives are summarized in Table 6-7. WSP recommends that OCEPD proceed with implementation of non-structural Alternatives 4, 5 and 6 and to conduct a feasibility study to evaluate Alternatives 1, 2, and 3. Potential TP load reduction could be over 290 lbs/yr (including the lake treatment element) if both stormwater treatment options are implemented. TN load reduction could be as high as 2,299 lbs/yr if both stormwater treatment options are implemented. Alternative 2 would involve land acquisition and potential wetland impacts so it would be more expensive, but it also has a higher removal rate than Alternative 1. Total nitrogen and total phosphorus removal efficiencies associated with Alternative 3 are similar to other structural projects, but it may be possible to construct at least a portion of these bioswales within easements obtained from adjacent property owners but would not have the land acquisition costs associated with Alternative 2

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TABLES

Table 1-1 - Florida's Lake Numeric Nutrient Criteria

Long Term Geometric Mean Lake Color and Alkalinity	Annual Geometric Mean Chlorophyll *a*	Minimum calculated numeric interpretation		Maximum calculated numeric interpretation	
		Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen	Annual Geometric Mean Total Phosphorus	Annual Geometric Mean Total Nitrogen
> 40 Platinum Cobalt Units	20 µg/L	0.05 mg/L	1.27 mg/L	0.16 mg/L[1]	2.23 mg/L
≤ 40 Platinum Cobalt Units and > 20 mg/L $CaCO_3$	20 µg/L	0.03 mg/L	1.05 mg/L	0.09 mg/L	1.91 mg/L
≤ 40 Platinum Cobalt Units and ≤ 20 mg/L $CaCO_3$	6 µg/L	0.01 mg/L	0.51 mg/L	0.03 mg/L	0.93 mg/L

[1] For lakes with color > 40 PCU in the West Central Nutrient Watershed Region, the maximum TP limit shall be the 0.49 mg/L TP streams threshold for the region.

From: *Florida Administrative Code 62-302.531*

Table 1-2 - Lake Buchanan Numeric Nutrient Criteria Exceedance Summary

Year	Total Nitrogen (mg/L)		Total Phosphorus (mg/L)		Chlorophyll-*a* (µg/L)	
	NNC	Annual Geometric Mean	NNC	Annual Geometric Mean	NNC	Annual Geometric Mean
2015*	1.05	1.16	0.03	0.048	20	24.4
2016		1.35		0.067		21.0
2017		1.48		0.076		33.4
2018	1.91	0.87	0.09	0.057		9.4
2019	1.05	1.66	0.03	0.188		24.5
2020		1.50		0.128		39.0
2021*		1.53		0.064		32.2
2022**		1.93		0.169		28.9

* Less than four samples used to calculate annual geometric mean for this year

**Value for annual geometric mean is a single value from January 11, 2022

Red shading indicates AGM exceedance of NNC

Yellow shading indicates insufficient information to determine NNC exceedance

No shading indicates NNC is not exceeded

Table 2-1 – Phosphorus Fractionation Forms with Drivers of Bioavailable Phosphorus Release

P FRACTION	P FORMS IN FRACTION	DRIVER OF BAP RELEASE FROM SEDIMENTS	LIKELIHOOD OF BAP RELEASE TO WATER COLUMN
Labile P	Directly bioavailable P; loosely bound or adsorbed P	Desorption; diffusion; steep concentration gradients	High
Reductant soluble P	P bound to Fe-hydroxides and Mn-compounds	Anoxia	High
Organic P	Allochthonous organic material; detritus	Bacterial mineralization (temperature dependent)	Medium to High
Metal-oxide adsorbed P	P adsorbed to metal oxides (mainly FE, Al); P exchangeable against OH-	High pH (e.g., from high levels of photosynthetic activity in water column)	Medium to High
Apatite bound P	P bound to carbonates and apatite P	Low pH	Low to Medium
Residual P	Refractory compounds		Low
Total BAP	**Labile P + Reductant soluble P + Metal oxide adsorbed P + Organic P**	**See above**	**Medium to High**

Note: Information adapted from Meis et al. 2012

Table 2-2A –Physical and Chemistry Data from Sediments Cores Collected in Lake Buchanan

Parameter	Core 1	Core 2	Core 3
Percent Dry Weight (%)	72.1	9.94	52.69
Bulk Density (g/cc)	1.2	0.10	0.75
Porewater Ammonia (mg/kg DW)	0.51	198.0	5.2
Porewater Soluble Reactive Phosphorus (mg/kg DW)	0.028	3.1	0.16
Total Organic Carbon (mg/kg DW)	16,700	307,000	27,000
Volatile Solids (%)	3.19	57.4	8.12

Table 2-2B –Phosphorus Fractionation Data from Sediments Collected in Lake Buchanan

Phosphorus Fractionation Concentration (mg/kg DW)			
P Fraction	**Core 1**	**Core 2**	**Core 3**
Labile P	2.2	7.5	4.1
Reductant Soluble P	4.1	131	38
Metal-oxide adsorbed P	300	2,600	1,590
Organic P	9.8	1,220	210
Total BAP*	316.1	3,958.5	1,842.1
Apatite bound P	9.6	112	92.7
Residual P	26	1,450	1,700
Total P	364	4,360	4,370

Note: DW = Dry weight, *BAP =Bioavailable phosphorus, which is the sum of: Labile P (NH_4Cl TSP) + Reductant-Soluble P ($NaHCO_3/Na_2S_2O_4$ TSP) + Metal-oxide P (NaOH-SRP) + Organic P (NaOH TSP minus NaOH SRP) (Meis et. al., 2012). Sum of phosphorus fractionations are less than the total phosphorus values, since the fractionation procedure is based on the soluble portion (e.g., the supernatant is filtered through a 0.45 µM filter), and not analyzed for total phosphorus. For calculated values, ½ the value was used for analyses below detection value.

Table 2-3 – Summary of Lake Buchanan Sediment Bulk Density and Phosphorus Fractionation Data

Parameter	Mean Value	Min Value	Max Value
Bulk Density (g/cc)	0.68	0.1	1.2
Total Phosphorus (mg/kg DW)	3,031	364	4,370
Bioavailable (mg/kg DW)*	2,039	316	3,959
Residual Phosphorus (mg/kg DW)	1,059	26	1,700
Reductant Soluble Phosphorus (mg/kg DW)	57.7	4.1	131

Note: Mean values are average of three samples. DW = Dry weight

* Bioavailable phosphorus includes: Labile P (NH_4Cl TSP) Reductant-Soluble P ($NaHCO_3/Na_2S_2O_4$ TSP), Metal-oxide P (NaOH-SRP) and Organic P (NaOH TSP minus NaOH SRP) (Meis et. al., 2012).

Table 2-4 – Ranges of In-situ Depth Profile Water Quality Data at Each Station

Station	Sample Depth (m)	Water Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (%)	Specific Conductance (uS/cm)	pH	Turbidity (NTU)
LB-3	0.5-7.6	19.6-20.6	0.6-8.8	6.4-97.8	157-178	6.4-8.1	3.1
LB-2	0.5-6.3	19.8-21.0	4.5-108.6	0.4-9.7	157-187	6.4-7.8	4.7
LB-1	0.5-3.7	20.0-21.1	5.7-9.3	62.3-104.6	156-157	7.0-8.1	3.7

Table 2-5 – Summary of Anoxic and Aerobic Flux Rates and Internal Loads (NRR Equation)

Site	REDOX (Oxygen) Conditions	Flux Parameter	Diffusive Flux Rate (mg/m2/d)	Load (lb/yr)
Sediment, LB-1	Anoxic	Total Phosphorus, as P, (mg/L)	1.65	254.13
Sediment, LB-2	Anoxic	Total Phosphorus, as P, (mg/L)	1.82	279.75
Sediment, LB-3	Anoxic	Total Phosphorus, as P, (mg/L)	1.35	208.02
Average	**Anoxic**	**Total Phosphorus, as P, (mg/L)**	**1.61**	**247.30**
Sediment, LB-1	Anoxic	Ammonia, as N, (mg/L)	0.00	0.00
Sediment, LB-2	Anoxic	Ammonia, as N, (mg/L)	0.00	0.00
Sediment, LB-3	Anoxic	Ammonia, as N, (mg/L)	0.00	0.00
Average	**Anoxic**	**Ammonia, as N, (mg/L)**	**0.00**	**0.00**
Sediment, LB-A	Aerobic	Total Phosphorus, as P, (mg/L)	10.29	1,581.14
Sediment, LB-B	Aerobic	Total Phosphorus, as P, (mg/L)	7.95	1,222.49
Sediment, LB-C	Aerobic	Total Phosphorus, as P, (mg/L)	6.95	1,068.78
Average	**Aerobic**	**Total Phosphorus, as P, (mg/L)**	**8.40**	**1290.80**
Sediment, LB-A	Aerobic	Ammonia, as N, (mg/L)	17.42	2,677.07
Sediment, LB-B	Aerobic	Ammonia, as N, (mg/L)	82.75	12,719.29
Sediment, LB-C	Aerobic	Ammonia, as N, (mg/L)	39.42	6,058.63
Average	**Aerobic**	**Ammonia, as N, (mg/L)**	**46.53**	**7,151.66**
Overall Average	**Anoxic and Aerobic**	**Total Phosphorus, as P, (mg/L)**	**5.00**	**769.05**
Overall Average	**Anoxic and Aerobic**	**Ammonia, as N, (mg/L)**	**23.26**	**3,575.83**
Weighted Average	**Anoxic and Aerobic***	**Total Phosphorus, as P, (mg/L)**	**3.85**	**591.65**
Weighted Average	**Anoxic and Aerobic***	**Ammonia, as N, (mg/L)**	**15.35**	**2,360.05**

*Anoxic 67% and Aerobic 33%

Table 2-6 - Lake Buchanan Summary Statistics, January 2015 through January 2022.

Parameter	Count	Geometric Mean	Mean	Median	Minimum	Maximum
Alkalinity (mg/L)*	47	46.0	47.18	48.0	27.0	66.0
True Color (PCU)*	47	24.2	26.7	24.0	5.0	50.0
Chlorophyll-*a* (µg/L)	32	20.7	31.9	30.4	1.1	87.9
Ammonia (mg/L)	30	0.03	0.11	0.02	<0.01	0.65
Nitrate-Nitrite (mg/L)	31	0.01	0.04	0.01	<0.009	0.32
Total Kjeldahl Nitrogen (mg/L)	31	1.24	1.32	1.28	0.57	3.23
Total Nitrogen (mg/L)	31	1.27	1.36	1.28	0.58	3.29
Total Phosphorus (mg/L)	31	0.072	0.103	0.064	<0.006	0.359
Orthophosphate (mg/L)	24	0.010	0.037	0.005	< 0.003	0.212
Secchi Depth (m)	33	1.1	1.2	1.1	0.3	2.7
Trophic State Index	30	60.3	61.2	63.0	36.0	79.0

*** Note: Alkalinity and true color period of record: January 1999 through January 2022.**

Table 2-7 – Surface Water Quality Summary Results for Lake Buchanan from March 2021 to February 2022

Parameters (units)	Count	Mean	Annual Geometric Mean	Minimum	Maximum	Standard Deviation	Coefficient of Variation
Ammonia (mg/L as N)	6	0.11	0.01	0.005	0.63	0.23	208.73
Chlorophyll a (µg/L)	6	29.15	24.62	14	74	20.41	70.01
Color (PCU)	6	28.33	27.39	20	45	7.99	28.21
Nitrate/Nitrite (mg/L as N)	6	0.08	0.02	0.008	0.31	0.11	147.82
Orthophosphate (mg/L as P)	6	0.02	0.01	0.002	0.086	0.03	124.90
pH (SU)	6	7.42	7.39	6.60	8.30	0.59	7.99
Total Phosphorus (mg/L as P)	6	0.11	0.09	0.04	0.20	0.06	59.15
Total Alkalinity (mg/L as $CaCO_3$)	6	33.98	33.16	26	49.80	7.96	23.42
Total Kjeldahl Nitrogen (mg/L as N)	6	1.38	1.33	0.96	1.90	0.35	25.33
Total Nitrogen (mg/L as N)	6	1.44	1.39	0.96	1.90	0.35	24.38
Total Suspended Solids (mg/L)	6	5.23	4.12	1.25	13	3.73	71.41
Turbidity (NTU)	6	6.13	2.82	0.30	25	8.49	138.49

Source: Wood (6 events)

Data qualified with a U code as below detection limit was calculated using one half the MDL (see Appendix E)

Table 2-8 - Summary of Lake Buchanan Surface Water Field Parameters from March 2021 through February 2022

Parameters	Count	Mean	Geometric Mean	Minimum	Maximum	Standard Deviation	Coefficient of Variation
Temperature (C°)	6	24.6	23.99	21.2	31.0	6.10	24.9
Dissolved Oxygen (%)	6	92.0	89.9	66.3	123.4	21.7	23.6
Dissolved Oxygen (mg/L)	6	7.9	7.5	4.9	12.3	2.8	35.3
Specific Conductance (µS/cm)	6	145	144	136	157	8.0	5.8
pH (SU)	6	8.0	8.0	7.3	9.1	0.7	8.5
Secchi Disk Depth (m)	6	1.1	1.1	0.8	1.4	0.3	25.5

Source: Wood (6 events), measured at 0.5 m depth

Table 3-1 Area of Sub-Basins in Lake Buchanan Basin

Sub-Basin Name	Area (acres)
LB-005	6.82
LB-010	8.91
LB-015	11.87
LB-020	5.06
LB-025	2.32
LB-030	4.68
LB-035	5.74
LB-040	8.09
LB-045	2.32
LB-050	3.72
LB-065	2.55
LB-070	8.34
LB-080	0.95
LB-085	3.11
LB-090	2.03
LB-095	11.25
LB-110	14.56
LB-115	4.24
LB-120	8.48
LB-125	4.10
LB-130	15.00
LB-135	10.53
Total Area	**144.67**

Table 3-2 - Landuse within Lake Buchanan Basin

Sub-Basin Name	Level 2 Landuse (ac)							
	1200: Residential, Medium Density	1300: Residential, High Density	1900: Open Land	4300: Upland Mixed Forests	5200: Lakes	5300: Reservoirs	8300: Utilities	Total
LB-005	-	6.82	-	-	-	-	-	6.82
LB-010	-	8.91	-	-	-	-	-	8.91
LB-015	0.29	11.48	0.01	-	0.08	-	-	11.87
LB-020	-	4.61	-	-	0.46	-	-	5.06
LB-025	-	2.23	-	-	0.08	-	-	2.32
LB-030	-	4.54	-	-	0.15	-	-	4.68
LB-035	-	5.64	-	-	0.09	-	-	5.74
LB-040	-	7.97	-	-	0.12	-	-	8.09
LB-045	-	2.30	-	-	0.02	-	-	2.32
LB-050	-	3.48	-	-	0.23	-	-	3.72
LB-065	-	2.51	-	-	0.04	-	-	2.55
LB-070	-	7.97	-	-	0.37	-	-	8.34
LB-080	-	0.78	-	-	0.16	-	-	0.95
LB-085	-	2.97	-	0.00	0.14	-	-	3.11
LB-090	-	0.05	-	1.68	0.29	-	-	2.03
LB-095	-	11.00	-	-	0.25	-	-	11.25
LB-110	-	12.62	-	-	-	-	1.94	14.56
LB-115	-	0.55	-	3.69	-	-	-	4.24
LB-120	-	6.85	-	-	-	1.62	0.02	8.48
LB-125	-	3.00	-	-	-	1.10	-	4.10
LB-130	-	15.00	-	-	-	-	-	15.00
LB-135	-	8.79	-	-	-	1.74	-	10.53
Total	**0.29**	**130.07**	**0.01**	**5.37**	**2.48**	**4.46**	**1.96**	**144.64**
% Total	**0.20**	**89.93**	**0.01**	**3.71**	**1.71**	**3.08**	**1.36**	**100.00**

Table 3-3 - Hydrologic Soil Groups within the Lake Buchanan Basin

Sub-Basin Name	HydroGroup (ac)				
	A/D	A	B/D	Water/Urban	Total
LB-005	6.82	0.00	0.00	0.00	6.82
LB-010	8.91	0.00	0.00	0.00	8.91
LB-015	7.74	4.11	0.00	0.01	11.87
LB-020	5.06	0.00	0.00	0.00	5.06
LB-025	2.32	0.00	0.00	0.00	2.32
LB-030	4.68	0.00	0.00	0.00	4.68
LB-035	2.89	2.84	0.00	0.00	5.74
LB-040	1.83	6.26	0.00	0.00	8.09
LB-045	2.32	0.00	0.00	0.00	2.32
LB-050	1.01	2.65	0.00	0.05	3.72
LB-065	2.55	0.00	0.00	0.01	2.55
LB-070	3.15	4.80	0.00	0.39	8.34
LB-080	0.93	0.00	0.00	0.01	0.95
LB-085	2.93	0.00	0.00	0.18	3.11
LB-090	1.77	0.00	0.00	0.25	2.03
LB-095	9.71	1.44	0.00	0.11	11.25
LB-110	8.64	0.00	5.92	0.00	14.56
LB-115	4.15	0.00	0.09	0.00	4.24
LB-120	3.28	0.00	5.20	0.00	8.48
LB-125	3.37	0.00	0.00	0.73	4.10
LB-130	2.40	0.00	0.00	12.60	15.00
LB-135	8.16	0.00	1.71	0.66	10.53
Total	**94.62**	**22.10**	**12.92**	**15.00**	**144.64**
% Total	**65.42**	**15.28**	**8.93**	**10.37**	**100.00**

Table 4-1 - Annual Rainfall at Lake Buchanan from 2002 through 2021 (NexRad Grid 10112707)

Year	Total Annual Rainfall (in.)
2002	64.30
2003	44.47
2004	63.31
2005	57.22
2006	37.94
2007	34.76
2008	58.99
2009	57.92
2010	46.36
2011	51.20
2012	45.19
2013	47.14
2014	51.56
2015	49.10
2016	53.26
2017	45.11
2018	60.67
2019	56.27
2020	52.70
2021	43.38
2002-2021 Average	**51.04**

Table 4-2 - Estimated Sub-Basin Stormwater Runoff for Lake Buchanan Basin

Sub-Basin	Sub-Basin Area (acre)	Annual Sub-Basin Runoff* (ac-ft)	% Contribution
LB-005	6.82	11.63	4.95%
LB-010	8.91	14.91	6.34%
LB-015	11.87	20.11	8.56%
LB-020	5.06	8.18	3.48%
LB-025	2.32	3.97	1.69%
LB-030	4.68	8.06	3.43%
LB-035	5.74	10.02	4.26%
LB-040	8.09	14.16	6.03%
LB-045	2.32	4.08	1.74%
LB-050	3.72	6.19	2.63%
LB-065	2.55	4.46	1.90%
LB-070	8.34	14.24	6.06%
LB-080	0.95	1.39	0.59%
LB-085	3.11	5.36	2.28%
LB-090	2.03	1.08	0.46%
LB-095	11.25	19.54	8.31%
LB-110	14.56	25.48	10.84%
LB-115	4.24	2.63	1.12%
LB-120	8.48	12.38	5.27%
LB-125	4.10	5.21	2.21%
LB-130	15.00	26.65	11.34%
LB-135	10.53	15.33	6.52%
Total	**144.67**	**235.04**	**100**

***Assumes 51.04 inches of rainfall*

Table 4-3 – Lake Buchanan Seepage Flow Monitoring Data

Collection Date	Seepage Meter ID	Initial Volume (mL)	Volume After Removal (mL)	Total Volume Change (mL)	Collection Period (Days)	Meter Area (m^2)	Seepage Flow Rate (mL/m^2-day)
6/28/21 11:31 AM	LBSM1	2,000	2,500	500	60.0	0.25	33
6/28/21 11:03 AM	LBSM2	2,000	8,500	6,500	60.0	0.25	433
6/28/21 12:17 PM	LBSM3	2,000	5,000	3,000	60.0	0.25	200
8/26/21 10:35 AM	LBSM1	2,000	45,800	43,800	59.0	0.25	2,972
8/2/21 10:04 AM	LBSM2	2,000	7,600	5,600	34.9	0.25	641
8/2/21 10:32 AM	LBSM3	2,000	N/A	N/A	34.9	0.25	N/A
9/29/21 12:00 PM	LBSM1	2,000	6,800	4,800	34.0	0.25	564
9/29/21 11:41 AM	LBSM2	2,000	8,300	6,300	58.1	0.25	434
9/29/21 12:14 PM	LBSM3	2,000	5,000	3,000	58.1	0.25	207
11/22/21 2:27 PM	LBSM1	2,000	23,500	21,500	54.1	0.25	1,590
11/22/21 2:06 PM	LBSM2	2,000	9,500	7,500	54.1	0.25	555
11/22/21 3:16 PM	LBSM3	2,000	4,700	2,700	54.1	0.25	200
2/1/22 10:58 AM	LBSM1	2,000	9,500	7,500	70.8	0.25	423
2/1/22 10:37 AM	LBSM2	2,000	5,700	3,700	70.8	0.25	209
2/1/22 11:55 AM	LBSM3	2,000	7,600	5,600	70.9	0.25	316
3/24/22 10:23 AM	LBSM1	2,000	13,200	11,200	51.0	0.25	879
3/24/22 10:08 AM	LBSM2	2,000	7,600	5,600	51.0	0.25	439
3/24/22 10:40 AM	LBSM3	2,000	7,600	5,600	50.9	0.25	440
Average							**620**

Table 4-4 - Volume of Water and YSI Field Measurements for Lake Buchanan Seepage Meters

Parameters	Count	Mean	Geometric Mean	Minimum	Maximum	Standard Deviation	Coefficient of Variation (%)
Temperature (C°)	17	24.8	24.1	15.3	32.5	5.7	22.9
Dissolved Oxygen (%)	17	58.0	57.1	39.4	79.8	10.8	18.6
Dissolved Oxygen (mg/L)	17	4.9	4.7	3.0	6.9	1.2	24.0
Specific Conductance (µS/cm)	17	257	213	79	562	166.9	64.9
pH (STU)	17	7.5	7.5	7.0	8.0	0.3	4.1
Volume (L)	17	8.5	5.6	0.5	43.8	10.1	119.9

Source: Wood (June 2021 – March 2022)

Table 4-5A - Hydrologic Inputs to Lake Buchanan

Hydrologic Input	ac-ft/yr	% Input
Stormwater Runoff	235.0	52.2
Direct Precipitation	201.0	44.7
Groundwater Seepage	13.8	3.1
Total	**449.8**	**100.0**

Table 4-5B - Hydrologic Outputs from Lake Buchanan

Hydrologic Output	ac-ft/yr	% Output
Discharge (to drain well or control structure)	231.7	51.5
Evaporation	186.6	41.5
Groundwater Recharge	31.5	7.0
Total	**449.8**	**100.0**

Table 5-1 - Lake Buchanan Sub-Basin TN, TP, and TSS EMCs

Sub-Basin	EMC Method	TN EMC (mg/L)	TP EMC (mg/L)	TSS EMC (mg/L)
LB-005	Composite Literature	0.86	0.12	17.9
LB-010	Composite Literature	0.86	0.12	17.9
LB-015	Site Specific	1.58	0.10	16.7
LB-020	Composite Literature	1.72	0.43	7.8
LB-025	Composite Literature	1.91	0.48	77.9
LB-030	Composite Literature	1.91	0.48	77.9
LB-035	Composite Literature	1.91	0.48	77.9
LB-040	Composite Literature	1.91	0.48	77.9
LB-045	Composite Literature	1.72	0.43	7.8
LB-050	Site Specific	1.60	0.33	29.2
LB-065	Composite Literature	1.72	0.43	7.8
LB-070	Composite Literature	1.91	0.48	77.9
LB-080	Composite Literature	1.91	0.48	77.9
LB-085	Composite Literature	1.22	0.09	77.9
LB-090	Composite Literature	1.91	0.48	14.7
LB-095	Composite Literature	1.91	0.48	77.9
LB-110	Composite Literature	1.44	0.21	76.1
LB-115	Composite Literature	1.27	0.18	34.4
LB-120	Composite Literature	1.28	0.18	17.9
LB-125	Composite Literature	1.91	0.48	17.9
LB-130	Composite Literature	1.83	0.45	77.9
LB-135	Composite Literature	0.86	0.07	17.9

Table 5-2 – Stormwater Water Quality Summary Data for Lake Buchanan Autosamplers

Buchanan DW				
Parameter	**Average**	**Minimum**	**Maximum**	**Standard Deviation**
Ammonia (mg/L)	0.177	0.044	0.500	0.165
Nitrate + Nitrite (mg/L)	0.075	0.015	0.270	0.097
Orthophosphate (mg/L)	0.051	0.021	0.096	0.034
TKN (mg/L)	1.17	0.93	1.60	0.27
TN (mg/L)	1.23	0.97	1.80	0.34
TP (mg/L)	0.120	0.072	0.170	0.037
TSS (mg/L)	5.5	2.5	11.6	3.68
Buchanan Palmetto				
Parameter	**Average**	**Minimum**	**Maximum**	**Standard Deviation**
Ammonia (mg/L)	0.167	0.042	0.39	0.168
Nitrate + Nitrite (mg/L)	0.375	0.13	0.710	0.259
Orthophosphate (mg/L)	0.269	0.093	0.540	0.212
TKN (mg/L)	1.31	0.54	2.20	0.65
TN (mg/L)	1.68	0.67	2.90	0.89
TP (mg/L)	0.420	0.170	0.760	0.268
TSS (mg/L)	29.2	16.0	48.9	12.1
All Stations, Combined				
Parameter	**Average**	**Minimum**	**Maximum**	**Standard Deviation**
Ammonia (mg/L)	0.172	0.042	0.500	0.158
Nitrate + Nitrite (mg/L)	0.225	0.015	0.710	0.243
Orthophosphate (mg/L)	0.160	0.021	0.540	0.183
TKN (mg/L)	1.23	0.54	2.20	0.482
TN (mg/L)	1.46	0.67	2.90	0.682
TP (mg/L)	0.270	0.072	0.760	0.240
TSS (mg/L)	17.3	2.5	48.9	15.0

Table 5-3 - TN, TP, and TSS Loading to Lake Buchanan by Sub-Basin

Sub-Basin	Estimated Existing Annual TN Load (lb)	% of Total TN Load	Estimated Existing Annual TP Load (lb)	% of Total TP Load	Estimated Existing Annual TSS Load (lb)	% of Total TSS Load
LB-005	27.12	2.64	3.87	1.77	565.94	1.72
LB-010	34.74	3.38	4.95	2.26	725.55	2.20
LB-015	86.31	8.40	5.20	2.37	972.06	2.95
LB-020	38.26	3.72	9.61	4.39	173.15	0.53
LB-025	20.60	2.01	5.18	2.36	839.26	2.55
LB-030	41.86	4.07	10.52	4.80	1,705.26	5.17
LB-035	52.07	5.07	13.09	5.97	2,120.88	6.44
LB-040	73.57	7.16	18.49	8.44	2,996.91	9.09
LB-045	19.09	1.86	4.80	2.19	86.40	0.26
LB-050	26.91	2.62	5.55	2.53	1,309.16	3.97
LB-065	20.86	2.03	5.24	2.39	94.39	0.29
LB-070	73.95	7.20	18.58	8.48	3,012.04	9.14
LB-080	7.21	0.70	1.81	0.83	293.72	0.89
LB-085	27.83	2.71	6.99	3.19	1,133.43	3.44
LB-090	3.57	0.35	0.27	0.12	42.90	0.13
LB-095	101.50	9.88	25.51	11.64	4,134.52	12.55
LB-110	126.96	12.36	31.51	14.38	5,266.73	15.98
LB-115	10.24	1.00	1.53	0.70	245.44	0.74
LB-120	42.84	4.17	6.17	2.82	602.19	1.83
LB-125	18.06	1.76	2.58	1.18	253.33	0.77
LB-130	138.41	13.47	34.78	15.88	5,637.99	17.11
LB-135	35.56	3.46	2.87	1.31	746.09	2.26
Total	**1,027.53**	**100.00**	**219.11**	**100.00**	**32,957.34**	**100.00**

Source: Wood

Table 5-4 – Water Quality Data and Loadings from Lake Buchanan Seepage Meters from June 2021 through March 2022

Seepage Meter	Collection Date	Temp °C	DO %	DO mg/L	Specific Conductance µS/cm	pH	Ammonia mg/L	Nitrate-Nitrite mg/L	OP mg/L	TP mg/L	TKN mg/L	TN mg/L	TSS mg/L	TP Seepage Load mg/m2-day	TN Seepage Load mg/m2-day
LBSM1	6/28/21	30.8	79.8	5.9	79	7.9	0.160	0.01	0.012	0.09	0.9	0.9	5.4	0.003	0.030
LBSM2	6/28/21	28.9	53	4.1	214	7.6	4.400	0.60	0.002	0.41	7.5	8.1	36.0	0.178	3.509
LBSM3	6/28/21	32.5	67.7	4.9	169	7.2	1.400	0.18	0.160	0.59	4.6	4.8	26.0	0.118	0.960
LBSM1*	8/26/21	NA	NA	NA	NA	NA	0.005	0.42	0.002	0.14	1.0	1.4	16.0	0.416	4.160
LBSM2	8/2/21	30.9	51.2	3.8	543	7.3	16	15	0.016	0.15	14	28	14	0.086	16.024
LBSM3**	8/2/21	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
LBSM1	9/29/21	29.1	53.8	4.1	110	7.6	0.005	0.48	0.002	0.13	0.8	1.3	16.0	0.073	0.733
LBSM2	9/29/21	29.3	39.4	3	420	7.1	0.720	20.0	0.002	0.46	3.8	24.0	46.0	0.200	10.416
LBSM3	9/29/21	29.4	45.2	3.4	562	7.9	27	0.07	0.880	1.80	29	29	29	0.372	5.993
LBSM1	11/22/21	21.8	52	4.6	147	7.1	0.005	0.27	0.002	0.23	0.9	1.2	16.0	0.446	2.325
LBSM2	11/22/21	21.9	69.5	6.1	271	7.2	0.590	25.0	0.002	0.55	3.4	29.0	24.0	0.382	20.158
LBSM3	11/22/21	21.7	51.1	4.5	441	7.4	22.0	0.21	1.000	1.30	23.0	23.0	18.0	0.356	6.290
LBSM1	2/1/22	15.3	59	5.9	153	7.0	0.018	0.19	0.022	0.32	1.7	1.9	21.1	0.135	0.800
LBSM2	2/1/22	15.4	67.5	6.8	172	7.0	0.290	0.76	0.019	1.90	1.9	2.6	21.4	0.086	0.543
LBSM3	2/1/22	16.2	70.7	6.9	511	7.7	15.7	14.40	0.093	1.60	14.4	0.93	18.3	0.506	8.820
LBSM1	3/24/22	23.2	45.5	3.9	141	8.0	0.058	0.32	0.039	0.69	3.8	4.1	53.2	0.596	3.539
LBSM2	3/24/22	23.2	63	5.4	172	7.6	1.100	0.90	0.041	0.35	3.2	4.1	31.6	0.165	1.930
LBSM3	3/24/22	23.1	63.8	5.4	155	7.5	0.610	1.50	0.390	1.20	2.7	4.1	33.0	0.565	1.932
LBSM1	**Average**	**24.0**	**58.0**	**4.9**	**126**	**7.6**	**3.56**	**0.057**	**0.01**	**0.5**	**1.27**	**1.49**	**17.82**	**0.28**	**1.93**
LBSM2	**Average**	**23.7**	**58.5**	**5.1**	**250**	**7.3**	**7.37**	**9.82**	**0.06**	**0.64**	**5.44**	**15.54**	**25.34**	**0.18**	**8.76**
LBSM3	**Average**	**24.6**	**59.7**	**5.0**	**368**	**7.5**	**13.86**	**7.41**	**3.63**	**3.68**	**14.74**	**12.37**	**21.52**	**0.32**	**4.00**
All Seepage	**Average**	**24.5**	**58.3**	**4.9**	**266**	**7.5**	**8.26**	**5.93**	**1.23**	**1.6**	**7.15**	**9.8**	**21.56**	**0.26**	**4.9**

*No field data available for LBSM1 on 8/26/21

**Seepage meter bag damaged for LBSM3 on 8/2/21 so no sample collected

Source: Wood

Table 5-5 - Lake Buchanan Seepage Meter Stable Isotope Results

Date	Seepage Meter	15N Isotope (‰)	18O Isotope (‰)
11/22/2021	LBSM1	5.08	6.95
	LBSM2	1.62	-26.6
	LBSM3	-8.73	12.5
3/24/2022	LBSM1	3.95	12.6
	LBSM2	-1.08	-12.3
	LBSM3	-0.78	-24.7
5/6/2022	LBSM1	NC	NC
	LBSM2	BM	BM
	LBSM3	0.23	-26.7
7/20/2022	LBSM1	4.94	-37.1
	LBSM2	10.3	-12.0
	LBSM3	7.52	-37.6
8/23/2022	LBSM1	4.08	-28.1
	LBSM2	1.79	-26.0
	LBSM3	-6.15	-30.2
10/11/2022	LBSM1	5.18	-21.8
	LBSM2	4.94	-10.2
	LBSM3	6.72	7.99
	Average	**2.48**	**-15.83**

Note: NC = not collected, BM = below minimum nitrate concentration

Table 5-6 - Annual Lake Buchanan Pollutant Loading Summary by Source

Inputs	TP (lbs/yr)	%	TN (lbs/yr)	%	TSS (lbs/yr)	%
External						
Surface Runoff	219.1	92.8	1,027.5	75.4	32,957.3	100%
Atmospheric Deposition	1.6	0.7	42.9	3.1	---	---
Seepage	15.4	6.5	293.0	21.5	---	---
Total External	**236.1**	**100%**	**1,363.4**	**100%**	**32,957.3**	**100%**
Internal						
Sediment Flux	592	100%	2,360	100%	---	---
Total Internal	**592**	**100%**	**2,360**	**100%**	**---**	**---**

Table 6-1 – BMP Alternative 1 – Recirculating Downflow Filtration Phosphorus Removal for Sub-Basins LB-005, LB-010, and LB-015

Stormwater Runoff					
Existing Condition: Annual Runoff Volume (ac-ft/ year)	**Existing Condition: Annual TP Loading from Runoff (lb/year as P)**	**TP concentration of Runoff (µg/L as P)**	**Proposed BMP: Annual Runoff Volume treated (ac-ft/year)**	**Proposed BMP: Total Annual TP Load Removal from Runoff (lb/yr as P)**	**Remaining TP Load from Runoff (lb/yr as P)**
46.6	10.2	80.0	40.4	8.4	1.8

Lake Water Recirculation				
Recirculation Contact Time (minutes)	**Recirculation Flow Rate (cfm)**	**Annual Recirculation Volume (ac-ft/ year)**	**Lake Buchanan TP Mean Concentration (µg/L as P)**	**Proposed BMP Annual TP removal (lb/yr as P)**
287.7	34.8	210.0	140	77.5

Note: Lake Water Recirculation Removal calculations assume that the system is constantly moving lake water through the filter the entire year. During storm events, the recirculation flow may need to be periodically interrupted since the system will need to treat stormwater runoff.

Additional Annual TP Removal Achieved beyond the Existing Condition (lb/yr as P)
85.9

Table 6-2 – BMP Alternative 1 – Recirculating Downflow Filtration Nitrogen Removal for Sub-Basin LB-050, LB-010, and LB-015

Stormwater Runoff					
Existing Condition: Annual Runoff Volume (ac-ft/ year)	**Existing Condition: Annual TN Loading from Runoff (lb/year as N)**	**TN concentration of Runoff (µg/L as N)**	**Proposed BMP: Annual Runoff Volume treated (ac-ft/year)**	**Proposed BMP: Total Annual TN Load Removal from Runoff (lb/yr as N)**	**Remaining TN Load from Runoff (lb/yr as N)**
46.6	148.2	1,170	40.4	102.5	45.7

Lake Water Recirculation				
Recirculation EBCT (minutes)	**Recirculation Flow Rate (cfm)**	**Annual Recirculation Volume (ac-ft/ year)**	**Lake Buchanan TN Mean Concentration (µg/L as N)**	**Proposed BMP Annual TN removal (lb/yr as N)**
287.7	34.8	210.0	1,490	680.6

Note: Lake Water Recirculation Removal calculations assume that the system is constantly moving lake water through the filter the entire year. During storm events, the recirculation flow may need to be periodically interrupted since the system will need to treat stormwater runoff.

Additional Annual TN Removal Achieved beyond the Existing Condition (lb/yr as N)
783.1

Table 6-3 – Cost Estimate: BMP Alternative 1 for Sub-Basin, LB-005, LB-010, and LB-015

	Wet Detention with IFGEM Shelf filter						
	Cost Reference						
Description	**FDOT Item # (as of 2022/05/23)**	**Quote**	**Description per Reference**	**Quantity**	**Unit**	**Unit Price (includes install unless otherwise stated)**	**Estimated Costs**
Upflow filter water distribution.	0440 1 50	NA		287	ft	$82	$23,597
Pond skimmer drains to here. Lake remediatior	0425 2 41	NA		1	Each	$6,491	$6,491
Discharge structure for upflow BAM wetland.	0425 1541	NA		1	Each	$5,432	$5,432
Modify existing structures	0425 11	NA		1	Each	$1,871	$1,871
floating skimmer from pond to filter	NA	5" Faircloth Skimmer® – Faircloth Skimmer		1	Each	$2,095	$2,095
Install of skimmer from pond to filter	NA	Assumed equal to item cost		1	Each	$2,095	$2,095
Floating skimmer from lake to filter	NA	5" Faircloth Skimmer® – Faircloth Skimmer		1	Each	$2,095	$2,095
Install of skimmer from lake to filter	NA	Assumed equal to item cost		1	Each	$2,095	$2,095
Continuous Flow Water Quality Pump (10 HP), ≈330 gpm ≈44 cfm. (Item Only)	NA	https://www.absolutewaterpumps.com		1	Each	$1,734	$1,734
Continuous Flow Water Quality Pump (10 HP), ≈330 gpm ≈44 cfm (Installation Labor Only)	NA	Assumed equal to item cost		1	Each	$1,734	$1,734
Install Electrical Power Service	0639 1111	NA		1	Each	$2,915	$2,915
Pipes for flow routing from: pond to upflow filter, from upflow filter to lake, from lake to upflow filter (remediationi stream)	0430174112	NA		218	ft	$78	$17,039
Flow regulation valve (vortex valve); rough cost from Contech	NA	Contech		1	Each	$2,100	$2,100
Excavation for BAM filter	0120 1	NA		371	CY	$10	$3,575
Filter media	NA	Ferguson Waterworks		371	CY	$450	$166,871
Delivery of filter media	NA	Ferguson Waterworks		371	CY	$30	$11,125
Install of Filter Media. Assume FDOT Embankment costs	0120 6	NA		371	CY	$13	$4,999
grass/ground cover over BAM filter	0570 1 2	NA		556	sqyd	$3	$1,606
Silt Fence	0104 12	NA		620	Linear foot	$5	$3,367
					CONSTRUCTION SUB-TOTAL		*$262,836*
Mobilization and Demobilization			Mobilization and Demobilization	1	Percentage of Construction Sub-	10%	$26,284
Construction Surveys			Construction Surveys	1	Percentage of Construction Sub-	1.5%	$3,943
					CONSTRUCTION TOTAL		$293,062
Survey and Testing			Survey and Testing	1	Percentage of Construction Sub-	10%	$26,284
Design			Design	1	Percentage of Construction Sub-	20%	$52,567
Permitting			Permitting	1	Percentage of Construction Sub-	2.0%	$5,257
Construction Inspection & Oversight			Construction Inspection & Oversight	1	Percentage of Construction Sub-	5%	$13,142
					ENGINEERING TOTAL		$97,249
			Present Worth of Electricty over 25 years, assum	1	Present Worth Lump Sum	$55,450.20	$55,450
			Present Worth of Water Quality Pump (item only) replacement over 20 years, assuming 4% interest. Life span of pump assumed to be 5	1	Present Worth Lump Sum	$5,827.86	$5,828
			Present Worth of Water Quality Pump (labor only) replacement over 20 years, assuming 4% interest. Life span of pump assumed to be 5	1	Present Worth Lump Sum	$5,827.86	$5,828
					OPERATING COST TOTAL (30 years with 4% interest)		$67,106
Contingency			Contingency	1	Percentage of Construction+ Engineering+Operating Totals	35%	$160,095.86
					ESTIMATED TOTAL COSTS		**$550,407**

Table 6-4 – BMP Alternative 2 - Wet Detention + Recirculating BAM Downflow Filtration Phosphorus Removal for Sub-Basins LB-110, LB-115, LB-120, LB125, LB130, and LB-135

Wet Detention Treatment of Stormwater Runoff (Sub-Basins LB-110 and LB-130)					
Existing Condition: Annual Runoff Volume (ac-ft/ year)	**Existing Condition: Annual TP Loading from Runoff (lb/year as P)**	**TP concentration of Runoff (µg/L as P)**	**Proposed BMP: Annual Runoff Volume treated (ac-ft/year)**	**Proposed BMP: Total Annual TP Load Removal from Runoff (lb/yr as P)**	**Remaining TP Load from Runoff (lb/yr as P)**
52.1	66.3	210 to 450	52.1	42.4	37.0
Downflow BAM Filter Treatment of Stormwater Runoff (Sub-Basins LB-110, LB-115, LB-120, LB-125, LB-130, and LB-135)					
Existing Condition: Annual Runoff Volume (ac-ft/ year)	**Existing Condition: Annual TP Loading from Runoff (lb/year as P)**	**TP concentration of Runoff (µg/L as P)**	**Proposed BMP: Annual Runoff Volume treated (ac-ft/year)**	**Proposed BMP: Total Annual TP Load Removal from Runoff (lb/yr as P)**	**Remaining TP Load from Runoff (lb/yr as P)**
75.4	79.4	20	75.4	3.0	34.0

Downflow BAM Filter Lake Water Recirculation				
Recirculation EBCT (minutes)	**Recirculation Flow Rate (cfm)**	**Annual Recirculation Volume (ac-ft/ year)**	**Lake Buchanan TP Mean Concentration (µg/L as P)**	**Proposed BMP Annual TP removal (lb/yr as P)**
287.7	34.8	210.0	140	159.8

Additional Annual TP Removal Achieved beyond the Existing Condition (lb/yr as P)
205.3

Table 6-5 – BMP Alternative 2 - Wet Detention + Recirculating BAM Downflow Filtration Nitrogen Removal for Sub-Basins LB-110, LB-115, LB-120, LB125, LB130, and LB-135

Wet Detention Treatment of Stormwater Runoff (Sub-Basins LB-110 and LB-130)					
Existing Condition: Annual Runoff Volume (ac-ft/ year)	**Existing Condition: Annual TN Loading from Runoff (lb/year as N)**	**TN concentration of Runoff (µg/L as N)**	**Proposed BMP: Annual Runoff Volume treated (ac-ft/year)**	**Proposed BMP: Total Annual TN Load Removal from Runoff (lb/yr as N)**	**Remaining TN Load from Runoff (lb/yr as N)**
52.1	265.4	1,440 to 1,830	52.1	93.5	171.9
Downflow BAM Filter Treatment of Stormwater Runoff (Sub-Basins LB-110, LB-115, LB-120, LB-125, LB-130, and LB-135)					
Existing Condition: Annual Runoff Volume (ac-ft/ year)	**Existing Condition: Annual TP Loading from Runoff (lb/year as N)**	**TN concentration of Runoff (µg/L as N)**	**Proposed BMP: Annual Runoff Volume treated (ac-ft/year)**	**Proposed BMP: Total Annual TN Load Removal from Runoff (lb/yr as N)**	**Remaining TN Load from Runoff (lb/yr as N)**
75.4	372.1	120	75.4	19.4	259.2

Downflow BAM Filter Lake Water Recirculation				
Recirculation EBCT (minutes)	**Recirculation Flow Rate (cfm)**	**Annual Recirculation Volume (ac-ft/ year)**	**Lake Buchanan TN Mean Concentration (µg/L as N)**	**Proposed BMP Annual TN removal (lb/yr as N)**
287.7	34.8	210.0	1,490	1,402.7

Additional Annual TN Removal Achieved beyond the Existing Condition (lb/yr as N)
1,516

Table 6-6 – Cost: BMP Alternative 2 for Sub-Basin LB-110, LB-115, LB-120, LB125, LB-130, and LB-135

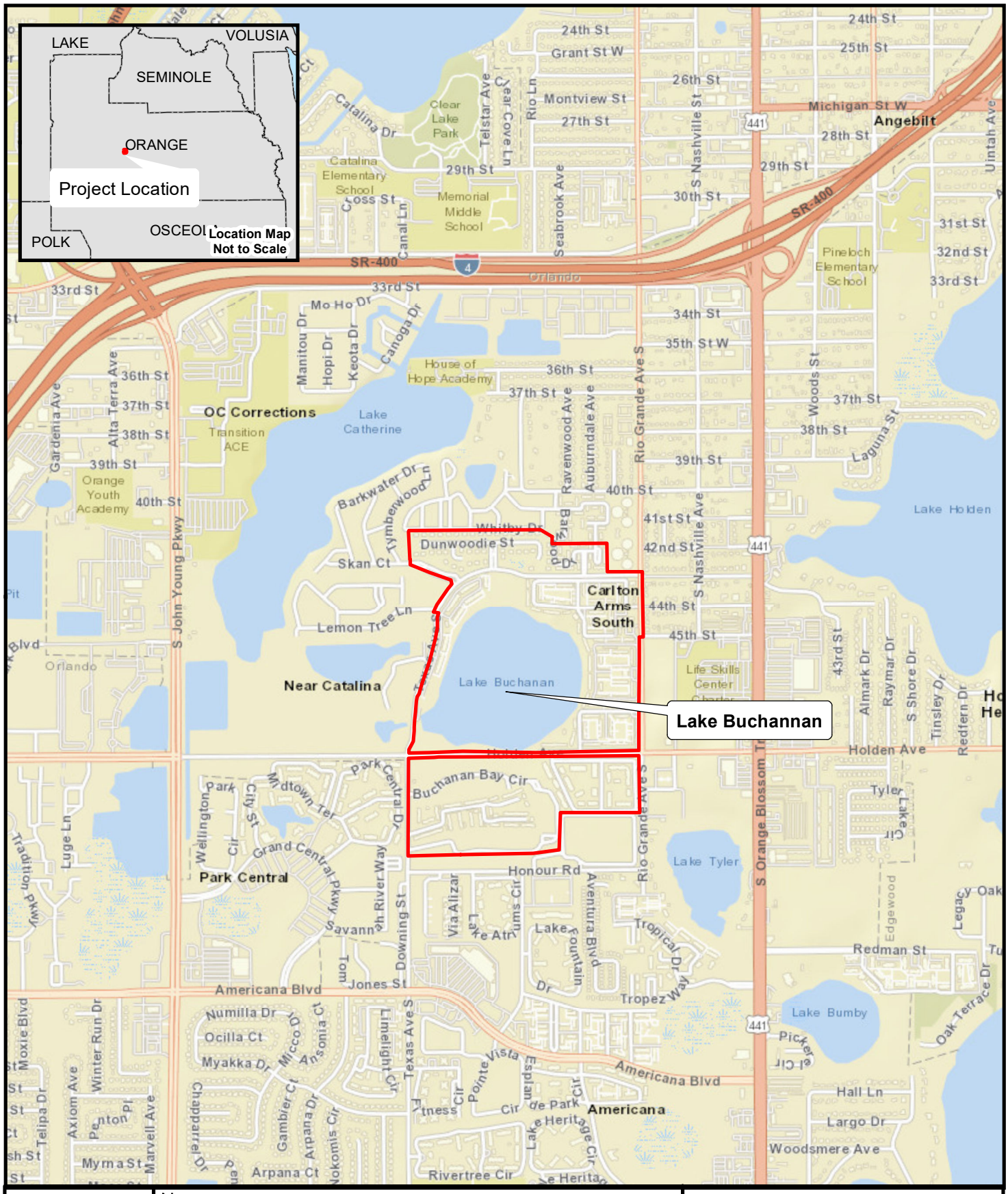
	Wet Detention with IFGEM filter					
	Cost Reference					
Usage Description	**FDOT Item # (as of 2022/05/23)**	**Quote**	**Quantity**	**Unit**	**Unit Price (includes install unless otherwise stated)**	**Estimated Costs**
Upflow filter water distribution system and media install	0440 1 50	NA	468	ft	$82	$38,438
from wet det ponds to upflow BAM wetland	0425 2 71	NA	3	Each	$9,775	$29,325
Pond skimmer flows to here. Lake remediation stream also flows to here. It provides the standpipe head for upflow filter stacks here	0425 2 41	NA	1	Each	$6,491	$6,491
discharge from upflow filter/upflow BAM wetland	0425 1541	NA	1	Each	$5,432	$5,432
Modify existing structures	0425 11	NA	4	Each	$1,871	$7,483
floating skimmer from pond to filter	NA	5" Faircloth Skimmer® – Faircloth Skimmer	1	Each	$2,095	$2,095
Install of skimmer from pond to filter	0	Assume equal to item cost	1	Each	$2,095	$2,095
floating skimmer from lake to filter	NA	5" Faircloth Skimmer® – Faircloth Skimmer	1	Each	$2,095	$2,095
Install of skimmer from lake to filter	0	assume equal to item cost	1	Each	$2,095	$2,095
Continuous Flow Water Quality Pump (5 HP), ≈550 gpm ≈88 cfm. (Item Only)	NA	Absolute Water Pumps; model 60400844	1	EAch	$5,358	$5,358
Continuous Flow Water Quality Pump (5 HP), ≈550 gpm ≈88 cfm. (Installation Labor Only)	NA	Assumed equal to item cost	1	Each	$5,332	$5,332
ELECTRICAL POWER SERVICE, F&I, OVERHEAD, METER FURNISHED BY POWER COMPANY	0639 1111	NA	1	Each	$2,915	$2,915
Pipes for flow routing from lake to upflow/downflow filter for remediation stream	0430174112	NA	209	ft	$78	$16,335
Pipes for flow routing from pond to upflow/downflow filter, from upflow filter to lake, from exisiting outfalls to LB-115 to new locations in LB-115	0430175124	NA	414	ft	$113	$46,985
Flow regulation valve (vortex valve); rough cost from Contech	NA	Contech	1	Each	$2,100	$2,100
Excavation for BAM filter	0120 1	NA	764	CY	$10	$7,368
Excavation for new or modified Wet Detention Pond	0120 1	NA	7887	CY	$10	$76,026
Filter media	NA	Ferguson Waterworks (2022/06/01)	764	CY	$450	$343,932
delivery of filter media	NA	Ferguson Waterworks (2022/03/17)	764	CY	$30	$22,929
grass/ground cover over BAM filter (v	0570 1 2	NA	1146	sqyd	$3	$3,313
Silt Fence	0104 12	NA	2252	Linear foot	$5	$12,228
				CONSTRUCTION SUB-TOTAL		*$640,372*
			1	Percentage of Construction Sub-Total	10%	$64,037
			1	Percentage of Construction Sub-Total	1.5%	$9,606
					CONSTRUCTION TOTAL	$714,015
Survey and Testing			1	Percentage of Construction Sub-Total	10%	$64,037
Design			1	Percentage of Construction Sub-Total	20%	$128,074
Permitting			1	Percentage of Construction Sub-Total	2.0%	$12,807
Construction Inspection & Oversight			1	Percentage of Construction Sub-Total	5%	$32,019
					ENGINEERING TOTAL	$236,938
Present Worth of Electricty over 25 years, assuming 4% interest			1	Present Worth Lump Sum	$27,725.10	$27,725
Present Worth of Water Quality Pump (item & labor) replacement over 25 years, assuming 4% interest. Life span of pump assumed to be 5 years.			1	Present Worth Lump Sum	$11,655.73	$11,656
Lifetime Present Worth of Wetland Maintenance			1	Present Worth Lump Sum	$253,494.79	$253,495
				OPERATING COST TOTAL based on 25 year lifespan with 4% interest		$292,876
Contingency			1	Percentage of Construction+ Engineering+Operating Totals	35%	$435,339.85
					ESTIMATED TOTAL COSTS	**$1,679,168**

Table 6-7 - Summary Cost Benefit for Conceptual Alternatives

Alternative	BMP Name	25-year TN Reduction (lbs)	25-year TP Reduction (lbs)	25-Year Cost ($)	Cost ($) per lb TN Removed	Cost ($) per lb TP Removed
Alternative 1	LB-015 Downflow	19,575	2,150	$550,407	$28	$256
Alternative 2	LB-115 Wet Pond and Downflow	37,900	5,133	$1,679,168	$44	$327
Alternative 3	Stormwater Bioswales	4,830	1,408	$973,325	$201	$588
Alternative 4[1]	Public Education	1,550	230	$40,000	$26	$174
Alternative 5[1]	Sediment Nutrient Inactivation	---	3,722	$740,795	---	$199
Alternative 6[1]	Aquatic Plant Harvesting	2,250	225	$30,000	$16	$156
Alternative 9	Natural Attenuation	---	---	---	---	---

Alternatives 4, 5, and 6 are one-time costs with no operation and maintenance

FIGURES



Notes:

1- Project No.:600713x2

2- Data Source - ESRI StreetMap

3- This map is intended to be used for planning purposes only. It is not a survey.

Date: 4/12/22
Created By:ZL
Checked By:

N

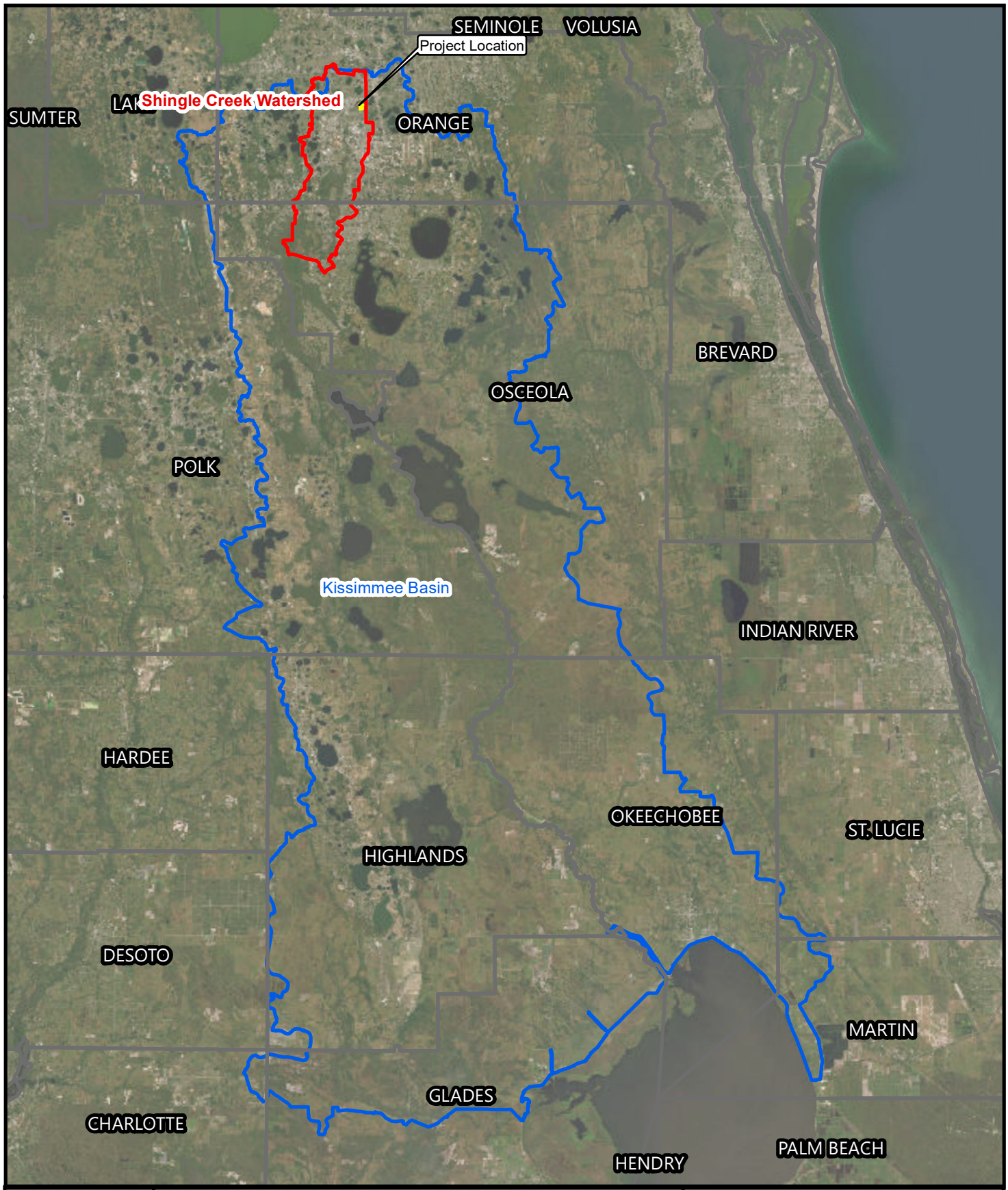
Explanation of Features

Lake Buchanan Basin

0 1,160
Feet

Figure 1-1
Location Map
Lake Buchanan Basin
Orange County, Florida

wsp



Notes:

1- Project No.:600713x2

2- Data Source - ESRI Imagery, SFWMD

3- This map is intended to be used for planning purposes only. It is not a survey.

Date: 9/28/22
Created By:ZL
Checked By: CL

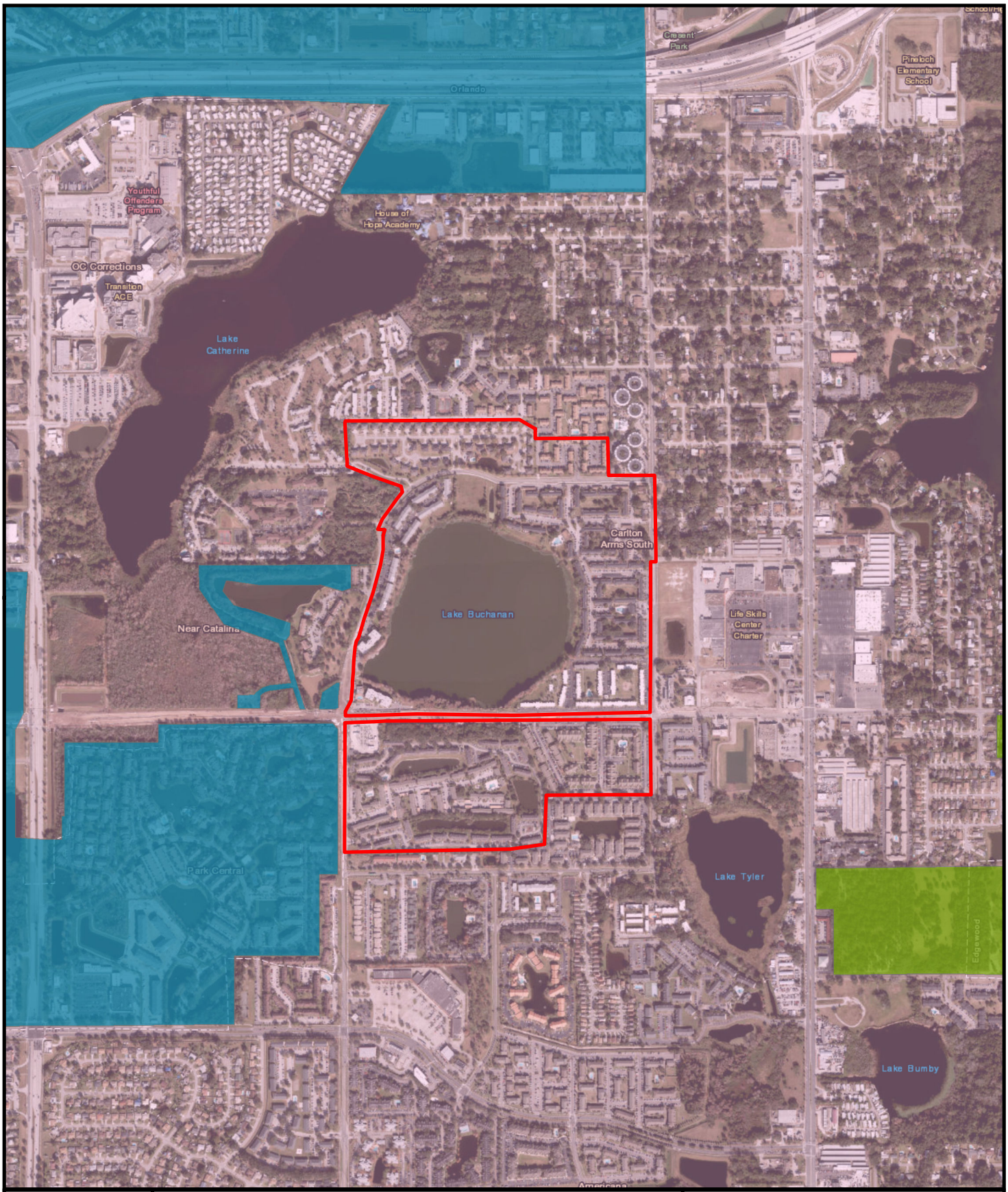
N

Explanation of Features

- Lake Buchanan Basin
- Shingle Creek Basin
- Kissimmee Basin

0 12
Miles

Figure 1-2
Kissimmee Basin
Orange County, Florida



Notes:

1- Project No.:600713x2

2- Data Source - ESRI Imagery SFWMD, Wood

3- This map is intended to be used for planning purposes only. It is not a survey.

Date: 9/28/22
Created By:ZL
Checked By: CL

N

Explanation of Features

- Lake Buchanan Basin
- Edgewood City Limits
- Orlando City Limits
- Unincorporated Orange County

0 940
Feet

Figure 1-3
Lake Buchanan Basin
Jurisdictional Map
Orange County, Florida

wsp

Figure 2-1 - Aerial Photographs of Lake Buchanan from 1954, 1969 and 1980

1954 **1969** **1980**

Source: **University of Florida Digital Collections**

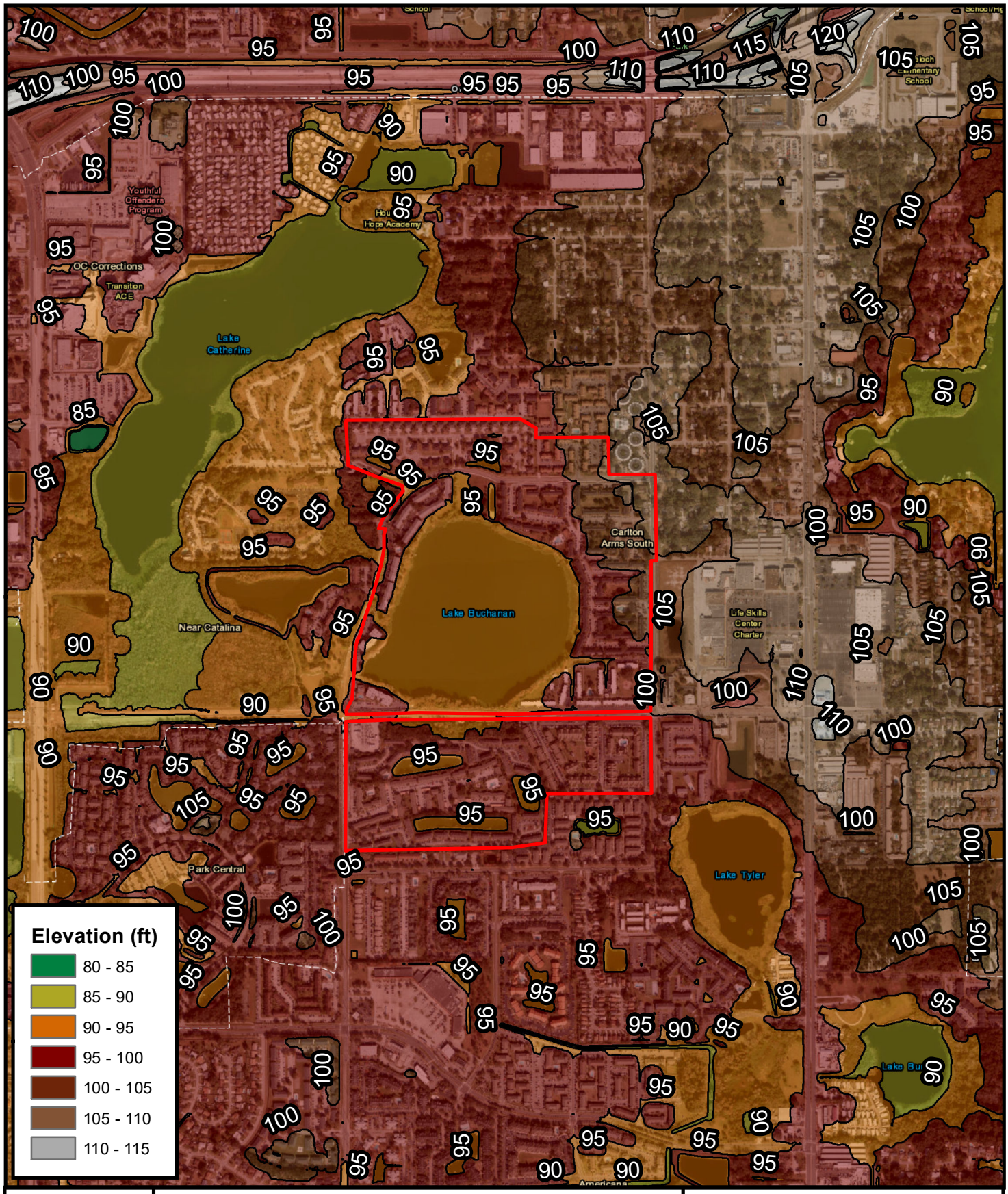
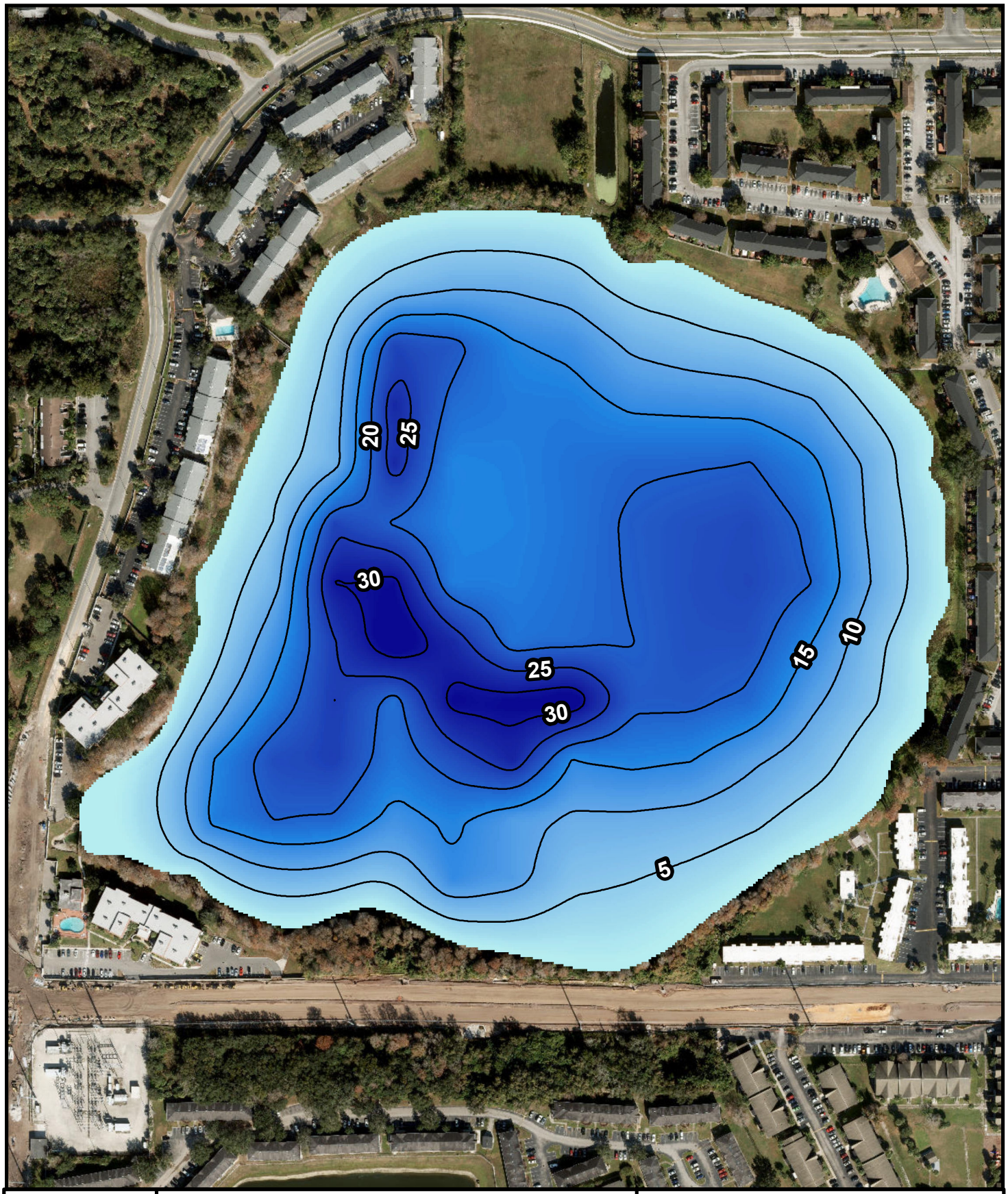


Figure 2-2
Digital Elevation Model (DEM)
Lake Buchanan
Orange County, Florida



Notes:

1- Project No.: 600713x2

2- Data Source - Wood BFA, ESRI

3- This map is intended to be used for planning purposes only. It is not a survey.

Date: 9/28/22
Revised: ZL
Checked By: CL

N

Explanation of Features

Water Depth (ft)

High : 34.55

Low : 0

Water Depth Contours (ft)

Surface to the top of the soft sediment

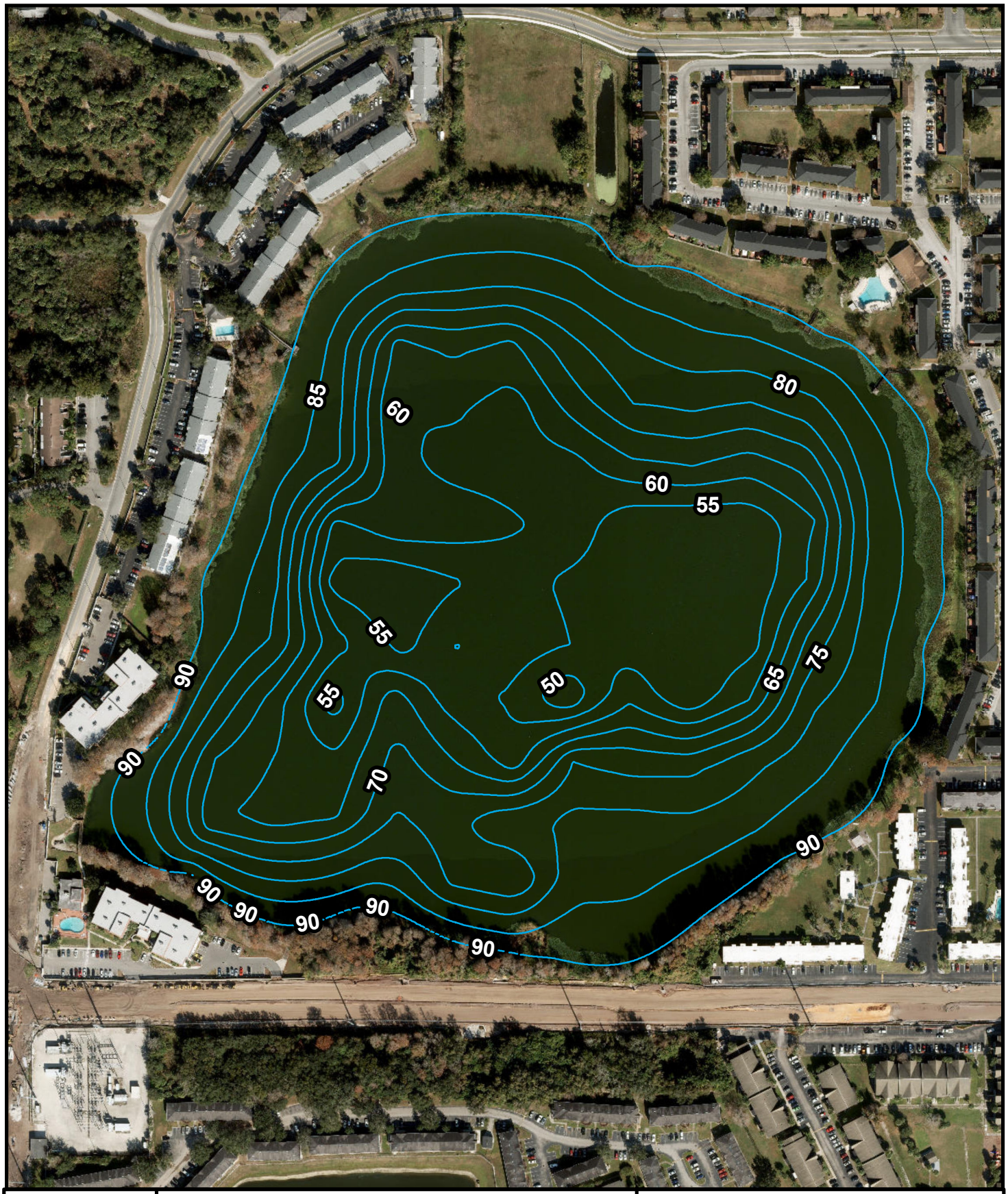
0 220

Feet

Figure 2-3
Lake Buchanan
Water Depth
Orange County, Florida

wsp

Path: C:\Users\lance.lumbard\Wood PLC\Orlando Water - Lake Buchanan\13_GIS\MXD\Fig2-3 BuchananLake_WaterDepth.mxd



Notes:

1- Project No.: 600713x2

2- Data Source - Wood BFA, ESRI

3- This map is intended to be used for planning purposes only. It is not a survey.

Date: 9/28/2022
Revised: ZL
Checked By: CL

N

Explanation of Features

Bathymetric Contours (ft)

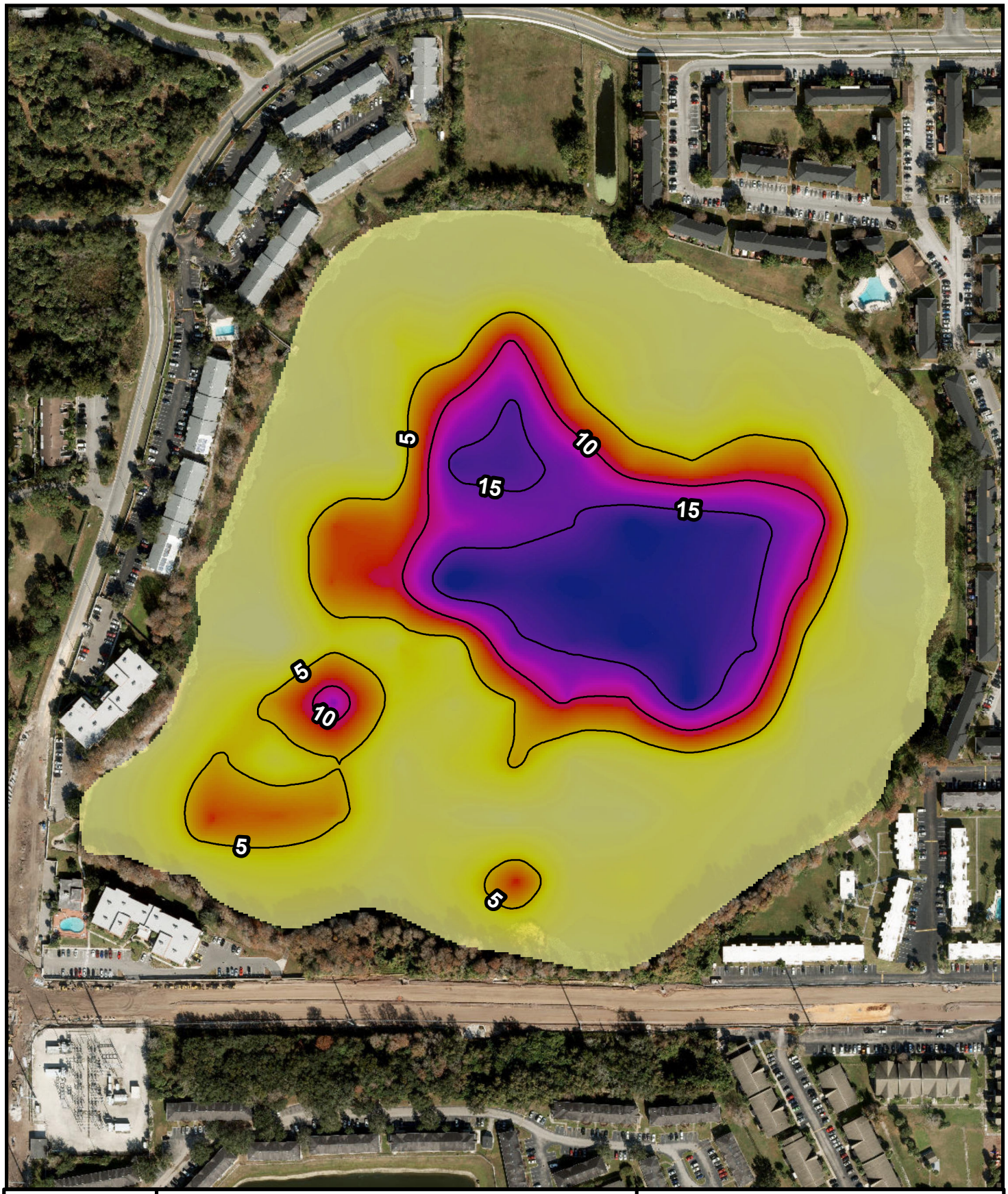
Top of Water: 90.44 ft
Surface to the hard bottom

0 220
Feet

Figure 2-4
Lake Buchanan
Bathymetric Elevation
Orange County, Florida

WSP

Path: C:\Users\lance.lumbard\Wood PLC\Orlando Water - Lake Buchanan\13_GIS\MXD\Fig2-4 BuchananLake_bathymetric.mxd



Notes:

1- Project No.: 600713x2

2- Data Source - Wood BFA, ESRI

3- This map is intended to be used for planning purposes only. It is not a survey.

Date: 9/28/2022
Revised: ZL
Checked By: CL

N

Explanation of Features

Thickness (ft) —— 5ft Contours

High : 19.7

Low : 0

Note that soft sediment thickness is top of soft bottom minus hard bottom

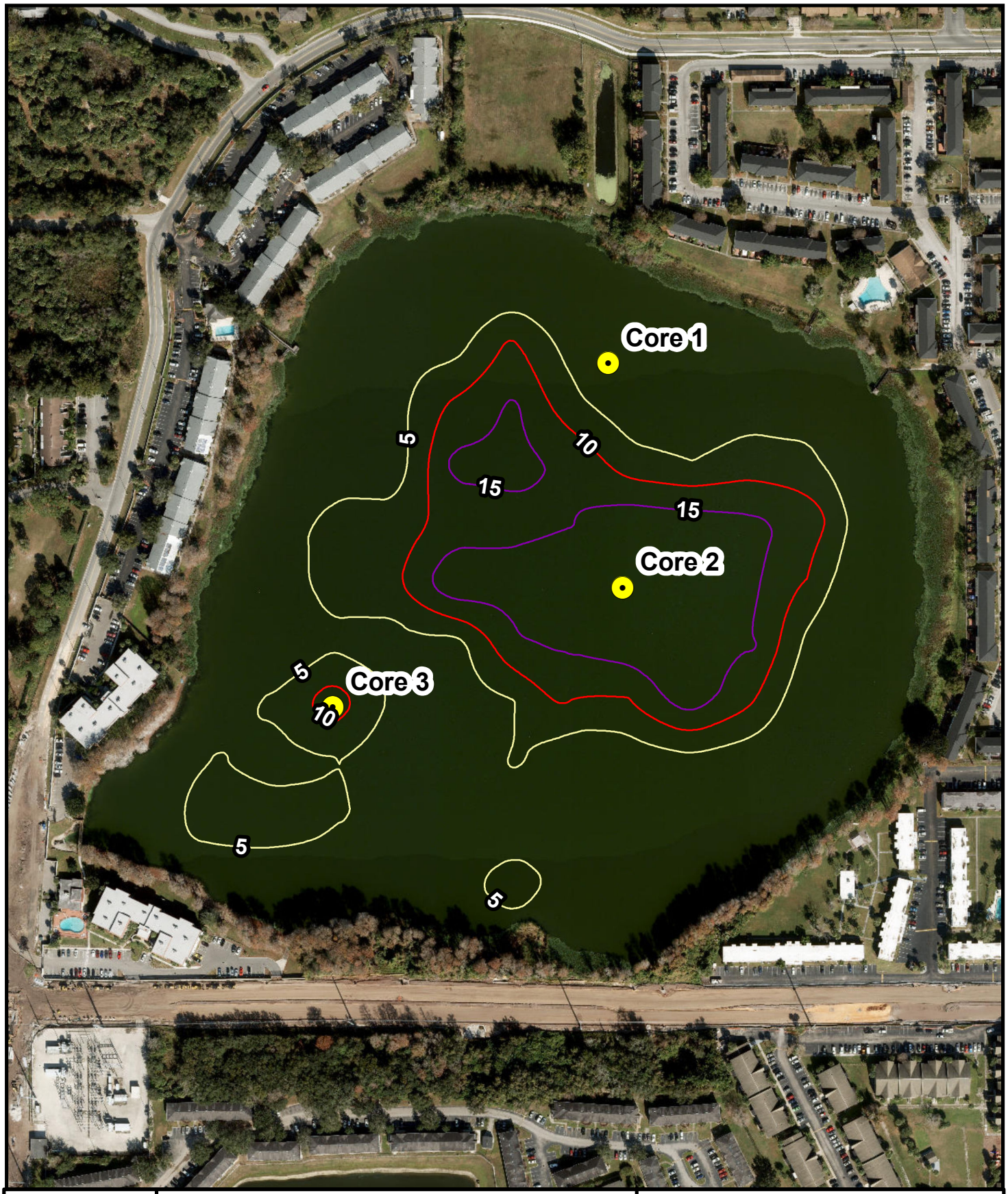
0 220

Feet

Figure 2-5
Lake Buchanan
Soft Sediment Thickness
Orange County, Florida

wsp

Path: C:\Users\lance.lumbard\Wood PLC\Orlando Water - Lake Buchanan\13_GIS\MXD\Fig2-5 Buchanan_sediment_thickness.mxd



Notes:

1- Project No.: 600713x2

2- Data Source - Wood BFA, ESRI

3- This map is intended to be used for planning purposes only. It is not a survey.

Date: 9/28/2022
Revised: ZL
Checked By: CL

N

Explanation of Features

Sediment Thickness (ft)

- 0-5
- 5-10
- 10-15

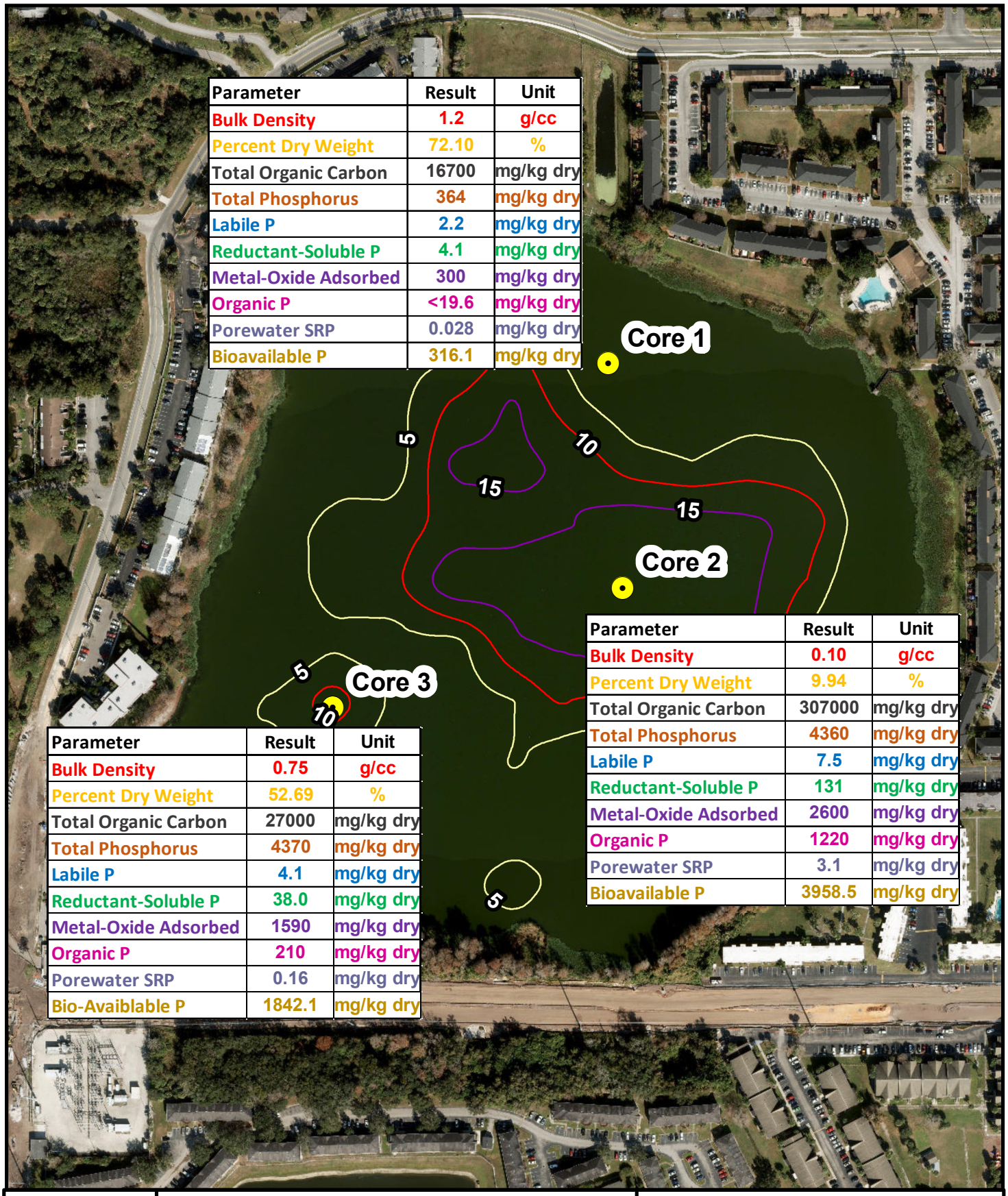
Sediment Sample Location

0 220

Feet

Figure 2-6
Lake Buchanan
Sediment Thickness and Phosphorus Fractionation Sample Locations

Path: C:\Users\lance.lumbard\Wood PLC\Orlando Water - Lake Buchanan\13_GIS\MXD\Fig2-6 BuchananLake_SedimentLocations.mxd



Parameter	Result	Unit
Bulk Density	1.2	g/cc
Percent Dry Weight	72.10	%
Total Organic Carbon	16700	mg/kg dry
Total Phosphorus	364	mg/kg dry
Labile P	2.2	mg/kg dry
Reductant-Soluble P	4.1	mg/kg dry
Metal-Oxide Adsorbed	300	mg/kg dry
Organic P	<19.6	mg/kg dry
Porewater SRP	0.028	mg/kg dry
Bioavailable P	316.1	mg/kg dry

Parameter	Result	Unit
Bulk Density	0.10	g/cc
Percent Dry Weight	9.94	%
Total Organic Carbon	307000	mg/kg dry
Total Phosphorus	4360	mg/kg dry
Labile P	7.5	mg/kg dry
Reductant-Soluble P	131	mg/kg dry
Metal-Oxide Adsorbed	2600	mg/kg dry
Organic P	1220	mg/kg dry
Porewater SRP	3.1	mg/kg dry
Bioavailable P	3958.5	mg/kg dry

Parameter	Result	Unit
Bulk Density	0.75	g/cc
Percent Dry Weight	52.69	%
Total Organic Carbon	27000	mg/kg dry
Total Phosphorus	4370	mg/kg dry
Labile P	4.1	mg/kg dry
Reductant-Soluble P	38.0	mg/kg dry
Metal-Oxide Adsorbed	1590	mg/kg dry
Organic P	210	mg/kg dry
Porewater SRP	0.16	mg/kg dry
Bio-Avaiblable P	1842.1	mg/kg dry

Notes:

1- Project No.: 600713x2

2- Data Source - Wood BFA, ESRI

3- This map is intended to be used for planning purposes only. It is not a survey.

Date: 9/28/2022
Revised: ZL
Checked By: CL

N

Explanation of Features

Sediment Thickness (ft)

- 0-5
- 5-10
- 10-15

Sediment Sample Location

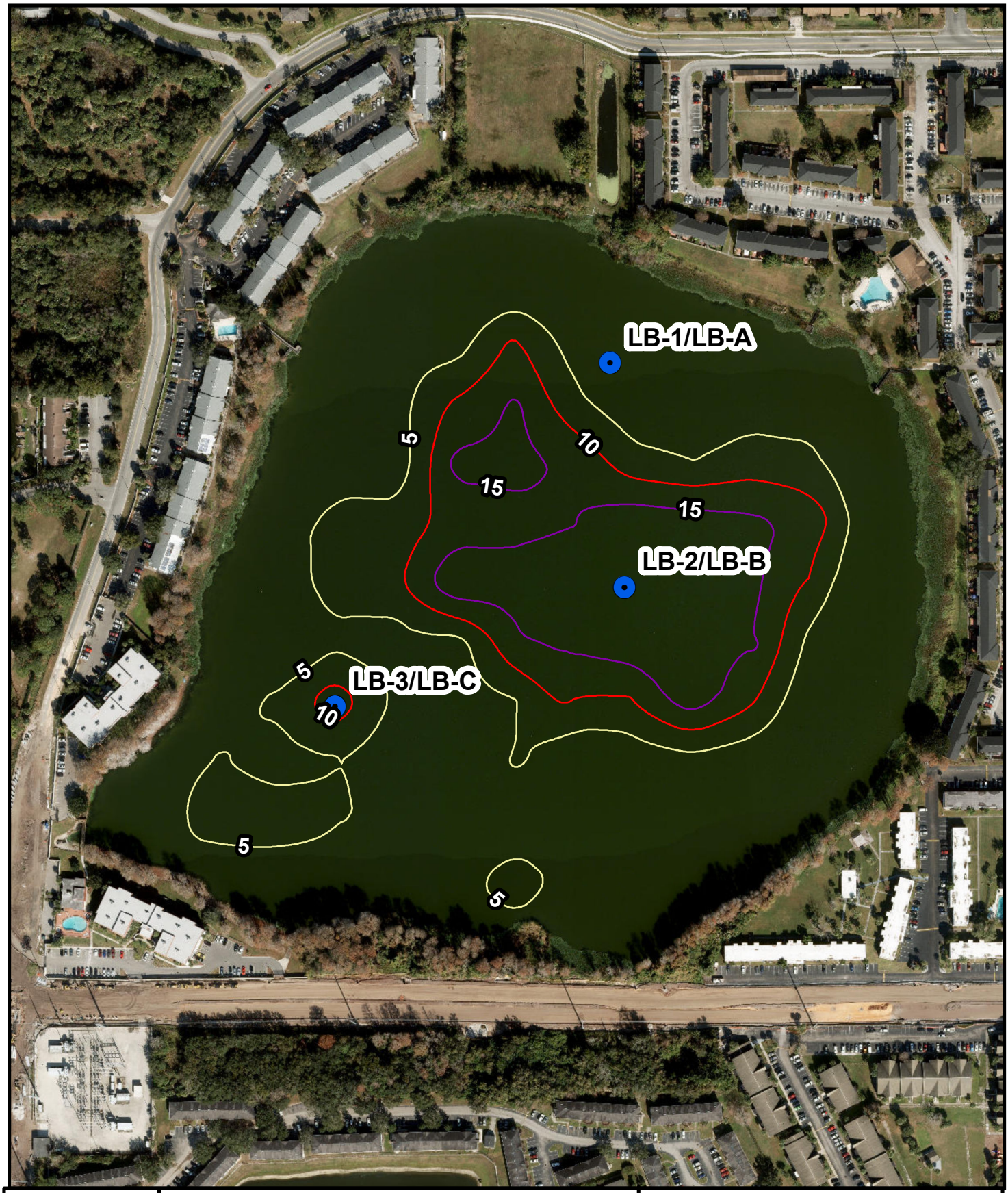
0 220

Feet

Figure 2-7
Lake Buchanan
Sediment Physical Characterization and Phosphorus Fractionation Results

wsp

Path: C:\Users\lance.lumbard\Wood PLC\Orlando Water - Lake Buchanan\13_GIS\MXD\Fig2-7 BuchananLake_SedimentChemistry.mxd



Notes:

1- Project No.: 600713x2

2- Data Source - Wood BFA, ESRI

3- This map is intended to be used for planning purposes only. It is not a survey.

Date: 9/28/2022
Revised: ZL
Checked By: CL

N

Explanation of Features

Sediment Thickness (ft)

- 0-5
- 5-10
- 10-15

Sediment_Flux_Locations

0 220

Feet

Figure 2-8
Lake Buchanan
Sediment Thickness and Sediment Flux Sample Locations

wsp

Path: C:\Users\lance.lumbard\Wood PLC\Orlando Water - Lake Buchanan\13_GIS\MXD\Fig2-8 BuchananLake_FLuxLocations.mxd

Figure 2-9 – Total Phosphorus Concentrations Measured under Anoxic Conditions during Laboratory Incubations of Sediment Cores

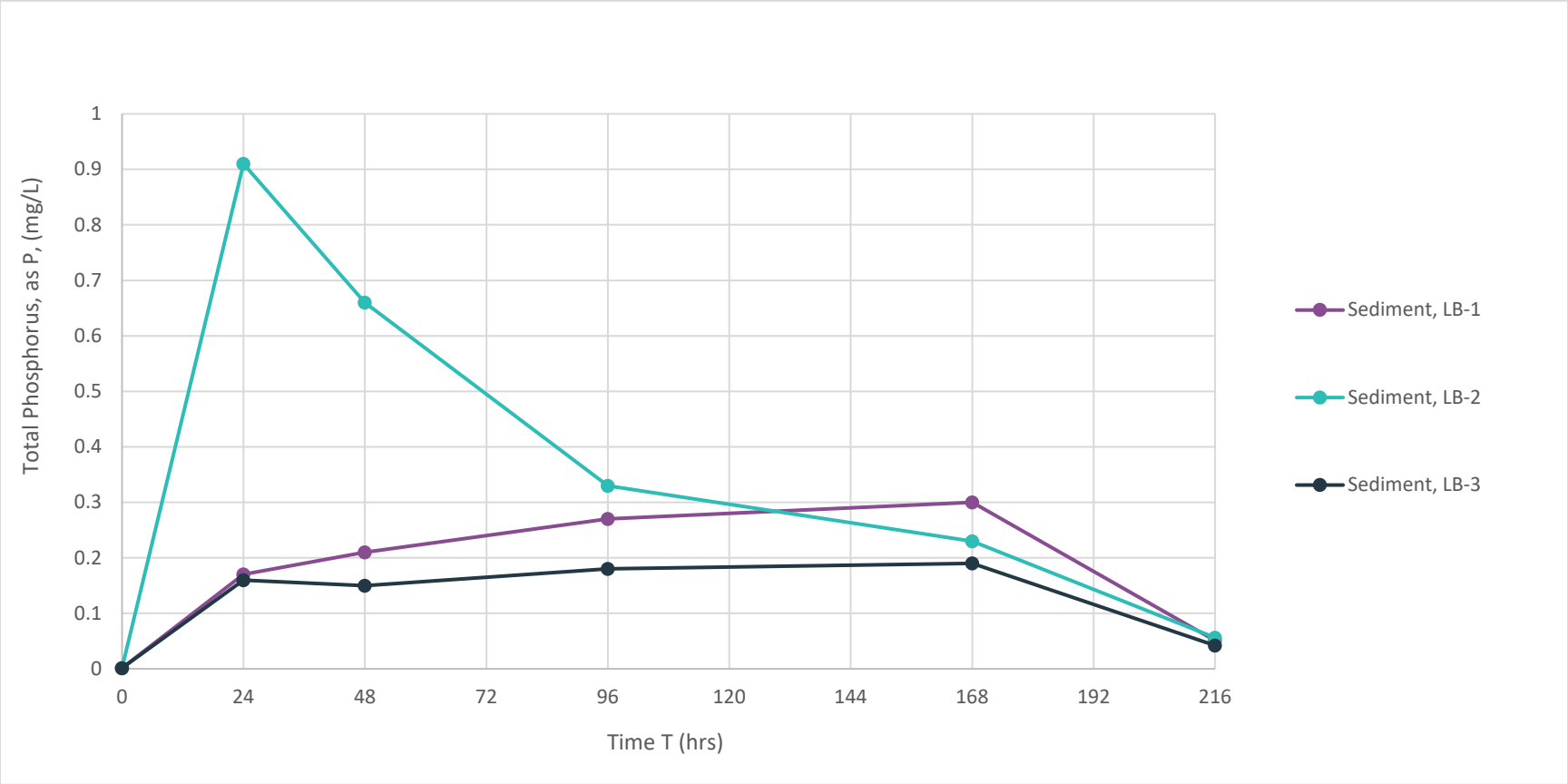


Figure 2-10 – Total Phosphorus Concentrations Measured under Aerobic Conditions during Laboratory Incubations of Sediment Cores

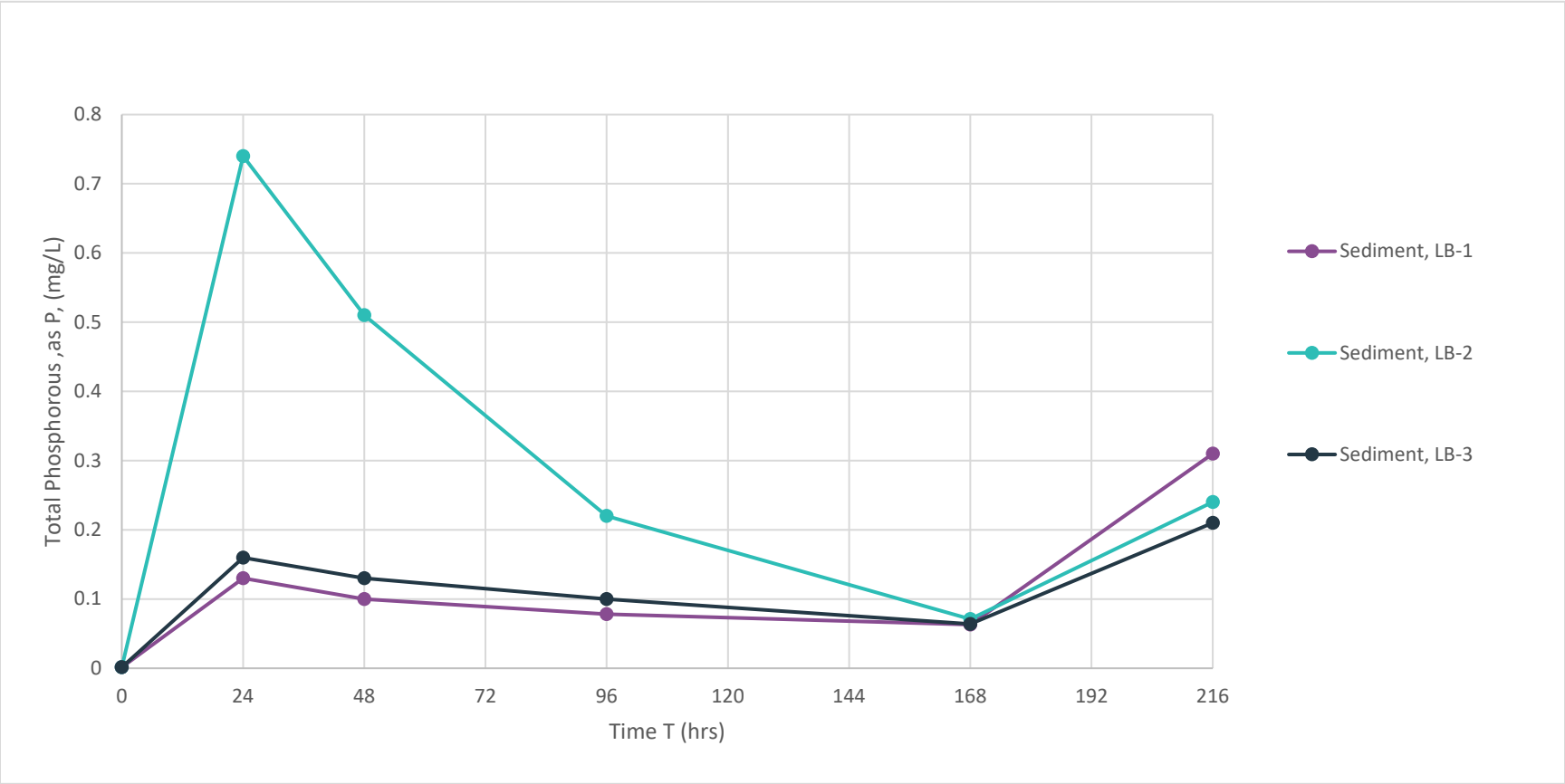


Figure 2-11 – Ammonia Concentrations Measured under Anoxic Conditions during Laboratory Incubations of Sediment Cores

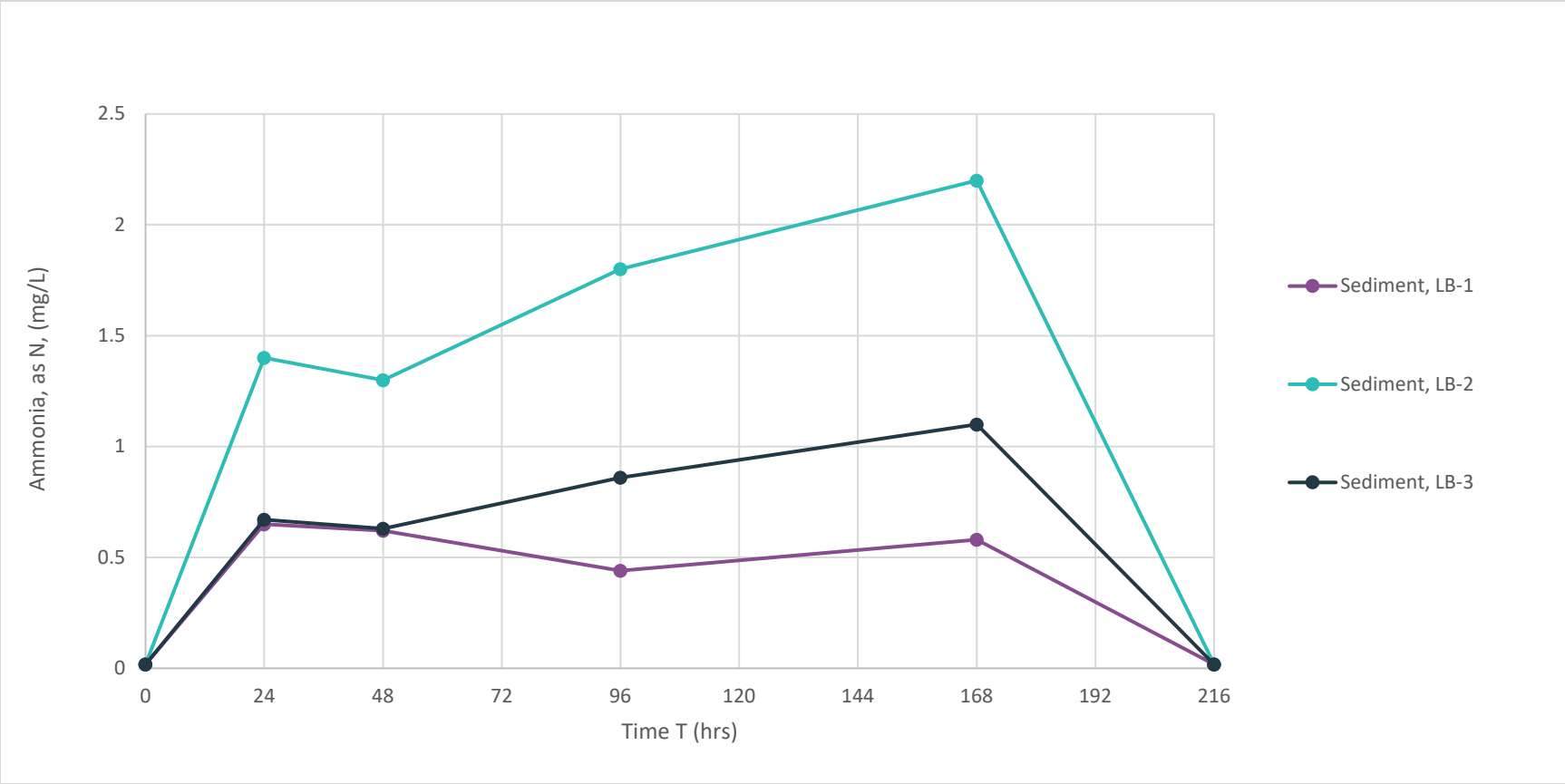
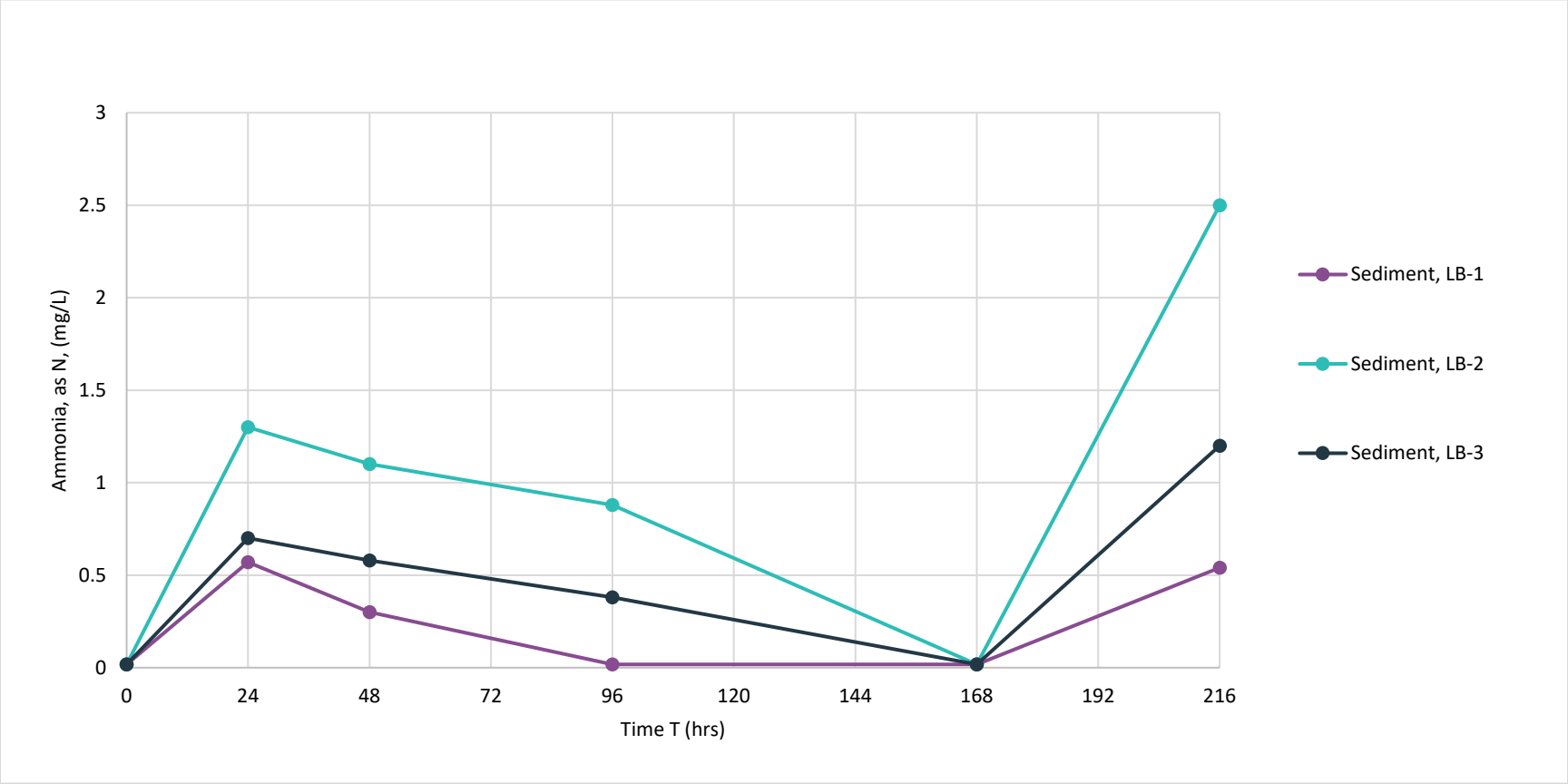
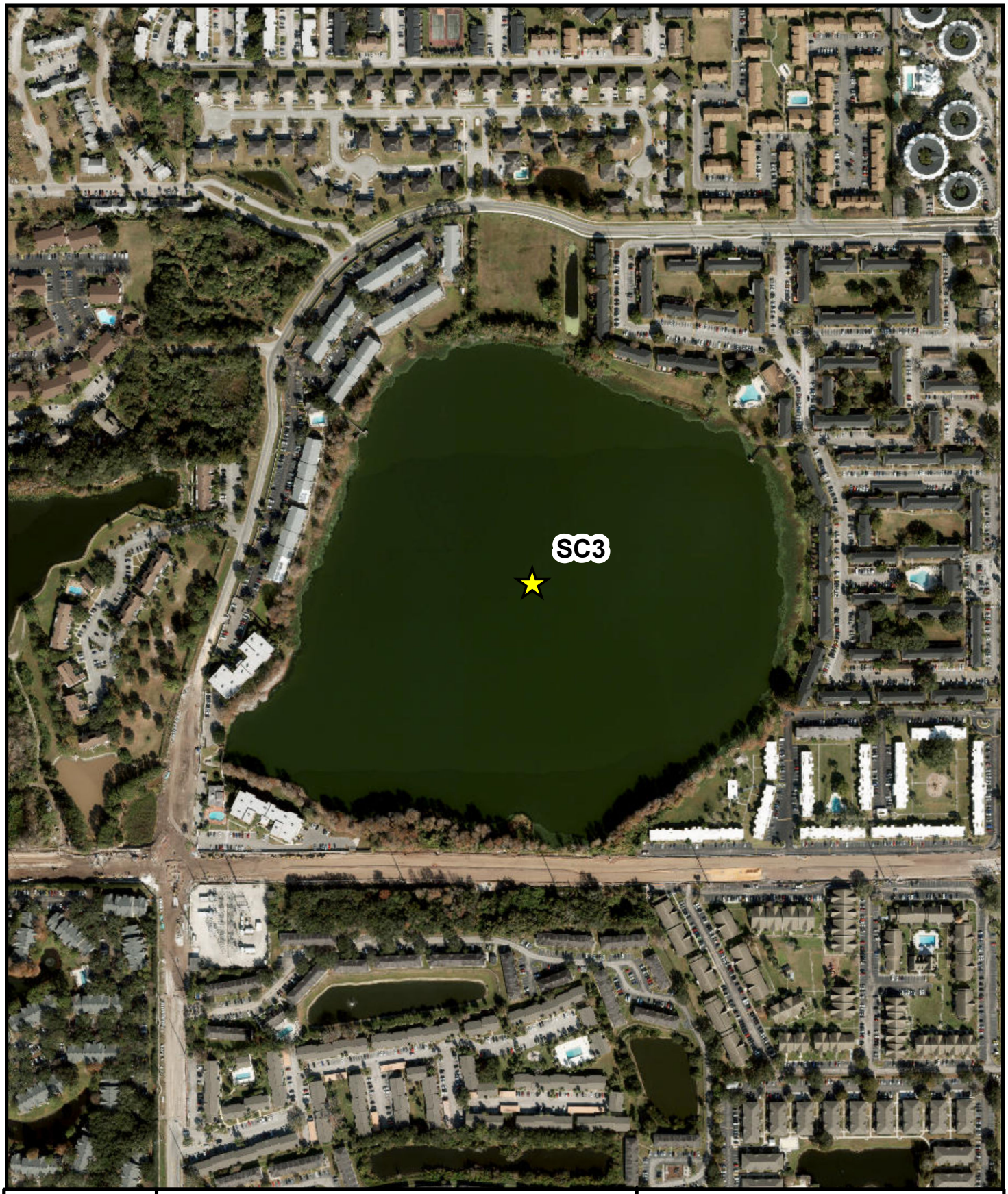


Figure 2-12 – Ammonia Concentrations Measured under Aerobic Conditions during Laboratory Incubations of Sediment Cores





Notes:

1- Project No.: 600713x2

2- Data Source - Wood BFA, ESRI

3- This map is intended to be used for planning purposes only. It is not a survey.

Date: 2/7/2022
Revised: ZL
Checked By:

N

Explanation of Features

Surface Water Quality Sample Location

0 340

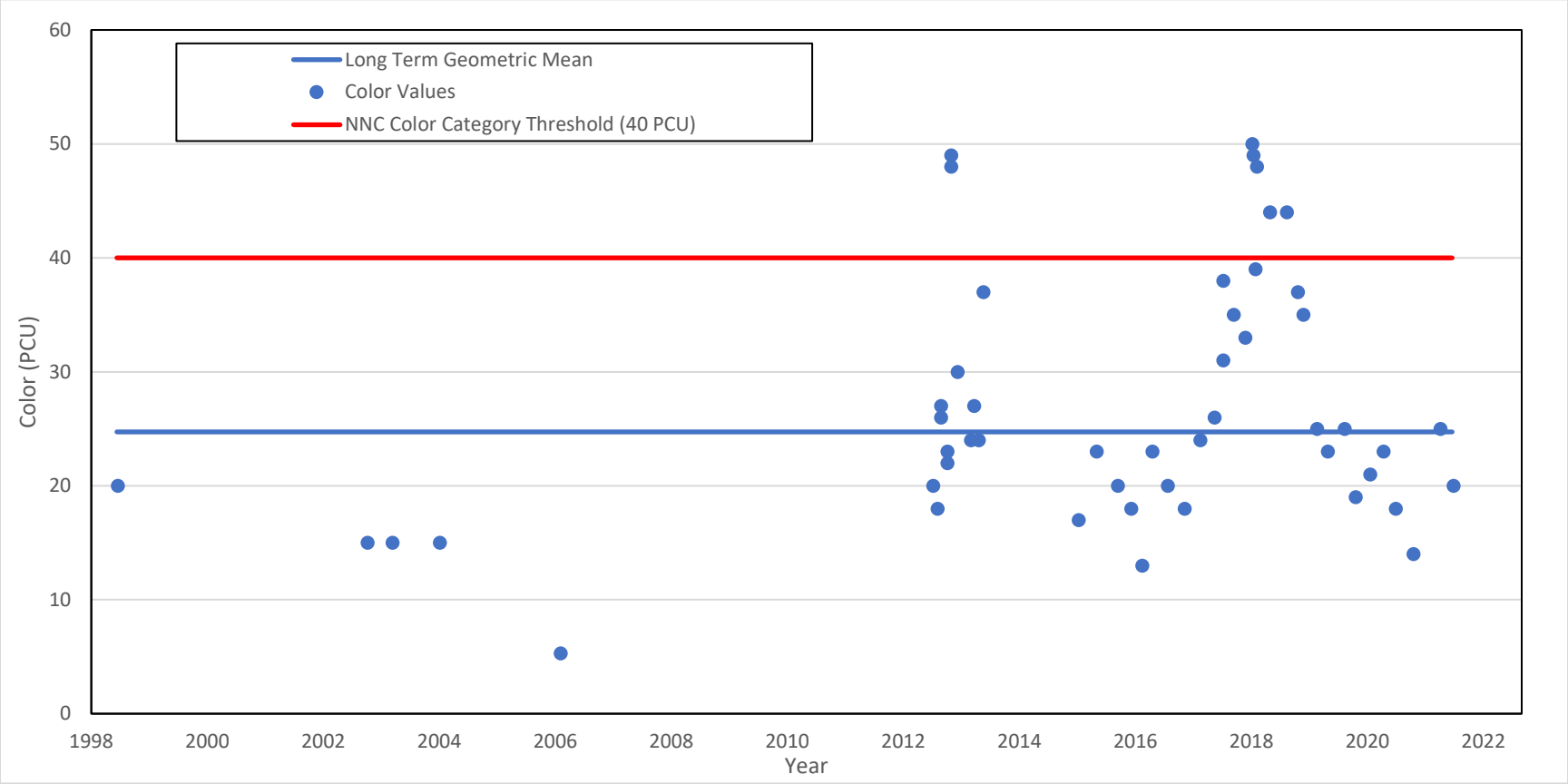
Feet

Figure 2-13
Lake Buchanan
Surface Sample Location
Orange County, Florida

wsp

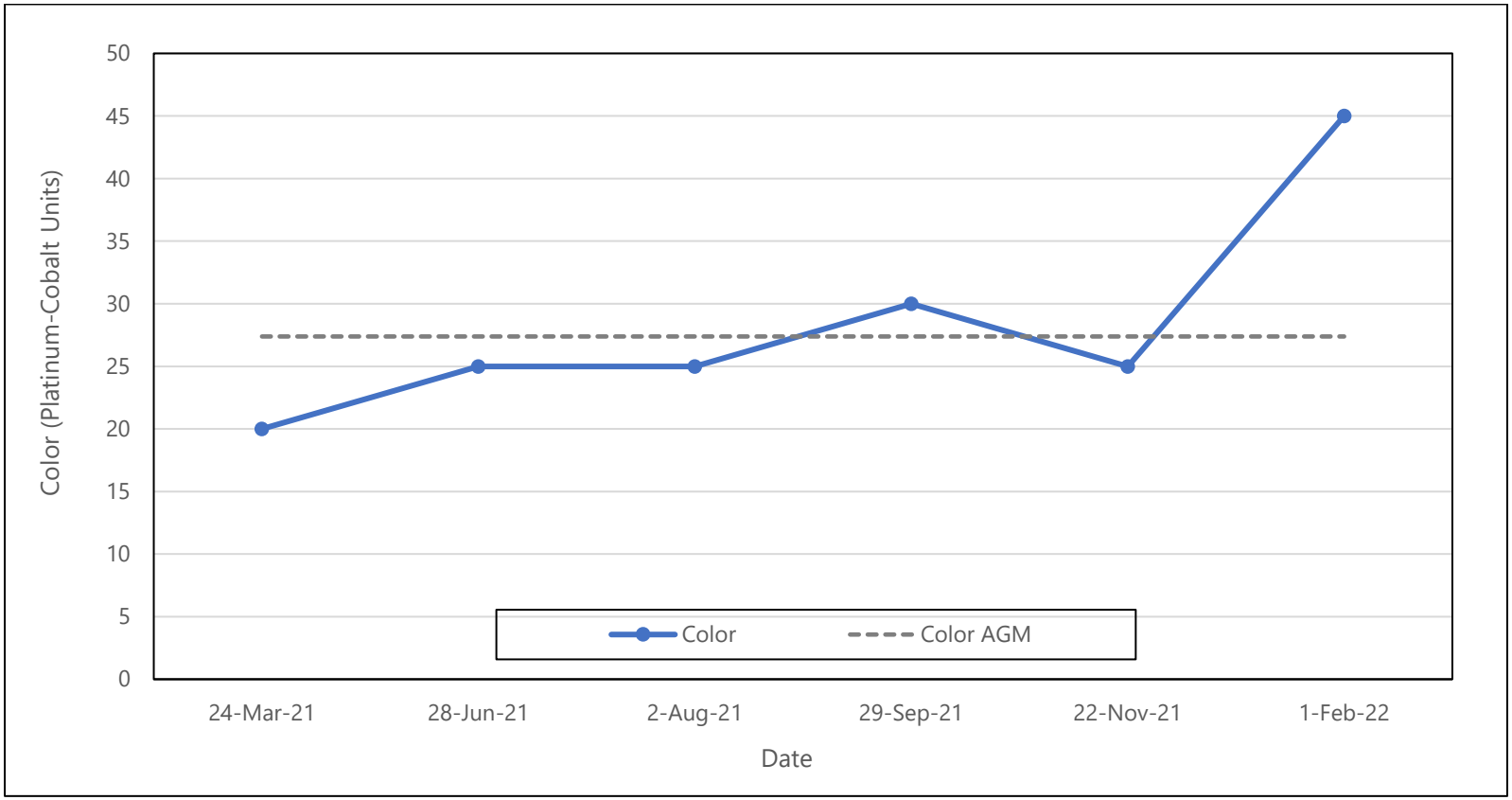
Path: C:\Users\lance.lumbard\Wood PLC\Orlando Water - Lake Buchanan\13_GIS\MXD\Fig2-13 Buchanan SC3 Sample Station.mxd

Figure 2-14 – Lake Buchanan Color (PCU) and Long-Term Geometric Mean, 1999-2022



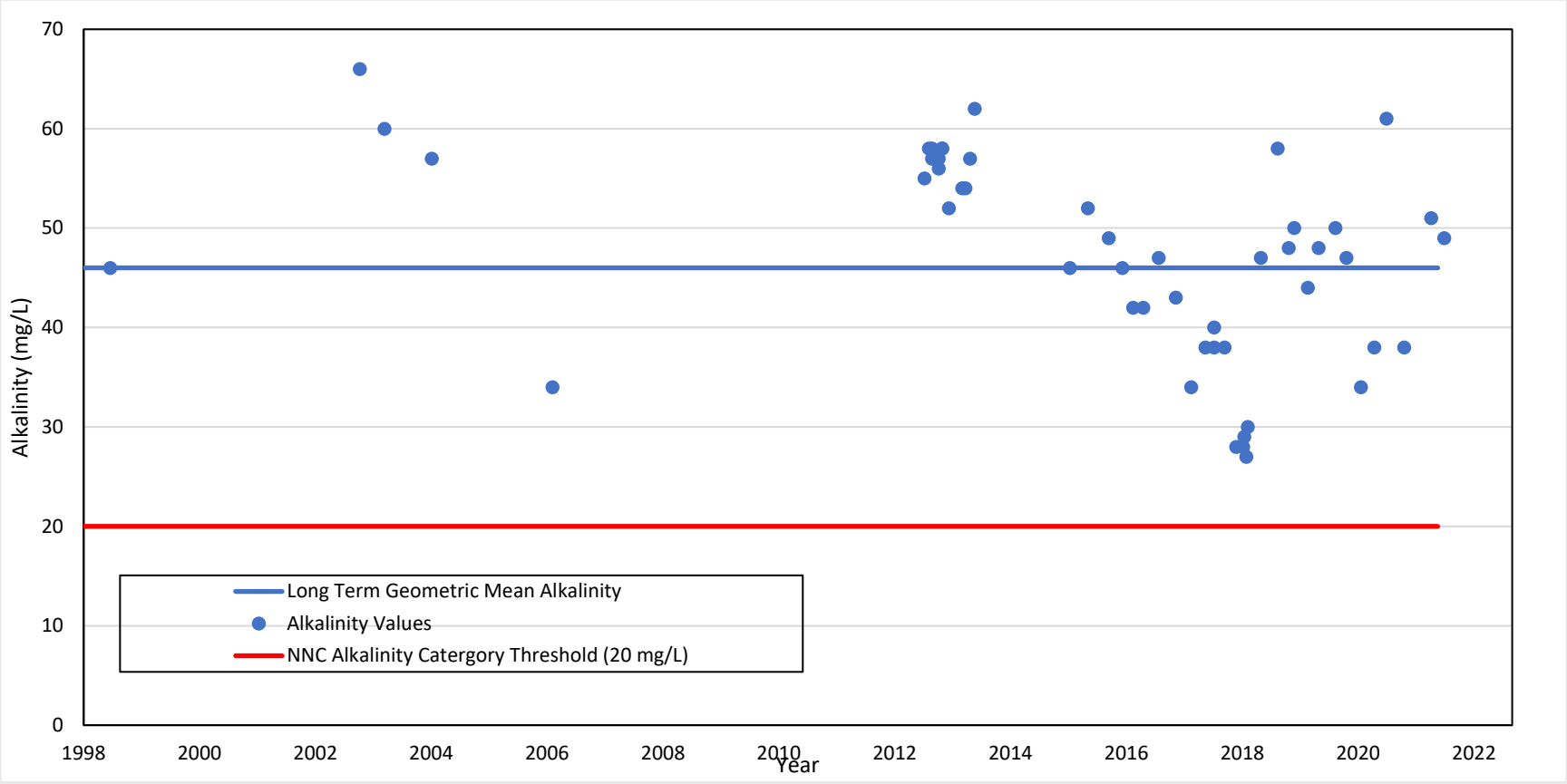
Source: **FDEP IWR Run 64 and WIN**

Figure 2-15 – Color (PCU) in Lake Buchanan Surface Water from March 2021 through February 2022



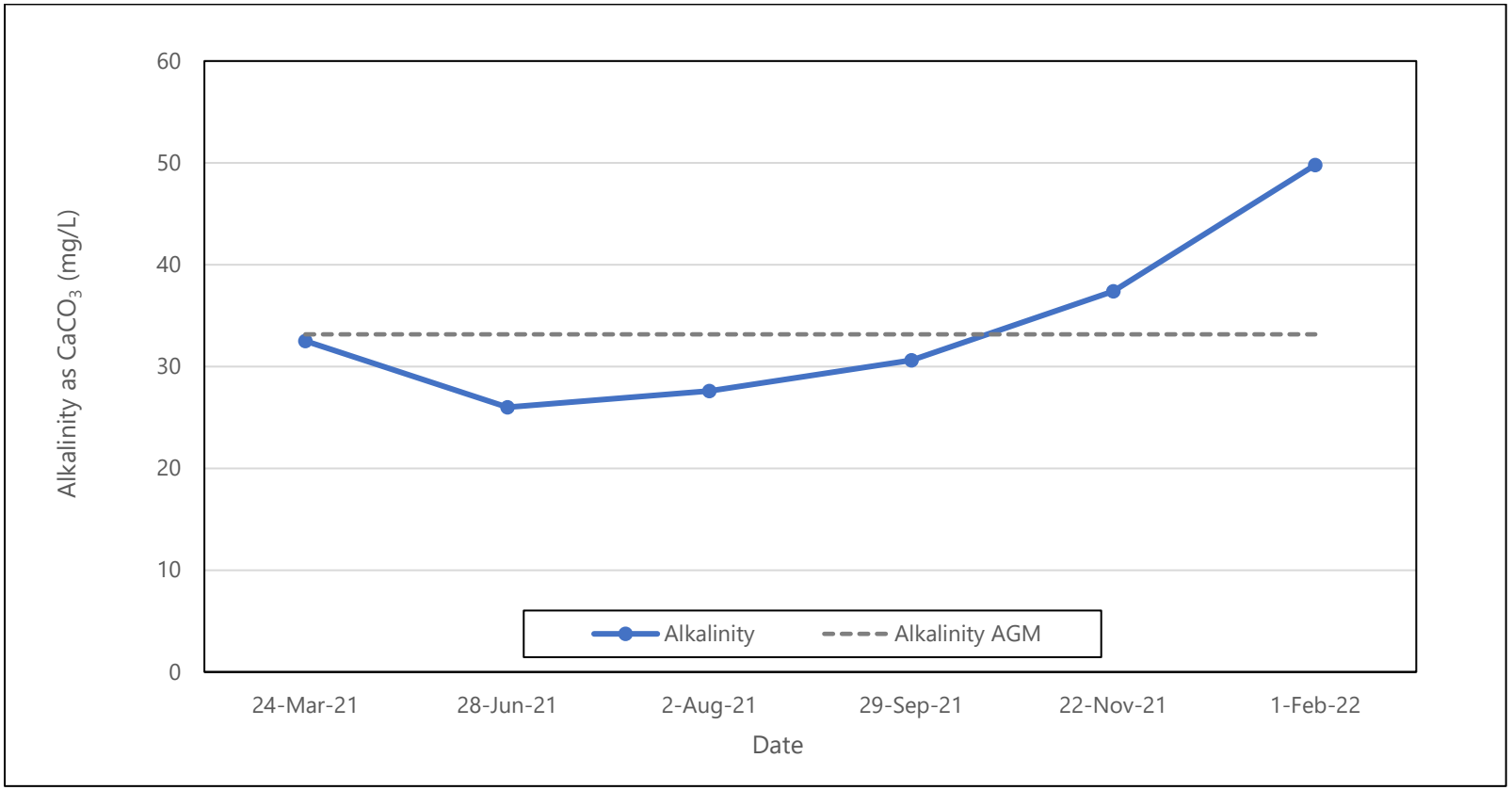
Source: **Wood (6 events)**

Figure 2-16 – Lake Buchanan Alkalinity (mg/L as $CaCO_3$) and Long-Term Geometric Mean, 1999-2022



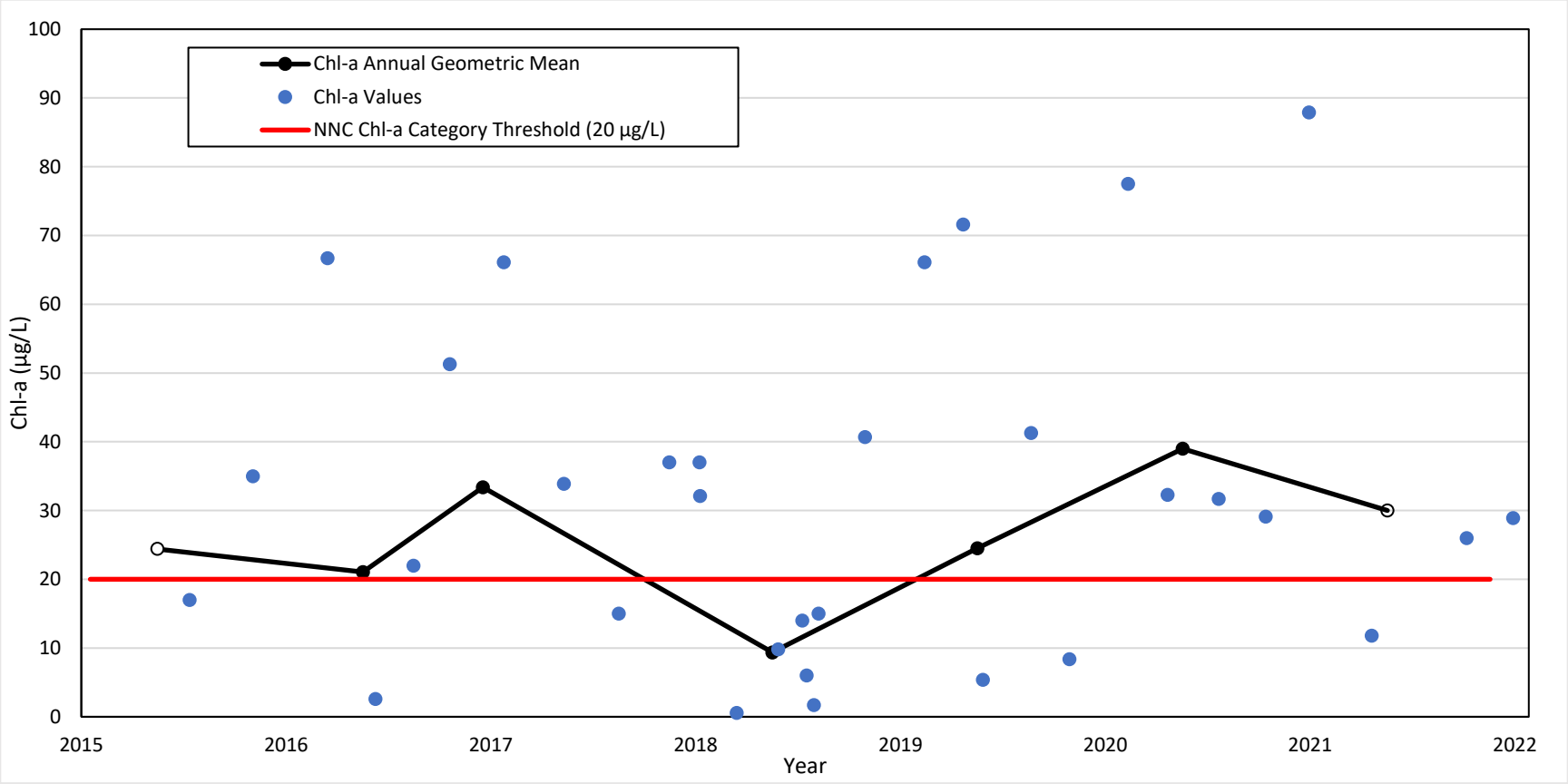
Source: **FDEP IWR Run 64 and WIN**

Figure 2-17 – Alkalinity (mg/L as $CaCO_3$) in Lake Buchanan Surface Water from March 2021 through February 2022



Source: **Wood (6 events)**

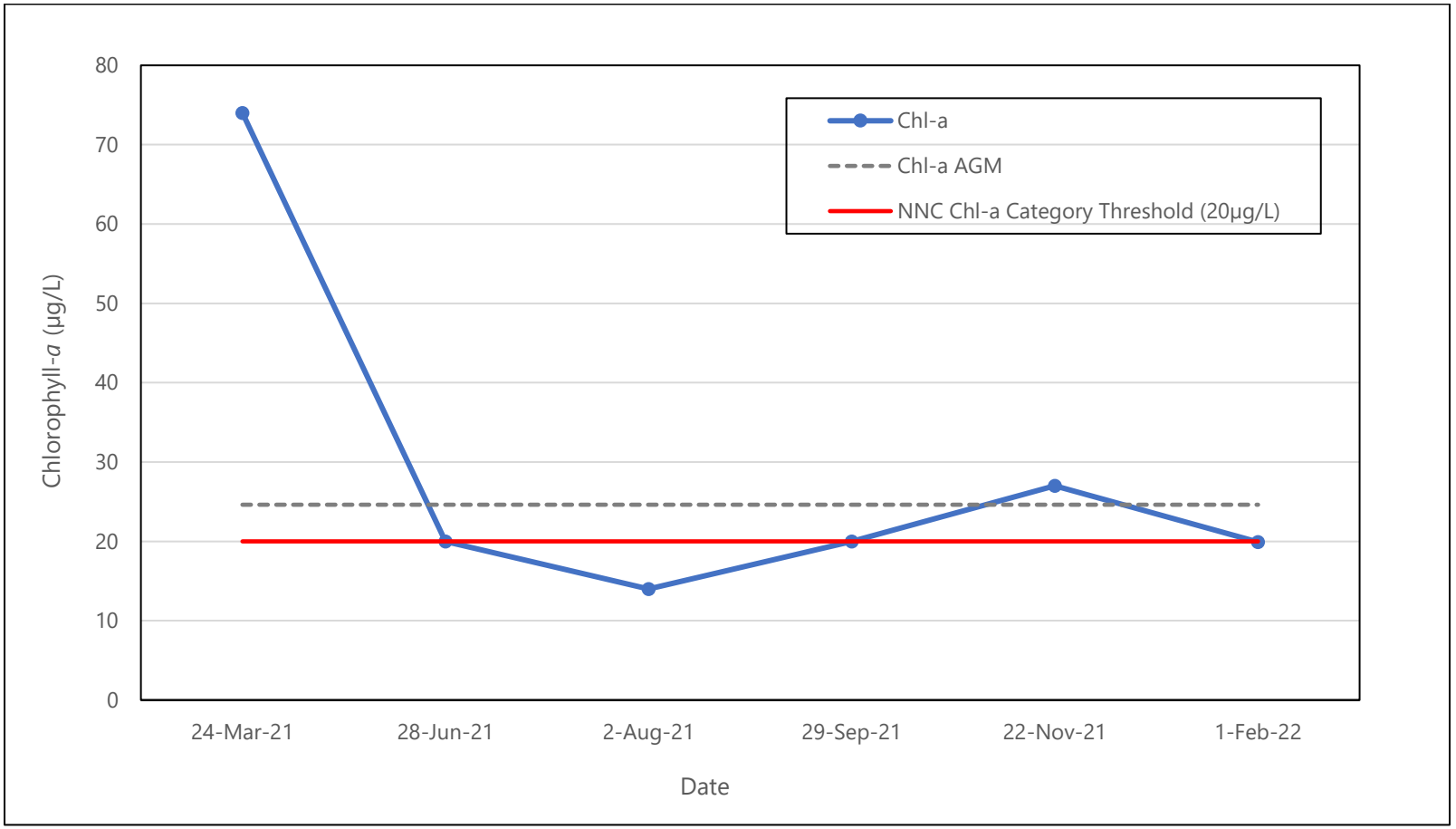
Figure 2-18 – Lake Buchanan Chlorophyll-*a* Concentration and Annual Geometric Means, 2015-2022



Note: Fill removed for AGMs when less than 4 samples were collected (2015 and 2021)

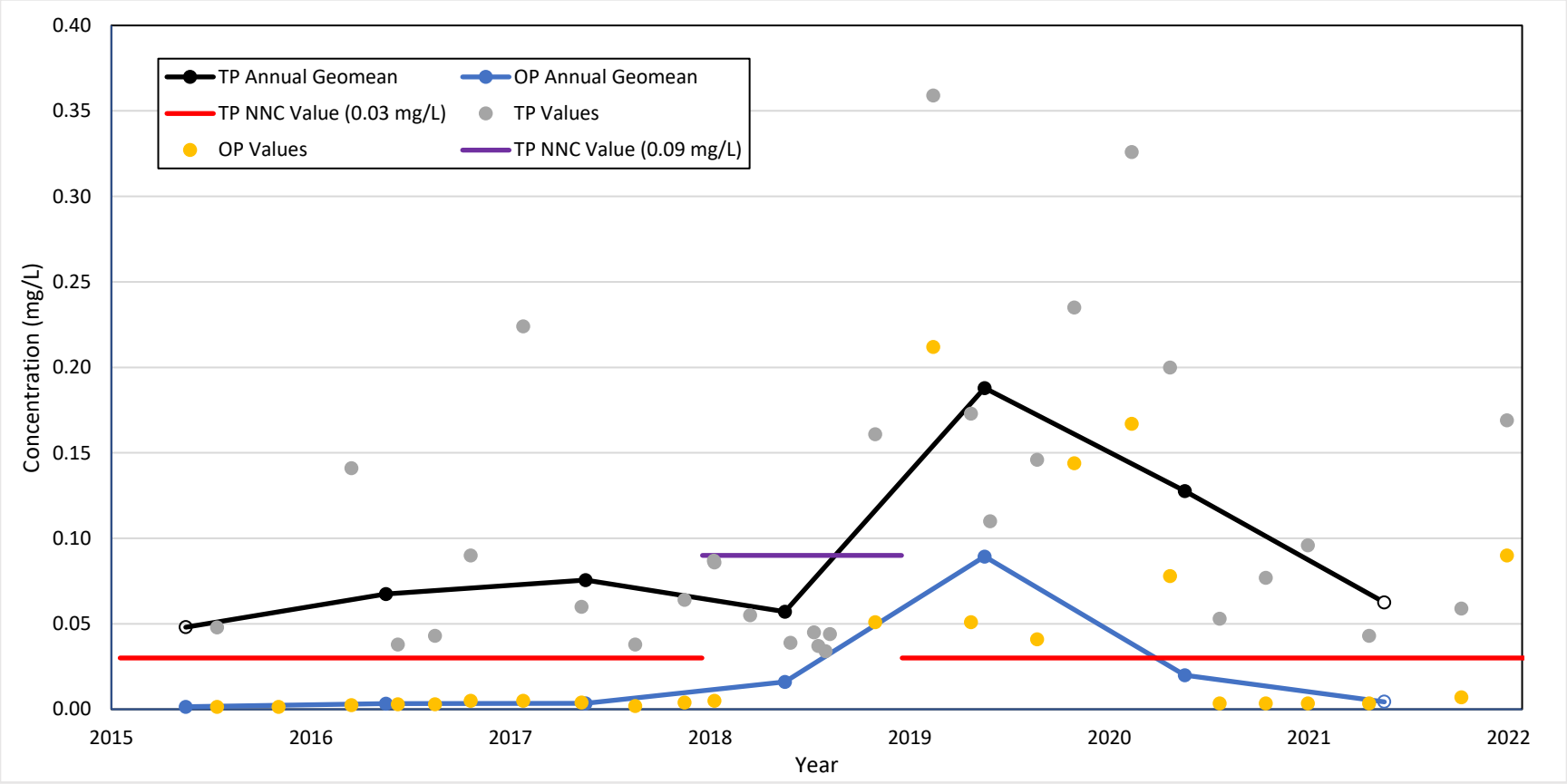
Source: **FDEP IWR Run 64 and WIN**

Figure 2-19 – Chlorophyll-*a* Concentration in Lake Buchanan Surface Water from March 2021 through February 2022



Source: Wood (6 events)

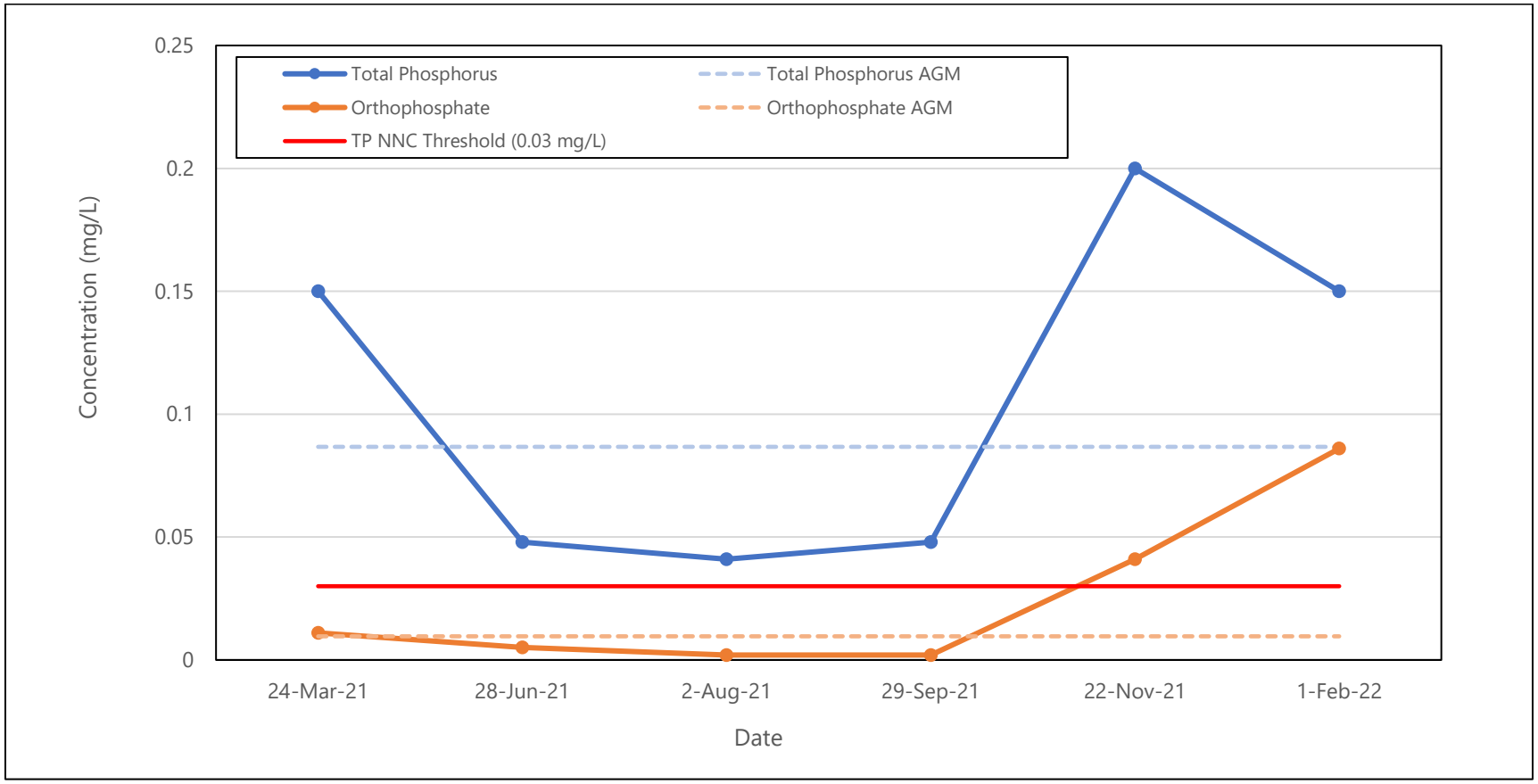
Figure 2-20 – Lake Buchanan Total Phosphorus and Orthophosphate Concentration with Annual Geometric Means, 2015-2022



Fill removed for AGMs when less than 4 samples were collected (2015 and 2021)

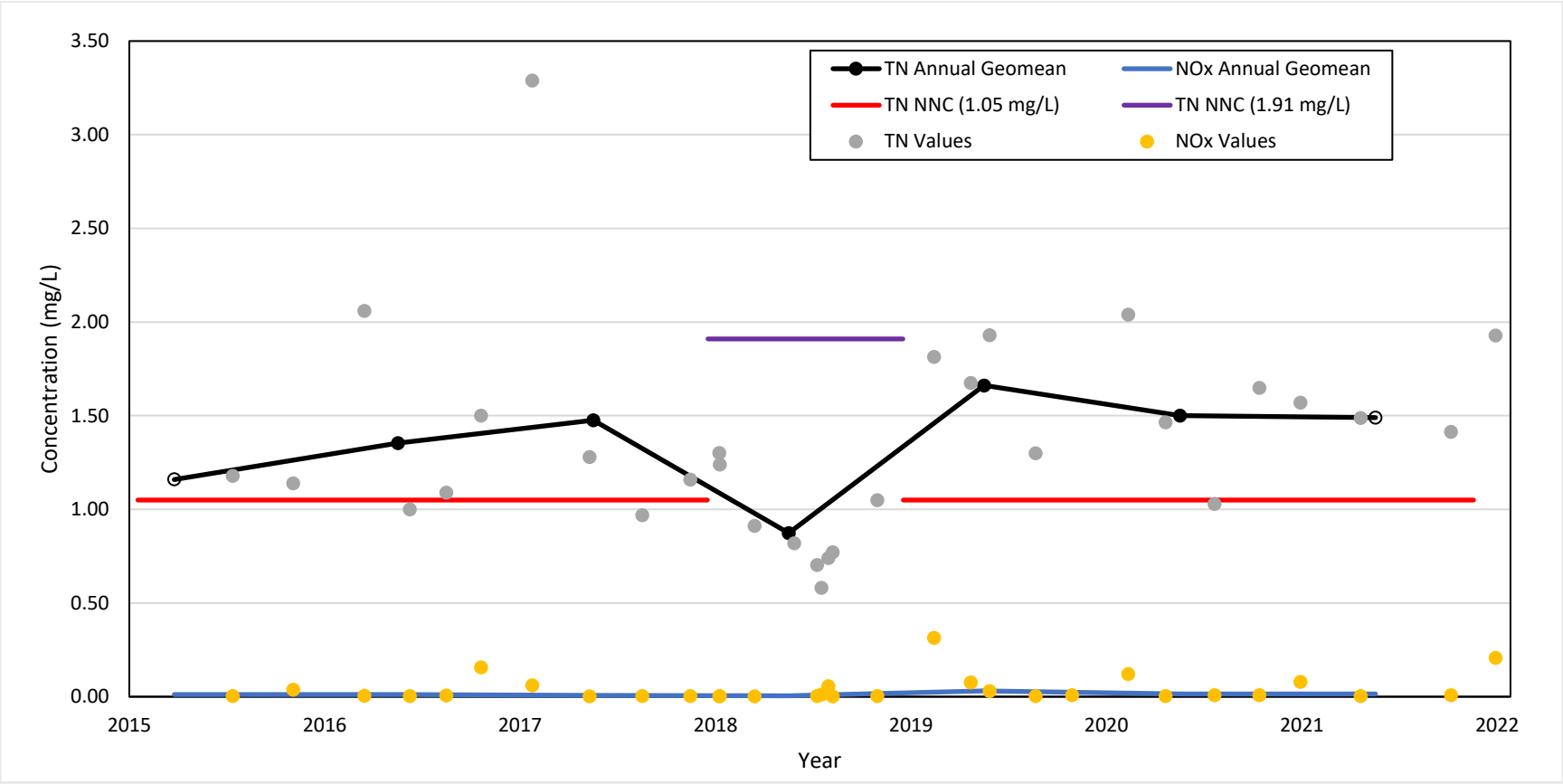
Source: **FDEP IWR Run 64 and WIN**

Figure 2-21 – Total Phosphorus and Orthophosphate Concentrations in Lake Buchanan Surface Water from March 2021 through February 2022



Source: **Wood (6 events)**

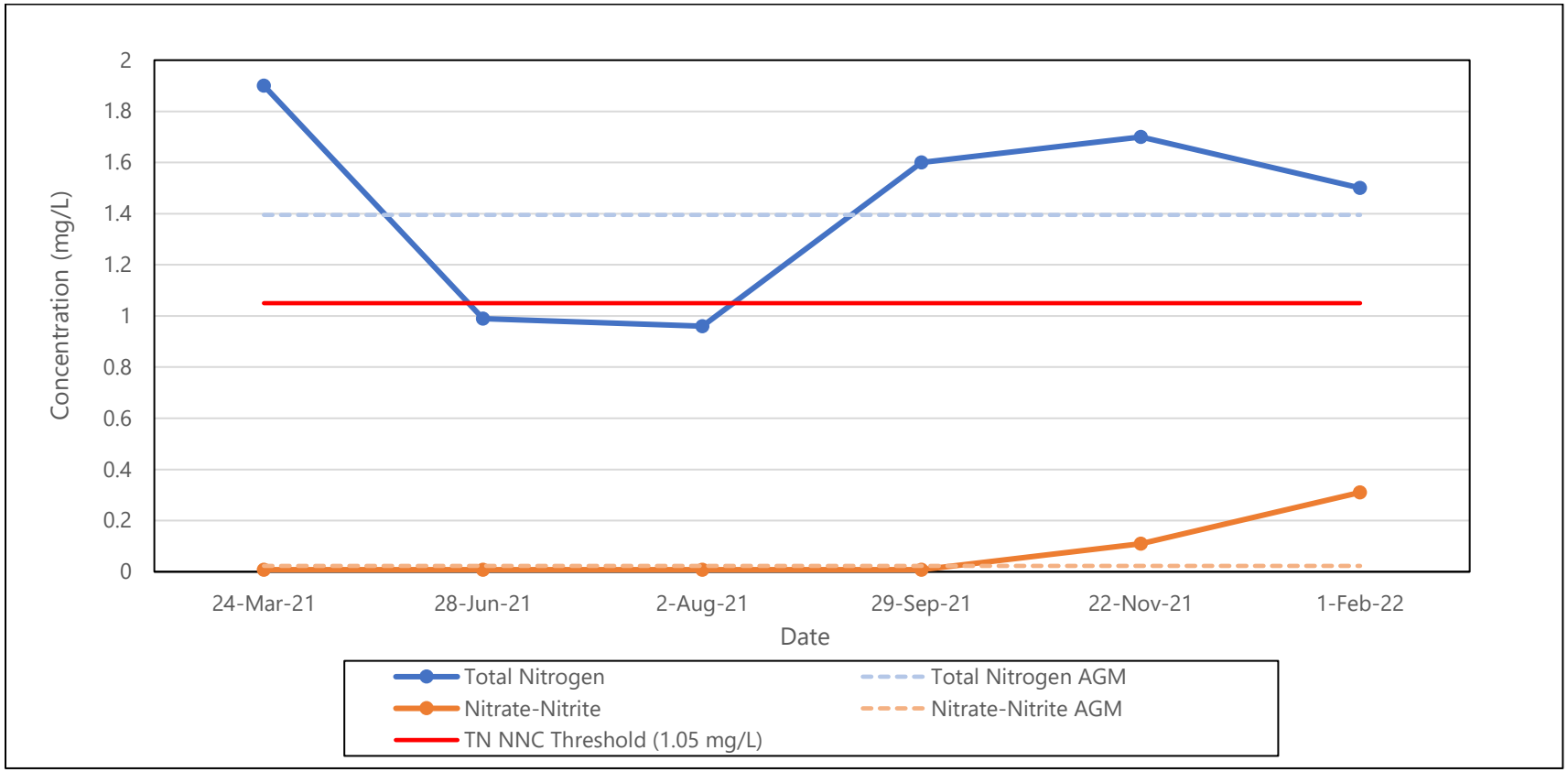
Figure 2-22 – Lake Buchanan Total Nitrogen and Nitrite+Nitrate Concentration with Annual Geometric Means, 2015-2022



Fill removed for AGMs when less than 4 samples were collected (2015 and 2021)

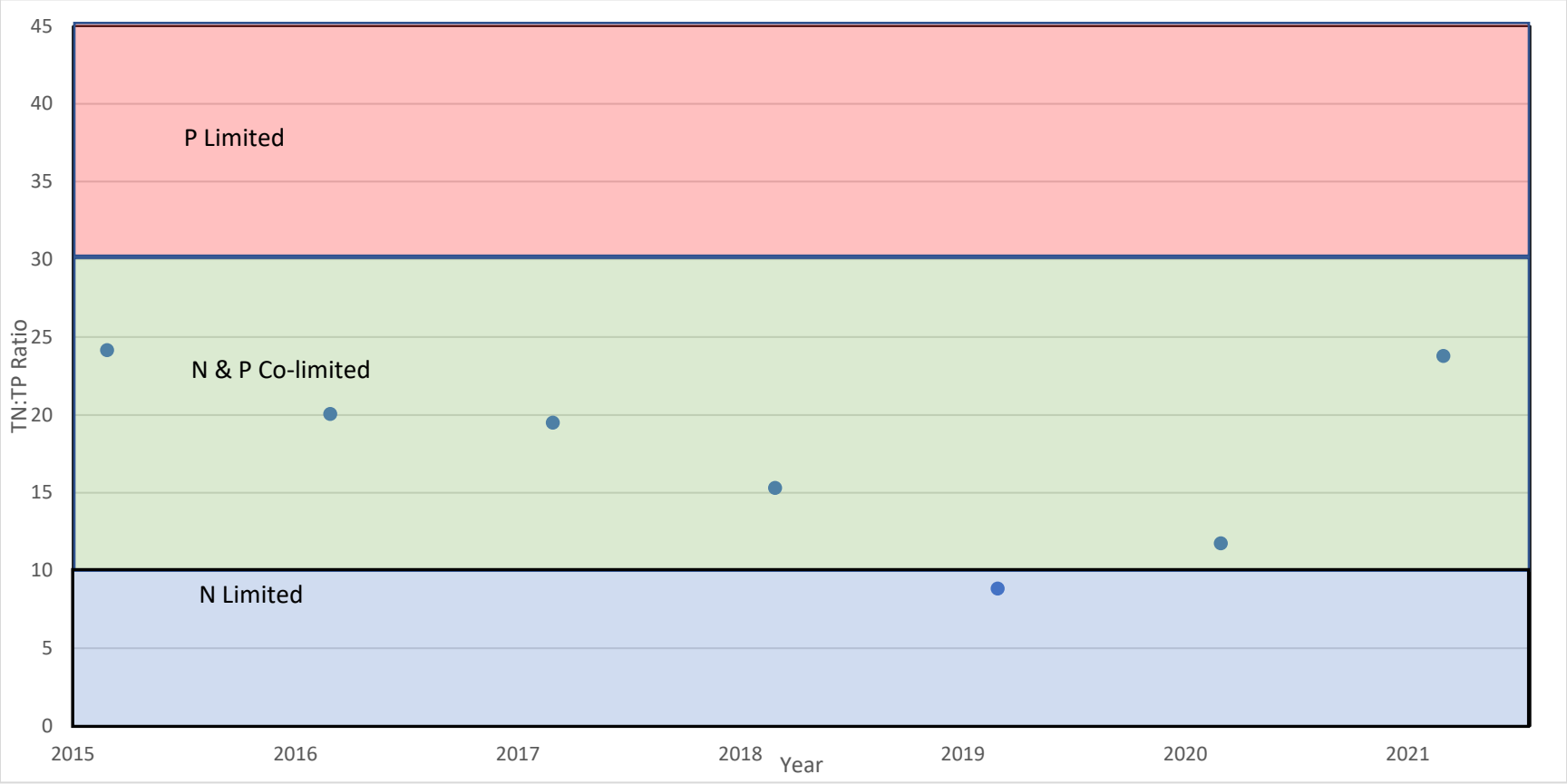
Source: **FDEP IWR Run 64 and WIN**

Figure 2-23 –Total Nitrogen and Nitrate-Nitrite Concentrations in Lake Buchanan Surface Water from March 2021 through February 2022



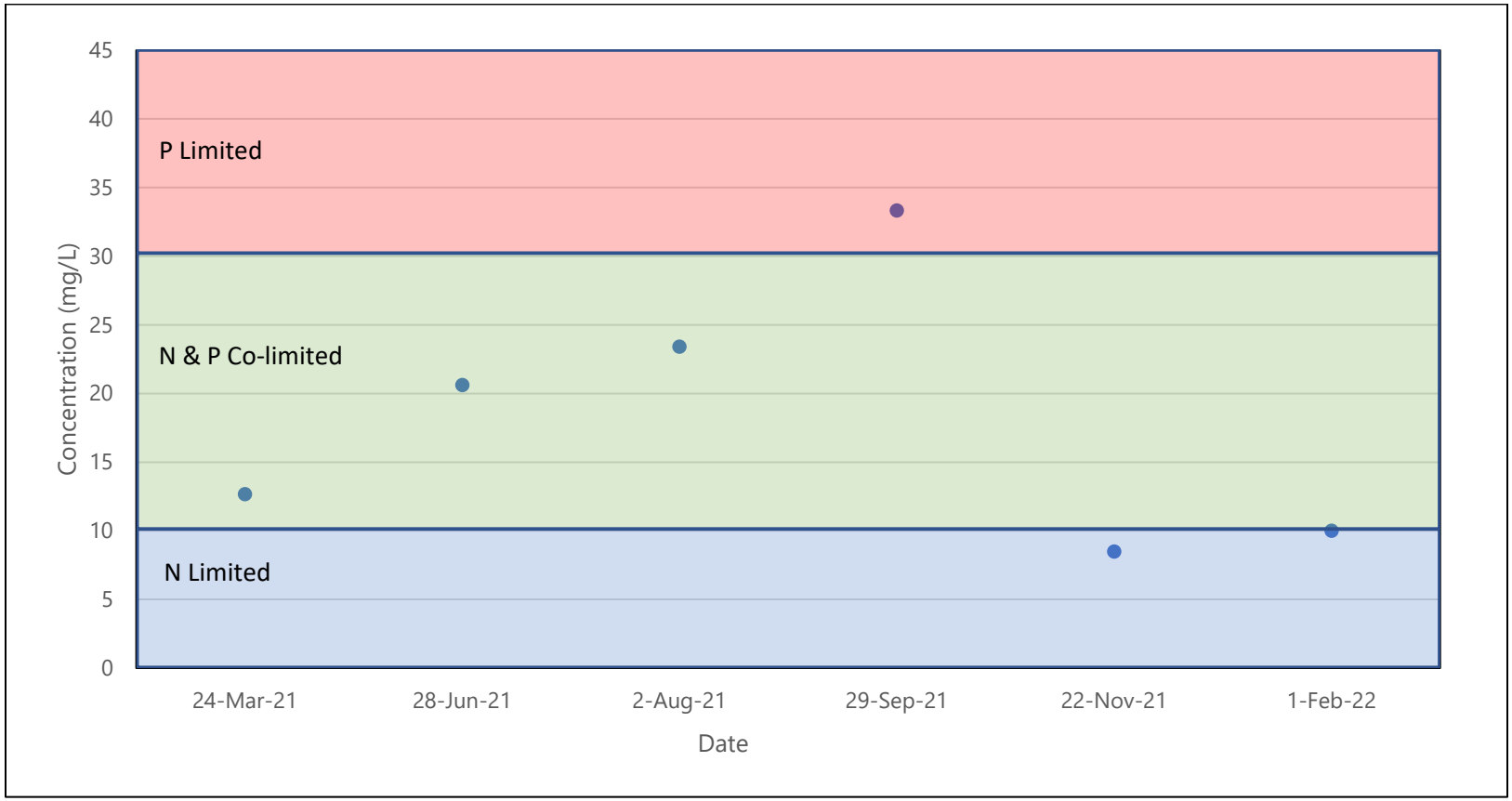
Source: Wood (6 events)

Figure 2-24 – Lake Buchanan Annual Geometric Mean TN:TP Ratio, 2015-2021



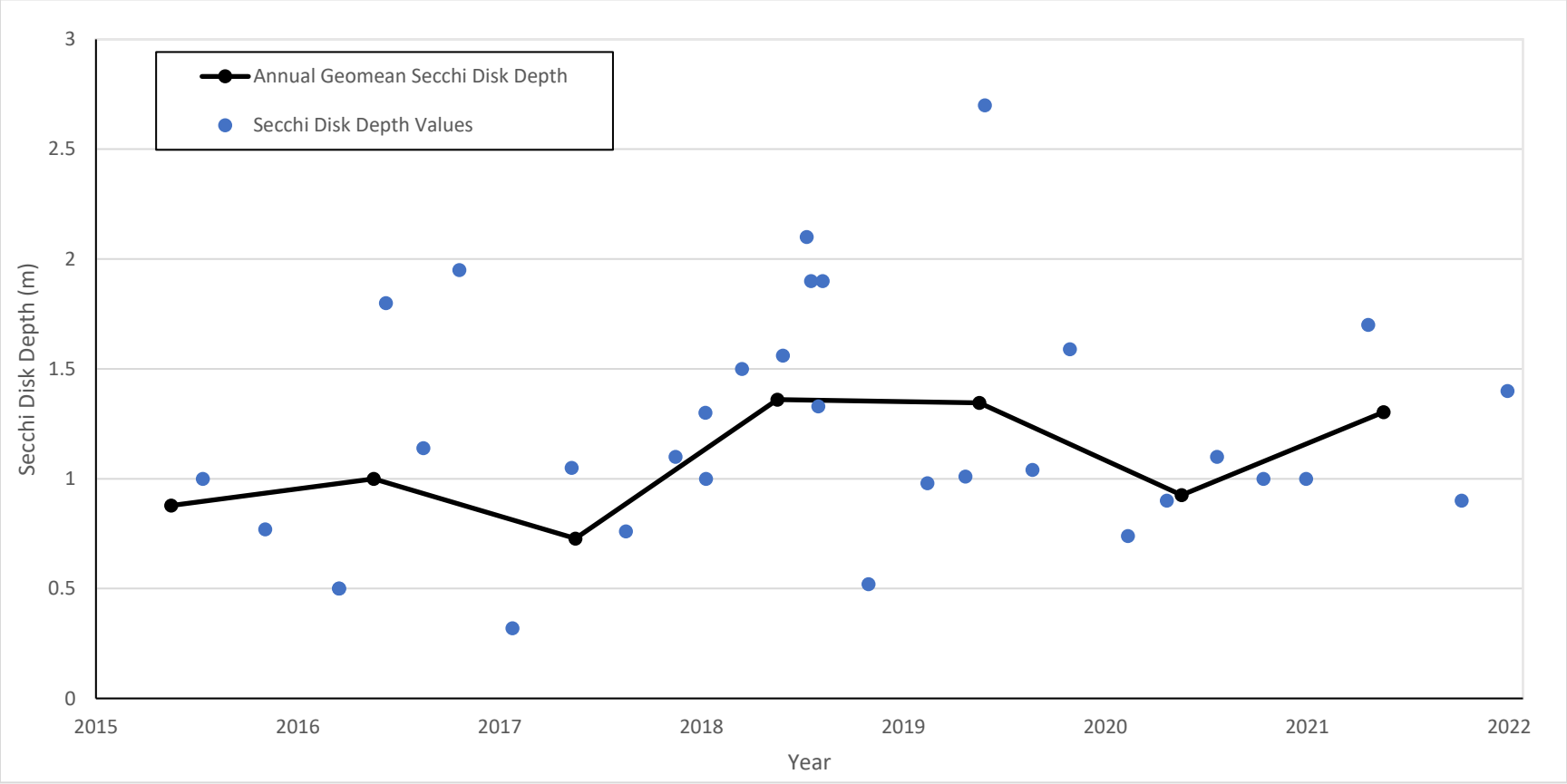
Source: FDEP IWR Run 62 and WIN

Figure 2-25 – Lake Buchanan TN:TP Ratio, March 2021 through February 2022



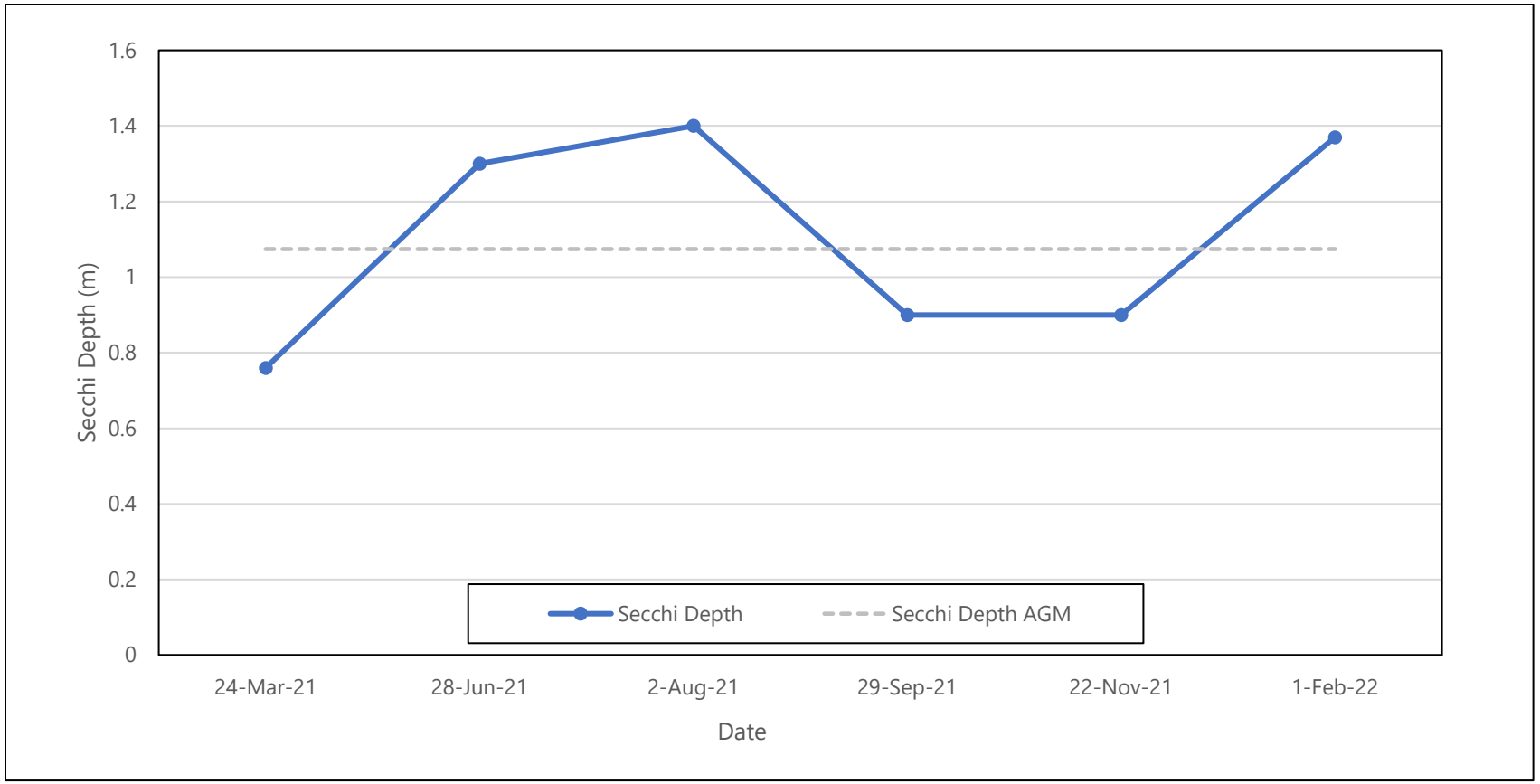
Source: **Wood (6 events)**

Figure 2-26 – Lake Buchanan Secchi Depth (m) and Annual Geometric Means, 2015-2022



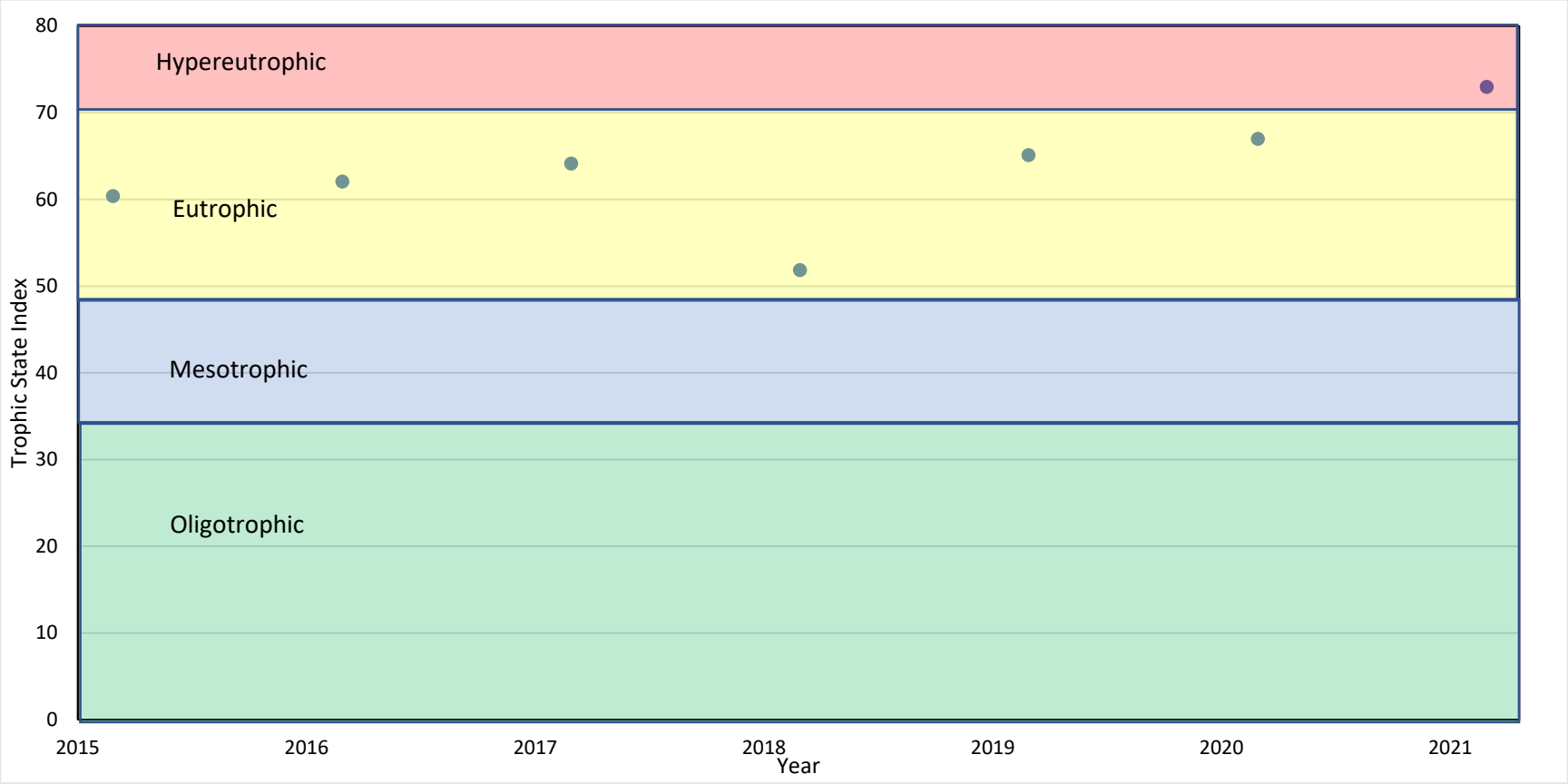
Source: **FDEP IWR Run 64 and WIN**

Figure 2-27 – Lake Buchanan Secchi Depth (m) from March 2021 through February 2022



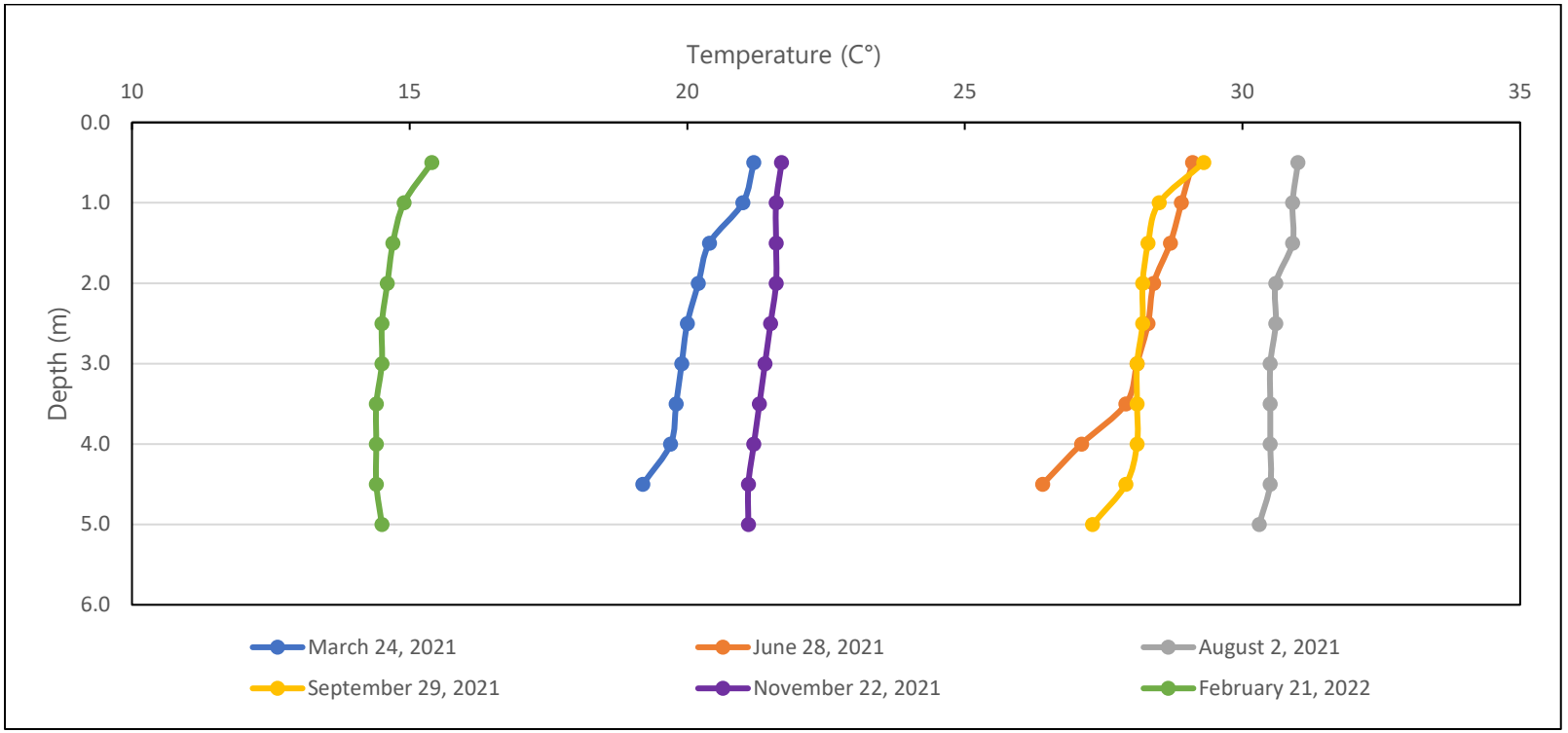
Source: **Wood (6 events)**

Figure 2-28 – Lake Buchanan Trophic State Index, Annual Geometric Means, 2015-2021



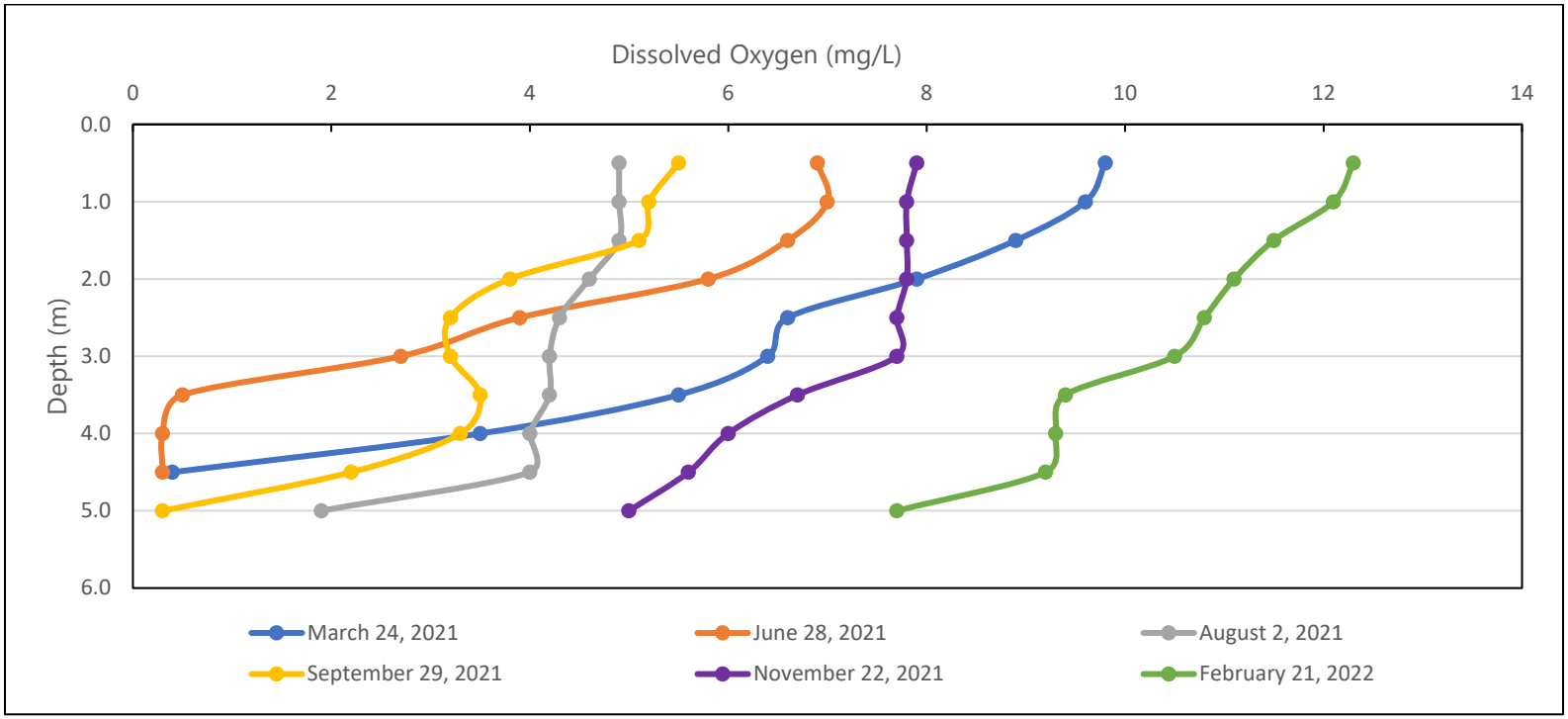
Source: Orange County Water Atlas

Figure 2-29 – Temperature Depth Profile for Lake Buchanan from March 2021 through February 2022

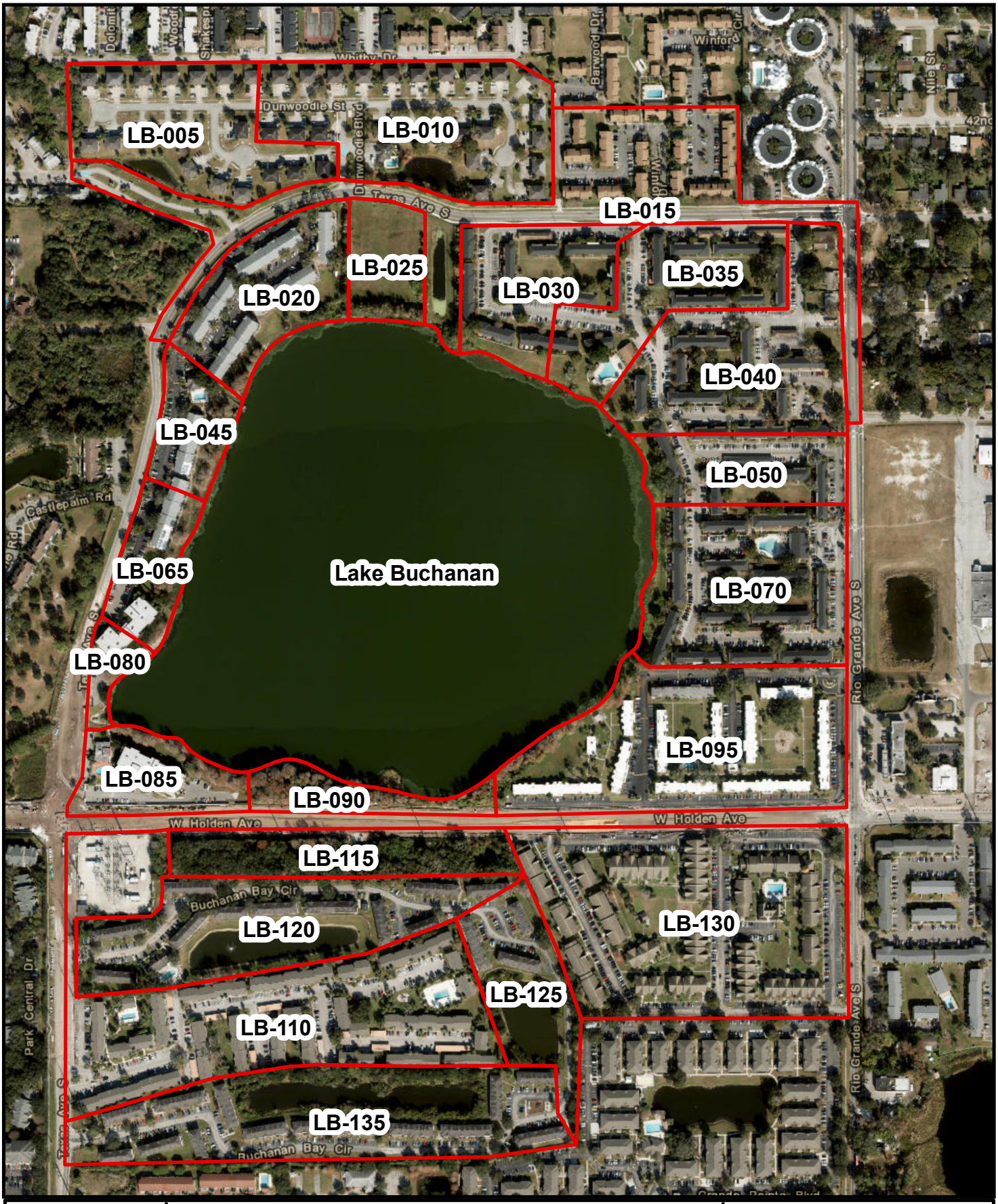


Source: Wood (6 events)

Figure 2-30 – Dissolved Oxygen Depth Profile for Lake Buchanan from March 2021 through February 2022



Source: **Wood (6 events)**



Notes:

1- Project No.:600713x2

2- Data Source - ESRI Imagery, BFA SJRWMD, Wood

3- This map is intended to be used for planning purposes only. It is not a survey.

Date: 4/18/22
Created By:ZL
Checked By:

N

Explanation of Features

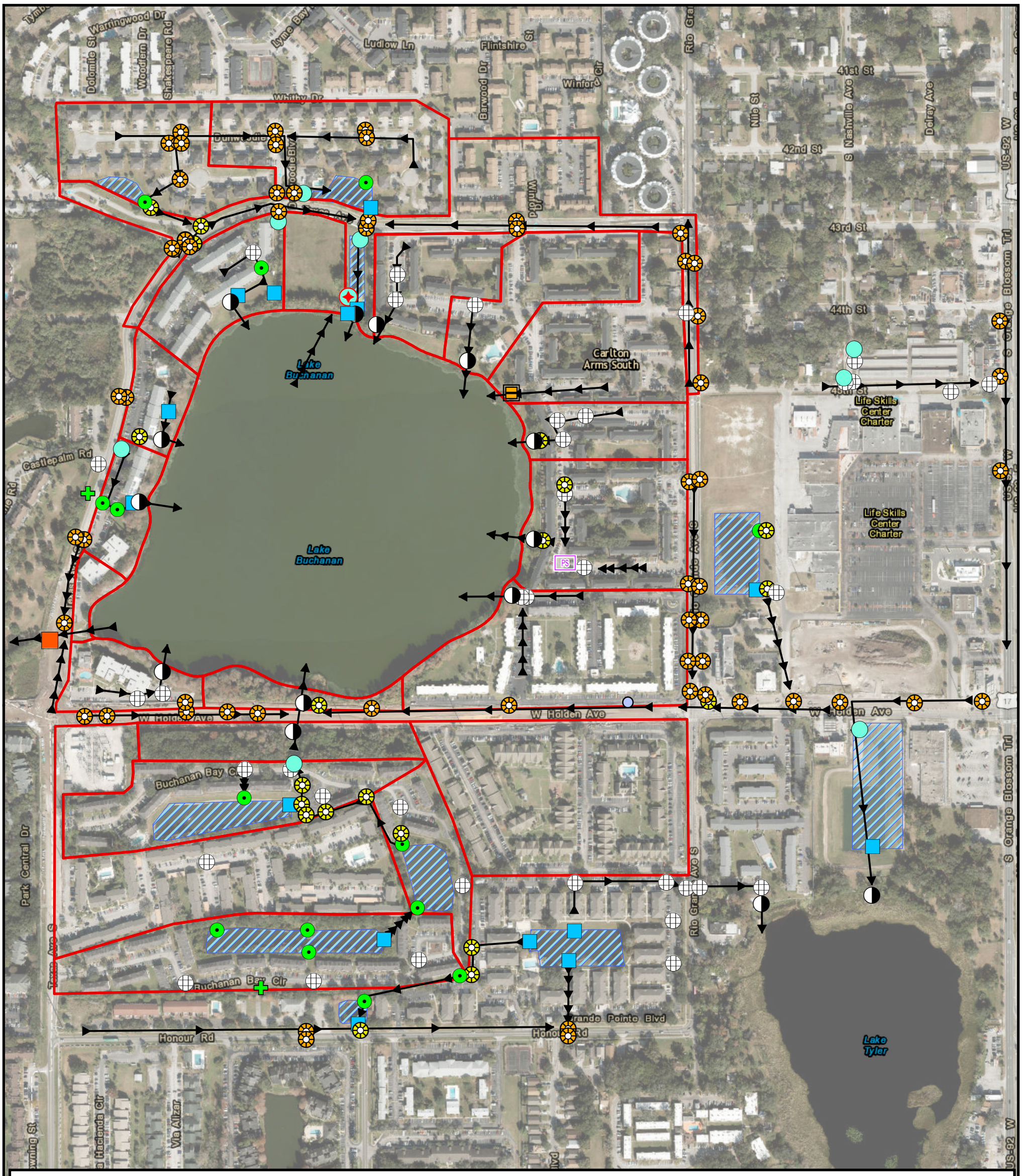
Lake Buchanan Sub-Basins

0 300

Feet

Figure 3-1
Sub-Basins
Lake Buchanan
Orange County, Florida

wsp



Stormwater Structures

- Drain Well
- Drop Inlet
- Mitered End Section
- Manhole
- Curb Inlet
- Outfall
- Overflow Weir
- Pump Station (PS)
- Culvert
- Door
- Flume
- Headwall
- Swale
- Flow
- Lake Buchanan Sub-Basins
- Ponds

Notes:

1- Project No.:600713x2

2- Data Source - ESRI Imagery, BFA SJRWMD, Wood

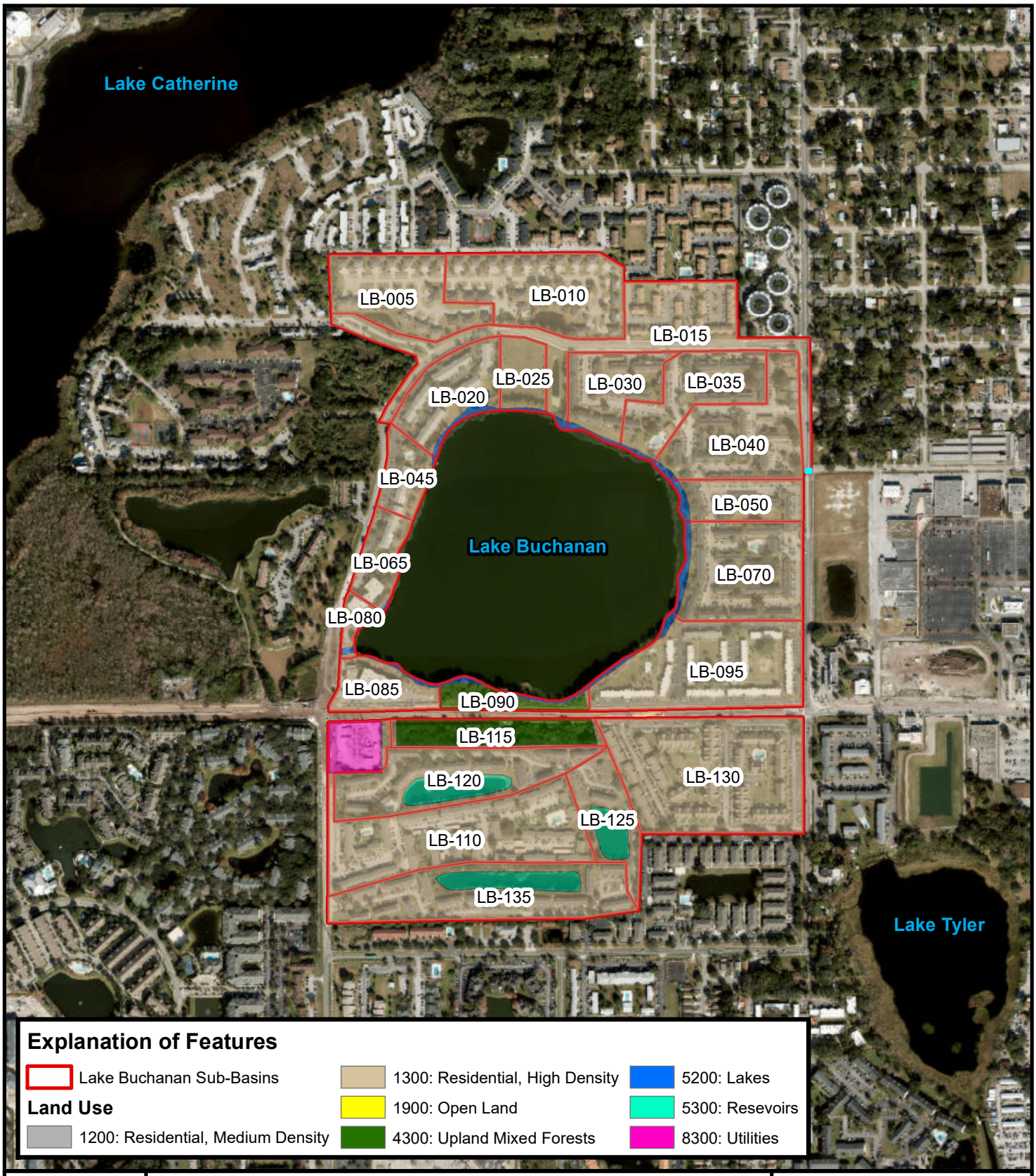
3- This map is intended to be used for planning purposes only. It is not a survey.

Date: 4/18/22
Created By:ZL
Checked By:

N

0 360
Feet

Figure 3-2
Stormwater Structures and Drainage Map
Lake Buchanan
Orange County, Florida



Notes:

1- Project No.:600713x2

2- Data Source - ESRI Imagery, SFWMD, Wood,

3- This map is intended to be used for planning purposes only. It is not a survey.

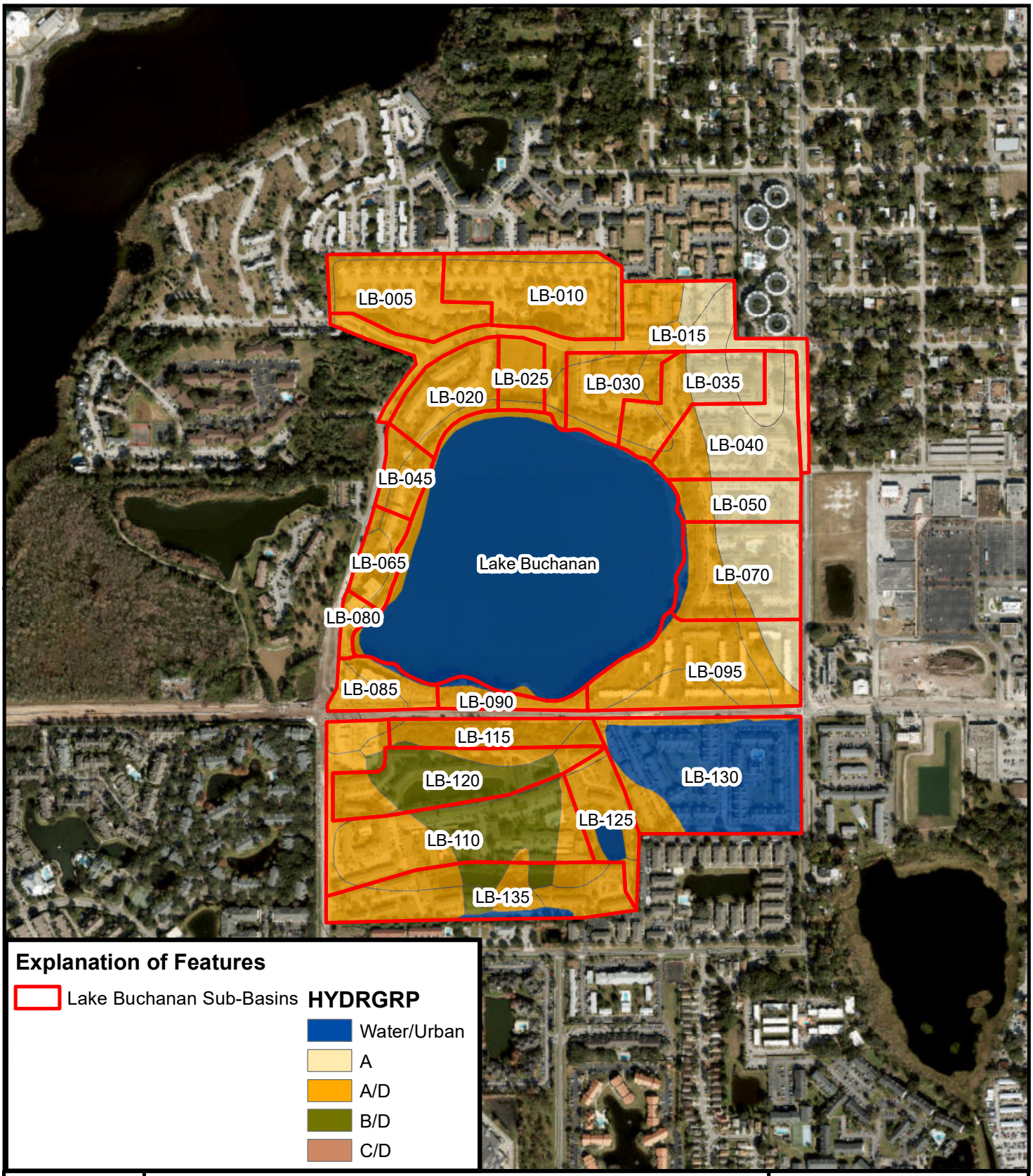
Date: 9/2822
Created By:ZL
Checked By: CL

N

0 620
Feet

Figure 3-3
SFWMD 2017-2019
Land Use Map
Lake Buchanan
Orange County, Florida

wsp



Notes:

1- Project No.:600713x2

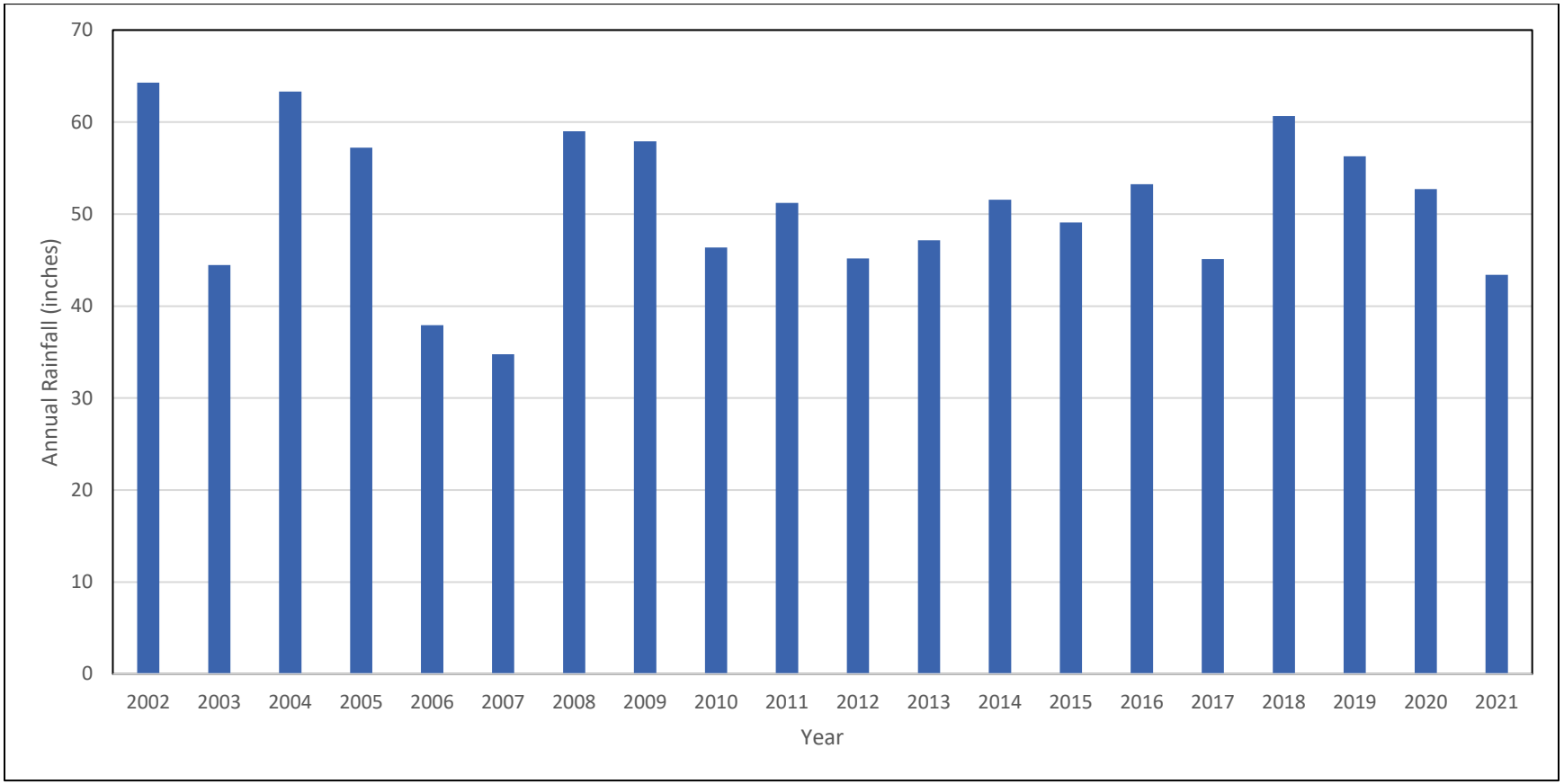
2- Data Source - ESRI Imagery, NRCS, Wood,

3- This map is intended to be used for planning purposes only. It is not a survey.

Date: 4/18/22
Created By:ZL
Checked By:

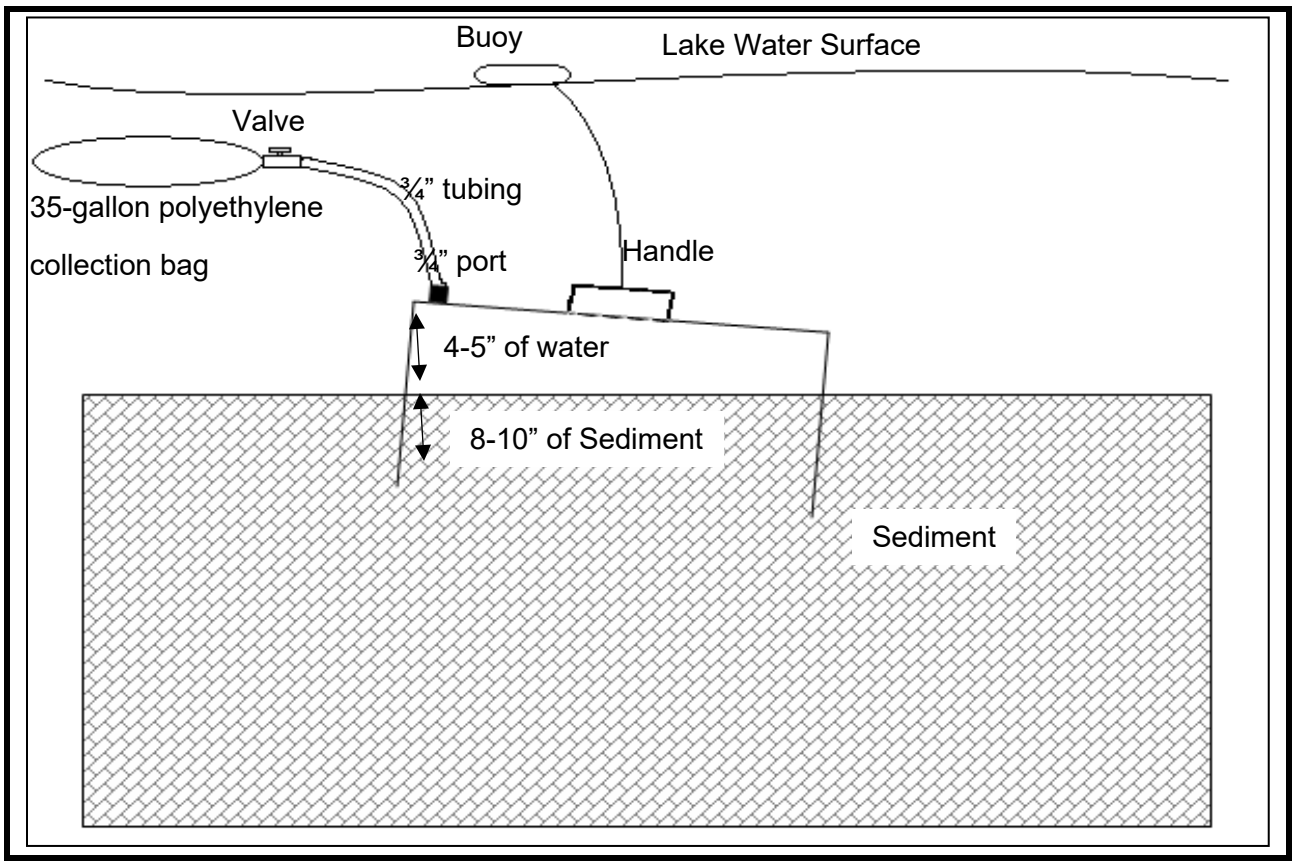
Figure 3-4
NRCS 2019
Hydrologic Soils Group
Lake Buchanan
Orange County, Florida

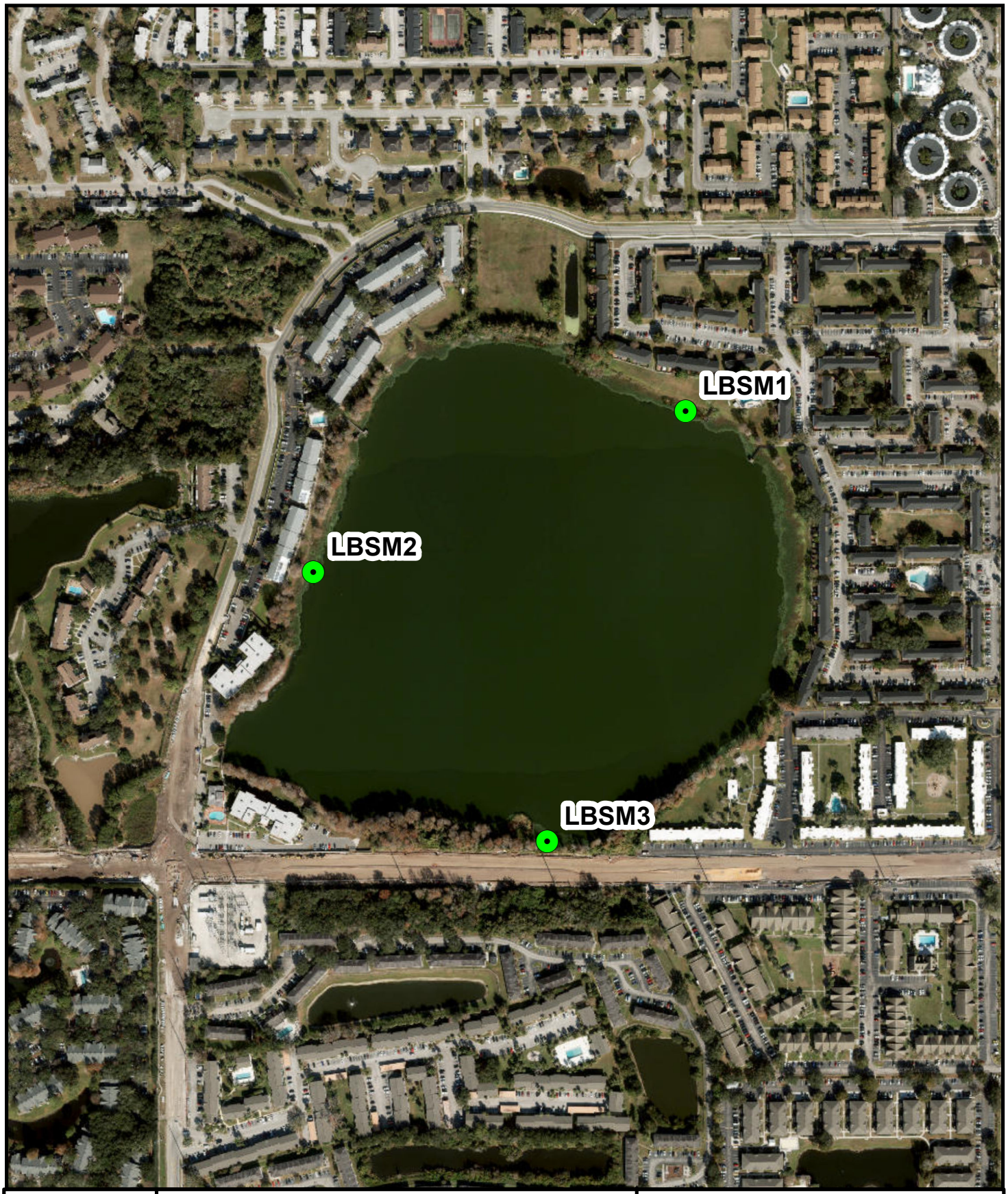
Figure 4-1 – Average Annual Rainfall for Lake Buchanan from 2002 through 2021 Based on NexRad Hydro ID 10112707



Source: SFWMD

Figure 4-2 - Typical Seepage Meter Installation





Notes:

1- Project No.: 600713x2

2- Data Source - Wood BFA, ESRI

3- This map is intended to be used for planning purposes only. It is not a survey.

Date: 2/7/2022
Revised: ZL
Checked By:

N

Explanation of Features

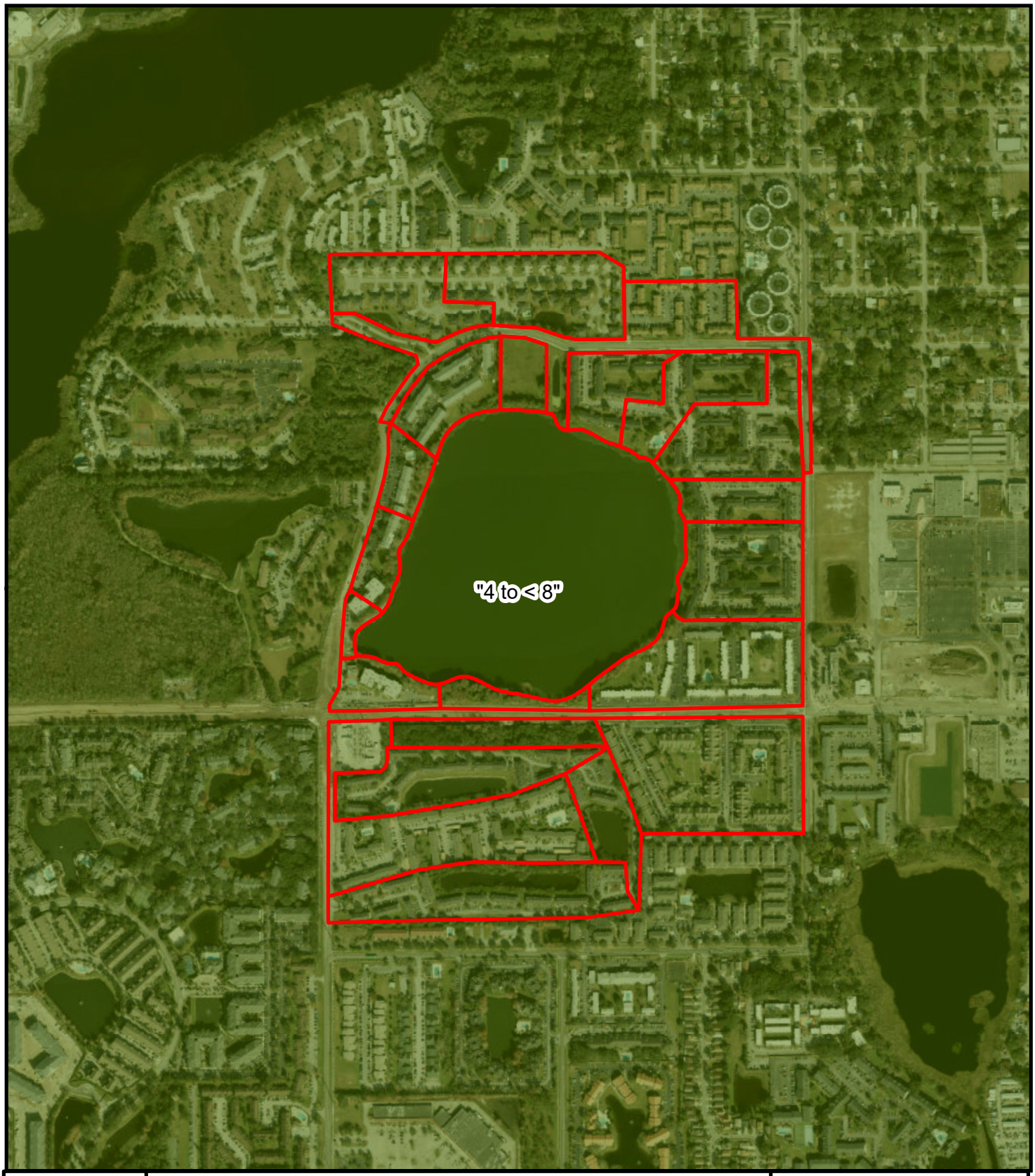
Seepage Meter Locations

0 340

Feet

Figure 4-3
Lake Buchanan
Seepage Meter Locations
Orange County, Florida

Path: C:\Users\lance.lumbard\Wood PLC\Orlando Water - Lake Buchanan\13_GIS\MXD\Fig4-3 BuchananLake_Autosampler_Locations.mxd



Notes:

1- Project No.:600713x2

2- Data Source - ESRI Imagery, SFWMD, Wood,

3- This map is intended to be used for planning purposes only. It is not a survey.

Date: 4/18/22
Created By:ZL
Checked By:

N

Explanation of Features

Lake Buchanan Sub-Basins

SFWMD Recharge

"0 to < 4 in/yr"

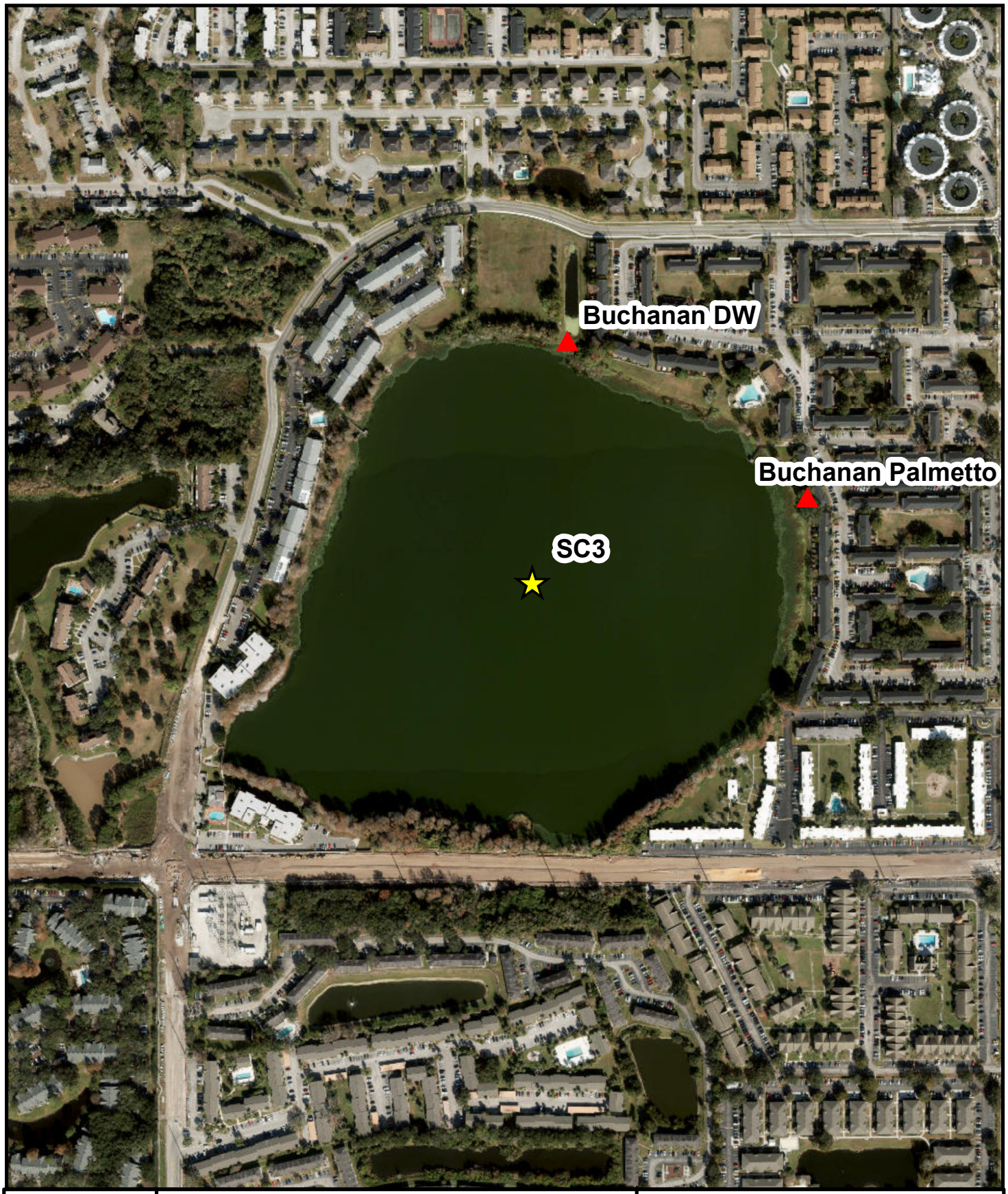
"4 to < 8 in/yr"

0 600

Feet

Figure 4-4
SFWMD Recharge Rates
Lake Buchanan
Orange County, Florida

wsp



Notes:

1- Project No.: 600713x2

2- Data Source - Wood BFA, ESRI

3- This map is intended to be used for planning purposes only. It is not a survey.

Date: 2/7/2022
Revised: ZL
Checked By:

N

Explanation of Features

Surface Water Quality Sample Location

Autosampler Locations

0 340

Feet

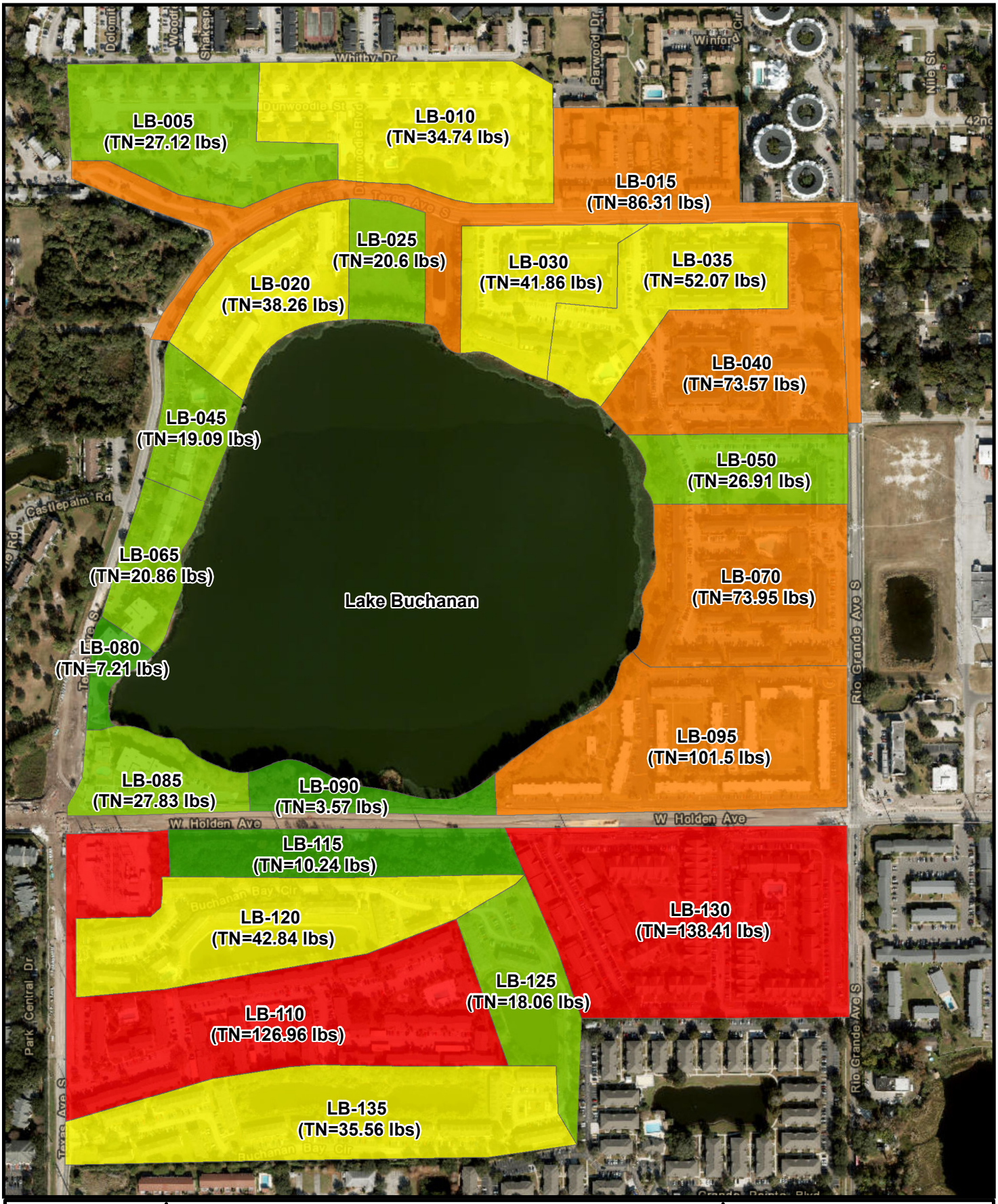
Figure 5-1
Lake Buchanan
Surface and Autosampler Locations
Orange County, Florida

wsp

Path: C:\Users\lance.lumbard\Wood PLC\Orlando Water - Lake Buchanan\13_GIS\MXD\Fig5-1 BuchananLake_Autosampler_Locations.mxd

Figure 5-2 – Autosampler BuchananDW Location

Figure 5-3 – Autosampler Buchanan Palmetto Location



Notes:

1- Project No.:600713x2

2- Data Source - ESRI Imagery, BFA SJRWMD, Wood

3- This map is intended to be used for planning purposes only. It is not a survey.

Date: 2/2/23
Created By: SB
Checked By: LL

N

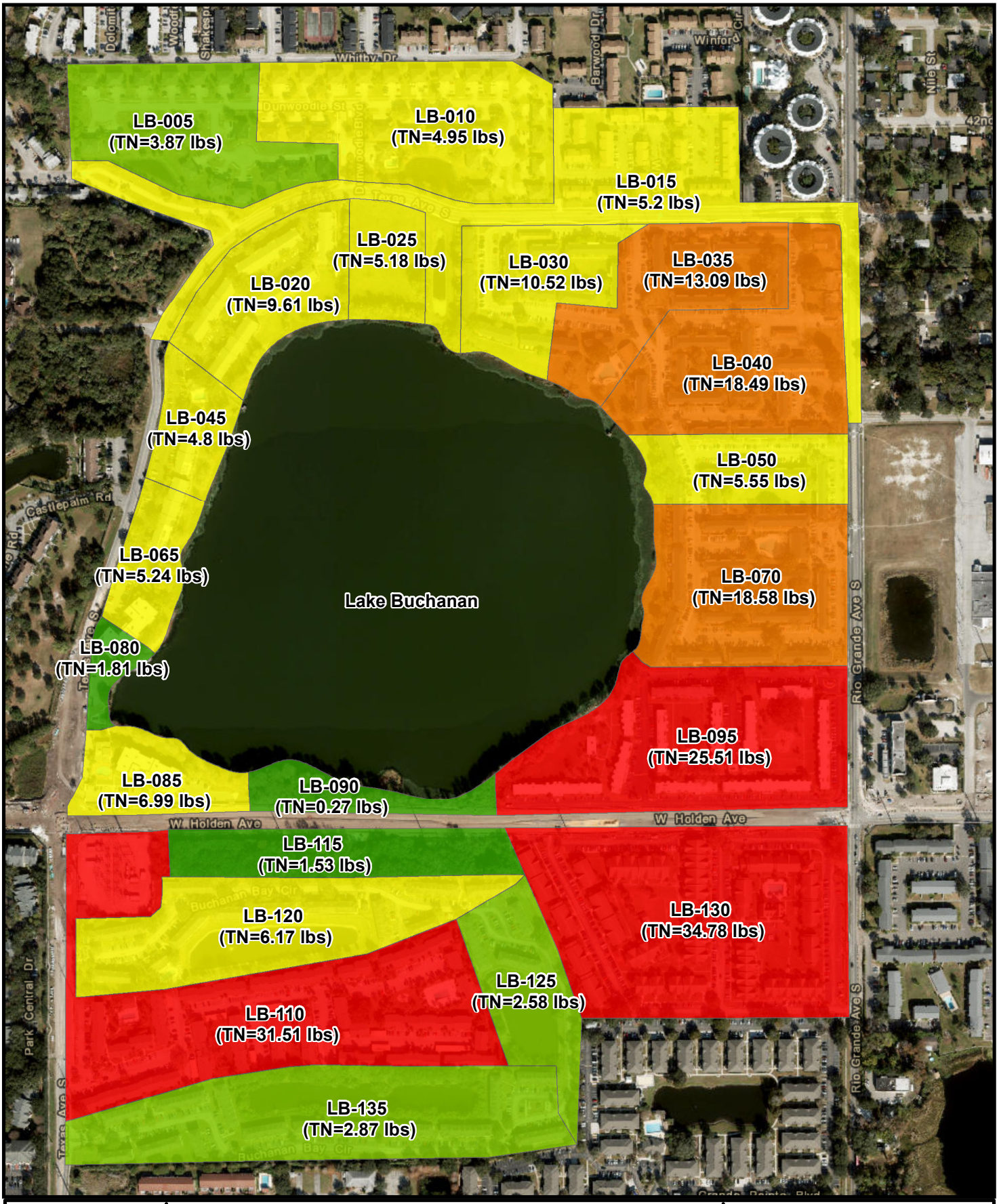
Estimated Annual TN Load (lbs)

- 3.57 - 10.24
- >10.24 - 27.83
- >27.83 - 52.07
- >52.07 - 101.50
- >101.50 - 138.41

0 300
Feet

Figure 5-4A
TN Sub-Basin Loading
Lake Buchanan
Orange County, Florida

WSP



Notes:

1- Project No.:600713x2

2- Data Source - ESRI Imagery, BFA SJRWMD, Wood

3- This map is intended to be used for planning purposes only. It is not a survey.

Date: 2/2/23
Created By: SB
Checked By: LL

N

Estimated Annual TP Load (lbs)

- 0.27 - 1.81
- >1.81 - 3.87
- >3.87 - 10.52
- >10.52 - 18.58
- >18.58 - 34.78

0 300
Feet

Figure 5-4B
TP Sub-Basin Loading
Lake Buchanan
Orange County, Florida

WSP

Figure 5-5 – Total Nitrogen Concentrations in Lake Buchanan Seepage Meters from June 2021 through March 2022

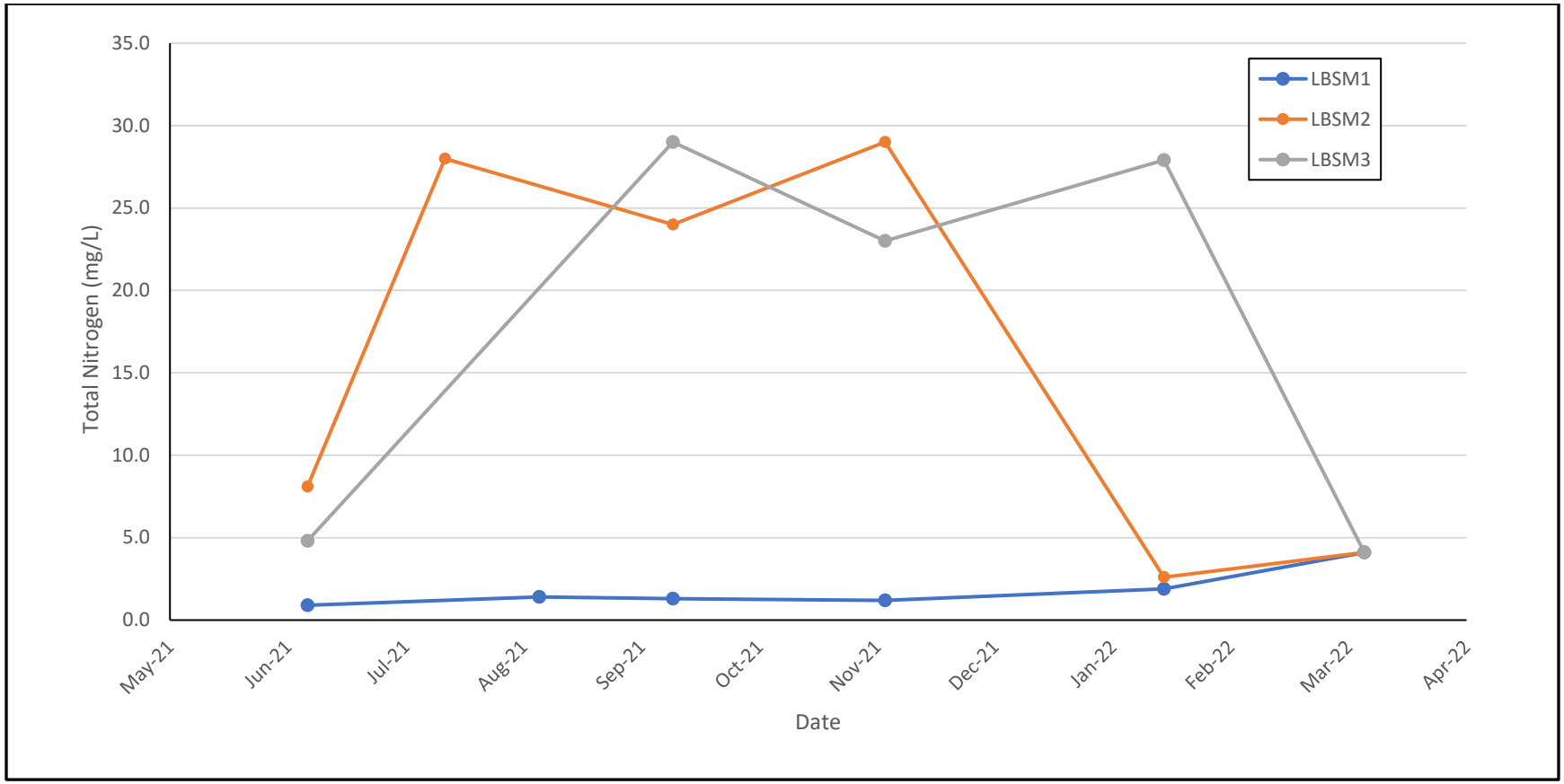


Figure 5-6 – Total Phosphorus Concentrations in Lake Buchanan Seepage Meters from June 2021through March 2022

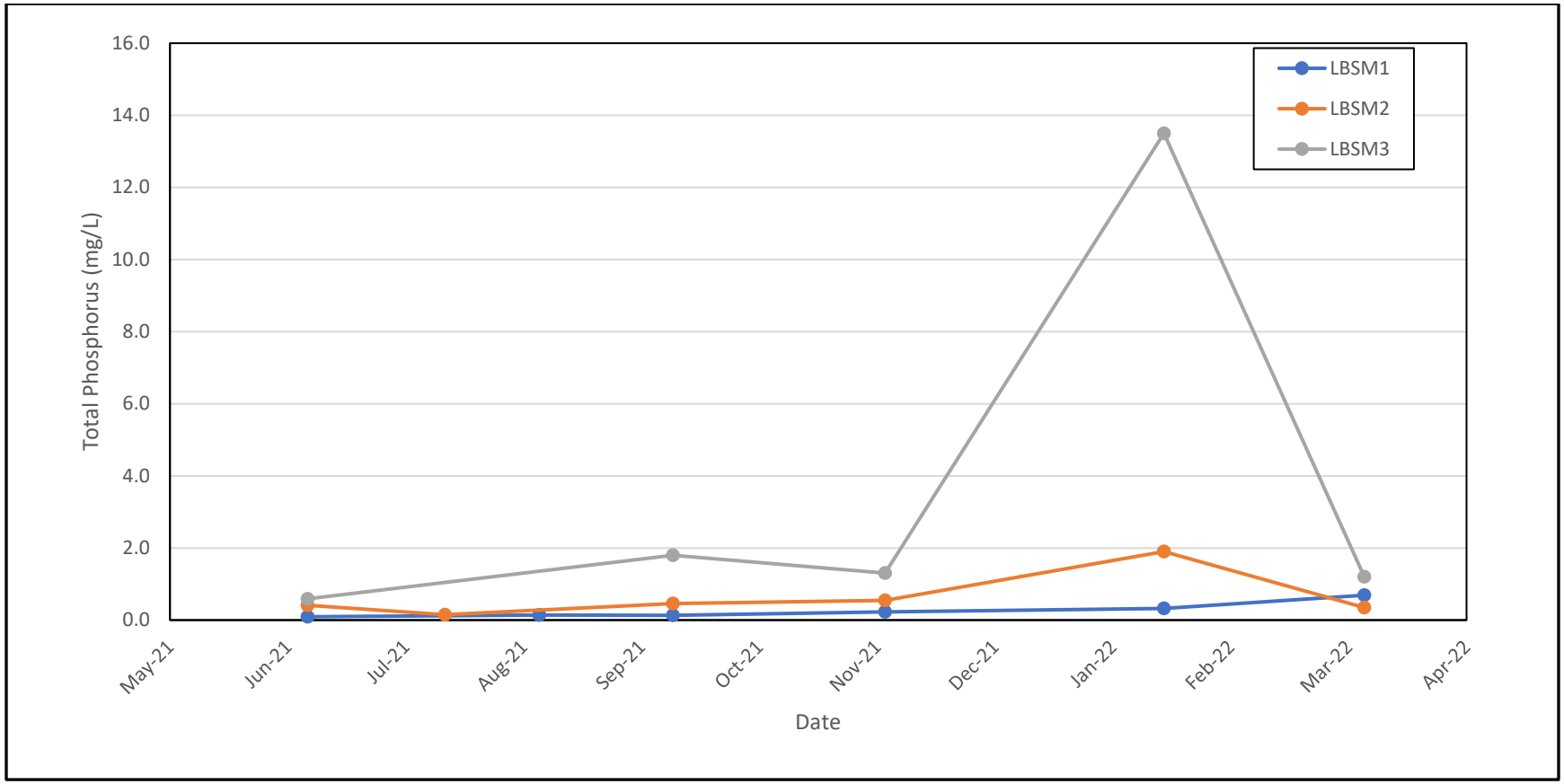


Figure 5-7– Ammonia Concentrations in Lake Buchanan Seepage Meters from June 2021 through March 2022

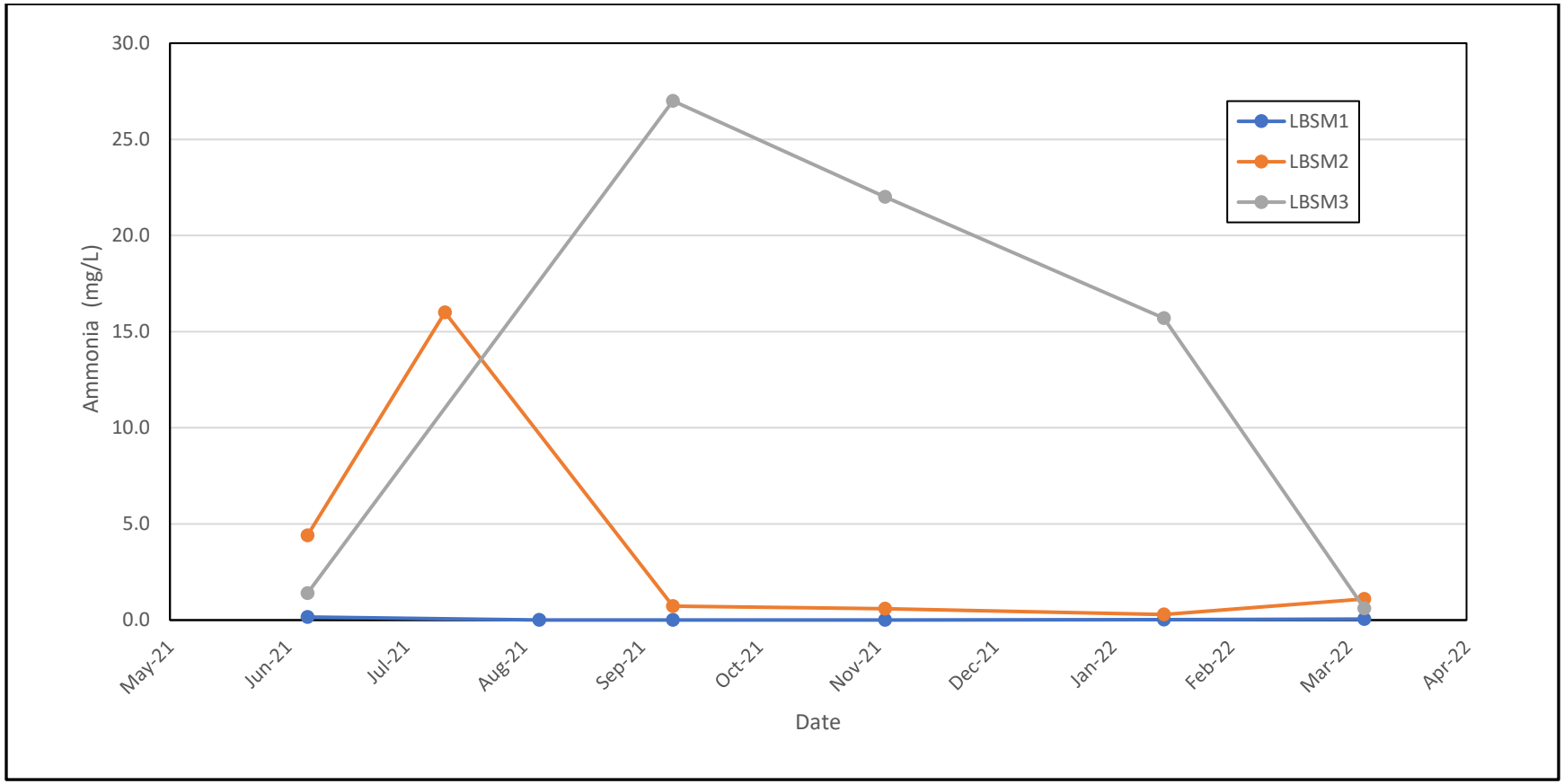


Figure 5-8 – Nitrate + Nitrite Concentrations in Lake Buchanan Seepage Meters from June 2021 through March 2022

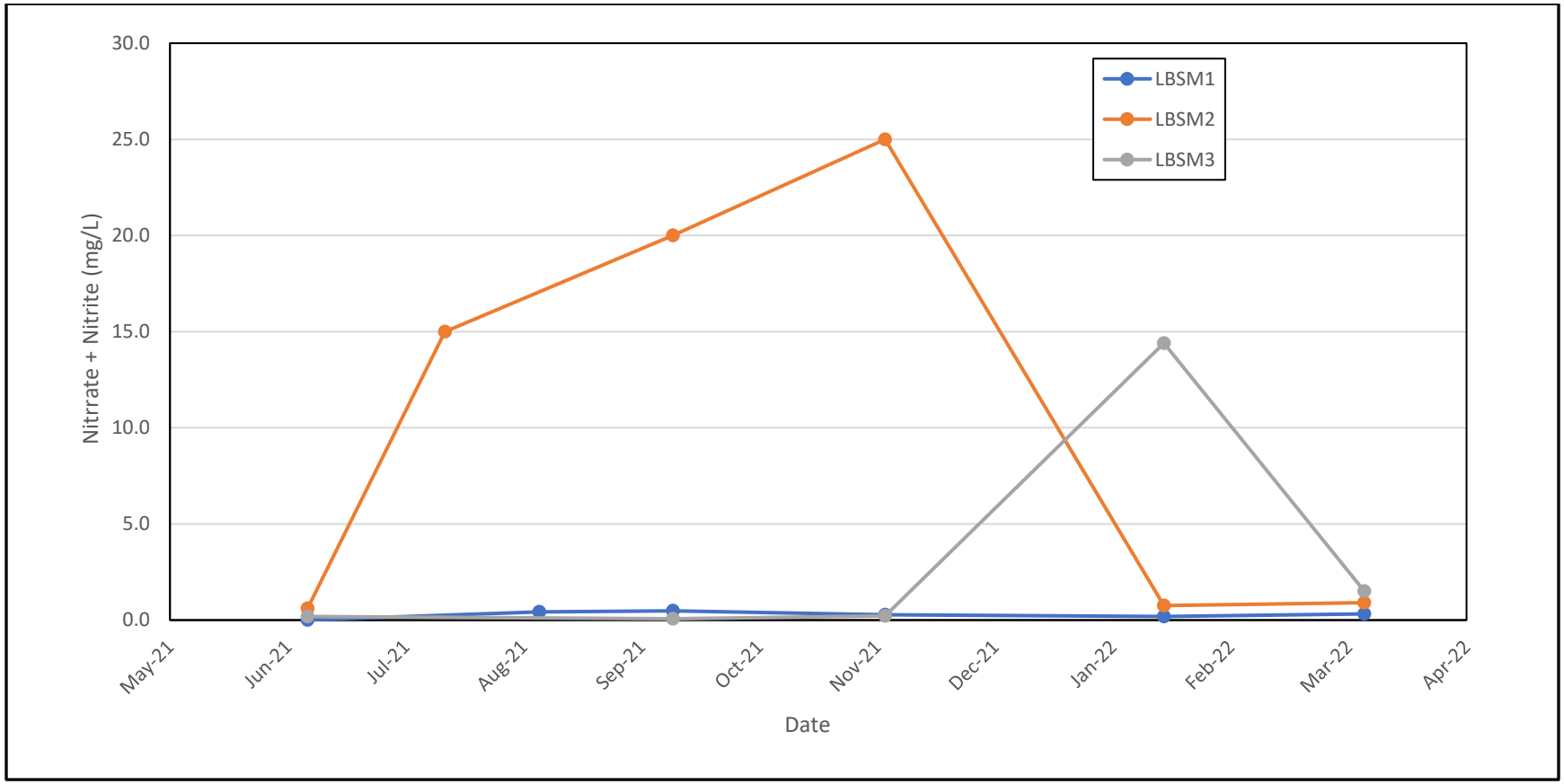
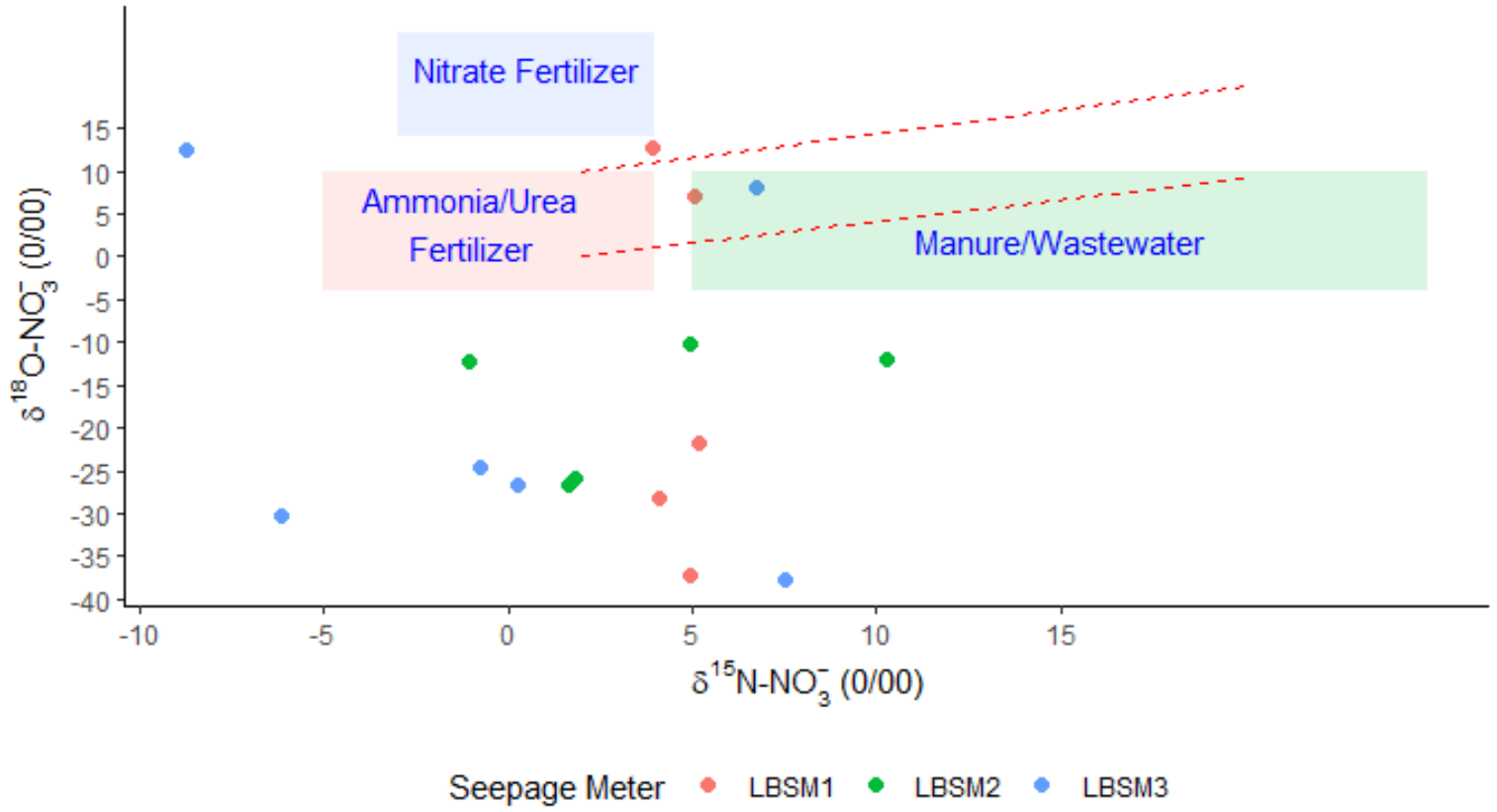
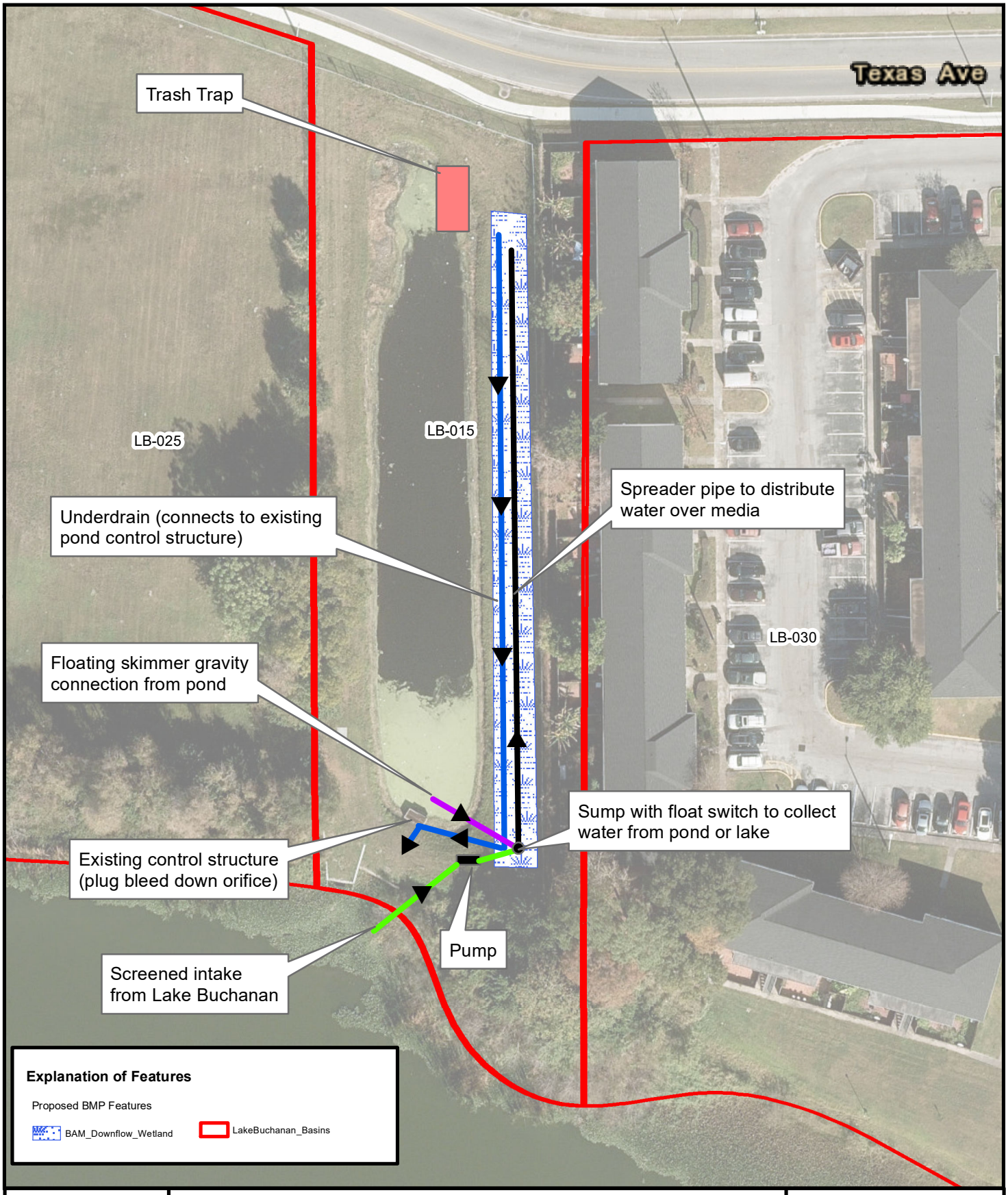


Figure 5-9 – Isotope biplot from Lake Buchanan Seepage Meters collected from November 2021 through October 2022



Note: Isotopic ranges for sources are represented using boxes bounded by values adapted from Canion et al. 2020. Purple diagonal lines indicate the approximate denitrification trajectory (as shown by Canion et al. 2020). Soil organic-N bounding box removed to illustrate anthropogenic sources of nitrogen.



Notes:

1- Project No.: 600713.2

2- Data Source - ESRI Imagery, Wood

3- This map is intended to be used for planning purposes only. It is not a survey.

Date: 06/29/2022
Revised: ACH
Checked By:

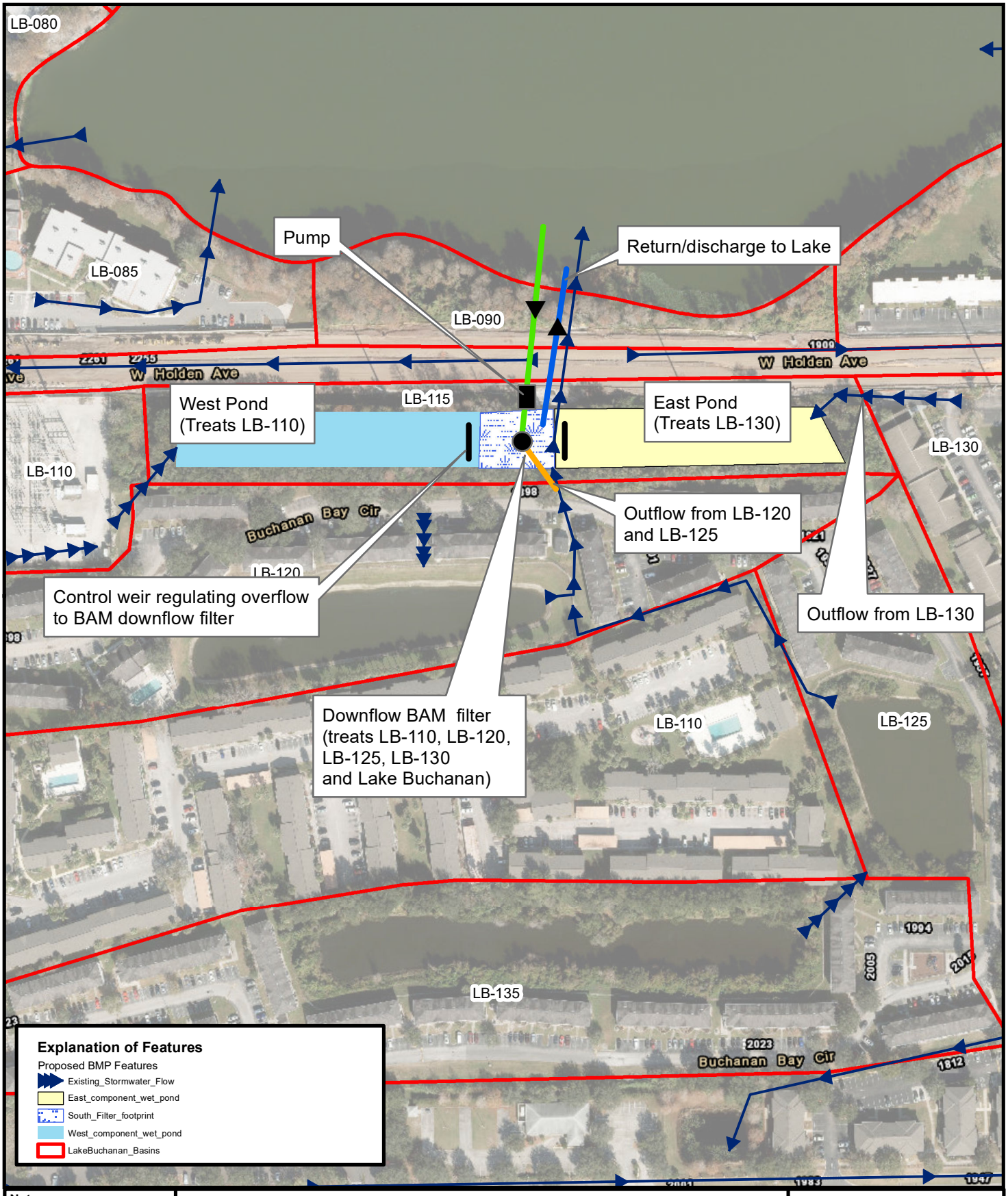
N

Figure 6-1
Alternative 1 BAM Downflow Filtration with Lake Water Remediation
Location: Basin LB-015
Lake Buchanan Watershed
Orange County, FL

0 40
Feet

wsp

Path: C:\Users\lance.lumbard\Wood PLC\Orlando Water - Lake Buchanan\13_GIS\PLA_Model\MXD\report_Lance\Lance_report_North_BMP_8x11p.mxd



Notes:

1- Project No.: 600713.2

2- Data Source - ESRI Imagery, Wood

3- This map is intended to be used for planning purposes only. It is not a survey.

Date: 06/29/2022
Revised: ACH
Checked By:

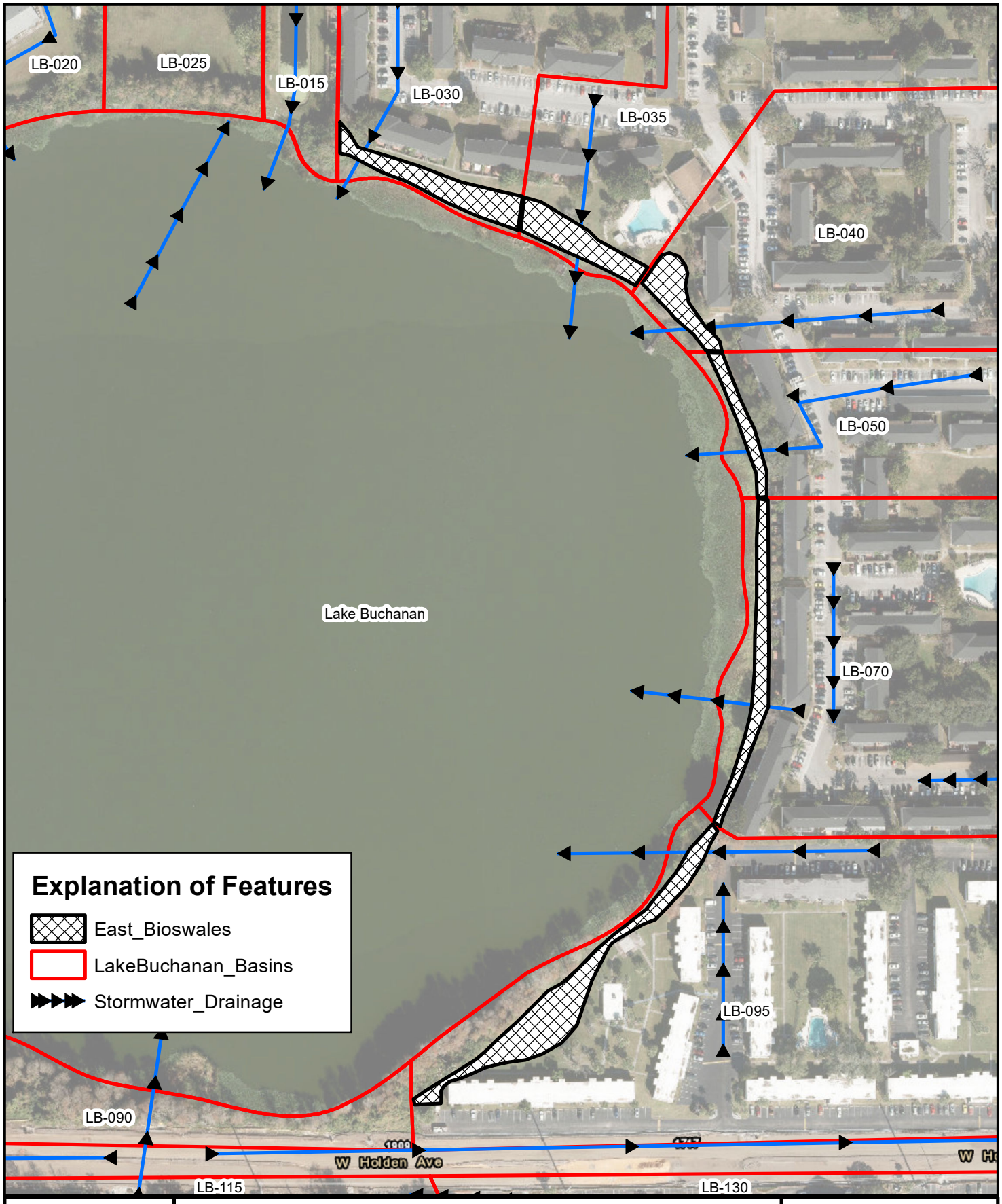
N

Figure 6-2
Alternative 2 BAM Downflow Wetland Filtration with Lake Water Remediation
Location: Basin LB-115
Lake Buchanan Watershed
Orange County, FL

0 150
Feet

wsp

Path: C:\Users\lance.lumbard\Wood PLC\Orlando Water - Lake Buchanan\13_GIS\MXD\Fig 6-2 BMP Alt 2.mxd



1- Project No.: 600713.2

2- Data Source - ESRI Imagery, Wood

3- This map is intended to be used for planning purposes only. It is not a survey.

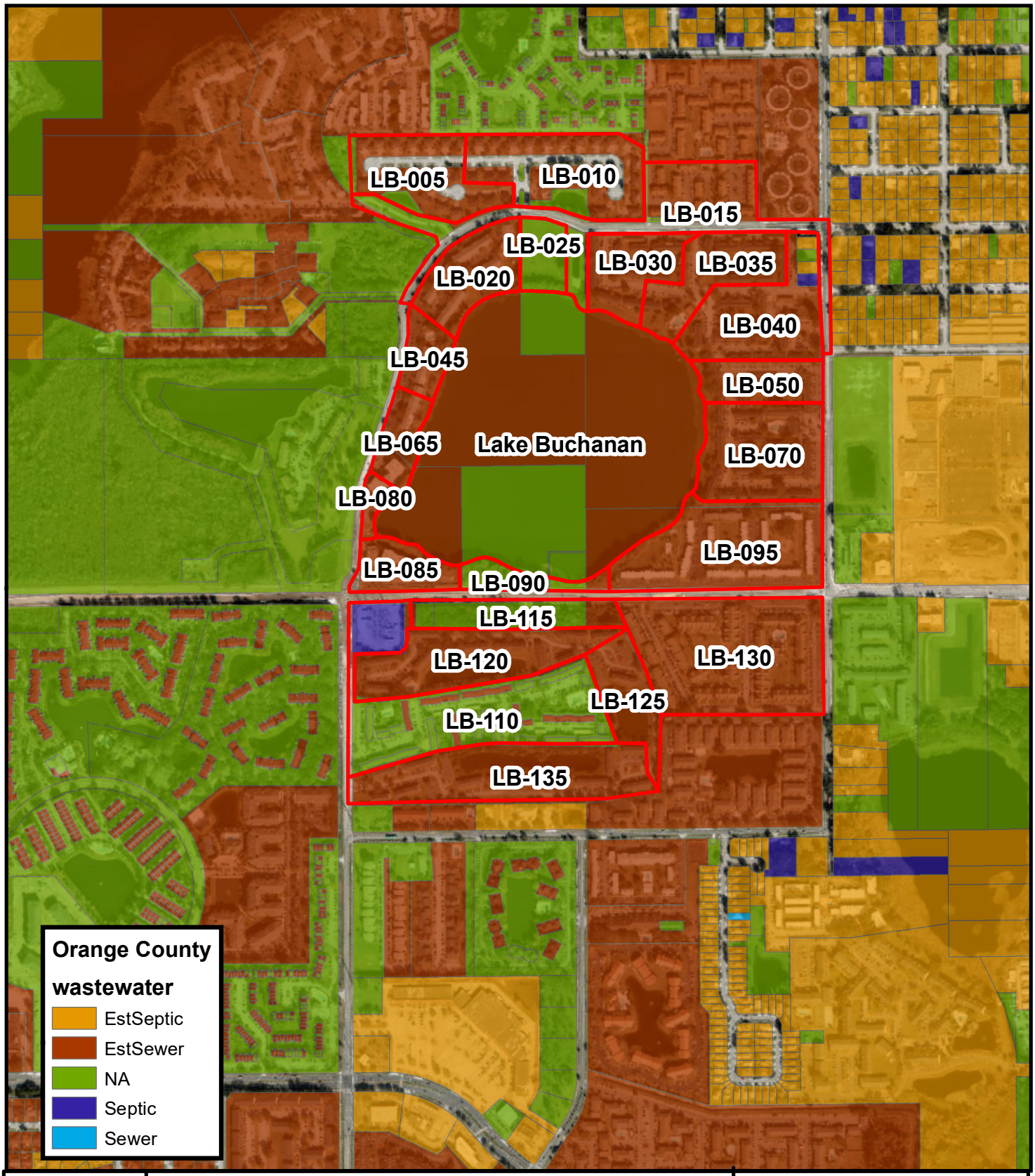
Date: 06/29/2022
Revised: ACH
Checked By:

N

Figure 6-3
Alternative 3 East Bioswales
Location: Basin LB-030, LB-035, LB-040, LB-050, LB-070, LB-095
Lake Buchanan Watershed
Orange County, FL

0 160
Feet

wsp



Notes:

1- Project No.:600713x2

2- Data Source - ESRI Imagery, FDOH, Wood,

3- This map is intended to be used for planning purposes only. It is not a survey.

Date: 4/18/22
Created By:ZL
Checked By:

N

Explanation of Features

Lake Buchanan Sub-Basins

0 600
Feet

Figure 6-4
Wastewater Treatment Type
Lake Buchanan
Orange County, Florida

wsp

APPENDIX A
Lake Bathymetry

Survey Point Location Map

TOPOGRAPHIC SURVEY

SECTION 10, TOWNSHIP 23 SOUTH, RANGE 29 EAST
CITY OF ORLANDO, ORANGE COUNTY, FLORIDA.

Surveyor's Notes

1. This Topographic Survey is not valid unless signed and embossed with the raised seal of a Florida licensed Surveyor and Mapper.
2. Lands were not researched by this firm for matters such as ownership, easements, right of way or other matters in the public records that may affect these lands. A title report was not provided for this survey.
3. Bearings & Coordinates are relative to the Florida State Plane Coordinate System, East Zone, North American Datum of 1983/ 2011 Adjustment.
4. Elevations shown hereon are relative to the following Benchmarks:

   P-1690-020: Elevation = 104.543'

   M-098008: Elevation = 93.807'

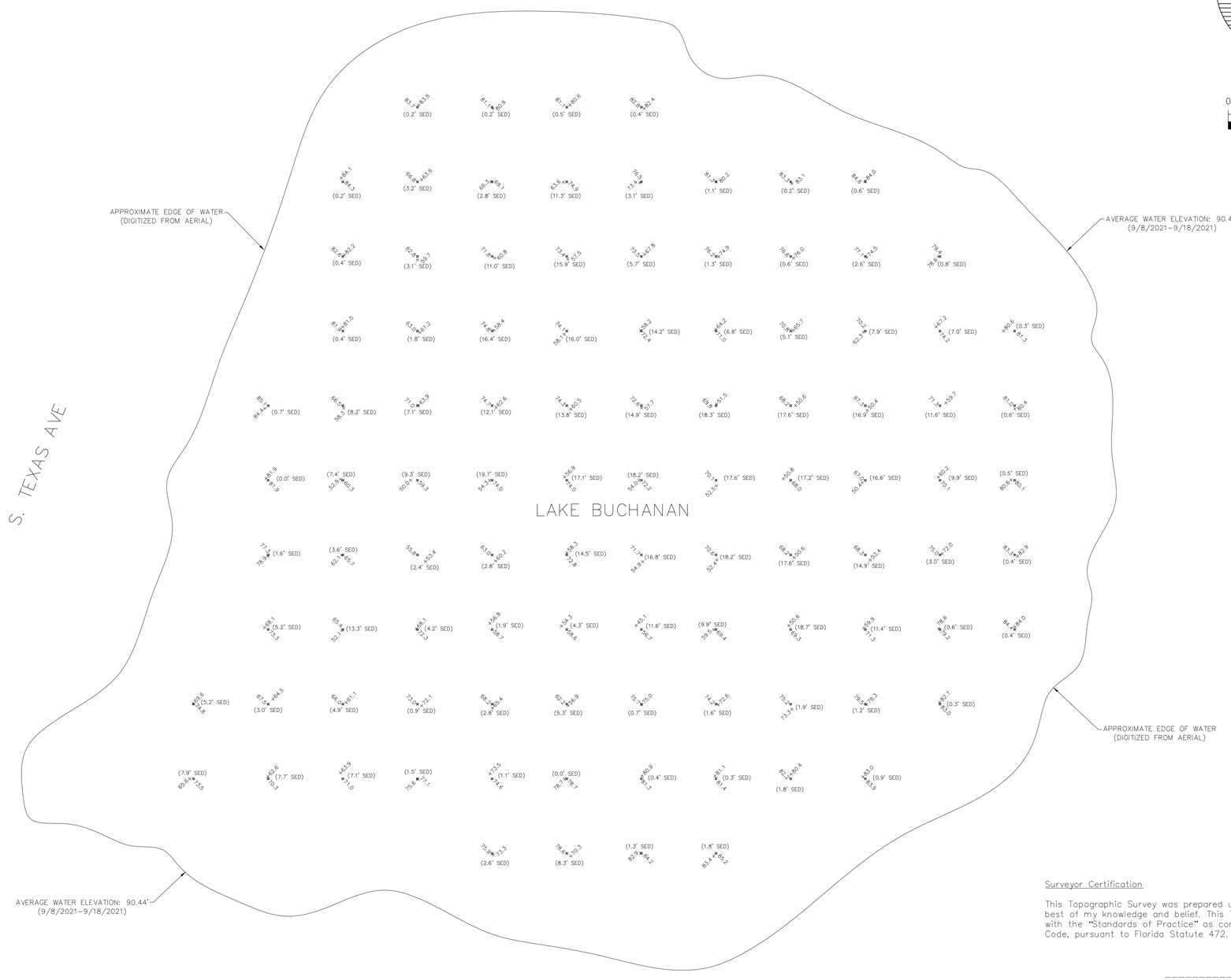
   North American Vertical Datum of 1988 (NAVD 88),
5. Last day in the field: 9/18/2021.
6. Contours and color banding are depicting hard bottom of Lake Buchanan.
7. Graphic symbols shown hereon may not be to scale.
8. This Topographic Survey is certified true and correct to: WOOD PLC.

ABBREVIATION LEGEND

CAMPH – CAMPHOR
CONC – CONCRETE
CMP – CORRUGATED METAL PIPE
DIP – DUCTILE IRON PIPE
DUE – DRAINAGE AND UTILITY EASEMENT
DE – DRAINAGE EASEMENT
EL – ELEVATION
FND – FOUND
ID – IDENTIFICATION
INV – INVERT
IP – IRON PIPE
IRC – IRON ROD AND CAP
IR – IRON ROD
LB – LICENSED BUSINESS
N&D – NAIL AND DISK
PG – PAGE
PKN – PARKER KALON NAIL
PCP – PERMANENT CONTROL POINT
PB – PLAT BOOK
PVC – POLYVINYL CHLORIDE
RCP – REINFORCED CONCRETE PIPE
R/W – RIGHT OF WAY
SED – SEDIMENT
TYP – TYPICAL
UE – UTILITY EASEMENT
VCP – VITRIFIED CLAY PIPE

SYMBOL LEGEND

ARV – AIR RELEASE VALVE
CATV – CABLE TV PEDESTAL
CB – COMMUNICATIONS BOX
COM – COMMUNICATIONS HAND HOLE
CO – CLEANOUT
E – ELECTRIC BOX
EH – ELECTRIC HAND HOLE
EM – ELECTRIC MANHOLE
FOM – FIBER OPTIC MARKER
FH – FIRE HYDRANT
GM – GAS MARKER
GV – GAS VALVE
IV – IRRIGATION VALVE
LP – LIGHT POLE
MB – MAIL BOX
MS – METAL SIGN
PX – PEDESTRIAN CROSSING POLE
RM – RECLAIM WATER MARKER
RWM – RECLAIM WATER METER
RV – RECLAIM WATER VALVE
SMH – SANITARY MANHOLE
THH – TELEPHONE HAND HOLE
TRH – TRAFFIC HAND HOLE
TB – TRAFFIC SIGNAL BOX
6" OAK – TREE (SIZE, TYPE)
UP – UTILITY POLE
WM – WATER METER
WV – WATER VALVE
W – WELL
-9.0 – BOTTOM LAKE ELEVATION
-9.0 / -8.5 – TOP OF SEDIMENT ELEVATION



GRAPHIC SCALE
0 50 100 200
1" = 100'

Surveyor Certification

This Topographic Survey was prepared under my direction and is true and correct to the best of my knowledge and belief. This Topographic Survey was performed in conformance with the "Standards of Practice" as contained in Chapter 5J-17, Florida Administrative Code, pursuant to Florida Statute 472.

Genel J. Sturgeon, PLS Date
Florida Surveyor and Mapper PSM 5866
Barnes Ferland and Associates LB 7774

*Not valid without the signature and original raised seal of the Florida licensed surveyor and mapper

No.	REVISIONS	BY	DATE

LINE IS 2 INCHES AT FULL SIZE (IF NOT SCALE ACCORDINGLY)

PREPARED FOR: WOOD PLC

BFA Environmental Consultants
Barnes, Ferland and Associates, Inc.
1230 Hillcrest St., Orlando, Florida 32803
PH: (407) 896-8608 FAX: (407) 896-1822
CERTIFICATE OF AUTHORIZATION NUMBER: LB 7774

LAKE BUCHANAN BOTTOM & SILT MAP

TOPOGRAPHIC SURVEY

* NOT VALID WITHOUT SIGNATURE AND EMBOSSED SEAL OF A FLORIDA LICENSED SURVEYOR.

DRAWING INFORMATION		DATE
PROJECT No.: 2020-13.4		
DRAWN BY: MC		10/1
CHECKED BY: GJS		10/1
PC: DR/CN	FB/PG: 74/69-72	
DRAWING FILE: SEE MARGIN	SCALE: 1" = 100'	

SHEET NUMBER 1 OF 1

Survey Point Location Tables

Point Number	Easting	Northing	Point Elevation	Raw Description	Longitude	Latitude
1	525960.87	1514330.3010'	93.50'	FBD O.C. NO	W81° 24' 19.38"	N28° 29' 56.24"
2	526024.25	1514680.3910'	93.68'	FXC "M098008	W81° 24' 18.68"	N28° 29' 59.71"
3	527339.87	1514656.3150'	104.52'	FAD P1690020	W81° 24' 03.93"	N28° 29' 59.52"
4	525271.55	1512739.0210'	95.35'	SND BFA TRAV	W81° 24' 27.04"	N28° 29' 40.46"
5	524801.88	1512738.0100'	96.18'	SND BFA TRAV	W81° 24' 32.30"	N28° 29' 40.44"
6	525946.74	1514331.5890'	93.43'	SIRC BFA TRAV	W81° 24' 19.53"	N28° 29' 56.25"
101	525960.87	1514330.3010'	93.50'	FBD O.C. NO	W81° 24' 19.38"	N28° 29' 56.24"
102	526024.25	1514680.3910'	93.68'	FXC "M098008	W81° 24' 18.68"	N28° 29' 59.71"
103	527339.87	1514656.3150'	104.52'	FAD P1690020	W81° 24' 03.93"	N28° 29' 59.52"
104	525271.55	1512739.0210'	95.35'	SND BFA TRAV	W81° 24' 27.04"	N28° 29' 40.46"
105	524801.88	1512738.0100'	96.18'	SND BFA TRAV	W81° 24' 32.30"	N28° 29' 40.44"
106	525946.74	1514331.5890'	93.43'	SIRC BFA TRAV	W81° 24' 19.53"	N28° 29' 56.25"
1000	526024.22	1514680.5130'	93.64'	CK 102	W81° 24' 18.68"	N28° 29' 59.71"
1001	525537.18	1514185.5600'	83.48'	GS TS-6.75	W81° 24' 24.12"	N28° 29' 54.80"
1002	525661.01	1514179.5840'	80.91'	GS TS-9.30	W81° 24' 22.73"	N28° 29' 54.74"
1003	525790.57	1514185.7100'	80.64'	GS TS-9.30	W81° 24' 21.28"	N28° 29' 54.81"
1004	525914.47	1514179.7060'	82.37'	GS TS-7.65	W81° 24' 19.89"	N28° 29' 54.75"
1005	526284.94	1514058.7230'	84.04'	GS TS-5.80	W81° 24' 15.73"	N28° 29' 53.56"
1006	526161.83	1514054.1620'	83.11'	GS TS-7.10	W81° 24' 17.11"	N28° 29' 53.52"
1007	526034.87	1514057.4570'	80.18'	GS TS-9.10	W81° 24' 18.54"	N28° 29' 53.54"
1008	525907.16	1514055.2330'	73.38'	GS TS-13.90	W81° 24' 19.97"	N28° 29' 53.52"
1009	525779.55	1514056.4120'	63.57'	GS TS-15.50	W81° 24' 21.40"	N28° 29' 53.52"
1010	525658.34	1514057.0590'	66.30'	GS TS-21.35	W81° 24' 22.76"	N28° 29' 53.53"
1011	525541.83	1514060.6370'	63.58'	GS TS-23.60	W81° 24' 24.06"	N28° 29' 53.56"
1012	525407.55	1514063.4790'	84.06'	GS TS-6.10	W81° 24' 25.57"	N28° 29' 53.58"
1013	525412.47	1513934.4470'	82.25'	GS TS-7.80	W81° 24' 25.51"	N28° 29' 52.30"
1014	525534.87	1513926.3170'	59.71'	GS TS-27.60	W81° 24' 24.13"	N28° 29' 52.23"
1015	525664.29	1513929.4100'	60.84'	GS TS-18.60	W81° 24' 22.68"	N28° 29' 52.26"
1016	525786.61	1513927.5080'	57.54'	GS TS-17.00	W81° 24' 21.31"	N28° 29' 52.25"
1017	525915.28	1513935.5350'	67.78'	GS TS-16.90	W81° 24' 19.87"	N28° 29' 52.33"
1018	526039.29	1513931.8140'	74.94'	GS TS-14.20	W81° 24' 18.48"	N28° 29' 52.30"
1019	526164.62	1513929.0420'	75.97'	GS TS-13.80	W81° 24' 17.08"	N28° 29' 52.28"
1020	526287.36	1513930.5030'	74.47'	GS TS-13.30	W81° 24' 15.70"	N28° 29' 52.30"

Point Number	Easting	Northing	Point Elevation	Raw Description	Longitude	Latitude
1021	526412.81	1513932.3590'	78.48'	GS TS-10.60	W81° 24' 14.29"	N28° 29' 52.32"
1022	526407.07	1513931.7500'	78.56'	GS TS-11.00	W81° 24' 14.36"	N28° 29' 52.31"
1023	526516.37	1513807.5210'	80.62'	GS TS-9.10	W81° 24' 13.13"	N28° 29' 51.08"
1024	526403.68	1513814.2660'	67.17'	GS TS-16.25	W81° 24' 14.39"	N28° 29' 51.15"
1025	526281.79	1513805.1490'	62.30'	GS TS-20.20	W81° 24' 15.76"	N28° 29' 51.05"
1026	526164.08	1513808.2670'	65.67'	GS TS-19.60	W81° 24' 17.08"	N28° 29' 51.08"
1027	525953.19	1514333.0120'	90.41'	SET HUB TOP WATE	W81° 24' 19.46"	N28° 29' 56.27"
1028	526024.21	1514680.4480'	93.62'	CK 102	W81° 24' 18.68"	N28° 29' 59.71"
1029	526034.57	1513809.8370'	64.25'	GS TS-19.40	W81° 24' 18.53"	N28° 29' 51.09"
1030	525908.76	1513808.2090'	58.15'	GS TS-18.00	W81° 24' 19.94"	N28° 29' 51.07"
1031	525780.66	1513801.6170'	58.06'	GS TS-16.30	W81° 24' 21.38"	N28° 29' 51.00"
1032	525663.01	1513808.3870'	58.36'	GS TS-15.65	W81° 24' 22.69"	N28° 29' 51.07"
1033	525409.72	1513813.8770'	81.53'	GS TS-8.55	W81° 24' 25.53"	N28° 29' 51.11"
1034	525279.16	1513677.4050'	84.37'	GS TS-5.65	W81° 24' 26.99"	N28° 29' 49.76"
1035	525411.26	1513677.9900'	58.33'	GS TS-23.90	W81° 24' 25.51"	N28° 29' 49.77"
1036	525537.00	1513682.5870'	63.91'	GS TS-19.45	W81° 24' 24.10"	N28° 29' 49.82"
1037	525666.56	1513679.0130'	62.59'	GS TS-15.70	W81° 24' 22.65"	N28° 29' 49.78"
1038	525791.71	1513676.0990'	60.54'	GS TS-16.10	W81° 24' 21.25"	N28° 29' 49.76"
1039	525910.26	1513678.2680'	57.70'	GS TS-17.80	W81° 24' 19.92"	N28° 29' 49.79"
1040	525539.12	1513804.6630'	61.22'	GS TS-27.45	W81° 24' 24.08"	N28° 29' 51.02"
1041	526035.69	1513684.6350'	51.48'	GS TS-20.60	W81° 24' 18.51"	N28° 29' 49.85"
1042	526168.00	1513682.0810'	50.64'	GS TS-22.20	W81° 24' 17.03"	N28° 29' 49.83"
1043	526288.31	1513674.2190'	50.42'	GS TS-23.10	W81° 24' 15.68"	N28° 29' 49.76"
1044	526419.94	1513686.5480'	59.68'	GS TS-19.10	W81° 24' 14.21"	N28° 29' 49.88"
1045	526535.29	1513676.4610'	80.42'	GS TS-9.40	W81° 24' 12.91"	N28° 29' 49.79"
1046	526528.85	1513557.4820'	80.61'	GS TS-10.30	W81° 24' 12.98"	N28° 29' 48.61"
1047	526407.19	1513562.4390'	60.23'	GS TS-20.30	W81° 24' 14.34"	N28° 29' 48.65"
1048	526279.64	1513553.2070'	50.40'	GS TS-23.45	W81° 24' 15.77"	N28° 29' 48.56"
1049	526147.73	1513559.4780'	50.80'	GS TS-22.40	W81° 24' 17.25"	N28° 29' 48.62"
1050	525951.18	1514333.6740'	90.46'	TOP WATER HUB	W81° 24' 19.48"	N28° 29' 56.28"
1051	526024.18	1514680.4850'	93.69'	CK 102	W81° 24' 18.68"	N28° 29' 59.71"
1052	526035.24	1513547.7140'	52.54'	GS TS-20.35	W81° 24' 18.51"	N28° 29' 48.50"
1053	525905.65	1513557.1460'	54.01'	GS TS-18.25	W81° 24' 19.96"	N28° 29' 48.59"

Point Number	Easting	Northing	Point Elevation	Raw Description	Longitude	Latitude
1054	525781.32	1513562.6220'	56.86'	GS TS-16.50	W81° 24' 21.36"	N28° 29' 48.64"
1055	525655.67	1513556.8590'	54.27'	GS TS-16.45	W81° 24' 22.77"	N28° 29' 48.57"
1056	525523.42	1513557.1660'	49.96'	GS TS-31.20	W81° 24' 24.25"	N28° 29' 48.57"
1057	525406.17	1513558.6200'	52.92'	GS TS-30.20	W81° 24' 25.56"	N28° 29' 48.58"
1058	525281.60	1513560.3530'	81.87'	GS TS-8.60	W81° 24' 26.96"	N28° 29' 48.60"
1059	525284.46	1513429.8340'	78.92'	GS TS-13.20	W81° 24' 26.92"	N28° 29' 47.30"
1060	525407.74	1513431.5980'	62.14'	GS TS-24.85	W81° 24' 25.54"	N28° 29' 47.33"
1061	525548.27	1513421.2030'	53.38'	GS TS-34.70	W81° 24' 23.97"	N28° 29' 47.23"
1062	525665.91	1513421.9440'	60.22'	GS TS-27.50	W81° 24' 22.65"	N28° 29' 47.24"
1063	525785.14	1513435.5500'	58.35'	GS TS-17.70	W81° 24' 21.31"	N28° 29' 47.38"
1064	525911.95	1513420.5290'	54.88'	GS TS-18.75	W81° 24' 19.89"	N28° 29' 47.23"
1065	526036.09	1513423.4220'	52.36'	GS TS-19.90	W81° 24' 18.50"	N28° 29' 47.27"
1066	526165.76	1513427.5830'	50.60'	GS TS-22.25	W81° 24' 17.04"	N28° 29' 47.31"
1067	526293.18	1513423.6340'	53.39'	GS TS-22.20	W81° 24' 15.62"	N28° 29' 47.28"
1068	526413.55	1513433.9430'	72.01'	GS TS-15.45	W81° 24' 14.27"	N28° 29' 47.38"
1069	526540.02	1513430.0240'	82.87'	GS TS-7.20	W81° 24' 12.85"	N28° 29' 47.35"
1070	526535.40	1513311.3880'	83.98'	GS TS-6.05	W81° 24' 12.90"	N28° 29' 46.17"
1071	526408.00	1513308.6340'	78.59'	GS TS-11.30	W81° 24' 14.33"	N28° 29' 46.14"
1072	526282.42	1513309.3730'	59.89'	GS TS-19.20	W81° 24' 15.73"	N28° 29' 46.14"
1073	526156.88	1513313.7100'	50.56'	GS TS-21.15	W81° 24' 17.14"	N28° 29' 46.18"
1074	526030.85	1513306.8760'	59.53'	GS TS-21.10	W81° 24' 18.55"	N28° 29' 46.11"
1075	525901.28	1513313.8430'	45.12'	GS TS-33.75	W81° 24' 20.00"	N28° 29' 46.18"
1076	525776.18	1513312.9500'	54.31'	GS TS-31.90	W81° 24' 21.41"	N28° 29' 46.16"
1077	525656.17	1513317.5210'	56.81'	GS TS-31.75	W81° 24' 22.75"	N28° 29' 46.20"
1078	525532.96	1513308.2010'	68.14'	GS TS-18.20	W81° 24' 24.13"	N28° 29' 46.11"
1079	525408.51	1513305.3090'	52.13'	GS TS-25.10	W81° 24' 25.53"	N28° 29' 46.08"
1080	525278.81	1513310.3060'	68.07'	GS TS-17.15	W81° 24' 26.98"	N28° 29' 46.12"
1081	525951.26	1514333.7350'	90.45'	TOP WATER HUB	W81° 24' 19.48"	N28° 29' 56.28"
1082	526024.13	1514680.5420'	93.65'	CK 102	W81° 24' 18.68"	N28° 29' 59.71"
1083	525159.51	1513183.0430'	69.58'	GS TS-15.60	W81° 24' 28.31"	N28° 29' 44.86"
1084	525293.04	1513190.3210'	64.52'	GS TS-22.95	W81° 24' 26.82"	N28° 29' 44.93"
1085	525415.60	1513184.7750'	61.13'	GS TS-24.45	W81° 24' 25.44"	N28° 29' 44.88"
1086	525541.92	1513179.3310'	72.10'	GS TS-17.40	W81° 24' 24.03"	N28° 29' 44.83"

Point Number	Easting	Northing	Point Elevation	Raw Description	Longitude	Latitude
1087	525660.50	1513175.6630'	65.39'	GS TS-22.30	W81° 24' 22.70"	N28° 29' 44.80"
1088	525786.97	1513179.6460'	56.90'	GS TS-28.25	W81° 24' 21.28"	N28° 29' 44.84"
1089	525910.37	1513180.8640'	74.96'	GS TS-14.75	W81° 24' 19.90"	N28° 29' 44.86"
1090	526038.67	1513181.0020'	72.60'	GS TS-16.20	W81° 24' 18.46"	N28° 29' 44.87"
1091	526161.81	1513173.2500'	73.26'	GS TS-15.20	W81° 24' 17.08"	N28° 29' 44.79"
1092	526287.15	1513181.4970'	78.25'	GS TS-10.95	W81° 24' 15.67"	N28° 29' 44.88"
1093	526409.49	1513185.1020'	82.75'	GS TS-7.40	W81° 24' 14.30"	N28° 29' 44.92"
1094	526281.14	1513060.3990'	83.00'	GS TS-6.55	W81° 24' 15.74"	N28° 29' 43.68"
1095	526160.94	1513064.5690'	80.37'	GS TS-8.30	W81° 24' 17.09"	N28° 29' 43.72"
1096	526033.31	1513061.7160'	81.11'	GS TS-9.1	W81° 24' 18.52"	N28° 29' 43.68"
1097	525951.25	1514333.7310'	90.46'	TOP WATER HUB	W81° 24' 19.48"	N28° 29' 56.28"
1098	526024.16	1514680.4780'	93.63'	CK 102	W81° 24' 18.68"	N28° 29' 59.71"
1099	525911.22	1513061.7680'	80.95'	GS TS-9.20	W81° 24' 19.88"	N28° 29' 43.68"
1100	525781.13	1513056.7110'	78.70'	GS TS-12.3	W81° 24' 21.34"	N28° 29' 43.63"
1101	525656.59	1513065.1800'	73.48'	GS TS-15.85	W81° 24' 22.74"	N28° 29' 43.71"
1102	525534.66	1513055.8350'	75.63'	GS TS-13.35	W81° 24' 24.10"	N28° 29' 43.61"
1103	525405.98	1513067.0430'	63.92'	GS TS-19.50	W81° 24' 25.55"	N28° 29' 43.72"
1104	525284.43	1513060.8840'	62.64'	GS TS-20.20	W81° 24' 26.91"	N28° 29' 43.65"
1105	525153.86	1513056.8870'	65.65'	GS TS-16.95	W81° 24' 28.37"	N28° 29' 43.61"
1106	525661.57	1512929.6570'	73.28'	GS TS-14.60	W81° 24' 22.68"	N28° 29' 42.36"
1107	525791.79	1512927.4170'	70.32'	GS TS-11.85	W81° 24' 21.22"	N28° 29' 42.35"
1108	525908.33	1512932.4780'	82.90'	GS TS-6.25	W81° 24' 19.91"	N28° 29' 42.40"
1109	526030.92	1512927.1230'	83.38'	GS TS-5.25	W81° 24' 18.54"	N28° 29' 42.35"

APPENDIX B

Sediment Phosphorus Fractionation Lab Report

DB Environmental

January 18, 2022

Wood PLC
Attention: Lance Lumbard
550 Northlake Blvd., Suite 1000
Altamonte Springs, FL 32701

PO #: C012610118
Project Name: Lake Buchanan
Project No.: 600713x2-03-09
Batch ID: 376755

Dear Lance Lumbard:

DB Environmental received 3 samples on November 18, 2021 @ 18:10 for the analyses presented in the following report.

Analyses are performed with method required calibration and QA/QC samples whenever applicable. Method performance, which is based on the calibration and QA/QC samples, establishes the validity and certainty of the reported sample results. These results are calculated on a dry-weight basis, unless otherwise noted. These results relate only to the samples as received. The report shall not be reproduced except in full, without the written approval of the laboratory.

This report contains a total of 7 pages:

cover letter	1	case narrative	1	report	3
QC summary	1	COC	1	analytical results	0
correspondence	0				

Please note that any unused portion of the samples will be disposed of 30 days following issuance of report, unless you have requested otherwise.

If you have any questions regarding the analytical results, please feel free to call me at 321-639-4896.

Sincerely,

Nancy Chan
Project Manager

Enclosure

cc: Craig Duxbury

THIS DOCUMENT MEETS NELAC STANDARDS
NELAP Certification #E 83330

DB Environmental

CASE NARRATIVE

January 18, 2022

Wood PLC
Attention: Lance Lumbard
550 Northlake Blvd., Suite 1000
Altamonte Springs, FL 32701

PO #: C012610118
Project Name: Lake Buchanan
Project No.: 600713x2-03-09
Batch ID: 376755

Parameter: NaOH TSP and NaOH SRP
Lab Log #: 376757

The NaOH SRP result was greater than the associated NaOH TSP result. However, the results were not qualified because the NaOH SRP concentration was less than 120% of the NaOH TSP concentration.

Nancy Chan
Project Manager

DB Environmental, Inc., 365 Gus Hipp Blvd., Rockledge, FL 32955 - (321) 639-4896
NELAP/FDOH# E 83330

Date: January 18, 2022

REPORT OF ANALYSIS

Client: Wood PLC
Attention: Lance Lumbard
550 Northlake Blvd., Suite 1000
Altamonte Springs, FL 32701

Date and Time Received: 11/18/2021 18:10

PO #: C012610118
Project Name : Lake Buchanan
Project No. : 600713x2-03-09
Matrix: Sediment

SAMPLE ID	LAB LOG NUMBER	DATE SAMPLED	TIME SAMPLED	PARAMETER	METHOD NUMBER	RESULTS	UNITS	METHOD DETECTION LIMIT	DATE/TIME OF ANALYSIS	QUALIFIER CODE
Buchanan Core 3	376755	11/18/2021	13:20	% Dry Weight	ASA 21-2	52.69	%	0.01	11/24/2021	
Buchanan Core 2	376756	11/18/2021	13:40	% Dry Weight	ASA 21-2	9.94	%	0.01	11/24/2021	
Buchanan Core 1	376757	11/18/2021	14:05	% Dry Weight	ASA 21-2	72.10	%	0.01	11/24/2021	
Buchanan Core 3	376755	11/18/2021	13:20	Bulk Density	ASA 13	0.75	g/cc	0.001	11/24/2021	
Buchanan Core 2	376756	11/18/2021	13:40	Bulk Density	ASA 13	0.10	g/cc	0.001	11/24/2021	
Buchanan Core 1	376757	11/18/2021	14:05	Bulk Density	ASA 13	1.2	g/cc	0.001	11/24/2021	
Buchanan Core 3	376755	11/18/2021	13:20	Volatile Solids	EPA/COE 3-59	8.12	%	1.35	12/9/2021	A
Buchanan Core 2	376756	11/18/2021	13:40	Volatile Solids	EPA/COE 3-59	57.4	%	1.35	12/9/2021	
Buchanan Core 1	376757	11/18/2021	14:05	Volatile Solids	EPA/COE 3-59	3.19	%	1.35	12/9/2021	I
Buchanan Core 3	376755	11/18/2021	13:20	Total Phosphorus	DBE SOP TP	4370	mg/kg dry	100	12/13/2021	
Buchanan Core 2	376756	11/18/2021	13:40	Total Phosphorus	DBE SOP TP	4360	mg/kg dry	100	12/13/2021	
Buchanan Core 1	376757	11/18/2021	14:05	Total Phosphorus	DBE SOP TP	364	mg/kg dry	10	12/13/2021	A
Buchanan Core 3	376755	11/18/2021	13:20	Porewater SRP	DBE SOP OPO4	0.16	mg/kg dry	0.001	11/24/2021 12:27	A
Buchanan Core 2	376756	11/18/2021	13:40	Porewater SRP	DBE SOP OPO4	3.1	mg/kg dry	0.018	11/24/2021 12:27	A
Buchanan Core 1	376757	11/18/2021	14:05	Porewater SRP	DBE SOP OPO4	0.028	mg/kg dry	0.0005	11/24/2021 12:27	

SAMPLE ID	LAB LOG NUMBER	DATE SAMPLED	TIME SAMPLED	PARAMETER	METHOD NUMBER	RESULTS	UNITS	METHOD DETECTION LIMIT	DATE/TIME OF ANALYSIS	QUALIFIER CODE
Buchanan Core 3	376755	11/18/2021	13:20	Porewater NH_3-N	EPA 350.1#	5.2	mg/kg dry	0.12	12/2/2021	A
Buchanan Core 2	376756	11/18/2021	13:40	Porewater NH_3-N	EPA 350.1#	198	mg/kg dry	1.8	12/2/2021	
Buchanan Core 1	376757	11/18/2021	14:05	Porewater NH_3-N	EPA 350.1#	0.51	mg/kg dry	0.02	12/2/2021	
Buchanan Core 3	376755	11/18/2021	13:20	NH_4Cl TSP*	DBE SOP TP	4.1	mg/kg dry	0.7	12/27/2021	A
Buchanan Core 2	376756	11/18/2021	13:40	NH_4Cl TSP*	DBE SOP TP	7.5	mg/kg dry	0.8	12/27/2021	A
Buchanan Core 1	376757	11/18/2021	14:05	NH_4Cl TSP*	DBE SOP TP	2.2	mg/kg dry	0.7	12/27/2021	I
Buchanan Core 3	376755	11/18/2021	13:20	$NaHCO_3/Na_2S_2O_4$ TSP**	DBE SOP TP	38.0	mg/kg dry	2.9	12/27/2021	A
Buchanan Core 2	376756	11/18/2021	13:40	$NaHCO_3/Na_2S_2O_4$ TSP**	DBE SOP TP	131	mg/kg dry	3.1	12/27/2021	A
Buchanan Core 1	376757	11/18/2021	14:05	$NaHCO_3/Na_2S_2O_4$ TSP**	DBE SOP TP	4.1	mg/kg dry	2.8	12/27/2021	I
Buchanan Core 3	376755	11/18/2021	13:20	NaOH SRP***	DBE SOP OPO4	1590	mg/kg dry	15.6	12/2/2021 13:39	A
Buchanan Core 2	376756	11/18/2021	13:40	NaOH SRP***	DBE SOP OPO4	2600	mg/kg dry	16.8	12/2/2021 13:39	A
Buchanan Core 1	376757	11/18/2021	14:05	NaOH SRP***	DBE SOP OPO4	300	mg/kg dry	14.9	12/2/2021 13:39	
Buchanan Core 3	376755	11/18/2021	13:20	NaOH TSP	DBE SOP TP	1800	mg/kg dry	41.0	12/29/2021	A
Buchanan Core 2	376756	11/18/2021	13:40	NaOH TSP	DBE SOP TP	3820	mg/kg dry	44.0	12/29/2021	A
Buchanan Core 1	376757	11/18/2021	14:05	NaOH TSP	DBE SOP TP	289	mg/kg dry	19.6	12/29/2021	
Buchanan Core 3	376755	11/18/2021	13:20	NaOH TSP minus NaOH SRP†	Calculation	210	mg/kg dry	41.0	n/a	A
Buchanan Core 2	376756	11/18/2021	13:40	NaOH TSP minus NaOH SRP†	Calculation	1220	mg/kg dry	44.0	n/a	A
Buchanan Core 1	376757	11/18/2021	14:05	NaOH TSP minus NaOH SRP†	Calculation	<19.6	mg/kg dry	19.6	n/a	U
Buchanan Core 3	376755	11/18/2021	13:20	HCl TSP††	DBE SOP TP	92.7	mg/kg dry	3.0	12/29/2021	
Buchanan Core 2	376756	11/18/2021	13:40	HCl TSP††	DBE SOP TP	112	mg/kg dry	3.0	12/29/2021	A
Buchanan Core 1	376757	11/18/2021	14:05	HCl TSP††	DBE SOP TP	9.6	mg/kg dry	3.0	12/29/2021	A I
Buchanan Core 3	376755	11/18/2021	13:20	Residual P	DBE SOP TP	1700	mg/kg dry	88	1/4/2022	
Buchanan Core 2	376756	11/18/2021	13:40	Residual P	DBE SOP TP	1450	mg/kg dry	59	1/4/2022	A
Buchanan Core 1	376757	11/18/2021	14:05	Residual P	DBE SOP TP	26	mg/kg dry	10	1/4/2022	A I

SAMPLE ID	LAB LOG NUMBER	DATE SAMPLED	TIME SAMPLED	PARAMETER	METHOD NUMBER	RESULTS	UNITS	METHOD DETECTION LIMIT	DATE/TIME OF ANALYSIS	QUALIFIER CODE
Buchanan Core 3	376755	11/18/2021	13:20	Total Organic Carbon	DBE SOP MVP/COE 3-73	27000	mg/kg dry	3030	12/23/2021	A
Buchanan Core 2	376756	11/18/2021	13:40	Total Organic Carbon	DBE SOP MVP/COE 3-73	307000	mg/kg dry	3030	12/23/2021	
Buchanan Core 1	376757	11/18/2021	14:05	Total Organic Carbon	DBE SOP MVP/COE 3-73	16700	mg/kg dry	3030	12/23/2021	

Key to Qualifier Code

A Result based on the mean of two or more determinations; average of lab dup and/or extraction dup results.

I Result is between the method detection limit and the practical quantitation limit,

U Indicates that the compound was analyzed for but not detected.

Project Manager: Nancy Chan

Nancy Chan

Subcontract Lab ENCO (E83182)

Reference

Meis, S., Spears, B.M., Maberly, S.C., O'Malley, M.B., Perkins, R.G. 2012. Sediment amendment with Phoslock® in Clatto Reservoir (Dundee, UK): Investigating changes in sediment elemental composition and phosphorus fractionation. *J. Environ. Manag*.; 93, 185-193.

*NH_4Cl TSP = Labile P

**$NaHCO_3/Na_2S_2O_4$ TSP = Reductant-Soluble P

***NaOH SRP = Metal-Oxide Adsorbed P

†NaOH TSP minus NaOH SRP = Organic P

††HCl TSP = Apatite Bound P

QC SUMMARY
Wood PLC
PO # : C012610118
Project Name: Lake Buchanan
Project No. : 600713x2-03-09
(376755 - 376757)

PARAMETER	LAB DUPLICATES	% RSD	SPIKES	% RECOVERY	BLANKS
Volatile Solids	376755	1.9			<1.35 %
Total Phosphorus	376757	3.1	376755	89	<10 mg/kg dry
Porewater SRP	376756	0.0	376757	83	<0.002 mg/kg dry
Porewater NH3-N			AE09473-01RE1 MS AE09474-01RE1 MS AE04973-01RE1 MSD	97 94 97	<0.008 mg/kg dry
NH_4Cl TSP	376755	6.8	376757	101	<0.8 mg/kg dry
$NaHCO_3/Na_2S_2O_4$ TSP	376755	2.9	376757	86	<3.0 mg/kg dry
NaOH SRP	376755	0.5	376757	103	<16.0 mg/kg dry
NaOH TSP	375755	2.9	376757	108	<21.1 mg/kg dry
HCl TSP	376757	0.0	376755	96	<3.0 mg/kg dry
Residual P	376757	2.9	376755	97	<10 mg/kg dry
Total Organic Carbon	376755	1.5	376756	106	<3030 mg/kg dry

DB Environmental Inc.

365 Gus Hipp Blvd. Rockledge, FL 32955
Ph: (321) 639-4896 Fax: (321) 631-3169
e-mail: info@dbenv.com Lab Certification #: E83330

CHAIN OF CUSTODY

Revision 6.0 Effective 4/15/2010

Client:	Address:	City:	State:	Zip:	Phone:	Fax:
Lance Lumbard	550 Northlake Blvd. Suiite 1000	Altamonte Springs	Fl	32701		

Contact Person:	Contact Info	Invoice #:
Lance Lumbard	407-592-3235 email: Lance.lumbard@woodplc.com	

Project: ~~600713X2.01.09~~	Turn Around Time:	Collected By: R. Sheridan
PO# C012610118	Std: X Rush: Days:	Z. Leibowitz
600713x2-0309 (SL 11/18/22)		Ground Sample Return Requested: Y N

Lab Log #:	Date	Time	Comp/ Grab	Matrix Code	Preserv- ative (Specify)	Field- Filter Y/N	Sample ID:		Sample Description	% Dry Weight	Bulk Density	Volitile Solids	TOC	TP	P-Frach (Meis et al.)	Porewater SRP	Porewater NH3-N	Remarks
376755	18-Nov-21	13:20	G	SE	ICE	N	Buchanan	Core 3	Lake Sediment Core	1	1	1	1	1	1	1	1	
376756	18-Nov-21	13:40	G	SE	ICE	N	Buchanan	Core 2	Lake Sediment Core	1	1	1	1	1	1	1	1	
376757	18-Nov-21	14:05	G	SE	ICE	N	Buchanan	Core 1	Lake Sediment Core	1	1	1	1	1	1	1	1	

Custody Transfer:

	Relinquished by: Signature	Date/Time	Received by: Signature	Date/Time
1	[signature]	11/18/21 18:10	Alexis Burke	11/18/21 18:10
2				
3				

Matrix ID

DW-Drinking Water	GW-Ground Water
SW-Surface Water	WW-Waste Water
SO-Soil	PW-Porewater
SE-Sediment	PT-Plant/Veg
SD-Sludge	PE- Periphyton
G-Gas	L-Leachate
	O-Other*

*If Other, please describe below:

Sample Receiving - For Lab Use Only

Delivery: _____ Lab _____ Shipped Hand delivered by Zach (wood PLC).
Method of Shipping: _____
Sample container in contact with wet ice Yes ✓ No ___
If no, receiving Temperature 2.1 °C Thermometer #64
Chemically preserved Yes ___ No ✓
pH checked Yes ___ No ✓
First Lab Log # (Batch ID): 376755
Received by: Alexis Burke

Comments:

APPENDIX C
Sediment Flux Lab Report

SOP Nutrient Flux: C-1

STANDARD OPERATING PROCEDURE
EVALUATION OF TREATMENT ALTERNATIVE EFFICIENCIESTHROUGH DIRECT MEASUREMENT OF DIFFUSIVE FLUX

Effective Date: June 11, 2018

Prepared by: Water Resources Technical Lead Scientist; Laboratory Scientist

Approved by: Quality Assurance Field Officer; Quality Assurance Laboratory Director

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2.0 **Scope, Application and Applicable Matrix** **1**
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1.0 Purpose

This SOP describes field and laboratory methods recommended to evaluate the potential internal nutrient loading from sediments that may occur in a waterbody, as part of the sediment nutrient flux assessment component of the subject Project. In addition, various treatment alternatives can also be evaluated by measuring the reduction of diffusive nutrient flux, which would directly relate to the alternative's treatment efficiency.

The flux study will aid in quantifying the potential beneficial impacts of adding a biological or chemical amendment or cap to improve water quality.

2.0 Scope, Application and Applicable Matrix

Sediment nutrient accumulations in waterbodies over time can contribute pollutant sources to the overlying water column, through biogeochemical processes such as adsorption, desorption and diffusion processes (Lijklema et al. 1993). Detailed physical and chemical characterizations of sediments are therefore essential to evaluate the nutrient exchange processes that occur at the sediment-water interface (Sahin et al. 2012).

Phosphorus is typically the limiting nutrient in lentic systems, and when found in excess, eutrophication can occur (Dorich et al. 1985). As a growing number of waterbodies worldwide suffer from cultural eutrophication, determination of the causes of water quality degradation is becoming increasingly important for water resource management and restoration (Ogdahl et al. 2014). Bottom sediments in waterbodies play a major role in releasing nutrients to the overlying water column during wind induced sediment resuspension and/or by constant flux due to diffusion (Reddy et al. 1996). Projects that include treatment alternatives to cap sediments containing high concentrations of biologically available

nutrients are beneficial to the recovery of water quality and ecological conditions in waterbodies such as lakes and streams.

Nutrient bioavailability and reactivity in the sediments can be quantified by measuring different forms of nitrogen (N) and phosphorus (P) content in the sediment (Olila et al. 1995) and release from the sediments into the water column (Ogdahl et al. 2014). The amounts and forms of reactive and nonreactive P in sediments can be examined using chemical extraction procedures to differentiate between the P fraction's solubility when exposed to various chemical extractants (Psenner et al. 1988; Olila et al. 1995). Readily available P (i.e. labile P) is defined as the sum of water-soluble P and NH_4Cl or KCl extractable P. These labile P fractions are desorbed and hydrolyzed or loosely bound or adsorbed (Hieltjes and Lijklema 1980; Topcu and Pulatsu 2008). The NaOH-extractable P fraction is the reductant soluble P form that can be released under certain environmental conditions and is extracted from iron hydroxide and aluminum hydroxide surfaces in the laboratory (Hieltjes and Lijklema 1980; Topcu and Pulatsu 2008). The sum of labile P and reductant soluble P forms typically account for the total biologically available P (BAP), which can be used as fuel to promote growth by phytoplankton in the water column (Reddy et al. 1998). Nutrient loading rates that diffuse from the sediments are dependent on the geologic nature (i.e. high natural phosphorus content) and/or legacy point source inputs into the system.

Flux rates of biologically available nutrients from the sediments can be quantified in the laboratory by incubating intact sediment cores under controlled laboratory conditions and measuring changes in nutrient concentrations over time in the water column overlying the sediment cores (e.g., Schelske et al. 1991, Trefry et al. 1992, Moore et al. 1998, and Ogdahl et al. 2014,). The primary benefit of the laboratory incubation approach is that the experimental conditions and the range of factors affecting flux rates can be carefully controlled. A slight drawback is the possibility that laboratory studies cannot completely mimic *in-situ* waterbody conditions and are subject to laboratory artifacts if sufficient controls are not put in place.

Intact sediment core incubations to determine flux rates rely on careful sediment extraction in the field and minimum disturbance during laboratory incubations. At the lab, nutrient concentration changes in the overlying water are evaluated overtime. Flux rates could be highly variable, dependending on the conditions that were encountered before and during inclubation. Some important considerations include the following:

1) Depth of sediment profiles collected and analyzed in the core
2) Depth of water analyzed on top of the sediment in the core
3) Initiation of incubation after inclusion of source water
4) The number and distribution (on time scale) of data points to develop the flux rate
5) The beginning and end points, and the length of incubation and time spanning between data points and from beginning to end of the run
6) Whether the tests are conducted in aerobic, anoxic, quiescent and/or turbulent conditions.

Depending on the study objective, it is possible to conduct the flux tests in both aerobic and anoxic conditions in separate core profiles (with replicates) to limit error introduced from biogeochemical processes not regularly encountered in the waterbody. Therefore, maintenance of low oxygen concentrations at anoxic levels by gentle purging with N_2 gas mixture is necessary to maintain the appropriate anoxic conditions. In contrast, gentle purging of air gas mixture is needed to mainain aerobic conditions. In addition, an appropriate stirring rate may be desired to establish a representative diffusive boundary layer thickness similar to the level of turbulance of the subject waterbody.

The intact sediment core laboratory incubation approach was selected to take advantage of strictly controlled laboratory conditions that can be manipulated to answer specific resource management questions.

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Details of the experimental design and methodology are provided below, which are applicable to sediment samples collected by Wood field technicians, processed and/or analyzed by the Wood Laboratory and/or other certified laboratories. Trained field technicians and laboratory technical staff with applicable training and experience are responsible for performance of this SOP.

3.0 **Materials and Methods**

3.1 **Field Sample Collection Procedures, Preservation and Storage**

Three different types of samples and analyses should be conducted at each sampling site. The three types are identified by letters **a** through **c** below and should be collected in the following order for quality control purposes:

a) Water Chemistry *In-situ* Vertical Profile
b) Sediment Depth (*In-situ*)
c) Intact Sediment Cores

Intact sediment cores should be transported to the Wood Flux Laboratory for set-up and immediately after core extrusion. Sampling methods and laboratory procedures for each of the different sampling types are described in the following sub-sections.

3.1.1 Field Equipment and Supplies

1) Safety plan
2) Boat with motor
3) GPS
4) Camera
5) Maps with access, site locations, and contact information
6) FDEP SOPs for water sampling
7) Field sheets
8) Fine point sharpies
9) Labels
10) Putty knife and screwdriver
11) Metric ruler
12) YSI MDS 550 multiparameter water quality sonde (calibrated and checked (ICV, CCV) documented on calibration logs per FDEP SOP)
13) Turbidimeter (calibrated and checked (ICV, CCV) documented on calibration logs per FDEP SOP)
14) Secchi disk
15) Levelling rod for muck depth and hard bottom depth
16) Peristaltic pump or submersible pump for collection of near-bottom ambient water for carboys/jugs for use in incubations
17) 12 X 3” outer diameter (OD) clean clear polycarbonate core tube, with 2 $^{7}/_{8}$” inner diameter (ID) and a $^{1}/_{16}$” wall thickness, cut into 2’ long pieces
18) Piston corer assembly for intact flux cores
19) Minimum of 16 3” test plugs to serve as bottom and top core plugs
20) Duct tape, epoxy glue, or other material to prevent leakage from cores
21) Extra-large black garbage bags to cover and keep core samples in the dark
22) Coolers with upright frame for flux core storage and transport

3.1.2 Field Equipment Calibration

Staff generated documentation of initial calibration, initial calibration verification and continuing calibration verification of water quality multiparameter sondes used to collect *in-situ* water chemistry profiles, and other field data collection equipment, as applicable. The FDEP SOPs (FS1000, FT1000, FD1000, FT1100, FT1200, FT1300, FT1400, FT1500, and FT1600), should be used for pre and post-

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event instrument calibration and/or verification conducted prior to commencing sampling and at the end of each sampling day.

3.1.3 Field Sample Collection and QA/QC Procedures

Several SOPs such as the FDEP SOPs for water and sediment sampling (FS1000, FS2000, FS2100, and FS4000) should be kept on-hand during mobilization or pre-event preparation, and sampling. These SOPs should be followed to maintain a high level of accuracy in data collection and to ensure sound QA/QC management practices should be being followed.

3.1.3.1 Sample Type A: *In-situ* Vertical Profile of Water Chemistry

1) At each site, photographs should be taken showing the water column and habitat conditions of the site. In addition, photos should be taken of each of the sediment cores collected. The photographs taken should be noted on the field sheets.
2) Any notable field conditions should be noted such as weather or other environmental conditions that may affect sampling results.
3) At each site, *in-situ* water chemistry vertical depth profiles should be collected with a properly calibrated YSI multiparameter sonde.
4) The length of the YSI cord should be long enough to reach the bottom of the water column
5) At each site, YSI measurements should be recorded at three depths in the water column at the top, middle, and as near to the bottom as possible without disturbing the sediments (within 0.5 m of benthic surface).
6) Care must be taken to not disturb the sediments to cause error in the measurements.
7) The following parameters should be recorded for the overall site: total water depth, Secchi depth and measurement depth.
8) The following parameters should be recorded at each incremental depth: water temperature, dissolved oxygen (DO), pH, specific conductivity, salinity, ORP, and turbidity.

3.1.3.2 Sample Type B: Sediment Depth Collection

1) At each site, the top and bottom depth of flocculent sediment layer (muck), and the depth to hard bottom (refusal) should be measured with a levelling rod.
2) Sediment muck depths should be recorded on corresponding field sheets.

3.1.3.3 Sample Type C: Sediment Intact Cores Collection

1) At three predetermined sites, intact undisturbed sediment cores should be collected with a coring assembly (3' clear polycarbonate tube coupled with drive rods) to a depth of 20 cm from the top of sediment (0-20 cm).
    a. At all three predetermined sites 2 cores will be collected at each location (one for anoxic and one for aerobic incubation).
    b. Two water controls (one aerobic, and one anoxic) will be incubated along with the intact cores.

2) All core tubes must be labeled properly with site name, date, time, sampler names, and replicate number (1-8) on a piece of removable tape.
3) Care should be taken to ensure that homogenous replicate samples are collected from each site, which will require inspection of the replicates prior to placing the samples into the upright core racks (for storage and transportation). If the stratigraphy of the core samples differ, then a different, more homogeneous sediment strata should be located.
4) 25 to 40 cm of near-bottom ambient water should be included on top of the sediment core
5) After sediment is captured by the coring device, the core will be brought to the water's surface, sealed with a rubber stopper prior to breaking the water surface. Core retrieval approach may vary depending on the type of substrate. Slippage of sediments out of the bottom of the core must be stopped to avoid sample loss out of the bottom of the core and to avoid disturbing the sediments within the core.

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6) The intact cores should be sealed with the appropriate top and bottom rubber stoppers.
7) The intact cores rubber stoppers will be wrapped with duct tape or an epoxy will be applied to the stopper to prevent leakage (epoxy is primarily needed for sandy samples with low organic matter content to prevent sample falling out the bottom of the core).
8) All cores must be,
    a. covered with a dark garbage bag to limit light affecting the cores, and
    b. transported in an upright position (using a rack) to the Wood Flux Lab for incubation and nutrient flux experiments
9) All COC paperwork must be filled out completely, and provided to the Wood lab
10) A copy of the COC signed by the laboratory must be received prior to departure

3.2 Sample Type C: Internal Laboratory Sample Preparation Procedure, Preservation and Storage for Intact Sediment Core Incubation Flux Measurement

3.2.1 Laboratory Equipment and Supplies

For set-up

1) Teflon tubing
2) Acid washed carboys
3) Deionized water (DI)
4) Labeling tape
5) 0.45 micron filtered ambient water

For nutrient flux experiment

1) Thermostat
2) Verification thermometer (ambient temperature)
3) pH meter
4) Oxygen meter with incorporated thermometer
5) Turbidity meter
6) Sterile polyethylene syringes
7) 0.45 µm membrane filters
8) Clean sample collection bottles (provided by analytical lab)
9) Diffuser
10) Teflon tubing
11) Labeling tape

3.2.2 Reagents and Standards

1) Nitrogen Gas

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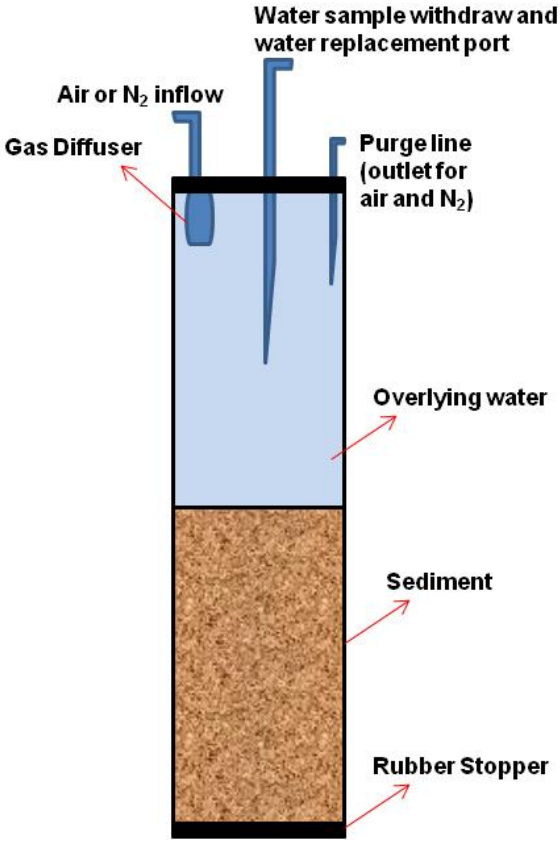
Figure 1. Intact Core Incubation Apparatus



3.2.3 Laboratory Procedure: Intact Sediment Core Preparation and Incubation

Near Bottom Ambient Water Preparation:

1) Prior to initialization of core incubation, the ambient water should be filtered using an in-line 0.45-micron capsule filter with a peristaltic pump. Once filtered, half of the containers should be bubbled with N_2 gas at a rapid rate to achieve and maintain anoxic conditions prior and during flux sampling. The other half will be stored until needed for water replacements on the intact cores. At that time, water containers will be bubbled with N_2 gas at room temperature until anoxic conditions are achieved and then used to refill intact cores.
2) The setup of the intact core apparatus is shown in **Figure 1**, and it includes fittings and tubing required for subsampling.

Adjustment of Sediment on Cores:

3) If cores are received with sediment depths that are not the desired amount (20 cm), then cores may be adjusted to the desired depth of sediment and overlying water column (~30 cm) prior to incubation.
4) To adjust sediment volumes on the cores, first remove overlaying water by siphoning with a Teflon tube, making sure not to disturb or remove the top layer of sediment, then remove the bottom stopper and carefully let the sediment out of the bottom of the core tube. Make sure to seal the bottom of the core well to prevent water leakage during flux study. Refill with filtered ambient water as described in step 5 below.

Replacing Overlying Water with Filtered Ambient Water:

5) If the sediments on the core do not require adjustment, remove the overlaying water and replace with ~30 cm of filtered near bottom ambient water from the carboy. The water should reach to the

top of the core. The water must be added slowly to prevent disturbance of sediments. After the water is replaced on the core, it is time to begin the stabilization/equilibration period.

Sediment Core Equilibration:

6) The time necessary for sedimentation/equilibration to be achieved is dependent on the composition of the sediment in upper portion of the core. Flocculent sediment material will require a longer duration for complete settling (up to 24 hours), whereby, sandy sediment may be equilibrated within the 12 hour timeframe). Systematic monitoring of turbidity can inform the length of time needed to achieve full equilibration and sedimentation in the core. It is recommended to allow enough time for the equilibration period to achieve ca. 85-90% reduction of measured turbidity values (via settling) prior to commencing flux sampling.
7) Nutrient release dynamics can be variable at the start of the intact sediment cores incubation, and are influenced by the cores equilibration time (Ogdahl et al. 2014). Therefore, the cores should be allowed to stabilize/equilibrate for a minimum of 24 hours, to allow for complete sedimentation processes to occur (Ogdahl et al. 2014) prior to commencement of the flux measurements.

Sediment Core Incubation and Sampling:

8) Cores from each site should be incubated in the dark using a temperature range between 23 to 27^0C (with a target incubation temperature of 25^0C), which should be consistent with ambient water conditions at the collection site with a tolerance range of $\pm 4^0$C during median temperature ranges.
9) The cores should be exposed and incubated under anoxic and aerobic conditions with replicates.
10) For the anoxic redox treatment, it is imperative to prevent oxygen exposure to the water column at all times while preparing for and during flux incubation and sampling. The water column should be bubbled with N_2 gas at a consistent rate that does not disturb and resuspend the upper layer of sediment in the core. However, the bubbling rate must be rapid enough to achieve and maintain anoxic conditions in the water column and sediment prior to commencing flux sampling.
11) Dissolved oxygen (DO) should be systematically monitored (e.g. every 6-8 hours) to ensure that the appropriate redox treatment is being achieved and maintained at the beginning and throughout the incubation. A DO concentration of less than 1 mg/L is required to maintain anoxic conditions.
12) The cores should be incubated for a period of no less than 5 days (120 hours), and up to 10 days (240 hours) with at least three discrete sampling time intervals between time= 0 hr, and time= 240 (if 10 days is selected as the length of incubation). Typically, sampling intervals should occur at T= at 48 hr, 168 hr, and 240 hours. However, depending on the day that the samples are collected, and the analytical lab's operating schedule, these intervals may be adjusted as needed. On many occasions, at four to five sampling intervals will be collected for better data resolution and to fit the curve.
13) A water sample should be periodically removed for sample analysis with a polyethylene syringe fitted with a length of 1-mm polyethylene tubing positioned to withdraw samples at mid-lower water column from each core as part of the sampling interval collections. Critical parameters for flux sampling include iron, total phosphorus and ammonia (NH_3) to meet project objectives, which should only require 50 ml per parameter, for a total of 150 ml of water removed from each core for a sample. However, additional parameters could also be sampled. The number of parameters sampled is based on the study design and goals, but it must be understood that with each parameter sampled, additional water volume must be replaced on the core, which can potentially introduce dilution error into later sampling interval samples. It is recommended to sample as few parameters as possible to avoid introducing dilution error into the results.
    a. For the NH3 sample, sulfuric acid must be added to properly preserve the sample.
14) The depth of water on top of the core should be maintained throughout the incubation at ~30 cm. The volume of water (150 ml) that is removed if all three parameters are collected during each subsampling interval shall be replaced with an equal volume of ambient water (under the appropriate redox condition). Based on a 7.3 cm diameter core, and a depth of 30 cm, the volume of water on top of each sediment core will be maintained at approximately 1260 ml. The ~150 ml

that would be removed if all three parameters are collected during each subsampling event represents less than 5% of the total volume of water on top of the sediment in the core, which should not have an effect on dilution of the remaining volume. The replacement amount shall not exceed more than 5% during each sampling interval to minimize the effect of replacement water on the remaining core water nutrient concentrations.

15) Discrete interval subsamples will be placed into sample containers and transported to the analytical laboratory in coolers on ice for analysis.

4.0 **Data Analyses**

4.1 **Calculation of Nutrient Flux Rates**

Nutrient flux rates should be estimated using the nutrient release rate equation, which was calculated based on the change of nutrient concentration over time (see equation below) and also by calculating the slope by using the interval sampling data and time step. Annual internal load of nutrients should be estimated following the methods described by Ogdahl et al. (2014) by using the nutrient release rate calculation and by calculating the rate with the slope.

Nutrient Release Rate Calculation - The flux rates for nitrogen and phosphorus species can be calculated using the following equation:

Eq. 1 Nrr = [(Ct - Ci) × V / A] / delta t

Where:

Nrr = the gross nutrient release (positive values) or retention (negative values) rate per unit surface area of sediment (mg /m^2/ d),

Ct = the final nutrient concentration at time t, or near the end of the incubation,

Ci = the initial nutrient concentration at time i, near the beginning of the incubation,

V = the volume of water in the water column,

A = the surface area of the sediment core, and

delta t = change in time, from time t-i.

5.0 **Quality Control**

1) All equipment was calibrated before use in the field and laboratory per FDEP SOPs noted in previous sections. Continuing verification of calibration was performed at the end of the day. SOPs should be used as a reference during field and laboratory activities to maintain quality control.

6.0 **Safety and Waste Management**

1) Laboratory staff must use proper safety equipment (e.g., eye protection, gloves, close-toe shoes)
2) Staff will perform necessary leak checks on gas cylinders.
3) Gas cylinders will be secured at all times and capped when not in use.
4) Sediments in core will be disposed as a solid waste.

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SRL Flux Study Lab Report : C-2

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Thank you Lance Lumbard for the opportunity to be of service to you and your company, We Sincerely Appreciate Your Business.

SRL certifies these Laboratory Results were produced in accordance with NELAC Standards. Hold times and preservation requirements were met for all analytes unless specifically call noted in the report. Results relate only to the samples as received.

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ANALYTICAL REPORT

For Project:
Lake Buchanan Flux

NELAP Certified
FDOH # : **E83484**
Lab Received Date : **01/12/22 18:00**

Company Name: **Wood Environment & Infrastructure**
Client's Name: **Lance Lumbard**
Client's Address: **550 Northlake Blvd. Suite 1000**
City: **Altamonte Springs**
State: **FL** Zip:**32701**

Facility ID: **NA**
Project Location: **Lake Buchanan**
Client's Phone: **407-522-7570**
Client's Project Number: **600713x2.01.09**
Lab Reporting Batch ID: **2201013**

Item#	Lab Sample ID	Client Sample ID	Collected Date	Collected Time	Sample Matrix	Analysis Requested
1	2201013-001	T=0, DI	01/10/22	18:00	AQUEOUS-Fresh	EPA 350.1,EPA 365.3,EPA 365.4 (Phosphorus -Total)
2	2201013-002	T=0, DI Dup	01/10/22	18:05	AQUEOUS-Fresh	EPA 350.1,EPA 365.3
3	2201013-003	T=0, Ambient	01/10/22	18:10	AQUEOUS-Fresh	EPA 350.1,EPA 365.3
4	2201013-004	T=0, Ambient Dup	01/10/22	18:15	AQUEOUS-Fresh	EPA 350.1,EPA 365.3
5	2201013-005	LB-1, T=24	01/11/22	17:00	AQUEOUS-Fresh	EPA 350.1,EPA 365.3
6	2201013-006	LB-2, T=24	01/11/22	17:05	AQUEOUS-Fresh	EPA 350.1,EPA 365.3
7	2201013-007	LB-3, T=24	01/11/22	17:10	AQUEOUS-Fresh	EPA 350.1,EPA 365.3
8	2201013-008	WC-1, T=24	01/11/22	17:15	AQUEOUS-Fresh	EPA 350.1,EPA 365.3
9	2201013-009	LB-A, T=24	01/11/22	17:20	AQUEOUS-Fresh	EPA 350.1,EPA 365.3
10	2201013-010	LB-B, T=24	01/11/22	17:25	AQUEOUS-Fresh	EPA 350.1,EPA 365.3
11	2201013-011	LB-C, T=24	01/11/22	17:30	AQUEOUS-Fresh	EPA 350.1,EPA 365.3
12	2201013-012	WC-A, T=24	01/11/22	17:35	AQUEOUS-Fresh	EPA 350.1,EPA 365.3

Sherri Payne
Vice President / Quality Assurance Officer - SRL

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ANALYTICAL REPORT

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Lake Buchanan Flux

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Company Name: **Wood Environment & Infrastructure**
Client's Name: **Lance Lumbard**
Client's Address: **550 Northlake Blvd. Suite 1000**
City: **Altamonte Springs**
State: **FL** Zip:**32701**

Facility ID: **NA**
Project Location: **Lake Buchanan**
Client's Phone: **407-522-7570**
Client's Project Number: **600713x2.01.09**
Lab Reporting Batch ID: **2201013**

********** Analytical Results **********

Client Sample ID: **T=0, DI**
Lab Sample ID: **2201013-001**
Date Collected: **01/10/22 18:00**
Collected By: **Fancesca Lawtermen**
Matrix ID : **AQUEOUS-Fresh**

Analyte Name (Analyte ID)	Results/Qual	Units	DF	MDL	PQL	Method	Analyzed Date	By	Batch	Notes
Ammonia (N) (7664-41-7)	0.035 U	mg/L	1	0.035	0.05	EPA 350.1	01/28/22 13:27	RRB	795540	-
Phosphorus (723-14-0)	0.0028 U	mg/L	1	0.0028	0.004	EPA 365.3	01/16/22 15:50	CLL	792535	-

This report, which includes the attached Chain-Of-Custody, shall not be reported except in full, without written approval of the laboratory.

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ANALYTICAL REPORT

For Project:
Lake Buchanan Flux

NELAP Certified
FDOH # : **E83484**
Lab Received Date : **01/12/22 18:00**

Company Name: **Wood Environment & Infrastructure**
Client's Name: **Lance Lumbard**
Client's Address: **550 Northlake Blvd. Suite 1000**
City: **Altamonte Springs**
State: **FL** Zip:**32701**

Facility ID: **NA**
Project Location: **Lake Buchanan**
Client's Phone: **407-522-7570**
Client's Project Number: **600713x2.01.09**
Lab Reporting Batch ID: **2201013**

********** Analytical Results **********

Client Sample ID: **T=0, DI Dup**
Lab Sample ID: **2201013-002**
Date Collected: **01/10/22 18:05**
Collected By: **Fancesca Lawtermen**
Matrix ID : **AQUEOUS-Fresh**

Analyte Name (Analyte ID)	Results/Qual	Units	DF	MDL	PQL	Method	Analyzed Date	By	Batch	Notes
Ammonia (N) (7664-41-7)	0.035 U	mg/L	1	0.035	0.05	EPA 350.1	01/28/22 13:28	RRB	795540	-
Phosphorus (723-14-0)	0.0028 U	mg/L	1	0.0028	0.004	EPA 365.3	01/16/22 15:51	CLL	792535	-

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Southern Research Laboratories, Inc
2251 Lynx Lane, Suite 1
Orlando, Florida 32804
(407) 522-7100 / Fax (407) 522-7043

ANALYTICAL REPORT

For Project:
Lake Buchanan Flux

NELAP Certified
FDOH # : **E83484**
Lab Received Date : **01/12/22 18:00**

Company Name: **Wood Environment & Infrastructure**
Client's Name: **Lance Lumbard**
Client's Address: **550 Northlake Blvd. Suite 1000**
City: **Altamonte Springs**
State: **FL** Zip: **32701**

Facility ID: **NA**
Project Location: **Lake Buchanan**
Client's Phone: **407-522-7570**
Client's Project Number: **600713x2.01.09**
Lab Reporting Batch ID: **2201013**

********** Analytical Results **********

Client Sample ID: **T=0, Ambient**
Lab Sample ID: **2201013-003**
Date Collected: **01/10/22 18:10**
Collected By: **Fancesca Lawtermen**
Matrix ID : **AQUEOUS-Fresh**

Analyte Name (Analyte ID)	Results/Qual	Units	DF	MDL	PQL	Method	Analyzed Date	By	Batch	Notes
Ammonia (N) (7664-41-7)	***0.67***	mg/L	1	0.035	0.05	EPA 350.1	01/28/22 13:30	RRB	795540	-
Phosphorus (723-14-0)	***0.13***	mg/L	1	0.0028	0.004	EPA 365.3	01/16/22 15:53	CLL	792535	-

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ANALYTICAL REPORT

For Project:
Lake Buchanan Flux

NELAP Certified
FDOH # : **E83484**
Lab Received Date : **01/12/22 18:00**

Company Name: **Wood Environment & Infrastructure**
Client's Name: **Lance Lumbard**
Client's Address: **550 Northlake Blvd. Suite 1000**
City: **Altamonte Springs**
State: **FL** Zip:**32701**

Facility ID: **NA**
Project Location: **Lake Buchanan**
Client's Phone: **407-522-7570**
Client's Project Number: **600713x2.01.09**
Lab Reporting Batch ID: **2201013**

********** Analytical Results **********

Client Sample ID: **T=0, Ambient Dup**
Lab Sample ID: **2201013-004**
Date Collected: **01/10/22 18:15**
Collected By: **Fancesca Lawtermen**
Matrix ID : **AQUEOUS-Fresh**

Analyte Name (Analyte ID)	Results/Qual	Units	DF	MDL	PQL	Method	Analyzed Date	By	Batch	Notes
Ammonia (N) (7664-41-7)	***0.66***	mg/L	1	0.035	0.05	EPA 350.1	01/28/22 13:32	RRB	795540	-
Phosphorus (723-14-0)	***0.13***	mg/L	1	0.0028	0.004	EPA 365.3	01/16/22 15:54	CLL	792535	-

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ANALYTICAL REPORT

For Project:
Lake Buchanan Flux

NELAP Certified
FDOH # : **E83484**
Lab Received Date : **01/12/22 18:00**

Company Name: **Wood Environment & Infrastructure**
Client's Name: **Lance Lumbard**
Client's Address: **550 Northlake Blvd. Suite 1000**
City: **Altamonte Springs**
State: **FL** Zip:**32701**

Facility ID: **NA**
Project Location: **Lake Buchanan**
Client's Phone: **407-522-7570**
Client's Project Number: **600713x2.01.09**
Lab Reporting Batch ID: **2201013**

********** Analytical Results **********

Client Sample ID: **LB-1, T=24**
Lab Sample ID: **2201013-005**
Date Collected: **01/11/22 17:00**
Collected By: **Fancesca Lawtermen**
Matrix ID : **AQUEOUS-Fresh**

Analyte Name (Analyte ID)	Results/Qual	Units	DF	MDL	PQL	Method	Analyzed Date	By	Batch	Notes
Ammonia (N) (7664-41-7)	***0.65***	mg/L	1	0.035	0.05	EPA 350.1	01/28/22 13:33	RRB	795540	-
Phosphorus (723-14-0)	***0.17***	mg/L	1	0.0028	0.004	EPA 365.3	01/16/22 15:55	CLL	792535	-

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ANALYTICAL REPORT

For Project:
Lake Buchanan Flux

NELAP Certified
FDOH # : **E83484**
Lab Received Date : **01/12/22 18:00**

Company Name: **Wood Environment & Infrastructure**
Client's Name: **Lance Lumbard**
Client's Address: **550 Northlake Blvd. Suite 1000**
City: **Altamonte Springs**
State: **FL** Zip:**32701**

Facility ID: **NA**
Project Location: **Lake Buchanan**
Client's Phone: **407-522-7570**
Client's Project Number: **600713x2.01.09**
Lab Reporting Batch ID: **2201013**

********** Analytical Results **********

Client Sample ID: **LB-2, T=24**
Lab Sample ID: **2201013-006**
Date Collected: **01/11/22 17:05**
Collected By: **Fancesca Lawtermen**
Matrix ID : **AQUEOUS-Fresh**

Analyte Name (Analyte ID)	Results/Qual	Units	DF	MDL	PQL	Method	Analyzed Date	By	Batch	Notes
Ammonia (N) (7664-41-7)	***1.4***	mg/L	1	0.035	0.05	EPA 350.1	01/28/22 13:35	RRB	795540	-
Phosphorus (723-14-0)	***0.91***	mg/L	1	0.0028	0.004	EPA 365.3	01/16/22 15:59	CLL	792535	-

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ANALYTICAL REPORT

For Project:
Lake Buchanan Flux

NELAP Certified
FDOH # : **E83484**
Lab Received Date : **01/12/22 18:00**

Company Name: **Wood Environment & Infrastructure**
Client's Name: **Lance Lumbard**
Client's Address: **550 Northlake Blvd. Suite 1000**
City: **Altamonte Springs**
State: **FL** Zip: **32701**

Facility ID: **NA**
Project Location: **Lake Buchanan**
Client's Phone: **407-522-7570**
Client's Project Number: **600713x2.01.09**
Lab Reporting Batch ID: **2201013**

********** Analytical Results **********

Client Sample ID: **LB-3, T=24**
Lab Sample ID: **2201013-007**
Date Collected: **01/11/22 17:10**
Collected By: **Fancesca Lawtermen**
Matrix ID : **AQUEOUS-Fresh**

Analyte Name (Analyte ID)	Results/Qual	Units	DF	MDL	PQL	Method	Analyzed Date	By	Batch	Notes
Ammonia (N) (7664-41-7)	***0.67***	mg/L	1	0.035	0.05	EPA 350.1	01/28/22 13:37	RRB	795540	-
Phosphorus (723-14-0)	***0.16***	mg/L	1	0.0028	0.004	EPA 365.3	01/16/22 16:00	CLL	792535	-

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ANALYTICAL REPORT

For Project:
Lake Buchanan Flux

NELAP Certified
FDOH # : **E83484**
Lab Received Date : **01/12/22 18:00**

Company Name: **Wood Environment & Infrastructure**
Client's Name: **Lance Lumbard**
Client's Address: **550 Northlake Blvd. Suite 1000**
City: **Altamonte Springs**
State: **FL** Zip: **32701**

Facility ID: **NA**
Project Location: **Lake Buchanan**
Client's Phone: **407-522-7570**
Client's Project Number: **600713x2.01.09**
Lab Reporting Batch ID: **2201013**

********** Analytical Results **********

Client Sample ID: **WC-1, T=24**
Lab Sample ID: **2201013-008**
Date Collected: **01/11/22 17:15**
Collected By: **Fancesca Lawtermen**
Matrix ID : **AQUEOUS-Fresh**

Analyte Name (Analyte ID)	Results/Qual	Units	DF	MDL	PQL	Method	Analyzed Date	By	Batch	Notes
Ammonia (N) (7664-41-7)	0.035 U	mg/L	1	0.035	0.05	EPA 350.1	01/28/22 13:42	RRB	795540	-
Phosphorus (723-14-0)	***0.0041***	mg/L	1	0.0028	0.004	EPA 365.3	01/16/22 16:01	CLL	792535	-

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ANALYTICAL REPORT

For Project:
Lake Buchanan Flux

NELAP Certified
FDOH # : **E83484**
Lab Received Date : **01/12/22 18:00**

Company Name: **Wood Environment & Infrastructure**
Client's Name: **Lance Lumbard**
Client's Address: **550 Northlake Blvd. Suite 1000**
City: **Altamonte Springs**
State: **FL** Zip: **32701**

Facility ID: **NA**
Project Location: **Lake Buchanan**
Client's Phone: **407-522-7570**
Client's Project Number: **600713x2.01.09**
Lab Reporting Batch ID: **2201013**

********** Analytical Results **********

Client Sample ID: **LB-A, T=24**
Lab Sample ID: **2201013-009**
Date Collected: **01/11/22 17:20**
Collected By: **Fancesca Lawtermen**
Matrix ID : **AQUEOUS-Fresh**

Analyte Name (Analyte ID)	Results/Qual	Units	DF	MDL	PQL	Method	Analyzed Date	By	Batch	Notes
Ammonia (N) (7664-41-7)	***0.57***	mg/L	1	0.035	0.05	EPA 350.1	01/28/22 13:47	RRB	795540	-
Phosphorus (723-14-0)	***0.13***	mg/L	1	0.0028	0.004	EPA 365.3	01/16/22 16:03	CLL	792535	-

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ANALYTICAL REPORT

For Project:
Lake Buchanan Flux

NELAP Certified
FDOH # : **E83484**
Lab Received Date : **01/12/22 18:00**

Company Name: **Wood Environment & Infrastructure**
Client's Name: **Lance Lumbard**
Client's Address: **550 Northlake Blvd. Suite 1000**
City: **Altamonte Springs**
State: **FL** Zip: **32701**

Facility ID: **NA**
Project Location: **Lake Buchanan**
Client's Phone: **407-522-7570**
Client's Project Number: **600713x2.01.09**
Lab Reporting Batch ID: **2201013**

********** Analytical Results **********

Client Sample ID: **LB-B, T=24**
Lab Sample ID: **2201013-010**
Date Collected: **01/11/22 17:25**
Collected By: **Fancesca Lawtermen**
Matrix ID : **AQUEOUS-Fresh**

Analyte Name (Analyte ID)	Results/Qual	Units	DF	MDL	PQL	Method	Analyzed Date	By	Batch	Notes
Ammonia (N) (7664-41-7)	***1.3***	mg/L	1	0.035	0.05	EPA 350.1	01/28/22 13:49	RRB	795540	-
Phosphorus (723-14-0)	***0.74***	mg/L	1	0.0028	0.004	EPA 365.3	01/16/22 16:04	CLL	792535	-

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ANALYTICAL REPORT

For Project:
Lake Buchanan Flux

NELAP Certified
FDOH # : **E83484**
Lab Received Date : **01/12/22 18:00**

Company Name: **Wood Environment & Infrastructure**
Client's Name: **Lance Lumbard**
Client's Address: **550 Northlake Blvd. Suite 1000**
City: **Altamonte Springs**
State: **FL** Zip:**32701**

Facility ID: **NA**
Project Location: **Lake Buchanan**
Client's Phone: **407-522-7570**
Client's Project Number: **600713x2.01.09**
Lab Reporting Batch ID: **2201013**

********** Analytical Results **********

Client Sample ID: **LB-C, T=24**
Lab Sample ID: **2201013-011**

Date Collected: **01/11/22 17:30**
Collected By: **Fancesca Lawtermen**

Matrix ID : **AQUEOUS-Fresh**

Analyte Name (Analyte ID)	Results/Qual	Units	DF	MDL	PQL	Method	Analyzed Date	By	Batch	Notes
Ammonia (N) (7664-41-7)	***0.7***	mg/L	1	0.035	0.05	EPA 350.1	01/28/22 13:50	RRB	795540	-
Phosphorus (723-14-0)	***0.16***	mg/L	1	0.0028	0.004	EPA 365.3	02/04/22 10:22	CLL	796090	-

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(407) 522-7100 / Fax (407) 522-7043

ANALYTICAL REPORT

For Project:
Lake Buchanan Flux

NELAP Certified
FDOH # : **E83484**
Lab Received Date : **01/12/22 18:00**

Company Name: **Wood Environment & Infrastructure**
Client's Name: **Lance Lumbard**
Client's Address: **550 Northlake Blvd. Suite 1000**
City: **Altamonte Springs**
State: **FL** Zip: **32701**

Facility ID: **NA**
Project Location: **Lake Buchanan**
Client's Phone: **407-522-7570**
Client's Project Number: **600713x2.01.09**
Lab Reporting Batch ID: **2201013**

********** Analytical Results **********

Client Sample ID: **WC-A, T=24**
Lab Sample ID: **2201013-012**
Date Collected: **01/11/22 17:35**
Collected By: **Fancesca Lawtermen**
Matrix ID : **AQUEOUS-Fresh**

Analyte Name (Analyte ID)	Results/Qual	Units	DF	MDL	PQL	Method	Analyzed Date	By	Batch	Notes
Ammonia (N) (7664-41-7)	0.035 U	mg/L	1	0.035	0.05	EPA 350.1	01/28/22 13:52	RRB	795540	-
Phosphorus (723-14-0)	***0.0068***	mg/L	1	0.0028	0.004	EPA 365.3	02/04/22 10:20	CLL	796090	-

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ANALYTICAL REPORT

For Project:
Lake Buchanan Flux

NELAP Certified
FDOH # : **E83484**
Lab Received Date : **01/12/22 18:00**

Company Name: **Wood Environment & Infrastructure**
Client's Name: **Lance Lumbard**
Client's Address: **550 Northlake Blvd. Suite 1000**
City: **Altamonte Springs**
State: **FL** Zip:**32701**

Facility ID: **NA**
Project Location: **Lake Buchanan**
Client's Phone: **407-522-7570**
Client's Project Number: **600713x2.01.09**
Lab Reporting Batch ID: **2201013**

********** Detection Summary : **********

Client Sample ID: **T=0, Ambient** Date Collected: **01/10/22 18:10** Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201013-003** Collected By: **Fancesca Lawtermen**

Analyte Name (Analyte ID)	Results/Qualifier	Units	DF	MDL	PQL	Date Analyzed	By	Batch ID	Method
Ammonia (N) (7664-41-7)	**0.67**	mg/L	1	0.035	0.05	01/28/22 13:30	RRB	795540	EPA 350.1
Phosphorus (723-14-0)	**0.13**	mg/L	1	0.0028	0.004	01/16/22 15:53	CLL	792535	EPA 365.3

Client Sample ID: **T=0, Ambient Dup** Date Collected: **01/10/22 18:15** Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201013-004** Collected By: **Fancesca Lawtermen**

Analyte Name (Analyte ID)	Results/Qualifier	Units	DF	MDL	PQL	Date Analyzed	By	Batch ID	Method
Ammonia (N) (7664-41-7)	**0.66**	mg/L	1	0.035	0.05	01/28/22 13:32	RRB	795540	EPA 350.1
Phosphorus (723-14-0)	**0.13**	mg/L	1	0.0028	0.004	01/16/22 15:54	CLL	792535	EPA 365.3

Client Sample ID: **LB-1, T=24** Date Collected: **01/11/22 17:00** Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201013-005** Collected By: **Fancesca Lawtermen**

Analyte Name (Analyte ID)	Results/Qualifier	Units	DF	MDL	PQL	Date Analyzed	By	Batch ID	Method
Ammonia (N) (7664-41-7)	**0.65**	mg/L	1	0.035	0.05	01/28/22 13:33	RRB	795540	EPA 350.1
Phosphorus (723-14-0)	**0.17**	mg/L	1	0.0028	0.004	01/16/22 15:55	CLL	792535	EPA 365.3

Client Sample ID: **LB-2, T=24** Date Collected: **01/11/22 17:05** Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201013-006** Collected By: **Fancesca Lawtermen**

Analyte Name (Analyte ID)	Results/Qualifier	Units	DF	MDL	PQL	Date Analyzed	By	Batch ID	Method
Ammonia (N) (7664-41-7)	**1.4**	mg/L	1	0.035	0.05	01/28/22 13:35	RRB	795540	EPA 350.1
Phosphorus (723-14-0)	**0.91**	mg/L	1	0.0028	0.004	01/16/22 15:59	CLL	792535	EPA 365.3

Client Sample ID: **LB-3, T=24** Date Collected: **01/11/22 17:10** Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201013-007** Collected By: **Fancesca Lawtermen**

Analyte Name (Analyte ID)	Results/Qualifier	Units	DF	MDL	PQL	Date Analyzed	By	Batch ID	Method
Ammonia (N) (7664-41-7)	**0.67**	mg/L	1	0.035	0.05	01/28/22 13:37	RRB	795540	EPA 350.1
Phosphorus (723-14-0)	**0.16**	mg/L	1	0.0028	0.004	01/16/22 16:00	CLL	792535	EPA 365.3

Client Sample ID: **WC-1, T=24** Date Collected: **01/11/22 17:15** Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201013-008** Collected By: **Fancesca Lawtermen**

Analyte Name (Analyte ID)	Results/Qualifier	Units	DF	MDL	PQL	Date Analyzed	By	Batch ID	Method
Phosphorus (723-14-0)	**0.0041**	mg/L	1	0.0028	0.004	01/16/22 16:01	CLL	792535	EPA 365.3

Client Sample ID: **LB-A, T=24** Date Collected: **01/11/22 17:20** Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201013-009** Collected By: **Fancesca Lawtermen**

Analyte Name (Analyte ID)	Results/Qualifier	Units	DF	MDL	PQL	Date Analyzed	By	Batch ID	Method
Ammonia (N) (7664-41-7)	**0.57**	mg/L	1	0.035	0.05	01/28/22 13:47	RRB	795540	EPA 350.1
Phosphorus (723-14-0)	**0.13**	mg/L	1	0.0028	0.004	01/16/22 16:03	CLL	792535	EPA 365.3

Client Sample ID: **LB-B, T=24** Date Collected: **01/11/22 17:25** Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201013-010** Collected By: **Fancesca Lawtermen**

Analyte Name (Analyte ID)	Results/Qualifier	Units	DF	MDL	PQL	Date Analyzed	By	Batch ID	Method
Ammonia (N) (7664-41-7)	**1.3**	mg/L	1	0.035	0.05	01/28/22 13:49	RRB	795540	EPA 350.1
Phosphorus (723-14-0)	**0.74**	mg/L	1	0.0028	0.004	01/16/22 16:04	CLL	792535	EPA 365.3

Client Sample ID: **LB-C, T=24** Date Collected: **01/11/22 17:30** Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201013-011** Collected By: **Fancesca Lawtermen**

Analyte Name (Analyte ID)	Results/Qualifier	Units	DF	MDL	PQL	Date Analyzed	By	Batch ID	Method
Ammonia (N) (7664-41-7)	**0.7**	mg/L	1	0.035	0.05	01/28/22 13:50	RRB	795540	EPA 350.1
Phosphorus (723-14-0)	**0.16**	mg/L	1	0.0028	0.004	02/04/22 10:22	CLL	796090	EPA 365.3

Client Sample ID: **WC-A, T=24** Date Collected: **01/11/22 17:35** Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201013-012** Collected By: **Fancesca Lawtermen**

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Southern Research Laboratories, Inc
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(407) 522-7100 / Fax (407) 522-7043

ANALYTICAL REPORT

For Proiect:
Lake Buchanan Flux

NELAP Certified
FDOH # : **E83484**
Lab Received Date : **01/12/22 18:00**

Company Name: **Wood Environment & Infrastructure**
Client's Name: **Lance Lumbard**
Client's Address: **550 Northlake Blvd. Suite 1000**
City: **Altamonte Springs**
State: **FL** Zip:**32701**

Facility ID: **NA**
Project Location: **Lake Buchanan**
Client's Phone: **407-522-7570**
Client's Project Number: **600713x2.01.09**
Lab Reporting Batch ID: **2201013**

Analyte Name (Analyte ID)	Results/Qualifier	Units	DF	MDL	PQL	Date Analyzed	By	Batch ID	Method
Phosphorus (723-14-0)	**0.0068**	mg/L	1	0.0028	0.004	02/04/22 10:20	CLL	796090	EPA 365.3

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ANALYTICAL REPORT

For Project:
Lake Buchanan Flux

NELAP Certified
FDOH # : **E83484**
Lab Received Date : **01/12/22 18:00**

Company Name: **Wood Environment & Infrastructure**
Client's Name: **Lance Lumbard**
Client's Address: **550 Northlake Blvd. Suite 1000**
City: **Altamonte Springs**
State: **FL** Zip:**32701**

Facility ID: **NA**
Project Location: **Lake Buchanan**
Client's Phone: **407-522-7570**
Client's Project Number: **600713x2.01.09**
Lab Reporting Batch ID: **2201013**

********** Quality Control : **********

Method Blank(MB)

Client Sample ID: **Method Blank-1** Sampled: 01/16/22 10:02 Analyzed: 01/16/22 15:30 Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201013-013** Prep: 01/16/22 10:02

EPA 365.3

Analyte Name (Analyte ID)	Results/Qual	Units	DF	MDL	PQL	By	Batch	Notes
Phosphorus, Total (723-14-0)	0.0028 U	mg/L	1	0.0028	0.004	CLL	792535	-

Laboratory Control Standard(LCS)

Client Sample ID: **LCS-1** Sampled: 01/16/22 10:02 Analyzed: 01/16/22 15:50 Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201013-014** Prep: 01/16/22 10:02

EPA 365.3

Analyte Name (Analyte ID)	Result	SPK	Units	DF	MDL	PQL	%Rec	By	Batch	%Limits	Notes
Phosphorus, Total (723-14-0)	0.1	0.1	mg/L	1	0.0028	0.004	102	CLL	792535	90-110	

Matrix Spike(MS)

Client Sample ID: **35689961001MSD** Sampled: 01/12/22 07:20 Analyzed: 01/16/22 15:33 Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201013-015** Prep: 01/16/22 10:02

EPA 365.3

Analyte Name (Analyte ID)	Result	SPK	Units	DF	MDL	PQL	%RPD	%Rec	Source	By	Batch	%Limits	Notes
Phosphorus, Total (723-14-0)	0.16	0.1	mg/L	1	0.0028	0.004		114	0.051	CLL	792535	80-120	

Matrix Spike Dup(MSD)

Client Sample ID: **35689961001MS** Sampled: 01/12/22 07:20 Analyzed: 01/16/22 15:35 Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201013-016** Prep: 01/16/22 10:02

EPA 365.3

Analyte Name (Analyte ID)	Result	SPK	Units	DF	MDL	PQL	%RPD	%Rec	Source	By	Batch	%Limits	Notes
Phosphorus, Total (723-14-0)	0.17	0.1	mg/L	1	0.0028	0.004	2	116	0.051	CLL	792535	80-120	

Method Blank(MB)

Client Sample ID: **Method Blank-1** Sampled: 01/28/22 13:10 Analyzed: 01/28/22 13:37 Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201013-017** Prep: 01/28/22 13:10

EPA 350.1

Analyte Name (Analyte ID)	Results/Qual	Units	DF	MDL	PQL	By	Batch	Notes
Ammonia (N) (7664-41-7)	0.035 U	mg/L	1	0.035	0.05	RRB	795540	-

Laboratory Control Standard(LCS)

Client Sample ID: **LCS-1** Sampled: 01/28/22 13:10 Analyzed: 01/28/22 13:37 Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201013-018** Prep: 01/28/22 13:10

EPA 350.1

Analyte Name (Analyte ID)	Result	SPK	Units	DF	MDL	PQL	%Rec	By	Batch	%Limits	Notes
Ammonia (N) (7664-41-7)	1.1	1	mg/L	1	0.035	0.05	108	RRB	795540	90-110	

Matrix Spike(MS)

Client Sample ID: **35692548017MS** Sampled: 01/25/22 14:42 Analyzed: 01/28/22 13:37 Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201013-019** Prep: 01/28/22 13:10

EPA 350.1

Analyte Name (Analyte ID)	Result	SPK	Units	DF	MDL	PQL	%Rec	Source	By	Batch	%Limits	Notes
Ammonia (N) (7664-41-7)	1.7	1	mg/L	1	0.035	0.05	104	0.67	RRB	795540	90-110	

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Southern Research Laboratories, Inc
2251 Lynx Lane, Suite 1
Orlando, Florida 32804
(407) 522-7100 / Fax (407) 522-7043

ANALYTICAL REPORT

For Project:
Lake Buchanan Flux

NELAP Certified
FDOH # : **E83484**
Lab Received Date : **01/12/22 18:00**

Company Name: **Wood Environment & Infrastructure**
Client's Name: **Lance Lumbard**
Client's Address: **550 Northlake Blvd. Suite 1000**
City: **Altamonte Springs**
State: **FL** Zip:**32701**

Facility ID: **NA**
Project Location: **Lake Buchanan**
Client's Phone: **407-522-7570**
Client's Project Number: **600713x2.01.09**
Lab Reporting Batch ID: **2201013**

********** Quality Control : **********

Matrix Spike Dup(MSD)

Client Sample ID: **35689961001MSD** Sampled: 01/25/22 14:42 Analyzed: 01/28/22 13:37 Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201013-020** Prep: 01/28/22 13:10

EPA 350.1

Analyte Name (Analyte ID)	Result	SPK	Units	DF	MDL	PQL	%RPD	%Rec	Source	By	Batch	%Limits	Notes
Ammonia (N) (7664-41-7)	1.7	1	mg/L	1	0.035	0.05	0	104	0.67	RRB	795540	90-110	

QC Batch Parent Sample(PS)

Client Sample ID: **35692548017** Sampled: 01/25/22 14:42 Analyzed: 01/16/22 15:32 Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201013-021** Prep: 01/16/22 10:02

EPA 365.3

Analyte Name (Analyte ID)	Results/Qual	Units	DF	MDL	PQL		By	Batch	Notes
Phosphorus, Total (365.4) Low-Level (723-14-0)	**0.051**	mg/L	1	0.0028	0.004	0.051	CLL	792535	-

Method Blank(MB)

Client Sample ID: **Method Blank-1** Sampled: 02/01/22 11:15 Analyzed: 02/04/22 10:15 Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201013-022** Prep: 02/01/22 11:15

EPA 365.3

Analyte Name (Analyte ID)	Results/Qual	Units	DF	MDL	PQL	By	Batch	Notes
Phosphorus, Total (365.4) Low-Level (723-14-0)	0.0028 U	mg/L	1	0.0028	0.004	CLL	796090	-

Laboratory Control Standard(LCS)

Client Sample ID: **LCS-1** Sampled: 02/01/22 11:15 Analyzed: 02/04/22 10:17 Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201013-023** Prep: 02/01/22 11:15

EPA 365.3

Analyte Name (Analyte ID)	Result	SPK	Units	DF	MDL	PQL	%Rec	By	Batch	%Limits	Notes
Phosphorus, Total (365.4) Low-Level (723-14-0)	0.099	0.1	mg/L	1	0.0028	0.004	99	CLL	796090	90-110	

Matrix Spike(MS)

Client Sample ID: **LB-C, T=24MS** Sampled: 01/11/22 17:30 Analyzed: 02/04/22 10:20 Matrix ID : **AQUEOUS-Groundwater**
Lab Sample ID: **2201013-025** Prep: 02/01/22 11:15

EPA 365.3

Analyte Name (Analyte ID)	Result	SPK	Units	DF	MDL	PQL	%Rec	Source	By	Batch	%Limits	Notes
Phosphorus, Total (365.4) Low-Level (723-14-0)	0.28	0.1	mg/L	1	0.0028	0.004	119	0.16	CLL	796090	80-120	

Matrix Spike Dup(MSD)

Client Sample ID: **LB-C, T=24MSD** Sampled: 01/11/22 17:30 Analyzed: 02/04/22 10:19 Matrix ID : **AQUEOUS-Groundwater**
Lab Sample ID: **2201013-026** Prep: 02/01/22 11:15

EPA 365.3

Analyte Name (Analyte ID)	Result	SPK	Units	DF	MDL	PQL	%RPD	%Rec	Source	By	Batch	%Limits	Notes
Phosphorus, Total (365.4) Low-Level (723-14-0)	0.29	0.1	mg/L	1	0.0028	0.004	3	126	0.16	CLL	796090	80-120	

QC Batch Parent Sample(PS)

Client Sample ID: **35689961001** Sampled: 01/12/22 07:20 Analyzed: 01/28/22 13:13 Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201013-027** Prep: 01/28/22 13:10

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Southern Research Laboratories, Inc
2251 Lynx Lane, Suite 1
Orlando, Florida 32804
(407) 522-7100 / Fax (407) 522-7043

ANALYTICAL REPORT

For Project:
Lake Buchanan Flux

NELAP Certified
FDOH # : **E83484**
Lab Received Date : **01/12/22 18:00**

Company Name: **Wood Environment & Infrastructure**
Client's Name: **Lance Lumbard**
Client's Address: **550 Northlake Blvd. Suite 1000**
City: **Altamonte Springs**
State: **FL** Zip:**32701**

Facility ID: **NA**
Project Location: **Lake Buchanan**
Client's Phone: **407-522-7570**
Client's Project Number: **600713x2.01.09**
Lab Reporting Batch ID: **2201013**

********** Quality Control : **********

QC Batch Parent Sample(PS)

Client Sample ID: **35689961001** Sampled: 01/12/22 07:20 Analyzed: 01/28/22 13:13 Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201013-027** Prep: 01/28/22 13:10

EPA 350.1

Analyte Name (Analyte ID)	Results/Qual	Units	DF	MDL	PQL		By	Batch	Notes
Ammonia (N) (7664-41-7)	**3.1**	mg/L	1	0.035	0.05	3.1	RRB	795540	-

Matrix Spike(MS)

Client Sample ID: **LB-3, T=24 MS** Sampled: 01/11/22 17:10 Analyzed: 01/28/22 13:39 Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201013-028** Prep: 01/28/22 13:10

EPA 350.1

Analyte Name (Analyte ID)	Result	SPK	Units	DF	MDL	PQL	%Rec	Source	By	Batch	%Limits	Notes
Ammonia (N) (7664-41-7)	1.7	1	mg/L	1	0.035	0.05	104	0.67	RRB	795540	90-110	

Matrix Spike Dup(MSD)

Client Sample ID: **LB-3, T=24 MSD** Sampled: 01/11/22 17:10 Analyzed: 01/28/22 13:40 Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201013-029** Prep: 01/28/22 13:10

EPA 350.1

Analyte Name (Analyte ID)	Result	SPK	Units	DF	MDL	PQL	%RPD	%Rec	Source	By	Batch	%Limits	Notes
Ammonia (N) (7664-41-7)	1.7	1	mg/L	1	0.035	0.05	0	104	0.67	RRB	795540	90-110	

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Southern Research Laboratories, Inc
2251 Lynx Lane, Suite 1
Orlando, Florida 32804
(407) 522-7100 / Fax (407) 522-7043

ANALYTICAL REPORT

For Proiect:
Lake Buchanan Flux

NELAP Certified
FDOH # : **E83484**
Lab Received Date : **01/12/22 18:00**

Company Name: **Wood Environment & Infrastructure**
Client's Name: **Lance Lumbard**
Client's Address: **550 Northlake Blvd. Suite 1000**
City: **Altamonte Springs**
State: **FL** Zip:**32701**

Facility ID: **NA**
Project Location: **Lake Buchanan**
Client's Phone: **407-522-7570**
Client's Project Number: **600713x2.01.09**
Lab Reporting Batch ID: **2201013**

**********Data Qualifiers Codes**********

Reporting Exceptions and Qualified Data

When quality control results are outside established control limits reanalysis, including re-extraction (if applicable), is preferred. If re-analysis is not viable or desirable, then results may be qualified. Sample results associated with quality control data that exceed acceptance criteria will be qualified with an appropriate comment. Any parameter for which the laboratory is not officially NELAP accredited is indicated by a '~' symbol. These are not included in the scope because NELAP accreditation is either not available or has not been applied for.

Lab Qualifier	Description
B-01	The sample dilutions set-up for the analysis did not meet the oxygen depletion criteria of at least 2 mg/l dissolved oxygen depletion. Therefore the reported result is an estimated value only.
B-04	The average DO uptake of the seeded controls does not meet the method required 0.6 - 1.0 mg/L.
B-06	Sample is supersaturated with DO. Initial DO exceeds the method required maximum initial DO of 9 mg/L.
B-07	LCS exceeded control limits. The test can not be repeated due to method constraints. Considered to be an estimated value.
D	Data reported from a dilution and or multiple dilutions. D2= 1/2, D5= 1/5, D10= 1/10, D20= 1/20, D50= 1/50, D100= 1/100
I, J	The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit.
J-01	Result may be biased high due to positive results in the associated method blank at a concentration above
L	Off-scale high. Actual value is known to be greater than value given.
LP-02	Less than 1000 ml of sample filtered and residue range of 2.5 insufficient sample, analysis cannot be repeated.
M	Presence of material is verified but not quantified; the actual value is less than the value given. The estimated concentration is greater than the MDL.
N	Presumptive evidence of presence of material.
O	Sampled, but analysis lost or not performed.
PS	PS = Parent Sample. The PS sample was used as the parent sample for the analysis batch to make a Matrix Spike (MS), Matrix Spike Duplicated (MSD) and / or Laboratory Duplicate (DUP).
Q	Sample held beyond the accepted holding time. Use this code if result derived from a sample prepared or analyzed after the approved holding time.
QB-01	The method blank had a positive result for the analyte; however, the concentration in the method blank is less than 10% of the sample result. There is minimal impact to the data.
QB-02	The method blank contains analyte at a concentration above the MDL and/or greater than one-half the MRL. The analyte was not detected in the sample.
QL-02	The associated laboratory control sample exhibited high bias; since the result is ND, there is no impact.
QM-02	The RPD and/or percent recovery for this QC spike sample cannot be accurately calculated due to the high concentration of analyte present in the sample.
QM-07	Spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on acceptable LCS recovery.
QM-11	Precision between duplicate matrix spikes of the same sample was outside acceptance limits.
QM-12	Precision between duplicate samples was outside acceptance limits.
QM-S	Surrogate recovery exceeded acceptance criteria due to the presence of a coeluting compound.
QR-04	Duplicate precision outside acceptance limits due to low analyte concentration.
QS-03	Surrogate recovery outside acceptance limits
QS-4	Surrogate recovery not calculated. Surrogate diluted out of the calibrtion range.
QS-6	Surrogate recovery exceeded accepance criteria due to coelution. Matrix effect confirmed.
QV-01	The associated continuing calibration verification standard exhibited high bias; since the result is ND, there is no impact.
R-01	The Reporting Limit for this analyte has been raised to account for matrix interference.
T	Value reported is less than the laboratory method detection limit. The value is reported for informational purposes only and shall not be used in statistical analysis.
U	Indicates the compound was analyzed for but not detected above the method detection limt.
V	Indicates the analyte was detected in both the sample and method blank.
V1	Common Laboratory Contaminant
Y	The laboratory analysis was performed on an improperly preserved sample. The result may not be accurate.

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Chain of Custody

2201013
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Page 1 of 2

Project Manager: Lance Lumbard	Southern Research Laboratories, Inc. 2251 Lynx Lane, Suite #1 Orlando, Florida 32804
Company: Wood Environment & Infrastructure Solutions, Inc.	Main (407) 522-7100 Fax: (407) 522-7043
Address: 350 Northlake Blvd., Suite 1000	
City, State, Zip: Altamonte Springs Florida 32701	
Phone: 407-522-7570 Fax: +1 (407) 522-7576	

Project Name: Lake Buchanan Flux

Project Location: PO: C012610100

Sampled by [Print Name(s)] / Affiliation: Francesca Watterson / Wood

Sampler(s) Signature(s):

Preservatives (see codes): S

Project Number: 600713x2.01.09

Analyses Requested: TP/ Ammonia

REQUESTED DUE DATE:

Facility ID#:

Petroleum Restoration Program ____ yes ____ no

	Sample Identification	Sampled Date:	Sampled Time:	Grab or Composite	Matrix: (see codes)	Total Number of Containers		
1	T=0, DI	1/10/22	1800	Grab	SW	1	1	22.01.013-001
2	T=0, DI Dup	1/10/22	1805		SW	1	1	-002
3	T=0, Ambient	1/10/22	1810		SW	1	1	-003
4	T=0, Ambient Dup	1/10/22	1815		SW	1	1	-004
5	LB-1, T=24	1/11/22	1700		SW	1	1	-005
6	LB-2, T=24	1/11/22	1705		SW	1	1	-006
7	LB-3, T=24	1/11/22	1710		SW	1	1	-007
8	WC-1, T=24	1/11/22	1715		SW	1	1	-008
9	LB-A, T=24	1/11/22	1720		SW	1	1	-009
10	LB-B, T=24	1/11/22	1725		SW	1	1	-010

Shipment Method:		Relinquished by	Date:	Time:	Accepted by:	Date:	Time:
Out: / /	Via:	[redacted]	3-21-21	15:15		3/21/21	1515
Returned: / /	Via:		1/12/22	1506		1/12/22	1500
			1/12/22	1800		1-12-22	1800

Additional Comments: PO No: C012610100

Cooler No.(s) / Temperature(s) (°C): Client cooler 0.6 435, 422, X426, 509

Sampling Kit No.: 8911

Equipment ID No.:

Matrix Codes: A = Air GW = Groundwater SE = Sediment SO = Soil SW = Surface Water W = Water(Blanks) HW = Potential Haz Waste O = Other(Specify:_____)

Preservative Codes: H = Hydrochloric Acid & Ice I = Ice Only N = Nitrie Acid& Ice S = Sulfuric Acid & Ice X = Sodium Hydroxide & Ice O = Other(Specify)

Chain of Custody

2201013
12

Page 2 of 2

Project Manager: Lance Lambard	Southern Research Laboratories, Inc. 2251 Lynx Lane, Suite #1 Orlando, Florida 32804
Company: Wood Environment & Infrastructure Solutions, Inc.	Main (407) 522-7100 Fax: (407) 522-7043
Address: 550 Northlake Blvd., Suite 1000	Project Name: Lake Buchanan Flux
City, State, Zip: Altamonte Springs Florida 32701	Project Location:
Phone: 407-522-7570 Fax: +1 (407) 522-7576	

Sampled by [Print Name(s)] / Affiliation: Francesca Lauterman / Wood

Sampler(s) Signature(s):

Preservatives (see codes): S

Project Number: 600713x2.01.09

Analyses Requested: TP, Ammonia

REQUESTED DUE DATE:

Facility ID#:

Petroleum Restoration Program ____ yes ____ no

	Sample Identification	Sampled Date:	Sampled Time:	Grab or Composite	Matrix: (see codes)	Total Number of Containers	TP	Ammonia	
11	LB-C, T=24	1/11/22	1730	Grab	SW	1	(1)		2201013-011
12	WC-A, T=24	1/11/22	1735	Grab	SW	1	(1)		2201013-012

Shipment Method:		Relinquished by	Date:	Time:	Accepted by:	Date:	Time:
Out: / /	Via:	Helen Yurkanin	1/12/21	15:15		1/12/21	1515
Returned: / /	Via:		1/12/22	1500		1/12/22	1500
Additional Comments:			1/12/22	1800		1-12-22	1800

Cooler No.(s) / Temperature(s) (°C): 435, 422, X426, 509

Sampling Kit No.: 8911

Equipment ID No.:

Matrix Codes: A = Air GW = Groundwater SE = Sediment SO = Soil SW = Surface Water W = Water(Blanks) HW = Potential Haz Waste O = Other(Specify:_____)

Preservative Codes: H = Hydrochloric Acid & Ice I = Ice Only N = Nitrie Acid& Ice S = Sulfuric Acid & Ice X = Sodium Hydroxide & Ice O = Other(Specify)

Southern Research Laboratories, Inc.
WWW.SRLAB.COM

Thank you Lance Lumbard for the opportunity to be of service to you and your company, We Sincerely Appreciate Your Business.

SRL certifies these Laboratory Results were produced in accordance with NELAC Standards. Hold times and preservation requirements were met for all analytes unless specifically call noted in the report. Results relate only to the samples as received.

Southern Research Laboratories, Inc
2251 Lynx Lane, Suite 1
Orlando, Florida 32804
(407) 522-7100 / Fax (407) 522-7043

ANALYTICAL REPORT

For Proiect:
Lake Buchanan Flux Study

NELAP Certified
FDOH # : **E83484**
Lab Received Date : **1/18/2022 4:06:00 PM**

Company Name: **Wood Environment & Infrastructure**
Client's Name: **Lance Lumbard**
Client's Address: **550 Northlake Blvd. Suite 1000**
City: **Altamonte Springs**
State: **FL** Zip: **32701**

Facility ID: **NA**
Project Location: **Orange County, FL.**
Client's Phone: **407-522-7570**
Client's Project Number: **600713x2.01.09**
Lab Reporting Batch ID: **2201026**

Item#	Lab Sample ID	Client Sample ID	Collected Date	Time	Sample Matrix	Analysis Requested
1	2201026-001	LB-1-T=48	01/12/22	16:00	AQUEOUS-Fresh	EPA 350.1,EPA 365.3
2	2201026-002	LB-2-T=48	01/12/22	16:05	AQUEOUS-Fresh	EPA 350.1,EPA 365.3
3	2201026-003	LB-3-T=48	01/12/22	16:10	AQUEOUS-Fresh	EPA 350.1,EPA 365.3
4	2201026-004	WC-1`-T=48	01/12/22	16:15	AQUEOUS-Fresh	EPA 350.1,EPA 365.3
5	2201026-005	LB-A-T=48	01/12/22	16:20	AQUEOUS-Fresh	EPA 350.1,EPA 365.3
6	2201026-006	LB-B-T=48	01/12/22	16:25	AQUEOUS-Fresh	EPA 350.1,EPA 365.3
7	2201026-007	LB-C-T=48	01/12/22	16:30	AQUEOUS-Fresh	EPA 350.1,EPA 365.3
8	2201026-008	WC-A-T=48	01/12/22	16:35	AQUEOUS-Fresh	EPA 350.1,EPA 365.3
9	2201026-009	LB-1-T=96	01/14/22	14:30	AQUEOUS-Fresh	EPA 350.1,EPA 365.3
10	2201026-010	LB-2-T=96	01/14/22	14:35	AQUEOUS-Fresh	EPA 350.1,EPA 365.3
11	2201026-011	LB-3-T=96	01/14/22	14:40	AQUEOUS-Fresh	EPA 350.1,EPA 365.3
12	2201026-012	WC-1-T=96	01/14/22	14:45	AQUEOUS-Fresh	EPA 350.1,EPA 365.3
13	2201026-013	LB-A-T=96	01/14/22	14:55	AQUEOUS-Fresh	EPA 350.1,EPA 365.3
14	2201026-014	LB-B-T=96	01/14/22	15:00	AQUEOUS-Fresh	EPA 350.1,EPA 365.3
15	2201026-015	LB-C-T=96	01/14/22	15:05	AQUEOUS-Fresh	EPA 350.1,EPA 365.3
16	2201026-016	WC-A-T=96	01/14/22	15:10	AQUEOUS-Fresh	EPA 350.1,EPA 365.3

Sherri Payne
Vice President / Quality Assurance Officer - SRL

This report, which includes the attached Chain-Of-Custody, shall not be reported except in full, without written approval of the laboratory.

Southern Research Laboratories, Inc
2251 Lynx Lane, Suite 1
Orlando, Florida 32804
(407) 522-7100 / Fax (407) 522-7043

ANALYTICAL REPORT

For Proiect:
Lake Buchanan Flux Study

NELAP Certified
FDOH # : **E83484**
Lab Received Date : **1/18/2022 4:06:00 PM**

Company Name: **Wood Environment & Infrastructure**
Client's Name: **Lance Lumbard**
Client's Address: **550 Northlake Blvd. Suite 1000**
City: **Altamonte Springs**
State: **FL** Zip: **32701**

Facility ID: **NA**
Project Location: **Orange County, FL.**
Client's Phone: **407-522-7570**
Client's Project Number: **600713x2.01.09**
Lab Reporting Batch ID: **2201026**

********** Analytical Results **********

Client Sample ID: **LB-1-T=48**
Lab Sample ID: **2201026-001**
Date Collected: **01/12/22 16:00**
Collected By: **Francesca Lauterman**
Matrix ID : **AQUEOUS-Fresh**

Classical Chemistry Parameters

Analyte Name (Analyte ID)	Results/Qual	Units	DF	MDL	PQL	Method	Analyzed Date	By	Batch	Notes
Ammonia (N) (7664417)	***0.62***	mg/L	1	0.035	0.05	EPA 350.1	02/04/22 17:26	RRB	797571	-
Phosphorus (7723140)	***0.21***	mg/L	1	0.0028	0.004	EPA 365.3	02/04/22 10:23	CLL	796090	-

This report, which includes the attached Chain-Of-Custody, shall not be reported except in full, without written approval of the laboratory.

Southern Research Laboratories, Inc
2251 Lynx Lane, Suite 1
Orlando, Florida 32804
(407) 522-7100 / Fax (407) 522-7043

ANALYTICAL REPORT

For Proiect:
Lake Buchanan Flux Study

NELAP Certified
FDOH # : **E83484**
Lab Received Date : **1/18/2022 4:06:00 PM**

Company Name: **Wood Environment & Infrastructure**
Client's Name: **Lance Lumbard**
Client's Address: **550 Northlake Blvd. Suite 1000**
City: **Altamonte Springs**
State: **FL** Zip: **32701**

Facility ID: **NA**
Project Location: **Orange County, FL.**
Client's Phone: **407-522-7570**
Client's Project Number: **600713x2.01.09**
Lab Reporting Batch ID: **2201026**

********** Analytical Results **********

Client Sample ID: **LB-2-T=48**
Lab Sample ID: **2201026-002**
Date Collected: **01/12/22 16:05**
Collected By: **Francesca Lauterman**
Matrix ID : **AQUEOUS-Fresh**

Classical Chemistry Parameters

Analyte Name (Analyte ID)	Results/Qual	Units	DF	MDL	PQL	Method	Analyzed Date	By	Batch	Notes
Ammonia (N) (7664417)	***1.3***	mg/L	1	0.035	0.05	EPA 350.1	02/04/22 17:31	RRB	797571	-
Phosphorus (7723140)	***0.66***	mg/L	1	0.0028	0.004	EPA 365.3	02/04/22 10:24	CLL	796090	-

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ANALYTICAL REPORT

For Proiect:
Lake Buchanan Flux Study

NELAP Certified
FDOH # : **E83484**
Lab Received Date : **1/18/2022 4:06:00 PM**

Company Name: **Wood Environment & Infrastructure**
Client's Name: **Lance Lumbard**
Client's Address: **550 Northlake Blvd. Suite 1000**
City: **Altamonte Springs**
State: **FL** Zip: **32701**

Facility ID: **NA**
Project Location: **Orange County, FL.**
Client's Phone: **407-522-7570**
Client's Project Number: **600713x2.01.09**
Lab Reporting Batch ID: **2201026**

********** Analytical Results **********

Client Sample ID: **LB-3-T=48**
Lab Sample ID: **2201026-003**
Date Collected: **01/12/22 16:10**
Collected By: **Francesca Lauterman**
Matrix ID : **AQUEOUS-Fresh**

Classical Chemistry Parameters

Analyte Name (Analyte ID)	Results/Qual	Units	DF	MDL	PQL	Method	Analyzed Date	By	Batch	Notes
Ammonia (N) (7664417)	***0.63***	mg/L	1	0.035	0.05	EPA 350.1	02/04/22 17:32	RRB	797571	-
Phosphorus (7723140)	***0.15***	mg/L	1	0.0028	0.004	EPA 365.3	02/04/22 10:26	CLL	796090	-

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ANALYTICAL REPORT

For Proiect:
Lake Buchanan Flux Study

NELAP Certified
FDOH # : **E83484**
Lab Received Date : **1/18/2022 4:06:00 PM**

Company Name: **Wood Environment & Infrastructure**
Client's Name: **Lance Lumbard**
Client's Address: **550 Northlake Blvd. Suite 1000**
City: **Altamonte Springs**
State: **FL** Zip: **32701**

Facility ID: **NA**
Project Location: **Orange County, FL.**
Client's Phone: **407-522-7570**
Client's Project Number: **600713x2.01.09**
Lab Reporting Batch ID: **2201026**

********** Analytical Results **********

Client Sample ID: **WC-1`-T=48**
Lab Sample ID: **2201026-004**
Date Collected: **01/12/22 16:15**
Collected By: **Francesca Lauterman**
Matrix ID : **AQUEOUS-Fresh**

Classical Chemistry Parameters

Analyte Name (Analyte ID)	Results/Qual	Units	DF	MDL	PQL	Method	Analyzed Date	By	Batch	Notes
Ammonia (N) (7664417)	0.035 U	mg/L	1	0.035	0.05	EPA 350.1	02/04/22 17:37	RRB	797574	-
Phosphorus (7723140)	0.0028 U	mg/L	1	0.0028	0.004	EPA 365.3	02/04/22 10:27	CLL	796090	-

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ANALYTICAL REPORT

For Proiect:
Lake Buchanan Flux Study

NELAP Certified
FDOH # : **E83484**
Lab Received Date : **1/18/2022 4:06:00 PM**

Company Name: **Wood Environment & Infrastructure**
Client's Name: **Lance Lumbard**
Client's Address: **550 Northlake Blvd. Suite 1000**
City: **Altamonte Springs**
State: **FL** Zip: **32701**

Facility ID: **NA**
Project Location: **Orange County, FL.**
Client's Phone: **407-522-7570**
Client's Project Number: **600713x2.01.09**
Lab Reporting Batch ID: **2201026**

********** Analytical Results **********

Client Sample ID: **LB-A-T=48**
Lab Sample ID: **2201026-005**
Date Collected: **01/12/22 16:20**
Collected By: **Francesca Lauterman**
Matrix ID : **AQUEOUS-Fresh**

Classical Chemistry Parameters

Analyte Name (Analyte ID)	Results/Qual	Units	DF	MDL	PQL	Method	Analyzed Date	By	Batch	Notes
Ammonia (N) (7664417)	***0.3***	mg/L	1	0.035	0.05	EPA 350.1	02/04/22 17:43	RRB	797574	-
Phosphorus (7723140)	***0.1***	mg/L	1	0.0028	0.004	EPA 365.3	02/04/22 10:31	CLL	796090	-

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ANALYTICAL REPORT

For Proiect:
Lake Buchanan Flux Study

NELAP Certified
FDOH # : **E83484**
Lab Received Date : **1/18/2022 4:06:00 PM**

Company Name: **Wood Environment & Infrastructure**
Client's Name: **Lance Lumbard**
Client's Address: **550 Northlake Blvd. Suite 1000**
City: **Altamonte Springs**
State: **FL** Zip: **32701**

Facility ID: **NA**
Project Location: **Orange County, FL.**
Client's Phone: **407-522-7570**
Client's Project Number: **600713x2.01.09**
Lab Reporting Batch ID: **2201026**

********** Analytical Results **********

Client Sample ID: **LB-B-T=48**
Lab Sample ID: **2201026-006**
Date Collected: **01/12/22 16:25**
Collected By: **Francesca Lauterman**
Matrix ID : **AQUEOUS-Fresh**

Classical Chemistry Parameters

Analyte Name (Analyte ID)	Results/Qual	Units	DF	MDL	PQL	Method	Analyzed Date	By	Batch	Notes
Ammonia (N) (7664417)	***1.1***	mg/L	1	0.035	0.05	EPA 350.1	02/04/22 17:44	RRB	797574	-
Phosphorus (7723140)	***0.51***	mg/L	1	0.0028	0.004	EPA 365.3	02/04/22 10:32	CLL	796090	-

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ANALYTICAL REPORT

For Proiect:
Lake Buchanan Flux Study

NELAP Certified
FDOH # : **E83484**
Lab Received Date : **1/18/2022 4:06:00 PM**

Company Name: **Wood Environment & Infrastructure**
Client's Name: **Lance Lumbard**
Client's Address: **550 Northlake Blvd. Suite 1000**
City: **Altamonte Springs**
State: **FL** Zip: **32701**

Facility ID: **NA**
Project Location: **Orange County, FL.**
Client's Phone: **407-522-7570**
Client's Project Number: **600713x2.01.09**
Lab Reporting Batch ID: **2201026**

********** Analytical Results **********

Client Sample ID: **LB-C-T=48**
Lab Sample ID: **2201026-007**
Date Collected: **01/12/22 16:30**
Collected By: **Francesca Lauterman**
Matrix ID : **AQUEOUS-Fresh**

Classical Chemistry Parameters

Analyte Name (Analyte ID)	Results/Qual	Units	DF	MDL	PQL	Method	Analyzed Date	By	Batch	Notes
Ammonia (N) (7664417)	***0.58***	mg/L	1	0.035	0.05	EPA 350.1	02/04/22 17:46	RRB	797574	-
Phosphorus (7723140)	***0.13***	mg/L	1	0.0028	0.004	EPA 365.3	02/04/22 10:33	CLL	796090	-

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ANALYTICAL REPORT

For Proiect:
Lake Buchanan Flux Study

NELAP Certified
FDOH # : **E83484**
Lab Received Date : **1/18/2022 4:06:00 PM**

Company Name: **Wood Environment & Infrastructure**
Client's Name: **Lance Lumbard**
Client's Address: **550 Northlake Blvd. Suite 1000**
City: **Altamonte Springs**
State: **FL** Zip: **32701**

Facility ID: **NA**
Project Location: **Orange County, FL.**
Client's Phone: **407-522-7570**
Client's Project Number: **600713x2.01.09**
Lab Reporting Batch ID: **2201026**

********** Analytical Results **********

Client Sample ID: **WC-A-T=48**
Lab Sample ID: **2201026-008**
Date Collected: **01/12/22 16:35**
Collected By: **Francesca Lauterman**
Matrix ID : **AQUEOUS-Fresh**

Classical Chemistry Parameters

Analyte Name (Analyte ID)	Results/Qual	Units	DF	MDL	PQL	Method	Analyzed Date	By	Batch	Notes
Ammonia (N) (7664417)	0.035 U	mg/L	1	0.035	0.05	EPA 350.1	02/04/22 17:51	RRB	797574	-
Phosphorus (7723140)	0.0028 U	mg/L	1	0.0028	0.004	EPA 365.3	02/04/22 10:34	CLL	796090	-

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ANALYTICAL REPORT

For Proiect:
Lake Buchanan Flux Study

NELAP Certified
FDOH # : **E83484**
Lab Received Date : **1/18/2022 4:06:00 PM**

Company Name: **Wood Environment & Infrastructure**
Client's Name: **Lance Lumbard**
Client's Address: **550 Northlake Blvd. Suite 1000**
City: **Altamonte Springs**
State: **FL** Zip: **32701**

Facility ID: **NA**
Project Location: **Orange County, FL.**
Client's Phone: **407-522-7570**
Client's Project Number: **600713x2.01.09**
Lab Reporting Batch ID: **2201026**

********** Analytical Results **********

Client Sample ID: **LB-1-T=96**
Lab Sample ID: **2201026-009**
Date Collected: **01/14/22 14:30**
Collected By: **Francesca Lauterman**
Matrix ID : **AQUEOUS-Fresh**

Classical Chemistry Parameters

Analyte Name (Analyte ID)	Results/Qual	Units	DF	MDL	PQL	Method	Analyzed Date	By	Batch	Notes
Ammonia (N) (7664417)	***0.44***	mg/L	1	0.035	0.05	EPA 350.1	02/08/22 12:31	RRB	798407	-
Phosphorus (7723140)	***0.27***	mg/L	1	0.0028	0.004	EPA 365.3	02/04/22 10:47	CLL	796090	-

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ANALYTICAL REPORT

For Proiect:
Lake Buchanan Flux Study

NELAP Certified
FDOH # : **E83484**
Lab Received Date : **1/18/2022 4:06:00 PM**

Company Name: **Wood Environment & Infrastructure**
Client's Name: **Lance Lumbard**
Client's Address: **550 Northlake Blvd. Suite 1000**
City: **Altamonte Springs**
State: **FL** Zip: **32701**

Facility ID: **NA**
Project Location: **Orange County, FL.**
Client's Phone: **407-522-7570**
Client's Project Number: **600713x2.01.09**
Lab Reporting Batch ID: **2201026**

********** Analytical Results **********

Client Sample ID: **LB-2-T=96**
Lab Sample ID: **2201026-010**
Date Collected: **01/14/22 14:35**
Collected By: **Francesca Lauterman**
Matrix ID : **AQUEOUS-Fresh**

Classical Chemistry Parameters

Analyte Name (Analyte ID)	Results/Qual	Units	DF	MDL	PQL	Method	Analyzed Date	By	Batch	Notes
Ammonia (N) (7664417)	***1.8***	mg/L	1	0.035	0.05	EPA 350.1	02/08/22 12:33	RRB	798407	-
Phosphorus (7723140)	***0.33***	mg/L	1	0.0028	0.004	EPA 365.3	02/04/22 10:48	CLL	796090	-

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ANALYTICAL REPORT

For Proiect:
Lake Buchanan Flux Study

NELAP Certified
FDOH # : **E83484**
Lab Received Date : **1/18/2022 4:06:00 PM**

Company Name: **Wood Environment & Infrastructure**
Client's Name: **Lance Lumbard**
Client's Address: **550 Northlake Blvd. Suite 1000**
City: **Altamonte Springs**
State: **FL** Zip: **32701**

Facility ID: **NA**
Project Location: **Orange County, FL.**
Client's Phone: **407-522-7570**
Client's Project Number: **600713x2.01.09**
Lab Reporting Batch ID: **2201026**

********** Analytical Results **********

Client Sample ID: **LB-3-T=96**
Lab Sample ID: **2201026-011**
Date Collected: **01/14/22 14:40**
Collected By: **Francesca Lauterman**
Matrix ID : **AQUEOUS-Fresh**

Classical Chemistry Parameters

Analyte Name (Analyte ID)	Results/Qual	Units	DF	MDL	PQL	Method	Analyzed Date	By	Batch	Notes
Ammonia (N) (7664417)	***0.86***	mg/L	1	0.035	0.05	EPA 350.1	02/08/22 12:38	RRB	798407	-
Phosphorus (7723140)	***0.18***	mg/L	1	0.0028	0.004	EPA 365.3	02/04/22 10:50	CLL	796090	-

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ANALYTICAL REPORT

For Proiect:
Lake Buchanan Flux Study

NELAP Certified
FDOH # : **E83484**
Lab Received Date : **1/18/2022 4:06:00 PM**

Company Name: **Wood Environment & Infrastructure**
Client's Name: **Lance Lumbard**
Client's Address: **550 Northlake Blvd. Suite 1000**
City: **Altamonte Springs**
State: **FL** Zip: **32701**

Facility ID: **NA**
Project Location: **Orange County, FL.**
Client's Phone: **407-522-7570**
Client's Project Number: **600713x2.01.09**
Lab Reporting Batch ID: **2201026**

********** Analytical Results **********

Client Sample ID: **WC-1-T=96**
Lab Sample ID: **2201026-012**
Date Collected: **01/14/22 14:45**
Collected By: **Francesca Lauterman**
Matrix ID : **AQUEOUS-Fresh**

Classical Chemistry Parameters

Analyte Name (Analyte ID)	Results/Qual	Units	DF	MDL	PQL	Method	Analyzed Date	By	Batch	Notes
Ammonia (N) (7664417)	0.035 U	mg/L	1	0.035	0.05	EPA 350.1	02/08/22 12:39	RRB	798407	-
Phosphorus (7723140)	0.0028 U	mg/L	1	0.0028	0.004	EPA 365.3	02/04/22 10:53	CLL	796092	-

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ANALYTICAL REPORT

For Proiect:
Lake Buchanan Flux Study

NELAP Certified
FDOH # : **E83484**
Lab Received Date : **1/18/2022 4:06:00 PM**

Company Name: **Wood Environment & Infrastructure**
Client's Name: **Lance Lumbard**
Client's Address: **550 Northlake Blvd. Suite 1000**
City: **Altamonte Springs**
State: **FL** Zip: **32701**

Facility ID: **NA**
Project Location: **Orange County, FL.**
Client's Phone: **407-522-7570**
Client's Project Number: **600713x2.01.09**
Lab Reporting Batch ID: **2201026**

********** Analytical Results **********

Client Sample ID: **LB-A-T=96**
Lab Sample ID: **2201026-013**
Date Collected: **01/14/22 14:55**
Collected By: **Francesca Lauterman**
Matrix ID : **AQUEOUS-Fresh**

Classical Chemistry Parameters

Analyte Name (Analyte ID)	Results/Qual	Units	DF	MDL	PQL	Method	Analyzed Date	By	Batch	Notes
Ammonia (N) (7664417)	0.035 U	mg/L	1	0.035	0.05	EPA 350.1	02/08/22 13:10	RRB	798409	-
Phosphorus (7723140)	***0.078***	mg/L	1	0.0028	0.004	EPA 365.3	02/04/22 10:57	CLL	796092	-

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ANALYTICAL REPORT

For Proiect:
Lake Buchanan Flux Study

NELAP Certified
FDOH # : **E83484**
Lab Received Date : **1/18/2022 4:06:00 PM**

Company Name: **Wood Environment & Infrastructure**
Client's Name: **Lance Lumbard**
Client's Address: **550 Northlake Blvd. Suite 1000**
City: **Altamonte Springs**
State: **FL** Zip: **32701**

Facility ID: **NA**
Project Location: **Orange County, FL.**
Client's Phone: **407-522-7570**
Client's Project Number: **600713x2.01.09**
Lab Reporting Batch ID: **2201026**

********** Analytical Results **********

Client Sample ID: **LB-B-T=96**
Lab Sample ID: **2201026-014**
Date Collected: **01/14/22 15:00**
Collected By: **Francesca Lauterman**
Matrix ID : **AQUEOUS-Fresh**

Classical Chemistry Parameters

Analyte Name (Analyte ID)	Results/Qual	Units	DF	MDL	PQL	Method	Analyzed Date	By	Batch	Notes
Ammonia (N) (7664417)	***0.88***	mg/L	1	0.035	0.05	EPA 350.1	02/08/22 13:18	RRB	798409	-
Phosphorus (7723140)	***0.22***	mg/L	1	0.0028	0.004	EPA 365.3	02/04/22 11:01	CLL	796092	-

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ANALYTICAL REPORT

For Proiect:
Lake Buchanan Flux Study

NELAP Certified
FDOH # : **E83484**
Lab Received Date : **1/18/2022 4:06:00 PM**

Company Name: **Wood Environment & Infrastructure**
Client's Name: **Lance Lumbard**
Client's Address: **550 Northlake Blvd. Suite 1000**
City: **Altamonte Springs**
State: **FL** Zip: **32701**

Facility ID: **NA**
Project Location: **Orange County, FL.**
Client's Phone: **407-522-7570**
Client's Project Number: **600713x2.01.09**
Lab Reporting Batch ID: **2201026**

********** Analytical Results **********

Client Sample ID: **LB-C-T=96**
Lab Sample ID: **2201026-015**
Date Collected: **01/14/22 15:05**
Collected By: **Francesca Lauterman**
Matrix ID : **AQUEOUS-Fresh**

Classical Chemistry Parameters

Analyte Name (Analyte ID)	Results/Qual	Units	DF	MDL	PQL	Method	Analyzed Date	By	Batch	Notes
Ammonia (N) (7664417)	***0.38***	mg/L	1	0.035	0.05	EPA 350.1	02/08/22 13:20	RRB	798409	-
Phosphorus (7723140)	***0.1***	mg/L	1	0.0028	0.004	EPA 365.3	02/04/22 11:02	CLL	796092	-

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ANALYTICAL REPORT

For Proiect:
Lake Buchanan Flux Study

NELAP Certified
FDOH # : **E83484**
Lab Received Date : **1/18/2022 4:06:00 PM**

Company Name: **Wood Environment & Infrastructure**
Client's Name: **Lance Lumbard**
Client's Address: **550 Northlake Blvd. Suite 1000**
City: **Altamonte Springs**
State: **FL** Zip: **32701**

Facility ID: **NA**
Project Location: **Orange County, FL.**
Client's Phone: **407-522-7570**
Client's Project Number: **600713x2.01.09**
Lab Reporting Batch ID: **2201026**

********** Analytical Results **********

Client Sample ID: **WC-A-T=96**
Lab Sample ID: **2201026-016**
Date Collected: **01/14/22 15:10**
Collected By: **Francesca Lauterman**
Matrix ID : **AQUEOUS-Fresh**

Classical Chemistry Parameters

Analyte Name (Analyte ID)	Results/Qual	Units	DF	MDL	PQL	Method	Analyzed Date	By	Batch	Notes
Ammonia (N) (7664417)	0.035 U	mg/L	1	0.035	0.05	EPA 350.1	02/08/22 13:22	RRB	798409	-
Phosphorus (7723140)	0.0028 U	mg/L	1	0.0028	0.004	EPA 365.3	02/04/22 11:04	CLL	796092	-

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ANALYTICAL REPORT

For Proiect:
Lake Buchanan Flux Study

NELAP Certified
FDOH # : **E83484**
Lab Received Date : **1/18/2022 4:06:00 PM**

Company Name: **Wood Environment & Infrastructure**
Client's Name: **Lance Lumbard**
Client's Address: **550 Northlake Blvd. Suite 1000**
City: **Altamonte Springs**
State: **FL** Zip: **32701**

Facility ID: **NA**
Project Location: **Orange County, FL.**
Client's Phone: **407-522-7570**
Client's Project Number: **600713x2.01.09**
Lab Reporting Batch ID: **2201026**

********** Detection Summary : **********

Client Sample ID: **LB-1-T=48** Date Collected: **01/12/22 16:00** Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201026-001** Collected By: **Francesca Lauterman**

Analyte Name (Analyte ID)	Results/Qualifier	Units	DF	MDL	PQL	Date Analyzed	By	Batch ID	Method
Ammonia (N) (7664417)	**0.62**	mg/L	1	0.035	0.05	02/04/22 17:26	RRB	797571	EPA 350.1
Phosphorus (7723140)	**0.21**	mg/L	1	0.0028	0.004	02/04/22 10:23	CLL	796090	EPA 365.3

Client Sample ID: **LB-2-T=48** Date Collected: **01/12/22 16:05** Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201026-002** Collected By: **Francesca Lauterman**

Analyte Name (Analyte ID)	Results/Qualifier	Units	DF	MDL	PQL	Date Analyzed	By	Batch ID	Method
Ammonia (N) (7664417)	**1.3**	mg/L	1	0.035	0.05	02/04/22 17:31	RRB	797571	EPA 350.1
Phosphorus (7723140)	**0.66**	mg/L	1	0.0028	0.004	02/04/22 10:24	CLL	796090	EPA 365.3

Client Sample ID: **LB-3-T=48** Date Collected: **01/12/22 16:10** Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201026-003** Collected By: **Francesca Lauterman**

Analyte Name (Analyte ID)	Results/Qualifier	Units	DF	MDL	PQL	Date Analyzed	By	Batch ID	Method
Ammonia (N) (7664417)	**0.63**	mg/L	1	0.035	0.05	02/04/22 17:32	RRB	797571	EPA 350.1
Phosphorus (7723140)	**0.15**	mg/L	1	0.0028	0.004	02/04/22 10:26	CLL	796090	EPA 365.3

Client Sample ID: **LB-A-T=48** Date Collected: **01/12/22 16:20** Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201026-005** Collected By: **Francesca Lauterman**

Analyte Name (Analyte ID)	Results/Qualifier	Units	DF	MDL	PQL	Date Analyzed	By	Batch ID	Method
Ammonia (N) (7664417)	**0.3**	mg/L	1	0.035	0.05	02/04/22 17:43	RRB	797574	EPA 350.1
Phosphorus (7723140)	**0.1**	mg/L	1	0.0028	0.004	02/04/22 10:31	CLL	796090	EPA 365.3

Client Sample ID: **LB-B-T=48** Date Collected: **01/12/22 16:25** Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201026-006** Collected By: **Francesca Lauterman**

Analyte Name (Analyte ID)	Results/Qualifier	Units	DF	MDL	PQL	Date Analyzed	By	Batch ID	Method
Ammonia (N) (7664417)	**1.1**	mg/L	1	0.035	0.05	02/04/22 17:44	RRB	797574	EPA 350.1
Phosphorus (7723140)	**0.51**	mg/L	1	0.0028	0.004	02/04/22 10:32	CLL	796090	EPA 365.3

Client Sample ID: **LB-C-T=48** Date Collected: **01/12/22 16:30** Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201026-007** Collected By: **Francesca Lauterman**

Analyte Name (Analyte ID)	Results/Qualifier	Units	DF	MDL	PQL	Date Analyzed	By	Batch ID	Method
Ammonia (N) (7664417)	**0.58**	mg/L	1	0.035	0.05	02/04/22 17:46	RRB	797574	EPA 350.1
Phosphorus (7723140)	**0.13**	mg/L	1	0.0028	0.004	02/04/22 10:33	CLL	796090	EPA 365.3

Client Sample ID: **LB-1-T=96** Date Collected: **01/14/22 14:30** Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201026-009** Collected By: **Francesca Lauterman**

Analyte Name (Analyte ID)	Results/Qualifier	Units	DF	MDL	PQL	Date Analyzed	By	Batch ID	Method
Ammonia (N) (7664417)	**0.44**	mg/L	1	0.035	0.05	02/08/22 12:31	RRB	798407	EPA 350.1
Phosphorus (7723140)	**0.27**	mg/L	1	0.0028	0.004	02/04/22 10:47	CLL	796090	EPA 365.3

Client Sample ID: **LB-2-T=96** Date Collected: **01/14/22 14:35** Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201026-010** Collected By: **Francesca Lauterman**

Analyte Name (Analyte ID)	Results/Qualifier	Units	DF	MDL	PQL	Date Analyzed	By	Batch ID	Method
Ammonia (N) (7664417)	**1.8**	mg/L	1	0.035	0.05	02/08/22 12:33	RRB	798407	EPA 350.1
Phosphorus (7723140)	**0.33**	mg/L	1	0.0028	0.004	02/04/22 10:48	CLL	796090	EPA 365.3

Client Sample ID: **LB-3-T=96** Date Collected: **01/14/22 14:40** Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201026-011** Collected By: **Francesca Lauterman**

Analyte Name (Analyte ID)	Results/Qualifier	Units	DF	MDL	PQL	Date Analyzed	By	Batch ID	Method
Ammonia (N) (7664417)	**0.86**	mg/L	1	0.035	0.05	02/08/22 12:38	RRB	798407	EPA 350.1
Phosphorus (7723140)	**0.18**	mg/L	1	0.0028	0.004	02/04/22 10:50	CLL	796090	EPA 365.3

This report, which includes the attached Chain-Of-Custody, shall not be reported except in full, without written approval of the laboratory.

Southern Research Laboratories, Inc
2251 Lynx Lane, Suite 1
Orlando, Florida 32804
(407) 522-7100 / Fax (407) 522-7043

ANALYTICAL REPORT

For Proiect:
Lake Buchanan Flux Study

NELAP Certified
FDOH # : **E83484**
Lab Received Date : **1/18/2022 4:06:00 PM**

Company Name: **Wood Environment & Infrastructure**
Client's Name: **Lance Lumbard**
Client's Address: **550 Northlake Blvd. Suite 1000**
City: **Altamonte Springs**
State: **FL** Zip: **32701**

Facility ID: **NA**
Project Location: **Orange County, FL.**
Client's Phone: **407-522-7570**
Client's Project Number: **600713x2.01.09**
Lab Reporting Batch ID: **2201026**

Client Sample ID: **LB-A-T=96** Date Collected: **01/14/22 14:55** Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201026-013** Collected By: **Francesca Lauterman**

Analyte Name (Analyte ID)	Results/Qualifier	Units	DF	MDL	PQL	Date Analyzed	By	Batch ID	Method
Phosphorus (7723140)	**0.078**	mg/L	1	0.0028	0.004	02/04/22 10:57	CLL	796092	EPA 365.3

Client Sample ID: **LB-B-T=96** Date Collected: **01/14/22 15:00** Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201026-014** Collected By: **Francesca Lauterman**

Analyte Name (Analyte ID)	Results/Qualifier	Units	DF	MDL	PQL	Date Analyzed	By	Batch ID	Method
Ammonia (N) (7664417)	**0.88**	mg/L	1	0.035	0.05	02/08/22 13:18	RRB	798409	EPA 350.1
Phosphorus (7723140)	**0.22**	mg/L	1	0.0028	0.004	02/04/22 11:01	CLL	796092	EPA 365.3

Client Sample ID: **LB-C-T=96** Date Collected: **01/14/22 15:05** Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201026-015** Collected By: **Francesca Lauterman**

Analyte Name (Analyte ID)	Results/Qualifier	Units	DF	MDL	PQL	Date Analyzed	By	Batch ID	Method
Ammonia (N) (7664417)	**0.38**	mg/L	1	0.035	0.05	02/08/22 13:20	RRB	798409	EPA 350.1
Phosphorus (7723140)	**0.1**	mg/L	1	0.0028	0.004	02/04/22 11:02	CLL	796092	EPA 365.3

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ANALYTICAL REPORT

For Proiect:
Lake Buchanan Flux Study

NELAP Certified
FDOH # : **E83484**
Lab Received Date : **1/18/2022 4:06:00 PM**

Company Name: **Wood Environment & Infrastructure**
Client's Name: **Lance Lumbard**
Client's Address: **550 Northlake Blvd. Suite 1000**
City: **Altamonte Springs**
State: **FL** Zip: **32701**

Facility ID: **NA**
Project Location: **Orange County, FL.**
Client's Phone: **407-522-7570**
Client's Project Number: **600713x2.01.09**
Lab Reporting Batch ID: **2201026**

********** Quality Control : **********

Method Blank(MB) — Classical Chemistry Parameters

Client Sample ID: **Method Blank-1** Sampled: 02/01/22 11:15 Analyzed: 02/04/22 10:51 Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201026-017** Prep: 02/01/22 11:15

EPA 365.3

Analyte Name (Analyte ID)	Results/Qual	Units	DF	MDL	PQL	By	Batch	Notes
Phosphorus (7723140)	0.0028 U	mg/L	1	0.0028	0.004	CLL	796092	-

Laboratory Control Standard(LCS) — Classical Chemistry Parameters

Client Sample ID: **LCS-1** Sampled: 02/01/22 11:15 Analyzed: 02/04/22 10:52 Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201026-018** Prep: 02/01/22 11:15

EPA 365.3

Analyte Name (Analyte ID)	Result	SPK	Units	DF	MDL	PQL	%Rec	By	Batch	%Limits	Notes
Phosphorus (7723140)	0.1	0.1	mg/L	1	0.0028	0.004	100	CLL	796092	90-110	

Matrix Spike(MS) — Classical Chemistry Parameters

Client Sample ID: **WC-1-T=96 MS** Sampled: 01/14/22 14:45 Analyzed: 02/04/22 10:56 Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201026-019** Prep: 02/01/22 11:15

EPA 365.3

Analyte Name (Analyte ID)	Result	SPK	Units	DF	MDL	PQL	%Rec	Source	By	Batch	%Limits	Notes
Phosphorus (7723140)	0.11	0.1	mg/L	1	0.0028	0.004	105	0.0028 U	CLL	796092	80-120	

Matrix Spike Dup(MSD) — Classical Chemistry Parameters

Client Sample ID: **WC-1-T=96 MSD** Sampled: 01/14/22 14:45 Analyzed: 02/04/22 10:55 Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201026-020** Prep: 02/01/22 11:15

EPA 365.3

Analyte Name (Analyte ID)	Result	SPK	Units	DF	MDL	PQL	%RPD	%Rec	Source	By	Batch	%Limits	Notes
Phosphorus (7723140)	0.11	0.1	mg/L	1	0.0028	0.004	1	106	0.0028 U	CLL	796092	80-120	

Method Blank(MB) — Classical Chemistry Parameters

Client Sample ID: **Method Blank-1** Sampled: 02/08/22 13:10 Analyzed: 02/08/22 13:06 Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201026-021** Prep: 02/08/22 13:06

EPA 350.1

Analyte Name (Analyte ID)	Results/Qual	Units	DF	MDL	PQL	By	Batch	Notes
Ammonia (N) (7664417)	0.035 U	mg/L	1	0.035	0.05	RRB	798409	-

Laboratory Control Standard(LCS) — Classical Chemistry Parameters

Client Sample ID: **LCS-1** Sampled: 02/08/22 13:10 Analyzed: 02/08/22 13:08 Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201026-022** Prep: 02/08/22 13:08

EPA 350.1

Analyte Name (Analyte ID)	Result	SPK	Units	DF	MDL	PQL	%Rec	By	Batch	%Limits	Notes
Ammonia (N) (7664417)	1.1	1	mg/L	1	0.035	0.05	109	RRB	798409	90-110	

Matrix Spike(MS) — Classical Chemistry Parameters

Client Sample ID: **LB-A-T=96 MS** Sampled: 01/14/22 14:55 Analyzed: 02/08/22 13:13 Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201026-023** Prep: 02/08/22 13:13

EPA 350.1

Analyte Name (Analyte ID)	Result	SPK	Units	DF	MDL	PQL	%Rec	Source	By	Batch	%Limits	Notes
Ammonia (N) (7664417)	1.1	1	mg/L	1	0.035	0.05	113	0.035 U	RRB	798409	90-110	

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Southern Research Laboratories, Inc
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Orlando, Florida 32804
(407) 522-7100 / Fax (407) 522-7043

ANALYTICAL REPORT

For Proiect:
Lake Buchanan Flux Study

NELAP Certified
FDOH # : **E83484**
Lab Received Date : **1/18/2022 4:06:00 PM**

Company Name: **Wood Environment & Infrastructure**
Client's Name: **Lance Lumbard**
Client's Address: **550 Northlake Blvd. Suite 1000**
City: **Altamonte Springs**
State: **FL** Zip: **32701**

Facility ID: **NA**
Project Location: **Orange County, FL.**
Client's Phone: **407-522-7570**
Client's Project Number: **600713x2.01.09**
Lab Reporting Batch ID: **2201026**

********** Quality Control : **********

Matrix Spike Dup(MSD) Classical Chemistry Parameters

Client Sample ID: **LB-A-T=96 MSD** Sampled: 01/14/22 14:55 Analyzed: 02/08/22 13:11 Matrix ID : **AQUEOUS-Fresh**

Lab Sample ID: **2201026-024** Prep: 02/08/22 13:11

EPA 350.1

Analyte Name (Analyte ID)	Result	SPK	Units	DF	MDL	PQL	%RPD	%Rec	Source	By	Batch	%Limits	Notes
Ammonia (N) (7664417)	1.1	1	mg/L	1	0.035	0.05	1	112	0.035 U	RRB	798409	90-110	

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ANALYTICAL REPORT

For Proiect:
Lake Buchanan Flux Study

NELAP Certified
FDOH # : **E83484**
Lab Received Date : **1/18/2022 4:06:00 PM**

Company Name: **Wood Environment & Infrastructure**
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City: **Altamonte Springs**
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Facility ID: **NA**
Project Location: **Orange County, FL.**
Client's Phone: **407-522-7570**
Client's Project Number: **600713x2.01.09**
Lab Reporting Batch ID: **2201026**

**********Data Qualifiers Codes**********

Reporting Exceptions and Qualified Data

When quality control results are outside established control limits reanalysis, including re-extraction (if applicable), is preferred. If re-analysis is not viable or desirable, then results may be qualified. Sample results associated with quality control data that exceed acceptance criteria will be qualified with an appropriate comment. Any parameter for which the laboratory is not officially NELAP accredited is indicated by a '~' symbol. These are not included in the scope because NELAP accreditation is either not available or has not been applied for.

Lab Qualifier	Description
B-01	The sample dilutions set-up for the analysis did not meet the oxygen depletion criteria of at least 2 mg/l dissolved oxygen depletion. Therefore the reported result is an estimated value only.
B-04	The average DO uptake of the seeded controls does not meet the method required 0.6 - 1.0 mg/L.
B-06	Sample is supersaturated with DO. Initial DO exceeds the method required maximum initial DO of 9 mg/L.
B-07	LCS exceeded control limits. The test can not be repeated due to method constraints. Considered to be an estimated value.
D	Data reported from a dilution and or multiple dilutions. D2= 1/2, D5= 1/5, D10= 1/10, D20= 1/20, D50= 1/50, D100= 1/100
I, J	The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit.
J-01	Result may be biased high due to positive results in the associated method blank at a concentration above
L	Off-scale high. Actual value is known to be greater than value given.
LP-02	Less than 1000 ml of sample filtered and residue range of 2.5 insufficient sample, analysis cannot be repeated.
M	Presence of material is verified but not quantified; the actual value is less than the value given. The estimated concentration is greater than the MDL.
N	Presumptive evidence of presence of material.
O	Sampled, but analysis lost or not performed.
PS	PS = Parent Sample. The PS sample was used as the parent sample for the analysis batch to make a Matrix Spike (MS), Matrix Spike Duplicated (MSD) and / or Laboratory Duplicate (DUP).
Q	Sample held beyond the accepted holding time. Use this code if result derived from a sample prepared or analyzed after the approved holding time.
QB-01	The method blank had a positive result for the analyte; however, the concentration in the method blank is less than 10% of the sample result. There is minimal impact to the data.
QB-02	The method blank contains analyte at a concentration above the MDL and/or greater than one-half the MRL. The analyte was not detected in the sample.
QL-02	The associated laboratory control sample exhibited high bias; since the result is ND, there is no impact.
QM-02	The RPD and/or percent recovery for this QC spike sample cannot be accurately calculated due to the high concentration of analyte present in the sample.
QM-07	Spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on acceptable LCS recovery.
QM-11	Precision between duplicate matrix spikes of the same sample was outside acceptance limits.
QM-12	Precision between duplicate samples was outside acceptance limits.
QM-S	Surrogate recovery exceeded acceptance criteria due to the presence of a coeluting compound.
QR-04	Duplicate precision outside acceptance limits due to low analyte concentration.
QS-03	Surrogate recovery outside acceptance limits
QS-4	Surrogate recovery not calculated. Surrogate diluted out of the calibrtion range.
QS-6	Surrogate recovery exceeded accepance criteria due to coelution. Matrix effect confirmed.
QV-01	The associated continuing calibration verification standard exhibited high bias; since the result is ND, there is no impact.
R-01	The Reporting Limit for this analyte has been raised to account for matrix interference.
T	Value reported is less than the laboratory method detection limit. The value is reported for informational purposes only and shall not be used in statistical analysis.
U	Indicates the compound was analyzed for but not detected above the method detection limt.
V	Indicates the analyte was detected in both the sample and method blank.
V1	Common Laboratory Contaminant
Y	The laboratory analysis was performed on an improperly preserved sample. The result may not be accurate.

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Chain of Custody

2201026-16

Page 1 of 2

Project Manager:	Lance Lumbard
Company:	Wood Environment & Infrastructure Solutions, Inc.
Address:	550 Northlake Blvd., Suite 1000
City, State, Zip:	Altamonte Springs Florida 32701
Phone:	407-522-7570
Fax:	+1 (407) 522-7576

Southern Research Laboratories, Inc.
2251 Lynx Lane, Suite #1
Orlando, Florida 32804
Main (407) 522-7100 Fax: (407) 522-7043

Project Name: Lake Buchanan Flux

Project Location: Lake Buchanan
PO# C012610100

Sampled by [Print Name(s)] / Affiliation: Francesca Hautemann

Sampler(s) Signature(s):

Preservatives (see codes): S

Project Number: 600713x2.01.09

Analyses Requested: Tot Ammonia

REQUESTED DUE DATE:

Facility ID#:

Petroleum Restoration Program ____ yes ____ no

	Sample Identification	Sampled Date:	Sampled Time:	Grab or Composite	Matrix: (see codes)	Total Number of Containers	Tot Ammonia								
1	LB-1 - T= 48	1/12/22	1600	Grab	SW	1	1								2201026-001
2	LB-2 - T= 48	1/12/22	1605	Grab	SW	1	1								-002
3	LB-3 - T= 48	1/12/22	1610	Grab	SW	1	1								-003
4	WC-1 - T= 48	1/12/22	1615	Grab	SW	1	1								-004
5	LB-A - T= 48	1/12/22	1620	Grab	SW	1	1								-005
6	LB-B - T= 48	1/12/22	1625	Grab	SW	1	1								-006
7	LB-C - T= 48	1/12/22	1630	Grab	SW	1	1								-007
8	WC-A - T= 48	1/12/22	1635	Grab	SW	1	1								-008
9	LB-1 - T= 96	1/14/22	1430	Grab	SW	1	1								-009
10	LB-2 - T= 96	1/14/22	1435	Grab	SW	1	1								-010

Shipment Method		Relinquished by	Date:	Time:	Accepted by:	Date:	Time:
Out: / /	Via:	Helen Turner	3/21/21	15:15			
Returned: / /	Via:		1/17/22	1500	James S. Preston	1/18/22	1345
Additional Comments:		James S. Preston	1/18/22	1606	Helen Turner	1/18/22	1606

Cooler No.(s) / Temperature(s) (°C): client cooler 435, 422, X426, 509 1.7 °C

Sampling Kit No.: 8911

Equipment ID No.:

Matrix Codes: A = Air GW = Groundwater SE = Sediment SO = Soil SW = Surface Water W = Water(Blanks) HW = Potential Haz Waste O = Other(Specify:_____)

Preservative Codes: H = Hydrochloric Acid & Ice I = Ice Only N = Nitrie Acid& Ice S = Sulfuric Acid & Ice X = Sodium Hydroxide & Ice O = Other(Specify)

Chain of Custody

2201026
16

Page 2 of 2

Project Manager: Lance Lumbard	Southern Research Laboratories, Inc. 2251 Lynx Lane, Suite #1 Orlando, Florida 32804
Company: Wood Environment & Infrastructure Solutions, Inc.	Main (407) 522-7100 Fax: (407) 522-7043
Address: 350 Northlake Blvd., Suite 1000	
City, State, Zip: Altamonte Springs Florida 32701	
Phone: 407-522-7570 Fax: +1 (407) 522-7576	

Project Name: Lake Buchanan Flux

Project Location: Lake Buchanan

PO# C012610100

Sampled by [Print Name(s)] / Affiliation:

Sampler(s) Signature(s):

Project Number: 600713x2.01.09

REQUESTED DUE DATE:

Facility ID#:

Petroleum Restoration Program ____ yes ____ no

	Sample Identification	Sampled Date:	Sampled Time:	Grab or Composite	Matrix: (see codes)	Total Number of Containers	Preservatives (see codes): T8/Ammonia	Analyses Requested	Project Number:
11	LB-3 - T=~~9~~	1/14/21	1440	Grab	SW	1	(1)		2201026-011
12	WC-1 - T=~~9~~6	1/14/21	1445	Grab	SW	1	(1)		-012
13	LB-A - T=~~9~~6	1/14/21	1455	Grab	SW	1	(1)		-013
14	LB-B - T=~~9~~6	1/14/21	1500	Grab	SW	1	(1)		-014
15	LB-C - T=~~9~~6	1/14/21	1505	Grab	SW	1	(1)		-015
16	WC-A - T=~~9~~6	1/14/21	1610	Grab	SW	1	(1)		-016

Shipment Method:		Relinquished by	Date:	Time:	Accepted by:	Date:	Time:
Out: / /	Via:	Helen Turnbull	3/24/21	15:15			
Returned: / /	Via:		1/17/22	1500	James B. Preston	1/18/22	1345
		James B. Preston	1/18/22	1606	Helen Turnbull	1-18-22	16:06

Additional Comments:

Cooler No.(s) / Temperature(s) (°C): 435, 422, X426, 509

Sampling Kit No.: 8911

Equipment ID No.:

Matrix Codes: A = Air GW = Groundwater SE = Sediment SO = Soil SW = Surface Water W = Water(Blanks) HW = Potential Haz Waste O = Other(Specify:_____)

Preservative Codes: H = Hydrochloric Acid & Ice I = Ice Only N = Nitrie Acid& Ice S = Sulfuric Acid & Ice X = Sodium Hydroxide & Ice O = Other(Specify)

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WWW.SRLAB.COM

Thank you Lance Lumbard for the opportunity to be of service to you and your company, We Sincerely Appreciate Your Business.

SRL certifies these Laboratory Results were produced in accordance with NELAC Standards. Hold times and preservation requirements were met for all analytes unless specifically call noted in the report. Results relate only to the samples as received.

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ANALYTICAL REPORT

For Proiect:
Lake Buchanan Flux Study

NELAP Certified
FDOH # : **E83484**
Lab Received Date : **01/18/22 16:06**

Company Name: **Wood Environment & Infrastructure**
Client's Name: **Lance Lumbard**
Client's Address: **550 Northlake Blvd. Suite 1000**
City: **Altamonte Springs**
State: **FL** Zip: **32701**

Facility ID: **NA**
Project Location: **Orange County, FL.**
Client's Phone: **407-522-7570**
Client's Project Number: **600713.x.01.09**
Lab Reporting Batch ID: **2201027**

Item#	Lab Sample ID	Client Sample ID	Collected Date	Collected Time	Sample Matrix	Analysis Requested
1	2201027-001	LB-1-T=168	01/17/22	14:00	AQUEOUS-Fresh	EPA 350.1,EPA 365.3
2	2201027-002	LB-2-T=168	01/17/22	14:05	AQUEOUS-Fresh	EPA 350.1,EPA 365.3
3	2201027-003	LB-3-T=168	01/17/22	14:10	AQUEOUS-Fresh	EPA 350.1,EPA 365.3
4	2201027-004	WC-1-T=168	01/17/22	14:15	AQUEOUS-Fresh	EPA 350.1,EPA 365.3
5	2201027-005	LB-A-T=168	01/17/22	14:20	AQUEOUS-Fresh	EPA 350.1,EPA 365.3
6	2201027-006	LB-B-T=168	01/17/22	14:25	AQUEOUS-Fresh	EPA 350.1,EPA 365.3
7	2201027-007	LB-C-T=168	01/17/22	14:30	AQUEOUS-Fresh	EPA 350.1,EPA 365.3
8	2201027-008	WC-A-T=168	01/17/22	14:35	AQUEOUS-Fresh	EPA 350.1,EPA 365.3

Sherri Payne
Vice President / Quality Assurance Officer - SRL

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ANALYTICAL REPORT

For Proiect:
Lake Buchanan Flux Study

NELAP Certified
FDOH # : **E83484**
Lab Received Date : **01/18/22 16:06**

Company Name: **Wood Environment & Infrastructure**
Client's Name: **Lance Lumbard**
Client's Address: **550 Northlake Blvd. Suite 1000**
City: **Altamonte Springs**
State: **FL** Zip: **32701**

Facility ID: **NA**
Project Location: **Orange County, FL.**
Client's Phone: **407-522-7570**
Client's Project Number: **600713.x.01.09**
Lab Reporting Batch ID: **2201027**

********** Analytical Results **********

Client Sample ID: **LB-1-T=168**
Lab Sample ID: **2201027-001**
Date Collected: **01/17/22 14:00**
Collected By: **Fancesca Lawtermen**
Matrix ID : **AQUEOUS-Fresh**

Classical Chemistry Parameters

Analyte Name (Analyte ID)	Results/Qual	Units	DF	MDL	PQL	Method	Analyzed Date	By	Batch	Notes
Ammonia (N) (7664417)	***0.58***	mg/L	1	0.035	0.05	EPA 350.1	02/08/22 13:23	RRB	798409	-
Phosphorus (7723140)	***0.3***	mg/L	1	0.0028	0.004	EPA 365.3	02/04/22 11:10	CLL	796092	-

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Southern Research Laboratories, Inc
2251 Lynx Lane, Suite 1
Orlando, Florida 32804
(407) 522-7100 / Fax (407) 522-7043

ANALYTICAL REPORT

For Proiect:
Lake Buchanan Flux Study

NELAP Certified
FDOH # : **E83484**
Lab Received Date : **01/18/22 16:06**

Company Name: **Wood Environment & Infrastructure**
Client's Name: **Lance Lumbard**
Client's Address: **550 Northlake Blvd. Suite 1000**
City: **Altamonte Springs**
State: **FL** Zip: **32701**

Facility ID: **NA**
Project Location: **Orange County, FL.**
Client's Phone: **407-522-7570**
Client's Project Number: **600713.x.01.09**
Lab Reporting Batch ID: **2201027**

********** Analytical Results **********

Client Sample ID: **LB-2-T=168**
Lab Sample ID: **2201027-002**
Date Collected: **01/17/22 14:05**
Collected By: **Fancesca Lawtermen**
Matrix ID : **AQUEOUS-Fresh**

Classical Chemistry Parameters

Analyte Name (Analyte ID)	Results/Qual	Units	DF	MDL	PQL	Method	Analyzed Date	By	Batch	Notes
Ammonia (N) (7664417)	***2.2***	mg/L	1	0.035	0.05	EPA 350.1	02/08/22 13:25	RRB	798409	-
Phosphorus (7723140)	***0.23***	mg/L	1	0.0028	0.004	EPA 365.3	02/04/22 11:11	CLL	796092	-

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ANALYTICAL REPORT

For Proiect:
Lake Buchanan Flux Study

NELAP Certified
FDOH # : **E83484**
Lab Received Date : **01/18/22 16:06**

Company Name: **Wood Environment & Infrastructure**
Client's Name: **Lance Lumbard**
Client's Address: **550 Northlake Blvd. Suite 1000**
City: **Altamonte Springs**
State: **FL** Zip: **32701**

Facility ID: **NA**
Project Location: **Orange County, FL.**
Client's Phone: **407-522-7570**
Client's Project Number: **600713.x.01.09**
Lab Reporting Batch ID: **2201027**

********** Analytical Results **********

Client Sample ID: **LB-3-T=168**
Lab Sample ID: **2201027-003**
Date Collected: **01/17/22 14:10**
Collected By: **Fancesca Lawtermen**
Matrix ID : **AQUEOUS-Fresh**

Classical Chemistry Parameters

Analyte Name (Analyte ID)	Results/Qual	Units	DF	MDL	PQL	Method	Analyzed Date	By	Batch	Notes
Ammonia (N) (7664417)	***1.1***	mg/L	1	0.035	0.05	EPA 350.1	02/08/22 13:27	RRB	798409	-
Phosphorus (7723140)	***0.19***	mg/L	1	0.0028	0.004	EPA 365.3	02/04/22 11:13	CLL	796092	-

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ANALYTICAL REPORT

For Proiect:
Lake Buchanan Flux Study

NELAP Certified
FDOH # : **E83484**
Lab Received Date : **01/18/22 16:06**

Company Name: **Wood Environment & Infrastructure**
Client's Name: **Lance Lumbard**
Client's Address: **550 Northlake Blvd. Suite 1000**
City: **Altamonte Springs**
State: **FL** Zip: **32701**

Facility ID: **NA**
Project Location: **Orange County, FL.**
Client's Phone: **407-522-7570**
Client's Project Number: **600713.x.01.09**
Lab Reporting Batch ID: **2201027**

********** Analytical Results **********

Client Sample ID: **WC-1-T=168**
Lab Sample ID: **2201027-004**
Date Collected: **01/17/22 14:15**
Collected By: **Fancesca Lawtermen**
Matrix ID : **AQUEOUS-Fresh**

Classical Chemistry Parameters

Analyte Name (Analyte ID)	Results/Qual	Units	DF	MDL	PQL	Method	Analyzed Date	By	Batch	Notes
Ammonia (N) (7664417)	0.035 U	mg/L	1	0.035	0.05	EPA 350.1	02/08/22 13:28	RRB	798409	-
Phosphorus (7723140)	0.0028 U	mg/L	1	0.0028	0.004	EPA 365.3	02/04/22 11:16	CLL	796092	-

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NELAP Certified
FDOH # : **E83484**
Lab Received Date : **01/18/22 16:06**

Company Name: **Wood Environment & Infrastructure**
Client's Name: **Lance Lumbard**
Client's Address: **550 Northlake Blvd. Suite 1000**
City: **Altamonte Springs**
State: **FL** Zip: **32701**

Facility ID: **NA**
Project Location: **Orange County, FL.**
Client's Phone: **407-522-7570**
Client's Project Number: **600713.x.01.09**
Lab Reporting Batch ID: **2201027**

********** Analytical Results **********

Client Sample ID: **LB-A-T=168**
Lab Sample ID: **2201027-005**
Date Collected: **01/17/22 14:20**
Collected By: **Fancesca Lawtermen**
Matrix ID : **AQUEOUS-Fresh**

Classical Chemistry Parameters

Analyte Name (Analyte ID)	Results/Qual	Units	DF	MDL	PQL	Method	Analyzed Date	By	Batch	Notes
Ammonia (N) (7664417)	0.035 U	mg/L	1	0.035	0.05	EPA 350.1	02/08/22 13:30	RRB	798409	-
Phosphorus (7723140)	***0.063***	mg/L	1	0.0028	0.004	EPA 365.3	02/04/22 11:18	CLL	796092	-

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ANALYTICAL REPORT

For Proiect:
Lake Buchanan Flux Study

NELAP Certified
FDOH # : **E83484**
Lab Received Date : **01/18/22 16:06**

Company Name: **Wood Environment & Infrastructure**
Client's Name: **Lance Lumbard**
Client's Address: **550 Northlake Blvd. Suite 1000**
City: **Altamonte Springs**
State: **FL** Zip: **32701**

Facility ID: **NA**
Project Location: **Orange County, FL.**
Client's Phone: **407-522-7570**
Client's Project Number: **600713.x.01.09**
Lab Reporting Batch ID: **2201027**

********** Analytical Results **********

Client Sample ID: **LB-B-T=168**
Lab Sample ID: **2201027-006**
Date Collected: **01/17/22 14:25**
Collected By: **Fancesca Lawtermen**
Matrix ID : **AQUEOUS-Fresh**

Classical Chemistry Parameters

Analyte Name (Analyte ID)	Results/Qual	Units	DF	MDL	PQL	Method	Analyzed Date	By	Batch	Notes
Ammonia (N) (7664417)	0.035 U	mg/L	1	0.035	0.05	EPA 350.1	02/08/22 13:32	RRB	798409	-
Phosphorus (7723140)	***0.071***	mg/L	1	0.0028	0.004	EPA 365.3	02/04/22 11:19	CLL	796092	-

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ANALYTICAL REPORT

For Proiect:
Lake Buchanan Flux Study

NELAP Certified
FDOH # : **E83484**
Lab Received Date : **01/18/22 16:06**

Company Name: **Wood Environment & Infrastructure**
Client's Name: **Lance Lumbard**
Client's Address: **550 Northlake Blvd. Suite 1000**
City: **Altamonte Springs**
State: **FL** Zip: **32701**

Facility ID: **NA**
Project Location: **Orange County, FL.**
Client's Phone: **407-522-7570**
Client's Project Number: **600713.x.01.09**
Lab Reporting Batch ID: **2201027**

********** Analytical Results **********

Client Sample ID: **LB-C-T=168**
Lab Sample ID: **2201027-007**
Date Collected: **01/17/22 14:30**
Collected By: **Fancesca Lawtermen**
Matrix ID : **AQUEOUS-Fresh**

Classical Chemistry Parameters

Analyte Name (Analyte ID)	Results/Qual	Units	DF	MDL	PQL	Method	Analyzed Date	By	Batch	Notes
Ammonia (N) (7664417)	0.035 U	mg/L	1	0.035	0.05	EPA 350.1	02/08/22 13:33	RRB	798409	-
Phosphorus (7723140)	***0.064***	mg/L	1	0.0028	0.004	EPA 365.3	02/04/22 11:20	CLL	796092	-

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ANALYTICAL REPORT

For Proiect:
Lake Buchanan Flux Study

NELAP Certified
FDOH # : **E83484**
Lab Received Date : **01/18/22 16:06**

Company Name: **Wood Environment & Infrastructure**
Client's Name: **Lance Lumbard**
Client's Address: **550 Northlake Blvd. Suite 1000**
City: **Altamonte Springs**
State: **FL** Zip: **32701**

Facility ID: **NA**
Project Location: **Orange County, FL.**
Client's Phone: **407-522-7570**
Client's Project Number: **600713.x.01.09**
Lab Reporting Batch ID: **2201027**

********** Analytical Results **********

Client Sample ID: **WC-A-T=168**
Lab Sample ID: **2201027-008**
Date Collected: **01/17/22 14:35**
Collected By: **Fancesca Lawtermen**
Matrix ID : **AQUEOUS-Fresh**

Classical Chemistry Parameters

Analyte Name (Analyte ID)	Results/Qual	Units	DF	MDL	PQL	Method	Analyzed Date	By	Batch	Notes
Ammonia (N) (7664417)	0.035 U	mg/L	1	0.035	0.05	EPA 350.1	02/08/22 13:42	RRB	798409	-
Phosphorus (7723140)	0.0028 U	mg/L	1	0.0028	0.004	EPA 365.3	02/04/22 11:21	CLL	796092	-

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ANALYTICAL REPORT

For Proiect:
Lake Buchanan Flux Study

NELAP Certified
FDOH # : **E83484**
Lab Received Date : **01/18/22 16:06**

Company Name: **Wood Environment & Infrastructure**
Client's Name: **Lance Lumbard**
Client's Address: **550 Northlake Blvd. Suite 1000**
City: **Altamonte Springs**
State: **FL** Zip: **32701**

Facility ID: **NA**
Project Location: **Orange County, FL.**
Client's Phone: **407-522-7570**
Client's Project Number: **600713.x.01.09**
Lab Reporting Batch ID: **2201027**

********** Detection Summary : **********

Client Sample ID: **LB-1-T=168** Date Collected: **01/17/22 14:00** Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201027-001** Collected By: **Fancesca Lawtermen**

Analyte Name (Analyte ID)	Results/Qualifier	Units	DF	MDL	PQL	Date Analyzed	By	Batch ID	Method
Ammonia (N) (7664417)	**0.58**	mg/L	1	0.035	0.05	02/08/22 13:23	RRB	798409	EPA 350.1
Phosphorus (7723140)	**0.3**	mg/L	1	0.0028	0.004	02/04/22 11:10	CLL	796092	EPA 365.3

Client Sample ID: **LB-2-T=168** Date Collected: **01/17/22 14:05** Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201027-002** Collected By: **Fancesca Lawtermen**

Analyte Name (Analyte ID)	Results/Qualifier	Units	DF	MDL	PQL	Date Analyzed	By	Batch ID	Method
Ammonia (N) (7664417)	**2.2**	mg/L	1	0.035	0.05	02/08/22 13:25	RRB	798409	EPA 350.1
Phosphorus (7723140)	**0.23**	mg/L	1	0.0028	0.004	02/04/22 11:11	CLL	796092	EPA 365.3

Client Sample ID: **LB-3-T=168** Date Collected: **01/17/22 14:10** Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201027-003** Collected By: **Fancesca Lawtermen**

Analyte Name (Analyte ID)	Results/Qualifier	Units	DF	MDL	PQL	Date Analyzed	By	Batch ID	Method
Ammonia (N) (7664417)	**1.1**	mg/L	1	0.035	0.05	02/08/22 13:27	RRB	798409	EPA 350.1
Phosphorus (7723140)	**0.19**	mg/L	1	0.0028	0.004	02/04/22 11:13	CLL	796092	EPA 365.3

Client Sample ID: **LB-A-T=168** Date Collected: **01/17/22 14:20** Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201027-005** Collected By: **Fancesca Lawtermen**

Analyte Name (Analyte ID)	Results/Qualifier	Units	DF	MDL	PQL	Date Analyzed	By	Batch ID	Method
Phosphorus (7723140)	**0.063**	mg/L	1	0.0028	0.004	02/04/22 11:18	CLL	796092	EPA 365.3

Client Sample ID: **LB-B-T=168** Date Collected: **01/17/22 14:25** Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201027-006** Collected By: **Fancesca Lawtermen**

Analyte Name (Analyte ID)	Results/Qualifier	Units	DF	MDL	PQL	Date Analyzed	By	Batch ID	Method
Phosphorus (7723140)	**0.071**	mg/L	1	0.0028	0.004	02/04/22 11:19	CLL	796092	EPA 365.3

Client Sample ID: **LB-C-T=168** Date Collected: **01/17/22 14:30** Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201027-007** Collected By: **Fancesca Lawtermen**

Analyte Name (Analyte ID)	Results/Qualifier	Units	DF	MDL	PQL	Date Analyzed	By	Batch ID	Method
Phosphorus (7723140)	**0.064**	mg/L	1	0.0028	0.004	02/04/22 11:20	CLL	796092	EPA 365.3

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ANALYTICAL REPORT

For Proiect:
Lake Buchanan Flux Study

NELAP Certified
FDOH # : **E83484**
Lab Received Date : **01/18/22 16:06**

Company Name: **Wood Environment & Infrastructure**
Client's Name: **Lance Lumbard**
Client's Address: **550 Northlake Blvd. Suite 1000**
City: **Altamonte Springs**
State: **FL** Zip: **32701**

Facility ID: **NA**
Project Location: **Orange County, FL.**
Client's Phone: **407-522-7570**
Client's Project Number: **600713.x.01.09**
Lab Reporting Batch ID: **2201027**

********** Quality Control : **********

Method Blank(MB) — Classical Chemistry Parameters

Client Sample ID: **Method Blank-1** Sampled: 02/01/22 11:15 Analyzed: 02/04/22 10:51 Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201027-009** Prep: 02/01/22 11:15

EPA 365.3

Analyte Name (Analyte ID)	Results/Qual	Units	DF	MDL	PQL	By	Batch	Notes
Phosphorus (7723140)	0.0028 U	mg/L	1	0.0028	0.004	CLL	796092	-

Laboratory Control Standard(LCS) — Classical Chemistry Parameters

Client Sample ID: **LCS-1** Sampled: 02/01/22 11:15 Analyzed: 02/04/22 10:52 Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201027-010** Prep: 02/01/22 11:15

EPA 365.3

Analyte Name (Analyte ID)	Result	SPK	Units	DF	MDL	PQL	%Rec	By	Batch	%Limits	Notes
Phosphorus (7723140)	0.1	0.1	mg/L	1	0.0028	0.004	100	CLL	796092	90-110	

Matrix Spike(MS) — Classical Chemistry Parameters

Client Sample ID: **WC-1-T=168 MS** Sampled: 01/17/22 14:15 Analyzed: 02/04/22 10:56 Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201027-011** Prep: 02/01/22 11:15

EPA 365.3

Analyte Name (Analyte ID)	Result	SPK	Units	DF	MDL	PQL	%Rec	Source	By	Batch	%Limits	Notes
Phosphorus (7723140)	0.11	0.1	mg/L	1	0.0028	0.004	105	0.0028 U	CLL	796092	80-120	

Matrix Spike Dup(MSD) — Classical Chemistry Parameters

Client Sample ID: **WC-1-T=168 MSD** Sampled: 01/17/22 14:15 Analyzed: 02/04/22 10:55 Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201027-012** Prep: 02/01/22 11:15

EPA 365.3

Analyte Name (Analyte ID)	Result	SPK	Units	DF	MDL	PQL	%RPD	%Rec	Source	By	Batch	%Limits	Notes
Phosphorus (7723140)	0.11	0.1	mg/L	1	0.0028	0.004	1	106	0.0028 U	CLL	796092	80-120	

Method Blank(MB) — Classical Chemistry Parameters

Client Sample ID: **Method Blank-1** Sampled: 02/08/22 13:33 Analyzed: 02/08/22 13:06 Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201027-013** Prep: 02/08/22 13:06

EPA 350.1

Analyte Name (Analyte ID)	Results/Qual	Units	DF	MDL	PQL	By	Batch	Notes
Ammonia (N) (7664417)	0.035 U	mg/L	1	0.035	0.05	RRB	798409	-

Laboratory Control Standard(LCS) — Classical Chemistry Parameters

Client Sample ID: **LCS-1** Sampled: 02/08/22 13:33 Analyzed: 02/08/22 13:08 Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201027-014** Prep: 02/08/22 13:08

EPA 350.1

Analyte Name (Analyte ID)	Result	SPK	Units	DF	MDL	PQL	%Rec	By	Batch	%Limits	Notes
Ammonia (N) (7664417)	1.1	1	mg/L	1	0.035	0.05	109	RRB	798409	90-110	

Matrix Spike(MS) — Classical Chemistry Parameters

Client Sample ID: **LB-C-T=168 MS** Sampled: 01/17/22 14:30 Analyzed: 02/08/22 13:38 Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201027-015** Prep: 02/08/22 13:38

EPA 350.1

Analyte Name (Analyte ID)	Result	SPK	Units	DF	MDL	PQL	%Rec	Source	By	Batch	%Limits	Notes
Ammonia (N) (7664417)	1.1	1	mg/L	1	0.035	0.05	112	0.035 U	RRB	798409	90-110	QM-07

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ANALYTICAL REPORT

For Proiect:
Lake Buchanan Flux Study

NELAP Certified
FDOH # : **E83484**
Lab Received Date : **01/18/22 16:06**

Company Name: **Wood Environment & Infrastructure**
Client's Name: **Lance Lumbard**
Client's Address: **550 Northlake Blvd. Suite 1000**
City: **Altamonte Springs**
State: **FL** Zip: **32701**

Facility ID: **NA**
Project Location: **Orange County, FL.**
Client's Phone: **407-522-7570**
Client's Project Number: **600713.x.01.09**
Lab Reporting Batch ID: **2201027**

********** Quality Control : **********

Matrix Spike Dup(MSD) Classical Chemistry Parameters

Client Sample ID: **LB-C-T=168 MSD** Sampled: 01/17/22 14:30 Analyzed: 02/08/22 13:40 Matrix ID : **AQUEOUS-Fresh**

Lab Sample ID: **2201027-016** Prep: 02/08/22 13:40

EPA 350.1

Analyte Name (Analyte ID)	Result	SPK	Units	DF	MDL	PQL	%RPD	%Rec	Source	By	Batch	%Limits	Notes
Ammonia (N) (7664417)	1.1	1	mg/L	1	0.035	0.05	0	112	0.035 U	RRB	798409	90-110	QM-07

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ANALYTICAL REPORT

For Proiect:
Lake Buchanan Flux Study

NELAP Certified
FDOH # : **E83484**
Lab Received Date : **01/18/22 16:06**

Company Name: **Wood Environment & Infrastructure**
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Facility ID: **NA**
Project Location: **Orange County, FL.**
Client's Phone: **407-522-7570**
Client's Project Number: **600713.x.01.09**
Lab Reporting Batch ID: **2201027**

**********Data Qualifiers Codes**********

Reporting Exceptions and Qualified Data

When quality control results are outside established control limits reanalysis, including re-extraction (if applicable), is preferred. If re-analysis is not viable or desirable, then results may be qualified. Sample results associated with quality control data that exceed acceptance criteria will be qualified with an appropriate comment. Any parameter for which the laboratory is not officially NELAP accredited is indicated by a '~' symbol. These are not included in the scope because NELAP accreditation is either not available or has not been applied for.

Lab Qualifier	Description
B-01	The sample dilutions set-up for the analysis did not meet the oxygen depletion criteria of at least 2 mg/l dissolved oxygen depletion. Therefore the reported result is an estimated value only.
B-04	The average DO uptake of the seeded controls does not meet the method required 0.6 - 1.0 mg/L.
B-06	Sample is supersaturated with DO. Initial DO exceeds the method required maximum initial DO of 9 mg/L.
B-07	LCS exceeded control limits. The test can not be repeated due to method constraints. Considered to be an estimated value.
D	Data reported from a dilution and or multiple dilutions. D2= 1/2, D5= 1/5, D10= 1/10, D20= 1/20, D50= 1/50, D100= 1/100
I, J	The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit.
J-01	Result may be biased high due to positive results in the associated method blank at a concentration above
L	Off-scale high. Actual value is known to be greater than value given.
LP-02	Less than 1000 ml of sample filtered and residue range of 2.5 insufficient sample, analysis cannot be repeated.
M	Presence of material is verified but not quantified; the actual value is less than the value given. The estimated concentration is greater than the MDL.
N	Presumptive evidence of presence of material.
O	Sampled, but analysis lost or not performed.
PS	PS = Parent Sample. The PS sample was used as the parent sample for the analysis batch to make a Matrix Spike (MS), Matrix Spike Duplicated (MSD) and / or Laboratory Duplicate (DUP).
Q	Sample held beyond the accepted holding time. Use this code if result derived from a sample prepared or analyzed after the approved holding time.
QB-01	The method blank had a positive result for the analyte; however, the concentration in the method blank is less than 10% of the sample result. There is minimal impact to the data.
QB-02	The method blank contains analyte at a concentration above the MDL and/or greater than one-half the MRL. The analyte was not detected in the sample.
QL-02	The associated laboratory control sample exhibited high bias; since the result is ND, there is no impact.
QM-02	The RPD and/or percent recovery for this QC spike sample cannot be accurately calculated due to the high concentration of analyte present in the sample.
QM-07	Spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on acceptable LCS recovery.
QM-11	Precision between duplicate matrix spikes of the same sample was outside acceptance limits.
QM-12	Precision between duplicate samples was outside acceptance limits.
QM-S	Surrogate recovery exceeded acceptance criteria due to the presence of a coeluting compound.
QR-04	Duplicate precision outside acceptance limits due to low analyte concentration.
QS-03	Surrogate recovery outside acceptance limits
QS-4	Surrogate recovery not calculated. Surrogate diluted out of the calibrtion range.
QS-6	Surrogate recovery exceeded accepance criteria due to coelution. Matrix effect confirmed.
QV-01	The associated continuing calibration verification standard exhibited high bias; since the result is ND, there is no impact.
R-01	The Reporting Limit for this analyte has been raised to account for matrix interference.
T	Value reported is less than the laboratory method detection limit. The value is reported for informational purposes only and shall not be used in statistical analysis.
U	Indicates the compound was analyzed for but not detected above the method detection limt.
V	Indicates the analyte was detected in both the sample and method blank.
V1	Common Laboratory Contaminant
Y	The laboratory analysis was performed on an improperly preserved sample. The result may not be accurate.

This report, which includes the attached Chain-Of-Custody, shall not be reported except in full, without written approval of the laboratory.

Chain of Custody

2201027
8

Page 1 of 1

Project Manager: Lance Lambard	Southern Research Laboratories, Inc. 2251 Lynx Lane, Suite #1 Orlando, Florida 32804
Company: Wood E&S inc	(407) 522-7100
Address: 550 Northlake Blvd Suite 1000	Toll Free 1 (888) 420-TEST Fax: (407) 522-7043
City, State, Zip: Altamonte Springs, FL 32701	Project Name: Lake Buchanan Flux
Phone: 407 552-7576 Fax:	Project Location: Lake Buchanan PO# C012610100

Sampled by [Print Name(s)] / Affiliation: Francesca Lautermen

Sampler(s) Signature(s):

Project Number: 60071322.01.09

REQUESTED DUE DATE:

Sampling QAP No.:

Approval Date:

Comments:

	Sample Identification	Sampled Date:	Sampled Time:	Grab or Composite	Matrix: (see codes)	Total Number of Containers	Preservatives (see codes): S	Analyses Requested: T&I Ammonia	Comments:
1	LB-1-T=168	1/17/22	1400	Grab	SW	1		(1)	2201027-001
2	LB-2-T=168	1/17/22	1405	Grab	SW	1		(1)	-002
3	LB-3-T=168	1/17/22	1410	Grab	SW	1		(1)	-003
4	~~EB~~WC-1-T=168	1/17/22	1415	Grab	SW	1		(1)	-004
5	LBA-T=168	1/17/22	1420	Grab	SW	1		(1)	-005
6	LB-B-T=168	1/17/22	1425	Grab	SW	1		(1)	-006
7	LB-C-T=168	1/17/22	1430	Grab	SW	1		(1)	-007
8	WC-A-T=168	1/17/22	1435	Grab	SW	1		(1)	-008
9									
10									

Shipment Method:		Relinquished by:	Date:	Time:	Accepted by:	Date:	Time:
Out: / /	Via:		1/17/22	1500	James S. Preston	1/18/22	1345
Returned: / /	Via:	James S. Preston	1/18/22	1606		1-18-22	16:06

Additional Comments:

Cooler No.(s) / Temperature(s) (°C): client cooler 1.7 °C

Sampling Kit No.: 8911

Equipment ID No.:

Matrix Codes: A = Air GW = Groundwater SE = Sediment SO = Soil SW = Surface Water W = Water(Blanks) HW = Potential Haz Waste O = Other(Specify:_____)

Preservative Codes: H = Hydrochloric Acid & Ice I = Ice Only N = Nitric Acid & Ice S = Sulfuric Acid & Ice X = Sodium Hydroxide & Ice O = Other(Specify)

Southern Research Laboratories, Inc.
WWW.SRLAB.COM

Thank you Lance Lumbard for the opportunity to be of service to you and your company, We Sincerely Appreciate Your Business.

SRL certifies these Laboratory Results were produced in accordance with NELAC Standards. Hold times and preservation requirements were met for all analytes unless specifically call noted in the report. Results relate only to the samples as received.

Southern Research Laboratories, Inc
2251 Lynx Lane, Suite 1
Orlando, Florida 32804
(407) 522-7100 / Fax (407) 522-7043

ANALYTICAL REPORT

For Project:
Lake Buchanan Flux

NELAP Certified
FDOH # : **E83484**
Lab Received Date : **01/20/22 16:30**

Company Name: **Wood Environment & Infrastructure**
Client's Name: **Lance Lumbard**
Client's Address: **550 Northlake Blvd. Suite 1000**
City: **Altamonte Springs**
State: **FL** Zip:**32701**

Facility ID: **NA**
Project Location: **Orange County, FL.**
Client's Phone: **407-522-7570**
Client's Project Number: **600713x2.01.09**
Lab Reporting Batch ID: **2201034**

Item#	Lab Sample ID	Client Sample ID	Collected Date	Collected Time	Sample Matrix	Analysis Requested
1	2201034-001	LB-A-T=216	01/19/22	14:00	AQUEOUS-Fresh	EPA 350.1,EPA 365.3
2	2201034-002	LB-B-T=216	01/19/22	14:05	AQUEOUS-Fresh	EPA 350.1,EPA 365.3
3	2201034-003	LB-C-T=216	01/19/22	14:10	AQUEOUS-Fresh	EPA 350.1,EPA 365.3
4	2201034-004	WQ-A-T=216	01/19/22	14:15	AQUEOUS-Fresh	EPA 350.1,EPA 365.3
5	2201034-005	LB-1-T=216	01/19/22	14:20	AQUEOUS-Fresh	EPA 350.1,EPA 365.3
6	2201034-006	LB-2-T=216	01/19/22	14:25	AQUEOUS-Fresh	EPA 350.1,EPA 365.3
7	2201034-007	LB-3-T=216	01/19/22	14:30	AQUEOUS-Fresh	EPA 350.1,EPA 365.3
8	2201034-008	WC-1-T=216	01/19/22	14:35	AQUEOUS-Fresh	EPA 350.1,EPA 365.3

Sherri Payne
Vice President / Quality Assurance Officer - SRL

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Orlando, Florida 32804
(407) 522-7100 / Fax (407) 522-7043

ANALYTICAL REPORT

For Project:
Lake Buchanan Flux

NELAP Certified
FDOH # : **E83484**
Lab Received Date : **01/20/22 16:30**

Company Name: **Wood Environment & Infrastructure**
Client's Name: **Lance Lumbard**
Client's Address: **550 Northlake Blvd. Suite 1000**
City: **Altamonte Springs**
State: **FL** Zip:**32701**

Facility ID: **NA**
Project Location: **Orange County, FL.**
Client's Phone: **407-522-7570**
Client's Project Number: **600713x2.01.09**
Lab Reporting Batch ID: **2201034**

********** Analytical Results **********

Client Sample ID: **LB-A-T=216**
Lab Sample ID: **2201034-001**
Date Collected: **01/19/22 14:00**
Collected By: **Francesca Lawtermen**
Matrix ID : **AQUEOUS-Fresh**

Classical Chemistry Parameters

Analyte Name (Analyte ID)	Results/Qual	Units	DF	MDL	PQL	Method	Analyzed Date	By	Batch	Notes
Ammonia (N) (7664417)	***0.54***	mg/L	1	0.035	0.05	EPA 350.1	02/08/22 13:43	RRB	798409	-
Phosphorus (7723140)	***0.31***	mg/L	1	0.0028	0.004	EPA 365.3	02/04/22 11:41	CLL	796093	-

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(407) 522-7100 / Fax (407) 522-7043

ANALYTICAL REPORT

For Project:
Lake Buchanan Flux

NELAP Certified
FDOH # : **E83484**
Lab Received Date : **01/20/22 16:30**

Company Name: **Wood Environment & Infrastructure**
Client's Name: **Lance Lumbard**
Client's Address: **550 Northlake Blvd. Suite 1000**
City: **Altamonte Springs**
State: **FL** Zip:**32701**

Facility ID: **NA**
Project Location: **Orange County, FL.**
Client's Phone: **407-522-7570**
Client's Project Number: **600713x2.01.09**
Lab Reporting Batch ID: **2201034**

********** Analytical Results **********

Client Sample ID: **LB-B-T=216**
Lab Sample ID: **2201034-002**
Date Collected: **01/19/22 14:05**
Collected By: **Francesca Lawtermen**
Matrix ID : **AQUEOUS-Fresh**

Classical Chemistry Parameters

Analyte Name (Analyte ID)	Results/Qual	Units	DF	MDL	PQL	Method	Analyzed Date	By	Batch	Notes
Ammonia (N) (7664417)	***2.5***	mg/L	1	0.035	0.05	EPA 350.1	02/08/22 13:45	RRB	798409	-
Phosphorus (7723140)	***0.24***	mg/L	1	0.0028	0.004	EPA 365.3	02/04/22 11:42	CLL	796093	-

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Orlando, Florida 32804
(407) 522-7100 / Fax (407) 522-7043

ANALYTICAL REPORT

For Project:
Lake Buchanan Flux

NELAP Certified
FDOH # : **E83484**
Lab Received Date : **01/20/22 16:30**

Company Name: **Wood Environment & Infrastructure**
Client's Name: **Lance Lumbard**
Client's Address: **550 Northlake Blvd. Suite 1000**
City: **Altamonte Springs**
State: **FL** Zip:**32701**

Facility ID: **NA**
Project Location: **Orange County, FL.**
Client's Phone: **407-522-7570**
Client's Project Number: **600713x2.01.09**
Lab Reporting Batch ID: **2201034**

********** Analytical Results **********

Client Sample ID: **LB-C-T=216**
Lab Sample ID: **2201034-003**
Date Collected: **01/19/22 14:10**
Collected By: **Francesca Lawtermen**
Matrix ID : **AQUEOUS-Fresh**

Classical Chemistry Parameters

Analyte Name (Analyte ID)	Results/Qual	Units	DF	MDL	PQL	Method	Analyzed Date	By	Batch	Notes
Ammonia (N) (7664417)	***1.2***	mg/L	1	0.035	0.05	EPA 350.1	02/08/22 13:47	RRB	798409	-
Phosphorus (7723140)	***0.21***	mg/L	1	0.0028	0.004	EPA 365.3	02/04/22 11:43	CLL	796093	-

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Orlando, Florida 32804
(407) 522-7100 / Fax (407) 522-7043

ANALYTICAL REPORT

For Project:
Lake Buchanan Flux

NELAP Certified
FDOH # : **E83484**
Lab Received Date : **01/20/22 16:30**

Company Name: **Wood Environment & Infrastructure**
Client's Name: **Lance Lumbard**
Client's Address: **550 Northlake Blvd. Suite 1000**
City: **Altamonte Springs**
State: **FL** Zip:**32701**

Facility ID: **NA**
Project Location: **Orange County, FL.**
Client's Phone: **407-522-7570**
Client's Project Number: **600713x2.01.09**
Lab Reporting Batch ID: **2201034**

********** Analytical Results **********

Client Sample ID: **WQ-A-T=216**
Lab Sample ID: **2201034-004**

Date Collected: **01/19/22 14:15**
Collected By: **Francesca Lawtermen**

Matrix ID : **AQUEOUS-Fresh**

Classical Chemistry Parameters

Analyte Name (Analyte ID)	Results/Qual	Units	DF	MDL	PQL	Method	Analyzed Date	By	Batch	Notes
Ammonia (N) (7664417)	0.035 U	mg/L	1	0.035	0.05	EPA 350.1	02/08/22 13:49	RRB	798409	-
Phosphorus (7723140)	***0.0069***	mg/L	1	0.0028	0.004	EPA 365.3	02/04/22 11:47	CLL	796093	-

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Orlando, Florida 32804
(407) 522-7100 / Fax (407) 522-7043

ANALYTICAL REPORT

For Project:
Lake Buchanan Flux

NELAP Certified
FDOH # : **E83484**
Lab Received Date : **01/20/22 16:30**

Company Name: **Wood Environment & Infrastructure**
Client's Name: **Lance Lumbard**
Client's Address: **550 Northlake Blvd. Suite 1000**
City: **Altamonte Springs**
State: **FL** Zip: **32701**

Facility ID: **NA**
Project Location: **Orange County, FL.**
Client's Phone: **407-522-7570**
Client's Project Number: **600713x2.01.09**
Lab Reporting Batch ID: **2201034**

********** Analytical Results **********

Client Sample ID: **LB-1-T=216**
Lab Sample ID: **2201034-005**
Date Collected: **01/19/22 14:20**
Collected By: **Francesca Lawtermen**
Matrix ID : **AQUEOUS-Fresh**

Classical Chemistry Parameters

Analyte Name (Analyte ID)	Results/Qual	Units	DF	MDL	PQL	Method	Analyzed Date	By	Batch	Notes
Ammonia (N) (7664417)	0.035 U	mg/L	1	0.035	0.05	EPA 350.1	02/08/22 13:50	RRB	798409	-
Phosphorus (7723140)	***0.051***	mg/L	1	0.0028	0.004	EPA 365.3	02/04/22 11:48	CLL	796093	-

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Southern Research Laboratories, Inc
2251 Lynx Lane, Suite 1
Orlando, Florida 32804
(407) 522-7100 / Fax (407) 522-7043

ANALYTICAL REPORT

For Project:
Lake Buchanan Flux

NELAP Certified
FDOH # : **E83484**
Lab Received Date : **01/20/22 16:30**

Company Name: **Wood Environment & Infrastructure**
Client's Name: **Lance Lumbard**
Client's Address: **550 Northlake Blvd. Suite 1000**
City: **Altamonte Springs**
State: **FL** Zip:**32701**

Facility ID: **NA**
Project Location: **Orange County, FL.**
Client's Phone: **407-522-7570**
Client's Project Number: **600713x2.01.09**
Lab Reporting Batch ID: **2201034**

********** Analytical Results **********

Client Sample ID: **LB-2-T=216**
Lab Sample ID: **2201034-006**

Date Collected: **01/19/22 14:25**
Collected By: **Francesca Lawtermen**

Matrix ID : **AQUEOUS-Fresh**

Classical Chemistry Parameters

Analyte Name (Analyte ID)	Results/Qual	Units	DF	MDL	PQL	Method	Analyzed Date	By	Batch	Notes
Ammonia (N) (7664417)	0.035 U	mg/L	1	0.035	0.05	EPA 350.1	02/08/22 13:52	RRB	798409	-
Phosphorus (7723140)	***0.056***	mg/L	1	0.0028	0.004	EPA 365.3	02/04/22 11:49	CLL	796093	-

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Orlando, Florida 32804
(407) 522-7100 / Fax (407) 522-7043

ANALYTICAL REPORT

For Project:
Lake Buchanan Flux

NELAP Certified
FDOH # : **E83484**
Lab Received Date : **01/20/22 16:30**

Company Name: **Wood Environment & Infrastructure**
Client's Name: **Lance Lumbard**
Client's Address: **550 Northlake Blvd. Suite 1000**
City: **Altamonte Springs**
State: **FL** Zip: **32701**

Facility ID: **NA**
Project Location: **Orange County, FL.**
Client's Phone: **407-522-7570**
Client's Project Number: **600713x2.01.09**
Lab Reporting Batch ID: **2201034**

********** Analytical Results **********

Client Sample ID: **LB-3-T=216**
Lab Sample ID: **2201034-007**
Date Collected: **01/19/22 14:30**
Collected By: **Francesca Lawtermen**
Matrix ID : **AQUEOUS-Fresh**

Classical Chemistry Parameters

Analyte Name (Analyte ID)	Results/Qual	Units	DF	MDL	PQL	Method	Analyzed Date	By	Batch	Notes
Ammonia (N) (7664417)	0.035 U	mg/L	1	0.035	0.05	EPA 350.1	02/08/22 13:54	RRB	798409	-
Phosphorus (7723140)	***0.042***	mg/L	1	0.0028	0.004	EPA 365.3	02/04/22 11:51	CLL	796093	-

This report, which includes the attached Chain-Of-Custody, shall not be reported except in full, without written approval of the laboratory.

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2251 Lynx Lane, Suite 1
Orlando, Florida 32804
(407) 522-7100 / Fax (407) 522-7043

ANALYTICAL REPORT

For Project:
Lake Buchanan Flux

NELAP Certified
FDOH # : **E83484**
Lab Received Date : **01/20/22 16:30**

Company Name: **Wood Environment & Infrastructure**
Client's Name: **Lance Lumbard**
Client's Address: **550 Northlake Blvd. Suite 1000**
City: **Altamonte Springs**
State: **FL** Zip:**32701**

Facility ID: **NA**
Project Location: **Orange County, FL.**
Client's Phone: **407-522-7570**
Client's Project Number: **600713x2.01.09**
Lab Reporting Batch ID: **2201034**

********** Analytical Results **********

Client Sample ID: **WC-1-T=216**
Lab Sample ID: **2201034-008**

Date Collected: **01/19/22 14:35**
Collected By: **Francesca Lawtermen**

Matrix ID : **AQUEOUS-Fresh**

Classical Chemistry Parameters

Analyte Name (Analyte ID)	Results/Qual	Units	DF	MDL	PQL	Method	Analyzed Date	By	Batch	Notes
Ammonia (N) (7664417)	0.035 U	mg/L	1	0.035	0.05	EPA 350.1	02/08/22 13:59	RRB	798409	-
Phosphorus (7723140)	***0.0087***	mg/L	1	0.0028	0.004	EPA 365.3	02/04/22 11:52	CLL	796093	-

This report, which includes the attached Chain-Of-Custody, shall not be reported except in full, without written approval of the laboratory.

Southern Research Laboratories, Inc
2251 Lynx Lane, Suite 1
Orlando, Florida 32804
(407) 522-7100 / Fax (407) 522-7043

ANALYTICAL REPORT

For Project:
Lake Buchanan Flux

NELAP Certified
FDOH # : **E83484**
Lab Received Date : **01/20/22 16:30**

Company Name: **Wood Environment & Infrastructure**
Client's Name: **Lance Lumbard**
Client's Address: **550 Northlake Blvd. Suite 1000**
City: **Altamonte Springs**
State: **FL** Zip: **32701**

Facility ID: **NA**
Project Location: **Orange County, FL.**
Client's Phone: **407-522-7570**
Client's Project Number: **600713x2.01.09**
Lab Reporting Batch ID: **2201034**

********** Detection Summary : **********

Client Sample ID: **LB-A-T=216** Date Collected: **01/19/22 14:00** Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201034-001** Collected By: **Francesca Lawtermen**

Analyte Name (Analyte ID)	Results/Qualifier	Units	DF	MDL	PQL	Date Analyzed	By	Batch ID	Method
Ammonia (N) (7664417)	**0.54**	mg/L	1	0.035	0.05	02/08/22 13:43	RRB	798409	EPA 350.1
Phosphorus (7723140)	**0.31**	mg/L	1	0.0028	0.004	02/04/22 11:41	CLL	796093	EPA 365.3

Client Sample ID: **LB-B-T=216** Date Collected: **01/19/22 14:05** Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201034-002** Collected By: **Francesca Lawtermen**

Analyte Name (Analyte ID)	Results/Qualifier	Units	DF	MDL	PQL	Date Analyzed	By	Batch ID	Method
Ammonia (N) (7664417)	**2.5**	mg/L	1	0.035	0.05	02/08/22 13:45	RRB	798409	EPA 350.1
Phosphorus (7723140)	**0.24**	mg/L	1	0.0028	0.004	02/04/22 11:42	CLL	796093	EPA 365.3

Client Sample ID: **LB-C-T=216** Date Collected: **01/19/22 14:10** Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201034-003** Collected By: **Francesca Lawtermen**

Analyte Name (Analyte ID)	Results/Qualifier	Units	DF	MDL	PQL	Date Analyzed	By	Batch ID	Method
Ammonia (N) (7664417)	**1.2**	mg/L	1	0.035	0.05	02/08/22 13:47	RRB	798409	EPA 350.1
Phosphorus (7723140)	**0.21**	mg/L	1	0.0028	0.004	02/04/22 11:43	CLL	796093	EPA 365.3

Client Sample ID: **WQ-A-T=216** Date Collected: **01/19/22 14:15** Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201034-004** Collected By: **Francesca Lawtermen**

Analyte Name (Analyte ID)	Results/Qualifier	Units	DF	MDL	PQL	Date Analyzed	By	Batch ID	Method
Phosphorus (7723140)	**0.0069**	mg/L	1	0.0028	0.004	02/04/22 11:47	CLL	796093	EPA 365.3

Client Sample ID: **LB-1-T=216** Date Collected: **01/19/22 14:20** Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201034-005** Collected By: **Francesca Lawtermen**

Analyte Name (Analyte ID)	Results/Qualifier	Units	DF	MDL	PQL	Date Analyzed	By	Batch ID	Method
Phosphorus (7723140)	**0.051**	mg/L	1	0.0028	0.004	02/04/22 11:48	CLL	796093	EPA 365.3

Client Sample ID: **LB-2-T=216** Date Collected: **01/19/22 14:25** Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201034-006** Collected By: **Francesca Lawtermen**

Analyte Name (Analyte ID)	Results/Qualifier	Units	DF	MDL	PQL	Date Analyzed	By	Batch ID	Method
Phosphorus (7723140)	**0.056**	mg/L	1	0.0028	0.004	02/04/22 11:49	CLL	796093	EPA 365.3

Client Sample ID: **LB-3-T=216** Date Collected: **01/19/22 14:30** Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201034-007** Collected By: **Francesca Lawtermen**

Analyte Name (Analyte ID)	Results/Qualifier	Units	DF	MDL	PQL	Date Analyzed	By	Batch ID	Method
Phosphorus (7723140)	**0.042**	mg/L	1	0.0028	0.004	02/04/22 11:51	CLL	796093	EPA 365.3

Client Sample ID: **WC-1-T=216** Date Collected: **01/19/22 14:35** Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201034-008** Collected By: **Francesca Lawtermen**

Analyte Name (Analyte ID)	Results/Qualifier	Units	DF	MDL	PQL	Date Analyzed	By	Batch ID	Method
Phosphorus (7723140)	**0.0087**	mg/L	1	0.0028	0.004	02/04/22 11:52	CLL	796093	EPA 365.3

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Southern Research Laboratories, Inc
2251 Lynx Lane, Suite 1
Orlando, Florida 32804
(407) 522-7100 / Fax (407) 522-7043

ANALYTICAL REPORT

For Project:
Lake Buchanan Flux

NELAP Certified
FDOH # : **E83484**
Lab Received Date : **01/20/22 16:30**

Company Name: **Wood Environment & Infrastructure**
Client's Name: **Lance Lumbard**
Client's Address: **550 Northlake Blvd. Suite 1000**
City: **Altamonte Springs**
State: **FL** Zip:**32701**

Facility ID: **NA**
Project Location: **Orange County, FL.**
Client's Phone: **407-522-7570**
Client's Project Number: **600713x2.01.09**
Lab Reporting Batch ID: **2201034**

********** Quality Control : **********

QC Batch Parent Sample(PS) — Classical Chemistry Parameters

Client Sample ID: **35691227003** Sampled: 01/18/22 10:50 Analyzed: 02/04/22 11:32 Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201034-009** Prep: 02/01/22 11:15

EPA 365.3

Analyte Name (Analyte ID)	Results/Qual	Units	DF	MDL	PQL		By	Batch	Notes
Phosphorus (7723140)	**0.12**	mg/L	1	0.0028	0.004	0.042	CLL	796093	-

Method Blank(MB) — Classical Chemistry Parameters

Client Sample ID: **Method Blank-1** Sampled: 02/01/22 11:15 Analyzed: 02/04/22 13:26 Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201034-010** Prep: 02/01/22 11:15

EPA 365.3

Analyte Name (Analyte ID)	Results/Qual	Units	DF	MDL	PQL	By	Batch	Notes
Phosphorus (7723140)	0.0028 U	mg/L	1	0.0028	0.004	CLL	796093	-

Laboratory Control Standard(LCS) — Classical Chemistry Parameters

Client Sample ID: **LCS-1** Sampled: 02/01/22 11:15 Analyzed: 02/04/22 11:28 Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201034-011** Prep: 02/01/22 11:15

EPA 365.3

Analyte Name (Analyte ID)	Result	SPK	Units	DF	MDL	PQL	%Rec	By	Batch	%Limits	Notes
Phosphorus (7723140)	0.1	0.1	mg/L	1	0.0028	0.004	101	CLL	796093	90-110	

Matrix Spike(MS) — Classical Chemistry Parameters

Client Sample ID: **35691227003MS** Sampled: 01/18/22 10:50 Analyzed: 02/04/22 11:34 Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201034-012** Prep: 02/01/22 11:15

EPA 365.3

Analyte Name (Analyte ID)	Result	SPK	Units	DF	MDL	PQL	%Rec	Source	By	Batch	%Limits	Notes
Phosphorus (7723140)	0.24	0.1	mg/L	1	0.0028	0.004	125	0.12	CLL	796093	80-120	QM-07

Matrix Spike Dup(MSD) — Classical Chemistry Parameters

Client Sample ID: **35691227003MSD** Sampled: 01/18/22 10:50 Analyzed: 02/04/22 11:33 Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201034-013** Prep: 02/01/22 11:15

EPA 365.3

Analyte Name (Analyte ID)	Result	SPK	Units	DF	MDL	PQL	%RPD	%Rec	Source	By	Batch	%Limits	Notes
Phosphorus (7723140)	0.23	0.1	mg/L	1	0.0028	0.004	3	118	0.12	CLL	796093	80-120	

Method Blank(MB) — Classical Chemistry Parameters

Client Sample ID: **Method Blank-1** Sampled: 02/08/22 13:06 Analyzed: 02/08/22 13:06 Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201034-014** Prep: 02/08/22 13:06

EPA 350.1

Analyte Name (Analyte ID)	Results/Qual	Units	DF	MDL	PQL		By	Batch	Notes
Ammonia (N) (7664417)	0.035 U	mg/L	1	0.035	0.05		RRB	798409	-

Laboratory Control Standard(LCS) — Classical Chemistry Parameters

Client Sample ID: **LCS-1** Sampled: 02/08/22 13:08 Analyzed: 02/08/22 13:08 Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201034-015** Prep: 02/08/22 13:08

EPA 350.1

Analyte Name (Analyte ID)	Result	SPK	Units	DF	MDL	PQL	%Rec	By	Batch	%Limits	Notes
Ammonia (N) (7664417)	1.1	1	mg/L	1	0.035	0.05	109	RRB	798409	80-120	

This report, which includes the attached Chain-Of-Custody, shall not be reported except in full, without written approval of the laboratory.

Southern Research Laboratories, Inc
2251 Lynx Lane, Suite 1
Orlando, Florida 32804
(407) 522-7100 / Fax (407) 522-7043

ANALYTICAL REPORT

For Project:
Lake Buchanan Flux

NELAP Certified
FDOH # : **E83484**
Lab Received Date : **01/20/22 16:30**

Company Name: **Wood Environment & Infrastructure**
Client's Name: **Lance Lumbard**
Client's Address: **550 Northlake Blvd. Suite 1000**
City: **Altamonte Springs**
State: **FL** Zip:**32701**

Facility ID: **NA**
Project Location: **Orange County, FL.**
Client's Phone: **407-522-7570**
Client's Project Number: **600713x2.01.09**
Lab Reporting Batch ID: **2201034**

********** Quality Control : **********

Matrix Spike(MS) — Classical Chemistry Parameters

Client Sample ID: **LB-C-T-168MS** Sampled: 01/17/22 14:30 Analyzed: 02/08/22 13:38 Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201034-016** Prep: 02/08/22 13:38

EPA 350.1

Analyte Name (Analyte ID)	Result	SPK	Units	DF	MDL	PQL	%Rec	Source	By	Batch	%Limits	Notes
Ammonia (N) (7664417)	1.1	1	mg/L	1	0.035	0.05	112	0.035 U	RRB	798409	90-110	

Matrix Spike Dup(MSD) — Classical Chemistry Parameters

Client Sample ID: **LB-C-T-168MSD** Sampled: 01/17/22 14:30 Analyzed: 02/08/22 13:40 Matrix ID : **AQUEOUS-Fresh**
Lab Sample ID: **2201034-017** Prep: 02/08/22 13:40

EPA 350.1

Analyte Name (Analyte ID)	Result	SPK	Units	DF	MDL	PQL	%RPD	%Rec	Source	By	Batch	%Limits	Notes
Ammonia (N) (7664417)	1.1	1	mg/L	1	0.035	0.05	0	112	0.035 U	RRB	798409	90-110	

This report, which includes the attached Chain-Of-Custody, shall not be reported except in full, without written approval of the laboratory.

Southern Research Laboratories, Inc
2251 Lynx Lane, Suite 1
Orlando, Florida 32804
(407) 522-7100 / Fax (407) 522-7043

ANALYTICAL REPORT

For Proiect:
Lake Buchanan Flux

NELAP Certified
FDOH # : **E83484**
Lab Received Date : **01/20/22 16:30**

Company Name: **Wood Environment & Infrastructure**
Client's Name: **Lance Lumbard**
Client's Address: **550 Northlake Blvd. Suite 1000**
City: **Altamonte Springs**
State: **FL** Zip:**32701**

Facility ID: **NA**
Project Location: **Orange County, FL.**
Client's Phone: **407-522-7570**
Client's Project Number: **600713x2.01.09**
Lab Reporting Batch ID: **2201034**

**********Data Qualifiers Codes**********

Reporting Exceptions and Qualified Data

When quality control results are outside established control limits reanalysis, including re-extraction (if applicable), is preferred. If re-analysis is not viable or desirable, then results may be qualified. Sample results associated with quality control data that exceed acceptance criteria will be qualified with an appropriate comment. Any parameter for which the laboratory is not officially NELAP accredited is indicated by a '~' symbol. These are not included in the scope because NELAP accreditation is either not available or has not been applied for.

Lab Qualifier	Description
B-01	The sample dilutions set-up for the analysis did not meet the oxygen depletion criteria of at least 2 mg/l dissolved oxygen depletion. Therefore the reported result is an estimated value only.
B-04	The average DO uptake of the seeded controls does not meet the method required 0.6 - 1.0 mg/L.
B-06	Sample is supersaturated with DO. Initial DO exceeds the method required maximum initial DO of 9 mg/L.
B-07	LCS exceeded control limits. The test can not be repeated due to method constraints. Considered to be an estimated value.
D	Data reported from a dilution and or multiple dilutions. D2= 1/2, D5= 1/5, D10= 1/10, D20= 1/20, D50= 1/50, D100= 1/100
I, J	The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit.
J-01	Result may be biased high due to positive results in the associated method blank at a concentration above
L	Off-scale high. Actual value is known to be greater than value given.
LP-02	Less than 1000 ml of sample filtered and residue range of 2.5 insufficient sample, analysis cannot be repeated.
M	Presence of material is verified but not quantified; the actual value is less than the value given. The estimated concentration is greater than the MDL.
N	Presumptive evidence of presence of material.
O	Sampled, but analysis lost or not performed.
PS	PS = Parent Sample. The PS sample was used as the parent sample for the analysis batch to make a Matrix Spike (MS), Matrix Spike Duplicated (MSD) and / or Laboratory Duplicate (DUP).
Q	Sample held beyond the accepted holding time. Use this code if result derived from a sample prepared or analyzed after the approved holding time.
QB-01	The method blank had a positive result for the analyte; however, the concentration in the method blank is less than 10% of the sample result. There is minimal impact to the data.
QB-02	The method blank contains analyte at a concentration above the MDL and/or greater than one-half the MRL. The analyte was not detected in the sample.
QL-02	The associated laboratory control sample exhibited high bias; since the result is ND, there is no impact.
QM-02	The RPD and/or percent recovery for this QC spike sample cannot be accurately calculated due to the high concentration of analyte present in the sample.
QM-07	Spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on acceptable LCS recovery.
QM-11	Precision between duplicate matrix spikes of the same sample was outside acceptance limits.
QM-12	Precision between duplicate samples was outside acceptance limits.
QM-S	Surrogate recovery exceeded acceptance criteria due to the presence of a coeluting compound.
QR-04	Duplicate precision outside acceptance limits due to low analyte concentration.
QS-03	Surrogate recovery outside acceptance limits
QS-4	Surrogate recovery not calculated. Surrogate diluted out of the calibrtion range.
QS-6	Surrogate recovery exceeded accepance criteria due to coelution. Matrix effect confirmed.
QV-01	The associated continuing calibration verification standard exhibited high bias; since the result is ND, there is no impact.
R-01	The Reporting Limit for this analyte has been raised to account for matrix interference.
T	Value reported is less than the laboratory method detection limit. The value is reported for informational purposes only and shall not be used in statistical analysis.
U	Indicates the compound was analyzed for but not detected above the method detection limt.
V	Indicates the analyte was detected in both the sample and method blank.
V1	Common Laboratory Contaminant
Y	The laboratory analysis was performed on an improperly preserved sample. The result may not be accurate.

This report, which includes the attached Chain-Of-Custody, shall not be reported except in full, without written approval of the laboratory.

Chain of Custody

2201034
8

Page 1 of 1

Project Manager:	Lance Lombard
Company:	Wood
Address:	550 Northlake Blvd Suite 1000
City, State, Zip:	Altamonte FL 32701
Phone:	407-522-7570 Fax:

Southern Research Laboratories, Inc.
2251 Lynx Lane, Suite #1
Orlando, Florida 32804
(407) 522-7100
Toll Free 1 (888) 420-TEST Fax: (407) 522-7043

Project Name:	Lake Buchanan Flux
Project Location:	Lake Buchanan PO# C0126101.00

Sampled by [Print Name(s)] / Affiliation:	Francesca Lautermen
Sampler(s) Signature(s):	
Project Number:	600713x2.01.09
REQUESTED DUE DATE:	
Sampling QAP No.:	
Approval Date:	

Preservatives (see codes): S

Analyses Requested: TP/Ammonia

	Sample Identification	Sampled Date:	Sampled Time:	Grab or Composite	Matrix: (see codes)	Total Number of Containers	Comments:
1	LB-A-T=216	1/19/22	1400	Grab	SW	1	2201034-001
2	LB-B-T=216		1405			1	-002
3	LB-C-T=216		1410			1	-003
4	WC-A-T=216		1415			1	-004
5	LB-1-T=216		1420			1	-005
6	LB-2-T=216		1425			1	-006
7	LB-3-T=216		1430			1	-007
8	WC-1-T=216		1435			1	-008
9							
10							

Shipment Method:		Relinquished by:	Date:	Time:	Accepted by:	Date:	Time:
Out: / /	Via:		1/19/22	1500	James S. Preston	1/20/22	1400
Returned: / /	Via:	James S. Preston	1/20/22	1130		1-20-22	16:30

Additional Comments:

Cooler No.(s) / Temperature(s) (°C): client cooler 1.9 °C
Sampling Kit No.: 8911
Equipment ID No.:

Matrix Codes: A = Air GW = Groundwater SE = Sediment SO = Soil SW = Surface Water W = Water(Blanks) HW = Potential Haz Waste O = Other(Specify:)

Preservative Codes: H = Hydrochloric Acid & Ice I = Ice Only N = Nitric Acid & Ice Sulfuric Acid & Ice X = Sodium Hydroxide & Ice O = Other(Specify)

Sediment Core Photos: C-3

Descriptions and Photos: Sediment Core Profiles

Client: Orange County **Site Name:** Lake Buchanan **Project Number:** 600713.2.09

Sample Location and Name:	Description:
LB-1, Anoxic	0-10 cm – Flocculant dark brown muck 10-25 cm – Dark brown spongy sediment, trace sand

Descriptions and Photos: Sediment Core Profiles

Client: Orange County **Site Name:** Lake Buchanan **Project Number:** 600713.2.09

Sample Location and Name:	Description:
LB-2, Anoxic	0-8 cm – Flocculant dark brown muck, plant material 8-25 cm – Dark brown spongy sediment, trace sand

Descriptions and Photos: Sediment Core Profiles

Client: Orange County **Site Name:** Lake Buchanan **Project Number:** 600713.2.09

Sample Location and Name:	Description:
LB-3, Anoxic	0-4 cm – Flocculant dark brown muck 4-11 cm – Dark brown sediment, tan sand mix 11-26 cm – Tan sand mix, Dark brown sediment

Descriptions and Photos: Sediment Core Profiles

Client: Orange County **Site Name:** Lake Buchanan **Project Number:** 600713.2.09

Sample Location and Name:
LB-1, Aerobic

Description:
0-10 cm – Flocculant dark brown muck, plant material
10-25 cm – Dark brown spongy sediment, trace sand

Descriptions and Photos: Sediment Core Profiles

Client: Orange County **Site Name:** Lake Buchanan **Project Number:** 600713.2.09

Sample Location and Name:
LB-2, Aerobic

Description:
0-12 cm – Flocculant dark brown muck, plant material
12-24 cm – Dark brown spongy sediment, trace sand

Descriptions and Photos: Sediment Core Profiles

Client: Orange County **Site Name:** Lake Buchanan **Project Number:** 600713.2.09

Sample Location and Name:
LB-3, Aerobic

Description:
0-3 cm – Flocculant dark brown muck
1-4 cm – Tan sand
4-26 cm – Tan sand mix, Dark brown sediment 11-26 cm –

APPENDIX D

Mann-Kendall Significance Results

Table D- 1. Significant trends in Lake Buchanan water quality, 2015-2021, as determined by Mann-Kendall trend tests

Parameter	Count	Sen Slope	MK-tau	P-value	Trend
Alkalinity	30	-0.75	-0.07	0.78	No significant trend
Chlorophyll-*a* (Corrected)	30	0.07	0.02	0.92	No significant trend
Color	30	-0.73	-0.13	0.4	No significant trend
Total Phosphorus	29	0	0.13	0.55	No significant trend
Orthophosphate	22	0	0.03	0.85	No significant trend
Total Nitrogen	29	0.01	0.02	1	No significant trend
Total Kjeldhal Nitrogen	29	0.02	0.02	1	No significant trend
Nitrate-Nitrite	29	0	0.17	0.28	No significant trend
Total Ammonia	28	0	0.05	0.84	No significant trend
Secchi Depth	31	0.02	0.1	0.64	No significant trend

APPENDIX E

Surface Water Quality Laboratory Reports

Southern Research Laboratories, Inc.

2251 Lynx Lane, Suite 1
Orlando, Florida 32804
(407) 522-7100 Fax (407) 522-7043
Toll Free 1 (888) 420-Test

Thank you **Lance Lumbard** for the opportunity to be of service to you and your company, we **S**incerely **A**ppreciate **Y**our **B**usiness. SRL certifies these **Laboratory Results** were produced in accordance with NELAC Standards. Hold times and preservation requirements were met for all analytes unless specifically noted in the report. Results relate only to the samples as received.

Client Name: **Wood Environment & Infrastructure Solutions, Inc.**	Date(s) Collected: 03/24/21
Contact Name: **Lance Lumbard**	Date Received: 03/24/21
Project Name: Lake Buchanan Surface Water	Time Received: 10:30
Project Number: 600713x2	Date Reported : 04/02/21
Phone Number: (407) 522-7570	Date Emailed : 04/02/21
Fax Number: (407) 522-7576	SRL Work Order # 21-03034

SRL WO #	Clients #	Matrix	Analysis Requested
2103034-001	Buchanan Surface	Liquid	TSS/Orthophosphate/Total Nitrogen/ Total Phosphorus/Ammonia/Color/ Alkalinity/Chlorophyll A/Turbidity

Sherri Payne
Vice President & Quality Assurance Officer
Southern Research Laboratories, Inc.

This report, which includes the attached Chain-of-Custody, shall not be reproduced except in full, without written approval of the laboratory.

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an MBE Environmental Laboratory
2251 Lynx Lane, Suite 1
Orlando, Florida 32804 (407) 522-7100

NELAP Certified
FDOH Cert # : E83484
SRL Lab Ref # : 21-03034
Received Date : 03/24/21

Lance Lumbard
Wood Env. & Infrastructure Solutions, Inc.
550 Northlake Blvd., Suite 1000
Altamonte Springs, FL. 32701 (407) 522-7570

Project Number/Project Name
600713x2
Lake Buchanan Surface Water
Lake Buchanan

Classical Chemistry Parameters

Client ID # : **Buchanan Surfac**
SRL (Lab) ID# : 2103034-001
Date Collected : 03/24/21
Lab FDOH Certification # : E83182

Analyte	CAS Number	Results	Flag	Units	Dilution Factor	MDL	PQL	Method	Date Prepared	Date Analyzed
Ammonia as N	7664-41-7	0.0098	U	mg/L	1	0.0098	0.020	EPA 350.1	03/24/21	03/25/21
Chlorophyll a	42617-16-3	**74**		mg/m3	1	0.50	0.50	A 10200 H-20	03/24/21	03/29/21
Color		**20**		Color Units	1	5.0	5.0	M 2120B-201	03/24/21	03/24/21
Nitrate/Nitrite as N		0.016	U	mg/L	1	0.016	0.050	4500NO3 H-	03/26/21	03/29/21
Orthophosphate as P	1426-54-42	**0.011**		mg/L	1	0.0040	0.010	EPA 365.1	03/24/21	03/24/21
pH for Color (pH units)		**8.1**		Color Units	1			SM 2120B-201	03/24/21	03/24/21
Phosphorus	7723-14-0	**0.15**		mg/L	1	0.010	0.015	EPA 365.4	03/26/21	03/30/21
Total Alkalinity as CaC03	471-34-1	**32.5**		mg/L	1	1.90	10.0	EPA 310.2	03/30/21	03/31/21
Total Kjeldahl Nitrogen		**1.9**		mg/L	1	0.037	0.050	EPA 351.2	03/25/21	03/30/21
Total Nitrogen	17778-88-0	**1.9**		mg/L	1	0.037	0.050	CALC	03/25/21	03/30/21
Total Suspended Solids		**13**		mg/L	1	2.5	2.5	M-2540D-201	03/30/21	03/31/21
Turbidity		**25**		NTU	1	1.0	1.0	EPA 180.1	03/24/21	03/24/21

Client ID # : **Blanks**
SRL (Lab) ID# : MB
Date Collected : NA
Lab FDOH Certification # : E83182

Analyte	CAS Number	Results	Flag	Units	Dilution Factor	MDL	PQL	Method	Date Prepared	Date Analyzed
Ammonia as N	7664-41-7	0.0098	U	mg/L	1	0.0098	0.020	EPA 350.1	03/24/21	03/25/21
Chlorophyll a	42617-16-3	0.50	U	mg/m3	1	0.50	0.50	A 10200 H-20	03/24/21	03/29/21
Color		5.0	U	Color Units	1	5.0	5.0	M 2120B-201	03/24/21	03/24/21
Nitrate/Nitrite as N		0.016	U	mg/L	1	0.016	0.050	4500NO3 H-	03/26/21	03/29/21
Orthophosphate as P	1426-54-42	0.0040	U	mg/L	1	0.0040	0.010	EPA 365.1	03/24/21	03/24/21
Phosphorus	7723-14-0	0.010	U	mg/L	1	0.010	0.015	EPA 365.4	03/26/21	03/30/21
Total Alkalinity as CaC03	471-34-1	1.90	U	mg/L	1	1.90	10.0	EPA 310.2	03/30/21	03/31/21
Total Kjeldahl Nitrogen		0.037	U	mg/L	1	0.037	0.050	EPA 351.2	03/25/21	03/30/21
Total Nitrogen	17778-88-0	0.037	U	mg/L	1	0.037	0.050	CALC	03/25/21	03/30/21
Total Suspended Solids		2.5	U	mg/L	1	2.5	2.5	M-2540D-201	03/30/21	03/31/21
Turbidity		1.0	U	NTU	1	1.0	1.0	EPA 180.1	03/24/21	03/24/21

Southern Research Laboratories, Inc.
an MBE Environmental Laboratory
2251 Lynx Lane, Suite 1
Orlando, Florida 32804 (407) 522-7100

NELAP Certified
FDOH Cert # : E83484
SRL Lab Ref # : 21-03034
Received Date : 03/24/21

Lance Lumbard
Wood Env. & Infrastructure Solutions, Inc.
550 Northlake Blvd., Suite 1000
Altamonte Springs, FL. 32701 (407) 522-7570

Project Number/Project Name
600713x2
Lake Buchanan Surface Water
Lake Buchanan

Classical Chemistry Parameters

QAQC

	% Recovery LCS/MS/MS2/MSD	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Nitrate/Nitrite as N	102/107/107	84-116	84-116		0.4	0-10
Total Kjeldahl Nitrogen	98/98/100/97	90-110	90-110		1	0-10

Total Nitrogen (Calculated as: (Nitrogen, Total Kjeldahl) + (Nitrogen, Nitrate + Nitrite)

	% Recovery LCS/MS/MSD	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Orthophosphate as P	98/96/95	90-110	90-110		0.9	0-10
Total Alkalinity as CaC03	99/56/60	90-110	90-110	QM-07	2	0-10

	% Recovery LCS/MS/MSD	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Phosphorus	99/88/100	90-110	90-110	QM-07	3	0-10

	% Recovery LCS/MS1/MS2/MSD1	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Nitrogen, Ammonia (as N)	102/92/100/92	90-110	90-110		0	0-10

	% Recovery LCS	Acceptable Limits
Total Suspended Solids	90	80-120

	Result	Source Result	RPD	RPD Limit
Total Suspended Solids (DUP-1)	42	42.0	0	0-20

	Result	Source Result	RPD	Notes	RPD Limit
Chlorophyll a (DUP-1)	0.58	1.7	100	QR-04	0-25

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an MBE Environmental Laboratory
2251 Lynx Lane, Suite 1
Orlando, Florida 32804 (407) 522-7100

NELAP Certified
FDOH Cert # : E83484
SRL Lab Ref # : 21-03034
Received Date : 03/24/21

Lance Lumbard
Wood Env. & Infrastructure Solutions, Inc.
550 Northlake Blvd., Suite 1000
Altamonte Springs, FL. 32701 (407) 522-7570

Project Number/Project Name
600713x2
Lake Buchanan Surface Water
Lake Buchanan

Classical Chemistry Parameters

QAQC

	% Recovery LCS	Acceptable Limits
Color	100	90-110

	Result	Source Result	RPD	Notes	RPD Limit
Color (DUP-1)	20	20	0		0-10

	% Recovery LCS	Acceptable Limits
Turbidity	102	90-110

	Result	Source Result	RPD	RPD Limit
Turbidity (DUP-1)	4.7	4.3	9	0-10

Southern Research Laboratories, Inc.
an MBE Environmental Laboratory
2251 Lynx Lane, Suite 1
Orlando, Florida 32804 (407) 522-7100

NELAP Certified
FDOH Cert # : E83484
SRL Lab Ref # : 21-03034
Received Date : 03/24/21

Lance Lumbard
Wood Env. & Infrastructure Solutions, Inc.
550 Northlake Blvd., Suite 1000
Altamonte Springs, FL. 32701 (407) 522-7570

Project Number/Project Name
600713x2
Lake Buchanan Surface Water
Lake Buchanan

DATA QUALIFIER CODES

Reporting Exceptions and Qualified Data

When quality control results are outside established control limits reanalysis, including re-extraction (if applicable), is preferred. If re-analysis is not viable or desirable, then results may be qualified. Sample results associated with quality control data that exceed acceptance criteria will be qualified with an appropriate comment.

D = Data reported from a dilution and or multiple dilutions.

I = Estimated Value, The reported value is between the Laboratory Method Detection Limit (**MDL**) and the Laboratory Practical Quantitation Limit (**PQL**)

J = Estimated Value

L = Off-Scale high; exceeds the linear range or highest calibration standard.

O = Sampled, but analysis lost or not performed

Q = Sample held beyond normal holding time
Q01 Analysis performed outside of method-specified holding time
Q02 Sample received outside of method-specified holding time

U = indicates the compound was analyzed for, but not detected. The numerical value preceding the "U" is the limit of detection for that compound based upon the dilution. **MEDF** = **M**atrix **E**ffected **D**ilution **F**actor.

V = Analyte was detected in both the sample and associated Laboratory Method Blank; Laboratory Contamination

Y = The analysis was from an unpreserved or improperly preserved sample. The data may not be accurate

Unless otherwise noted, ug/Kg and mg/Kg denote dry weight.

(SOILS) Actual Reporting Limit will depend on moisture content of sample and the amount of sample received.

QM-07 The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on acceptable LCS recovery.

QR-04 Duplicate precision outside acceptance limits due to low analyte concentration

Chain of Custody

2103034
1

Page 1 of 1

Project Manager:	Lance Lumbard
Company:	Wood Environment & Infrastructure Solutions, Inc.
Address:	550 Northlake Blvd., Suite 1000
City, State, Zip:	Altamonte Springs Florida 32701
Phone:	407-522-7570
Fax:	+1 (407) 522-7576

Southern Research Laboratories, Inc.
2251 Lynx Lane, Suite #1
Orlando, Florida 32804
Main (407) 522-7100 Fax: (407) 522-7043

Project Name: Lake Buchanan Surface Water

Project Location: Lake Buchanan

Sampled by [Print Name(s)] / Affiliation: James Preston (wood) Katie Ballew BFA

Sampler(s) Signature(s): James S. Preston

Project Number: 600713x2

REQUESTED DUE DATE:

Facility ID#:

Petroleum Restoration Program ___ yes ✓ no

	Sample Identification	Sampled Date:	Sampled Time:	Grab or Composite	Matrix: (see codes)	Total Number of Containers	Preservatives (see codes)						Analyses Requested: TN/low level TP/NH3	Color	Chl-a	Alkalinity/turbidity	low level OP (filtered)	TSS				
							S	I	I	I	I	I										
1	Buchanan Surface	3/24/21	1000	G	SW	6							✓	✓	✓	✓	✓	✓				2103034-001

Shipment Method:		Relinquished by	Date:	Time:	Accepted by:	Date:	Time:
Out: / /	Via:	Helen Turner	3/16/21	15:40	James S. Preston	3/16/21	1540
Returned: / /	Via:	James S. Preston	3/24/21	1010	Katie Ballew	3/24/21	1010
			3/24/21	1030	Helen Turner	3-24-21	10:30

Additional Comments:

Cooler No.(s) / Temperature(s) (°C): 424, 124 (422) 4.5

Sampling Kit No.: 8904

Equipment ID No.:

Matrix Codes: A = Air GW = Groundwater SE = Sediment SO = Soil SW = Surface Water W = Water(Blanks) HW = Potential Haz Waste O = Other(Specify:_____)

Preservative Codes: H = Hydrochloric Acid & Ice I = Ice Only N = Nitrie Acid& Ice S = Sulfuric Acid & Ice X = Sodium Hydroxide & Ice O = Other(Specify)

Southern Research Laboratories, Inc.

2251 Lynx Lane, Suite 1
Orlando, Florida 32804
(407) 522-7100 Fax (407) 522-7043
Toll Free 1 (888) 420-Test

Thank you **Lance Lumbard** for the opportunity to be of service to you and your company, we **S**incerely **A**ppreciate **Y**our **B**usiness. SRL certifies these **Laboratory Results** were produced in accordance with NELAC Standards. Hold times and preservation requirements were met for all analytes unless specifically noted in the report. Results relate only to the samples as received.

Client Name: **Wood Environment & Infrastructure Solutions, Inc.**	Date(s) Collected: 06/28/21
Contact Name: **Lance Lumbard**	Date Received: 06/28/21
Project Name: Lake Buchanan Surface Water	Time Received: 13:25
Project Number: 600713x2	Date Reported : 07/12/21
Phone Number: (407) 522-7570	Date Emailed : 07/12/21
Fax Number: (407) 522-7576	SRL Work Order # 21-06037

SRL WO #	Clients #	Matrix	Analysis Requested
2106037-001	Buchanan Surface	Liquid	TSS/Orthophosphate/Total Nitrogen/ Total Phosphorus/Ammonia/Color/ Alkalinity/Chlorophyll A/Turbidity

Sherri Payne
Vice President & Quality Assurance Officer
Southern Research Laboratories, Inc.

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Southern Research Laboratories, Inc.
an MBE Environmental Laboratory
2251 Lynx Lane, Suite 1
Orlando, Florida 32804 (407) 522-7100

NELAP Certified
FDOH Cert # : E83484
SRL Lab Ref # : 21-06037
Received Date : 06/28/21

Lance Lumbard
Wood Env. & Infrastructure Solutions, Inc.
550 Northlake Blvd., Suite 1000
Altamonte Springs, FL. 32701 (407) 522-7570

Project Number/Project Name
600713x2
Lake Buchanan Surface Water
Lake Buchanan

Classical Chemistry Parameters

Client ID # : **Buchanan Surfac**
SRL (Lab) ID# : 2106037-001
Date Collected : 06/28/21
Lab FDOH Certification # : E83182

Analyte	CAS Number	Results	Flag	Units	Dilution Factor	MDL	PQL	Method	Date Prepared	Date Analyzed
Ammonia as N	7664-41-7	0.0098	U	mg/L	1	0.0098	0.020	EPA 350.1	06/29/21	06/30/21
Chlorophyll a	42617-16-3	**20**		mg/m3	1	0.50	0.50	A 10200 H-20	06/29/21	07/08/21
Color		**25**		Color Units	1	5.0	5.0	M 2120B-201	06/29/21	06/29/21
Nitrate/Nitrite as N		0.016	U	mg/L	1	0.016	0.050	4500NO3 H-	07/01/21	07/02/21
Orthophosphate as P	1426-54-42	**0.0051**	I	mg/L	1	0.0040	0.010	EPA 365.1	06/29/21	06/29/21
pH for Color (pH units)		**7.2**		Color Units	1			SM 2120B-201	06/29/21	06/29/21
Phosphorus	7723-14-0	**0.048**		mg/L	1	0.010	0.015	EPA 365.4	06/29/21	07/01/21
Total Alkalinity as CaC03	471-34-1	**26.0**		mg/L	1	1.90	10.0	EPA 310.2	07/02/21	07/06/21
Total Kjeldahl Nitrogen		**0.99**		mg/L	1	0.037	0.050	EPA 351.2	06/29/21	07/01/21
Total Nitrogen	17778-88-0	**0.99**		mg/L	1	0.037	0.050	CALC	07/01/21	07/02/21
Total Suspended Solids		**3.4**		mg/L	1	2.5	2.5	M-2540D-201	07/02/21	07/06/21
Turbidity		**3.0**		NTU	1	1.0	1.0	EPA 180.1	06/29/21	06/29/21

Client ID # : **Blanks**
SRL (Lab) ID# : MB
Date Collected : NA
Lab FDOH Certification # : E83182

Analyte	CAS Number	Results	Flag	Units	Dilution Factor	MDL	PQL	Method	Date Prepared	Date Analyzed
Ammonia as N	7664-41-7	0.0098	U	mg/L	1	0.0098	0.020	EPA 350.1	06/29/21	06/30/21
Chlorophyll a	42617-16-3	0.50	U	mg/m3	1	0.50	0.50	A 10200 H-20	06/29/21	07/08/21
Color		5.0	U	Color Units	1	5.0	5.0	M 2120B-201	06/29/21	06/29/21
Nitrate/Nitrite as N		0.016	U	mg/L	1	0.016	0.050	4500NO3 H-	07/01/21	07/02/21
Orthophosphate as P	1426-54-42	0.0040	U	mg/L	1	0.0040	0.010	EPA 365.1	06/29/21	06/29/21
Phosphorus	7723-14-0	0.010	U	mg/L	1	0.010	0.015	EPA 365.4	06/29/21	07/01/21
Total Alkalinity as CaC03	471-34-1	1.90	U	mg/L	1	1.90	10.0	EPA 310.2	07/02/21	07/06/21
Total Kjeldahl Nitrogen		0.037	U	mg/L	1	0.037	0.050	EPA 351.2	06/29/21	07/01/21
Total Nitrogen	17778-88-0	0.037	U	mg/L	1	0.037	0.050	CALC	07/01/21	07/02/21
Total Suspended Solids		2.5	U	mg/L	1	2.5	2.5	M-2540D-201	07/02/21	07/06/21
Turbidity		1.0	U	NTU	1	1.0	1.0	EPA 180.1	06/29/21	06/29/21

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an MBE Environmental Laboratory
2251 Lynx Lane, Suite 1
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NELAP Certified
FDOH Cert # : E83484
SRL Lab Ref # : 21-06037
Received Date : 06/28/21

Lance Lumbard
Wood Env. & Infrastructure Solutions, Inc.
550 Northlake Blvd., Suite 1000
Altamonte Springs, FL. 32701 (407) 522-7570

Project Number/Project Name
600713x2
Lake Buchanan Surface Water
Lake Buchanan

Classical Chemistry Parameters

QAQC

	% Recovery LCS/MS/MS2/MSD	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Nitrate/Nitrite as N	93/96/100	84-116	84-116		3	0-10
Total Kjeldahl Nitrogen	106/64/107/84	90-110	90-110	QM-07	3	0-10

Total Nitrogen (Calculated as: (Nitrogen, Total Kjeldahl) + (Nitrogen, Nitrate + Nitrite)

	% Recovery LCS/MS/MSD	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Orthophosphate as P	97/94/91	90-110	90-110		3	0-10
Total Alkalinity as CaC03	94/99/111	90-110	90-110	QM-07	8	0-10

	% Recovery LCS/MS/MSD	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Phosphorus	108/103/104	90-110	90-110		0.7	0-10

	% Recovery LCS/MS1/MS2/MSD1	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Nitrogen, Ammonia (as N)	104/103/99/106	90-110	90-110		3	0-10

	% Recovery LCS	Acceptable Limits
Total Suspended Solids	89	80-120

	Result	Source Result	RPD	Notes	RPD Limit
Total Suspended Solids (DUP-1)	12	13.0	8	LP-02	0-20

	Result	Source Result	RPD	Notes	RPD Limit
Chlorophyll a (DUP-1)	18	20	8		0-25

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NELAP Certified
FDOH Cert # : E83484
SRL Lab Ref # : 21-06037
Received Date : 06/28/21

Lance Lumbard
Wood Env. & Infrastructure Solutions, Inc.
550 Northlake Blvd., Suite 1000
Altamonte Springs, FL. 32701 (407) 522-7570

Project Number/Project Name
600713x2
Lake Buchanan Surface Water
Lake Buchanan

Classical Chemistry Parameters

QAQC

	% Recovery LCS	Acceptable Limits
Color	100	90-110

	Result	Source Result	RPD	Notes	RPD Limit
Color (DUP-1)	25	25	0		0-10

	% Recovery LCS	Acceptable Limits
Turbidity	104	90-110

	Result	Source Result	RPD	RPD Limit
Turbidity (DUP-1)	3.0	3.0	0	0-10

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NELAP Certified
FDOH Cert # : E83484
SRL Lab Ref # : 21-06037
Received Date : 06/28/21

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550 Northlake Blvd., Suite 1000
Altamonte Springs, FL. 32701 (407) 522-7570

Project Number/Project Name
600713x2
Lake Buchanan Surface Water
Lake Buchanan

DATA QUALIFIER CODES

Reporting Exceptions and Qualified Data

When quality control results are outside established control limits reanalysis, including re-extraction (if applicable), is preferred. If re-analysis is not viable or desirable, then results may be qualified. Sample results associated with quality control data that exceed acceptance criteria will be qualified with an appropriate comment.

D = Data reported from a dilution and or multiple dilutions.

I = Estimated Value, The reported value is between the Laboratory Method Detection Limit (**MDL**) and the Laboratory Practical Quantitation Limit (**PQL**)

J = Estimated Value

L = Off-Scale high; exceeds the linear range or highest calibration standard.

O = Sampled, but analysis lost or not performed

Q = Sample held beyond normal holding time
Q01 Analysis performed outside of method-specified holding time
Q02 Sample received outside of method-specified holding time

U = indicates the compound was analyzed for, but not detected. The numerical value preceding the "U" is the limit of detection for that compound based upon the dilution. **MEDF** = **M**atrix **E**ffected **D**ilution **F**actor.

V = Analyte was detected in both the sample and associated Laboratory Method Blank; Laboratory Contamination

Y = The analysis was from an unpreserved or improperly preserved sample. The data may not be accurate

Unless otherwise noted, ug/Kg and mg/Kg denote dry weight.

(SOILS) Actual Reporting Limit will depend on moisture content of sample and the amount of sample received.

LP-02 Filtered residue did not meet 2.5-200mg range

QM-07 The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on acceptable LCS recovery.

Chain of Custody

2106037
1

Page 1 of 1

Project Manager:	Lance Lambard
Company:	Wood Environment & Infrastructure Solutions, Inc.
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City, State, Zip:	Altamonte Springs Florida 32701
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Southern Research Laboratories, Inc.
2251 Lynx Lane, Suite #1
Orlando, Florida 32804
Main (407) 522-7100 Fax: (407) 522-7043

Project Name: Lake Buchanan Surface Water

Project Location: Lake Buchanan

Sampled by [Print Name(s)] / Affiliation: James S. Preston/Wood Kate Ballew/BFA

Sampler(s) Signature(s): James S. Preston

Preservatives (see codes): I I S I I I

Project Number: 600713x2

REQUESTED DUE DATE:

Facility ID#:

Petroleum Restoration Program ___ yes ✓ no

	Sample Identification	Sampled Date:	Sampled Time:	Grab or Composite	Matrix: (see codes)	Total Number of Containers	TSS	chl-a	TN/low level TP /Amonia low level ortho-P	Color	Alkalinity/ Turbidity				
1	Buchanan Surface	6/28/21	1155	G	SW	6	✓	✓	✓	✓	✓	✓			2106037-001

Analyses Requested

Shipment Method:		Relinquished by	Date:	Time:	Accepted by:	Date:	Time:
Out: / /	Via:	Helen Turner FEDEX	3/16/21	15:40	James S. Preston	3/16/21	1540
Returned: / /	Via:	James S. Preston	6/28/21	1248		6/28/21	1248
Additional Comments:			6/28/21	1325	Helen Turner	6.28.21	13:25

Cooler No.(s) / Temperature(s) (°C): 424, 124 2.0 00

Sampling Kit No.: 8904

Equipment ID No.:

Matrix Codes: A = Air GW = Groundwater SE = Sediment SO = Soil SW = Surface Water W = Water(Blanks) HW = Potential Haz Waste O = Other(Specify:_____)

Preservative Codes: H = Hydrochloric Acid & Ice I = Ice Only N = Nitrie Acid& Ice S = Sulfuric Acid & Ice X = Sodium Hydroxide & Ice O = Other(Specify)

Southern Research Laboratories, Inc.

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Client Name: **Wood Environment & Infrastructure Solutions, Inc.**	Date(s) Collected: 08/02/21
Contact Name: **Lance Lumbard**	Date Received: 08/02/21
Project Name: Lake Buchanan Surface Water	Time Received: 12:20
Project Number: 600713x2.02.07	Date Reported : 08/11/21
Phone Number: (407) 522-7570	Date Emailed : 08/11/21
Fax Number: (407) 522-7576	SRL Work Order # 21-08003

SRL WO #	Clients #	Matrix	Analysis Requested
2108003-001	Buchanan Surface	Liquid	TSS/Orthophosphate/Total Nitrogen/ Total Phosphorus/Ammonia/Color/ Alkalinity/Chlorophyll A/Turbidity

Sherri Payne
Vice President & Quality Assurance Officer
Southern Research Laboratories, Inc.

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NELAP Certified
FDOH Cert # : E83484
SRL Lab Ref # : 21-08003
Received Date : 08/02/21

Lance Lumbard
Wood Env. & Infrastructure Solutions, Inc.
550 Northlake Blvd., Suite 1000
Altamonte Springs, FL. 32701 (407) 522-7570

Project Number/Project Name
600713x2.02.07
Lake Buchanan Surface Water
Lake Buchanan

Classical Chemistry Parameters

Client ID # : **Buchanan Surfac**
SRL (Lab) ID# : 2108003-001
Date Collected : 08/02/21
Lab FDOH Certification # : E83182

Analyte	CAS Number	Results	Flag	Units	Dilution Factor	MDL	PQL	Method	Date Prepared	Date Analyzed
Ammonia as N	7664-41-7	0.0098	U	mg/L	1	0.0098	0.020	EPA 350.1	08/05/21	08/06/21
Chlorophyll a	42617-16-3	**14**		mg/m3	1	0.50	0.50	A 10200 H-20	08/03/21	08/09/21
Color		**25**		Color Units	1	5.0	5.0	M 2120B-201	08/03/21	08/03/21
Nitrate/Nitrite as N		0.016	U	mg/L	1	0.016	0.050	4500NO3 H-	08/03/21	08/04/21
Orthophosphate as P	1426-54-42	0.0040	U	mg/L	1	0.0040	0.010	EPA 365.1	08/03/21	08/03/21
pH for Color (pH units)		**7.1**		Color Units	1			SM 2120B-201	08/03/21	08/03/21
Phosphorus	7723-14-0	**0.041**		mg/L	1	0.010	0.015	EPA 365.4	08/03/21	08/05/21
Total Alkalinity as CaC03	471-34-1	**27.6**		mg/L	1	1.90	10.0	EPA 310.2	08/06/21	08/09/21
Total Kjeldahl Nitrogen		**0.96**		mg/L	1	0.037	0.050	EPA 351.2	08/03/21	08/05/21
Total Nitrogen	17778-88-0	**0.96**		mg/L	1	0.037	0.050	CALC	08/03/21	08/05/21
Total Suspended Solids		2.5	U	mg/L	1	2.5	2.5	M-2540D-201	08/06/21	08/10/21
Turbidity		**2.4**		NTU	1	1.0	1.0	EPA 180.1	08/04/21	08/04/21

Client ID # : **Blanks**
SRL (Lab) ID# : MB
Date Collected : NA
Lab FDOH Certification # : E83182

Analyte	CAS Number	Results	Flag	Units	Dilution Factor	MDL	PQL	Method	Date Prepared	Date Analyzed
Ammonia as N	7664-41-7	0.0098	U	mg/L	1	0.0098	0.020	EPA 350.1	08/05/21	08/06/21
Chlorophyll a	42617-16-3	0.50	U	mg/m3	1	0.50	0.50	A 10200 H-20	08/03/21	08/09/21
Color		5.0	U	Color Units	1	5.0	5.0	M 2120B-201	08/03/21	08/03/21
Nitrate/Nitrite as N		0.016	U	mg/L	1	0.016	0.050	4500NO3 H-	08/03/21	08/04/21
Orthophosphate as P	1426-54-42	0.0040	U	mg/L	1	0.0040	0.010	EPA 365.1	08/03/21	08/03/21
Phosphorus	7723-14-0	0.010	U	mg/L	1	0.010	0.015	EPA 365.4	08/03/21	08/05/21
Total Alkalinity as CaC03	471-34-1	1.90	U	mg/L	1	1.90	10.0	EPA 310.2	08/06/21	08/09/21
Total Kjeldahl Nitrogen		0.037	U	mg/L	1	0.037	0.050	EPA 351.2	08/03/21	08/05/21
Total Nitrogen	17778-88-0	0.037	U	mg/L	1	0.037	0.050	CALC	08/03/21	08/05/21
Total Suspended Solids		2.5	U	mg/L	1	2.5	2.5	M-2540D-201	08/06/21	08/10/21
Turbidity		1.0	U	NTU	1	1.0	1.0	EPA 180.1	08/04/21	08/04/21

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NELAP Certified
FDOH Cert # : E83484
SRL Lab Ref # : 21-08003
Received Date : 08/02/21

Lance Lumbard
Wood Env. & Infrastructure Solutions, Inc.
550 Northlake Blvd., Suite 1000
Altamonte Springs, FL. 32701 (407) 522-7570

Project Number/Project Name
600713x2.02.07
Lake Buchanan Surface Water
Lake Buchanan

Classical Chemistry Parameters

QAQC

	% Recovery LCS/MS/MS3/MSD	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Nitrate/Nitrite as N	96/20/50	84-116	84-116	QM-07	1	0-10
Total Kjeldahl Nitrogen	104/103/128/104	90-110	90-110	QM-07	0.6	0-10

Total Nitrogen (Calculated as: (Nitrogen, Total Kjeldahl) + (Nitrogen, Nitrate + Nitrite)

	% Recovery LCS/MS/MSD	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Orthophosphate as P	96/97/104	90-110	90-110		7	0-10
Total Alkalinity as CaC03	95/101/106	90-110	90-110		5	0-10

	% Recovery LCS/MS/MSD	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Phosphorus	105/102/101	90-110	90-110		0.8	0-10

	% Recovery LCS/MS3/MS2/MSD3	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Nitrogen, Ammonia (as N)	96/106/110/101	90-110	90-110		3	0-10

	% Recovery LCS	Acceptable Limits
Total Suspended Solids	90	80-120

	Result	Source Result	RPD	Notes	RPD Limit
Total Suspended Solids (DUP-1)	2.5 U	2.5 U		LP-02	0-20

	Result	Source Result	RPD	Notes	RPD Limit
Chlorophyll a (DUP-1)	13	14	12		0-25

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NELAP Certified
FDOH Cert # : E83484
SRL Lab Ref # : 21-08003
Received Date : 08/02/21

Lance Lumbard
Wood Env. & Infrastructure Solutions, Inc.
550 Northlake Blvd., Suite 1000
Altamonte Springs, FL. 32701 (407) 522-7570

Project Number/Project Name
600713x2.02.07
Lake Buchanan Surface Water
Lake Buchanan

Classical Chemistry Parameters

QAQC

	% Recovery LCS	Acceptable Limits
Color	100	90-110

	Result	Source Result	RPD	Notes	RPD Limit
Color (DUP-1)	50	50	0		0-10

	% Recovery LCS	Acceptable Limits
Turbidity	99	90-110

	Result	Source Result	RPD	RPD Limit
Turbidity (DUP-1)	2.4	2.4	0	0-10

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FDOH Cert # : E83484
SRL Lab Ref # : 21-08003
Received Date : 08/02/21

Lance Lumbard
Wood Env. & Infrastructure Solutions, Inc.
550 Northlake Blvd., Suite 1000
Altamonte Springs, FL. 32701 (407) 522-7570

Project Number/Project Name
600713x2.02.07
Lake Buchanan Surface Water
Lake Buchanan

DATA QUALIFIER CODES

Reporting Exceptions and Qualified Data

When quality control results are outside established control limits reanalysis, including re-extraction (if applicable), is preferred. If re-analysis is not viable or desirable, then results may be qualified. Sample results associated with quality control data that exceed acceptance criteria will be qualified with an appropriate comment.

D = Data reported from a dilution and or multiple dilutions.

I = Estimated Value, The reported value is between the Laboratory Method Detection Limit (**MDL**) and the Laboratory Practical Quantitation Limit (**PQL**)

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O = Sampled, but analysis lost or not performed

Q = Sample held beyond normal holding time
Q01 Analysis performed outside of method-specified holding time
Q02 Sample received outside of method-specified holding time

U = indicates the compound was analyzed for, but not detected. The numerical value preceding the "U" is the limit of detection for that compound based upon the dilution. **MEDF** = **M**atrix **E**ffected **D**ilution **F**actor.

V = Analyte was detected in both the sample and associated Laboratory Method Blank; Laboratory Contamination

Y = The analysis was from an unpreserved or improperly preserved sample. The data may not be accurate

Unless otherwise noted, ug/Kg and mg/Kg denote dry weight.

(SOILS) Actual Reporting Limit will depend on moisture content of sample and the amount of sample received.

LP-02 Filtered residue did not meet 2.5-200mg range

QM-07 The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on acceptable LCS recovery.

Chain of Custody

2108003
1

Page 1 of 1

Project Manager: Lance Lumbard
Company: Wood Environment & Infrastructure Solutions, Inc.
Address: 550 Northlake Blvd., Suite 1000
City, State, Zip: Altamonte Springs Florida 32701
Phone: 407-522-7570 Fax: +1 (407) 522-7576

Southern Research Laboratories, Inc.
2251 Lynx Lane, Suite #1
Orlando, Florida 32804
Main (407) 522-7100 Fax: (407) 522-7043

Project Name: PO#C20906C001
Lake Buchanan Surface Water
Project Location: Lake Buchanan

Sampled by [Print Name(s)] / Affiliation: James S. Preston/Wood Katie Ballew/BFA
Sampler(s) Signature(s): James S. Preston

Project Number: 600713x2.02.07
REQUESTED DUE DATE:
Facility ID#:
Petroleum Restoration Program ___ yes ✓ no

Sample Identification	Sampled Date:	Sampled Time:	Grab or Composite	Matrix: (see codes)	Total Number of Containers	Preservatives (see codes)						Analyses Requested: TSS	Chl-a	TN/low level TP/Ammonia	low level ortho-P	Color	Alkalinity/Turbidity				
						I	I	S	I	I	I										
Buchanan Surface	8/2/2021	1100	G	SW	6							✓	✓	✓	✓	✓	✓				2108003-001

Shipment Method:		Relinquished by	Date:	Time:	Accepted by:	Date:	Time:
Out: / /	Via:	Helen Simpson	3/16/21	15:40	James S. Preston	3/16/21	1540
Returned: / /	Via:	James S. Preston	8/2/21	1149		8/2/2021	1149
			8-2-21	1220		8-2-21	1220

Additional Comments:

Cooler No.(s) / Temperature(s) (°C): 424, 124 Clientcooler 0.9
Sampling Kit No.: 8904
Equipment ID No.:

Matrix Codes: A = Air GW = Groundwater SE = Sediment SO = Soil SW = Surface Water W = Water(Blanks) HW = Potential Haz Waste O = Other(Specify:_____)

Preservative Codes: H = Hydrochloric Acid & Ice I = Ice Only N = Nitrie Acid& Ice S = Sulfuric Acid & Ice X = Sodium Hydroxide & Ice O = Other(Specify)

Southern Research Laboratories, Inc.

2251 Lynx Lane, Suite 1
Orlando, Florida 32804
(407) 522-7100 Fax (407) 522-7043
Toll Free 1 (888) 420-Test

Thank you **Lance Lumbard** for the opportunity to be of service to you and your company, we **S**incerely **A**ppreciate **Y**our **B**usiness. SRL certifies these **Laboratory Results** were produced in accordance with NELAC Standards. Hold times and preservation requirements were met for all analytes unless specifically noted in the report. Results relate only to the samples as received.

Client Name: **Wood Environment & Infrastructure Solutions, Inc.**	Date(s) Collected: 09/29/21
Contact Name: **Lance Lumbard**	Date Received: 09/29/21
Project Name: Lake Buchanan Surface Water	Time Received: 13:50
Project Number: 600713x2.02.07	Date Reported : 10/12/21
Phone Number: (407) 522-7570	Date Emailed : 10/12/21
Fax Number: (407) 522-7576	SRL Work Order # 21-09048

SRL WO #	Clients #	Matrix	Analysis Requested
2109048-001	Buchanan Surface	Liquid	TSS/Orthophosphate/Total Nitrogen/ Total Phosphorus/Ammonia/Color/ Alkalinity/Chlorophyll A/Turbidity

Sherri Payne
Vice President & Quality Assurance Officer
Southern Research Laboratories, Inc.

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an MBE Environmental Laboratory
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Orlando, Florida 32804 (407) 522-7100

NELAP Certified
FDOH Cert # : E83484
SRL Lab Ref # : 21-09048
Received Date : 09/29/21

Lance Lumbard
Wood Env. & Infrastructure Solutions, Inc.
550 Northlake Blvd., Suite 1000
Altamonte Springs, FL. 32701 (407) 522-7570

Project Number/Project Name
600713x2.02.07
Lake Buchanan Surface Water
Lake Buchanan

Classical Chemistry Parameters

Client ID # : **Buchanan Surfac**
SRL (Lab) ID# : 2109048-001
Date Collected : 09/29/21
Lab FDOH Certification # : E83182

Analyte	CAS Number	Results	Flag	Units	Dilution Factor	MDL	PQL	Method	Date Prepared	Date Analyzed
Ammonia as N	7664-41-7	0.0098	U	mg/L	1	0.0098	0.020	EPA 350.1	09/30/21	10/01/21
Chlorophyll a	42617-16-3	**20**		mg/m3	1	0.50	0.50	A 10200 H-20	09/30/21	10/05/21
Color		**30**		Color Units	1	5.0	5.0	M 2120B-201	10/01/21	10/01/21
Nitrate/Nitrite as N		0.016	U	mg/L	1	0.016	0.050	4500NO3 H-	10/05/21	10/05/21
Orthophosphate as P	1426-54-42	0.0040	U	mg/L	1	0.0040	0.010	EPA 365.1	09/30/21	09/30/21
pH for Color (pH units)		**7.2**		Color Units	1			SM 2120B-201	10/01/21	10/01/21
Phosphorus	7723-14-0	**0.048**		mg/L	1	0.010	0.015	EPA 365.4	09/30/21	10/05/21
Total Alkalinity as CaC03	471-34-1	**30.6**		mg/L	1	1.90	10.0	EPA 310.2	10/01/21	10/04/21
Total Kjeldahl Nitrogen		**1.6**		mg/L	1	0.037	0.050	EPA 351.2	09/30/21	10/05/21
Total Nitrogen	17778-88-0	**1.6**		mg/L	1	0.037	0.050	CALC	10/05/21	10/06/21
Total Suspended Solids		**3.4**		mg/L	1	2.5	2.5	M-2540D-201	10/05/21	10/06/21
Turbidity		**3.3**		NTU	1	1.0	1.0	EPA 180.1	10/01/21	10/01/21

Client ID # : **Blanks**
SRL (Lab) ID# : MB
Date Collected : NA
Lab FDOH Certification # : E83182

Analyte	CAS Number	Results	Flag	Units	Dilution Factor	MDL	PQL	Method	Date Prepared	Date Analyzed
Ammonia as N	7664-41-7	0.0098	U	mg/L	1	0.0098	0.020	EPA 350.1	09/30/21	10/01/21
Chlorophyll a	42617-16-3	0.50	U	mg/m3	1	0.50	0.50	A 10200 H-20	09/30/21	10/05/21
Color		5.0	U	Color Units	1	5.0	5.0	M 2120B-201	10/01/21	10/01/21
Nitrate/Nitrite as N		0.016	U	mg/L	1	0.016	0.050	4500NO3 H-	10/05/21	10/05/21
Orthophosphate as P	1426-54-42	0.0040	U	mg/L	1	0.0040	0.010	EPA 365.1	09/30/21	09/30/21
Phosphorus	7723-14-0	0.010	U	mg/L	1	0.010	0.015	EPA 365.4	09/30/21	10/05/21
Total Alkalinity as CaC03	471-34-1	1.90	U	mg/L	1	1.90	10.0	EPA 310.2	10/01/21	10/04/21
Total Kjeldahl Nitrogen		0.037	U	mg/L	1	0.037	0.050	EPA 351.2	09/30/21	10/05/21
Total Nitrogen	17778-88-0	0.037	U	mg/L	1	0.037	0.050	CALC	10/05/21	10/06/21
Total Suspended Solids		2.5	U	mg/L	1	2.5	2.5	M-2540D-201	10/05/21	10/06/21
Turbidity		1.0	U	NTU	1	1.0	1.0	EPA 180.1	10/01/21	10/01/21

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NELAP Certified
FDOH Cert # : E83484
SRL Lab Ref # : 21-09048
Received Date : 09/29/21

Lance Lumbard
Wood Env. & Infrastructure Solutions, Inc.
550 Northlake Blvd., Suite 1000
Altamonte Springs, FL. 32701 (407) 522-7570

Project Number/Project Name
600713x2.02.07
Lake Buchanan Surface Water
Lake Buchanan

Classical Chemistry Parameters

QAQC

	% Recovery LCS/MS/MS3/MSD	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Nitrate/Nitrite as N	103/99/105	84-116	84-116		2	0-10
Total Kjeldahl Nitrogen	100/101/102/101	90-110	90-110		0	0-10

Total Nitrogen (Calculated as: (Nitrogen, Total Kjeldahl) + (Nitrogen, Nitrate + Nitrite)

	% Recovery LCS/MS/MSD	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Orthophosphate as P	105/26/76	90-110	90-110	QM-07	3	0-10
Total Alkalinity as CaC03	101/113/116	90-110	90-110	QM-07	2	0-10

	% Recovery LCS/MS/MSD	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Phosphorus	102/103/96	90-110	90-110		6	0-10

	% Recovery LCS/MS1/MS2/MSD1	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Nitrogen, Ammonia (as N)	100/107/90/111	90-110	90-110	QM-07	4	0-10

	% Recovery LCS	Acceptable Limits
Total Suspended Solids	104	80-120

	Result	Source Result	RPD	Notes	RPD Limit
Total Suspended Solids (DUP-1)	140	140	2		0-20

	Result	Source Result	RPD	Notes	RPD Limit
Chlorophyll a (DUP-1)	8.2	8.7	6		0-25

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NELAP Certified
FDOH Cert # : E83484
SRL Lab Ref # : 21-09048
Received Date : 09/29/21

Lance Lumbard
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550 Northlake Blvd., Suite 1000
Altamonte Springs, FL. 32701 (407) 522-7570

Project Number/Project Name
600713x2.02.07
Lake Buchanan Surface Water
Lake Buchanan

Classical Chemistry Parameters

QAQC

	% Recovery LCS	Acceptable Limits
Color	100	90-110

	Result	Source Result	RPD	Notes	RPD Limit
Color (DUP-1)	30	30	0		0-10

	% Recovery LCS	Acceptable Limits
Turbidity	96	90-110

	Result	Source Result	RPD	RPD Limit
Turbidity (DUP-1)	3.2	3.3	3	0-10

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NELAP Certified
FDOH Cert # : E83484
SRL Lab Ref # : 21-09048
Received Date : 09/29/21

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Project Number/Project Name
600713x2.02.07
Lake Buchanan Surface Water
Lake Buchanan

DATA QUALIFIER CODES

Reporting Exceptions and Qualified Data

When quality control results are outside established control limits reanalysis, including re-extraction (if applicable), is preferred. If re-analysis is not viable or desirable, then results may be qualified. Sample results associated with quality control data that exceed acceptance criteria will be qualified with an appropriate comment.

D = Data reported from a dilution and or multiple dilutions.

I = Estimated Value, The reported value is between the Laboratory Method Detection Limit (**MDL**) and the Laboratory Practical Quantitation Limit (**PQL**)

J = Estimated Value

L = Off-Scale high; exceeds the linear range or highest calibration standard.

O = Sampled, but analysis lost or not performed

Q = Sample held beyond normal holding time
Q01 Analysis performed outside of method-specified holding time
Q02 Sample received outside of method-specified holding time

U = indicates the compound was analyzed for, but not detected. The numerical value preceding the "U" is the limit of detection for that compound based upon the dilution. **MEDF** = **M**atrix **E**ffected **D**ilution **F**actor.

V = Analyte was detected in both the sample and associated Laboratory Method Blank; Laboratory Contamination

Y = The analysis was from an unpreserved or improperly preserved sample. The data may not be accurate

Unless otherwise noted, ug/Kg and mg/Kg denote dry weight.

(SOILS) Actual Reporting Limit will depend on moisture content of sample and the amount of sample received.

QM-07 The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on acceptable LCS recovery.

Chain of Custody

2109048

1

Page 1 of 1

Project Manager:	Lance Lumbard
Company:	Wood Environment & Infrastructure Solutions, Inc.
Address:	550 Northlake Blvd., Suite 1000
City, State, Zip:	Altamonte Springs Florida 32701
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Southern Research Laboratories, Inc.
2251 Lynx Lane, Suite #1
Orlando, Florida 32804
Main (407) 522-7100 Fax: (407) 522-7043

Project Name: Buchanan Surface Lake ~~Orlando~~ water ~~Seepage~~ PO#C20906C001

Project Location: Lake Buchanan

Sampled by [Print Name(s)] / Affiliation: James S. Preston/Wood Katie Ballew / BFA

Sampler(s) Signature(s): James S. Preston, KatieBallew

Project Number: 60071312.02.07

REQUESTED DUE DATE:

Facility ID#:

Petroleum Restoration Program ___ yes ✓ no

	Sample Identification	Sampled Date:	Sampled Time:	Grab or Composite	Matrix: (see codes)	Total Number of Containers	Preservatives (see codes)	Analyses Requested: TSS	Chl-a	TN/low level TP/ NH3	low-level OP	Color	Alkalinity/Turbidity				
								I	I	S	I	I	I				
1	Buchanan Surface	9/29/21	1240	G	SW	6		✓	✓	✓	✓	✓	✓				21.09048-001

Shipment Method:		Relinquished by	Date:	Time:	Accepted by:	Date:	Time:
Out: / /	Via:	Helen Turner FEDEX KIT	19/2/20	14:35	James S. Preston	10/1/20	1435
Returned: / /	Via:	KatieBallew	9/29/21	1350	Helen Turner	9.29.21	13:50

Additional Comments:

Cooler No.(s) / Temperature(s) (°C): 446 X430 Clientcooler 1.5°C

Sampling Kit No.: 8776

Equipment ID No.:

Matrix Codes: A = Air GW = Groundwater SE = Sediment SO = Soil SW = Surface Water W = Water(Blanks) HW = Potential Haz Waste O = Other(Specify:)

Preservative Codes: H = Hydrochloric Acid & Ice I = Ice Only N = Nitrie Acid& Ice S = Sulfuric Acid & Ice X = Sodium Hydroxide & Ice O = Other(Specify)

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Client Name: **Wood Environment & Infrastructure Solutions, Inc.**	Date(s) Collected: 11/22/21
Contact Name: **Lance Lumbard**	Date Received: 11/22/21
Project Name: Lake Buchanan Surface Water	Time Received: 16:15
Project Number: 600713x2.01.07	Date Reported : 12/07/21
Phone Number: (407) 522-7570	Date Emailed : 12/07/21
Fax Number: (407) 522-7576	SRL Work Order # 21-11048

SRL WO #	Clients #	Matrix	Analysis Requested
2111048-001	Buchanan Surface	Liquid	TSS/Orthophosphate/Total Nitrogen/ Total Phosphorus/Ammonia/Color/ Alkalinity/Chlorophyll A/Turbidity

Sherri Payne
Vice President & Quality Assurance Officer
Southern Research Laboratories, Inc.

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NELAP Certified
FDOH Cert # : E83484
SRL Lab Ref # : 21-11048
Received Date : 11/22/21

Lance Lumbard
Wood Env. & Infrastructure Solutions, Inc.
550 Northlake Blvd., Suite 1000
Altamonte Springs, FL. 32701 (407) 522-7570

Project Number/Project Name
600713x2.01.07
Lake Buchanan Surface Water
Lake Buchanan

Classical Chemistry Parameters

Client ID # : **Buchanan Surfac**
SRL (Lab) ID# : 2111048-001
Date Collected : 11/22/21
Lab FDOH Certification # : E83182

Analyte	CAS Number	Results	Flag	Units	Dilution Factor	MDL	PQL	Method	Date Prepared	Date Analyzed
Ammonia as N	7664-41-7	**0.63**		mg/L	1	0.0098	0.020	EPA 350.1	11/29/21	12/02/21
Chlorophyll a	42617-16-3	**27**		mg/m3	1	0.50	0.50	M 10200 H-20	11/23/21	11/29/21
Color		**25**		Color Units	1	5.0	5.0	M 2120B-201	11/24/21	11/24/21
Nitrate/Nitrite as N		**0.11**		mg/L	1	0.016	0.050	4500NO3 H-	11/23/21	11/24/21
Orthophosphate as P	1426-54-42	**0.041**		mg/L	1	0.0040	0.010	EPA 365.1	11/23/21	11/23/21
pH for Color (pH units)		**6.6**		Color Units	1			SM 2120B-201	11/24/21	11/24/21
Phosphorus	7723-14-0	**0.20**		mg/L	1	0.010	0.015	EPA 365.4	11/23/21	11/29/21
Total Alkalinity as CaC03	471-34-1	**37.4**		mg/L	1	1.90	10.0	EPA 310.2	11/29/21	11/30/21
Total Kjeldahl Nitrogen		**1.6**		mg/L	1	0.037	0.050	EPA 351.2	11/23/21	11/29/21
Total Nitrogen	17778-88-0	**1.7**		mg/L	1	0.037	0.050	CALC	11/23/21	11/29/21
Total Suspended Solids		**4.6**		mg/L	1	2.5	2.5	M-2540D-201	11/29/21	12/02/21
Turbidity		**2.8**		NTU	1	1.0	1.0	EPA 180.1	11/24/21	11/24/21

Client ID # : **Blanks**
SRL (Lab) ID# : MB
Date Collected : NA
Lab FDOH Certification # : E83182

Analyte	CAS Number	Results	Flag	Units	Dilution Factor	MDL	PQL	Method	Date Prepared	Date Analyzed
Ammonia as N	7664-41-7	0.0098	U	mg/L	1	0.0098	0.020	EPA 350.1	11/29/21	12/02/21
Chlorophyll a	42617-16-3	0.50	U	mg/m3	1	0.50	0.50	M 10200 H-20	11/23/21	11/29/21
Color		5.0	U	Color Units	1	5.0	5.0	M 2120B-201	11/24/21	11/24/21
Nitrate/Nitrite as N		0.016	U	mg/L	1	0.016	0.050	4500NO3 H-	11/23/21	11/24/21
Orthophosphate as P	1426-54-42	0.0040	U	mg/L	1	0.0040	0.010	EPA 365.1	11/23/21	11/23/21
Phosphorus	7723-14-0	0.010	U	mg/L	1	0.010	0.015	EPA 365.4	11/23/21	11/29/21
Total Alkalinity as CaC03	471-34-1	1.90	U	mg/L	1	1.90	10.0	EPA 310.2	11/29/21	11/30/21
Total Kjeldahl Nitrogen		0.037	U	mg/L	1	0.037	0.050	EPA 351.2	11/23/21	11/29/21
Total Nitrogen	17778-88-0	0.037	U	mg/L	1	0.037	0.050	CALC	11/23/21	11/29/21
Total Suspended Solids		2.5	U	mg/L	1	2.5	2.5	M-2540D-201	11/29/21	12/02/21
Turbidity		1.0	U	NTU	1	1.0	1.0	EPA 180.1	11/24/21	11/24/21

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NELAP Certified
FDOH Cert # : E83484
SRL Lab Ref # : 21-11048
Received Date : 11/22/21

Lance Lumbard
Wood Env. & Infrastructure Solutions, Inc.
550 Northlake Blvd., Suite 1000
Altamonte Springs, FL. 32701 (407) 522-7570

Project Number/Project Name
600713x2.01.07
Lake Buchanan Surface Water
Lake Buchanan

Classical Chemistry Parameters

QAQC

	% Recovery LCS/MS/MS3/MSD	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Nitrate/Nitrite as N	108/32/48	84-116	84-116	QM-07	0.4	0-10
Total Kjeldahl Nitrogen	97/108/105/109	90-110	90-110		0.3	0-10

Total Nitrogen (Calculated as: (Nitrogen, Total Kjeldahl) + (Nitrogen, Nitrate + Nitrite)

	% Recovery LCS/MS/MSD	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Orthophosphate as P	100/93/94	90-110	90-110		1	0-10
Total Alkalinity as CaC03	92/97/100	90-110	90-110		2	0-10

	% Recovery LCS/MS1/MS2/MSD1	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Phosphorus	100/88/93/84	90-110	90-110	QM-07	3	0-10

	% Recovery LCS/MS1/MS2/MSD1	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Nitrogen, Ammonia (as N)	97/170/NR/68	90-110	90-110	QM-07	4	0-10

	% Recovery LCS	Acceptable Limits
Total Suspended Solids	104	80-120

	Result	Source Result	RPD	Notes	RPD Limit
Total Suspended Solids (DUP-1)	4.0	5.0	22	QM-12	0-20

	Result	Source Result	RPD	Notes	RPD Limit
Chlorophyll a (DUP-1)	27	27	0		0-25

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NELAP Certified
FDOH Cert # : E83484
SRL Lab Ref # : 21-11048
Received Date : 11/22/21

Lance Lumbard
Wood Env. & Infrastructure Solutions, Inc.
550 Northlake Blvd., Suite 1000
Altamonte Springs, FL. 32701 (407) 522-7570

Project Number/Project Name
600713x2.01.07
Lake Buchanan Surface Water
Lake Buchanan

Classical Chemistry Parameters

QAQC

	% Recovery LCS	Acceptable Limits
Color	100	90-110

	Result	Source Result	RPD	Notes	RPD Limit
Color (DUP-1)	25	25	0		0-10

	% Recovery LCS	Acceptable Limits
Turbidity	99	90-110

	Result	Source Result	RPD	RPD Limit
Turbidity (DUP-1)	2.6	2.8	7	0-10

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SRL Lab Ref # : 21-11048
Received Date : 11/22/21

Lance Lumbard
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550 Northlake Blvd., Suite 1000
Altamonte Springs, FL. 32701 (407) 522-7570

Project Number/Project Name
600713x2.01.07
Lake Buchanan Surface Water
Lake Buchanan

DATA QUALIFIER CODES

Reporting Exceptions and Qualified Data

When quality control results are outside established control limits reanalysis, including re-extraction (if applicable), is preferred. If re-analysis is not viable or desirable, then results may be qualified. Sample results associated with quality control data that exceed acceptance criteria will be qualified with an appropriate comment.

D = Data reported from a dilution and or multiple dilutions.

I = Estimated Value, The reported value is between the Laboratory Method Detection Limit (**MDL**) and the Laboratory Practical Quantitation Limit (**PQL**)

J = Estimated Value

L = Off-Scale high; exceeds the linear range or highest calibration standard.

O = Sampled, but analysis lost or not performed

Q = Sample held beyond normal holding time
Q01 Analysis performed outside of method-specified holding time
Q02 Sample received outside of method-specified holding time

U = indicates the compound was analyzed for, but not detected. The numerical value preceding the "U" is the limit of detection for that compound based upon the dilution. **MEDF** = **M**atrix **E**ffected **D**ilution **F**actor.

V = Analyte was detected in both the sample and associated Laboratory Method Blank; Laboratory Contamination

Y = The analysis was from an unpreserved or improperly preserved sample. The data may not be accurate

Unless otherwise noted, ug/Kg and mg/Kg denote dry weight.

(SOILS) Actual Reporting Limit will depend on moisture content of sample and the amount of sample received.

QM-07 The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on acceptable LCS recovery.

QM-12 Precision between duplicate samples was outside acceptance limits

Chain of Custody

2111048
1

Project Manager:	**Lance Lumbard**
Company:	**WOOD**
Address:	**550 Northlake Blvd. Suite 1000**
City, State, Zip:	**Altamonte Springs, Fl 32701**
Phone:	407-592-3235
Fax:	

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2251 Lynx Lane, Suite #1
Orlando, Florida 32804
(407) 522-7100
Toll Free 1 (888) 420-TEST
Fax: (407) 522-7043

Page 1 of 1

Project Name:	Lake Buchanan Surface Water
PO#	C012610100
Project Location:	Orange County
	Lake Buchanana

Sampled by [Print Name(s)] / Affiliation: James S. Preston Wood; Katie Ballew / BFA

Sampler(s) Signature(s): James S. Preston

Project Number: 6007163X2.01.07

REQUESTED DUE DATE:

Sampling QAP No.:

Approval Date:

Comments:

	Sample Identification	Sampled Date:	Sampled Time:	Grab or Composite	Matrix: (see codes)	Total Number of Containers	Preservatives (see codes)									Analyses Requested								
							S	I	I	I	I	I				TN, NH_3 Low Level TP	Color	Chl-A	Alkalinity, Turbidity	Low Level OP	TSS			
1	Buchanan Surface	11/22/21	1455	G	SW	6										✓	✓	✓	✓	✓	✓			
2																								
3																								
4																								
5																								
6																								
7																								
8																								
9																								
10																								

2111048-001

Shipment Method:		Relinquished by:	Date:	Time:	Accepted by:	Date:	Time:
Out: / /	Via:				Helen Turner	11-22-21	16:15
Returned: / /	Via:		11/22/21	1615			

Additional Comments:

Cooler No.(s) / Temperature(s) (°C): Client Cooler 3.1 UC

Sampling Kit No.: Stork

Equipment ID No.:

Matrix Codes: A = Air GW = Groundwater SE = Sediment SO = Soil SW = Surface Water W = Water(Blanks) HW = Potential Haz Waste O = Other(Specify:_____)

Preservative Codes: H = Hydrochloric Acid & Ice I = Ice Only N = Nitric Acid & Ice S = Sulfuric Acid & Ice X = Sodium Hydroxide & Ice O = Other(Specify)

Southern Research Laboratories, Inc.

2251 Lynx Lane, Suite 1
Orlando, Florida 32804
(407) 522-7100 Fax (407) 522-7043
Toll Free 1 (888) 420-Test

Thank you **Lance Lumbard** for the opportunity to be of service to you and your company, we **S**incerely **A**ppreciate **Y**our **B**usiness. SRL certifies these **Laboratory Results** were produced in accordance with NELAC Standards. Hold times and preservation requirements were met for all analytes unless specifically noted in the report. Results relate only to the samples as received.

Client Name: **Wood Environment & Infrastructure Solutions, Inc.**	Date(s) Collected: 02/01/22
Contact Name: **Lance Lumbard**	Date Received: 02/01/22
Project Name: OC Lake Buchanan Surface Water	Time Received: 12:50
Project Number: 6007163X2.01.07	Date Reported : 02/23/22
Phone Number: (407) 522-7570	Date Emailed : 02/23/22
Fax Number: (407) 522-7576	SRL Work Order # 22-02001

SRL WO #	Clients #	Matrix	Analysis Requested
2202001-001	Buchanan Surface	Liquid	TSS/Orthophosphate/Total Nitrogen/ Total Phosphorus/Ammonia/Color/ Alkalinity/Chlorophyll A/Turbidity

Sherri Payne
Vice President & Quality Assurance Officer
Southern Research Laboratories, Inc.

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an MBE Environmental Laboratory
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Orlando, Florida 32804 (407) 522-7100

NELAP Certified
FDOH Cert # : E83484
SRL Lab Ref # : 22-02001
Received Date : 02/01/22

Lance Lumbard
Wood Env. & Infrastructure Solutions, Inc.
550 Northlake Blvd., Suite 1000
Altamonte Springs, FL. 32701 (407) 522-7570

Project Number/Project Name
6007163X2.01.07
Lake Buchanan Surface Water
Lake Orlando

Classical Chemistry Parameters

Client ID # : **Buchanan Surfac**
SRL (Lab) ID# : 2202001-001
Date Collected : 02/01/22
Lab FDOH Certification # : E83079

Analyte	CAS Number	Results	Flag	Units	Dilution Factor	MDL	PQL	Method	Date Prepared	Date Analyzed
Ammonia as N	7664-41-7	0.035	U	mg/L	1	0.035	0.050	EPA 350.1	02/08/22	02/08/22
Chlorophyll a	42617-16-3	**19.9**		mg/m3	1	1.0	5.0	M 10200 H-20	02/03/22	02/07/22
Color		**45.0**		Color Units	1	5.0	5.0	SM2120B-201	02/03/22	02/03/22
Nitrate/Nitrite as N		**0.31**		mg/L	1	0.015	0.050	EPA 353.2	02/03/22	02/03/22
Orthophosphate as P	1426-54-42	**0.086**		mg/L	1	0.0038	0.0040	EPA 365.1	02/03/22	02/03/22
pH for Color (pH units)		**8.3**		Color Units	1			SM 2120B-201	02/03/22	02/03/22
Phosphorus	7723-14-0	**0.15**		mg/L	1	0.0028	0.0040	EPA 365.3	02/11/22	02/14/22
Total Alkalinity as CaC03	471-34-1	**49.8**		mg/L	1	5.0	5.0	EPA 310.2	02/03/22	02/03/22
Total Kjeldahl Nitrogen	7727-37-9	**1.2**		mg/L	1	0.20	0.50	EPA 351.2	02/09/22	02/10/22
Total Nitrogen	17778-88-0	**1.5**		mg/L	1	0.086	0.50	CALC	02/10/22	02/10/22
Total Suspended Solids		**5.7**		mg/L	1	1.0	1.0	M-2540D-201	02/07/22	02/07/22
Turbidity		**0.30**		NTU	1	0.20	0.20	EPA 180.1	02/03/22	02/03/22

Client ID # : **Blanks**
SRL (Lab) ID# : MB
Date Collected : NA
Lab FDOH Certification # : E83079

Analyte	CAS Number	Results	Flag	Units	Dilution Factor	MDL	PQL	Method	Date Prepared	Date Analyzed
Ammonia as N	7664-41-7	0.035	U	mg/L	1	0.035	0.050	EPA 350.1	02/08/22	02/08/22
Chlorophyll a	42617-16-3	1.0	U	mg/m3	1	1.0	5.0	M 10200 H-20	02/03/22	02/07/22
Color		5.0	U	Color Units	1	5.0	5.0	M 2120B-201	02/03/22	02/03/22
Nitrate/Nitrite as N		0.015	U	mg/L	1	0.015	0.050	4500NO3 H-	02/03/22	02/03/22
Orthophosphate as P	1426-54-42	0.0038	U	mg/L	1	0.0038	0.0040	EPA 365.1	02/03/22	02/03/22
Phosphorus		0.0028	U	mg/L	1	0.0028	0.0040	EPA 365.4	02/11/22	02/14/22
Total Alkalinity as CaC03	7723-14-0	5.0	U	mg/L	1	5.0	5.0	EPA 310.2	02/03/22	02/03/22
Total Kjeldahl Nitrogen	471-34-1	0.20	U	mg/L	1	0.20	0.50	EPA 351.2	02/09/22	02/10/22
Total Nitrogen	7727-37-9	0.20	U	mg/L	1	0.20	0.50	CALC	02/10/22	02/10/22
Total Suspended Solids	17778-88-0	1.0	U	mg/L	1	1.0	1.0	M-2540D-201	02/07/22	02/07/22

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Orlando, Florida 32804 (407) 522-7100

NELAP Certified
FDOH Cert # : E83484
SRL Lab Ref # : 22-02001
Received Date : 02/01/22

Lance Lumbard
Wood Env. & Infrastructure Solutions, Inc.
550 Northlake Blvd., Suite 1000
Altamonte Springs, FL. 32701 (407) 522-7570

Project Number/Project Name
6007163X2.01.07
Lake Buchanan Surface Water
Lake Orlando

Classical Chemistry Parameters

QAQC

	% Recovery LCS/MS/MSD	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Nitrate/Nitrite as N	104/95/95	90-110	90-110		0	0-20
Total Kjeldahl Nitrogen	97/106/105	90-110	90-110		1	0-20

Total Nitrogen (Calculated as: (Nitrogen, Total Kjeldahl) + (Nitrogen, Nitrate + Nitrite)

	% Recovery LCS/MS/MSD	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Orthophosphate as P	94/97/97	90-110	90-110		0	0-20

	% Recovery LCS/MS/MSD	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Phosphorus	110/110/103	90-110	90-110		2	0-20

	% Recovery LCS/MS/MSD	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Nitrogen, Ammonia (as N)	104/105/105	90-110	90-110		0	0-20

	% Recovery LCS	Acceptable Limits
Total Suspended Solids	96	90-110

	Result	Source Result	RPD	Notes	RPD Limit
Total Suspended Solids (DUP-1)	97.0	94.0	3		0-10

	Result	Source Result	RPD	Notes	RPD Limit
Chlorophyll a (DUP-1)	102	102	0		0-25

	% Recovery LCS/LCSD	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Total Alkalinity as CaC03	92/104	90-110	90-110		4	0-20

	% Recovery LCS	Acceptable Limits
Turbidity	90	90-110

	Result	Source Result	RPD	Notes	RPD Limit
Turbidity (DUP-1)	1.4	1.4	0		0-20

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SRL Lab Ref # : 22-02001
Received Date : 02/01/22

Lance Lumbard
Wood Env. & Infrastructure Solutions, Inc.
550 Northlake Blvd., Suite 1000
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Project Number/Project Name
6007163X2.01.07
Lake Buchanan Surface Water
Lake Orlando

Classical Chemistry Parameters

QAQC

	% Recovery LCS	Acceptable Limits
Color	100	90-110

	Result	Source Result	RPD	Notes	RPD Limit
Color (DUP-1)	45.0	45.0	0		0-20

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Received Date : 02/01/22

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Project Number/Project Name
6007163X2.01.07
Lake Buchanan Surface Water
Lake Orlando

DATA QUALIFIER CODES

Reporting Exceptions and Qualified Data

When quality control results are outside established control limits reanalysis, including re-extraction (if applicable), is preferred. If re-analysis is not viable or desirable, then results may be qualified. Sample results associated with quality control data that exceed acceptance criteria will be qualified with an appropriate comment.

D = Data reported from a dilution and or multiple dilutions.

I = Estimated Value, The reported value is between the Laboratory Method Detection Limit (**MDL**) and the Laboratory Practical Quantitation Limit (**PQL**)

J = Estimated Value

L = Off-Scale high; exceeds the linear range or highest calibration standard.

O = Sampled, but analysis lost or not performed

Q = Sample held beyond normal holding time
Q01 Analysis performed outside of method-specified holding time
Q02 Sample received outside of method-specified holding time

U = indicates the compound was analyzed for, but not detected. The numerical value preceding the "U" is the limit of detection for that compound based upon the dilution. **MEDF** = **M**atrix **E**ffected **D**ilution **F**actor.

V = Analyte was detected in both the sample and associated Laboratory Method Blank; Laboratory Contamination

Y = The analysis was from an unpreserved or improperly preserved sample. The data may not be accurate

Unless otherwise noted, ug/Kg and mg/Kg denote dry weight.

(SOILS) Actual Reporting Limit will depend on moisture content of sample and the amount of sample received.

Chain of Custody

2202001*

Project Manager:	**Lance Lumbard**
Company:	**WOOD**
Address:	**550 Northlake Blvd. Suite 1000**
City, State, Zip:	**Altamonte Springs, Fl 32701**
Phone: 407-592-3235	Fax:

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Fax: (407) 522-7043

Page 1 of 1

Project Name:	Lake Buchanan Surface Water
PO#	C012610100
Project Location:	Orange County
	Lake Buchanana

Sampled by [Print Name(s)] / Affiliation: James S. Preston (Wood) Katie Ballew/BFA

Sampler(s) Signature(s): James S. Preston

Project Number: 6007163X2.01.07

REQUESTED DUE DATE:

Sampling QAP No.:

Approval Date:

	Sample Identification	Sampled Date:	Sampled Time:	Grab or Composite	Matrix: (see codes)	Total Number of Containers	Preservatives (see codes)									Analyses Requested									Comments:
							S	I	I	I	I	I				TN; NH_3 Low Level TP	Color	Chl-A	Alkalinity; Turbidity	Low Level OP	TSS				
1	Buchanan Surface	2/1/22	1120	G	SW	6										✓	✓	✓	✓	✓	✓				2202001-001
2																									
3																									
4																									
5																									
6																									
7																									
8																									
9																									
10																									

Shipment Method:		Relinquished by:	Date:	Time:	Accepted by:	Date:	Time:
Out: / /	Via:		2/1/22	1250		2/1/22	12:54
Returned: / /	Via:						

Additional Comments:

Cooler No.(s) / Temperature(s) (°C): 424 1.5

Sampling Kit No.: 8910

Equipment ID No.:

Matrix Codes: A = Air GW = Groundwater SE = Sediment SO = Soil SW = Surface Water W = Water(Blanks) HW = Potential Haz Waste O = Other(Specify:)

Preservative Codes: H = Hydrochloric Acid & Ice I = Ice Only N = Nitric Acid & Ice S = Sulfuric Acid & Ice X = Sodium Hydroxide & Ice O = Other(Specify)

Southern Research Laboratories, Inc.

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Thank you **Lance Lumbard** for the opportunity to be of service to you and your company, we **S**incerely **A**ppreciate **Y**our **B**usiness. SRL certifies these **Laboratory Results** were produced in accordance with NELAC Standards. Hold times and preservation requirements were met for all analytes unless specifically noted in the report. Results relate only to the samples as received.

Client Name: **Wood Environment & Infrastructure Solutions, Inc.**	Date(s) Collected: 06/28/21
Contact Name: **Lance Lumbard**	Date Received: 06/28/21
Project Name: Lake Buchanan Surface Water	Time Received: 13:25
Project Number: 600713x2	Date Reported : 07/12/21
Phone Number: (407) 522-7570	Date Emailed : 07/12/21
Fax Number: (407) 522-7576	SRL Work Order # 21-06036

SRL WO #	Clients #	Matrix	Analysis Requested
2106036-001	LBSM1	Liquid	TSS/Total Nitrogen/Ammonia/ Total Phosphorus/Orthophosphate
2106036-002	LBSM2	Liquid	TSS/Total Nitrogen/Ammonia/ Total Phosphorus/Orthophosphate
2106036-003	LBSM3	Liquid	TSS/Total Nitrogen/Ammonia/ Total Phosphorus/Orthophosphate

Sherri Payne
Vice President & Quality Assurance Officer
Southern Research Laboratories, Inc.

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NELAP Certified
FDOH Cert # : E83484
SRL Lab Ref # : 21-06036
Received Date : 06/28/21

Lance Lumbard
Wood Env. & Infrastructure Solutions, Inc.
550 Northlake Blvd., Suite 1000
Altamonte Springs, FL. 32701 (407) 522-7570

Project Number/Project Name
600713x2
Lake Buchanan Seepage Meters
Lake Buchanan

Classical Chemistry Parameters

Client ID # : **LBSM1**
SRL (Lab) ID# : 2106036-001
Date Collected : 06/28/21
Lab FDOH Certification # : E83182

Analtye	CAS Number	Results	Flag	Units	Dilution Factor	MDL	PQL	Method	Date Prepared	Date Analyzed
Ammonia as N	7664-41-7	**0.16**		mg/L	1	0.0098	0.020	EPA 350.1	06/29/21	06/30/21
Nitrate/Nitrite as N		0.016	U	mg/L	1	0.016	0.050	4500NO3 H-	07/01/21	07/02/21
Orthophosphate as P	1426-54-42	**0.012**		mg/L	1	0.0040	0.010	EPA 365.1	06/29/21	06/29/21
Phosphorus	7723-14-0	**0.092**		mg/L	1	0.010	0.015	EPA 365.4	06/29/21	07/01/21
Total Kjeldahl Nitrogen		**0.90**		mg/L	1	0.037	0.050	EPA 351.2	06/29/21	07/01/21
Total Nitrogen	17778-88-0	**0.90**		mg/L	1	0.037	0.050	CALC	07/01/21	07/02/21
Total Suspended Solids		**5.4**		mg/L	1	2.5	2.5	M-2540D-201	07/02/21	07/06/21

Client ID # : **LBSM2**
SRL (Lab) ID# : 2106036-002
Date Collected : 06/28/21
Lab FDOH Certification # : E83182

Analtye	CAS Number	Results	Flag	Units	Dilution Factor	MDL	PQL	Method	Date Prepared	Date Analyzed
Ammonia as N	7664-41-7	**4.4**		mg/L	5	0.049	0.10	EPA 350.1	06/29/21	06/30/21
Nitrate/Nitrite as N		**0.60**		mg/L	1	0.016	0.050	4500NO3 H-	07/01/21	07/02/21
Orthophosphate as P	1426-54-42	0.0040	U	mg/L	1	0.0040	0.010	EPA 365.1	06/29/21	06/29/21
Phosphorus	7723-14-0	**0.41**		mg/L	1	0.010	0.015	EPA 365.4	06/29/21	07/01/21
Total Kjeldahl Nitrogen		**7.5**		mg/L	2	0.074	0.10	EPA 351.2	06/29/21	07/01/21
Total Nitrogen	17778-88-0	**8.1**		mg/L	2	0.074	0.10	CALC	07/01/21	07/02/21
Total Suspended Solids		**36**		mg/L	1	2.5	2.5	M-2540D-201	07/02/21	07/06/21

Client ID # : **LBSM3**
SRL (Lab) ID# : 2106036-003
Date Collected : 06/28/21
Lab FDOH Certification # : E83182

Analtye	CAS Number	Results	Flag	Units	Dilution Factor	MDL	PQL	Method	Date Prepared	Date Analyzed
Ammonia as N	7664-41-7	**1.4**		mg/L	1	0.0098	0.020	EPA 350.1	06/29/21	06/30/21
Nitrate/Nitrite as N		**0.18**		mg/L	1	0.016	0.050	4500NO3 H-	07/01/21	07/02/21
Orthophosphate as P	1426-54-42	**0.16**		mg/L	1	0.0040	0.010	EPA 365.1	06/29/21	06/29/21
Phosphorus	7723-14-0	**0.59**		mg/L	1	0.010	0.015	EPA 365.4	06/29/21	07/01/21
Total Kjeldahl Nitrogen		**4.6**		mg/L	1	0.037	0.050	EPA 351.2	06/29/21	07/01/21
Total Nitrogen	17778-88-0	**4.8**		mg/L	1	0.037	0.050	CALC	07/01/21	07/02/21
Total Suspended Solids		**26**		mg/L	1	2.5	2.5	M-2540D-201	07/02/21	07/06/21

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NELAP Certified
FDOH Cert # : E83484
SRL Lab Ref # : 21-06036
Received Date : 06/28/21

Lance Lumbard
Wood Env. & Infrastructure Solutions, Inc.
550 Northlake Blvd., Suite 1000
Altamonte Springs, FL. 32701 (407) 522-7570

Project Number/Project Name
600713x2
Lake Buchanan Seepage Meters
Lake Buchanan

Classical Chemistry Parameters

Client ID # : **Blanks**
SRL (Lab) ID# : MB
Date Collected : NA
Lab FDOH Certification # : E83182

Analtye	CAS Number	Results	Flag	Units	Dilution Factor	MDL	PQL	Method	Date Prepared	Date Analyzed
Ammonia as N	7664-41-7	0.0098	U	mg/L	1	0.0098	0.020	EPA 350.1	06/29/21	06/30/21
Nitrate/Nitrite as N		0.016	U	mg/L	1	0.016	0.050	4500NO3 H-	07/01/21	07/02/21
Nitrate/Nitrite as N		0.016	U	mg/L	1	0.016	0.050	4500NO3 H-	07/01/21	07/02/21
Orthophosphate as P	1426-54-42	0.0040	U	mg/L	1	0.0040	0.010	EPA 365.1	06/29/21	06/29/21
Phosphorus	7723-14-0	0.010	U	mg/L	1	0.010	0.015	EPA 365.4	06/29/21	07/01/21
Total Kjeldahl Nitrogen		0.037	U	mg/L	1	0.037	0.050	EPA 351.2	06/29/21	07/01/21
Total Nitrogen	17778-88-0	0.037	U	mg/L	1	0.037	0.050	CALC	07/01/21	07/02/21
Total Suspended Solids		2.5	U	mg/L	1	2.5	2.5	M-2540D-201	07/02/21	07/06/21

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NELAP Certified
FDOH Cert # : E83484
SRL Lab Ref # : 21-06036
Received Date : 06/28/21

Lance Lumbard
Wood Env. & Infrastructure Solutions, Inc.
550 Northlake Blvd., Suite 1000
Altamonte Springs, FL. 32701 (407) 522-7570

Project Number/Project Name
600713x2
Lake Buchanan Seepage Meters
Lake Buchanan

Classical Chemistry Parameters

QAQC

	% Recovery LCS/MS/MS2/MSD	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Nitrate/Nitrite as N	93/96/100	84-116	84-116		3	0-10
Nitrate/Nitrite as N	99/97/99	84-116	84-116		2	0-10
Total Kjeldahl Nitrogen	106/64/107/84	90-110	90-110	QM-07	3	0-10

Total Nitrogen (Calculated as: (Nitrogen, Total Kjeldahl) + (Nitrogen, Nitrate + Nitrite)

	% Recovery LCS/MS/MSD	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Orthophosphate as P	97/94/91	90-110	90-110		3	0-10

	% Recovery LCS/MS/MSD	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Phosphorus	108/103/104	90-110	90-110		0.7	0-10

	% Recovery LCS/MS1/MS2/MSD1	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Nitrogen, Ammonia (as N)	104/103/99/106	90-110	90-110		3	0-10

	% Recovery LCS	Acceptable Limits
Total Suspended Solids	89	80-120

	Result	Source Result	RPD	Notes	RPD Limit
Total Suspended Solids (DUP-1)	12	13.0	8	LP-02	0-20

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NELAP Certified
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SRL Lab Ref # : 21-06036
Received Date : 06/28/21

Lance Lumbard
Wood Env. & Infrastructure Solutions, Inc.
550 Northlake Blvd., Suite 1000
Altamonte Springs, FL. 32701 (407) 522-7570

Project Number/Project Name
600713x2
Lake Buchanan Seepage Meters
Lake Buchanan

DATA QUALIFIER CODES

Reporting Exceptions and Qualified Data

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I = Estimated Value, The reported value is between the Laboratory Method Detection Limit (**MDL**) and the Laboratory Practical Quantitation Limit (**PQL**)

J = Estimated Value

L = Off-Scale high; exceeds the linear range or highest calibration standard.

O = Sampled, but analysis lost or not performed

Q = Sample held beyond normal holding time
Q01 Analysis performed outside of method-specified holding time
Q02 Sample received outside of method-specified holding time

U = indicates the compound was analyzed for, but not detected. The numerical value preceding the "U" is the limit of detection for that compound based upon the dilution. **MEDF** = **M**atrix **E**ffected **D**ilution **F**actor.

V = Analyte was detected in both the sample and associated Laboratory Method Blank; Laboratory Contamination

Y = The analysis was from an unpreserved or improperly preserved sample. The data may not be accurate

Unless otherwise noted, ug/Kg and mg/Kg denote dry weight.

(SOILS) Actual Reporting Limit will depend on moisture content of sample and the amount of sample received.

QM-07 The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on acceptable LCS recovery.

LP-02 Filtered residue did not meet 2.5-200mg range

APPENDIX F

Depth Profile Data

Date	Depth (m)	Event	Temp. (C°)	DO (%)	DO (mg/L)	SC (µS/cm)	pH (SU)	ORP (mV)	Secchi Disk (m)	Total Depth (m)	Notes
24-Mar-21	0.50	1	21.2	110	9.8	144	8.1	190	0.76	4.86	
24-Mar-21	1.00	1	21	107	9.6	144	8.1	195	0.76	4.86	
24-Mar-21	1.50	1	20.4	98.5	8.9	144	8.0	205	0.76	4.86	
24-Mar-21	2.00	1	20.2	87.6	7.9	144	7.8	218	0.76	4.86	
24-Mar-21	2.50	1	20	72.4	6.6	144	7.6	227	0.76	4.86	
24-Mar-21	3.00	1	19.9	70.7	6.4	144	7.5	232	0.76	4.86	
24-Mar-21	3.50	1	19.8	60.5	5.5	144	7.4	237	0.76	4.86	
24-Mar-21	4.00	1	19.7	38.2	3.5	145	7.2	242	0.76	4.86	
24-Mar-21	4.50	1	19.2	3.9	0.4	150	6.8	-44	0.76	4.86	
28-Jun-21	0.50	2	29.1	89.8	6.9	136	7.3	306	1.3	4.87	
28-Jun-21	1.00	2	28.9	90.3	7	136	7	330	1.3	4.87	
28-Jun-21	1.50	2	28.7	85.5	6.6	136	7	337	1.3	4.87	
28-Jun-21	2.00	2	28.4	75.2	5.8	136	6.9	346	1.3	4.87	
28-Jun-21	2.50	2	28.3	50.3	3.9	136	6.8	355	1.3	4.87	
28-Jun-21	3.00	2	28.1	33.9	2.7	136	6.7	358	1.3	4.87	
28-Jun-21	3.50	2	27.9	5.9	0.5	135	6.6	350	1.3	4.87	
28-Jun-21	4.00	2	27.1	4.1	0.3	153	6.5	333	1.3	4.87	
28-Jun-21	4.50	2	26.4	3.6	0.3	174	6.3	208	1.3	4.87	
2-Aug-21	0.50	3	31	66.3	4.9	138	7.7	310	1.4	5	
2-Aug-21	1.00	3	30.9	65.6	4.9	138	7.7	319	1.4	5	
2-Aug-21	1.50	3	30.9	65.4	4.9	138	7.6	325	1.4	5	
2-Aug-21	2.00	3	30.6	61.3	4.6	138	7.6	330	1.4	5	
2-Aug-21	2.50	3	30.6	57.8	4.3	138	7.5	334	1.4	5	
2-Aug-21	3.00	3	30.5	56.2	4.2	138	7.4	339	1.4	5	
2-Aug-21	3.50	3	30.5	55.6	4.2	138	7.4	340	1.4	5	

Date	Depth (m)	Event	Temp. (C°)	DO (%)	DO (mg/L)	SC (µS/cm)	pH (SU)	ORP (mV)	Secchi Disk (m)	Total Depth (m)	Notes
2-Aug-21	4.00	3	30.5	53.8	4	138	7.4	341	1.4	5	
2-Aug-21	4.50	3	30.5	53.3	4	138	7.3	344	1.4	5	
2-Aug-21	5.00	3	30.3	26.2	1.9	138	7.2	350	1.4	5	
29-Sep-21	0.50	4	29.3	72.6	5.5	140	8.4	255	0.9	5.1	pH probe failed CCV, J Qualifier (Estimated) for pH. Due to pH probe fail, ORP may also be J Qualifier
29-Sep-21	1.00	4	28.5	67.5	5.2	140	7.9	330	0.9	5.1	pH probe failed CCV, J Qualifier (Estimated) for pH. Due to pH probe fail, ORP may also be J Qualifier
29-Sep-21	1.50	4	28.3	65.4	5.1	140	7.9	335	0.9	5.1	pH probe failed CCV, J Qualifier (Estimated) for pH. Due to pH probe fail, ORP may also be J Qualifier
29-Sep-21	2.00	4	28.2	48.7	3.8	140	7.8	345	0.9	5.1	pH probe failed CCV, J Qualifier (Estimated) for pH. Due to pH probe fail, ORP may also be J Qualifier
29-Sep-21	2.50	4	28.2	40.2	3.2	141	7.6	350	0.9	5.1	pH probe failed CCV, J Qualifier (Estimated) for pH. Due to pH probe fail, ORP may also be J Qualifier
29-Sep-21	3.00	4	28.1	40.7	3.2	141	7.6	352	0.9	5.1	pH probe failed CCV, J Qualifier (Estimated) for pH. Due to pH probe fail, ORP may also be J Qualifier
29-Sep-21	3.50	4	28.1	44.8	3.5	140	7.6	353	0.9	5.1	pH probe failed CCV, J Qualifier (Estimated) for pH. Due to pH probe fail, ORP may also be J Qualifier
29-Sep-21	4.00	4	28.1	41.8	3.3	141	7.6	354	0.9	5.1	pH probe failed CCV, J Qualifier (Estimated) for pH. Due to pH probe fail, ORP may also be J Qualifier
29-Sep-21	4.50	4	27.9	28.3	2.2	153	7.6	354	0.9	5.1	pH probe failed CCV, J Qualifier (Estimated) for pH. Due to pH probe fail, ORP may also be J Qualifier
29-Sep-21	5.00	4	27.3	4	0.3	200	7.2	99	0.9	5.1	pH probe failed CCV, J Qualifier (Estimated) for pH. Due to pH probe fail, ORP may also be J Qualifier

Date	Depth (m)	Event	Temp. (C°)	DO (%)	DO (mg/L)	SC (µS/cm)	pH (SU)	ORP (mV)	Secchi Disk (m)	Total Depth (m)	Notes
29-Sep-21	5.1	4	27.1	3.2	0.3	308	7.2	87	0.9	5.1	pH probe failed CCV, J Qualifier (Estimated) for pH. Due to pH probe fail, ORP may also be J Qualifier
22-Nov-21	0.50	5	21.7	89.9	7.9	157	7.4		0.9	5.4	ORP probe malfunctioning
22-Nov-21	1.00	5	21.6	89.0	7.8	156	7.2		0.9	5.4	ORP probe malfunctioning
22-Nov-21	1.50	5	21.6	88.4	7.8	157	7.1		0.9	5.4	ORP probe malfunctioning
22-Nov-21	2.00	5	21.6	88.1	7.8	156	7.0		0.9	5.4	ORP probe malfunctioning
22-Nov-21	2.50	5	21.5	87.7	7.7	157	7.0		0.9	5.4	ORP probe malfunctioning
22-Nov-21	3.00	5	21.4	86.7	7.7	156	7.0		0.9	5.4	ORP probe malfunctioning
22-Nov-21	3.50	5	21.3	75.8	6.7	157	6.8		0.9	5.4	ORP probe malfunctioning
22-Nov-21	4.00	5	21.2	67.7	6.0	157	6.8		0.9	5.4	ORP probe malfunctioning
22-Nov-21	4.50	5	21.1	63.3	5.6	157	6.7		0.9	5.4	ORP probe malfunctioning
22-Nov-21	5.00	5	21.1	55.5	5.0	158	6.7		0.9	5.4	ORP probe malfunctioning
22-Nov-21	5.37	5	21.0	8.6	0.7	162	6.3		0.9	5.4	ORP probe malfunctioning
1-Feb-22	0.50	6	15.4	123.4	12.3	152	9.1		1.37	5.08	ORP probe malfunctioning
1-Feb-22	1.00	6	14.9	120.1	12.1	151	9		1.37	5.08	ORP probe malfunctioning
1-Feb-22	1.50	6	14.7	112.9	11.5	152	8.6		1.37	5.08	ORP probe malfunctioning
1-Feb-22	2.00	6	14.6	109.3	11.1	152	8.4		1.37	5.08	ORP probe malfunctioning
1-Feb-22	2.50	6	14.5	106.2	10.8	152	8.3		1.37	5.08	ORP probe malfunctioning
1-Feb-22	3.00	6	14.5	103.4	10.5	152	8.1		1.37	5.08	ORP probe malfunctioning
1-Feb-22	3.50	6	14.4	92.4	9.4	152	7.7		1.37	5.08	ORP probe malfunctioning
1-Feb-22	4.00	6	14.4	91.2	9.3	153	7.7		1.37	5.08	ORP probe malfunctioning
1-Feb-22	4.50	6	14.4	90.3	9.2	153	7.6		1.37	5.08	ORP probe malfunctioning
1-Feb-22	5.00	6	14.5	75.5	7.7	154	7.5		1.37	5.08	ORP probe malfunctioning
1-Feb-22	5.08	6	14.7	15.2	1.5	153	7.1		1.37	5.08	ORP probe malfunctioning

Note: DO: dissolved oxygen, SC: specific conductance

APPENDIX G

Stormwater Structure Report

BFA Environmental Consultants
Barnes, Ferland and Associates, Inc.

PROJECT MEMORANDUM

TO: Lance Lumbard, Project Manager, Wood Environment and Infrastructure

FROM: Katie Ballew, Environmental Scientist, Barnes, Ferland and Associates, Inc.

SUBJECT: Summary of Watershed Delineation – Lake Buchanan

DATE: August 30, 2022

BFA JOB: 2020-13.4

INTRODUCTION

The overall objective for this project is to identify the source of the elevated nitrogen concentrations in the Lake Buchanan basin and to develop conceptual management recommendations to reduce total nitrogen concentrations and loadings discharging into Lake Buchanan

Specifically, Barnes, Ferland and Associates, Inc (BFA), under the direction of Wood Environment and Infrastructure Solutions, Inc. (Wood) was tasked with field reconnaissance of the Lake Buchanan Basin to identify the conveyance characteristics of the stormwater drainage system and field verification of the Lake Buchanan sub-basins. Field verification of drainage structures throughout the Lake Buchanan basin began in April 2021. Katie Ballew and Patrick Barnes Jr. with BFA utilized three days to walk and drive the Lake Buchanan basin area. Where access was available, the watershed basin of Lake Buchanan was surveyed to identify storm water curb inlets, Best Management Practices (BMP), weirs, and storm water ponds. Some manhole covers were removed to provide a visual identification of storm water piping leading to Lake Buchanan and to verify the water conveyance directional flow.

Information from this reconnaissance is attached titled *Exhibit 1* and *Exhibit 1a* which includes a structure map and reference table. *Exhibits 2-1* through *2-6* include structure photographs taken during the field investigation.

BASIN BOUNDARY DELINEATION

Drainage plans for the area surrounding Lake Buchanan were accessed through the Florida Department of Environmental Protection (FDEP) Environmental Resource Permit (ERP) portal. Drainage plans for most of the apartment complexes surrounding Lake Buchanan were utilized, and BFA and Wood walked and drove throughout the watershed basin and investigated storm manholes to verify flow direction and pipe size where plans were unclear or unavailable. Google Earth was also utilized for historical aerial reference.

CONVEYANCE SYSTEM AND BEST MANAGEMENT PRACTICES

Exhibit 1 shows the Lake Buchanan Basin Boundaries. The Lake Buchanan drainage basin extends from The Dunwoodie Place Apartments north of Texas Avenue to condominiums south of Holden Avenue, and South Texas Avenue west of Lake Buchanan to Rio Grande Avenue east of Lake Buchanan. The Lake Buchanan basin area covers approximately 0.36 square miles. Using the information gathered in the field and through drainage maps, BFA was able to identify 12 outfalls and 21 subbasins to track water flow more accurately throughout the Lake Buchanan area.

Each condominium surrounding Lake Buchanan has at least one outfall, while the Palmetto at Lakeside utilizes 5 outfalls for each section of the complex. The retention pond on the north side of Lake Buchanan collects runoff from South Texas Avenue, the northern portion of Rio Grande Avenue, and the Dunwoodie Place Apartments. A drain well is also located within this retention area. A large conduit on the south side of Lake Buchanan collects runoff from high traffic streets such as Holden Avenue, Rio Grande Avenue, and Buchanan Bay Circle. Lake Buchanan appears to drain west to Lake Catherine through a series of ponds west of South Texas Avenue.

Ongoing construction of Holden Avenue during reconnaissance and storm water characterization prevented access and temporarily blocked flow to Lake Buchanan. Two outfalls located at the retention pond on South Texas Avenue and at the Palmetto at Lakeside Condominiums were selected to characterize the water quality entering the lake through these sub-basins. The sub-basins surrounding Lake Buchanan are discussed in more detail below.

1. Dunwoodie Place Apartments

Dunwoodie Place Apartments is located at 4213 Dunwoodie Boulevard, north of South Texas Avenue. A curb inlet conveyance system leading to two retention ponds on the east and west sections of the complex serve as stormwater drainage for Dunwoodie Street, Teryn Court, Heather Court, and Dunwoodie Boulevard. The western retention pond on Teryn Court flows to South Texas Avenue via manhole connections. The eastern retention pond on Heather Court contains an overflow weir which drains to the larger retention area on South Texas Avenue.

2. Retention Pond on South Texas Avenue

The retention pond north of Lake Buchanan collects stormwater run-off from the northern sections of South Texas Avenue and Rio Grande Avenue as well as overflow from the Dunwoodie Place Apartments retention pond on Heather Court. This retention pond contains an overflow weir which outfalls to Lake Buchanan. A drain well is located adjacent to the retention pond and discharges to Lake Buchanan.

3. Palmetto at Lakeside

The Palmetto at Lakeside is located at 4444 Rio Grande Avenue and spans approximately 0.25 miles of Lake Buchanan's eastern shore. Stormwater from the parking lot discharges to Lake Buchanan through 5 outfalls on the property. The conveyance system is primarily made up of grated inlets, though a few manholes are used to direct stormwater to the outfalls with higher drainage demands in the main part of the complex. A boat ramp serves as an outfall for overland flow from a portion of the complex without grated inlets.

4. The Lakeshore at East Mil

The parking lot at the Lakeshore at East Mil, located at 1717 Holden Avenue, is graded so stormwater flows overland toward two grated inlets which outfall to Lake Buchanan. This complex is set back from the lake with over an acre of green space between the parking lot and Lake Buchanan.

5. Holden Avenue and Buchanan Bay Circle

Stormwater from the southern portion Rio Grande Avenue the Castillo Apartments on the southern corner of Holden Avenue flow to the Holden Avenue stormwater conveyance system. Stormwater on Holden Avenue discharges to Lake Buchanan via 3 culverts on the south end of the lake. Buchanan Bay, Millennium Cove, and London Trace Townhomes are all situated around Buchanan Bay Circle and their parking lots utilize a system of grated inlets and manholes to convey stormwater to 3 connected retention ponds. This system discharges to a wooded area adjacent to the south side of Holden Avenue and eventually outfalls to Lake Buchanan via the 3 culverts on the south side of Lake Buchanan.

6. Alhambra Condominium

The Alhambra Condominium, located on 2225 Holden Avenue, is graded so stormwater flows overland toward two grated inlets which outfall to Lake Buchanan. Some run-off from the Alhambra parking lot and Holden Avenue flows overland into Lake Buchanan through the boat ramp on the property.

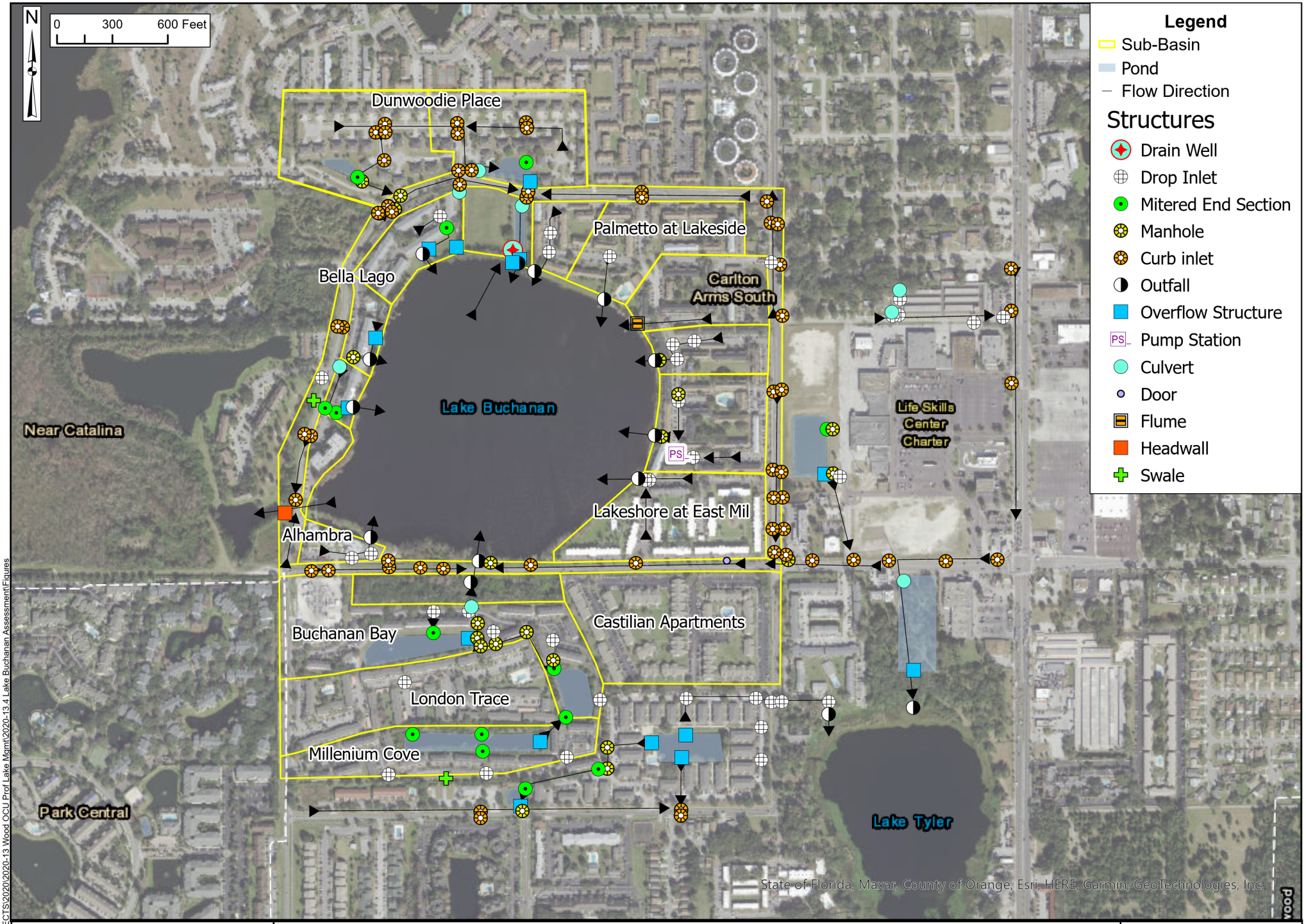
7. Bella Lago

The Bella Lago apartment complex is located at 4405 South Texas Avenue and spans approximately 0.23 miles of Lake Buchanan's western shore. Bella Lago's two entrances split the parking lot into 3 sections, with one outfall in each section. A swale system with culverts runs along the west side of the southern parking lot into a small retention pond that overflows into Lake Buchanan.

BFA staff performed reconnaissance of the areas surrounding Lake Buchanan throughout the construction of Holden Avenue. Some work is ongoing which resulted in some data gaps around the Rio Grande Avenue and Holden Avenue intersection as well as the intersection at South Texas Avenue and Holden Avenue. However, this memo captures the main conveyance systems and sub-basins which serve Lake Buchanan.

Katie Ballew
Environmental Scientist

Attachment
F:\HYDRO\PROJECTS\2020\2020-13 Wood OCU Prof Lake Mgmt\2020-13.4 Lake Buchanan Assessment (Y20-906C Contract)



F:\HYDRO\PROJECTS\2020\2020-13 Wood OCU Prof Lake Mgmt\2020-13.4 Lake Buchanan Assessment\Figures

BFA

Lake Buchanan Overview Map

FIGURE 1

Orange County Nutrient Loading Evaluation and Conceptual Projects

Field Data - Lake Buchanan

CI- curb inlet, MES- mitered end section, MH- manhole, GDI- grated drop inlet, OS- overflow structure, OF- outfall
*unless otherwise indicated

Waypoint	Structure_ID	Latitude (N)	Longitude (W)	Size of pipes coming INTO* structure	Description	Picture_1	Picture_2	Picture_3
					South Texas Avenue			
Y	MHCI	28.499720	-81.407463	18"	east side of Texas ave. Pipe coming in (higher than others) from east 18". 2 pipes leading out west and north both 24/32"			
Z	MH	28.499743	-81.407425	32"	15 feet north of MHCI. Big trunk leading north/south no other inlets or outlets			
AA	MHCI	28.499788	-81.407539		West side of texas ave. Pipe coming in from south and leading out east toward other MHCI			
AB	MHCI	28.499681	-81.407684		west side of Texas ave picks up runoff sends north to MHCI. Obstructed by debris			
AC	MH	28.499945	-81.407333		West side of Texas ave. Leading from west and making an elbow in drain to flow south toward MHCI system			
A	GDI	28.497231	-81.408646		GDI at north end of swale west side of Texas Ave. at entrance to Alhambra Village	PXL143308575		
CR	MHCI	28.500010	-81.403267		north side of Texas av. One 18 inch pipe leading south. No other pipes			
CS	MHCI	28.499928	-81.403259		pipe in from north. Smaller pipe coming in from east heading toward larger pipe west 24 inch			
CT	MHCI	28.500113	-81.406334		South side Texas Ave. Full of water and debris. Only visible pipe leading west.			
EO	MHCI	28.499784	-81.407539		NW side Texas Ave at tymberskan condos. Pipe coming in from north retention pond manhole			
EP	MHCI	28.499704	-81.407478		SE side Texas ave			
EQ	MHCI	28.499685	-81.407707		SW side Texas Ave no pipes in sends water to Texas ave			
N	swale	28.496897	-81.408783		West side of street going into GDI entrance of Bella Lago	PXL143239995		
O	MHCI	28.497984	-81.408295	18"	East side of street- gdi top pipe coming in from south and out toward north. Pipe to east walled off			
P	MHCI	28.497997	-81.408386		no pipes coming in. 1 pipe leading east to other MHCI. Collects road runoff and heads north			
					Holden Avenue			
B	Box Culvert	28.494192	-81.406128	32"	South side of Holden Ave. 3 oblong culverts leading north/south across Holden Ave. 1 culvert coming in from east.	PXL135012512		
C	OF	28.494514	-81.405991	32"	North side of Holden Ave. 3 oblong culverts leading north/south across Holden Ave. 1 culvert coming in from east.	PXL135638628		
D	new MHCI	28.494396	-81.406586	42"	New MHCI not yet connected along Holden Ave. flows east/west	PXL133954963		
E	new MHCI	28.494356	-81.408813		New MHCI not yet connected along Holden Ave. flows east/west			
F	new MHCI	28.494493	-81.403343		New MHCI not yet connected along Holden Ave. flows east/west			
G	MH	28.494486	-81.405792	42"	MH from older Holden Ave. drainage trunk. Pipe leading north to Lk. Buchanan walled off- only flows east/west			
H	control	28.496103	-81.409058		Pipe/control structure w meter. Might be sewer line control.			
I	new MHCI	28.49436	-81.408524		New MHCI not yet connected along Holden Ave. flows east/west			
J	new MHCI	28.494457	-81.405113	18"	New MHCI not yet connected along Holden Ave. flows east/west			

Orange County Nutrient Loading Evaluation and Conceptual Projects

Field Data - Lake Buchanan

CI- curb inlet, MES- mitered end section, MH- manhole, GDI- grated drop inlet, OS- overflow structure, OF- outfall
*unless otherwise indicated

Waypoint	Structure_ID	Latitude (N)	Longitude (W)	Size of pipes coming INTO* structure	Description	Picture_1	Picture_2	Picture_3
K	new MHCI	28.49441	-81.406975		New MHCI not yet connected along Holden Ave. flows east/west			
L	headwall	28.495222	-81.409264		Walled off on west side pending new culvert construction	PXL134841689		
M	new MHCI	28.494411	-81.407501		Holden pipes leading east/west			
BV	MHCI	28.494535	-81.398117		On Holden north side. Pipes coming in from south and east. Heading west.			
BW	MHCI	28.494541	-81.400368		on Holden. Unclear where flow comes or goes. Possibly west. Large hub- full of water cannot see pipes			
BX	MH	28.494547	-81.400772		on north side of Holden. Flows east to west across rio grande ave			
BY	MHCI	28.494551	-81.399673		pipe coming in from south. Other pipes not visible if present. Possibly flows west toward rio grand av			
BZ	MHCI	28.494543	-81.399078		higher pipe coming in from east. Other pipes not visible. filled with water. Possibly heads west.			
CA	MHCI	28.494562	-81.397247		on Holden and OBT. No eastern inlet. Collects from Holden- flows west. Pipe on south side filled with small pvc pipe and valve in its place. Construction ongoing south side of Holden.			
DC	MHCI	28.494518	-81.407516	6" E	North side of Holden. 6 inch pipe coming in from east. No other pipes visible.			
					Bella Lago			
Q	MES	28.496714	-81.408401	12"	Culvert 12" into retention pond in Bella Lago southwest side of lake			
R	OS	28.496788	-81.408203		overflow weir in retention pond at Bella Lago apts. leads east into buchannan.	PXL145327680		
S	OF	28.496798	-81.408119		Headwall into lake Buchanan from retention pond at Bella Lago apts	PXL145603295		
T	MES	28.496782	-81.408592	12"	culvert 12" into retention pond from swale along apartment border wall			
U	culvert	28.497398	-81.408348	12"	12" into swale along Bella lago border wall- into retention pond			
V	MH	28.497541	-81.408119		In Bella lago parking lot. Could not open manhole- car over spot. May try again another time. Possibly pipe coming in from nw and out east to lake buchanan			
W	OF	28.497507	-81.407837	12"	12" MES culvert from MH in Bella lago parking to lake Buchanan	PXL151933087		
X	OS	28.497829	-81.407745		overflow weir no pipe. In swale along lake Buchanan	PXL152136697	PXL165047993	
AJ	MES	28.499470	-81.406555		Culvert into retention pond north Bella lago			
AK	GDI	28.499641	-81.406662		in parking lot of Bella lago- should flow to retention pond. Cannot see- obstructed by leaves			
AL	OS	28.499153	-81.406853		Overflow weir in north Bella lago retention pond. Pipe coming in from west and pipe out toward south			
AN	culvert	28.500000	-81.406342	14"	Headwall/ culvert. Pipe coming in from west- pipe along Bella lago wall. 14" no pipe visible from north.	PXL165220626		
AO	OS	28.499184	-81.406387		overflow weir in swale northeast side of Bella lago out to lkBuchanan	PXL164546047		
					Retention Pond on South Texas Avenue			
AD	culvert	28.499798	-81.405281	48"	Headwall 48" into retention pond east side of Texas ave	PXL154302390		

Orange County Nutrient Loading Evaluation and Conceptual Projects

Field Data - Lake Buchanan

CI- curb inlet, MES- mitered end section, MH- manhole, GDI- grated drop inlet, OS- overflow structure, OF- outfall
*unless otherwise indicated

Waypoint	Structure_ID	Latitude (N)	Longitude (W)	Size of pipes coming INTO* structure	Description	Picture_1	Picture_2	Picture_3
AE	DW	28.499142	-81.405434		Drain well 076			
AF	OS	28.499000	-81.405319		Overflow weir in retention pond south side of Texas ave	PXL154456313		
AG	OF	28.498945	-81.405342	48"	Headwall culvert 48" from retention pond south side of Texas ave	PXL154721872		
AH	OS	28.498955	-81.405441		overflow weir from lake Buchanan to drain well			
AI	MHCI	28.499924	-81.405205		north and west side of Texas ave going into retention pond.			
AM	OF	28.499079	-81.406952	18"	Headwall culvert 18" from retention pond into swale to lake Buchanan			
CX	MHCI	28.500021	-81.405159		north side of Texas av. Large pipe heading south across street to retention pond near drain well. No other pipes coming in.			
CY	door	28.494534	-81.40181		2 small pipes 6 inch east and west.			
					Palmetto at Lakeside			
AP	flume	28.498056	-81.403328		water flows over concrete down incline to lk Buchanan	PXL134601141	PXL134527029	
AQ	pipe	28.498350	-81.403831		Two 2" PVC pipes into lake from pool/ irrigation controller. May not be functional			
AR	OF	28.498415	-81.403893	24"	OF headwall 24" into lk Buchanan from north	PXL135225363		
AS	GDI	28.499054	-81.403801		24 in. Going out to lk Buchanan. No pipes coming in.			
AT	GDI	28.499113	-81.404823	18"	18 in coming in from north GDI 24 in leading south to lk Buchanan			
AU	GDI	28.499399	-81.404800		18 in. Pipe leading south no pipes coming in			
AV	OF	28.498825	-81.405067	24"	24 in pipe into a small depression/pond near shore of lk Buchanan	PXL141329393		
AW	GDI	28.497746	-81.402733	18"	18 in pipe coming in from east leading south			
AX	GDI	28.497526	-81.402657	18"	pipes coming in 18 in from east and north leading west 24 in to lk buchanan. No pipes coming in from south			
AY	MH	28.497509	-81.402954	32"	BMP manhole to box with large pipe coming in from east. Leading out to lake Buchanan	PXL142721629		
AZ	OF	28.497507	-81.403030		box culvert headwall into lk Buchanan	PXL142751318		
BA	GDI	28.497797	-81.402367		no pipes coming in. Leads west to GDI system going to lake			
BB	GDI	28.496906	-81.402634		no pipes coming in. One pipe 18 in leading south			
BC	MH	28.497007	-81.402634		15 feet north of GDI. Unable to open.			
BD	irrigation	28.496943	-81.402931		GDI box with pipes and a meter possibly for irrigation? PVC Pipes leading to lake			
BE	GDI	28.496067	-81.402382		leading west to lake no pipes coming in	PXL143812379		
BF	PS	28.496119	-81.402626		Pump station # 3167	PXL144631679		

Orange County Nutrient Loading Evaluation and Conceptual Projects

Field Data - Lake Buchanan

CI- curb inlet, MES- mitered end section, MH- manhole, GDI- grated drop inlet, OS- overflow structure, OF- outfall
*unless otherwise indicated

Waypoint	Structure_ID	Latitude (N)	Longitude (W)	Size of pipes coming INTO* structure	Description	Picture_1	Picture_2	Picture_3
BG	MH	28.496376	-81.402916		No visible pipes leading in- box culvert leading out to lake	PXL145346862		
BH	OF	28.496391	-81.403030	24"	box culvert headwall. 24 in from MH box	PXL143815411	PXL145549586	
					Lakeside at East Mil			
BI	GDI	28.495728	-81.403122		flooded. no visible pipes coming in. One pvc pipe 6 in leading west	PXL150048769		
BJ	GDI	28.495728	-81.403191	6"	6 in pipe leading from east. pipe leading west to lake	PXL150112279		
BK	OF	28.495749	-81.403305		? Pipe from GDI or headwall not visible			
					Rio Grande Avenue			
CB	MHCI	28.495888	-81.401039		Debris trap. West side of Rio grande Ave. no pipes in possibly heading east to MHCI			
CC	MHCI	28.495857	-81.400894	24" S, 18" W	east side rio grande. Big pipe 24 inch coming in from south. Small pipe 18 inch coming in from west. Small pipe 18 inch leading north.			
CD	MHCI	28.495476	-81.400871	32" S, 24" W	east side of rio grande. Lowest pipe 32 inch from south. 24 inch from west. Higher pipe 24 inch to north.			
CE	MHCI	28.495008	-81.400848	48" S, 24" W	big pipe 48 inch in from south. 24 inch in from west. 32 inch out going north			
CF	MHCI	28.494623	-81.400810	36" S, 32" W/E	On east side of rio grande. 36 inch pipe in from south. Smaller pipe 6 inch above. 32 inch heading north. 24 inch pipes in from west and east.			
CG	MHCI	28.494663	-81.401009	6" SW	2 small higher pipes 6 inch in from southwest and north. 24 inch toward east.			
CH	MHCI	28.495008	-81.401039	6" N/S	West side rio grande. 6 inch pipes in from north and south. 24 inch pipe going east.			
CI	MHCI	28.495472	-81.401024	6" N/S	west side of rio grande. 6 inch pipes in from north and south. 24 inch heading east.			
CJ	MHCI	28.497049	-81.401031		west side rio grande. No pipes in. 18 inch pipe heading east across street.			
CK	MHCI	28.497078	-81.400894	18" W	18 inch from west curves to 24 inch heading south. No other pipes. End of line			
CL	MHCI	28.499559	-81.401085	24" E	West side of rio grande. Higher 24 inch in from East. 36 inch pipes north and southeast.			
CM	MHCI	28.498938	-81.400925	36" S	East side of rio grande. 36 inch pipe in from south toward GDI on west side of street.			
CN	GDI	28.498972	-81.401077		west side of rio grande. From MHCI on east side toward north			
CO	MHCI	28.498177	-81.400887		at 45th street and rio grande. east side of rio grande. No pipes coming in. One pipe heading northwest ? Unclear.			
CP	MHCI	28.499538	-81.400970		East side of rio grande. 36 inch pipe heading to MHCI on west side. No pipes coming in.			
CQ	MHCI	28.499878	-81.401154		west side rio grande south side of Texas Ave. pipes coming in from south and northeast. Likely heading west on Texas Ave			
					Dunwoodie Place			
CU	MHCI	28.500322	-81.406357		north side Texas Ave. at dunwoodie place entrance. Filled with water and debris. Small pipe visible from north. No other pipes visible.			
CV	culvert	28.500319	-81.406013		Into retention pond north side of Texas Ave in dunwoodie complex.			

Orange County Nutrient Loading Evaluation and Conceptual Projects

Field Data - Lake Buchanan

CI- curb inlet, MES- mitered end section, MH- manhole, GDI- grated drop inlet, OS- overflow structure, OF- outfall
*unless otherwise indicated

Waypoint	Structure_ID	Latitude (N)	Longitude (W)	Size of pipes coming INTO* structure	Description	Picture_1	Picture_2	Picture_3
CW	MHCI	28.500326	-81.406136		North side Texas. East side of dunwoodie place entrance. Pipe leading east toward dunwoodie retention pond			
ED	MHCI	28.50104	-81.40522		North side dunwoodie st			
EF	MHCI	28.500956	-81.405205		South side dunwoodie st			
EG	MHCI	28.501024	-81.40638		North side dunwoodie st at entrance. No pipes north. leads south			
EH	MHCI	28.500872	-81.406372		West side entrance to Dunwoodie st. Unable to open manhole			
EI	MHCI	28.501009	-81.4076		north side dunwoodie			
EJ	MHCI	28.500883	-81.407753		NW side Taryn Ct			
EK	MHCI	28.500887	-81.407593		NW side taryn ct			
EL	MHCI	28.500469	-81.407608		SW side Taryn ct. leads SW to MH then to retention pond			
EM	MH	28.500154	-81.407982		From MHCI at taryn ct to retention pond			
EN	MES	28.500217	-81.408058		In retention pond from taryn ct			
					Alhambra Condominium			
CZ	GDI	28.494553	-81.408134		in alhambra complex near boat ramp. Pipe leading east toward GDI. No pipes in			
DA	GDI	28.494619	-81.407806		south and west. Pipe out north to lake Buchanan. On other side of wall there is no inlet to Alhambra GDI. South pipe may be blocked off.			
DB	OF	28.494862	-81.407814		outfall headwall into lake Buchanan from GDI in Alhambra complex.	PXL140638191		
DD	MHCI	28.495417	-81.409081		New- not connected. East side of Texas Ave. pipe coming in from south. Pipe leading west. Possibly pipe heading north. Not visible			
DE	MHCI	28.496368	-81.408829		East side of Texas av. Pipe coming in from south. Pipe out toward west. No other pipes visible			
DF	MHCI	28.496393	-81.408936		West side of Texas Ave. Pipe coming in from south heading east. No other pipes visible. Possibly end of Holden/Texas drainage trunk.			
					Buchanan Bay South of Holden Ave			
DG	GDI	28.493692	-81.406723		Pipe heading east and south.			
DH	MES	28.493435	-81.406754		Into retention pond			
DI	MH	28.49358	-81.406006		pipe in from southwest. Unclear if there are pipes leading out.			
DJ	OS	28.493357	-81.406166		In retention pond			
DK	GDI	28.493778	-81.406105		Pipe leading south			
DL	MH	28.493359	-81.406013		pipes from retention pond OS south and possibly east			
DM	MH	28.49324	-81.405952		no pipes visible. Water level high no indication of flow			

Orange County Nutrient Loading Evaluation and Conceptual Projects

Field Data - Lake Buchanan

CI- curb inlet, MES- mitered end section, MH- manhole, GDI- grated drop inlet, OS- overflow structure, OF- outfall
*unless otherwise indicated

Waypoint	Structure_ID	Latitude (N)	Longitude (W)	Size of pipes coming INTO* structure	Description	Picture_1	Picture_2	Picture_3
DN	MH	28.493275	-81.405701		possible pipe north. Not visible			
DO	GDI	28.493456	-81.405739		Pipe leading south.			
DP	culvert	28.493822	-81.406113		Into wetland from south retention pond	IMG9552		
DQ	GDI	28.493332	-81.404739		in complex			
DR	MH	28.493027	-81.404739		Into retention pond from GDI system. High WL Pipes not visible	IMG9553		
DS	GDI	28.491592	-81.404495		Into retention pond			
DT	GDI	28.491348	-81.405853		Into retention pond			
DU	GDI	28.491323	-81.407501		Into retention pond			
DV	GDI	28.492699	-81.407234		possible connection btwn retention ponds			
DW	GDI	28.492445	-81.403938		Into retention pond			
DX	swale	28.49127	-81.406532		Drainage swale south of complex			
DY	OS	28.49086	-81.405273		overflow weir in retention pond honour road			
DZ	MHCI	28.490774	-81.405945		north side honour rd. 24 inch pipe east. 6 inch pipe west. 18 inch pipe coming in from north GDI			
EA	MHCI	28.490683	-81.405945		South side honour road. No pipes south. 6 inch pipes east and west. 12 inch pipe north			
EB	MH	28.490789	-81.405243		unable to open			
EC	MES	28.500446	-81.405212		Into retention pond			

PXL133954963, new curb inlet to Lake Buchanan, looking north

PXL134841689, blocked outfall to Lake Buchanan, looking north

PXL135012512, culverts outfall to Lake Buchanan, looking south

PXL135638628, culverts on south side of Holden Ave, looking north

PXL140638191, boat ramp at Alhambra, looking north

PXL141137693, Lake Buchanan outfall to Lake Catherine, S Texas Ave looking west

wood.

BFA Environmental Consultants
Barnes, Ferland and Associates, Inc.
1230 Hillcrest Street, Orlando, FL, 32803
PH: (407) 896-8608 FAX: (407) 896-1822

Lake Buchanan
Field Verification Photos

Exhibit 2-1

PXL143239995, drainage swale on west side of S. Texas have, looking south

PXL143308575, grated drop inlet in swale on west side of S. Texas Ave, looking north

PXL, 145327680, retention pond at Alhambra Club, looking northeast

PXL145603295, headwall and outfall to Lake Buchanan from retention pond, looking east

PXL152136697, overflow weir at Bella Lago, looking southeast

PXL151933087, culvert at Bella Lago outfall to Lake Buchanan, looking east

wood.

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Lake Buchanan
Field Verification Photos

Exhibit 2-2

PXL165220626, headwall into swale at Bella Lago, looking northeast.

PXL165047993, swale at Bella Lago, looking north

PXL164546047, overflow weir and outfall to Lake Buchanan at Bella Lago, looking south

PXL154302390 retention pond on S. Texas Avenue north of Lake Buchanan, looking south

PXL154456313, overflow weir in retention pond north of Lake Buchanan, looking north

PXL154721872, headwall from retention pond, overflow weir and outfall to Lake Buchanan, looking south

wood.

BFA Environmental Consultants
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Lake Buchanan
Field Verification Photos

Exhibit 2-3

PXL140050258, grated drop inlet in Palmetto at Lakeside parking lot, looking south

PXL141329393, outfall to Lake Buchanan in Palmetto at Lakeside, looking south

PXL13553492, grated drop inlet in Palmetto at Lakeside parking lot, looking south

PXL135225363, headwall and outfall to Lake Buchanan from Palmetto at Lakeside parking lot, looking south

PXL134601141, boat ramp for Palmetto at Lakeside, looking east

PXL134527029, boat ramp outfall to Lake Buchanan from Palmetto at Lakeside, looking west

wood.

BFA Environmental Consultants
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Lake Buchanan
Field Verification Photos

Exhibit 2-4

PXL142721629, manhole at Palmetto at Lakeside, looking west

PXL142751318, headwall outfall to Lake Buchanan at Palmetto at Lakeside, looking east

PXL142807284, outfall to Lake Buchanan from Palmetto at Lakeside, looking west

PXL143812379, grated drop inlet at Palmetto at Lakeside, looking south

PXL143815411, outfall to Lake Buchanan from Palmetto at Lakeside, looking west

PXL144631679, private pump station in Palmetto at Lakeside, looking east

wood.

BFA Environmental Consultants
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Lake Buchanan
Field Verification Photos

Exhibit 2-5

PXL145346862, manhole from Palmetto at Lakeside parking lot, looking west

PXL145549586, headwall outfall to Lake Buchanan from Palmetto at Lakeside, looking east

PXL150048769, grated drop inlet in Lakeshore at East Mil parking lot, looking west

PXL150112279, grated drop inlet and outfall to Lake Buchanan in Lakeshore at East Mil parking lot, looking west

IMG9552, culvert headwall in wetland south of Holden Ave. outfalls to Lake Buchanan, looking north

IMG9553, retention pond in Buchanan Bay, drains to Lake Buchanan via Holden Avenue wetland

wood.

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Lake Buchanan
Field Verification Photos

Exhibit 2-6

APPENDIX H

Hydrologic Tables

Table 1-1 Summary of Curve Numbers Based on Land use and Soil Group
Table 1-2 Published Runoff Coefficients (c) for Meteorological Zone 2 Based on Non-DCIA CN and Percent DCIA
Table 1-3 Summary of Literature-Based Runoff Characterization for General Land use Categories in Florida

TABLE 1-1
Summary of Curve Numbers Based on Land use and Soil Group

FLUCCS	Generalized Land Use Description	% DCIA	Hydrologic Soils Group					
			A	B	B/D	C	D	W
1100	Residential-Low Density	20	39	61	61	74	80	99.8
1200	Residential-Med Density	25	39	61	61	74	80	99.8
1300	Residential-High Density	50	39	61	61	74	80	99.8
1400	Commercial	85	39	61	61	74	80	99.8
1500	Industrial	72	39	61	61	74	80	99.8
1600	Extractive	0	39	61	61	74	80	99.8
1700	Institutional	16	39	61	61	74	80	99.8
1800	Recreational	10	39	61	80	74	80	99.8
1900	Open Land	0	39	61	80	74	80	99.8
2100	Cropland and Pastureland	0	39	61	80	74	80	99.8
2200	Tree Crops - Citrus	10	32	58	79	72	79	99.8
2300	Feeding Operations	10	32	58	79	72	79	99.8
2400	Nurseries and Vineyards	5	67	78	89	85	89	99.8
2500	Specialty Farms	5	67	78	89	85	89	99.8
2600	Other Open Lands - Rural	0	39	61	80	74	80	99.8
3100	Herbaceous Rangeland	0	39	61	80	74	80	99.8
3200	Shrub and Brush Rangeland	0	30	48	73	65	73	99.8
3300	Mixed Rangeland	0	30	48	73	65	73	99.8
4100	Upland Coniferous Forest	0	32	58	79	72	79	99.8
4200	Upland Hardwood Forests	0	32	58	79	72	79	99.8
4300	Mixed Hardwood Forests	0	32	58	79	72	79	99.8

TABLE 1-2
Continued
Summary of Curve Numbers Based on Land use and Soil Group

FLUCCS	Generalized Land Use Description	% DCIA	Hydrologic Soils Group					
			A	B	B/D	C	D	W
4400	Tree Plantations	0	32	58	79	72	79	99.8
5000	Water	100	99.8	99.8	99.8	99.8	99.8	99.8
5100	Streams and Waterways	100	99.8	99.8	99.8	99.8	99.8	99.8
5200	Lakes	100	99.8	99.8	99.8	99.8	99.8	99.8
5300	Reservoirs	100	99.8	99.8	99.8	99.8	99.8	99.8
6100	Wetland Hardwood Forests	100	99.8	99.8	99.8	99.8	99.8	99.8
6200	Wetland Coniferous Forests	100	99.8	99.8	99.8	99.8	99.8	99.8
6300	Wetland Forested Mixed	100	98	98	98	98	98	99.8
6400	Vegetated Non-Forested Wetlands	100	98	98	98	98	98	99.8
7400	Mining	0	39	61	80	74	80	99.8
8100	Transportation / Utilities	25	83	89	89	92	93	99.8
8200	Communications	25	83	89	89	92	93	99.8
8300	Utilities	25	83	89	89	92	93	99.8

TABLE 1-2
Published Runoff Coefficients (c) for Meteorological Zone 2 Based on Non-DCIA CN and Percent DCIA

NDCIA CN	PERCENT DCIA																				
	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
30	0.002	0.043	0.083	0.123	0.164	0.204	0.244	0.285	0.325	0.366	0.406	0.446	0.487	0.527	0.567	0.608	0.648	0.688	0.729	0.769	0.809
35	0.004	0.044	0.085	0.125	0.165	0.205	0.246	0.286	0.326	0.366	0.407	0.447	0.487	0.528	0.568	0.608	0.648	0.689	0.729	0.769	0.809
40	0.007	0.047	0.087	0.127	0.167	0.207	0.248	0.288	0.328	0.368	0.408	0.448	0.488	0.528	0.569	0.609	0.649	0.689	0.729	0.769	0.809
45	0.01	0.05	0.09	0.13	0.17	0.21	0.25	0.29	0.33	0.37	0.41	0.45	0.49	0.53	0.57	0.61	0.65	0.69	0.729	0.769	0.809
50	0.015	0.055	0.095	0.134	0.174	0.214	0.254	0.293	0.333	0.373	0.412	0.452	0.492	0.531	0.571	0.611	0.651	0.69	0.73	0.77	0.809
55	0.022	0.061	0.101	0.14	0.179	0.219	0.258	0.298	0.337	0.376	0.416	0.455	0.494	0.534	0.573	0.613	0.652	0.691	0.731	0.77	0.809
60	0.03	0.069	0.108	0.147	0.186	0.225	0.264	0.303	0.342	0.381	0.42	0.459	0.498	0.537	0.576	0.615	0.654	0.693	0.731	0.77	0.809
65	0.042	0.08	0.119	0.157	0.195	0.234	0.272	0.311	0.349	0.387	0.426	0.464	0.502	0.541	0.579	0.618	0.656	0.694	0.733	0.771	0.809
70	0.057	0.095	0.133	0.17	0.208	0.245	0.283	0.321	0.358	0.396	0.433	0.471	0.509	0.546	0.584	0.621	0.659	0.697	0.734	0.772	0.809
75	0.079	0.116	0.152	0.189	0.225	0.262	0.298	0.335	0.371	0.408	0.444	0.481	0.517	0.554	0.59	0.627	0.663	0.7	0.736	0.773	0.809
80	0.111	0.146	0.181	0.216	0.251	0.285	0.32	0.355	0.39	0.425	0.46	0.495	0.53	0.565	0.6	0.635	0.67	0.705	0.74	0.774	0.809
85	0.16	0.192	0.225	0.257	0.29	0.322	0.355	0.387	0.42	0.452	0.485	0.517	0.55	0.582	0.614	0.647	0.679	0.712	0.744	0.777	0.809
90	0.242	0.27	0.299	0.327	0.355	0.384	0.412	0.44	0.469	0.497	0.526	0.554	0.582	0.611	0.639	0.667	0.696	0.724	0.753	0.781	0.809
95	0.404	0.424	0.444	0.464	0.485	0.505	0.525	0.546	0.566	0.586	0.606	0.627	0.647	0.667	0.688	0.708	0.728	0.749	0.769	0.789	0.809
98	0.595	0.605	0.616	0.627	0.638	0.648	0.659	0.67	0.68	0.691	0.702	0.713	0.723	0.734	0.745	0.756	0.766	0.777	0.788	0.799	0.809

Source: Stormwater Quality Applicant's Handbook, Design Requirements for storm water Treatment Systems in Florida, March 2010 Draft

TABLE 1-3
Summary of Literature-Based Runoff Characterization for General Land use Categories in Florida

Land Use Category	Typical Runoff Concentration (mg/l)						
	TN	TP	BOD	TSS	Cu	Pb	Zn
Low-Density Residential[1]	1.5	0.18	4.7	23	0.008[4]	0.002[4]	0.031[4]
Single-Family	1.85	0.31	7.9	37.5	0.016	0.004	0.062
Multi-Family	1.91	0.48	11.3	77.8	0.009	0.006	0.086
Low-Intensity Commercial	0.93	0.16	7.7	57.5	0.018	0.005	0.094
High-Intensity Commercial	2.48	0.23	11.3	69.7	0.015	--	0.16
Light Industrial	1.14	0.23	7.6	60	0.003	0.002	0.057
Highway	1.37	0.17	5.2	37.3	0.032	0.011	0.126
Pasture	2.48	0.7	5.1	94.3	--	--	--
Citrus	2.31	0.16	2.55	15.5	0.003	0.001	0.012
Row Crops	2.47	0.51	--	19.8	0.022	0.004	0.03
General Agriculture[2]	2.42	0.46	3.8	43.2	0.013	0.003	0.021
Undeveloped / Rangeland / Forest	1.15	0.055	1.4	8.4	--	--	--
Mining / Extractive	1.18	0.15	7.6[3]	60.0[3]	0.003[3]	0.002[3]	0.057[3]

TABLE 1-3
Continued
Summary of Literature-Based Runoff Characterization for General Land use Categories in Florida

Land Use Category	Typical Runoff Concentration (mg/l)						
	TN	TP	BOD	TSS	Cu	Pb	Zn
Wetland	1.01	0.09	2.63	11.2	0.001	0.001	0.006
Open Water / Lake	1.6	0.067	1.6	3.1		0.025[5]	0.028

1. Average of single-family and undeveloped loading rates
2. Mean of pasture, citrus, and row crop land uses
3. Runoff concentrations assumed equal to industrial values for these parameters
4. Value assumed to be equal to 50% of single-family concentration
5. Runoff concentrations assumed equal to wetland values for these parameters

Notes: This table is a replica of the Table 4-17 in the Final Report of "Evaluation of Current Stormwater Design Criteria within the state of Florida" prepared for: Florida Department of Environmental Protection (June 2007). Prepared by Environmental Research & Design, Inc. Harvey H. Harper, Ph.D., P.E. & David M. Baker, P.E.

Total N and Total P EMC values are from the Table 3.4 in March 2010 Draft Department of Environmental Protection and Water Management Districts Environmental Resource Permit Stormwater Quality Applicant's Handbook Design Requirements for Stormwater Treatment Systems in Florida.

Wetland and Open Water/Lake EMC values are from Table 7 of the Final Report of "Evaluation of Alternative Stormwater Regulations for Southwest Florida". (Revised Sept 08, 2003) Submitted to Water Enhancement & Restoration Coalition, Inc. Prepared by Environmental Research & Design, Inc. Harvey H. Harper, Ph.D., P.E. & David M. Baker, P

APPENDIX I

Stormwater Quality Laboratory Reports

Southern Research Laboratories, Inc.

2251 Lynx Lane, Suite 1
Orlando, Florida 32804
(407) 522-7100 Fax (407) 522-7043
Toll Free 1 (888) 420-Test

Thank you **Lance Lumbard** for the opportunity to be of service to you and your company, we **S**incerely **A**ppreciate **Y**our **B**usiness. SRL certifies these **Laboratory Results** were produced in accordance with NELAC Standards. Hold times and preservation requirements were met for all analytes unless specifically noted in the report. Results relate only to the samples as received.

Client Name: **Wood Environment & Infrastructure Solutions, Inc.**	Date(s) Collected: 09/15/21
Contact Name: **Lance Lumbard**	Date Received: 09/15/21
Project Name: Lake Buchanan Stormwater	Time Received: 13:00
Project Number: 600713x2.02.07	Date Reported : 09/27/21
Phone Number: (407) 522-7570	Date Emailed : 09/27/21
Fax Number: (407) 522-7576	SRL Work Order # 21-09021

SRL WO #	Clients #	Matrix	Analysis Requested
2109021-001	Buchanan Palmetto	Liquid	TSS/Total Nitrogen/Ammonia/ Total Phosphorus/Orthophosphate
2109021-002	Buchanan DW	Liquid	TSS/Total Nitrogen/Ammonia/ Total Phosphorus/Orthophosphate

Sherri Payne
Vice President & Quality Assurance Officer
Southern Research Laboratories, Inc.

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Southern Research Laboratories, Inc.
an MBE Environmental Laboratory
2251 Lynx Lane, Suite 1
Orlando, Florida 32804 (407) 522-7100

NELAP Certified
FDOH Cert # : E83484
SRL Lab Ref # : 21-09021
Received Date : 09/15/21

Lance Lumbard
Wood Env. & Infrastructure Solutions, Inc.
550 Northlake Blvd., Suite 1000
Altamonte Springs, FL. 32701 (407) 522-7570

Project Number/Project Name
600713x2.02.07
Lake Buchanan Stormwater
Lake Buchanan

Classical Chemistry Parameters

Client ID # : **Buchanan Palmett**
SRL (Lab) ID# : 2109021-001
Date Collected : 09/15/21
Lab FDOH Certification # : E83182

Analtye	CAS Number	Results	Flag	Units	Dilution Factor	MDL	PQL	Method	Date Prepared	Date Analyzed
Ammonia as N	7664-41-7	**0.078**		mg/L	1	0.0098	0.020	EPA 350.1	09/16/21	09/17/21
Nitrate/Nitrite as N		**0.18**		mg/L	1	0.016	0.050	4500NO3 H-	09/21/21	09/22/21
Orthophosphate as P	1426-54-42	**0.12**		mg/L	1	0.0040	0.010	EPA 365.1	09/16/21	09/16/21
Phosphorus	7723-14-0	**0.26**		mg/L	1	0.010	0.015	EPA 365.4	09/16/21	09/21/21
Total Kjeldahl Nitrogen		**1.4**		mg/L	1	0.037	0.050	EPA 351.2	09/16/21	09/21/21
Total Nitrogen	17778-88-0	**1.6**		mg/L	1	0.037	0.050	CALC	09/21/21	09/22/21
Total Suspended Solids		**17**		mg/L	1	2.5	2.5	M-2540D-201	09/22/21	09/23/21

Client ID # : **Buchanan DW**
SRL (Lab) ID# : 2109021-002
Date Collected : 09/15/21
Lab FDOH Certification # : E83182

Analtye	CAS Number	Results	Flag	Units	Dilution Factor	MDL	PQL	Method	Date Prepared	Date Analyzed
Ammonia as N	7664-41-7	**0.044**		mg/L	1	0.0098	0.020	EPA 350.1	09/16/21	09/17/21
Nitrate/Nitrite as N		**0.042**	I	mg/L	1	0.016	0.050	4500NO3 H-	09/21/21	09/22/21
Orthophosphate as P	1426-54-42	**0.028**		mg/L	1	0.0040	0.010	EPA 365.1	09/16/21	09/16/21
Phosphorus	7723-14-0	**0.088**		mg/L	1	0.010	0.015	EPA 365.4	09/16/21	09/21/21
Total Kjeldahl Nitrogen		**0.93**		mg/L	1	0.037	0.050	EPA 351.2	09/16/21	09/21/21
Total Nitrogen	17778-88-0	**0.97**		mg/L	1	0.037	0.050	CALC	09/21/21	09/22/21
Total Suspended Solids		**3.6**		mg/L	1	2.5	2.5	M-2540D-201	09/22/21	09/23/21

Client ID # : **Blanks**
SRL (Lab) ID# : MB
Date Collected : NA
Lab FDOH Certification # : E83182

Analtye	CAS Number	Results	Flag	Units	Dilution Factor	MDL	PQL	Method	Date Prepared	Date Analyzed
Ammonia as N	7664-41-7	0.0098	U	mg/L	1	0.0098	0.020	EPA 350.1	09/16/21	09/17/21
Nitrate/Nitrite as N		0.016	U	mg/L	1	0.016	0.050	4500NO3 H-	09/21/21	09/22/21
Orthophosphate as P	1426-54-42	0.0040	U	mg/L	1	0.0040	0.010	EPA 365.1	09/16/21	09/16/21
Phosphorus	7723-14-0	0.010	U	mg/L	1	0.010	0.015	EPA 365.4	09/16/21	09/21/21
Total Kjeldahl Nitrogen		0.037	U	mg/L	1	0.037	0.050	EPA 351.2	09/16/21	09/21/21
Total Nitrogen	17778-88-0	0.037	U	mg/L	1	0.037	0.050	CALC	09/21/21	09/22/21
Total Suspended Solids		2.5	U	mg/L	1	2.5	2.5	M-2540D-201	09/22/21	09/23/21

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NELAP Certified
FDOH Cert # : E83484
SRL Lab Ref # : 21-09021
Received Date : 09/15/21

Lance Lumbard
Wood Env. & Infrastructure Solutions, Inc.
550 Northlake Blvd., Suite 1000
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Project Number/Project Name
600713x2.02.07
Lake Buchanan Stormwater
Lake Buchanan

Classical Chemistry Parameters

QAQC

	% Recovery LCS/MS/MS2/MSD	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Nitrate/Nitrite as N	103/87/87	84-116	84-116		0.2	0-10
Total Kjeldahl Nitrogen	108/100/94/104	90-110	90-110		3	0-10

Total Nitrogen (Calculated as: (Nitrogen, Total Kjeldahl) + (Nitrogen, Nitrate + Nitrite)

	% Recovery LCS/MS/MSD	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Orthophosphate as P	101/98/94	90-110	90-110		5	0-10

	% Recovery LCS/MS/MSD	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Phosphorus	101/99/97	90-110	90-110		2	0-10

	% Recovery LCS/MS1/MS2/MSD1	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Nitrogen, Ammonia (as N)	98/100/89/93	90-110	90-110	QM-07	2	0-10

	% Recovery LCS	Acceptable Limits
Total Suspended Solids	110	80-120

	Result	Source Result	RPD	Notes	RPD Limit
Total Suspended Solids (DUP-1)	530	480	9		0-20

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NELAP Certified
FDOH Cert # : E83484
SRL Lab Ref # : 21-09021
Received Date : 09/15/21

Lance Lumbard
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550 Northlake Blvd., Suite 1000
Altamonte Springs, FL. 32701 (407) 522-7570

Project Number/Project Name
600713x2.02.07
Lake Buchanan Stormwater
Lake Buchanan

DATA QUALIFIER CODES

Reporting Exceptions and Qualified Data

When quality control results are outside established control limits reanalysis, including re-extraction (if applicable), is preferred. If re-analysis is not viable or desirable, then results may be qualified. Sample results associated with quality control data that exceed acceptance criteria will be qualified with an appropriate comment.

D = Data reported from a dilution and or multiple dilutions.

I = Estimated Value, The reported value is between the Laboratory Method Detection Limit (**MDL**) and the Laboratory Practical Quantitation Limit (**PQL**)

J = Estimated Value

L = Off-Scale high; exceeds the linear range or highest calibration standard.

O = Sampled, but analysis lost or not performed

Q = Sample held beyond normal holding time
Q01 Analysis performed outside of method-specified holding time
Q02 Sample received outside of method-specified holding time

U = indicates the compound was analyzed for, but not detected. The numerical value preceding the "U" is the limit of detection for that compound based upon the dilution. **MEDF** = **M**atrix **E**ffected **D**ilution **F**actor.

V = Analyte was detected in both the sample and associated Laboratory Method Blank; Laboratory Contamination

Y = The analysis was from an unpreserved or improperly preserved sample. The data may not be accurate

Unless otherwise noted, ug/Kg and mg/Kg denote dry weight.

(SOILS) Actual Reporting Limit will depend on moisture content of sample and the amount of sample received.

QM-07 The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on acceptable LCS recovery.

Chain of Custody

2109021
2

Page 1 of 1

Project Manager:	Lance Lumbard
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Fax:	+1 (407) 522-7576

Southern Research Laboratories, Inc.
2251 Lynx Lane, Suite #1
Orlando, Florida 32804
Main (407) 522-7100 Fax: (407) 522-7043

Project Name: Lake Buchanan Stormwater

Project Location: Lake Buchanan
#600713x2.02.07
PO# C012610100

Sampled by [Print Name(s)] / Affiliation: Katie Ballew / BFA

Sampler(s) Signature(s):

Preservatives (see codes): 1 | 1 | 9

Project Number: 600713x2

Analyses Requested: TSS; Orthophosphate, H (Field Filter); Total Nitrogen, Phos, Ammonia

REQUESTED DUE DATE:

Facility ID#:

Petroleum Restoration Program ___ yes ___ no

	Sample Identification	Sampled Date:	Sampled Time:	Grab or Composite (KB 9/15/21)	Matrix: (see codes)	Total Number of Containers	TSS	Orthophosphate, H (Field Filter)	Total Nitrogen, Phos, Ammonia	
1	Buchanan Palmetto	9/15/21	1200	C	SW	3	✓	✓	✓	2109021-001
2	Buchanan DW	9/15/21	1225	C	SW	3	✓	✓	✓	-002

Shipment Method:		Relinquished by	Date:	Time:	Accepted by:	Date:	Time:
Out: / /	Via:	Helen Turner	3-21-21	14:15			
Returned: / /	Via:		9/15/21	1300	Helen Turner	9-15-21	13:00

Additional Comments:

Cooler No.(s) / Temperature(s) (°C): stock, 433 3.2

Sampling Kit No.: 8910

Equipment ID No.:

Matrix Codes: A = Air GW = Groundwater SE = Sediment SO = Soil SW = Surface Water W = Water(Blanks) HW = Potential Haz Waste O = Other(Specify:_____)

Preservative Codes: H = Hydrochloric Acid & Ice I = Ice Only N = Nitrie Acid& Ice S = Sulfuric Acid & Ice X = Sodium Hydroxide & Ice O = Other(Specify)

Southern Research Laboratories, Inc.

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Thank you **Lance Lumbard** for the opportunity to be of service to you and your company, we **S**incerely **A**ppreciate **Y**our **B**usiness. SRL certifies these **Laboratory Results** were produced in accordance with NELAC Standards. Hold times and preservation requirements were met for all analytes unless specifically noted in the report. Results relate only to the samples as received.

Client Name: **Wood Environment & Infrastructure Solutions, Inc.**	Date(s) Collected: 09/23/21
Contact Name: **Lance Lumbard**	Date Received: 09/23/21
Project Name: Lake Buchanan Stormwater	Time Received: 15:08
Project Number: 600713x2.02.07	Date Reported : 10/04/21
Phone Number: (407) 522-7570	Date Emailed : 10/04/21
Fax Number: (407) 522-7576	SRL Work Order # 21-09032

SRL WO #	Clients #	Matrix	Analysis Requested
2109032-001	Buchanan DW	Liquid	TSS/Total Nitrogen/Ammonia/ Total Phosphorus/Orthophosphate

Sherri Payne
Vice President & Quality Assurance Officer
Southern Research Laboratories, Inc.

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NELAP Certified
FDOH Cert # : E83484
SRL Lab Ref # : 21-09032
Received Date : 09/23/21

Lance Lumbard
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550 Northlake Blvd., Suite 1000
Altamonte Springs, FL. 32701 (407) 522-7570

Project Number/Project Name
600713x2.02.07
Lake Buchanan Stormwater
Lake Buchanan

Classical Chemistry Parameters

Client ID # : **Buchanan DW**
SRL (Lab) ID# : 2109032-001
Date Collected : 09/23/21
Lab FDOH Certification # : E83182

Analtye	CAS Number	Results	Flag	Units	Dilution Factor	MDL	PQL	Method	Date Prepared	Date Analyzed
Ammonia as N	7664-41-7	**0.093**		mg/L	1	0.0098	0.020	EPA 350.1	09/24/21	09/27/21
Nitrate/Nitrite as N		**0.065**		mg/L	1	0.016	0.050	4500NO3 H-	09/28/21	09/29/21
Orthophosphate as P	1426-54-42	**0.036**		mg/L	1	0.0040	0.010	EPA 365.1	09/24/21	09/24/21
Phosphorus	7723-14-0	**0.072**		mg/L	1	0.010	0.015	EPA 365.4	09/24/21	09/28/21
Total Kjeldahl Nitrogen		**0.98**		mg/L	1	0.037	0.050	EPA 351.2	09/24/21	09/28/21
Total Nitrogen	17778-88-0	**1.0**		mg/L	1	0.037	0.050	CALC	09/28/21	09/29/21
Total Suspended Solids		2.5	U	mg/L	1	2.5	2.5	M-2540D-201	09/29/21	09/30/21

Client ID # : **Blanks**
SRL (Lab) ID# : MB
Date Collected : NA
Lab FDOH Certification # : E83182

Analtye	CAS Number	Results	Flag	Units	Dilution Factor	MDL	PQL	Method	Date Prepared	Date Analyzed
Ammonia as N	7664-41-7	0.0098	U	mg/L	1	0.0098	0.020	EPA 350.1	09/24/21	09/27/21
Nitrate/Nitrite as N		0.016	U	mg/L	1	0.016	0.050	4500NO3 H-	09/28/21	09/29/21
Orthophosphate as P	1426-54-42	0.0040	U	mg/L	1	0.0040	0.010	EPA 365.1	09/24/21	09/24/21
Phosphorus	7723-14-0	0.010	U	mg/L	1	0.010	0.015	EPA 365.4	09/24/21	09/28/21
Total Kjeldahl Nitrogen		0.037	U	mg/L	1	0.037	0.050	EPA 351.2	09/24/21	09/28/21
Total Nitrogen	17778-88-0	0.037	U	mg/L	1	0.037	0.050	CALC	09/28/21	09/29/21
Total Suspended Solids		2.5	U	mg/L	1	2.5	2.5	M-2540D-201	09/29/21	09/30/21

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NELAP Certified
FDOH Cert # : E83484
SRL Lab Ref # : 21-09032
Received Date : 09/23/21

Lance Lumbard
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Altamonte Springs, FL. 32701 (407) 522-7570

Project Number/Project Name
600713x2.02.07
Lake Buchanan Stormwater
Lake Buchanan

Classical Chemistry Parameters

QAQC

	% Recovery LCS/MS/MS2/MSD	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Nitrate/Nitrite as N	113/109/112	84-116	84-116		3	0-10
Total Kjeldahl Nitrogen	101/105/116/109	90-110	90-110	QM-07	3	0-10

Total Nitrogen (Calculated as: (Nitrogen, Total Kjeldahl) + (Nitrogen, Nitrate + Nitrite)

	% Recovery LCS/MS/MSD	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Orthophosphate as P	102/112/118	90-110	90-110	QM-07	4	0-10

	% Recovery LCS/MS/MSD	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Phosphorus	96/103/104	90-110	90-110		1	0-10

	% Recovery LCS/MS/MSD	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Nitrogen, Ammonia (as N)	101/109/110	90-110	90-110		0.9	0-10

	% Recovery LCS	Acceptable Limits
Total Suspended Solids	96	80-120

	Result	Source Result	RPD	Notes	RPD Limit
Total Suspended Solids (DUP-1)	8.0	10	22	LP-02 QM-12	0-20

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NELAP Certified
FDOH Cert # : E83484
SRL Lab Ref # : 21-09032
Received Date : 09/23/21

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550 Northlake Blvd., Suite 1000
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Project Number/Project Name
600713x2.02.07
Lake Buchanan Stormwater
Lake Buchanan

DATA QUALIFIER CODES

Reporting Exceptions and Qualified Data

When quality control results are outside established control limits reanalysis, including re-extraction (if applicable), is preferred. If re-analysis is not viable or desirable, then results may be qualified. Sample results associated with quality control data that exceed acceptance criteria will be qualified with an appropriate comment.

D = Data reported from a dilution and or multiple dilutions.

I = Estimated Value, The reported value is between the Laboratory Method Detection Limit (**MDL**) and the Laboratory Practical Quantitation Limit (**PQL**)

J = Estimated Value

L = Off-Scale high; exceeds the linear range or highest calibration standard.

O = Sampled, but analysis lost or not performed

Q = Sample held beyond normal holding time
Q01 Analysis performed outside of method-specified holding time
Q02 Sample received outside of method-specified holding time

U = indicates the compound was analyzed for, but not detected. The numerical value preceding the "U" is the limit of detection for that compound based upon the dilution. **MEDF** = **M**atrix **E**ffected **D**ilution **F**actor.

V = Analyte was detected in both the sample and associated Laboratory Method Blank; Laboratory Contamination

Y = The analysis was from an unpreserved or improperly preserved sample. The data may not be accurate

Unless otherwise noted, ug/Kg and mg/Kg denote dry weight.

(SOILS) Actual Reporting Limit will depend on moisture content of sample and the amount of sample received.

LP-02 Filtered residue did not meet 2.5-200mg range

QM-12 Precision between duplicate samples was outside acceptance limits

QM-07 The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on acceptable LCS recovery.

Chain of Custody

2109032

1

Page 1 of 1

Project Manager: Lance Lombard	Southern Research Laboratories, Inc. 2251 Lynx Lane, Suite #1 Orlando, Florida 32804
Company: Wood Environment & Infrastructure Solutions, Inc.	Main (407) 522-7100 Fax: (407) 522-7043
Address: 250 Northlake Blvd., Suite 1000	Project Name: Lake Buchanan Stormwater
City, State, Zip: Altamonte Springs Florida 32701	Project Location: PO# C0126101 00 600713x2,02.07
Phone: 407-522-7570 Fax: +1 (407) 522-7576	

Sampled by [Print Name(s)] / Affiliation: Katie Ballew / BFA

Sampler(s) Signature(s):

Preservatives (see codes): 1 | 1 | S

Project Number: 600713x2

Analyses Requested: TSS; Orthophos Fld Filtered; TN Nitrogen Tot Persulfate Ammonia

REQUESTED DUE DATE:

Facility ID#:

Petroleum Restoration Program ____ yes ____ no

	Sample Identification	Sampled Date:	Sampled Time:	Grab or Composite	Matrix: (see codes)	Total Number of Containers	TSS	Orthophos Fld Filtered	TN Nitrogen Tot Persulfate Ammonia						
1	Buchanan DW	9/23/21	1025	C	SW	3	✓	✓	✓						2109032-001

Shipment Method:		Relinquished by	Date:	Time:	Accepted by:	Date:	Time:
Out: / /	Via:	Helen Turner	3-21-21	14:15			
Returned: / /	Via:		9/23/21	1508	Helen Turner	9.23.21	15:08

Additional Comments:

Cooler No.(s) / Temperature(s) (°C): Stock, 433 Client cooler 2.0

Sampling Kit No.: 8910

Equipment ID No.:

Matrix Codes: A = Air GW = Groundwater SE = Sediment SO = Soil SW = Surface Water W = Water(Blanks) HW = Potential Haz Waste O = Other(Specify:_____)

Preservative Codes: H = Hydrochloric Acid & Ice I = Ice Only N = Nitrie Acid& Ice S = Sulfuric Acid & Ice X = Sodium Hydroxide & Ice O = Other(Specify)

Southern Research Laboratories, Inc.

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Client Name: **Wood Environment & Infrastructure Solutions, Inc.**	Date(s) Collected: 10/29/21
Contact Name: **Lance Lumbard**	Date Received: 10/29/21
Project Name: Lake Buchanan Stormwater	Time Received: 15:10
Project Number: 600713x2.01.07	Date Reported : 11/11/21
Phone Number: (407) 522-7570	Date Emailed : 11/11/21
Fax Number: (407) 522-7576	SRL Work Order # 21-10050

SRL WO #	Clients #	Matrix	Analysis Requested
2110050-001	Buchanan Palmetto	Liquid	TSS/Total Nitrogen/Ammonia/ Total Phosphorus/Orthophosphate
2110050-002	Buchanan DW	Liquid	TSS/Total Nitrogen/Ammonia/ Total Phosphorus/Orthophosphate

Sherri Payne
Vice President & Quality Assurance Officer
Southern Research Laboratories, Inc.

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APPENDIX J

Seepage Water Laboratory Reports

Chain of Custody

2106036
3

Page 1 of 1

Project Manager:	Lance Lambard
Company:	Wood Environment & Infrastructure Solutions, Inc.
Address:	350 Northlake Blvd., Suite 1000
City, State, Zip:	Altamonte Springs Florida 32701
Phone:	407-522-7570
Fax:	+1 (407) 522-7576

Southern Research Laboratories, Inc.
2251 Lynx Lane, Suite #1
Orlando, Florida 32804
Main (407) 522-7100 Fax: (407) 522-7043

Project Name: Lake Buchanan Seepage Meters

Project Location: Lake Buchanan

Sampled by [Print Name(s)] / Affiliation: James S. Preston/Wood Katie Ballew / BFA

Sampler(s) Signature(s): James S. Preston

Project Number: 6007l3x2

REQUESTED DUE DATE:

Facility ID#:

Petroleum Restoration Program ___ yes ✓ no

	Sample Identification	Sampled Date:	Sampled Time:	Grab or Composite	Matrix: (see codes)	Total Number of Containers	Preservatives (see codes): TSS: H	TN/low level TP/ Ammonia: S	low level ortho-P: I	Analyses Requested	Lab ID
1	LBSM1	6/28/21	1135	G	SW	3	✓	✓	✓		2106036-001
2	LBSM2	6/28/21	1110	G	SW	3	✓	✓	✓		-002
3	LBSM3	6/28/21	1225	G	SW	3	✓	✓	✓		-003

Shipment Method:		Relinquished by	Date:	Time:	Accepted by:	Date:	Time:
Out: / /	Via:	~~FEDEX~~ Helen Turner	3/21/20	13:45	James S. Preston	3/21/20	1345
Returned: / /	Via:	James S. Preston	6/24/21	1248		6/28/21	1248
Additional Comments:			6/28/21	1325	Helen Turner	6/28/21	13:25

Cooler No.(s) / Temperature(s) (°C): 134, 150 (12.4) 20

Sampling Kit No.: 8909

Equipment ID No.:

Matrix Codes: A = Air GW = Groundwater SE = Sediment SO = Soil SW = Surface Water W = Water(Blanks) HW = Potential Haz Waste O = Other(Specify:)

Preservative Codes: H = Hydrochloric Acid & Ice I = Ice Only N = Nitrie Acid& Ice S = Sulfuric Acid & Ice X = Sodium Hydroxide & Ice O = Other(Specify)

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Thank you **Lance Lumbard** for the opportunity to be of service to you and your company, we **S**incerely **A**ppreciate **Y**our **B**usiness. SRL certifies these **Laboratory Results** were produced in accordance with NELAC Standards. Hold times and preservation requirements were met for all analytes unless specifically noted in the report. Results relate only to the samples as received.

Client Name: **Wood Environment & Infrastructure Solutions, Inc.**	Date(s) Collected: 08/26/21
Contact Name: **Lance Lumbard**	Date Received: 08/26/21
Project Name: Lake Buchanan Seepage	Time Received: 11:58
Project Number: 600713x2.02.06	Date Reported : 09/09/21
Phone Number: (407) 522-7570	Date Emailed : 09/09/21
Fax Number: (407) 522-7576	SRL Work Order # 21-08038

SRL WO #	Clients #	Matrix	Analysis Requested
2108038-001	LBSM1	Liquid	TSS/Total Nitrogen/Ammonia/ Total Phosphorus/Orthophosphate

Sherri Payne
Vice President & Quality Assurance Officer
Southern Research Laboratories, Inc.

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NELAP Certified
FDOH Cert # : E83484
SRL Lab Ref # : 21-08038
Received Date : 08/26/21

Lance Lumbard
Wood Env. & Infrastructure Solutions, Inc.
550 Northlake Blvd., Suite 1000
Altamonte Springs, FL. 32701 (407) 522-7570

Project Number/Project Name
600713x2.02.06
Lake Buchanan Seepage Meters
Lake Buchanan

Classical Chemistry Parameters

Client ID # : **LBSM1**
SRL (Lab) ID# : 2108038-001
Date Collected : 08/26/21
Lab FDOH Certification # : E83182

Analtye	CAS Number	Results	Flag	Units	Dilution Factor	MDL	PQL	Method	Date Prepared	Date Analyzed
Ammonia as N	7664-41-7	0.0098	U	mg/L	1	0.0098	0.020	EPA 350.1	08/30/21	08/30/21
Nitrate/Nitrite as N		**0.42**		mg/L	1	0.016	0.050	4500NO3 H-	08/31/21	09/01/21
Orthophosphate as P	1426-54-42	0.0040	U	mg/L	1	0.0040	0.010	EPA 365.1	08/27/21	08/27/21
Phosphorus	7723-14-0	**0.14**		mg/L	1	0.010	0.015	EPA 365.4	08/30/21	08/31/21
Total Kjeldahl Nitrogen		**1.0**		mg/L	1	0.037	0.050	EPA 351.2	08/27/21	08/31/21
Total Nitrogen	17778-88-0	**1.4**		mg/L	1	0.037	0.050	CALC	08/31/21	09/01/21
Total Suspended Solids		**16**		mg/L	1	2.5	2.5	M-2540D-201	09/02/21	09/03/21

Client ID # : **Blanks**
SRL (Lab) ID# : MB
Date Collected : NA
Lab FDOH Certification # : E83182

Analtye	CAS Number	Results	Flag	Units	Dilution Factor	MDL	PQL	Method	Date Prepared	Date Analyzed
Ammonia as N	7664-41-7	0.0098	U	mg/L	1	0.0098	0.020	EPA 350.1	08/30/21	08/30/21
Nitrate/Nitrite as N		0.016	U	mg/L	1	0.016	0.050	4500NO3 H-	08/31/21	09/01/21
Orthophosphate as P	1426-54-42	0.0040	U	mg/L	1	0.0040	0.010	EPA 365.1	08/27/21	08/27/21
Phosphorus	7723-14-0	0.010	U	mg/L	1	0.010	0.015	EPA 365.4	08/30/21	08/31/21
Total Kjeldahl Nitrogen		0.037	U	mg/L	1	0.037	0.050	EPA 351.2	08/27/21	08/31/21
Total Nitrogen	17778-88-0	0.037	U	mg/L	1	0.037	0.050	CALC	08/31/21	09/01/21
Total Suspended Solids		2.5	U	mg/L	1	2.5	2.5	M-2540D-201	09/02/21	09/03/21

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NELAP Certified
FDOH Cert # : E83484
SRL Lab Ref # : 21-08038
Received Date : 08/26/21

Lance Lumbard
Wood Env. & Infrastructure Solutions, Inc.
550 Northlake Blvd., Suite 1000
Altamonte Springs, FL. 32701 (407) 522-7570

Project Number/Project Name
600713x2.02.06
Lake Buchanan Seepage Meters
Lake Buchanan

Classical Chemistry Parameters

QAQC

	% Recovery LCS/MS/MS2/MSD	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Nitrate/Nitrite as N	97/96/94	84-116	84-116		2	0-10
Total Kjeldahl Nitrogen	103/107/107/104	90-110	90-110		2	0-10

Total Nitrogen (Calculated as: (Nitrogen, Total Kjeldahl) + (Nitrogen, Nitrate + Nitrite)

	% Recovery LCS/MS/MSD	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Orthophosphate as P	98/105/91	90-110	90-110	QM-11	15	0-10

	% Recovery LCS/MS/MSD	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Phosphorus	104/104/104	90-110	90-110		0	0-10

	% Recovery LCS/MS2/MS3/MSD2	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Nitrogen, Ammonia (as N)	102/109/107	90-110	90-110		2	0-10

	% Recovery LCS	Acceptable Limits
Total Suspended Solids	91	80-120

	Result	Source Result	RPD	Notes	RPD Limit
Total Suspended Solids (DUP-1)	2.5 U	2.5 U		LP-02	0-20

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NELAP Certified
FDOH Cert # : E83484
SRL Lab Ref # : 21-08038
Received Date : 08/26/21

Lance Lumbard
Wood Env. & Infrastructure Solutions, Inc.
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Project Number/Project Name
600713x2.02.06
Lake Buchanan Seepage Meters
Lake Buchanan

DATA QUALIFIER CODES

Reporting Exceptions and Qualified Data

When quality control results are outside established control limits reanalysis, including re-extraction (if applicable), is preferred. If re-analysis is not viable or desirable, then results may be qualified. Sample results associated with quality control data that exceed acceptance criteria will be qualified with an appropriate comment.

D = Data reported from a dilution and or multiple dilutions.

I = Estimated Value, The reported value is between the Laboratory Method Detection Limit (**MDL**) and the Laboratory Practical Quantitation Limit (**PQL**)

J = Estimated Value

L = Off-Scale high; exceeds the linear range or highest calibration standard.

O = Sampled, but analysis lost or not performed

Q = Sample held beyond normal holding time
Q01 Analysis performed outside of method-specified holding time
Q02 Sample received outside of method-specified holding time

U = indicates the compound was analyzed for, but not detected. The numerical value preceding the "U" is the limit of detection for that compound based upon the dilution. **MEDF** = **M**atrix **E**ffected **D**ilution **F**actor.

V = Analyte was detected in both the sample and associated Laboratory Method Blank; Laboratory Contamination

Y = The analysis was from an unpreserved or improperly preserved sample. The data may not be accurate

Unless otherwise noted, ug/Kg and mg/Kg denote dry weight.

(SOILS) Actual Reporting Limit will depend on moisture content of sample and the amount of sample received.

LP-02 Filtered residue did not meet 2.5-200mg range

QM-11 Precision between duplicate matrix spikes of the same sample was outsiode acceptance limits

Chain of Custody

2108038
1

Page 1 of 1

Project Manager:	**Lance Lumbard**
Company:	**Wood**
Address:	**550 Northlake Blvd**
City, State, Zip:	**Alatamonte Springs, Fl 32701**
Phone: 407-522-*7570	Fax:

Southern Research Laboratories, Inc.
2251 Lynx Lane, Suite #1
Orlando, Florida 32804
(407) 522-7100
Toll Free 1 (888) 420-TEST
Fax: (407) 522-7043

Project Name: Lake Buchanan Seepage
PO# C20906C001
Project Location: Lake Buchanan

Sampled by [Print Name(s)] / Affiliation:
Robert Sheridan, Zach Leibowitz Wood

Sampler(s) Signature(s):

Project Number: 600713X2.02.06
REQUESTED DUE DATE:
Sampling QAP No.:
Approval Date:

	Sample Identification	Sampled Date:	Sampled Time:	Grab or Composite	Matrix: (see codes)	Total Number of Containers	Preservatives (see codes) TSS	TN/TP (low level) Ammonia	Ortho-P (Low Level)	Comments
							I	S	I	
1	LBSM1	8/26/21	10:40	G	SW	3	(1)	(1)	(1)	2108038-001
2										
3										
4										
5										
6										
7										
8										
9										
10										

Analyses Requested

Shipment Method:		Relinquished by:	Date:	Time:	Accepted by:	Date:	Time:
Out: / /	Via:	Zachary Leibowitz	8/26/21	11:58	Helen Swann	8/26/21	11:58
Returned: / /	Via:						

Additional Comments:

Cooler No.(s) / Temperature(s) (°C): 4895 1.8 VC
Sampling Kit No.: stock
Equipment ID No.:

Matrix Codes: A = Air GW = Groundwater SE = Sediment SO = Soil SW = Surface Water W = Water(Blanks) HW = Potential Haz Waste O = Other(Specify:)

Preservative Codes: H = Hydrochloric Acid & Ice I = Ice Only N = Nitric Acid & Ice S = Sulfuric Acid & Ice X = Sodium Hydroxide & Ice O = Other(Specify)

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Toll Free 1 (888) 420-Test

Thank you **Lance Lumbard** for the opportunity to be of service to you and your company, we **S**incerely **A**ppreciate **Y**our **B**usiness. SRL certifies these **Laboratory Results** were produced in accordance with NELAC Standards. Hold times and preservation requirements were met for all analytes unless specifically noted in the report. Results relate only to the samples as received.

Client Name: **Wood Environment & Infrastructure Solutions, Inc.**	Date(s) Collected: 08/02/21
Contact Name: **Lance Lumbard**	Date Received: 08/02/21
Project Name: Lake Buchanan Surface Water	Time Received: 12:20
Project Number: 600713x2.02.06	Date Reported : 08/11/21
Phone Number: (407) 522-7570	Date Emailed : 08/11/21
Fax Number: (407) 522-7576	SRL Work Order # 21-08002

SRL WO #	Clients #	Matrix	Analysis Requested
2108002-001	LBSM2	Liquid	TSS/Total Nitrogen/Ammonia/ Total Phosphorus/Orthophosphate

Nonconformance: Larger dilution factors, can lead to variability in results that may not be as accurate. In this case, the Ammonia result at a 20 times dilution factor is greater than the TKN results at 5 times dilution factor.

Sherri Payne
Vice President & Quality Assurance Officer
Southern Research Laboratories, Inc.

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NELAP Certified
FDOH Cert # : E83484
SRL Lab Ref # : 21-08002
Received Date : 08/02/21

Lance Lumbard
Wood Env. & Infrastructure Solutions, Inc.
550 Northlake Blvd., Suite 1000
Altamonte Springs, FL. 32701 (407) 522-7570

Project Number/Project Name
600713x2.02.06
Lake Buchanan Seepage Meters
Lake Buchanan

Classical Chemistry Parameters

Client ID # : **LBSM2**
SRL (Lab) ID# : 2108002-001
Date Collected : 08/02/21
Lab FDOH Certification # : E83182

Analtye	CAS Number	Results	Flag	Units	Dilution Factor	MDL	PQL	Method	Date Prepared	Date Analyzed
Ammonia as N	7664-41-7	**16**		mg/L	20	0.20	0.40	EPA 350.1	08/05/21	08/06/21
Nitrate/Nitrite as N		**15**		mg/L	20	0.32	1.0	4500NO3 H-	08/03/21	08/04/21
Orthophosphate as P	1426-54-42	**0.016**		mg/L	1	0.0040	0.010	EPA 365.1	08/03/21	08/03/21
Phosphorus	7723-14-0	**0.15**		mg/L	1	0.010	0.015	EPA 365.4	08/03/21	08/05/21
Total Kjeldahl Nitrogen		**14**		mg/L	5	0.18	0.25	EPA 351.2	08/03/21	08/05/21
Total Nitrogen	17778-88-0	**28**		mg/L	20	0.32	1.0	CALC	08/03/21	08/05/21
Total Suspended Solids		**14**		mg/L	1	2.5	2.5	M-2540D-201	08/06/21	08/10/21

Client ID # : **Blanks**
SRL (Lab) ID# : MB
Date Collected : NA
Lab FDOH Certification # : E83182

Analtye	CAS Number	Results	Flag	Units	Dilution Factor	MDL	PQL	Method	Date Prepared	Date Analyzed
Ammonia as N	7664-41-7	0.0098	U	mg/L	1	0.0098	0.020	EPA 350.1	08/05/21	08/06/21
Nitrate/Nitrite as N		0.016	U	mg/L	1	0.016	0.050	4500NO3 H-	08/03/21	08/04/21
Orthophosphate as P	1426-54-42	0.0040	U	mg/L	1	0.0040	0.010	EPA 365.1	08/03/21	08/03/21
Phosphorus	7723-14-0	0.010	U	mg/L	1	0.010	0.015	EPA 365.4	08/03/21	08/05/21
Total Kjeldahl Nitrogen		0.037	U	mg/L	1	0.037	0.050	EPA 351.2	08/03/21	08/05/21
Total Nitrogen	17778-88-0	0.037	U	mg/L	1	0.037	0.050	CALC	08/03/21	08/05/21
Total Suspended Solids		2.5	U	mg/L	1	2.5	2.5	M-2540D-201	08/06/21	08/10/21

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NELAP Certified
FDOH Cert # : E83484
SRL Lab Ref # : 21-08002
Received Date : 08/02/21

Lance Lumbard
Wood Env. & Infrastructure Solutions, Inc.
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Altamonte Springs, FL. 32701 (407) 522-7570

Project Number/Project Name
600713x2.02.06
Lake Buchanan Seepage Meters
Lake Buchanan

Classical Chemistry Parameters

QAQC

	% Recovery LCS/MS/MS2/MSD	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Nitrate/Nitrite as N	96/20/50	84-116	84-116	QM-07	1	0-10
Total Kjeldahl Nitrogen	104/103/104	90-110	90-110		0.6	0-10

Total Nitrogen (Calculated as: (Nitrogen, Total Kjeldahl) + (Nitrogen, Nitrate + Nitrite)

	% Recovery LCS/MS/MSD	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Orthophosphate as P	96/97/104	90-110	90-110		7	0-10

	% Recovery LCS/MS/MSD	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Phosphorus	105/102/101	90-110	90-110		0.8	0-10

	% Recovery LCS/MS2/MS3/MSD2	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Nitrogen, Ammonia (as N)	96/106/110/101	90-110	90-110		3	0-10

	% Recovery LCS	Acceptable Limits
Total Suspended Solids	90	80-120

	Result	Source Result	RPD	Notes	RPD Limit
Total Suspended Solids (DUP-1)	2.5 U	2.5 U		LP-02	0-20

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NELAP Certified
FDOH Cert # : E83484
SRL Lab Ref # : 21-08002
Received Date : 08/02/21

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Altamonte Springs, FL. 32701 (407) 522-7570

Project Number/Project Name
600713x2.02.06
Lake Buchanan Seepage Meters
Lake Buchanan

DATA QUALIFIER CODES

Reporting Exceptions and Qualified Data

When quality control results are outside established control limits reanalysis, including re-extraction (if applicable), is preferred. If re-analysis is not viable or desirable, then results may be qualified. Sample results associated with quality control data that exceed acceptance criteria will be qualified with an appropriate comment.

D = Data reported from a dilution and or multiple dilutions.

I = Estimated Value, The reported value is between the Laboratory Method Detection Limit (**MDL**) and the Laboratory Practical Quantitation Limit (**PQL**)

J = Estimated Value

L = Off-Scale high; exceeds the linear range or highest calibration standard.

O = Sampled, but analysis lost or not performed

Q = Sample held beyond normal holding time
Q01 Analysis performed outside of method-specified holding time
Q02 Sample received outside of method-specified holding time

U = indicates the compound was analyzed for, but not detected. The numerical value preceding the "U" is the limit of detection for that compound based upon the dilution. **MEDF** = **M**atrix **E**ffected **D**ilution **F**actor.

V = Analyte was detected in both the sample and associated Laboratory Method Blank; Laboratory Contamination

Y = The analysis was from an unpreserved or improperly preserved sample. The data may not be accurate

Unless otherwise noted, ug/Kg and mg/Kg denote dry weight.

(SOILS) Actual Reporting Limit will depend on moisture content of sample and the amount of sample received.

QM-07 The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on acceptable LCS recovery.

LP-02 Filtered residue did not meet 2.5-200mg range

Chain of Custody

2108002

1

Page 1 of 1

Project Manager:	Lance Lumbard
Company:	Wood Environment & Infrastructure Solutions, Inc.
Address:	350 Northlake Blvd., Suite 1000
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Southern Research Laboratories, Inc.
2251 Lynx Lane, Suite #1
Orlando, Florida 32804
Main (407) 522-7100 Fax: (407) 522-7043

Project Name: PO# C20906C001
Lake Buchanan Seepage Meters

Project Location: Lake Buchanan

Sampled by [Print Name(s)] / Affiliation: James S. Preston/Wood Katie Ballew / BFA

Sampler(s) Signature(s): James S. Preston

Project Number: 600713x2.02.06

REQUESTED DUE DATE:

Facility ID#:

Petroleum Restoration Program ___ yes ✓ no

	Sample Identification	Sampled Date:	Sampled Time:	Grab or Composite	Matrix: (see codes)	Total Number of Containers	Preservatives (see codes)									Analyses Requested									
							I	S	I							TSS	TN/low level TP/ Ammonia	low level ortho-P								
	LBSM1			G	SW	3																			
1	LBSM2	8/2/2021	1010	G	SW	3										✓	✓	✓							
	LBSM3			G	SW	3																			

LBSM1: No. Sample due to hyacinth
2108002-001
LBSM3: No Sample due to holes

Shipment Method:		Relinquished by	Date:	Time:	Accepted by:	Date:	Time:
Out: / /	Via:	Helen Turner	3/21/21	13:45	James S. Preston	3/21/21	1345
Returned: / /	Via:	James S. Preston	8/2/2021	1150		8/2/2021	1150
			8.2.21	1220		8.2.21	1220

Additional Comments:

Cooler No.(s) / Temperature(s) (°C): 134, 150 Client cooler 0.9

Sampling Kit No.: 8909

Equipment ID No.:

Matrix Codes: A = Air GW = Groundwater SE = Sediment SO = Soil SW = Surface Water W = Water(Blanks) HW = Potential Haz Waste O = Other(Specify:_____)

Preservative Codes: H = Hydrochloric Acid & Ice I = Ice Only N = Nitrie Acid& Ice S = Sulfuric Acid & Ice X = Sodium Hydroxide & Ice O = Other(Specify)

Southern Research Laboratories, Inc.

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Thank you **Lance Lumbard** for the opportunity to be of service to you and your company, we **S**incerely **A**ppreciate **Y**our **B**usiness. SRL certifies these **Laboratory Results** were produced in accordance with NELAC Standards. Hold times and preservation requirements were met for all analytes unless specifically noted in the report. Results relate only to the samples as received.

Client Name: **Wood Environment & Infrastructure Solutions, Inc.**	Date(s) Collected: 09/29/21
Contact Name: **Lance Lumbard**	Date Received: 09/29/21
Project Name: Lake Buchanan Seepage Meters	Time Received: 13:50
Project Number: 600713x2.02.06	Date Reported : 10/11/21
Phone Number: (407) 522-7570	Date Emailed : 10/11/21
Fax Number: (407) 522-7576	SRL Work Order # 21-09047

SRL WO #	Clients #	Matrix	Analysis Requested
2109047-001	LBSM1	Liquid	TSS/Total Nitrogen/Ammonia/ Total Phosphorus/Orthophosphate
2109047-002	LBSM2	Liquid	TSS/Total Nitrogen/Ammonia/ Total Phosphorus/Orthophosphate
2109047-003	LBSM3	Liquid	TSS/Total Nitrogen/Ammonia/ Total Phosphorus/Orthophosphate

Sherri Payne
Vice President & Quality Assurance Officer
Southern Research Laboratories, Inc.

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NELAP Certified
FDOH Cert # : E83484
SRL Lab Ref # : 21-09047
Received Date : 09/29/21

Lance Lumbard
Wood Env. & Infrastructure Solutions, Inc.
550 Northlake Blvd., Suite 1000
Altamonte Springs, FL. 32701 (407) 522-7570

Project Number/Project Name
600713x2.02.06
Lake Buchanan Seepage Meters
Lake Buchanan

Classical Chemistry Parameters

Client ID # : **LBSM1**
SRL (Lab) ID# : 2109047-001
Date Collected : 09/29/21
Lab FDOH Certification # : E83182

Analtye	CAS Number	Results	Flag	Units	Dilution Factor	MDL	PQL	Method	Date Prepared	Date Analyzed
Ammonia as N	7664-41-7	0.0098	U	mg/L	1	0.0098	0.020	EPA 350.1	09/30/21	10/01/21
Nitrate/Nitrite as N		**0.48**		mg/L	1	0.016	0.050	4500NO3 H-	10/05/21	10/06/21
Orthophosphate as P	1426-54-42	0.0040	U	mg/L	1	0.0040	0.010	EPA 365.1	09/30/21	09/30/21
Phosphorus	7723-14-0	**0.13**		mg/L	1	0.010	0.015	EPA 365.4	09/30/21	10/05/21
Total Kjeldahl Nitrogen		**0.84**		mg/L	1	0.037	0.050	EPA 351.2	09/30/21	10/05/21
Total Nitrogen	17778-88-0	**1.3**		mg/L	1	0.037	0.050	CALC	10/05/21	10/06/21
Total Suspended Solids		**16**		mg/L	1	2.5	2.5	M-2540D-201	10/05/21	10/06/21

Client ID # : **LBSM2**
SRL (Lab) ID# : 2109047-002
Date Collected : 09/29/21
Lab FDOH Certification # : E83182

Analtye	CAS Number	Results	Flag	Units	Dilution Factor	MDL	PQL	Method	Date Prepared	Date Analyzed
Ammonia as N	7664-41-7	**0.72**		mg/L	1	0.0098	0.020	EPA 350.1	09/30/21	10/01/21
Nitrate/Nitrite as N		**20**		mg/L	50	0.80	2.5	4500NO3 H-	10/05/21	10/06/21
Orthophosphate as P	1426-54-42	0.0040	U	mg/L	1	0.0040	0.010	EPA 365.1	09/30/21	09/30/21
Phosphorus	7723-14-0	**0.46**		mg/L	1	0.010	0.015	EPA 365.4	09/30/21	10/05/21
Total Kjeldahl Nitrogen		**3.8**		mg/L	1	0.037	0.050	EPA 351.2	09/30/21	10/05/21
Total Nitrogen	17778-88-0	**24**		mg/L	50	0.80	2.5	CALC	10/05/21	10/06/21
Total Suspended Solids		**46**		mg/L	1	2.5	2.5	M-2540D-201	10/05/21	10/06/21

Client ID # : **LBSM3**
SRL (Lab) ID# : 2109047-003
Date Collected : 09/29/21
Lab FDOH Certification # : E83182

Analtye	CAS Number	Results	Flag	Units	Dilution Factor	MDL	PQL	Method	Date Prepared	Date Analyzed
Ammonia as N	7664-41-7	**27**		mg/L	50	0.49	1.0	EPA 350.1	09/30/21	10/01/21
Nitrate/Nitrite as N		**0.068**		mg/L	1	0.016	0.050	4500NO3 H-	10/05/21	10/06/21
Orthophosphate as P	1426-54-42	**0.88**		mg/L	10	0.040	0.10	EPA 365.1	09/30/21	09/30/21
Phosphorus	7723-14-0	**1.8**		mg/L	5	0.050	0.075	EPA 365.4	09/30/21	10/05/21
Total Kjeldahl Nitrogen		**29**		mg/L	10	0.37	0.50	EPA 351.2	09/30/21	10/05/21
Total Nitrogen	17778-88-0	**29**		mg/L	10	0.37	0.50	CALC	10/05/21	10/06/21
Total Suspended Solids		**29**		mg/L	1	2.5	2.5	M-2540D-201	10/05/21	10/06/21

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NELAP Certified
FDOH Cert # : E83484
SRL Lab Ref # : 21-09047
Received Date : 09/29/21

Lance Lumbard
Wood Env. & Infrastructure Solutions, Inc.
550 Northlake Blvd., Suite 1000
Altamonte Springs, FL. 32701 (407) 522-7570

Project Number/Project Name
600713x2.02.06
Lake Buchanan Seepage Meters
Lake Buchanan

Classical Chemistry Parameters

Client ID # : **Blanks**
SRL (Lab) ID# : MB
Date Collected : NA
Lab FDOH Certification # : E83182

Analtye	CAS Number	Results	Flag	Units	Dilution Factor	MDL	PQL	Method	Date Prepared	Date Analyzed
Ammonia as N	7664-41-7	0.0098	U	mg/L	1	0.0098	0.020	EPA 350.1	09/30/21	10/01/21
Nitrate/Nitrite as N		0.016	U	mg/L	1	0.016	0.050	4500NO3 H-	10/05/21	10/06/21
Orthophosphate as P	1426-54-42	0.0040	U	mg/L	1	0.0040	0.010	EPA 365.1	09/30/21	09/30/21
Phosphorus	7723-14-0	0.010	U	mg/L	1	0.010	0.015	EPA 365.4	09/30/21	10/05/21
Total Kjeldahl Nitrogen		0.037	U	mg/L	1	0.037	0.050	EPA 351.2	09/30/21	10/05/21
Total Nitrogen	17778-88-0	0.037	U	mg/L	1	0.037	0.050	CALC	10/05/21	10/06/21
Total Suspended Solids		2.5	U	mg/L	1	2.5	2.5	M-2540D-201	10/05/21	10/06/21

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NELAP Certified
FDOH Cert # : E83484
SRL Lab Ref # : 21-09047
Received Date : 09/29/21

Lance Lumbard
Wood Env. & Infrastructure Solutions, Inc.
550 Northlake Blvd., Suite 1000
Altamonte Springs, FL. 32701 (407) 522-7570

Project Number/Project Name
600713x2.02.06
Lake Buchanan Seepage Meters
Lake Buchanan

Classical Chemistry Parameters

QAQC

	% Recovery LCS/MS/MS2/MSD	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Nitrate/Nitrite as N	103/99/105	84-116	84-116		2	0-10
Total Kjeldahl Nitrogen	100/101/102/101	90-110	90-110		0	0-10

Total Nitrogen (Calculated as: (Nitrogen, Total Kjeldahl) + (Nitrogen, Nitrate + Nitrite)

	% Recovery LCS/MS/MSD	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Orthophosphate as P	105/26/76	90-110	90-110	QM-07	3	0-10

	% Recovery LCS/MS/MSD	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Phosphorus	102/103/96	90-110	90-110		6	0-10

	% Recovery LCS/MS1/MS2/MSD1	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Nitrogen, Ammonia (as N)	100/107/90/111	90-110	90-110	QM-07	4	0-10

	% Recovery LCS	Acceptable Limits
Total Suspended Solids	104	80-120

	Result	Source Result	RPD	Notes	RPD Limit
Total Suspended Solids (DUP-1)	140	140.0	2		0-20

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NELAP Certified
FDOH Cert # : E83484
SRL Lab Ref # : 21-09047
Received Date : 09/29/21

Lance Lumbard
Wood Env. & Infrastructure Solutions, Inc.
550 Northlake Blvd., Suite 1000
Altamonte Springs, FL. 32701 (407) 522-7570

Project Number/Project Name
600713x2.02.06
Lake Buchanan Seepage Meters
Lake Buchanan

DATA QUALIFIER CODES

Reporting Exceptions and Qualified Data

When quality control results are outside established control limits reanalysis, including re-extraction (if applicable), is preferred. If re-analysis is not viable or desirable, then results may be qualified. Sample results associated with quality control data that exceed acceptance criteria will be qualified with an appropriate comment.

D = Data reported from a dilution and or multiple dilutions.

I = Estimated Value, The reported value is between the Laboratory Method Detection Limit (**MDL**) and the Laboratory Practical Quantitation Limit (**PQL**)

J = Estimated Value

L = Off-Scale high; exceeds the linear range or highest calibration standard.

O = Sampled, but analysis lost or not performed

Q = Sample held beyond normal holding time
Q01 Analysis performed outside of method-specified holding time
Q02 Sample received outside of method-specified holding time

U = indicates the compound was analyzed for, but not detected. The numerical value preceding the "U" is the limit of detection for that compound based upon the dilution. **MEDF** = **M**atrix **E**ffected **D**ilution **F**actor.

V = Analyte was detected in both the sample and associated Laboratory Method Blank; Laboratory Contamination

Y = The analysis was from an unpreserved or improperly preserved sample. The data may not be accurate

Unless otherwise noted, ug/Kg and mg/Kg denote dry weight.

(SOILS) Actual Reporting Limit will depend on moisture content of sample and the amount of sample received.

QM-07 The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on acceptable LCS recovery.

Chain of Custody

2109047
3

Page 1 of 1

Project Manager:	Lance Lambard
Company:	Wood Environment & Infrastructure Solutions, Inc.
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City, State, Zip:	Altamonte Springs Florida 32701
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2251 Lynx Lane, Suite #1
Orlando, Florida 32804
Main (407) 522-7100 Fax: (407) 522-7043

Project Name: P0# C20906C001
Lake Buchanan Seepage Meters

Project Location: Lake Buchanan

Sampled by [Print Name(s)] / Affiliation: James S. Preston/Wood Katie Ballew/BFA

Sampler(s) Signature(s): James S. Preston

Project Number: 600713x2.02.06

REQUESTED DUE DATE:

Facility ID#:

Petroleum Restoration Program ___ yes ✓ no

	Sample Identification	Sampled Date:	Sampled Time:	Grab or Composite	Matrix: (see codes)	Total Number of Containers	Preservatives (see codes): TSS: I	TN/low-level TP/Ammonia low-level OP: S	I	Analyses Requested	
1	LBSM 1	9/29/21	1205	G	SW	3	✓	✓	✓		2109047-001
2	LBSM 2	1	1154	1	1	1	✓	✓	✓	time on containers = 11:45	-002
3	LBSM 3	1	1220	1	1	1	✓	✓	✓		-003

Shipment Method:		Relinquished by	Date:	Time:	Accepted by:	Date:	Time:
Out: / /	Via:	Helen Turner	3/21/21	13:45	James S. Preston	3/21/21	1345
Returned: / /	Via:		9/29/21	1350	Helen Turner	9-29-21	13:50

Additional Comments:

Cooler No.(s) / Temperature(s) (°C): 134, 150 Client cooler 1.5 w

Sampling Kit No.: 8909

Equipment ID No.:

Matrix Codes: A = Air GW = Groundwater SE = Sediment SO = Soil SW = Surface Water W = Water(Blanks) HW = Potential Haz Waste O = Other(Specify:_____)

Preservative Codes: H = Hydrochloric Acid & Ice I = Ice Only N = Nitrie Acid& Ice S = Sulfuric Acid & Ice X = Sodium Hydroxide & Ice O = Other(Specify)

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Thank you **Lance Lumbard** for the opportunity to be of service to you and your company, we **S**incerely **A**ppreciate **Y**our **B**usiness. SRL certifies these **Laboratory Results** were produced in accordance with NELAC Standards. Hold times and preservation requirements were met for all analytes unless specifically noted in the report. Results relate only to the samples as received.

Client Name: **Wood Environment & Infrastructure Solutions, Inc.**	Date(s) Collected: 11/22/21
Contact Name: **Lance Lumbard**	Date Received: 11/22/21
Project Name: Lake Buchanan Seepage Meters	Time Received: 16:15
Project Number: 600713x2.02.06	Date Reported : 12/06/21
Phone Number: (407) 522-7570	Date Emailed : 12/06/21
Fax Number: (407) 522-7576	SRL Work Order # 21-11047

SRL WO #	Clients #	Matrix	Analysis Requested
2111047-001	LBSM2	Liquid	TSS/Total Nitrogen/Ammonia/ Total Phosphorus/Orthophosphate
2111047-002	LBSM1	Liquid	TSS/Total Nitrogen/Ammonia/ Total Phosphorus/Orthophosphate
2111047-003	LBSM3	Liquid	TSS/Total Nitrogen/Ammonia/ Total Phosphorus/Orthophosphate

Sherri Payne
Vice President & Quality Assurance Officer
Southern Research Laboratories, Inc.

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NELAP Certified
FDOH Cert # : E83484
SRL Lab Ref # : 21-11047
Received Date : 11/22/21

Lance Lumbard
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Altamonte Springs, FL. 32701 (407) 522-7570

Project Number/Project Name
600713x2.02.06
Lake Buchanan Seepage Meters
Lake Buchanan

Classical Chemistry Parameters

Client ID # : **LBSM2**
SRL (Lab) ID# : 2111047-001
Date Collected : 11/22/21
Lab FDOH Certification # : E83182

Analtye	CAS Number	Results	Flag	Units	Dilution Factor	MDL	PQL	Method	Date Prepared	Date Analyzed
Ammonia as N	7664-41-7	**0.59**		mg/L	1	0.0098	0.020	EPA 350.1	11/29/21	12/02/21
Nitrate/Nitrite as N		**25**		mg/L	40	0.64	2.0	4500NO3 H-	11/23/21	11/24/21
Orthophosphate as P	1426-54-42	0.0040	U	mg/L	1	0.0040	0.010	EPA 365.1	11/23/21	11/23/21
Phosphorus	7723-14-0	**0.55**		mg/L	1	0.010	0.015	EPA 365.4	11/23/21	11/29/21
Total Kjeldahl Nitrogen		**3.4**		mg/L	1	0.037	0.050	EPA 351.2	11/23/21	11/29/21
Total Nitrogen	17778-88-0	**29**		mg/L	40	0.64	2.0	CALC	11/23/21	11/29/21
Total Suspended Solids		**24**		mg/L	1	2.5	2.5	M-2540D-201	11/29/21	12/02/21

Client ID # : **LBSM1**
SRL (Lab) ID# : 2111047-002
Date Collected : 11/22/21
Lab FDOH Certification # : E83182

Analtye	CAS Number	Results	Flag	Units	Dilution Factor	MDL	PQL	Method	Date Prepared	Date Analyzed
Ammonia as N	7664-41-7	0.0098	U	mg/L	1	0.0098	0.020	EPA 350.1	11/29/21	12/02/21
Nitrate/Nitrite as N		**0.27**		mg/L	1	0.016	0.050	4500NO3 H-	11/23/21	11/24/21
Orthophosphate as P	1426-54-42	0.0040	U	mg/L	1	0.0040	0.010	EPA 365.1	11/23/21	11/23/21
Phosphorus	7723-14-0	**0.23**		mg/L	1	0.010	0.015	EPA 365.4	11/23/21	11/29/21
Total Kjeldahl Nitrogen		**0.88**		mg/L	1	0.037	0.050	EPA 351.2	11/23/21	11/29/21
Total Nitrogen	17778-88-0	**1.2**		mg/L	1	0.037	0.050	CALC	11/23/21	11/29/21
Total Suspended Solids		**16**		mg/L	1	2.5	2.5	M-2540D-201	11/29/21	12/02/21

Client ID # : **LBSM3**
SRL (Lab) ID# : 2111047-003
Date Collected : 11/22/21
Lab FDOH Certification # : E83182

Analtye	CAS Number	Results	Flag	Units	Dilution Factor	MDL	PQL	Method	Date Prepared	Date Analyzed
Ammonia as N	7664-41-7	**22**		mg/L	50	0.49	1.0	EPA 350.1	11/29/21	12/02/21
Nitrate/Nitrite as N		**0.21**		mg/L	1	0.016	0.050	4500NO3 H-	11/23/21	11/24/21
Orthophosphate as P	1426-54-42	**1.0**		mg/L	10	0.040	0.10	EPA 365.1	11/23/21	11/23/21
Phosphorus	7723-14-0	**1.3**		mg/L	1	0.010	0.015	EPA 365.4	11/23/21	11/29/21
Total Kjeldahl Nitrogen		**23**		mg/L	10	0.37	0.50	EPA 351.2	11/23/21	11/29/21
Total Nitrogen	17778-88-0	**23**		mg/L	10	0.37	0.50	CALC	11/23/21	11/29/21
Total Suspended Solids		**18**		mg/L	1	2.5	2.5	M-2540D-201	11/29/21	12/02/21

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NELAP Certified
FDOH Cert # : E83484
SRL Lab Ref # : 21-11047
Received Date : 11/22/21

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Altamonte Springs, FL. 32701 (407) 522-7570

Project Number/Project Name
600713x2.02.06
Lake Buchanan Seepage Meters
Lake Buchanan

Classical Chemistry Parameters

Client ID # : **Blanks**
SRL (Lab) ID# : MB
Date Collected : NA
Lab FDOH Certification # : E83182

Analtye	CAS Number	Results	Flag	Units	Dilution Factor	MDL	PQL	Method	Date Prepared	Date Analyzed
Ammonia as N	7664-41-7	0.0098	U	mg/L	1	0.0098	0.020	EPA 350.1	11/29/21	12/02/21
Nitrate/Nitrite as N		0.016	U	mg/L	1	0.016	0.050	4500NO3 H-	11/23/21	11/24/21
Orthophosphate as P	1426-54-42	0.0040	U	mg/L	1	0.0040	0.010	EPA 365.1	11/23/21	11/23/21
Phosphorus	7723-14-0	0.010	U	mg/L	1	0.010	0.015	EPA 365.4	11/23/21	11/29/21
Total Kjeldahl Nitrogen		0.037	U	mg/L	1	0.037	0.050	EPA 351.2	11/23/21	11/29/21
Total Nitrogen	17778-88-0	0.037	U	mg/L	1	0.037	0.050	CALC	11/23/21	11/29/21
Total Suspended Solids		2.5	U	mg/L	1	2.5	2.5	M-2540D-201	11/29/21	12/02/21

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NELAP Certified
FDOH Cert # : E83484
SRL Lab Ref # : 21-11047
Received Date : 11/22/21

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Project Number/Project Name
600713x2.02.06
Lake Buchanan Seepage Meters
Lake Buchanan

Classical Chemistry Parameters

QAQC

	% Recovery LCS/MS/MS2/MSD	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Nitrate/Nitrite as N	108/32/48	84-116	84-116	QM-07	0.4	0-10
Total Kjeldahl Nitrogen	97/108/105/109	90-110	90-110		0.3	0-10

Total Nitrogen (Calculated as: (Nitrogen, Total Kjeldahl) + (Nitrogen, Nitrate + Nitrite)

	% Recovery LCS/MS/MSD	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Orthophosphate as P	100/93/94	90-110	90-110		1	0-10

	% Recovery LCS/MS/MSD	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Phosphorus	100/88/93/84	90-110	90-110	QM-07	3	0-10

	% Recovery LCS/MS1/MS2/MSD1	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Nitrogen, Ammonia (as N)	97/170/NR/420	90-110	90-110	QM-07	4	0-10

	% Recovery LCS	Acceptable Limits
Total Suspended Solids	104	80-120

	Result	Source Result	RPD	Notes	RPD Limit
Total Suspended Solids (DUP-1)	4.0	5.0	22	QM-12	0-20

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FDOH Cert # : E83484
SRL Lab Ref # : 21-11047
Received Date : 11/22/21

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Project Number/Project Name
600713x2.02.06
Lake Buchanan Seepage Meters
Lake Buchanan

DATA QUALIFIER CODES

Reporting Exceptions and Qualified Data

When quality control results are outside established control limits reanalysis, including re-extraction (if applicable), is preferred. If re-analysis is not viable or desirable, then results may be qualified. Sample results associated with quality control data that exceed acceptance criteria will be qualified with an appropriate comment.

D = Data reported from a dilution and or multiple dilutions.

I = Estimated Value, The reported value is between the Laboratory Method Detection Limit (**MDL**) and the Laboratory Practical Quantitation Limit (**PQL**)

J = Estimated Value

L = Off-Scale high; exceeds the linear range or highest calibration standard.

O = Sampled, but analysis lost or not performed

Q = Sample held beyond normal holding time
Q01 Analysis performed outside of method-specified holding time
Q02 Sample received outside of method-specified holding time

U = indicates the compound was analyzed for, but not detected. The numerical value preceding the "U" is the limit of detection for that compound based upon the dilution. **MEDF** = **M**atrix **E**ffected **D**ilution **F**actor.

V = Analyte was detected in both the sample and associated Laboratory Method Blank; Laboratory Contamination

Y = The analysis was from an unpreserved or improperly preserved sample. The data may not be accurate

Unless otherwise noted, ug/Kg and mg/Kg denote dry weight.

(SOILS) Actual Reporting Limit will depend on moisture content of sample and the amount of sample received.

QM-07 The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on acceptable LCS recovery.

QM-12 Precision between duplicate samples was outside acceptance limits

Chain of Custody

2111047
3

Page 1 of 1

Project Manager: Lance Lumbard
Company: Wood Environment & Infrastructure Solutions, Inc.
Address: 550 Northlake Blvd., Suite 1000
City, State, Zip: Altamonte Springs Florida 32701
Phone: 407-522-7570 Fax: +1 (407) 522-7576

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Orlando, Florida 32804
Main (407) 522-7100 Fax: (407) 522-7043

Project Name: PO# C20906001
Lake Buchanan Seepage Meters

Project Location: Lake Buchanan

Sampled by [Print Name(s)] / Affiliation: James S. Preston/Wood Katie Ballew/BFA

Sampler(s) Signature(s): James S. Preston

Project Number: 600713x2.01.06

REQUESTED DUE DATE:

Facility ID#:

Petroleum Restoration Program ___ yes ✓ no

	Sample Identification	Sampled Date:	Sampled Time:	Grab or Composite	Matrix: (see codes)	Total Number of Containers	Preservatives (see codes): TSS: I	Orthophosphate (low-level): I	TN/Ammonia/TP (low-level): S	Analyses Requested	Project Number
1	LBSM2	11/22/21	1410	G	SW	3	✓	✓	✓		21-11047-001
2	LBSM1	"	1430	"	"	"	✓	✓	✓		-002
3	LBSM3	"	1520	"	"	"	✓	✓	✓		-003

Shipment Method:	Relinquished by	Date:	Time:	Accepted by:	Date:	Time:
Out: / / Via:	Helen Turner (FEDEX KIT)	3/21/21	13:45	James S. Preston	3/21/21	1345
Returned: / / Via:		11/22/21	1615	Helen Turner	11-22-21	16:15

Additional Comments:

Cooler No.(s) / Temperature(s) (°C): 134, 150 Client cooler 3.1 oc

Sampling Kit No.: 8909

Equipment ID No.:

Matrix Codes: A = Air GW = Groundwater SE = Sediment SO = Soil SW = Surface Water W = Water(Blanks) HW = Potential Haz Waste O = Other(Specify:_____)

Preservative Codes: H = Hydrochloric Acid & Ice I = Ice Only N = Nitrie Acid& Ice S = Sulfuric Acid & Ice X = Sodium Hydroxide & Ice O = Other(Specify)

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Thank you **Lance Lumbard** for the opportunity to be of service to you and your company, we **S**incerely **A**ppreciate **Y**our **B**usiness. SRL certifies these **Laboratory Results** were produced in accordance with NELAC Standards. Hold times and preservation requirements were met for all analytes unless specifically noted in the report. Results relate only to the samples as received.

Client Name: **Wood Environment & Infrastructure Solutions, Inc.**	Date(s) Collected: 02/01/22
Contact Name: **Lance Lumbard**	Date Received: 02/01/22
Project Name: Lake Buchanan Seepage Meters	Time Received: 12:50
Project Number: 600713x2.01.06	Date Reported : 02/23/22
Phone Number: (407) 522-7570	Date Emailed : 02/23/22
Fax Number: (407) 522-7576	SRL Work Order # 22-02002

SRL WO #	Clients #	Matrix	Analysis Requested
2202002-001	LBSM2	Liquid	TSS/Total Nitrogen/Ammonia/ Total Phosphorus/Orthophosphate
2202002-002	LBSM1	Liquid	TSS/Total Nitrogen/Ammonia/ Total Phosphorus/Orthophosphate
2202002-003	LBSM3	Liquid	TSS/Total Nitrogen/Ammonia/ Total Phosphorus/Orthophosphate

Sherri Payne
Vice President & Quality Assurance Officer
Southern Research Laboratories, Inc.

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NELAP Certified
FDOH Cert # : E83484
SRL Lab Ref # : 22-02002
Received Date : 02/01/22

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Project Number/Project Name
600713x2.01.06
Lake Buchanan Seepage Meters
Lake Buchanan

Classical Chemistry Parameters

Client ID # : **LBSM2**
SRL (Lab) ID# : 2202002-001
Date Collected : 02/01/22
Lab FDOH Certification # : E83079

Analtye	CAS Number	Results	Flag	Units	Dilution Factor	MDL	PQL	Method	Date Prepared	Date Analyzed
Total Suspended Solids		**21.4**		mg/L	1	2.4	2.4	M-2540D-201	02/07/22	02/07/22
Total Nitrogen		**2.6**		mg/L	1	0.086	0.50	CALC	02/09/22	02/09/22
Ammonia as N	7664-41-7	**0.29**		mg/L	1	0.035	0.050	EPA 350.1	02/10/22	02/10/22
Total Kjeldahl Nitrogen	7727-37-9	**1.9**		mg/L	1	0.20	0.50	EPA 351.2	02/08/22	02/09/22
Nitrate/Nitrite as N		**0.76**		mg/L	1	0.015	0.050	EPA 353.2	02/03/22	02/03/22
Orthophosphate as P		**0.019**		mg/L	1	0.0038	0.0040	EPA 365.1	02/03/22	02/03/22
Phosphorus	7723-14-0	**0.41**		mg/L	1	0.0028	0.0040	EPA 365.3	02/05/22	02/06/22

Client ID # : **LBSM1**
SRL (Lab) ID# : 2202002-002
Date Collected : 02/01/22
Lab FDOH Certification # : E83079

Analtye	CAS Number	Results	Flag	Units	Dilution Factor	MDL	PQL	Method	Date Prepared	Date Analyzed
Total Suspended Solids		**21.1**		mg/L	1	2.1	2.1	M-2540D-201	02/07/22	02/07/22
Total Nitrogen		**1.9**		mg/L	1	0.086	0.50	CALC	02/09/22	02/09/22
Ammonia as N	7664-41-7	0.035	U	mg/L	1	0.035	0.050	EPA 350.1	02/10/22	02/10/22
Total Kjeldahl Nitrogen	7727-37-9	**1.7**		mg/L	1	0.20	0.50	EPA 351.2	02/08/22	02/09/22
Nitrate/Nitrite as N		**0.19**		mg/L	1	0.015	0.050	EPA 353.2	02/03/22	02/03/22
Orthophosphate as P		**0.022**		mg/L	1	0.0038	0.0040	EPA 365.1	02/03/22	02/03/22
Phosphorus	7723-14-0	**0.32**		mg/L	1	0.0028	0.0040	EPA 365.3	02/11/22	02/14/22

Client ID # : **LBSM3**
SRL (Lab) ID# : 2202002-003
Date Collected : 02/01/22
Lab FDOH Certification # : E83079

Analtye	CAS Number	Results	Flag	Units	Dilution Factor	MDL	PQL	Method	Date Prepared	Date Analyzed
Total Suspended Solids		**18.3**		mg/L	1	2.2	2.2	M-2540D-201	02/07/22	02/07/22
Total Nitrogen		**27.9**		mg/L	1	0.086	0.50	CALC	02/09/22	02/09/22
Ammonia as N	7664-41-7	**15.7**		mg/L	1	0.035	0.050	EPA 350.1	02/10/22	02/10/22
Total Kjeldahl Nitrogen	7727-37-9	**13.5**		mg/L	1	0.20	0.50	EPA 351.2	02/08/22	02/09/22
Nitrate/Nitrite as N		**14.4**		mg/L	10	0.15	0.50	EPA 353.2	02/03/22	02/03/22
Orthophosphate as P		**0.93**		mg/L	1	0.0038	0.0040	EPA 365.1	02/03/22	02/03/22
Phosphorus	7723-14-0	**1.6**		mg/L	1	0.0028	0.0040	EPA 365.3	02/11/22	02/14/22

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NELAP Certified
FDOH Cert # : E83484
SRL Lab Ref # : 22-02002
Received Date : 02/01/22

Lance Lumbard
Wood Env. & Infrastructure Solutions, Inc.
550 Northlake Blvd., Suite 1000
Altamonte Springs, FL. 32701 (407) 522-7570

Project Number/Project Name
600713x2.01.06
Lake Buchanan Seepage Meters
Lake Buchanan

Classical Chemistry Parameters

Client ID # : **Blanks**
SRL (Lab) ID# : MB
Date Collected : NA
Lab FDOH Certification # : E83079

Analtye	CAS Number	Results	Flag	Units	Dilution Factor	MDL	PQL	Method	Date Prepared	Date Analyzed
Total Suspended Solids		1.0	U	mg/L	1	1.0	1.0	M-2540D-201	02/07/22	02/07/22
Total Nitrogen		0.20	U	mg/L	1	0.20	0.50	CALC	02/09/22	02/09/22
Ammonia as N	7664-41-7	0.035	U	mg/L	1	0.035	0.050	EPA 350.1	02/10/22	02/10/22
Total Kjeldahl Nitrogen	7727-37-9	0.20	U	mg/L	1	0.20	0.50	EPA 351.2	02/08/22	02/09/22
Nitrate/Nitrite as N		0.015	U	mg/L	1	0.015	0.050	EPA 353.2	02/03/22	02/03/22
Orthophosphate as P		0.0038	U	mg/L	1	0.0038	0.0040	EPA 365.1	02/03/22	02/03/22
Phosphorus	7723-14-0	0.0028	U	mg/L	1	0.0028	0.0040	EPA 365.3	02/05/22	02/06/22
Phosphorus	7723-14-0	0.0028	U	mg/L	1	0.0028	0.0040	EPA 365.3	02/11/22	02/14/22

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FDOH Cert # : E83484
SRL Lab Ref # : 22-02002
Received Date : 02/01/22

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Project Number/Project Name
600713x2.01.06
Lake Buchanan Seepage Meters
Lake Buchanan

Classical Chemistry Parameters

QAQC

	% Recovery LCS/MS/MSD	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Nitrate/Nitrite as N	104/95/95	90-110	90-110		0	0-20
Total Kjeldahl Nitrogen	101/100/101	90-110	90-110		0	0-20

Total Nitrogen (Calculated as: (Nitrogen, Total Kjeldahl) + (Nitrogen, Nitrate + Nitrite)

	% Recovery LCS/MS/MSD	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Orthophosphate as P	94/97/97	90-110	90-110		0	0-20

	% Recovery LCS/MS/MSD	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Phosphorus	104/110/111	90-110	90-110		1	0-20
Phosphorus	110/110/103	90-110	90-110		2	0-20

	% Recovery LCS/MS/MSD	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Nitrogen, Ammonia (as N)	108/109/105	90-110	90-110		3	0-20

	% Recovery LCS/LCSD	Acceptable Limits
Total Suspended Solids	96/93	90-110

	Result	Source Result	RPD	Notes	RPD Limit
Total Suspended Solids (DUP-1)	97.0	94.0	3		0-10

	% Recovery LCS/MS/MSD	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Phosphorus	110/110/103	90-110	90-110		2	0-20

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FDOH Cert # : E83484
SRL Lab Ref # : 22-02002
Received Date : 02/01/22

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Project Number/Project Name
600713x2.01.06
Lake Buchanan Seepage Meters
Lake Buchanan

DATA QUALIFIER CODES

Reporting Exceptions and Qualified Data

When quality control results are outside established control limits reanalysis, including re-extraction (if applicable), is preferred. If re-analysis is not viable or desirable, then results may be qualified. Sample results associated with quality control data that exceed acceptance criteria will be qualified with an appropriate comment.

D = Data reported from a dilution and or multiple dilutions.

I = Estimated Value, The reported value is between the Laboratory Method Detection Limit (**MDL**) and the Laboratory Practical Quantitation Limit (**PQL**)

J = Estimated Value

L = Off-Scale high; exceeds the linear range or highest calibration standard.

O = Sampled, but analysis lost or not performed

Q = Sample held beyond normal holding time
Q01 Analysis performed outside of method-specified holding time
Q02 Sample received outside of method-specified holding time

U = indicates the compound was analyzed for, but not detected. The numerical value preceding the "U" is the limit of detection for that compound based upon the dilution. **MEDF** = **M**atrix **E**ffected **D**ilution **F**actor.

V = Analyte was detected in both the sample and associated Laboratory Method Blank; Laboratory Contamination

Y = The analysis was from an unpreserved or improperly preserved sample. The data may not be accurate

Unless otherwise noted, ug/Kg and mg/Kg denote dry weight.

(SOILS) Actual Reporting Limit will depend on moisture content of sample and the amount of sample received.

Chain of Custody

2202002
3

Page 1 of 1

Project Manager: Lance Lambard	Southern Research Laboratories, Inc. 2251 Lynx Lane, Suite #1 Orlando, Florida 32804
Company: Wood Environment & Infrastructure Solutions, Inc.	Main (407) 522-7100 Fax: (407) 522-7043
Address: 350 Northlake Blvd., Suite 1000	
City, State, Zip: Altamonte Springs Florida 32701	
Phone: 407-522-7570 Fax: +1 (407) 522-7576	

Project Name: PO# C012610100
Lake Buchanan Seepage Meters

Project Location: Lake Buchanan

Sampled by [Print Name(s)] / Affiliation: James S. Preston (Wood) Katie Ballew/BFA

Sampler(s) Signature(s): James S. Preston

Project Number: 600713x2.01.06

REQUESTED DUE DATE:

Facility ID#:

Petroleum Restoration Program ___ yes ✓ no

	Sample Identification	Sampled Date:	Sampled Time:	Grab or Composite	Matrix: (see codes)	Total Number of Containers	Preservatives (see codes)	Analyses Requested: TSS	low-level OP	TN/Ammonia/ low-level TP						
1	LBSM2	2/1/22	1040	G	SW	3		✓	✓	✓						2202002-001
2	LBSM1	2/1/22	1100	"	"	"		✓	✓	✓						-002
3	LBSM3	2/1/22	1200	"	"	"		✓	✓	✓						-003

Shipment Method:		Relinquished by	Date:	Time:	Accepted by:	Date:	Time:
Out: / /	Via:	Helen Turner	3/21/21	13:45	James S. Preston	3/21/21	1345
Returned: / /	Via:		2/1/22	1250	Helen Turner	2/1/22	12:50

Additional Comments:

Cooler No.(s) / Temperature(s) (°C): 134, 150 424 1.5 °C

Sampling Kit No.: 8909

Equipment ID No.:

Matrix Codes: A = Air GW = Groundwater SE = Sediment SO = Soil SW = Surface Water W = Water(Blanks) HW = Potential Haz Waste O = Other(Specify: _____)

Preservative Codes: H = Hydrochloric Acid & Ice I = Ice Only N = Nitrie Acid& Ice S = Sulfuric Acid & Ice X = Sodium Hydroxide & Ice O = Other(Specify)

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Thank you **Lance Lumbard** for the opportunity to be of service to you and your company, we **S**incerely **A**ppreciate **Y**our **B**usiness. SRL certifies these **Laboratory Results** were produced in accordance with NELAC Standards. Hold times and preservation requirements were met for all analytes unless specifically noted in the report. Results relate only to the samples as received.

Client Name: **Wood Environment & Infrastructure Solutions, Inc.**	Date(s) Collected: 03/24/22
Contact Name: **Lance Lumbard**	Date Received: 03/24/22
Project Name: Lake Buchanan Seepage Meters	Time Received: 11:35
Project Number: 600713x2.01.06	Date Reported : 04/06/22
Phone Number: (407) 522-7570	Date Emailed : 04/06/22
Fax Number: (407) 522-7576	SRL Work Order # 22-03029

SRL WO #	Clients #	Matrix	Analysis Requested
2203029-001	LBSM1	Liquid	TSS/Total Nitrogen/Ammonia/ Total Phosphorus/Orthophosphate
2203029-002	LBSM2	Liquid	TSS/Total Nitrogen/Ammonia/ Total Phosphorus/Orthophosphate
2203029-003	LBSM3	Liquid	TSS/Total Nitrogen/Ammonia/ Total Phosphorus/Orthophosphate

Sherri Payne
Vice President & Quality Assurance Officer
Southern Research Laboratories, Inc.

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NELAP Certified
FDOH Cert # : E83484
SRL Lab Ref # : 22-03029
Received Date : 03/24/22

Lance Lumbard
Wood Env. & Infrastructure Solutions, Inc.
550 Northlake Blvd., Suite 1000
Altamonte Springs, FL. 32701 (407) 522-7570

Project Number/Project Name
600713x2.01.06
Lake Buchanan Seepage Meters
Lake Buchanan

Classical Chemistry Parameters

Client ID # : **LBSM1**
SRL (Lab) ID# : 2203029-001
Date Collected : 03/24/22
Lab FDOH Certification # : E83079

Analtye	CAS Number	Results	Flag	Units	Dilution Factor	MDL	PQL	Method	Date Prepared	Date Analyzed
Total Suspended Solids		**53.2**		mg/L	1	4.3	4.3	M-2540D-201	03/29/22	03/29/22
Total Nitrogen		**4.1**		mg/L	1	0.086	0.50	CALC	04/05/22	04/05/22
Ammonia as N	7664-41-7	**0.058**		mg/L	1	0.035	0.050	EPA 350.1	03/31/22	03/31/22
Total Kjeldahl Nitrogen	7727-37-9	**3.8**		mg/L	1	0.20	0.50	EPA 351.2	04/02/22	04/05/22
Nitrate/Nitrite as N		**0.32**		mg/L	1	0.015	0.050	EPA 353.2	03/31/22	03/31/22
Orthophosphate as P		**0.039**		mg/L	1	0.0038	0.0040	EPA 365.1	03/25/22	03/25/22
Phosphorus	7723-14-0	**0.69**		mg/L	1	0.0028	0.0040	EPA 365.3	03/26/22	03/30/22

Client ID # : **LBSM2**
SRL (Lab) ID# : 2203029-002
Date Collected : 03/24/22
Lab FDOH Certification # : E83079

Analtye	CAS Number	Results	Flag	Units	Dilution Factor	MDL	PQL	Method	Date Prepared	Date Analyzed
Total Suspended Solids		**31.6**		mg/L	1	2.7	2.7	M-2540D-201	03/29/22	03/29/22
Total Nitrogen		**4.1**		mg/L	1	0.086	0.50	CALC	04/05/22	04/05/22
Ammonia as N	7664-41-7	**1.1**		mg/L	1	0.035	0.050	EPA 350.1	03/31/22	03/31/22
Total Kjeldahl Nitrogen	7727-37-9	**3.2**		mg/L	1	0.20	0.50	EPA 351.2	04/02/22	04/05/22
Nitrate/Nitrite as N		**0.90**		mg/L	1	0.015	0.050	EPA 353.2	03/31/22	03/31/22
Orthophosphate as P		**0.041**		mg/L	1	0.0038	0.0040	EPA 365.1	03/25/22	03/25/22
Phosphorus	7723-14-0	**0.35**		mg/L	1	0.0028	0.0040	EPA 365.3	03/26/22	03/30/22

Client ID # : **LBSM3**
SRL (Lab) ID# : 2203029-003
Date Collected : 03/24/22
Lab FDOH Certification # : E83079

Analtye	CAS Number	Results	Flag	Units	Dilution Factor	MDL	PQL	Method	Date Prepared	Date Analyzed
Total Suspended Solids		**33.0**		mg/L	1	3.3	3.3	M-2540D-201	03/29/22	03/29/22
Total Nitrogen		**4.1**		mg/L	1	0.086	0.50	CALC	04/05/22	04/05/22
Ammonia as N	7664-41-7	**0.61**		mg/L	1	0.035	0.050	EPA 350.1	03/31/22	03/31/22
Total Kjeldahl Nitrogen	7727-37-9	**2.7**		mg/L	1	0.20	0.50	EPA 351.2	04/02/22	04/05/22
Nitrate/Nitrite as N		**1.5**		mg/L	1	0.015	0.050	EPA 353.2	03/31/22	03/31/22
Orthophosphate as P		**0.39**		mg/L	1	0.0038	0.0040	EPA 365.1	03/25/22	03/25/22
Phosphorus	7723-14-0	**1.2**		mg/L	1	0.0028	0.0040	EPA 365.3	03/31/22	04/03/22

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NELAP Certified
FDOH Cert # : E83484
SRL Lab Ref # : 22-03029
Received Date : 03/24/22

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Project Number/Project Name
600713x2.01.06
Lake Buchanan Seepage Meters
Lake Buchanan

Classical Chemistry Parameters

Client ID # : **Blanks**
SRL (Lab) ID# : MB
Date Collected : NA
Lab FDOH Certification # : E83079

Analtye	CAS Number	Results	Flag	Units	Dilution Factor	MDL	PQL	Method	Date Prepared	Date Analyzed
Total Suspended Solids		1.0	U	mg/L	1	1.0	1.0	M-2540D-201	03/29/22	03/29/22
Total Nitrogen		0.20	U	mg/L	1	0.20	0.50	CALC		
Ammonia as N	7664-41-7	0.035	U	mg/L	1	0.035	0.050	EPA 350.1	03/31/22	03/31/22
Total Kjeldahl Nitrogen	7727-37-9	0.20	U	mg/L	1	0.20	0.50	EPA 351.2	04/02/22	04/05/22
Nitrate/Nitrite as N		0.015	U	mg/L	1	0.015	0.050	EPA 353.2	03/31/22	03/31/22
Orthophosphate as P		0.0038	U	mg/L	1	0.0038	0.0040	EPA 365.1	03/25/22	03/25/22
Phosphorus	7723-14-0	0.0028	U	mg/L	1	0.0028	0.0040	EPA 365.3	03/26/22	03/30/22
Phosphorus	7723-14-0	0.0028	U	mg/L	1	0.0028	0.0040	EPA 365.3	03/31/22	04/03/22

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FDOH Cert # : E83484
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Received Date : 03/24/22

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Project Number/Project Name
600713x2.01.06
Lake Buchanan Seepage Meters
Lake Buchanan

Classical Chemistry Parameters

QAQC

	% Recovery LCS/MS/MSD	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Nitrate/Nitrite as N	103/107/106	90-110	90-110		1	0-20
Total Kjeldahl Nitrogen	97/98/98	90-110	90-110		0	0-20

Total Nitrogen (Calculated as: (Nitrogen, Total Kjeldahl) + (Nitrogen, Nitrate + Nitrite)

	% Recovery LCS/MS/MSD	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Orthophosphate as P	94/94/94	90-110	90-110		0	0-20

	% Recovery LCS/MS/MSD	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Phosphorus	103/103/108	90-110	80-120		2	0-20
Phosphorus	96/107/99	90-110	80-120		1	0-20

	% Recovery LCS/MS/MSD	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Nitrogen, Ammonia (as N)	104/98/98	90-110	90-110		0	0-20

	% Recovery LCS/LCSD	Acceptable Limits	RPD
Total Suspended Solids	96/99	90-110	3

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SRL Lab Ref # : 22-03029
Received Date : 03/24/22

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Project Number/Project Name
600713x2.01.06
Lake Buchanan Seepage Meters
Lake Buchanan

DATA QUALIFIER CODES

Reporting Exceptions and Qualified Data

When quality control results are outside established control limits reanalysis, including re-extraction (if applicable), is preferred. If re-analysis is not viable or desirable, then results may be qualified. Sample results associated with quality control data that exceed acceptance criteria will be qualified with an appropriate comment.

D = Data reported from a dilution and or multiple dilutions.

I = Estimated Value, The reported value is between the Laboratory Method Detection Limit (**MDL**) and the Laboratory Practical Quantitation Limit (**PQL**)

J = Estimated Value

L = Off-Scale high; exceeds the linear range or highest calibration standard.

O = Sampled, but analysis lost or not performed

Q = Sample held beyond normal holding time
Q01 Analysis performed outside of method-specified holding time
Q02 Sample received outside of method-specified holding time

U = indicates the compound was analyzed for, but not detected. The numerical value preceding the "U" is the limit of detection for that compound based upon the dilution. **MEDF** = **M**atrix **E**ffected **D**ilution **F**actor.

V = Analyte was detected in both the sample and associated Laboratory Method Blank; Laboratory Contamination

Y = The analysis was from an unpreserved or improperly preserved sample. The data may not be accurate

Unless otherwise noted, ug/Kg and mg/Kg denote dry weight.

(SOILS) Actual Reporting Limit will depend on moisture content of sample and the amount of sample received.

Chain of Custody

2203029

3

Page 1 of 1

Project Manager: Lance Lumbard	Southern Research Laboratories, Inc. 2251 Lynx Lane, Suite #1 Orlando, Florida 32804
Company: Wood Environment & Infrastructure Solutions, Inc.	Main (407) 522-7100 Fax: (407) 522-7043
Address: 550 Northlake Blvd., Suite 1000	
City, State, Zip: Altamonte Springs Florida 32701	
Phone: 407-522-7570 Fax: +1 (407) 522-7576	

Project Name: ~~or~~ Lake Buchanan ~~Lake Orlando~~

Project Location: Lake Buchanan C012610100

Sampled by [Print Name(s)] / Affiliation: James S. Preston/Wood, Katie Ballew/BFA

Sampler(s) Signature(s): James S. Preston

Project Number: 600713x2.01.06

REQUESTED DUE DATE:

Facility ID#:

Petroleum Restoration Program ___ yes ✓ no

	Sample Identification	Sampled Date:	Sampled Time:	Grab or Composite	Matrix: (see codes)	Total Number of Containers	Preservatives (see codes): S	I	I	Analyses Requested: low level TP/TN/Ammonia	low level OP	TSS							
1	LBSM1	3/24/21	1025	G	SW	3				1	1	1							2203029-001
2	LBSM2	1	1015	G	SW	3				1	1	1							-002
3	LBSM3	1	1045	G	SW	3				1	1	1							-003
																			~~-004~~

Shipment Method:	Relinquished by	Date:	Time:	Accepted by:	Date:	Time:
Out: / / Via:	SRL KIT					
Returned: / / Via:	James S. Preston	3/24/22	1135	Helen Jurn	3/24/22	11:35

Additional Comments:

Cooler No.(s) / Temperature(s) (°C): 150 2.3

Sampling Kit No.: 8909

Equipment ID No.:

Matrix Codes: A = Air GW = Groundwater SE = Sediment SO = Soil SW = Surface Water W = Water(Blanks) HW = Potential Haz Waste O = Other(Specify:_____)

Preservative Codes: H = Hydrochloric Acid & Ice I = Ice Only N = Nitrie Acid& Ice S = Sulfuric Acid & Ice X = Sodium Hydroxide & Ice O = Other(Specify)

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Thank you **Lance Lumbard** for the opportunity to be of service to you and your company, we **S**incerely **A**ppreciate **Y**our **B**usiness. SRL certifies these **Laboratory Results** were produced in accordance with NELAC Standards. Hold times and preservation requirements were met for all analytes unless specifically noted in the report. Results relate only to the samples as received.

Client Name: **Wood Environment & Infrastructure Solutions, Inc.**	Date(s) Collected: 05/06/22
Contact Name: **Lance Lumbard**	Date Received: 05/06/22
Project Name: Lake Buchanan Seepage	Time Received: 10:55
Project Number: 600713x2.02.06	Date Reported : 05/19/22
Phone Number: (407) 522-7570	Date Emailed : 05/19/22
Fax Number: (407) 522-7576	SRL Work Order # 22-05009

SRL WO #	Clients #	Matrix	Analysis Requested
2205009-001	LBSM2	Liquid	NOX=Nitrate+Nitrite
2205009-002	LBSM3	Liquid	NOX=Nitrate+Nitrite

Sherri Payne
Vice President & Quality Assurance Officer
Southern Research Laboratories, Inc.

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NELAP Certified
FDOH Cert # : E83484
SRL Lab Ref # : 22-05009
Received Date : 05/06/22

Lance Lumbard
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Altamonte Springs, FL. 32701 (407) 522-7570

Project Number/Project Name
600713x2.02.06
Lake Buchanan Seepage
Lake Buchanan

Classical Chemistry Parameters

Client ID # : **LBSM2**
SRL (Lab) ID# : 2205009-001
Date Collected : 05/06/22
Lab FDOH Certification # : E83079

Analtye	CAS Number	Results	Flag	Units	Dilution Factor	MDL	PQL	Method	Date Prepared	Date Analyzed
Nitrate/Nitrite as N		**1.0**		mg/L	1	0.015	0.050	EPA 353.2	05/17/22	05/17/22

Client ID # : **LBSM3**
SRL (Lab) ID# : 2205009-002
Date Collected : 05/06/22
Lab FDOH Certification # : E83079

Analtye	CAS Number	Results	Flag	Units	Dilution Factor	MDL	PQL	Method	Date Prepared	Date Analyzed
Nitrate/Nitrite as N		**14.6**		mg/L	15	0.22	0.75	EPA 353.2	05/17/22	05/17/22

Client ID # : **Blanks**
SRL (Lab) ID# : MB051722
Date Collected : NA
Lab FDOH Certification # : E83079

Analtye	CAS Number	Results	Flag	Units	Dilution Factor	MDL	PQL	Method	Date Prepared	Date Analyzed
Nitrate/Nitrite as N		0.015	U	mg/L	1	0.015	0.050	EPA 353.2	05/17/22	05/17/22

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Orlando, Florida 32804 (407) 522-7100

NELAP Certified
FDOH Cert # : E83484
SRL Lab Ref # : 22-05009
Received Date : 05/06/22

Lance Lumbard
Wood Env. & Infrastructure Solutions, Inc.
550 Northlake Blvd., Suite 1000
Altamonte Springs, FL. 32701 (407) 522-7570

Project Number/Project Name
600713x2.02.06
Lake Buchanan Seepage
Lake Buchanan

Classical Chemistry Parameters

QAQC

	% Recovery LCS/MS/MSD	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Nitrate/Nitrite as N	101/90/96	90-110	90-110		5	0-20

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NELAP Certified
FDOH Cert # : E83484
SRL Lab Ref # : 22-05009
Received Date : 05/06/22

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Project Number/Project Name
600713x2.02.06
Lake Buchanan Seepage
Lake Buchanan

DATA QUALIFIER CODES

Reporting Exceptions and Qualified Data

When quality control results are outside established control limits reanalysis, including re-extraction (if applicable), is preferred. If re-analysis is not viable or desirable, then results may be qualified. Sample results associated with quality control data that exceed acceptance criteria will be qualified with an appropriate comment.

D = Data reported from a dilution and or multiple dilutions.

I = Estimated Value, The reported value is between the Laboratory Method Detection Limit (**MDL**) and the Laboratory Practical Quantitation Limit (**PQL**)

J = Estimated Value

L = Off-Scale high; exceeds the linear range or highest calibration standard.

O = Sampled, but analysis lost or not performed

Q = Sample held beyond normal holding time
Q01 Analysis performed outside of method-specified holding time
Q02 Sample received outside of method-specified holding time

U = indicates the compound was analyzed for, but not detected. The numerical value preceding the "U" is the limit of detection for that compound based upon the dilution. **MEDF** = **M**atrix **E**ffected **D**ilution **F**actor.

V = Analyte was detected in both the sample and associated Laboratory Method Blank; Laboratory Contamination

Y = The analysis was from an unpreserved or improperly preserved sample. The data may not be accurate

Unless otherwise noted, ug/Kg and mg/Kg denote dry weight.

(SOILS) Actual Reporting Limit will depend on moisture content of sample and the amount of sample received.

Chain of Custody

2205009
2

Page 1 of 1

Project Manager:	Lance Lumbard
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Southern Research Laboratories, Inc.
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Orlando, Florida 32804
Main (407) 522-7100 Fax: (407) 522-7043

Project Name: LAKE Buchanan Seepage
PO # C012610100

Project Location: Lake Buchanan, ORANGE County

Sampled by [Print Name(s)] / Affiliation: R. SHERIDAN, J. PRESTON / WOOD

Sampler(s) Signature(s):

Project Number: 600713x2.02.06

REQUESTED DUE DATE:

Facility ID#:

Petroleum Restoration Program ___ yes ✓ no

	Sample Identification	Sampled Date:	Sampled Time:	Grab or Composite	Matrix: (see codes)	Total Number of Containers	Preservatives (see codes)	Analyses Requested: (NOx) Nitrate-Nitrite
							S	
1	LBSM2	5/6/22	0940	G	GW	1		1
2	LBSM3	"	0910	"	"	1		1

2205009-001
-002

Shipment Method:		Relinquished by	Date:	Time:	Accepted by:	Date:	Time:
Out: / /	Via:	James S. Preston	5/6/22	1055	Helen Turner	5.6.22	10:55
Returned: / /	Via:						

Additional Comments:

Cooler No.(s) / Temperature(s) (°C): Client cooler 1.5 °C

Sampling Kit No.: Stock

Equipment ID No.:

Matrix Codes: A = Air GW = Groundwater SE = Sediment SO = Soil SW = Surface Water W = Water(Blanks) HW = Potential Haz Waste O = Other(Specify:_____)

Preservative Codes: H = Hydrochloric Acid & Ice I = Ice Only N = Nitrie Acid& Ice S = Sulfuric Acid & Ice X = Sodium Hydroxide & Ice O = Other(Specify)

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NELAP Certified
FDOH Cert # : E83484
SRL Lab Ref # : 21-10050
Received Date : 10/29/21

Lance Lumbard
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Project Number/Project Name
600713x2.01.07
Lake Buchanan Stormwater
Lake Buchanan

Classical Chemistry Parameters

Client ID # : **Buchanan Palmett**
SRL (Lab) ID# : 2110050-001
Date Collected : 10/29/21
Lab FDOH Certification # : E83182

Analtye	CAS Number	Results	Flag	Units	Dilution Factor	MDL	PQL	Method	Date Prepared	Date Analyzed
Ammonia as N	7664-41-7	**0.072**		mg/L	1	0.0098	0.020	EPA 350.1	11/01/21	11/01/21
Nitrate/Nitrite as N		**0.31**		mg/L	1	0.016	0.050	4500NO3 H-	11/02/21	11/03/21
Orthophosphate as P	1426-54-42	**0.18**		mg/L	1	0.014	0.040	EPA 365.3	10/30/21	10/30/21
Phosphorus	7723-14-0	**0.40**		mg/L	1	0.010	0.015	EPA 365.4	11/01/21	11/02/21
Total Kjeldahl Nitrogen		**1.3**		mg/L	1	0.037	0.050	EPA 351.2	10/29/21	11/02/21
Total Nitrogen	17778-88-0	**1.6**		mg/L	1	0.037	0.050	CALC	11/02/21	11/03/21
Total Suspended Solids		**32**		mg/L	1	2.5	2.5	M-2540D-201	11/04/21	11/08/21

Client ID # : **Buchanan DW**
SRL (Lab) ID# : 2110050-002
Date Collected : 10/29/21
Lab FDOH Certification # : E83182

Analtye	CAS Number	Results	Flag	Units	Dilution Factor	MDL	PQL	Method	Date Prepared	Date Analyzed
Ammonia as N	7664-41-7	**0.16**		mg/L	1	0.0098	0.020	EPA 350.1	11/01/21	11/01/21
Nitrate/Nitrite as N		**0.026**	I	mg/L	1	0.016	0.050	4500NO3 H-	11/02/21	11/03/21
Orthophosphate as P	1426-54-42	**0.035**	I	mg/L	1	0.014	0.040	EPA 365.3	10/30/21	10/30/21
Phosphorus	7723-14-0	**0.11**		mg/L	1	0.010	0.015	EPA 365.4	11/01/21	11/02/21
Total Kjeldahl Nitrogen		**1.1**		mg/L	1	0.037	0.050	EPA 351.2	10/29/21	11/02/21
Total Nitrogen	17778-88-0	**1.1**		mg/L	1	0.037	0.050	CALC	11/02/21	11/03/21
Total Suspended Solids		**4.5**		mg/L	1	2.5	2.5	M-2540D-201	11/04/21	11/08/21

Client ID # : **Blanks**
SRL (Lab) ID# : MB
Date Collected : NA
Lab FDOH Certification # : E83182

Analtye	CAS Number	Results	Flag	Units	Dilution Factor	MDL	PQL	Method	Date Prepared	Date Analyzed
Ammonia as N	7664-41-7	0.0098	U	mg/L	1	0.0098	0.020	EPA 350.1	11/01/21	11/01/21
Nitrate/Nitrite as N		0.016	U	mg/L	1	0.016	0.050	4500NO3 H-	11/02/21	11/03/21
Orthophosphate as P	1426-54-42	0.014	U	mg/L	1	0.014	0.040	EPA 365.3	10/30/21	10/30/21
Phosphorus	7723-14-0	0.010	U	mg/L	1	0.010	0.015	EPA 365.4	11/01/21	11/02/21
Total Kjeldahl Nitrogen		0.037	U	mg/L	1	0.037	0.050	EPA 351.2	10/29/21	11/02/21
Total Nitrogen	17778-88-0	0.037	U	mg/L	1	0.037	0.050	CALC	11/02/21	11/03/21
Total Suspended Solids		2.5	U	mg/L	1	2.5	2.5	M-2540D-201	11/04/21	11/08/21

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NELAP Certified
FDOH Cert # : E83484
SRL Lab Ref # : 21-10050
Received Date : 10/29/21

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Project Number/Project Name
600713x2.01.07
Lake Buchanan Stormwater
Lake Buchanan

Classical Chemistry Parameters

QAQC

	% Recovery LCS/MS/MS2/MSD	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Nitrate/Nitrite as N	99/89/93	84-116	84-116		4	0-10
Total Kjeldahl Nitrogen	100/100/100/84	90-110	90-110	QM-07 QM-11	11	0-10

Total Nitrogen (Calculated as: (Nitrogen, Total Kjeldahl) + (Nitrogen, Nitrate + Nitrite)

	% Recovery LCS/MS/MSD	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Orthophosphate as P	97/96/97	90-110	90-110		0.2	0-10

	% Recovery LCS/MS/MSD	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Phosphorus	103/94/97	90-110	90-110		2	0-10

	% Recovery LCS/MS1/MSD1	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Nitrogen, Ammonia (as N)	104/107/108	90-110	90-110		0.9	0-10

	% Recovery LCS	Acceptable Limits
Total Suspended Solids	93	80-120

	Result	Source Result	RPD	Notes	RPD Limit
Total Suspended Solids (DUP-1)	100	100	2		0-20

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NELAP Certified
FDOH Cert # : E83484
SRL Lab Ref # : 21-10050
Received Date : 10/29/21

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Project Number/Project Name
600713x2.01.07
Lake Buchanan Stormwater
Lake Buchanan

DATA QUALIFIER CODES

Reporting Exceptions and Qualified Data

When quality control results are outside established control limits reanalysis, including re-extraction (if applicable), is preferred. If re-analysis is not viable or desirable, then results may be qualified. Sample results associated with quality control data that exceed acceptance criteria will be qualified with an appropriate comment.

D = Data reported from a dilution and or multiple dilutions.

I = Estimated Value, The reported value is between the Laboratory Method Detection Limit (**MDL**) and the Laboratory Practical Quantitation Limit (**PQL**)

J = Estimated Value

L = Off-Scale high; exceeds the linear range or highest calibration standard.

O = Sampled, but analysis lost or not performed

Q = Sample held beyond normal holding time
Q01 Analysis performed outside of method-specified holding time
Q02 Sample received outside of method-specified holding time

U = indicates the compound was analyzed for, but not detected. The numerical value preceding the "U" is the limit of detection for that compound based upon the dilution. **MEDF** = **M**atrix **E**ffected **D**ilution **F**actor.

V = Analyte was detected in both the sample and associated Laboratory Method Blank; Laboratory Contamination

Y = The analysis was from an unpreserved or improperly preserved sample. The data may not be accurate

Unless otherwise noted, ug/Kg and mg/Kg denote dry weight.

(SOILS) Actual Reporting Limit will depend on moisture content of sample and the amount of sample received.

QM-07 The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on acceptable LCS recovery.

QM-11 Precision between duplicate matrix spikes of the same sample was outside acceptance limits

Chain of Custody

2110050
2

Page 1 of 1

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Orlando, Florida 32804
Main (407) 522-7100 Fax: (407) 522-7043

Project Name: Lake Buchanan Stormwater

Project Location: 600713x2.01.07
C0126101OO

Sampled by [Print Name(s)] / Affiliation: Katie Ballew/RSA

Sampler(s) Signature(s):

Project Number: 600713x2

REQUESTED DUE DATE:

Facility ID#:

Petroleum Restoration Program ____ yes ____ no

Sample Identification	Sampled Date:	Sampled Time:	Grab or Composite	Matrix: (see codes)	Total Number of Containers	Preservatives (see codes)	Analyses Requested: TSS	Nitrogen Nitrate Ammonia	OP filtered						Project Number
						1	S	1							
1 Buchanan Palmetto	10/29/21	1320	C	SW	3		✓	✓	✓						2110050-001
2 Buchanan DW	10/29/21	1340	C	SW	3		✓	✓	✓						-002

Shipment Method:		Relinquished by	Date:	Time:	Accepted by:	Date:	Time:
Out: / /	Via:	Helen Turner SUBMITTED	3-21-21	14:15			
Returned: / /	Via:	Katie Ballew	10/29/21	1500	Helen Turner	10-29-21	15:10

Additional Comments:

Cooler No.(s) / Temperature(s) (°C): STOCK, 433 Client Cooler 2.5

Sampling Kit No.: 8910

Equipment ID No.:

Matrix Codes: A = Air GW = Groundwater SE = Sediment SO = Soil SW = Surface Water W = Water(Blanks) HW = Potential Haz Waste O = Other(Specify:_____)

Preservative Codes: H = Hydrochloric Acid & Ice I = Ice Only N = Nitrie Acid& Ice S = Sulfuric Acid & Ice X = Sodium Hydroxide & Ice O = Other(Specify)

Southern Research Laboratories, Inc.

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Toll Free 1 (888) 420-Test

Thank you **Lance Lumbard** for the opportunity to be of service to you and your company, we **S**incerely **A**ppreciate **Y**our **B**usiness. SRL certifies these **Laboratory Results** were produced in accordance with NELAC Standards. Hold times and preservation requirements were met for all analytes unless specifically noted in the report. Results relate only to the samples as received.

Client Name: **Wood Environment & Infrastructure Solutions, Inc.**	Date(s) Collected: 12/21/21
Contact Name: **Lance Lumbard**	Date Received: 12/21/21
Project Name: Lake Buchanan Stormwater	Time Received: 15:58
Project Number: 600713x2.01.07	Date Reported : 01/04/22
Phone Number: (407) 522-7570	Date Emailed : 01/04/22
Fax Number: (407) 522-7576	SRL Work Order # 21-12032

SRL WO #	Clients #	Matrix	Analysis Requested
2112032-001	Buchanan DW	Liquid	TSS/Total Nitrogen/Ammonia/ Total Phosphorus/Orthophosphate
2112032-002	Buchanan Palmetto	Liquid	TSS/Total Nitrogen/Ammonia/ Total Phosphorus/Orthophosphate

Sherri Payne
Vice President & Quality Assurance Officer
Southern Research Laboratories, Inc.

This report, which includes the attached Chain-of-Custody, shall not be reproduced except in full, without written approval of the laboratory.

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NELAP Certified
FDOH Cert # : E83484
SRL Lab Ref # : 21-12032
Received Date : 12/21/21

Lance Lumbard
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Altamonte Springs, FL. 32701 (407) 522-7570

Project Number/Project Name
600713x2.01.07
Lake Buchanan Stormwater
Lake Buchanan

Classical Chemistry Parameters

Client ID # : **Buchanan DW**
SRL (Lab) ID# : 2112032-001
Date Collected : 12/21/21
Lab FDOH Certification # : E83182

Analtye	CAS Number	Results	Flag	Units	Dilution Factor	MDL	PQL	Method	Date Prepared	Date Analyzed
Ammonia as N	7664-41-7	**0.50**		mg/L	1	0.0098	0.020	EPA 350.1	01/03/22	01/04/22
Nitrate/Nitrite as N		**0.27**		mg/L	1	0.016	0.050	4500NO3 H-	12/30/21	12/30/21
Orthophosphate as P	1426-54-42	**0.095**		mg/L	1	0.0040	0.010	EPA 365.1	12/22/21	12/22/21
Phosphorus	7723-14-0	**0.14**		mg/L	1	0.010	0.015	EPA 365.4	12/28/21	01/03/22
Total Kjeldahl Nitrogen		**1.6**		mg/L	1	0.037	0.050	EPA 351.2	12/30/21	01/03/22
Total Nitrogen	17778-88-0	**1.8**		mg/L	1	0.037	0.050	CALC	12/30/21	01/03/22
Total Suspended Solids		2.5	U	mg/L	1	2.5	2.5	M-2540D-201	12/27/21	12/28/21

Client ID # : **Buchanan Palmetto**
SRL (Lab) ID# : 2112032-002
Date Collected : 12/21/21
Lab FDOH Certification # : E83182

Analtye	CAS Number	Results	Flag	Units	Dilution Factor	MDL	PQL	Method	Date Prepared	Date Analyzed
Ammonia as N	7664-41-7	**0.042**		mg/L	1	0.0098	0.020	EPA 350.1	01/03/22	01/04/22
Nitrate/Nitrite as N		**0.23**		mg/L	1	0.016	0.050	4500NO3 H-	12/30/21	12/30/21
Orthophosphate as P	1426-54-42	**0.14**		mg/L	1	0.0040	0.010	EPA 365.1	12/22/21	12/22/21
Phosphorus	7723-14-0	**0.19**		mg/L	1	0.010	0.015	EPA 365.4	12/28/21	01/03/22
Total Kjeldahl Nitrogen		**0.60**		mg/L	1	0.037	0.050	EPA 351.2	12/30/21	01/03/22
Total Nitrogen	17778-88-0	**0.83**		mg/L	1	0.037	0.050	CALC	12/30/21	01/03/22
Total Suspended Solids		**16**		mg/L	1	2.5	2.5	M-2540D-201	12/27/21	12/28/21

Client ID # : **Blanks**
SRL (Lab) ID# : MB
Date Collected : NA
Lab FDOH Certification # : E83182

Analtye	CAS Number	Results	Flag	Units	Dilution Factor	MDL	PQL	Method	Date Prepared	Date Analyzed
Ammonia as N	7664-41-7	0.0098	U	mg/L	1	0.0098	0.020	EPA 350.1	01/03/22	01/04/22
Nitrate/Nitrite as N		0.016	U	mg/L	1	0.016	0.050	4500NO3 H-	12/30/21	12/30/21
Orthophosphate as P	1426-54-42	0.0040	U	mg/L	1	0.0040	0.010	EPA 365.1	12/22/21	12/22/21
Phosphorus	7723-14-0	0.010	U	mg/L	1	0.010	0.015	EPA 365.4	12/28/21	01/03/22
Total Kjeldahl Nitrogen		0.037	U	mg/L	1	0.037	0.050	EPA 351.2	12/30/21	01/03/22
Total Nitrogen	17778-88-0	0.037	U	mg/L	1	0.037	0.050	CALC	12/30/21	01/03/22
Total Suspended Solids		2.5	U	mg/L	1	2.5	2.5	M-2540D-201	12/27/21	12/28/21

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NELAP Certified
FDOH Cert # : E83484
SRL Lab Ref # : 21-12032
Received Date : 12/21/21

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Project Number/Project Name
600713x2.01.07
Lake Buchanan Stormwater
Lake Buchanan

Classical Chemistry Parameters

QAQC

	% Recovery LCS/MS1/MS2/MSD1	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Nitrate/Nitrite as N	98/99/99	84-116	84-116		0.2	0-10
Total Kjeldahl Nitrogen	101/103/98/104	90-110	90-110		0.7	0-10

Total Nitrogen (Calculated as: (Nitrogen, Total Kjeldahl) + (Nitrogen, Nitrate + Nitrite)

	% Recovery LCS/MS/MSD	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Orthophosphate as P	100/62/61	90-110	90-110	QM-07	0.7	0-10

	% Recovery LCS/MS/MS2/MSD	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Phosphorus	97/93/99/95	90-110	90-110		2	0-10

	% Recovery LCS/MS1/MS2/MSD1	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Nitrogen, Ammonia (as N)	95/100/94/99	90-110	90-110		1	0-10

	% Recovery LCS	Acceptable Limits
Total Suspended Solids	94	80-120

	Result	Source Result	RPD	Notes	RPD Limit
Total Suspended Solids (DUP-1)	19	20	5	LP-02	0-20

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NELAP Certified
FDOH Cert # : E83484
SRL Lab Ref # : 21-12032
Received Date : 12/21/21

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Project Number/Project Name
600713x2.01.07
Lake Buchanan Stormwater
Lake Buchanan

DATA QUALIFIER CODES

Reporting Exceptions and Qualified Data

When quality control results are outside established control limits reanalysis, including re-extraction (if applicable), is preferred. If re-analysis is not viable or desirable, then results may be qualified. Sample results associated with quality control data that exceed acceptance criteria will be qualified with an appropriate comment.

D = Data reported from a dilution and or multiple dilutions.

I = Estimated Value, The reported value is between the Laboratory Method Detection Limit (**MDL**) and the Laboratory Practical Quantitation Limit (**PQL**)

J = Estimated Value

L = Off-Scale high; exceeds the linear range or highest calibration standard.

O = Sampled, but analysis lost or not performed

Q = Sample held beyond normal holding time
Q01 Analysis performed outside of method-specified holding time
Q02 Sample received outside of method-specified holding time

U = indicates the compound was analyzed for, but not detected. The numerical value preceding the "U" is the limit of detection for that compound based upon the dilution. **MEDF** = **M**atrix **E**ffected **D**ilution **F**actor.

V = Analyte was detected in both the sample and associated Laboratory Method Blank; Laboratory Contamination

Y = The analysis was from an unpreserved or improperly preserved sample. The data may not be accurate

Unless otherwise noted, ug/Kg and mg/Kg denote dry weight.

(SOILS) Actual Reporting Limit will depend on moisture content of sample and the amount of sample received.

QM-07 The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on acceptable LCS recovery.

LP-02 Filtered residue did not meet 2.5-200mg range

Chain of Custody

2112032
2

Page of

Project Manager: Lance Lambard	Southern Research Laboratories, Inc. 2251 Lynx Lane, Suite #1 Orlando, Florida 32804
Company: Wood Environment & Infrastructure Solutions, Inc.	
Address: 350 Northlake Blvd., Suite 1000	
City, State, Zip: Altamonte Springs Florida 32701	
Phone: 407-522-7570 Fax: +1 (407) 522-7576	Main (407) 522-7100 Fax: (407) 522-7043

Project Name: Lake Buchanan Stormwater

Project Location: 600713x2. 01.07 C0126101 00

Sampled by [Print Name(s)] / Affiliation: Patrick Barnes / BFA

Sampler(s) Signature(s):

Preservatives (see codes): 1 | S | 1

Project Number: 600713x2

Analyses Requested: TSS | T Nitrogen T Phos Ammonia | OP Field filter (ortho phos)

REQUESTED DUE DATE:

Facility ID#:

Petroleum Restoration Program ____ yes ____ no

	Sample Identification	Sampled Date:	Sampled Time:	Grab or Composite	Matrix: (see codes)	Total Number of Containers	TSS	T Nitrogen T Phos Ammonia	OP Field filter (ortho phos)						
1	Buchanan DW	12/21/21	1113	C	SW	3	✓	✓	✓						2112032-001
2	Buchanan Palmetto	12/21/21	1222	C	SW	3	✓	✓	✓						-002

Shipment Method:		Relinquished by	Date:	Time:	Accepted by:	Date:	Time:
Out: / /	Via:	Helen Turner	3-21-21	14:15			
Returned: / /	Via:		12/21/21	1558	Helen Turner	12/21/21	15:58

Additional Comments:

Cooler No.(s) / Temperature(s) (°C): Stock, 433 Client cooler 15°

Sampling Kit No.: 8910

Equipment ID No.:

Matrix Codes: A = Air GW = Groundwater SE = Sediment SO = Soil SW = Surface Water W = Water(Blanks) HW = Potential Haz Waste O = Other(Specify:)

Preservative Codes: H = Hydrochloric Acid & Ice I = Ice Only N = Nitrie Acid& Ice S = Sulfuric Acid & Ice X = Sodium Hydroxide & Ice O = Other(Specify)

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Thank you **Lance Lumbard** for the opportunity to be of service to you and your company, we **S**incerely **A**ppreciate **Y**our **B**usiness. SRL certifies these **Laboratory Results** were produced in accordance with NELAC Standards. Hold times and preservation requirements were met for all analytes unless specifically noted in the report. Results relate only to the samples as received.

Client Name: **Wood Environment & Infrastructure Solutions, Inc.**	Date(s) Collected: 01/17/22
Contact Name: **Lance Lumbard**	Date Received: 01/17/22
Project Name: Lake Buchanan Stormwater	Time Received: 15:20
Project Number: 600713x2.01.07	Date Reported : 02/17/22
Phone Number: (407) 522-7570	Date Emailed : 02/17/22
Fax Number: (407) 522-7576	SRL Work Order # 22-01021

SRL WO #	Clients #	Matrix	Analysis Requested
2201021-001	Lake Buchanan Palmetto	Liquid	TSS/Total Nitrogen/Ammonia/ Total Phosphorus/Orthophosphate

Sherri Payne
Vice President & Quality Assurance Officer
Southern Research Laboratories, Inc.

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NELAP Certified
FDOH Cert # : E83484
SRL Lab Ref # : 22-01021
Received Date : 01/17/22

Lance Lumbard
Wood Env. & Infrastructure Solutions, Inc.
550 Northlake Blvd., Suite 1000
Altamonte Springs, FL. 32701 (407) 522-7570

Project Number/Project Name
600713x2.01.07
Lake Buchanan Stormwater
Lake Buchanan

Classical Chemistry Parameters

Client ID # : **Lake Buchanan Palmetto**
SRL (Lab) ID# : 2201021-001
Date Collected : 01/17/22
Lab FDOH Certification # : E83079

Analtye	CAS Number	Results	Flag	Units	Dilution Factor	MDL	PQL	Method	Date Prepared	Date Analyzed
Total Suspended Solids		**48.9**		mg/L	1	1.0	1.3	M-2540D-201	01/23/22	01/23/22
Total Nitrogen		**2.9**		mg/L	1	0.20	0.50	CALC	02/08/22	02/08/22
Ammonia as N	7664-41-7	**0.37**		mg/L	1	0.035	0.050	EPA 350.1	02/03/22	02/03/22
Total Kjeldahl Nitrogen	7727-37-9	**2.2**		mg/L	1	0.20	0.50	EPA 351.2	02/06/22	02/08/22
Nitrate/Nitrite as N		**0.71**		mg/L	1	0.015	0.050	EPA 353.2	01/18/22	01/18/22
Orthophosphate as P		**0.54**		mg/L	1	0.0038	0.0040	EPA 365.1	01/18/22	01/18/22
Phosphorus	7723-14-0	**0.76**		mg/L	1	0.0028	0.0040	EPA 365.3	02/01/22	02/04/22

Client ID # : **Blanks**
SRL (Lab) ID# : MB
Date Collected : NA
Lab FDOH Certification # : E83079

Analtye	CAS Number	Results	Flag	Units	Dilution Factor	MDL	PQL	Method	Date Prepared	Date Analyzed
Total Suspended Solids		1.0	U	mg/L	1	1.0	1.0	M-2540D-201	01/23/22	01/23/22
Total Nitrogen		0.20	U	mg/L	1	0.20	0.50	CALC	02/08/22	02/08/22
Ammonia as N	7664-41-7	0.035	U	mg/L	1	0.035	0.050	EPA 350.1	02/03/22	02/03/22
Total Kjeldahl Nitrogen	7727-37-9	0.20	U	mg/L	1	0.20	0.50	EPA 351.2	02/06/22	02/08/22
Nitrate/Nitrite as N		0.015	U	mg/L	1	0.015	0.050	EPA 353.2	01/18/22	01/18/22
Orthophosphate as P		0.0038	U	mg/L	1	0.0038	0.0040	EPA 365.1	01/18/22	01/18/22
Phosphorus	7723-14-0	0.0028	U	mg/L	1	0.0028	0.0040	EPA 365.3	02/01/22	02/04/22

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NELAP Certified
FDOH Cert # : E83484
SRL Lab Ref # : 22-01021
Received Date : 01/17/22

Lance Lumbard
Wood Env. & Infrastructure Solutions, Inc.
550 Northlake Blvd., Suite 1000
Altamonte Springs, FL. 32701 (407) 522-7570

Project Number/Project Name
600713x2.01.07
Lake Buchanan Stormwater
Lake Buchanan

Classical Chemistry Parameters

QAQC

	% Recovery LCS/MS/MSD	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Nitrate/Nitrite as N	98/91/98	90-110	90-110		6	0-20
Total Kjeldahl Nitrogen	97/110/106	90-110	90-110		1	0-20

Total Nitrogen (Calculated as: (Nitrogen, Total Kjeldahl) + (Nitrogen, Nitrate + Nitrite)

	% Recovery LCS/MS/MSD	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Orthophosphate as P	100/98/98	90-110	90-110		0	0-20

	% Recovery LCS/MS/MSD	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Phosphorus	100/105/106	90-110	90-110		1	0-20

	% Recovery LCS/MS/MSD	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Nitrogen, Ammonia (as N)	106/109/110	90-110	90-110		0	0-20

	% Recovery LCS/LCSD	Acceptable Limits
Total Suspended Solids	92/95	90-110

	Result	Source Result	RPD	Notes	RPD Limit
Total Suspended Solids (DUP-1)	93.0	96.0	3		0-10

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NELAP Certified
FDOH Cert # : E83484
SRL Lab Ref # : 22-01021
Received Date : 01/17/22

Lance Lumbard
Wood Env. & Infrastructure Solutions, Inc.
550 Northlake Blvd., Suite 1000
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Project Number/Project Name
600713x2.01.07
Lake Buchanan Stormwater
Lake Buchanan

DATA QUALIFIER CODES

Reporting Exceptions and Qualified Data

When quality control results are outside established control limits reanalysis, including re-extraction (if applicable), is preferred. If re-analysis is not viable or desirable, then results may be qualified. Sample results associated with quality control data that exceed acceptance criteria will be qualified with an appropriate comment.

D = Data reported from a dilution and or multiple dilutions.

I = Estimated Value, The reported value is between the Laboratory Method Detection Limit (**MDL**) and the Laboratory Practical Quantitation Limit (**PQL**)

J = Estimated Value

L = Off-Scale high; exceeds the linear range or highest calibration standard.

O = Sampled, but analysis lost or not performed

Q = Sample held beyond normal holding time
Q01 Analysis performed outside of method-specified holding time
Q02 Sample received outside of method-specified holding time

U = indicates the compound was analyzed for, but not detected. The numerical value preceding the "U" is the limit of detection for that compound based upon the dilution. **MEDF** = **M**atrix **E**ffected **D**ilution **F**actor.

V = Analyte was detected in both the sample and associated Laboratory Method Blank; Laboratory Contamination

Y = The analysis was from an unpreserved or improperly preserved sample. The data may not be accurate

Unless otherwise noted, ug/Kg and mg/Kg denote dry weight.

(SOILS) Actual Reporting Limit will depend on moisture content of sample and the amount of sample received.

Chain of Custody

2201021
1

Page 1 of 1

Project Manager:	Lance Lumbard
Company:	Wood Environment & Infrastructure Solutions, Inc.
Address:	550 Northlake Blvd., Suite 1000
City, State, Zip:	Altamonte Springs Florida 32701
Phone:	407-522-7570
Fax:	+1 (407) 522-7576

Southern Research Laboratories, Inc.
2251 Lynx Lane, Suite #1
Orlando, Florida 32804
Main (407) 522-7100 Fax: (407) 522-7043

Project Name: Lake Buchanan Stormwater

Project Location: PO C012610100

Sampled by [Print Name(s)] / Affiliation: Patrick Barnes / BFA Environmental

Sampler(s) Signature(s):

Preservatives (see codes): 1 | S | 1

Project Number: 600713x2

Analyses Requested: TSS | Nitrogen, Phosphorus | Orthophos

REQUESTED DUE DATE:

Facility ID#:

Petroleum Restoration Program ____ yes ____ no

	Sample Identification	Sampled Date:	Sampled Time:	Grab or Composite	Matrix: (see codes)	Total Number of Containers	TSS	Nitrogen, Phosphorus	Orthophos	
1	Lake Buchanan Palmetto	1/17/22	1204	C	SW	3	✓	✓	✓	2201021-001

Shipment Method:		Relinquished by	Date:	Time:	Accepted by:	Date:	Time:
Out: / /	Via:	[illegible]	321-21	1415		1-17-22	1001
Returned: / /	Via:		1-17-22	~~1-17-22~~ 1520		1-17-22	1520

Additional Comments:

Cooler No.(s) / Temperature(s) (°C): Client cooler stock, 433 1.8°C

Sampling Kit No.: 8910

Equipment ID No.:

Matrix Codes: A = Air GW = Groundwater SE = Sediment SO = Soil SW = Surface Water W = Water(Blanks) HW = Potential Haz Waste O = Other(Specify:_____)

Preservative Codes: H = Hydrochloric Acid & Ice I = Ice Only N = Nitric Acid& Ice S = Sulfuric Acid & Ice X = Sodium Hydroxide & Ice O = Other(Specify)

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Client Name: **Wood Environment & Infrastructure Solutions, Inc.**	Date(s) Collected: 03/08/22
Contact Name: **Lance Lumbard**	Date Received: 03/08/22
Project Name: Lake Buchanan Stormwater	Time Received: 12:05
Project Number: 600713x2.02.07	Date Reported : 03/24/22
Phone Number: (407) 522-7570	Date Emailed : 03/24/22
Fax Number: (407) 522-7576	SRL Work Order # 22-03008

SRL WO #	Clients #	Matrix	Analysis Requested
2203008-001	Buchanan Palmetto	Liquid	TSS/Total Nitrogen/Ammonia/ Total Phosphorus/Orthophosphate

Sherri Payne
Vice President & Quality Assurance Officer
Southern Research Laboratories, Inc.

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NELAP Certified
FDOH Cert # : E83484
SRL Lab Ref # : 22-03008
Received Date : 03/08/22

Lance Lumbard
Wood Env. & Infrastructure Solutions, Inc.
550 Northlake Blvd., Suite 1000
Altamonte Springs, FL. 32701 (407) 522-7570

Project Number/Project Name
600713x2.02.07
Lake Buchanan Stormwater
Lake Buchanan

Classical Chemistry Parameters

Client ID # : **Buchanan Palmetto**
SRL (Lab) ID# : 2203008-001
Date Collected : 03/08/22
Lab FDOH Certification # : E83079

Analtye	CAS Number	Results	Flag	Units	Dilution Factor	MDL	PQL	Method	Date Prepared	Date Analyzed
Total Suspended Solids		**32.6**		mg/L	1	2.1	2.1	M-2540D-201	03/14/22	03/14/22
Total Nitrogen		**2.5**		mg/L	1	0.086	0.50	CALC	03/17/22	03/17/22
Ammonia as N	7664-41-7	**0.39**		mg/L	1	0.035	0.050	EPA 350.1	03/18/22	03/18/22
Total Kjeldahl Nitrogen	7727-37-9	**1.8**		mg/L	1	0.20	0.50	EPA 351.2	03/16/22	03/17/22
Nitrate/Nitrite as N		**0.69**		mg/L	1	0.015	0.050	EPA 353.2	03/15/22	03/15/22
Orthophosphate as P		**0.54**		mg/L	1	0.0038	0.0040	EPA 365.1	03/09/22	03/09/22
Phosphorus	7723-14-0	**0.74**		mg/L	1	0.0028	0.0040	EPA 365.3	03/12/22	03/14/22

Client ID # : **Blanks**
SRL (Lab) ID# : MB
Date Collected : NA
Lab FDOH Certification # : E83079

Analtye	CAS Number	Results	Flag	Units	Dilution Factor	MDL	PQL	Method	Date Prepared	Date Analyzed
Total Suspended Solids		1.0	U	mg/L	1	1.0	1.0	M-2540D-201	03/14/22	03/14/22
Total Nitrogen		0.20	U	mg/L	1	0.20	0.50	CALC	03/17/22	03/17/22
Ammonia as N	7664-41-7	0.035	U	mg/L	1	0.035	0.050	EPA 350.1	03/18/22	03/18/22
Total Kjeldahl Nitrogen	7727-37-9	0.20	U	mg/L	1	0.20	0.50	EPA 351.2	03/16/22	03/17/22
Nitrate/Nitrite as N		0.015	U	mg/L	1	0.015	0.050	EPA 353.2	03/15/22	03/15/22
Orthophosphate as P		0.0038	U	mg/L	1	0.0038	0.0040	EPA 365.1	03/09/22	03/09/22
Phosphorus	7723-14-0	0.0028	U	mg/L	1	0.0028	0.0040	EPA 365.3	03/12/22	03/14/22

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NELAP Certified
FDOH Cert # : E83484
SRL Lab Ref # : 22-03008
Received Date : 03/08/22

Lance Lumbard
Wood Env. & Infrastructure Solutions, Inc.
550 Northlake Blvd., Suite 1000
Altamonte Springs, FL. 32701 (407) 522-7570

Project Number/Project Name
600713x2.02.07
Lake Buchanan Stormwater
Lake Buchanan

Classical Chemistry Parameters

QAQC

	% Recovery LCS/MS/MSD	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Nitrate/Nitrite as N	108/99/99	90-110	90-110		0	0-20
Total Kjeldahl Nitrogen	93/94/94	90-110	90-110		0	0-20

Total Nitrogen (Calculated as: (Nitrogen, Total Kjeldahl) + (Nitrogen, Nitrate + Nitrite)

	% Recovery LCS/MS/MSD	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Orthophosphate as P	96/94/92	90-110	90-110		2	0-20

	% Recovery LCS/MS/MSD	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Phosphorus	96/106/110	90-110	90-110		3	0-20

	% Recovery LCS/MS/MSD	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Nitrogen, Ammonia (as N)	107/109/110	90-110	90-110		1	0-20

	% Recovery LCS/LCSD	Acceptable Limits
Total Suspended Solids	93/100	90-110

	Result	Source Result	RPD	Notes	RPD Limit
Total Suspended Solids (DUP-1)	94.0	101	7		0-10

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NELAP Certified
FDOH Cert # : E83484
SRL Lab Ref # : 22-03008
Received Date : 03/08/22

Lance Lumbard
Wood Env. & Infrastructure Solutions, Inc.
550 Northlake Blvd., Suite 1000
Altamonte Springs, FL. 32701 (407) 522-7570

Project Number/Project Name
600713x2.02.07
Lake Buchanan Stormwater
Lake Buchanan

DATA QUALIFIER CODES

Reporting Exceptions and Qualified Data

When quality control results are outside established control limits reanalysis, including re-extraction (if applicable), is preferred. If re-analysis is not viable or desirable, then results may be qualified. Sample results associated with quality control data that exceed acceptance criteria will be qualified with an appropriate comment.

D = Data reported from a dilution and or multiple dilutions.

I = Estimated Value, The reported value is between the Laboratory Method Detection Limit (**MDL**) and the Laboratory Practical Quantitation Limit (**PQL**)

J = Estimated Value

L = Off-Scale high; exceeds the linear range or highest calibration standard.

O = Sampled, but analysis lost or not performed

Q = Sample held beyond normal holding time
Q01 Analysis performed outside of method-specified holding time
Q02 Sample received outside of method-specified holding time

U = indicates the compound was analyzed for, but not detected. The numerical value preceding the "U" is the limit of detection for that compound based upon the dilution. **MEDF** = **M**atrix **E**ffected **D**ilution **F**actor.

V = Analyte was detected in both the sample and associated Laboratory Method Blank; Laboratory Contamination

Y = The analysis was from an unpreserved or improperly preserved sample. The data may not be accurate

Unless otherwise noted, ug/Kg and mg/Kg denote dry weight.

(SOILS) Actual Reporting Limit will depend on moisture content of sample and the amount of sample received.

Chain of Custody

2203008
1

Page 1 of 1

Project Manager: Lance Lambard	Southern Research Laboratories, Inc. 2251 Lynx Lane, Suite #1 Orlando, Florida 32804
Company: Wood Environment & Infrastructure Solutions, Inc.	Main (407) 522-7100 Fax: (407) 522-7043
Address: 550 Northlake Blvd., Suite 1000	
City, State, Zip: Altamonte Springs Florida 32701	
Phone: 407-522-7570 Fax: +1 (407) 522-7576	

Project Name: Lake Buchanan Stormwater ~~OC Hickorynut Project~~

Project Location: 600713X2,02.07

PO# C0126 10100

Sampled by [Print Name(s)] / Affiliation: Katie Ballew / BFA

Sampler(s) Signature(s):

Preservatives (see codes): 1 | 1 | S

Project Number:

Analyses Requested: TSS; Orthophosphate; TN Nitrogen TPN & Nitrate+Nitrite Ammonia

REQUESTED DUE DATE:

Facility ID#:

Petroleum Restoration Program ____ yes ____ no

	Sample Identification	Sampled Date:	Sampled Time:	Grab or Composite	Matrix: (see codes)	Total Number of Containers	TSS	Orthophosphate	TN Nitrogen TPN & Nitrate+Nitrite Ammonia	
1	Buchanan Palmetto	3/8/22	1005	G	SW	3	✓	✓	✓	2203008-001

Shipment Method:

Out: / / Via:

Returned: / / Via:

Additional Comments:

Relinquished by	Date:	Time:	Accepted by:	Date:	Time:
SRL KIT					
	3/8/22	1205	Helen Turner	3/8/22	12:05

Cooler No.(s) / Temperature(s) (°C): Client Cooler 3,8 °C

Sampling Kit No.: Spark

Equipment ID No.:

Matrix Codes: A = Air GW = Groundwater SE = Sediment SO = Soil SW = Surface Water W = Water(Blanks) HW = Potential Haz Waste O = Other(Specify:_____)

Preservative Codes: H = Hydrochloric Acid & Ice I = Ice Only N = Nitrie Acid& Ice S = Sulfuric Acid & Ice X = Sodium Hydroxide & Ice O = Other(Specify)

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Client Name: **Wood Environment & Infrastructure Solutions, Inc.**	Date(s) Collected: 03/16/22
Contact Name: **Lance Lumbard**	Date Received: 03/16/22
Project Name: Lake Buchanan Stormwater	Time Received: 17:35
Project Number: 600713x2	Date Reported : 03/29/22
Phone Number: (407) 522-7570	Date Emailed : 03/29/22
Fax Number: (407) 522-7576	SRL Work Order # 22-03018

SRL WO #	Clients #	Matrix	Analysis Requested
2203018-001	Buchanan DW	Liquid	TSS/Total Nitrogen/Ammonia/ Total Phosphorus/Orthophosphate
2203018-002	Buchanan Palmetto	Liquid	TSS/Total Nitrogen/Ammonia/ Total Phosphorus/Orthophosphate

Sherri Payne
Vice President & Quality Assurance Officer
Southern Research Laboratories, Inc.

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NELAP Certified
FDOH Cert # : E83484
SRL Lab Ref # : 22-03018
Received Date : 03/16/22

Lance Lumbard
Wood Env. & Infrastructure Solutions, Inc.
550 Northlake Blvd., Suite 1000
Altamonte Springs, FL. 32701 (407) 522-7570

Project Number/Project Name
600713x2
Lake Buchanan Stormwater
Lake Buchanan

Classical Chemistry Parameters

Client ID # : **Buchanan DW**
SRL (Lab) ID# : 2203018-001
Date Collected : 03/16/22
Lab FDOH Certification # : E83079

Analtye	CAS Number	Results	Flag	Units	Dilution Factor	MDL	PQL	Method	Date Prepared	Date Analyzed
Total Suspended Solids		**8.3**		mg/L	1	1.1	1.1	M-2540D-201	03/22/22	03/22/22
Total Nitrogen		**1.0**		mg/L	1	0.086	0.50	CALC	03/28/22	03/28/22
Ammonia as N	7664-41-7	**0.17**		mg/L	1	0.035	0.050	EPA 350.1	03/24/22	03/24/22
Total Kjeldahl Nitrogen	7727-37-9	**1.0**		mg/L	1	0.20	0.50	EPA 351.2	03/25/22	03/28/22
Nitrate/Nitrite as N		0.015	U	mg/L	1	0.015	0.050	EPA 353.2	03/23/22	03/23/22
Orthophosphate as P		**0.096**		mg/L	1	0.0038	0.0040	EPA 365.1	03/17/22	03/17/22
Phosphorus	7723-14-0	**0.17**		mg/L	1	0.0028	0.0040	EPA 365.3	03/19/22	03/23/22

Client ID # : **Buchanan Palmetto**
SRL (Lab) ID# : 2203018-002
Date Collected : 03/16/22
Lab FDOH Certification # : E83079

Analtye	CAS Number	Results	Flag	Units	Dilution Factor	MDL	PQL	Method	Date Prepared	Date Analyzed
Total Suspended Solids		**28.5**		mg/L	1	1.1	1.1	M-2540D-201	03/22/22	03/22/22
Total Nitrogen		**0.67**		mg/L	1	0.086	0.50	CALC	03/28/22	03/28/22
Ammonia as N	7664-41-7	**0.051**		mg/L	1	0.035	0.050	EPA 350.1	03/24/22	03/24/22
Total Kjeldahl Nitrogen	7727-37-9	**0.54**		mg/L	1	0.20	0.50	EPA 351.2	03/25/22	03/28/22
Nitrate/Nitrite as N		**0.13**		mg/L	1	0.015	0.050	EPA 353.2	03/23/22	03/23/22
Orthophosphate as P		**0.093**		mg/L	1	0.0038	0.0040	EPA 365.1	03/17/22	03/17/22
Phosphorus	7723-14-0	**0.17**		mg/L	1	0.0028	0.0040	EPA 365.3	03/19/22	03/23/22

Client ID # : **Blanks**
SRL (Lab) ID# : MB
Date Collected : NA
Lab FDOH Certification # : E83079

Analtye	CAS Number	Results	Flag	Units	Dilution Factor	MDL	PQL	Method	Date Prepared	Date Analyzed
Total Suspended Solids		1.0	U	mg/L	1	1.0	1.0	M-2540D-201	03/22/22	03/22/22
Total Nitrogen		0.20	U	mg/L	1	0.20	0.50	CALC	03/28/22	03/28/22
Ammonia as N	7664-41-7	0.035	U	mg/L	1	0.035	0.050	EPA 350.1	03/24/22	03/24/22
Total Kjeldahl Nitrogen	7727-37-9	0.20	U	mg/L	1	0.20	0.50	EPA 351.2	03/25/22	03/28/22
Nitrate/Nitrite as N		0.015	U	mg/L	1	0.015	0.050	EPA 353.2	03/23/22	03/23/22
Orthophosphate as P		0.0038	U	mg/L	1	0.0038	0.0040	EPA 365.1	03/17/22	03/17/22
Phosphorus	7723-14-0	0.0028	U	mg/L	1	0.0028	0.0040	EPA 365.3	03/19/22	03/23/22

Southern Research Laboratories, Inc.
an MBE Environmental Laboratory
2251 Lynx Lane, Suite 1
Orlando, Florida 32804 (407) 522-7100

NELAP Certified
FDOH Cert # : E83484
SRL Lab Ref # : 22-03018
Received Date : 03/16/22

Lance Lumbard
Wood Env. & Infrastructure Solutions, Inc.
550 Northlake Blvd., Suite 1000
Altamonte Springs, FL. 32701 (407) 522-7570

Project Number/Project Name
600713x2
Lake Buchanan Stormwater
Lake Buchanan

Classical Chemistry Parameters

QAQC

	% Recovery LCS/MS/MSD	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Nitrate/Nitrite as N	103/101/101	90-110	90-110		0	0-20
Total Kjeldahl Nitrogen	96/97/97	90-110	90-110		0	0-20

Total Nitrogen (Calculated as: (Nitrogen, Total Kjeldahl) + (Nitrogen, Nitrate + Nitrite)

	% Recovery LCS/MS/MSD	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Orthophosphate as P	95/100/96	90-110	90-110		2	0-20

	% Recovery LCS/MS/MSD	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Phosphorus	98/103/107	90-110	90-110		1	0-20

	% Recovery LCS/MS/MSD	LCS Acceptable Limits	MS/MSD Acceptable Limits	Notes	%RPD MS/MSD	Acceptable Limits
Nitrogen, Ammonia (as N)	106/100/101	90-110	90-110		1	0-20

	% Recovery LCS/LCSD	Acceptable Limits
Total Suspended Solids	96/96	90-110

	Result	Source Result	RPD	Notes	RPD Limit
Total Suspended Solids (DUP-1)	97.0	97.0	0		0-10

Southern Research Laboratories, Inc.
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NELAP Certified
FDOH Cert # : E83484
SRL Lab Ref # : 22-03018
Received Date : 03/16/22

Lance Lumbard
Wood Env. & Infrastructure Solutions, Inc.
550 Northlake Blvd., Suite 1000
Altamonte Springs, FL. 32701 (407) 522-7570

Project Number/Project Name
600713x2
Lake Buchanan Stormwater
Lake Buchanan

DATA QUALIFIER CODES

Reporting Exceptions and Qualified Data

When quality control results are outside established control limits reanalysis, including re-extraction (if applicable), is preferred. If re-analysis is not viable or desirable, then results may be qualified. Sample results associated with quality control data that exceed acceptance criteria will be qualified with an appropriate comment.

D = Data reported from a dilution and or multiple dilutions.

I = Estimated Value, The reported value is between the Laboratory Method Detection Limit (**MDL**) and the Laboratory Practical Quantitation Limit (**PQL**)

J = Estimated Value

L = Off-Scale high; exceeds the linear range or highest calibration standard.

O = Sampled, but analysis lost or not performed

Q = Sample held beyond normal holding time
Q01 Analysis performed outside of method-specified holding time
Q02 Sample received outside of method-specified holding time

U = indicates the compound was analyzed for, but not detected. The numerical value preceding the "U" is the limit of detection for that compound based upon the dilution. **MEDF** = **M**atrix **E**ffected **D**ilution **F**actor.

V = Analyte was detected in both the sample and associated Laboratory Method Blank; Laboratory Contamination

Y = The analysis was from an unpreserved or improperly preserved sample. The data may not be accurate

Unless otherwise noted, ug/Kg and mg/Kg denote dry weight.

(SOILS) Actual Reporting Limit will depend on moisture content of sample and the amount of sample received.

Chain of Custody

22 03018
2

Page 1 of 1

Project Manager:	Laura Lumbard
Company:	Wood Environment & Infrastructure Solutions, Inc.
Address:	550 Northlake Blvd., Suite 1000
City, State, Zip:	Altamonte Springs, Florida, 32701
Phone:	407-522-7570
Fax:	+1 (407) 522-7576

Southern Research Laboratories, Inc.
2251 Lynx Lane, Suite #1
Orlando, Florida 32804
Main (407) 522-7100
Fax: (407) 522-7043

Project Name:	Lake Buchanan
Project Location:	Orange County, FL PO# C012610100

Sampled by [Print Name(s)] / Affiliation: Katie Ballew / BFA

Sampler(s) Signature(s):

Preservatives (see codes): 1 | S | 1

Project Number: 600713X2

REQUESTED DUE DATE:

Facility ID#:

Petroleum Restoration Program ____ yes ____ no

	Sample Identification	Sampled Date:	Sampled Time:	Grab or Composite	Matrix: (see codes)	Total Number of Containers	Analyses Requested: TSS	Total Phosphorus & Ammonia + Nitrogen	Ortho-phosphorus						
1	Buchanan DW	3/16/22	1600	G	SW	3	✓	✓	✓						22 03018-001
2	Buchanan Palmetto	3/16/22	1620	G	SW	3	✓	✓	✓						-002

Shipment Method:		Relinquished by	Date:	Time:	Accepted by:	Date:	Time:
Out: / /	Via:	[illegible] BRUKIT	1-31-22	14:00			
Returned: / /	Via:	[illegible]	3/16/22	1735	[signature]	3-16-22	1735

Additional Comments:

Cooler No.(s) / Temperature(s) (°C): 509 2.3

Sampling Kit No.: 9155

Equipment ID No.:

Matrix Codes: A = Air GW = Groundwater SE = Sediment SO = Soil SW = Surface Water W = Water(Blanks) HW = Potential Haz Waste O = Other(Specify:_____)

Preservative Codes: H = Hydrochloric Acid & Ice I = Ice Only N = Nitrie Acid& Ice S = Sulfuric Acid & Ice X = Sodium Hydroxide & Ice O = Other(Specify)

APPENDIX K

Stable Isotope Laboratory Reports

Beta Analytic, Inc.
4985 SW 74th Court
Miami, FL 33155 USA
Tel: 305-667-5167
Fax: 305-663-0964
info@betalabservices.com

ISO/IEC 17025:2017-Accredited Testing Laboratory

January 28, 2022

Mr. Craig Duxbury
Wood, PLC
550 NorthLake Blvd.
Altamonte Springs, FL 32701
United States

Dear Mr. Duxbury,

Please find enclosed the nitrate isotope (δ18O and δ15N) analysis results for 3 water samples.

Samples were analyzed by the chemical reduction of nitrate to nitrous oxide followed by continuous flow (CF) Isotope Ratio Mass Spectrometry (IRMS) (Casciotti et al., 2002; Foreman et al., 2016; and Altabet et al., 2019).

Isotope ratio data are reported as delta (δ) values in units of parts per thousand (per mill) (‰) (Coplen, 2011). Nitrogen isotope ratios are reported relative to N2 in air (Mariotti, 1983) and oxygen isotope ratios are reported relative to VSMOW reference water and normalized on a scale such that δ18OSLAP = -55.5‰ (Coplen, 1994; IAEA, 2017).

The results are also presented graphically on a plot which includes representative areas of the isotopic composition (δ18O and δ15N) of various nitrate sources (Kendall et al., 2007; Hastings et al., 2013).

As always, if you have any questions or would like to discuss the results, don't hesitate to contact us.

Our invoice will be emailed separately. Please forward it to the appropriate officer or send a credit card authorization. Thank you. As always, if you have any questions or would like to discuss the results, don't hesitate to contact us.

Sincerely,

Digital signature on file

Chris Patrick
Vice President of Laboratory Operations

Beta Analytic, Inc.
4985 SW 74th Court
Miami, FL 33155 USA
Tel: 305-667-5167
Fax: 305-663-0964
info@betalabservices.com

Analysis Details

Submitter: Mr. Craig Duxbury
Material submitted: Groundwater well
Date received: 12/01/2021
Date reported: 01/28/2022
Isotopic analysis: $\delta^{18}O$ and $\delta^{15}N$
Method: Chemical reduction of nitrate to nitrous oxide followed by continuous flow Isotope Ratio Mass Spectrometry (IRMS) (Foreman et al., 2016, and Altabet et al., 2019)
Instrument: Thermo Scientific Denitrification Kit installed on a Gas Bench II connected to a Thermo Scientific Delta V IRMS

Lab Identification	Submitter ID	Material	Nitrate (mg-N/L)	$\delta^{18}O$ (‰) (to VSMOW)	$\delta^{15}N$ (‰) (to Air-N_2)
Beta-611410	LBSM2. 11/22/2021	Water	11.2	-26.6	1.62
Beta-611411	LBSM1. 11/22/2021	Water	0.19	6.95	5.08
Beta-611412	LBSM3. 11/22/2021	Water	0.15	12.5	-8.73

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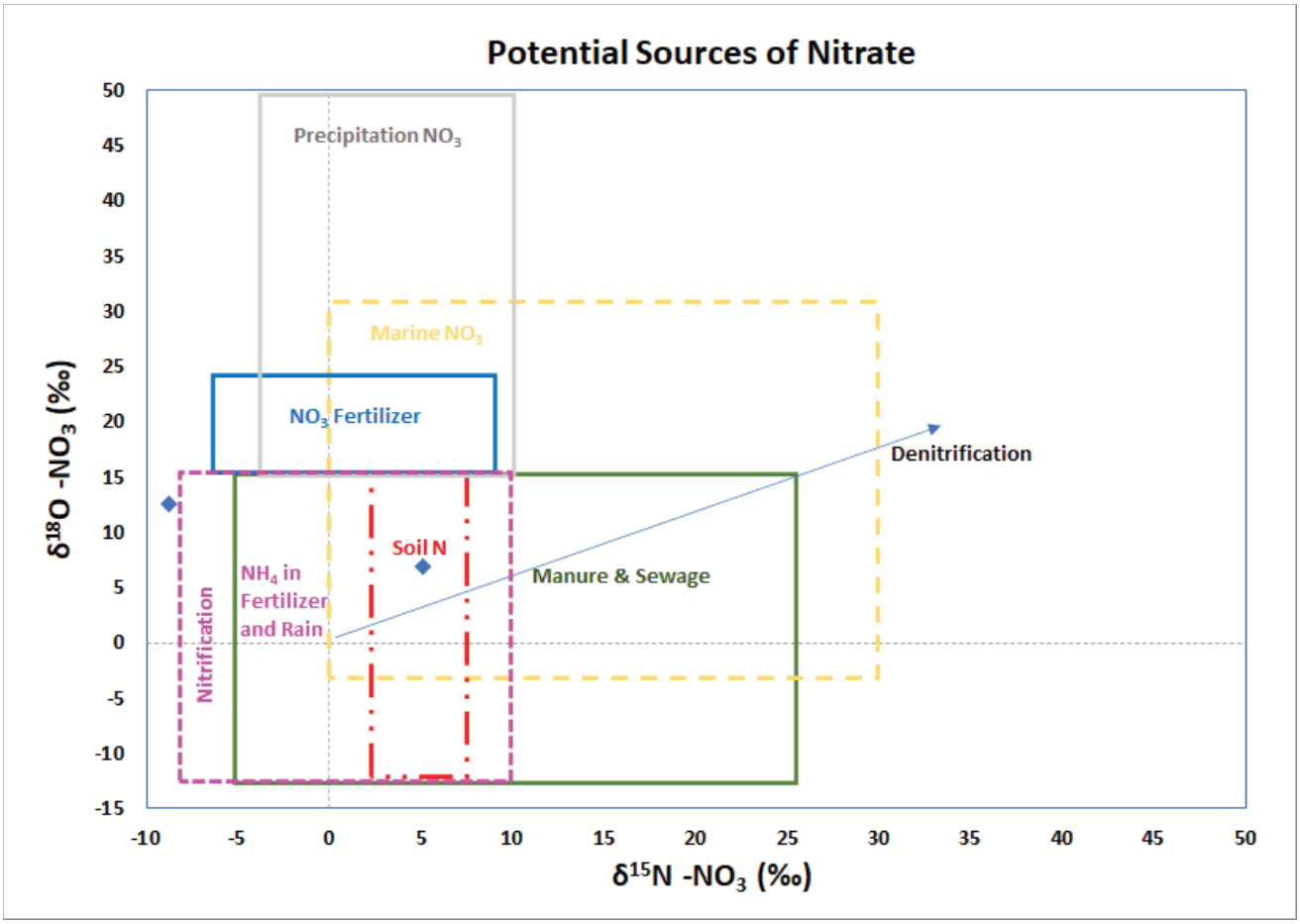
Results (cont.)



Plot of $\delta^{18}O$-NO_3 vs. $\delta^{15}N$-NO_3 results for the tested samples. The data are presented on a plot with representative areas of the isotopic composition ($\delta^{18}O$ and $\delta^{15}N$) of various nitrate sources (Kendall et al, 2007; Hastings et al., 2013).

This graphical representation is for reference only and should not be construed as an interpretation of the nitrate sources for these test results. The areas for the various nitrate sources overlap and additional data is required to definitively identify sources.

Beta Analytic
TESTING LABORATORY

Beta Analytic, Inc.
4985 SW 74th Court
Miami, FL 33155 USA
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info@betalabservices.com

Methods

Each reduced sample was loaded into a PAL auto-sampler which delivered sample gas to a Thermo Scientific Gas Bench II equipped with a denitrification kit installed as per Casciotti et al, 2002. Each sample was run on a continuous flow Delta V IRMS with 10 pulses of reference N_2O gas with a standard deviation of <0.1‰ for $\delta^{18}O$ and $\delta^{15}N$. This laboratory reference gas is standardized to USGS-32, USGS-34 and USGS-35 (Coplen, 2018)). The nitrate isotope method uncertainty is ±2‰ (1 SD) for $\delta^{18}O$ and ±0.5‰ (1 SD) for $\delta^{15}N$.

Quality Control Reference Standard-$\delta^{18}O$ for Nitrate Isotope Analysis

Reference Standard	Measured $\delta^{18}O$ (‰) (to VSMOW-SLAP)	Expected $\delta^{18}O$ (‰) (to VSMOW-SLAP)
USGS 34	-28.2 ± 1.0	-27.9
USGS 35	57.4 ± 0.1	57.5
Lab Mix	-16.7 ± 0.5	-17.2

Quality Control Reference Standard-$\delta^{15}N$ for Nitrate Isotope Analysis

Reference Standard	Measured $\delta^{15}N$ (‰) (to Air-N_2)	Expected $\delta^{15}N$ (‰) (to Air-N_2)
USGS 34	-1.48 ± 0.2	-1.80
USGS 35	2.2 ± 0.04	2.70
Lab Mix	34.7 ± 0.4	34.6

USGS standards are primary Reference Materials (RMs) prepared and distributed by the Reston Stable Isotope Lab (RSIL) (Coplen, 2018). Lab Mix is a secondary in-house standard traceable to the USGS RMs.

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References

Casciotti, K. L., Sigman, D. M., Hastings, M. G., Böhlke, J. K., & Hilkert, A. (2002). Measurement of the oxygen isotopic composition of nitrate in seawater and freshwater using the denitrifier method. Anal. Chem, 74(19), 4905-4912.

Foreman, R. K., Segura-Noguera, M., & Karl, D. M. (2016). Validation of Ti (III) as a reducing agent in the chemiluminescent determination of nitrate and nitrite in seawater. Marine Chemistry, 186, 83-89.

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Hastings, et al. (2013). Stable Isotopes as Tracers of Anthropogenic Nitrogen Sources, Deposition, and Impacts. Elements, 9(5), 339-344.

International Atomic Energy Agency (IAEA), Reference Sheet for International Measurement Standards, http://nucleus.iaea.org/rpst/Documents/VSMOW2_SLAP2.pdf, 2017

Coplen, T. B. (1994). Reporting of Stable Hydrogen, Carbon, and Oxygen Isotopic Abundances. Pure and Applied Chemistry, v. 66, p. 273-276.

Coplen, T. B. (2011). Guidelines and recommended terms for expression of stable-isotope-ratio and gas-ratio measurement results. Rapid Communications in Mass Spectrometry, v. 25, 2538–2560. Available at http://dx.doi.org/10.1002/rcm.5129

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Mariotti, A. (1983). Atmospheric nitrogen is a reliable standard for natural ^{15}N abundance measurements. Nature, v. 303, p. 685-687.

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ISO/IEC 17025:2017-Accredited Testing Laboratory

May 25, 2022

Mr. Craig Duxbury
Wood, PLC
550 NorthLake Blvd.
Altamonte Springs, FL 32701
United States

Samples collected 24 March 2022

Dear Mr. Duxbury,

Please find enclosed the nitrate isotope (δ18O and δ15N) analysis results for 3 water samples.

Samples were analyzed by the chemical reduction of nitrate to nitrous oxide followed by continuous flow (CF) Isotope Ratio Mass Spectrometry (IRMS) (Casciotti et al., 2002; Foreman et al., 2016; and Altabet et al., 2019).

Isotope ratio data are reported as delta (δ) values in units of parts per thousand (per mill) (‰) (Coplen, 2011). Nitrogen isotope ratios are reported relative to N2 in air (Mariotti, 1983) and oxygen isotope ratios are reported relative to VSMOW reference water and normalized on a scale such that δ18OSLAP = -55.5‰ (Coplen, 1994; IAEA, 2017).

The results are also presented graphically on a plot which includes representative areas of the isotopic composition (δ18O and δ15N) of various nitrate sources (Kendall et al., 2007; Hastings et al., 2013).

As always, if you have any questions or would like to discuss the results, don't hesitate to contact us.

Our invoice has been sent separately. Thank you for your prior efforts in arranging payment. As always, if you have any questions or would like to discuss the results, don't hesitate to contact us.

Sincerely,

Digital signature on file

Chris Patrick
Vice President of Laboratory Operations

Beta Analytic, Inc.
4985 SW 74th Court
Miami, FL 33155 USA
Tel: 305-667-5167
Fax: 305-663-0964
info@betalabservices.com

Analysis Details

Submitter: Mr. Craig Duxbury

Material submitted: Groundwater well

Date received: 04/14/2022

Date reported: 05/25/2022

Isotopic analysis: $\delta^{18}O$ and $\delta^{15}N$

Method: Chemical reduction of nitrate to nitrous oxide followed by continuous flow Isotope Ratio Mass Spectrometry (IRMS) (Foreman et al., 2016, and Altabet et al., 2019)

Instrument: Thermo Scientific Denitrification Kit installed on a Gas Bench II connected to a Thermo Scientific Delta V IRMS

Lab Identification	Submitter ID	Material	Nitrate (mg-N/L)	$\delta^{18}O$ (‰) (to VSMOW)	$\delta^{15}N$ (‰) (to Air-N_2)
Beta-624967	LBSM1	Water	0.14	12.6	3.95
Beta-624968	LBSM2	Water	0.57	-12.3	-1.08
Beta-624969	LBSM3	Water	0.98	-24.7	-0.78

Samples collected 24 March 2022

Beta Analytic, Inc.
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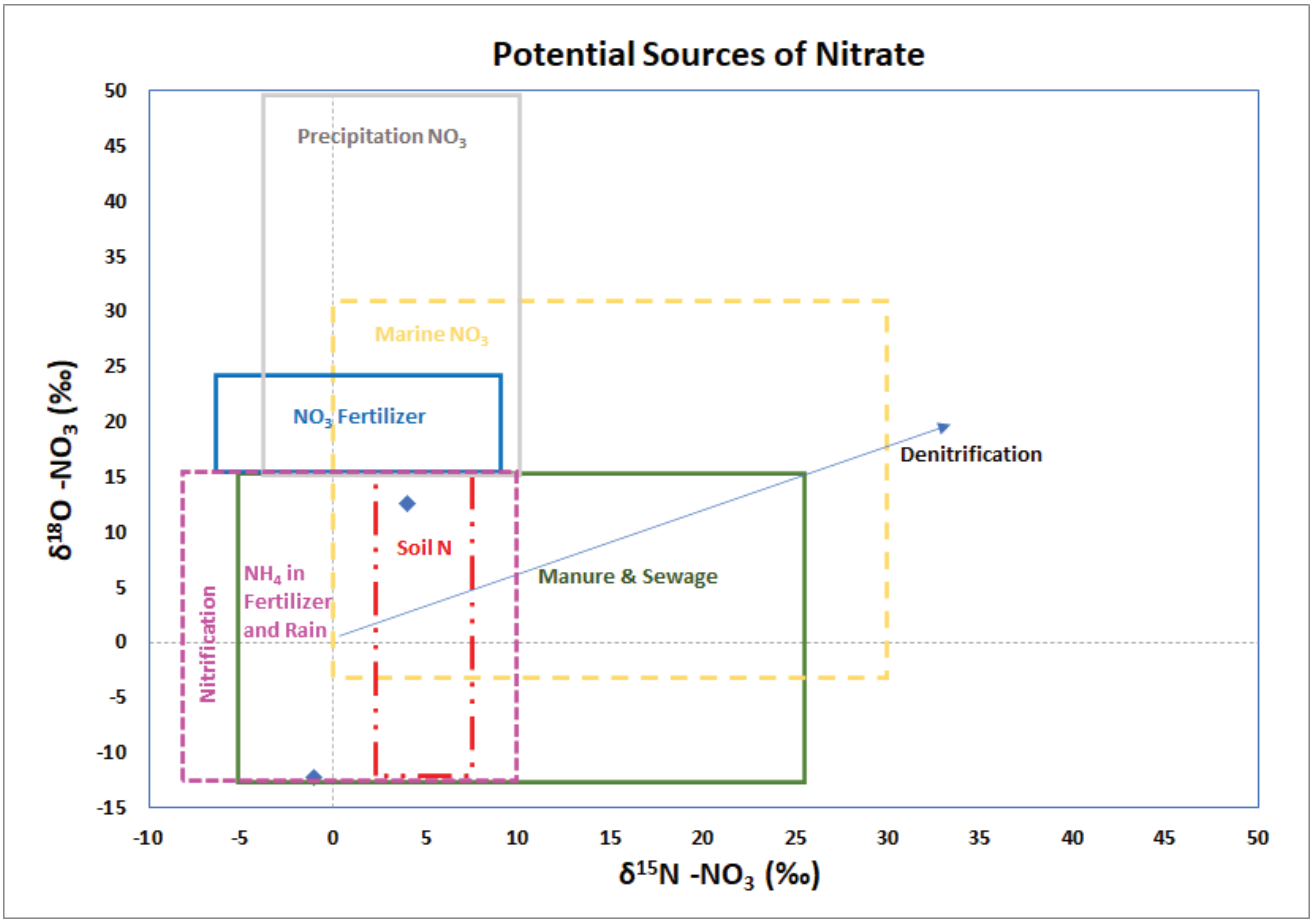
Results (cont.)



Plot of $\delta^{18}O$-NO_3 vs. $\delta^{15}N$-NO_3 results for the tested samples. The data are presented on a plot with representative areas of the isotopic composition ($\delta^{18}O$ and $\delta^{15}N$) of various nitrate sources (Kendall et al, 2007; Hastings et al., 2013).

This graphical representation is for reference only and should not be construed as an interpretation of the nitrate sources for these test results. The areas for the various nitrate sources overlap and additional data is required to definitively identify sources.

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Methods

Each reduced sample was loaded into a PAL auto-sampler which delivered sample gas to a Thermo Scientific Gas Bench II equipped with a denitrification kit installed as per Casciotti et al, 2002. Each sample was run on a continuous flow Delta V IRMS with 10 pulses of reference N_2O gas with a standard deviation of <0.1‰ for $\delta^{18}O$ and $\delta^{15}N$. This laboratory reference gas is standardized to USGS-32, USGS-34 and USGS-35 (Coplen, 2018)). The nitrate isotope method uncertainty is ±2‰ (1 SD) for $\delta^{18}O$ and ±0.5‰ (1 SD) for $\delta^{15}N$.

Quality Control Reference Standard-$\delta^{18}O$ for Nitrate Isotope Analysis

Reference Standard	Measured $\delta^{18}O$ (‰) (to VSMOW-SLAP)	Expected $\delta^{18}O$ (‰) (to VSMOW-SLAP)
USGS 34	-27.8 ± 0.09	-27.9
USGS 35	57.6 ± 0.4	57.5
Lab Mix	-17.4 ± 0.01	-17.2

Quality Control Reference Standard-$\delta^{15}N$ for Nitrate Isotope Analysis

Reference Standard	Measured $\delta^{15}N$ (‰) (to Air-N_2)	Expected $\delta^{15}N$ (‰) (to Air-N_2)
USGS 34	-2.1 ± 0.3	-1.80
USGS 35	2.32 ± 0.1	2.70
Lab Mix	34.7 ± 0.01	34.6

USGS standards are primary Reference Materials (RMs) prepared and distributed by the Reston Stable Isotope Lab (RSIL) (Coplen, 2018). Lab Mix is a secondary in-house standard traceable to the USGS RMs.

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References

Casciotti, K. L., Sigman, D. M., Hastings, M. G., Böhlke, J. K., & Hilkert, A. (2002). Measurement of the oxygen isotopic composition of nitrate in seawater and freshwater using the denitrifier method. Anal. Chem, 74(19), 4905-4912.

Foreman, R. K., Segura-Noguera, M., & Karl, D. M. (2016). Validation of Ti (III) as a reducing agent in the chemiluminescent determination of nitrate and nitrite in seawater. Marine Chemistry, 186, 83-89.

Altabet, M.A., Wassenaar, L.I., Douence, C., and Rupsa, R. (2019). A Ti(III) reduction method for one-step conversion of seawater and freshwater nitrate into N_2O for stable isotopic analysis of $^{15}N/^{14}N$, $^{18}O/^{16}O$ and $^{17}O/^{16}O$. Rapid Communications in Mass Spectrometry, v. 33, 1227–1239.

Hastings, et al. (2013). Stable Isotopes as Tracers of Anthropogenic Nitrogen Sources, Deposition, and Impacts. Elements, 9(5), 339-344.

International Atomic Energy Agency (IAEA), Reference Sheet for International Measurement Standards, http://nucleus.iaea.org/rpst/Documents/VSMOW2_SLAP2.pdf, 2017

Coplen, T. B. (1994). Reporting of Stable Hydrogen, Carbon, and Oxygen Isotopic Abundances. Pure and Applied Chemistry, v. 66, p. 273-276.

Coplen, T. B. (2011). Guidelines and recommended terms for expression of stable-isotope-ratio and gas-ratio measurement results. Rapid Communications in Mass Spectrometry, v. 25, 2538–2560. Available at http://dx.doi.org/10.1002/rcm.5129

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ISO/IEC 17025:2017-Accredited Testing Laboratory

July 11, 2022

Sample date: 6 May 2022

Mr. Craig Duxbury
Wood, PLC
550 NorthLake Blvd.
Altamonte Springs, FL 32701
United States

Dear Mr. Duxbury,

Please find enclosed the nitrate isotope (δ18O and δ15N) analysis result for one water sample.

Samples were analyzed by the chemical reduction of nitrate to nitrous oxide followed by continuous flow (CF) Isotope Ratio Mass Spectrometry (IRMS) (Casciotti et al., 2002; Foreman et al., 2016; and Altabet et al., 2019).

Isotope ratio data are reported as delta (δ) values in units of parts per thousand (per mill) (‰) (Coplen, 2011). Nitrogen isotope ratios are reported relative to N2 in air (Mariotti, 1983) and oxygen isotope ratios are reported relative to VSMOW reference water and normalized on a scale such that δ18OSLAP = -55.5‰ (Coplen, 1994; IAEA, 2017).

The results are also presented graphically on a plot which includes representative areas of the isotopic composition (δ18O and δ15N) of various nitrate sources (Kendall et al., 2007; Hastings et al., 2013).

As always, if you have any questions or would like to discuss the results, don't hesitate to contact us.

Thank you for prepaying the analyses. As always, if you have any questions or would like to discuss the results, don't hesitate to contact us.

Sincerely,

Chris Patrick
Digital signature on file

Chris Patrick
Vice President of Laboratory Operations

Beta Analytic, Inc.
4985 SW 74th Court
Miami, FL 33155 USA
Tel: 305-667-5167
Fax: 305-663-0964
info@betalabservices.com

Analysis Details

Submitter: Mr. Craig Duxbury
Material submitted: Groundwater well
Date received: 06/17/2022
Date reported: 07/11/2022
Isotopic analysis: $\delta^{18}O$ and $\delta^{15}N$
Method: Chemical reduction of nitrate to nitrous oxide followed by continuous flow Isotope Ratio Mass Spectrometry (IRMS) (Foreman et al., 2016, and Altabet et al., 2019)
Instrument: Thermo Scientific Denitrification Kit installed on a Gas Bench II connected to a Thermo Scientific Delta V IRMS

Lab Identification	Submitter ID	Material	Nitrate (mg-N/L)	$\delta^{18}O$ (‰) (to VSMOW)	$\delta^{15}N$ (‰) (to Air-N_2)
Beta-630657*	LBSM2	Water	BDL	NA	NA
Beta-630658	LBSM3	Water	7.11	-26.7	0.23

* COMMENT: The sample is below detectable limit

Sample Date: 6 May 2022

Beta Analytic, Inc.
4985 SW 74th Court
Miami, FL 33155 USA
Tel: 305-667-5167
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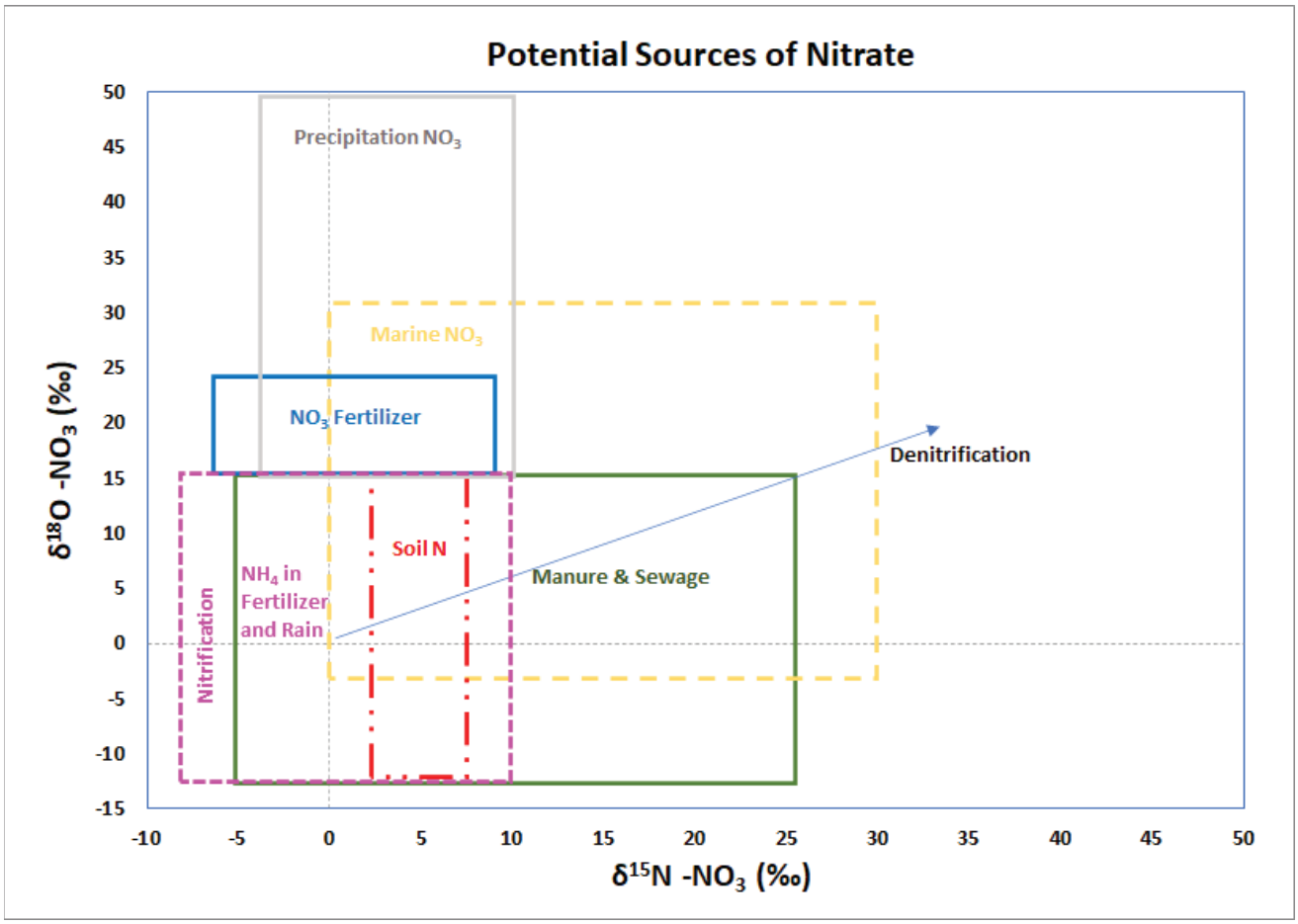
Results (cont.)



Plot of $\delta^{18}O$-NO_3 vs. $\delta^{15}N$-NO_3 results for the tested samples. The data are presented on a plot with representative areas of the isotopic composition ($\delta^{18}O$ and $\delta^{15}N$) of various nitrate sources (Kendall et al, 2007; Hastings et al., 2013).

This graphical representation is for reference only and should not be construed as an interpretation of the nitrate sources for these test results. The areas for the various nitrate sources overlap and additional data is required to definitively identify sources.

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4985 SW 74th Court
Miami, FL 33155 USA
Tel: 305-667-5167
Fax: 305-663-0964
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Methods

Each reduced sample was loaded into a PAL auto-sampler which delivered sample gas to a Thermo Scientific Gas Bench II equipped with a denitrification kit installed as per Casciotti et al, 2002. Each sample was run on a continuous flow Delta V IRMS with 10 pulses of reference N_2O gas with a standard deviation of <0.1‰ for $\delta^{18}O$ and $\delta^{15}N$. This laboratory reference gas is standardized to USGS-32, USGS-34 and USGS-35 (Coplen, 2018)). The nitrate isotope method uncertainty is ±2‰ (1 SD) for $\delta^{18}O$ and ±0.5‰ (1 SD) for $\delta^{15}N$.

Quality Control Reference Standard-$\delta^{18}O$ for Nitrate Isotope Analysis

Reference Standard	Measured $\delta^{18}O$ (‰) (to VSMOW-SLAP)	Expected $\delta^{18}O$ (‰) (to VSMOW-SLAP)
USGS 34	-26.8 ± 0.09	-27.9
USGS 35	57.5 ± 1.0	57.5
Lab Mix	-18.3 ± 0.01	-17.2

Quality Control Reference Standard-$\delta^{15}N$ for Nitrate Isotope Analysis

Reference Standard	Measured $\delta^{15}N$ (‰) (to Air-N_2)	Expected $\delta^{15}N$ (‰) (to Air-N_2)
USGS 34	-1.8 ± 0.01	-1.80
USGS 35	2.7 ± 0.6	2.70
Lab Mix	34.6 ± 0.1	34.6

USGS standards are primary Reference Materials (RMs) prepared and distributed by the Reston Stable Isotope Lab (RSIL) (Coplen, 2018). Lab Mix is a secondary in-house standard traceable to the USGS RMs.

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Mariotti, A. (1983). Atmospheric nitrogen is a reliable standard for natural ^{15}N abundance measurements. Nature, v. 303, p. 685-687.

From: Zeneida Cernada
To: Duxbury, Craig
Subject: RE: Beta - report posted to your private library
Date: Monday, July 11, 2022 12:14:44 PM
Attachments: image001.png

CAUTION: External email. Please do not click on links/attachments unless you know the content is genuine and safe.

Good afternoon Mr. Duxbury,

Two out of the four samples that we received on June17, 2022, Beta-630657 & 630659 (**LBSM2 & XWEKIVAMWBU (4/20/2022)**)are below detectable limit and therefore cannot be measured in our IRMS for d15N & d18O on Nitrate. The report for the other two samples will be published today.
Thank You,

Zeneida Cernada
IRMS Manager
Zcernada@radiocarbon.com
Phone Number: 305-667-5167 ext. 125

www.radiocarbon.com www.betalabservices.com

Beta Analytic Inc. - Accredited ISO/IEC 17025:2017 Testing Laboratory
IMPORTANT: Services are provided under our Terms and Conditions. All other terms and conditions are declined. This e-mail and any files transmitted are confidential and may also be privileged. All communication between you and Beta Analytic is subject to our Privacy Policy.

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ISO/IEC 17025:2017-Accredited Testing Laboratory

November 08, 2022

Mr. Craig Duxbury
Wood, PLC
550 NorthLake Blvd.
Altamonte Springs, FL 32701
United States

Dear Mr. Duxbury,

Please find enclosed the nitrate isotope (δ18O and δ15N) analysis results for 3 water samples.

Samples were analyzed by the chemical reduction of nitrate to nitrous oxide followed by continuous flow (CF) Isotope Ratio Mass Spectrometry (IRMS) (Casciotti et al., 2002; Foreman et al., 2016; and Altabet et al., 2019).

Isotope ratio data are reported as delta (δ) values in units of parts per thousand (per mill) (‰) (Coplen, 2011). Nitrogen isotope ratios are reported relative to N2 in air (Mariotti, 1983) and oxygen isotope ratios are reported relative to VSMOW reference water and normalized on a scale such that δ18OSLAP = -55.5‰ (Coplen, 1994; IAEA, 2017).

The results are also presented graphically on a plot which includes representative areas of the isotopic composition (δ18O and δ15N) of various nitrate sources (Kendall et al., 2007; Hastings et al., 2013).

As always, if you have any questions or would like to discuss the results, don't hesitate to contact us.

Our invoice has been sent separately. Thank you for your prior efforts in arranging payment. As always, if you have any questions or would like to discuss the results, don't hesitate to contact us.

Sincerely,

Digital signature on file

Chris Patrick
Vice President of Laboratory Operations

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Analysis Details

Submitter: Mr. Craig Duxbury
Material submitted: Groundwater well
Date received: 08/11/2022
Date reported: 11/08/2022
Isotopic analysis: $\delta^{18}O$ and $\delta^{15}N$
Method: Chemical reduction of nitrate to nitrous oxide followed by continuous flow Isotope Ratio Mass Spectrometry (IRMS) (Foreman et al., 2016, and Altabet et al., 2019)
Instrument: Thermo Scientific Denitrification Kit installed on a Gas Bench II connected to a Thermo Scientific Delta V IRMS

Lab Identification	Submitter ID	Material	Nitrate (mg-N/L)	$\delta^{18}O$ (‰) (to VSMOW)	$\delta^{15}N$ (‰) (to Air-N_2)
Beta-635964	LBSM1 (7/20/2022)	Water	0.22	-37.1	4.94
Beta-635965	LBSM2 (7/20/2022)	Water	0.99	-12.00	10.3
Beta-635966	LBSM3 (7/20/2022)	Water	0.34	-37.6	7.52

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Analysis Details

Submitter: Mr. Craig Duxbury
Material submitted: Groundwater well
Date received: 09/08/2022
Date reported: 11/08/2022
Isotopic analysis: $\delta^{18}O$ and $\delta^{15}N$
Method: Chemical reduction of nitrate to nitrous oxide followed by continuous flow Isotope Ratio Mass Spectrometry (IRMS) (Foreman et al., 2016, and Altabet et al., 2019)
Instrument: Thermo Scientific Denitrification Kit installed on a Gas Bench II connected to a Thermo Scientific Delta V IRMS

Lab Identification	Submitter ID	Material	Nitrate (mg-N/L)	$\delta^{18}O$ (‰) (to VSMOW)	$\delta^{15}N$ (‰) (to Air-N_2)
Beta-638674	LBSM2 (8/23/22)	Water	3.30	-26.0	1.79
Beta-638675	LBSM1 (8/23/22)	Water	1.11	-28.1	4.08
Beta-638676	LBSM3 (8/23/22)	Water	2.91	-30.2	-6.15

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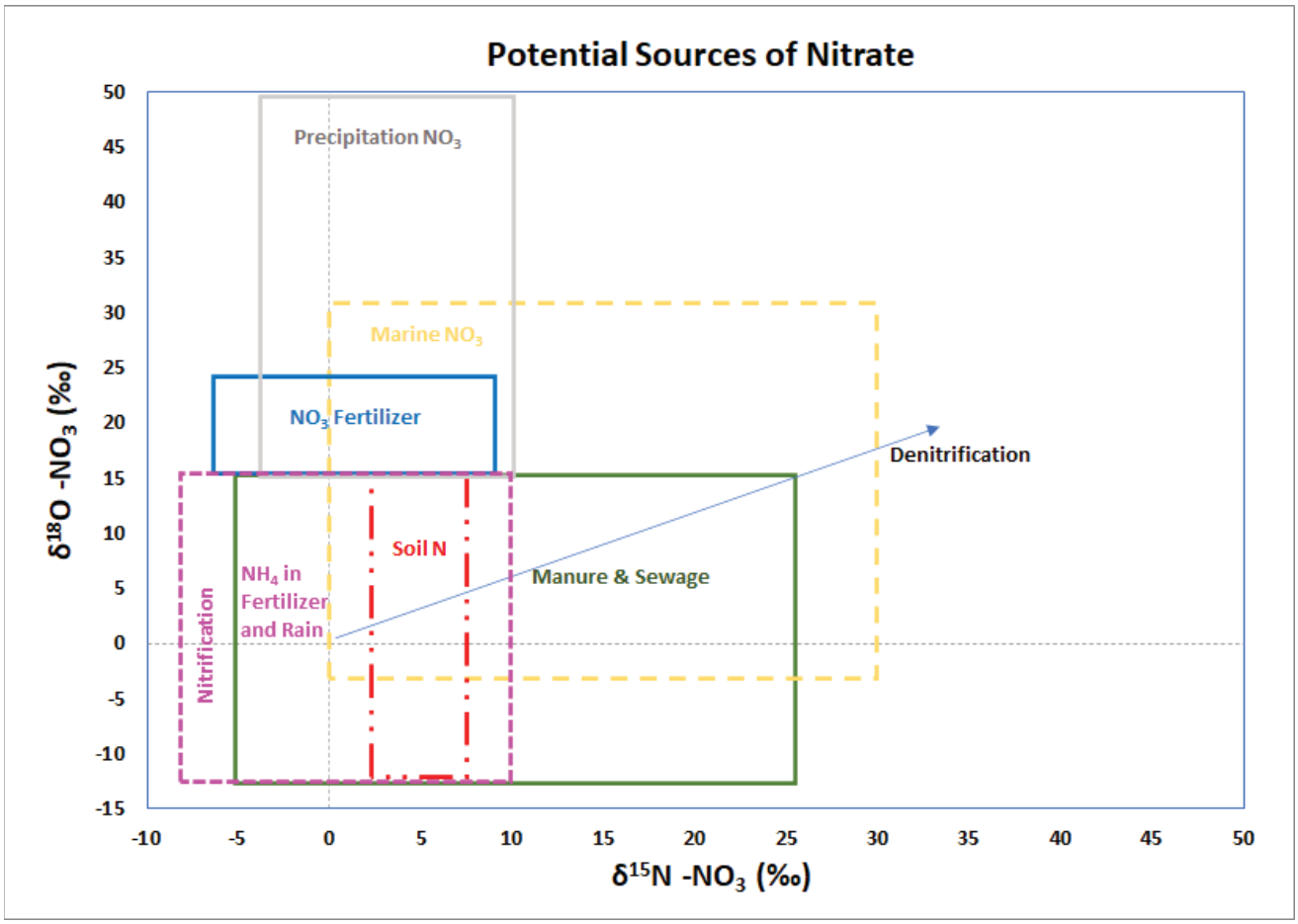
Results (cont.)



Plot of $\delta^{18}O$-NO_3 vs. $\delta^{15}N$-NO_3 results for the tested samples. The data are presented on a plot with representative areas of the isotopic composition ($\delta^{18}O$ and $\delta^{15}N$) of various nitrate sources (Kendall et al, 2007; Hastings et al., 2013).

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Quality Control Reference Standard-$\delta^{18}O$ for Nitrate Isotope Analysis

Reference Standard	Measured $\delta^{18}O$ (‰) (to VSMOW-SLAP)	Expected $\delta^{18}O$ (‰) (to VSMOW-SLAP)
USGS 34	-27.6 ± 0.10	-27.9
USGS 35	57.9 ± 0.3	57.5
Lab Mix	-17.0 ± 0.02	-17.2

Quality Control Reference Standard-$\delta^{15}N$ for Nitrate Isotope Analysis

Reference Standard	Measured $\delta^{15}N$ (‰) (to Air-N_2)	Expected $\delta^{15}N$ (‰) (to Air-N_2)
USGS 34	-2.3 ± 0.1	-1.80
USGS 35	3.1 ± 0.3	2.70
Lab Mix	34.6 ± 0.03	34.6

USGS standards are primary Reference Materials (RMs) prepared and distributed by the Reston Stable Isotope Lab (RSIL) (Coplen, 2018). Lab Mix is a secondary in-house standard traceable to the USGS RMs.

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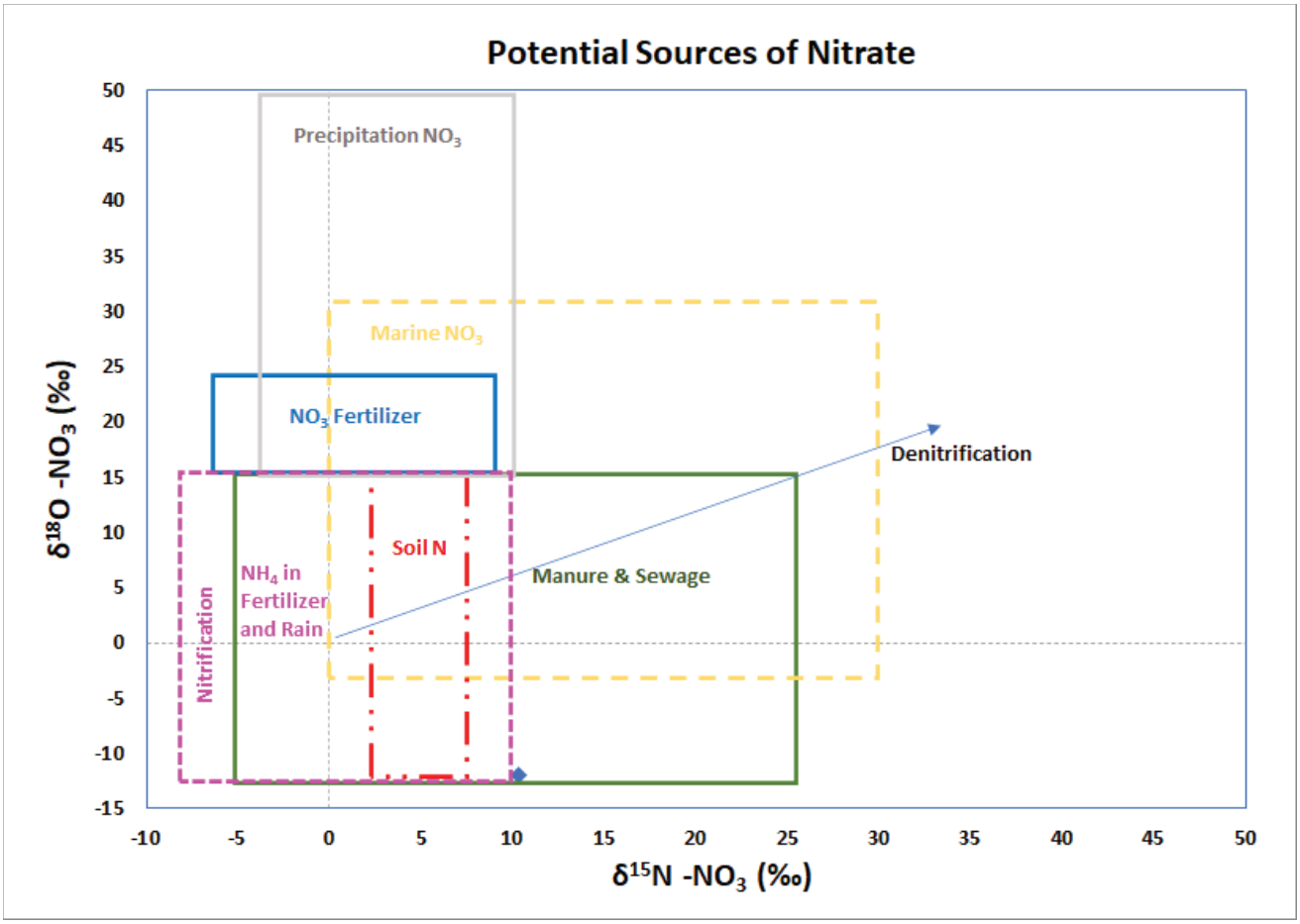
Results (cont.)



Plot of $\delta^{18}O$-NO_3 vs. $\delta^{15}N$-NO_3 results for the tested samples. The data are presented on a plot with representative areas of the isotopic composition ($\delta^{18}O$ and $\delta^{15}N$) of various nitrate sources (Kendall et al, 2007; Hastings et al., 2013).

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Quality Control Reference Standard-$\delta^{18}O$ for Nitrate Isotope Analysis

Reference Standard	Measured $\delta^{18}O$ (‰) (to VSMOW-SLAP)	Expected $\delta^{18}O$ (‰) (to VSMOW-SLAP)
USGS 34	-27.6 ± 0.10	-27.9
USGS 35	57.9 ± 0.3	57.5
Lab Mix	-17.0 ± 0.02	-17.2

Quality Control Reference Standard-$\delta^{15}N$ for Nitrate Isotope Analysis

Reference Standard	Measured $\delta^{15}N$ (‰) (to Air-N_2)	Expected $\delta^{15}N$ (‰) (to Air-N_2)
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USGS 35	3.1 ± 0.3	2.70
Lab Mix	34.6 ± 0.03	34.6

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ISO/IEC 17025:2017-Accredited Testing Laboratory

November 08, 2022

Mr. Craig Duxbury
Wood, PLC
550 NorthLake Blvd.
Altamonte Springs, FL 32701
United States

Dear Mr. Duxbury,

Please find enclosed the nitrate isotope (δ18O and δ15N) analysis results for 3 water samples.

Samples were analyzed by the chemical reduction of nitrate to nitrous oxide followed by continuous flow (CF) Isotope Ratio Mass Spectrometry (IRMS) (Casciotti et al., 2002; Foreman et al., 2016; and Altabet et al., 2019).

Isotope ratio data are reported as delta (δ) values in units of parts per thousand (per mill) (‰) (Coplen, 2011). Nitrogen isotope ratios are reported relative to N2 in air (Mariotti, 1983) and oxygen isotope ratios are reported relative to VSMOW reference water and normalized on a scale such that δ18OSLAP = -55.5‰ (Coplen, 1994; IAEA, 2017).

The results are also presented graphically on a plot which includes representative areas of the isotopic composition (δ18O and δ15N) of various nitrate sources (Kendall et al., 2007; Hastings et al., 2013).

As always, if you have any questions or would like to discuss the results, don't hesitate to contact us.

Thank you for prepaying the analyses. As always, if you have any questions or would like to discuss the results, don't hesitate to contact us.

Sincerely,

Chris Patrick
Vice President of Laboratory Operations

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ISO/IEC 17025:2017-Accredited Testing Laboratory

November 23, 2022

Mr. Craig Duxbury
Wood, PLC
550 NorthLake Blvd.
Altamonte Springs, FL 32701
United States

Dear Mr. Duxbury,

Please find enclosed the nitrate isotope (δ18O and δ15N) analysis results for 3 water samples.

Samples were analyzed by the chemical reduction of nitrate to nitrous oxide followed by continuous flow (CF) Isotope Ratio Mass Spectrometry (IRMS) (Casciotti et al., 2002; Foreman et al., 2016; and Altabet et al., 2019).

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Fax: 305-663-0964
info@betalabservices.com

Analysis Details

Submitter: Mr. Craig Duxbury
Material submitted: Groundwater well
Date received: 10/12/2022
Date reported: 11/23/2022
Isotopic analysis: $\delta^{18}O$ and $\delta^{15}N$
Method: Chemical reduction of nitrate to nitrous oxide followed by continuous flow Isotope Ratio Mass Spectrometry (IRMS) (Foreman et al., 2016, and Altabet et al., 2019)
Instrument: Thermo Scientific Denitrification Kit installed on a Gas Bench II connected to a Thermo Scientific Delta V IRMS

Lab Identification	Submitter ID	Material	Nitrate (mg-N/L)	$\delta^{18}O$ (‰) (to VSMOW)	$\delta^{15}N$ (‰) (to Air-N_2)
Beta-642227	LBSM2 (10/11/22)	Water	0.73	-10.2	4.94
Beta-642228	LBSM3 (10/11/22)	Water	0.22	7.99	6.72
Beta-642229	LBSM1 (10/11/22)	Water	3.04	-21.8	5.18

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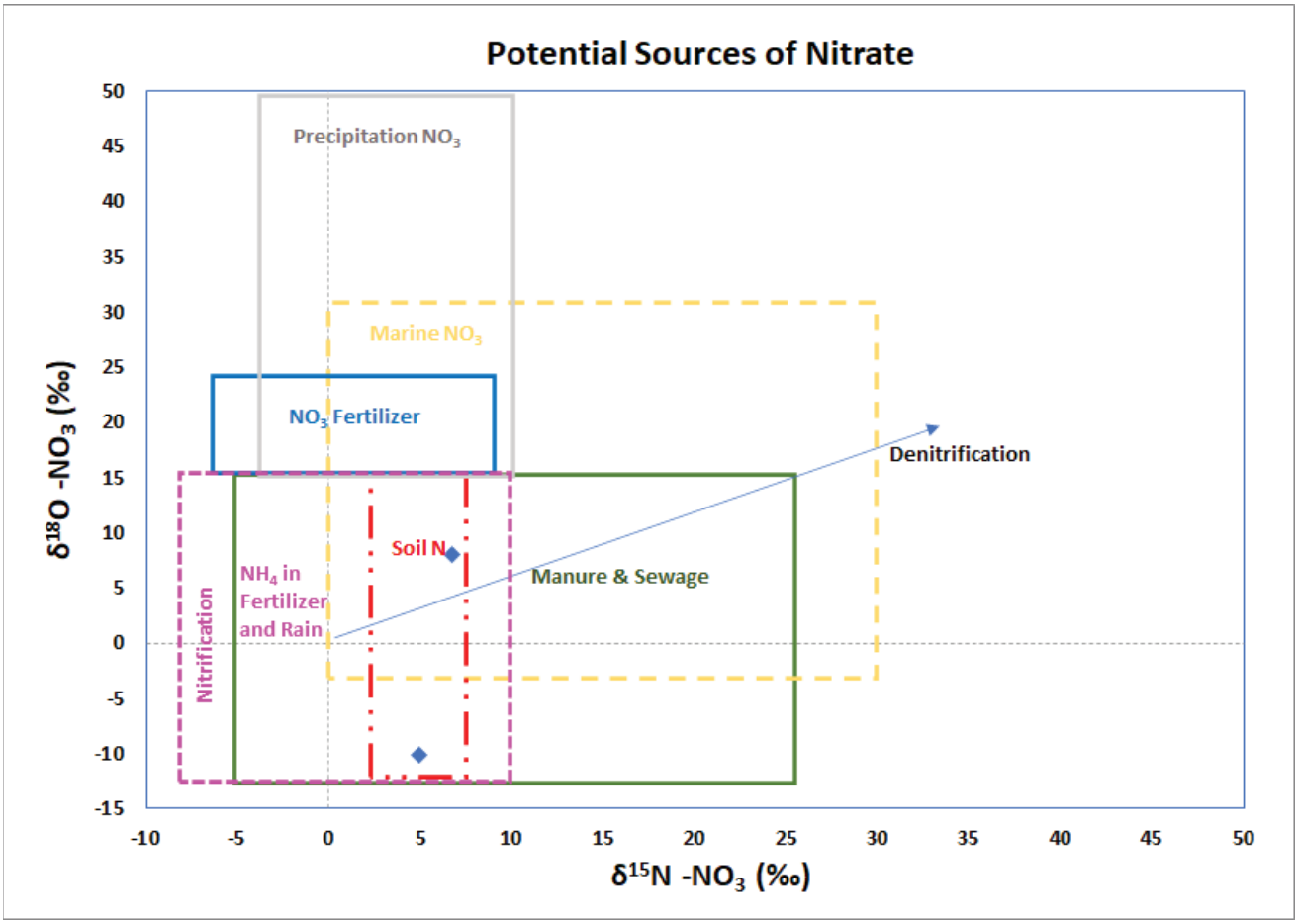
Results (cont.)



Plot of $\delta^{18}O$-NO_3 vs. $\delta^{15}N$-NO_3 results for the tested samples. The data are presented on a plot with representative areas of the isotopic composition ($\delta^{18}O$ and $\delta^{15}N$) of various nitrate sources (Kendall et al, 2007; Hastings et al., 2013).

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Quality Control Reference Standard-$\delta^{18}O$ for Nitrate Isotope Analysis

Reference Standard	Measured $\delta^{18}O$ (‰) (to VSMOW-SLAP)	Expected $\delta^{18}O$ (‰) (to VSMOW-SLAP)
USGS 34	-27.3 ± 0.3	-27.9
USGS 35	57.7 ± 0.9	57.5
Lab Mix	-17.9 ± 0.1	-17.2

Quality Control Reference Standard-$\delta^{15}N$ for Nitrate Isotope Analysis

Reference Standard	Measured $\delta^{15}N$ (‰) (to Air-N_2)	Expected $\delta^{15}N$ (‰) (to Air-N_2)
USGS 34	-1.7 ± 0.01	-1.80
USGS 35	2.6 ± 0.4	2.70
Lab Mix	34.6 ± 0.1	34.6

USGS standards are primary Reference Materials (RMs) prepared and distributed by the Reston Stable Isotope Lab (RSIL) (Coplen, 2018). Lab Mix is a secondary in-house standard traceable to the USGS RMs.

Beta Analytic, Inc.
4985 SW 74th Court
Miami, FL 33155 USA
Tel: 305-667-5167
Fax: 305-663-0964
info@betalabservices.com

References

Casciotti, K. L., Sigman, D. M., Hastings, M. G., Böhlke, J. K., & Hilkert, A. (2002). Measurement of the oxygen isotopic composition of nitrate in seawater and freshwater using the denitrifier method. Anal. Chem, 74(19), 4905-4912.

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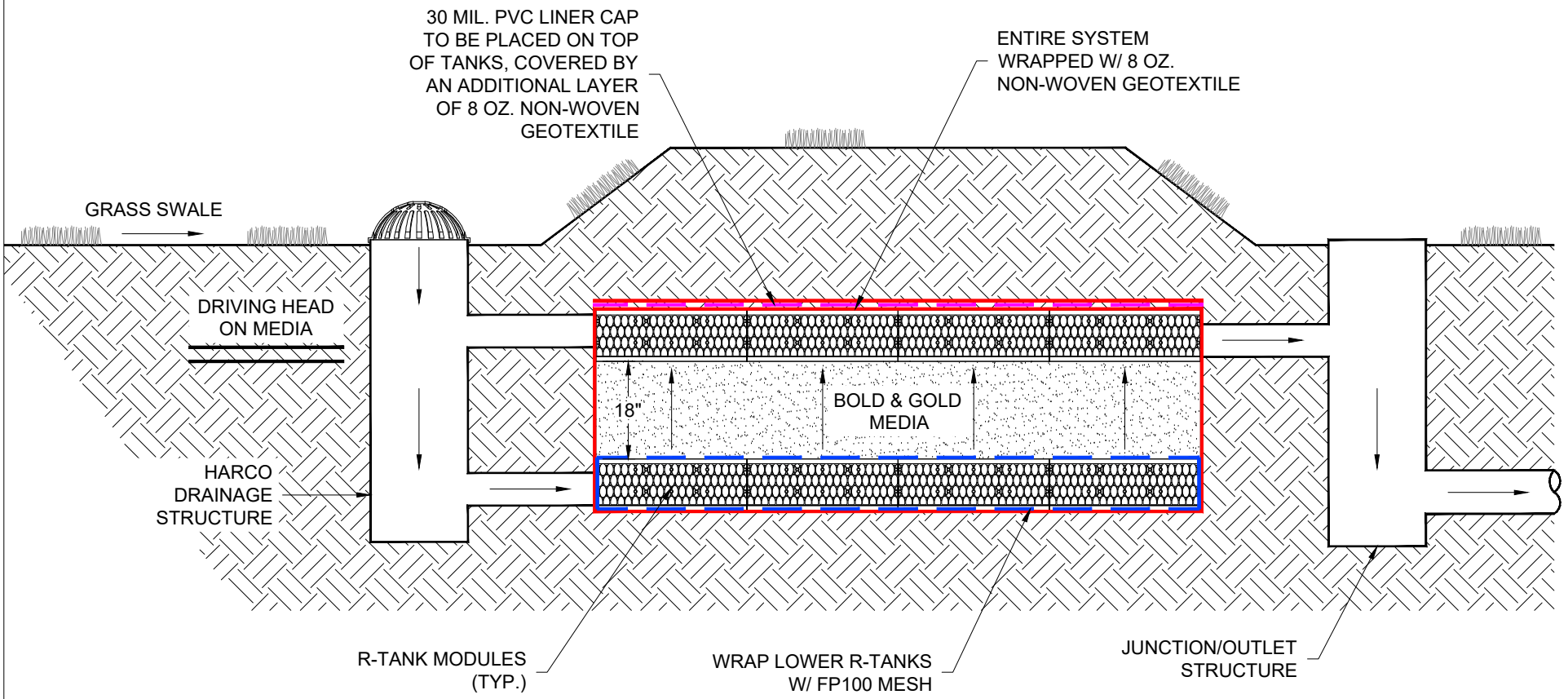
Mariotti, A. (1983). Atmospheric nitrogen is a reliable standard for natural ^{15}N abundance measurements. Nature, v. 303, p. 685-687.

APPENDIX L

Downflow BAM Filter System Examples



06/06/18

UP-FLOW BOLD & GOLD FILTER W/ GRASS SWALE

FOR ADDITIONAL INFORMATION PLEASE CONTACT: ACF ENVIRONMENTAL, 1-800-448-3636, www.acfenvironmental.com

SUMMIT

HIGH-PERFORMANCE UPFLOW FILTER

STORMWATER MANAGEMENT

SUMMIT
High-Performance Up-Flow Filter
Powered by Bold & Gold

NUTRIENT MANAGEMENT SYSTEM

ACCEPTED BY FLORIDA WATER MANAGEMENT DISTRICTS

The Summit High-Performance Upflow filter System (Summit HPUF) includes a mix of products to remove nitrogen, phosphorus, bacteria and more from stormwater, wastewater and agriculture applications. The system is powered by Bold & Gold® biosorption activated media which is composed of natural materials (clay and sand) and recycled products (tires).

Often, higher water-quality goals and pollutant removal rates are required in areas where standard solutions won't suffice. This system offers a space-efficient option to meet these difficult goals.

COMMON APPLICATIONS INCLUDE:

Wetponds: The system is useful as a polishing filter in wetponds and can reduce the wetpond size while increasing treatment effectiveness.

Ultra-Urban Developments: This system integrates well with detention, permeable pavement, biofiltration, bioswales, etc.

Non-Infiltrating Areas: The Summit HPUF filter offers filtration and discharge assistance in non-infiltrating areas.

Accepted by Florida Water Management Districts as a filtration BMP.

- Can be used in BMAPS (Basin Management Action Plans)
- Useful in Net Improvement Projects

Integrated in BMP Trains 2020

ADVANTAGES

- Upflow design reduces clogging and maintenance
- Targets TN, TP, TSS and bacteria
- No leaching of pollutants as it permanently bonds with dissolved nutrients
- Media is non-toxic and non-organic (won't degrade)
- Designed with longevity and sustainability in mind
- Space efficient footprint

3.19

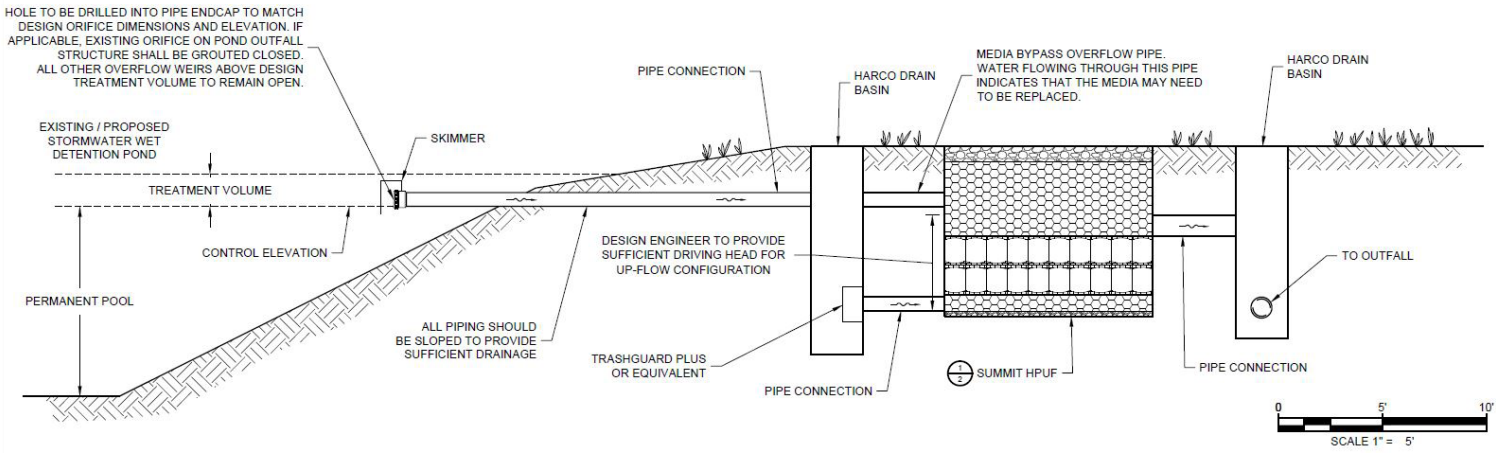
For more information about Stormwater Management, contact Inside Sales at 800.448.3636
email at info@acfenv.com

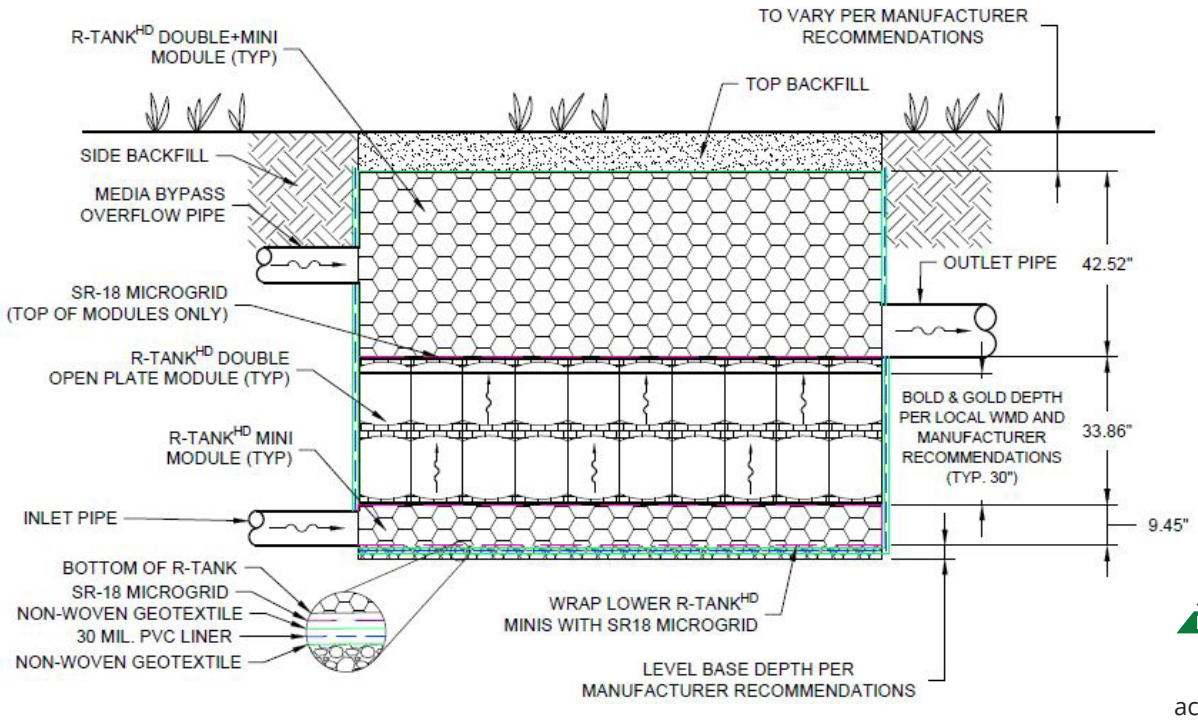
ACF ENVIRONMENTAL

SUMMIT HPUF STANDARD SIZES:

Larger sizes are available and can be customized to site specific conditions.

PROPERTY	TREATMENT MEDIA (SF)	TREATMENT FLOW (CFS)	TREATMENT VOLUME OVER 24 HOURS (FT^3)
S-HPUF 3-5	12.0	0.027	2,309
S-HPUF 3-7	18.5	0.041	3,354
S-HPUF 3-9	24.6	0.055	4,734
S-HPUF 4-5	28.0	0.062	5,388
S-HPUF 5-9	49.0	0.191	9,429
S-HPUF 7-9	61.6	0.137	11,854
S-HPUF 7-12	77.0	0.171	14,817
S-HPUF 8-12	92.4	0.206	17,780





ENVIRONMENTAL
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800.448.3636
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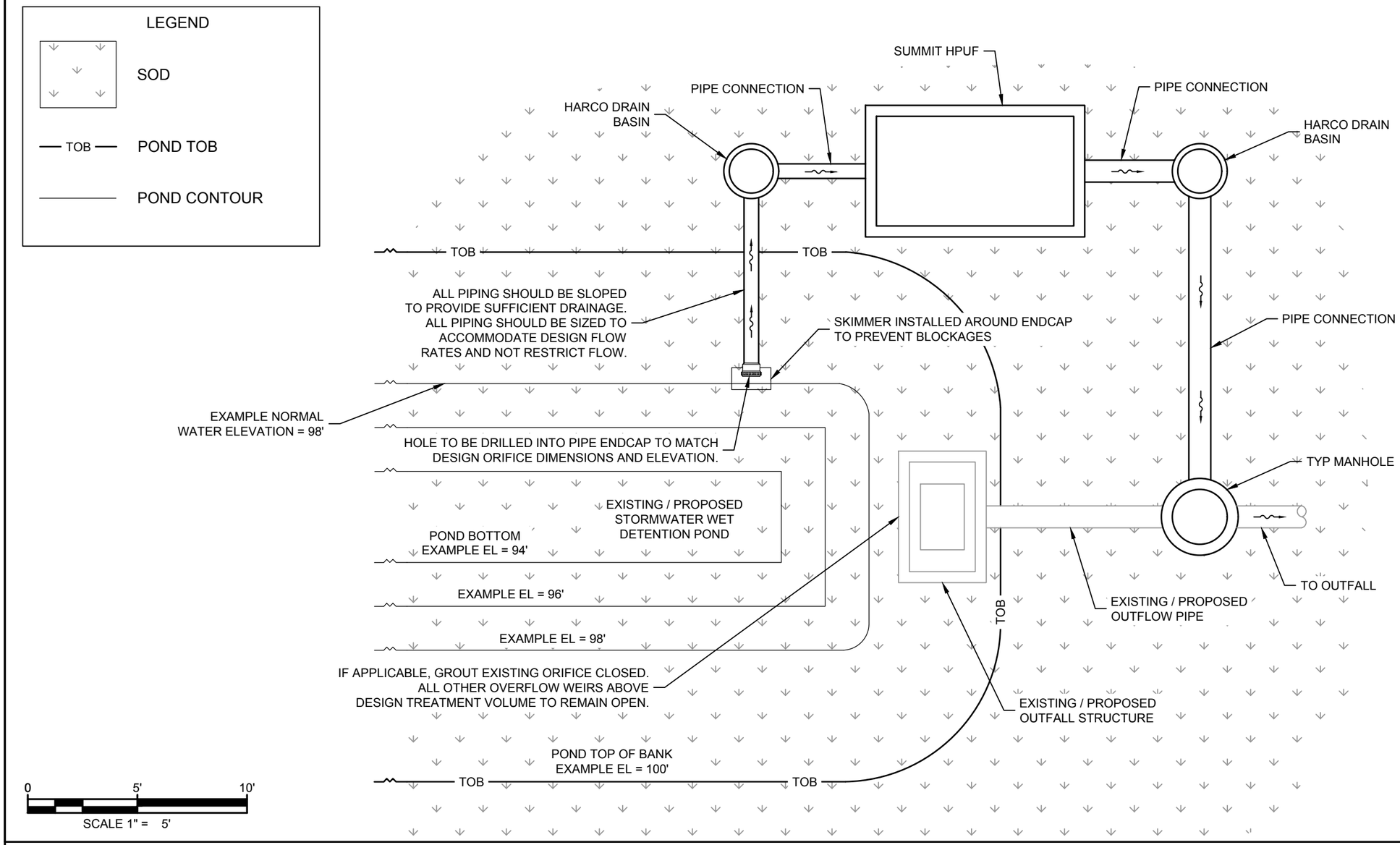


GENERAL NOTES

1. THE SUMMIT HIGH PERFORMANCE UPFLOW FILTER (HPUF), HARCO DRAIN BASINS, AND INTAKE PIPE ENDCAP SHOULD BE INSPECTED ON A ROUTINE BASIS TO ENSURE THAT THEY ARE FUNCTIONING ACCORDING TO MANUFACTURER RECOMMENDATIONS.
2. INSPECTIONS SHOULD BE PERFORMED ON A SEMI-ANNUAL BASIS AND FOLLOWING MAJOR STORMS PER SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT (SWFWMD) OPERATION AND MAINTENANCE GUIDELINES.
3. RECORDS SHOULD BE KEPT ON ALL MAINTENANCE OPERATIONS TO HELP PLAN FUTURE WORK AND IDENTIFY FACILITIES REQUIRING ATTENTION.
4. PER SWFWMD OPERATION AND MAINTENANCE GUIDELINES, NORMAL MAINTENANCE REQUIREMENTS ARE AS FOLLOWS:
   - 4.1. THE INTAKE PIPE ENDCAP SHOULD BE INSPECTED TO CHECK THAT THE ORIFICE IS NOT CLOGGED AND IS FLOWING AT A SUBSTANTIAL RATE.
   - 4.2. THE DISCHARGE PIPE(S) SHOULD BE VISUALLY INSPECTED TO DETERMINE IF THE PIPE(S) REQUIRE CLEANING. ALL DEBRIS FOUND IN THE PIPE SHOULD BE REMOVED.
   - 4.3. BERMS AND OTHER STRUCTURES SHOULD BE INSPECTED FOR BREAKS. REPAIRS, IF NECESSARY, SHOULD BE PERFORMED IMMEDIATELY.
5. FAILURE TO EFFECTIVELY MAINTAIN THESE SYSTEMS WILL RESULT IN INSUFFICIENT DRAWDOWN OF DETAINED STORMWATER RUNOFF AFTER RAINFALL EVENTS.
6. THE UPSTREAM HARCO DRAIN BASIN SHOULD BE INSPECTED PER MANUFACTURER RECOMMENDATIONS TO SEE IF WATER IS BYPASSING THE MEDIA FILTER. WATER FLOWING THROUGH THE MEDIA BYPASS OVERFLOW PIPE COULD INDICATE THAT THE FILTER MEDIA HAS ACCUMULATED EXCESS DEBRIS AND SILT.
7. DEBRIS SHOULD BE REMOVED FROM HARCO DRAIN BASINS AND ASSOCIATED PIPING IN ACCORDANCE WITH MANUFACTURER RECOMMENDATIONS.
8. PER SWFWMD OPERATION AND MAINTENANCE GUIDELINES, EFFLUENT FILTERS SHOULD DISCHARGE THE DESIGN TREATMENT VOLUME WITHIN A 36-HOUR PERIOD. OBSERVATIONS SHOULD BE MADE PERIODICALLY TO VERIFY THAT THE FILTER IS PASSING THE RUNOFF WITHIN THE DESIGN TIME FRAME.
9. PER SWFWMD OPERATION AND MAINTENANCE GUIDELINES, RUNOFF REMAINING IN THE DESIGN TREATMENT VOLUME LONGER THAN 72 HOURS FOLLOWING A STORM EVENT IS INDICATIVE OF A CLOGGED OR SILT LADEN FILTER, SHOULD THIS OCCUR, THE MEDIA MAY NEED TO BE REPLACED. THE OWNER SHOULD RETAIN A QUALIFIED CONTRACTOR AND SHOULD CONSULT WITH THE ENGINEER PRIOR TO REPLACING FILTER MEDIA.
10. REFERENCES TO A SPECIFIC WATER MANAGEMENT DISTRICT (WMD) IN THESE NOTES ARE INCLUDED FOR GUIDANCE AND INFORMATIONAL PURPOSES. THE ENGINEER SHALL ADHERE TO THEIR LOCAL WMD REQUIREMENTS AND REGULATIONS.

FILTER MEDIA

1. FILTER MEDIA SHALL BE BOLD & GOLD ECT3 MEDIA. BOLD & GOLD ECT3 MEDIA IS A BIOSORPTION ACTIVATED MEDIA (BAM) THAT PROVIDES STORMWATER TREATMENT IN CONJUNCTION WITH OTHER STRUCTURAL OR NON-STRUCTURAL STORMWATER BEST MANAGEMENT PRACTICES (BMPs).
2. PER SAINT JOHNS RIVER WATER MANAGEMENT DISTRICT (SJRWMD), AT LEAST 2 FEET OF SUITABLE FINE TEXTURED GRANULAR MEDIA SHALL BE USED FOR FILTRATION APPLICATIONS.
3. THE ENGINEER SHALL REFER TO MANUFACTURER SPECIFICATIONS FOR ADDITIONAL DETAILS AND DESIGN CRITERIA RELATED TO BOLD & GOLD ECT3 MEDIA.

R-TANK UNITS

1. R-TANK UNITS ARE INJECTION MOLDED PLASTIC TANK PLATES ASSEMBLED TO FORM A 95% VOID MODULAR STRUCTURE OF PREDESIGNED HEIGHT (CUSTOM FOR EACH PROJECT).
2. THE ENGINEER SHALL REFER TO MANUFACTURER SPECIFICATIONS FOR ADDITIONAL DETAILS AND DESIGN CRITERIA RELATED TO R-TANK UNITS.

SUMMIT High-Performance Up-Flow Filter
Powered by Bold & Gold

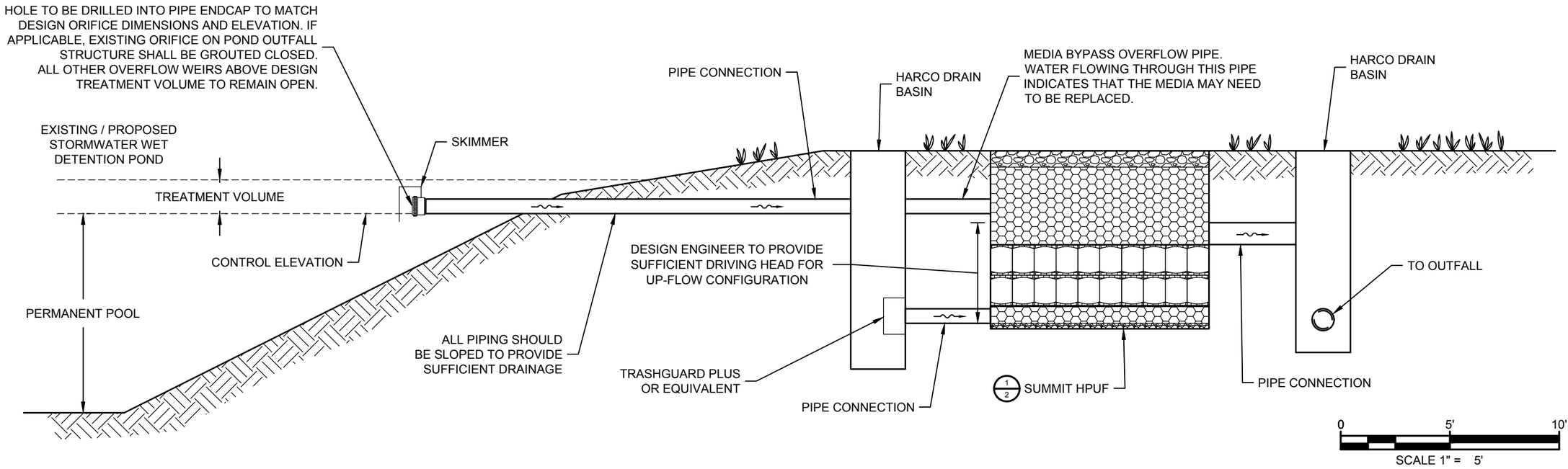
ENGINEER OF RECORD TO REVIEW, APPROVE AND ENDORSE FINAL SITE SPECIFIC DESIGN.

FOR ADDITIONAL INFORMATION PLEASE CONTACT:
ACF ENVIRONMENTAL 1-800-448-3636
www.acfenvironmental.com

ACF ENVIRONMENTAL
LET'S GET IT DONE

SUMMIT HPUF POWERED BY BOLD & GOLD MEDIA - PLAN DETAIL
PROJECT NAME
LOCATION, STATE
SITE DESIGNATION: ##
ACF ENVIRONMENTAL, 1-800-448-3636, www.acfenvironmental.com

DRAWN BY: NH
DATE: 03/13/2019
SHEET NO.: 1 of 2



GEOSYNTHETICS

1. A GEOTEXTILE ENVELOPE IS REQUIRED TO PREVENT BACKFILL MATERIAL FROM ENTERING THE R-TANK MODULES. PER MANUFACTURER RECOMMENDATIONS, THE STANDARD GEOTEXTILE SHALL BE AN 8 OZ PER SQUARE YARD NONWOVEN GEOTEXTILE (ACF N080 OR EQUIVALENT).
2. THE ENGINEER SHALL REFER TO MANUFACTURER SPECIFICATIONS FOR ADDITIONAL DETAILS AND DESIGN CRITERIA RELATED TO THE 30 MIL. PVC LINER.
3. PER MANUFACTURER RECOMMENDATIONS, FOR INSTALLATIONS SUBJECT TO TRAFFIC LOADS AND/OR WHEN REQUIRED BY PROJECT PLANS, INSTALL GEOGRID (ACF BX12 OR EQUIVALENT) TO REINFORCE BACKFILL ABOVE THE R-TANK SYSTEM.
4. THE ENGINEER SHALL REFER TO MANUFACTURER SPECIFICATIONS FOR ADDITIONAL DETAILS AND DESIGN CRITERIA RELATED TO ALL GEOSYNTHETICS.

BACKFILL & COVER MATERIAL

1. PER MANUFACTURER RECOMMENDATIONS, STONE (ANGULAR AND SMALLER THAN 1.5" IN DIAMETER) OR SOIL (GW, GP, SW, OR SP AS CLASSIFIED BY THE UNIFIED SOIL CLASSIFICATION SYSTEM) SHALL BE USED BELOW THE R-TANK SYSTEM (MINIMUM DEPTH SPECIFIED BY MANUFACTURER).
2. PER MANUFACTURER RECOMMENDATIONS, SIDE AND TOP BACKFILL MATERIAL MUST BE FREE FROM LUMPS, DEBRIS, AND ANY SHARP OBJECTS THAT COULD CUT, PUNCTURE, OR OTHERWISE DAMAGE THE GEOTEXTILE. THE ENGINEER SHALL REFER TO R-TANK MANUFACTURER SPECIFICATIONS FOR TRAFFIC & NON-TRAFFIC / GREEN SPACE APPLICATIONS.
3. PER MANUFACTURER RECOMMENDATIONS, STRUCTURAL FILL SHALL CONSIST OF GRANULAR MATERIALS MEETING THE GRADATIONAL REQUIREMENTS OF SM, SP, SW, GM, GP, OR GW AS CLASSIFIED BY THE UNIFIED SOIL CLASSIFICATION SYSTEM.
4. THE ENGINEER SHALL REFER TO MANUFACTURER SPECIFICATIONS FOR RECOMMENDED DEPTHS AND COMPACTION OF BACKFILL & COVER MATERIAL.

HARCO DRAINAGE STRUCTURES

1. HARCO DRAIN BASINS ARE FABRICATED FROM PVC PIPE STOCK. HARCO EMPLOYS A THERMO-MOLDING PROCESS TO ENSURE A CONSISTENT WATERTIGHT SEAL THROUGHOUT THE DRAINAGE STRUCTURE AND ITS OUTLET STUBS.
2. THE ENGINEER SHALL REFER TO MANUFACTURER SPECIFICATIONS FOR ADDITIONAL DETAILS AND DESIGN CRITERIA RELATED TO HARCO DRAINAGE STRUCTURES.

DESIGN CONSIDERATIONS

1. THE ENGINEER SHALL PROVIDE SUFFICIENT DRIVING HEAD FOR UP-FLOW CONFIGURATION PER THE MEDIA MANUFACTURER AND ACF DESIGN SPECIFICATIONS AND RECOMMENDATIONS.
2. THE ENGINEER SHALL SIZE THE SUMMIT HPUF TO ACHIEVE A MINIMUM HYDRAULIC RESIDENCE TIME (HRT) PER THE MEDIA MANUFACTURERS RECOMMENDATIONS.
3. THE HRT CAN BE DIVIDED BY THE TOTAL POROSITY OF THE BOLD & GOLD ECT3 MEDIA TO CALCULATE AN EMPTY BED CONTACT TIME (EBCT).
4. THE MINIMUM MEDIA VOLUME CAN BE CALCULATED BY MULTIPLYING THE EBCT BY THE DESIGN FLOW RATE TO THE SUMMIT HPUF.
5. THE FOOTPRINT CAN BE CALCULATED BY DIVIDING THE MEDIA VOLUME BY THE DESIGN DEPTH OF THE BOLD & GOLD ECT3 MEDIA.
6. IT IS RECOMMENDED THAT THE ENGINEER APPLY A SAFETY FACTOR APPROPRIATE FOR THE SPECIFIC PROJECT APPLICATION DURING THE CALCULATIONS.

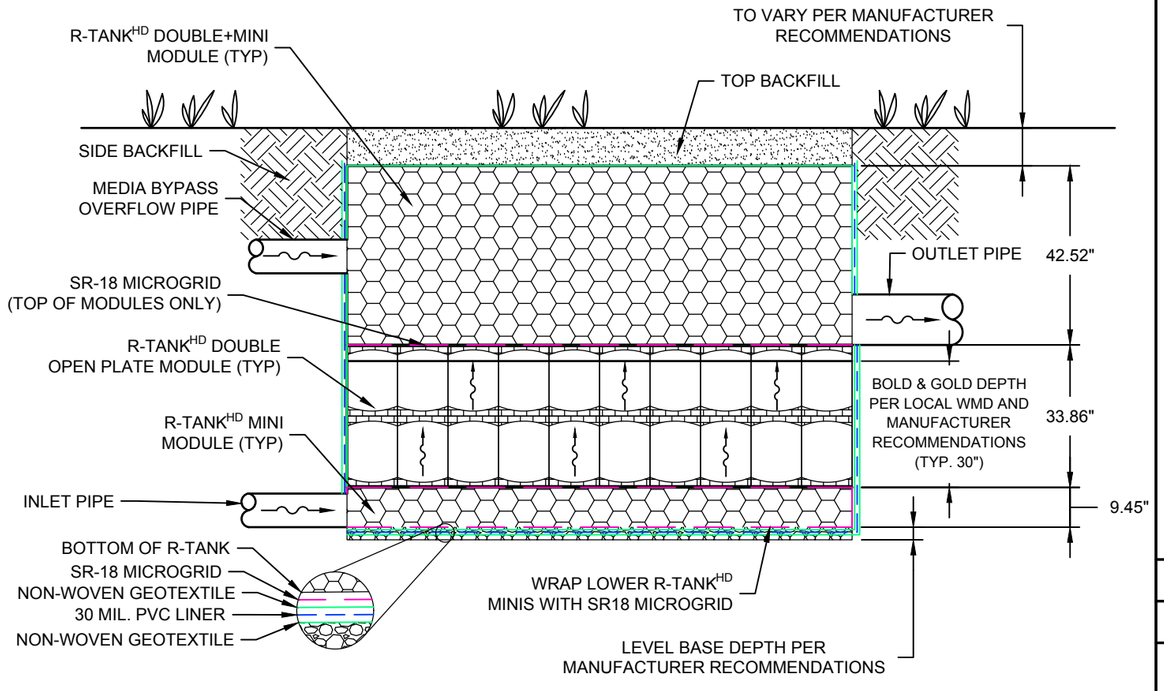
EBCT = HRT / *n*
Where *n* = Total media porosity

Min. Media Volume = EBCT x Q
Where Q = Design flow rate to the Summit HPUF

Media Footprint = Min. Media Volume / *y*
Where *y* = Design depth of filter media

Note: Design Engineer to apply a safety factor as appropriate.

1/2 DETAIL
SECTION VIEW OF SUMMIT HPUF
SCALE: N.T.S.
XREF:



SUMMIT High-Performance Up-Flow Filter
Powered by Bold & Gold

ENGINEER OF RECORD TO REVIEW, APPROVE AND ENDORSE FINAL SITE SPECIFIC DESIGN.

FOR ADDITIONAL INFORMATION PLEASE CONTACT:
ACF ENVIRONMENTAL 1-800-448-3636
www.acfenvironmental.com

ACF ENVIRONMENTAL
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SUMMIT HPUF POWERED BY BOLD & GOLD MEDIA - SECTION DETAIL
PROJECT NAME
LOCATION, STATE
SITE DESIGNATION: ##
ACF ENVIRONMENTAL, 1-800-448-3636, www.acfenvironmental.com

DRAWN BY
NH

DATE
03/13/2019

SHEET NO.
2 of 2

APPENDIX M

BAM Media
Fact Sheets

DESCRIPTION OF MEDIA		PROJECTED TREATMENT PERFORMANCE *			TYPICAL OPERATING LIMITING FILTRATION RATE (in/hr)
Media and Typical Location in BMP Treatment Train	MATERIAL	TSS REMOVAL EFFICIENCY	TN REMOVAL EFFICIENCY	TP REMOVAL** EFFICIENCY	
B&G ECT (ref A) Follows a BMP Stand alone first BMP	Tire Chips[1] Expanded Clay[2]	60% 70%	25% 45%	25% 45%	96 in/hr
IFGEM (ref B) down flow or upflow filters pervious pave, tree well, rain garden, swale, VFS, side filter	Iron[8] Tire Crumb[5] Clay[6] and Sand[7]	95%	80%	95%	5 in/hr
B&G ECT3 (ref C) After Wet Detention using Up-flow Filter Stand alone first BMP	Expanded Clay[4] Tire Chip[1]	60% 70%	25% 45%	25% 45%	96 in/hr
SAT (ref D) A first BMP, as a Down-flow Filter (FILTRATION)	Sand[3]	85%	30%	45%	2 in/hr
B&G CTS (ref E,F) Bottom of dry basin 12" depth*** use rate = 1 in/hr pervious pave, tree well, rain garden, swale, VFS, side filter	Clay[6] Tire Crumb[5] Sand[7] & Topsoil[9]	90%	60%	90%	5 in/hr
B&G CTS (ref E,F) Bottom of dry basin 24" depth*** use rate = 1 in/hr pervious pave, tree well, rain garden, swale, VFS, side filter	Clay[6] Tire Crumb[5] Sand[7] & Topsoil[9]	95%	75%	95%	5 in/hr

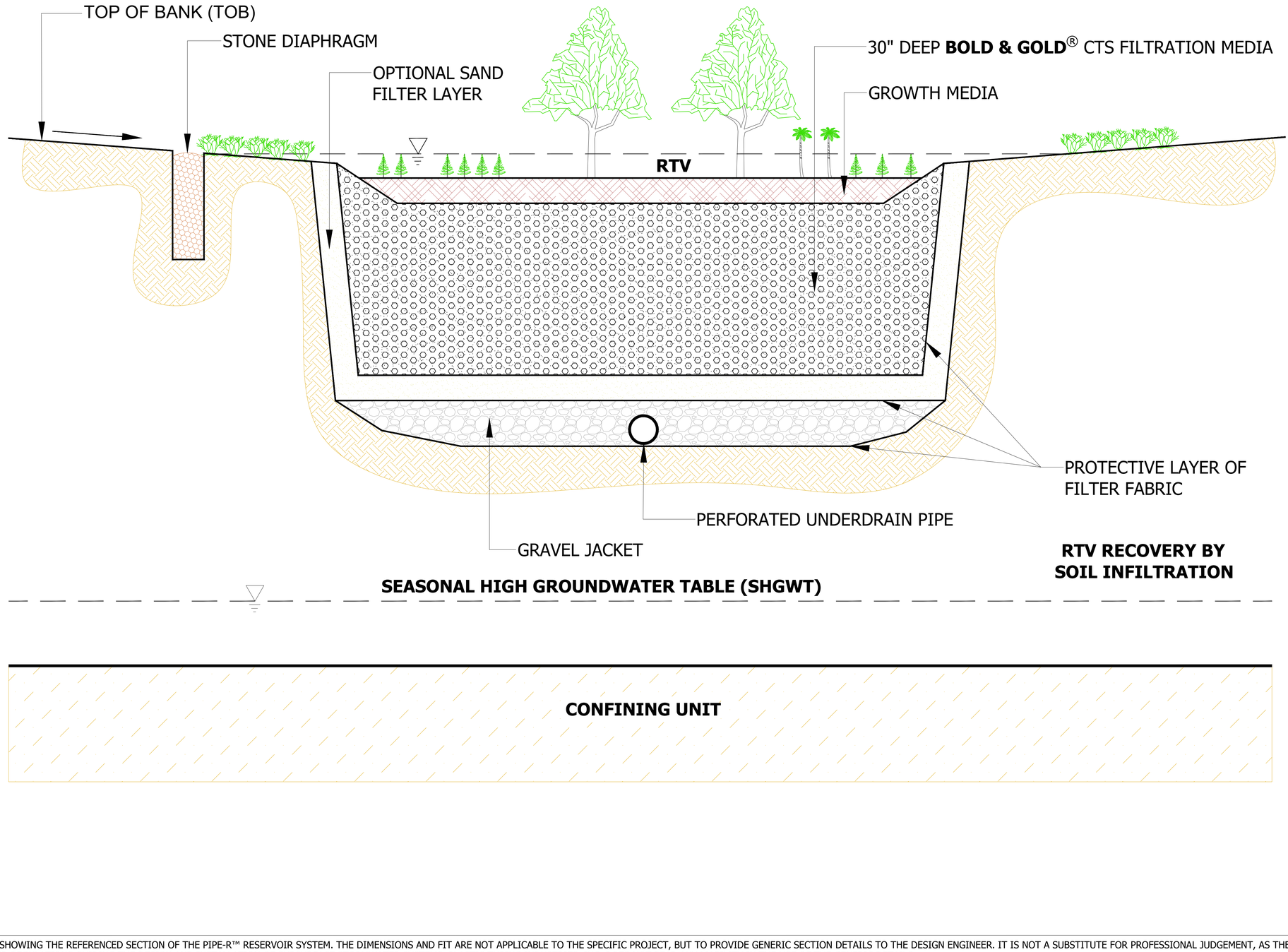
NOTES ⁋No generally accepted BMP at this time. Also can be used as a donwstream BMP but the removal must be lowered.
*All Effectiveness Estimates to nearest 5%: **Phosphorus removal has limited life expectancy: ***24" depth has TN and TP removals of 75 & 95%
acronyms B&G - BOLD & GOLD; SAT - Sand Austin Tx; ECT- Expanded Clay and Tire; ECT3 Expanded Clay and Tire in Treatment Train

[1] Tire Chip 3/8" and no measurable metal content (approximate dry density = 730 lbs/CY)
[2] Expanded Clay 5/8 and 3/8 blend (approximate dry density = 950 lbs/CY)
[3] Sand ASTM C-33 with no more than 3% passing # 200 sieve (approximate dry density = 2200 lbs/CY)
[4] Expanded Clay 3/8 in blend (approximate density = 950 lbs/CY)
[5] Tire Crumb 1-5 mm and no measurable metal content (approximate density = 730 lbs/CY)
[6] Medium Plasticity typically light colored Clay (approximate density = 2500 lbs/CY)
[7] Sand with less than 5% passing #200 sieve (approximate density = 2200 lbs/CY)
[8] Iron Filings 110-140 pounds/cubic foot, 4-6% by volume
[9] Local top soil is used over CTS media in dry basins, gardens, swales and strips, is free of roots & debris but is not used in other BMPs.

A - Demonstration Bio Media for Ultra-urban Stormwater Treatment, Wanielista, et.al. FDOT Project BDK78 977-19, 2014
B - Optimal Recipe Assessmenet of Iron-Filing Based..., Valencia, et.al., Environmental Engineering Science, 36, 10, 2019
C - Up-Flow Filtration for Wet Detention Ponds, Wanielista and Flint, Florida Stormwater Association, June 12, 2014.
D - City of Austin Environmental Criteria Manual, Section 1.6.5, Texas, 2012
E - Nitrogen Transport and Transformation in Retention Basins, Marion Co, Fl, Wanielista, et al, State DEP, 2011
F - Improving Nitrogen Efficiencies in Dry Ponds, Williams and Wanielista, Florida Stormwater Association, June 18 2015

APPENDIX N

Examples of Biofiltration Systems



THIS IS A GENERIC CADD DETAIL SHOWING THE REFERENCED SECTION OF THE PIPE-R™ RESERVOIR SYSTEM. THE DIMENSIONS AND FIT ARE NOT APPLICABLE TO THE SPECIFIC PROJECT, BUT TO PROVIDE GENERIC SECTION DETAILS TO THE DESIGN ENGINEER. IT IS NOT A SUBSTITUTE FOR PROFESSIONAL JUDGEMENT, AS THE DESIGN ENGINEER IS RESPONSIBLE TO COMPLY FULLY WITH APPLICABLE LAWS AND REGULATIONS GUIDING THE DESIGN AND INSTALLATION OF SUBSURFACE STORMWATER SYSTEMS. PLASTIC TUBING INDUSTRIES, INC. DOES NOT BEAR ANY LIABILITY IN THE USE OF THE GENERIC DETAILS.

TITLE:
Section Details for Bioretention Basin Using 30-inch Deep B&G® Filter Media

DATE: **09/10/2019**
DRAWN: **IGA**
PROJECT #: **ECS/~/yy####**
CHECKED: **IGA**

REV	DRW	CHK	DESCRIPTIONS

PROJECT NAME:
XYZ

PROJECT LOCATION:
Street Address
City, State, Zip Code

BOLD & GOLD®
Bold & Gold® Filtration Media
(Biosorption Activated Media - BAM)

Environmental Conservation Solutions, LLC.
2346 Vulcan Road,
Apopka, FL 32703

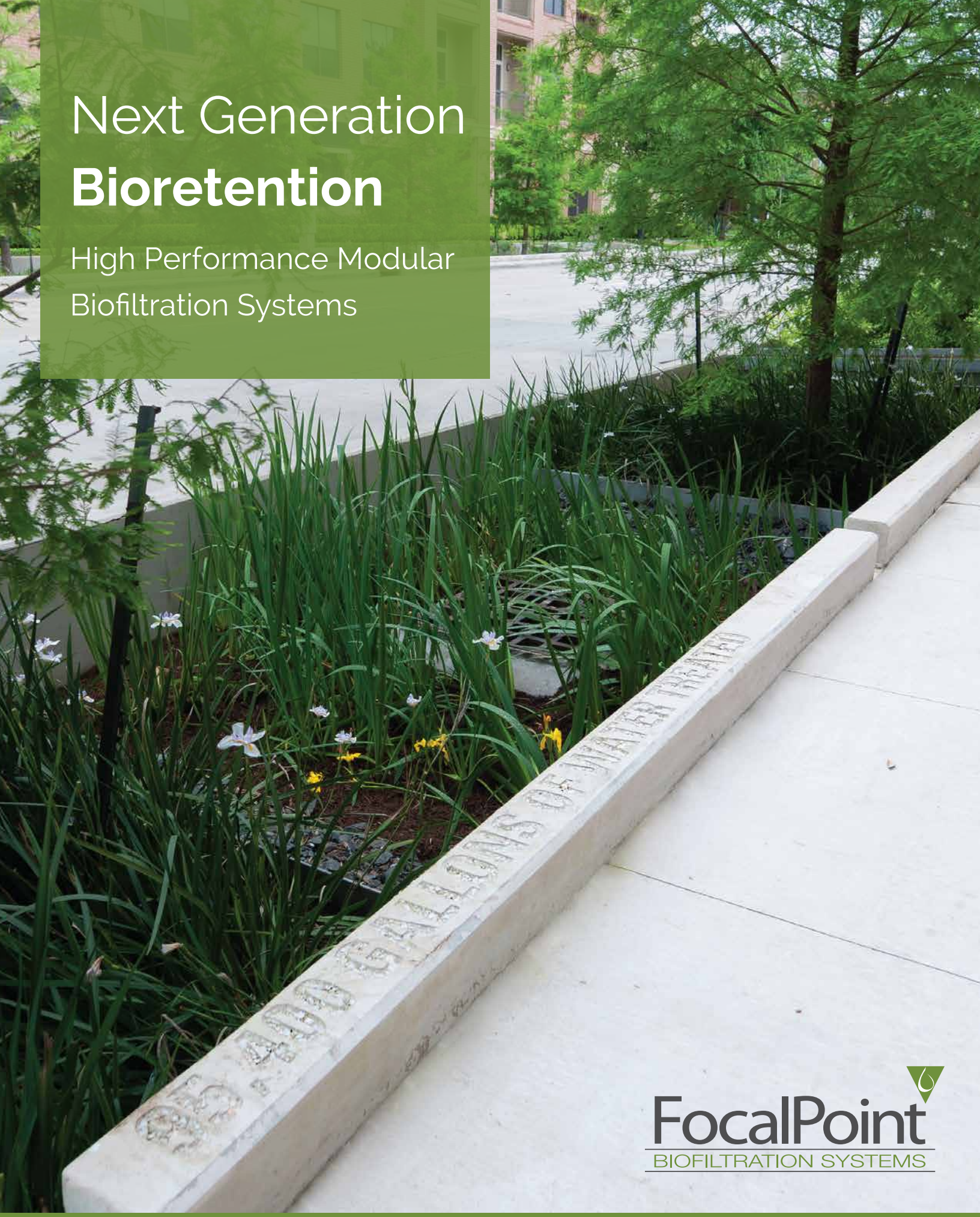
Scale: NTS

SHEET **00**

B&G_Bioretention Cell.dwg
9/10/2019
lkiengogo

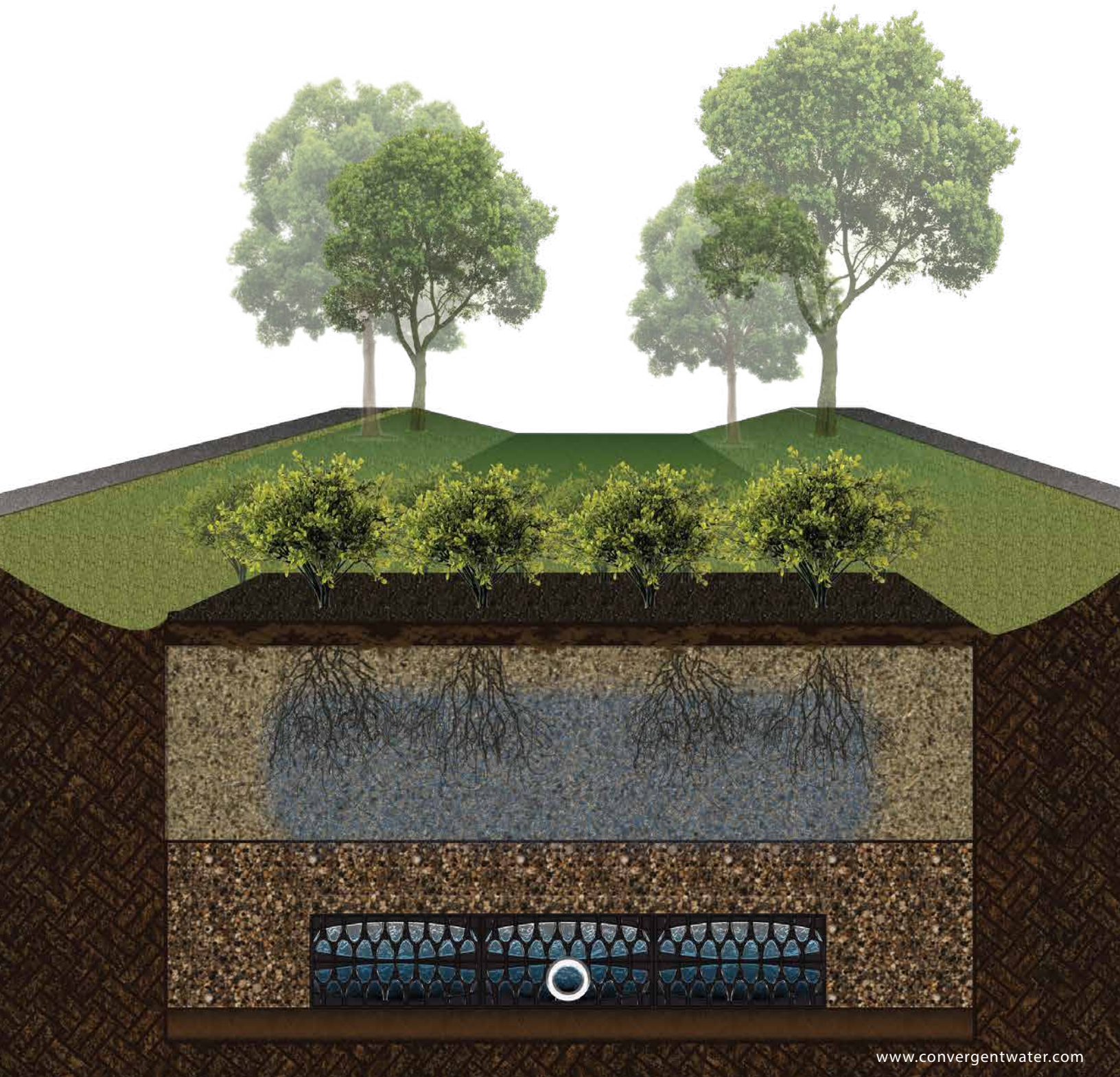
Next Generation **Bioretention**

High Performance Modular Biofiltration Systems

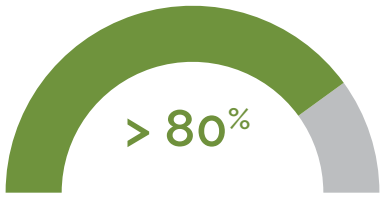


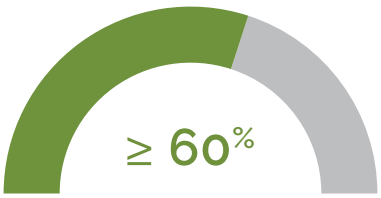
FocalPoint
BIOFILTRATION SYSTEMS

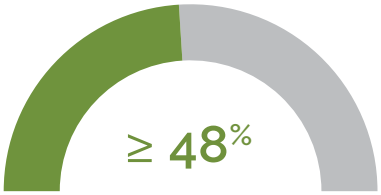
FocalPoint High Performance Modular Biofiltration Systems (HPMBS) is a scalable biofiltration system which combines the efficiency of high flow rate engineered soils with the durability and modularity of a highly pervious expandable underdrain/storage/infiltration system. The modular FocalPoint HPMBS is a complete, integrated system with a demanding specification that insures functionality, performance and maintainability. With rigorous quality assurance standards and post-construction in-situ performance verification, FocalPoint HPMBS provides guaranteed performance.



Pollutant Removal Efficiency







Uniquely Specified, Site Built

System Components

High Flow Media

At the heart of every FocalPoint HPMBS is its high performance engineered soil blend. Developed by LID pioneer, Larry Coffman, advanced high flow rate biofiltration media utilizes physical, chemical and biological mechanisms of the soil, plant and microbe complex, to remove pollutants found in stormwater runoff. Infiltration rates at 100" per hour or more, overcome many of the challenges inherent in traditional slow flow rate media and creates design flexibilities that drive lower costs and greater application opportunities.

Separation Layer

A wide aperture mesh layer is utilized to prevent bridging stone from entering the underdrain system. A separation layer which utilizes the concept of 'bridging' to separate the biofiltration media from the underdrain without the use of geotextile fabrics.

Open Cell Underdrain

A modular, high infiltration rate underdrain/storage system which is designed to directly infiltrate or exfiltrate water through it's surface. The modular underdrain overcomes the limited collection capacity of traditional stone and pipe underdrains. A 95% open surface area accepts water significantly faster and can be extended to accommodate any volume needs.

Mulch

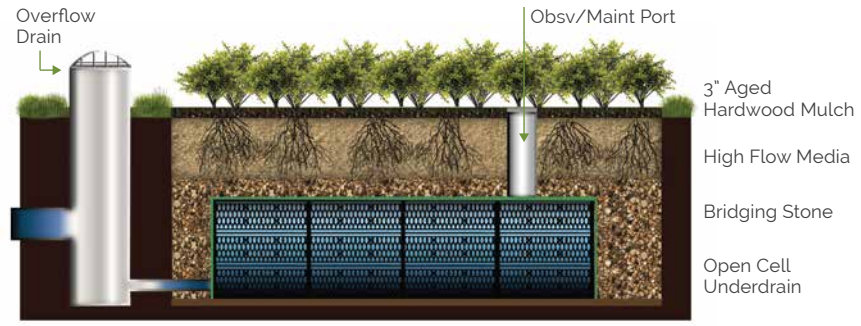
Shredded, hardwood mulch acts as a pre-treatment mechanism, capturing silt, sediment and certain other pollutants, and preventing trash from entering the system. Removal and replacement of mulch is typically necessary at 6-12 month intervals and is the most significant maintenance activity required with the FocalPoint HPMBS.

Plants

Native plants are preferred, but a broad palette of plants which thrive in FocalPoint HPMBS systems exist. They are typically characterized by rhizomatous root systems and tolerate both drought and inundation.

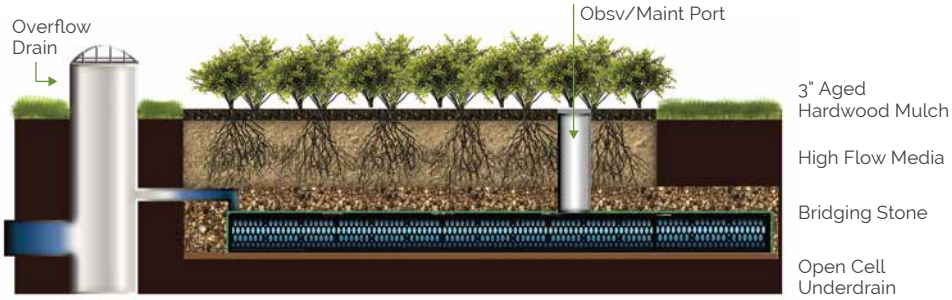
Modular Design — Scalability — Flexibility — Factors of Safety

The FocalPoint's modular underdrain, unlike a traditional perforated pipe, not only supports the flow rate of the media, but can be expanded beyond the footprint of the media bed to provide unlimited underground detention, infiltration and/or storage for water reuse/infiltration.



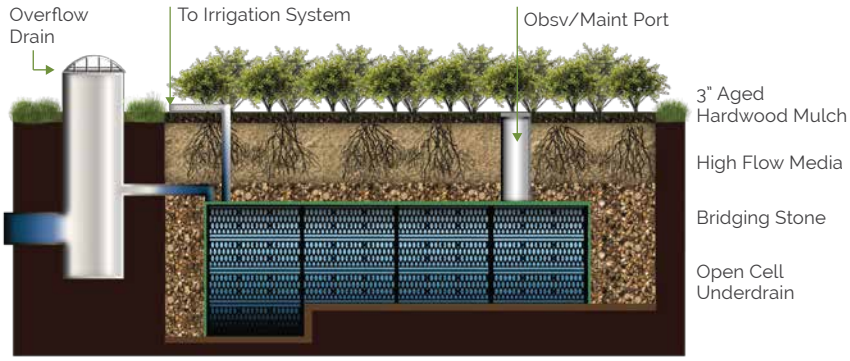
Expanded Detention

FocalPoint HPMBS gives designers maximum flexibility in meeting both water quality and volume requirements



Expanded Infiltration

The system can be used in combination with traditional LID BMPs such as grassy swales and vegetated depressions. It enables implementation of green streets using urban sidewalk planters; which because of the small footprint can support designs with large trees. These systems are also used for downspout planters, replacing underground treatment systems and are an easy retrofit for failed traditional bioretention systems. FocalPoint provides unlimited application opportunities for new construction and redevelopment.



Rainwater Harvesting

'Cap & Seal' Protection

During Ongoing Construction Activity

Protecting the FocalPoint HPMBS during construction is of the utmost importance. The 'Cap & Seal' protection ensures a viable system regardless of the construction sequencing by sealing off the media bed until the contributing drainage area is stabilized. Solving this problem solves one of the most problematic issues in bioretention. Due to it's small scale, FocalPoint HPMBS can be capped and sealed, allowing installation to take place early in the project construction cycle when other site utilities are installed.

Convergent Water Technologies guarantees post-construction performance and we make sure your client gets it.

Performance Guaranteed

Post-Installation Verification

The first year's maintenance is included in all FocalPoint HPMBS installations to insure that the system is given the best opportunity to succeed, and low cost annual maintenance contracts are available.

The potential of failure for most LID/GI BMP's is highest within the first year and success and failure is often dependent on whether the system is being properly inspected and maintained. Convergent's commitment to system success doesn't stop when the installation is complete.

Maintenance In Mind

Simple & Cost Effective

This hydraulic conductivity test procedure measures the entire media profile under saturated conditions to produce a reliable and accurate result.

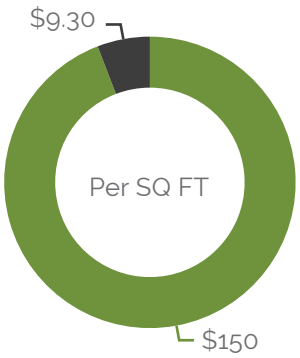
To ensure the highest level of effectiveness, Convergent specifies that the FocalPoint HPMBS be tested within 90 days of activiation and we recommend the system be tested annually thereafter to provide ongoing quality assurance.

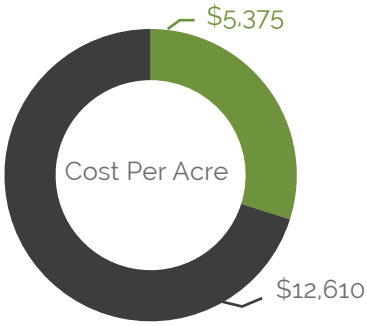
The Economic Case

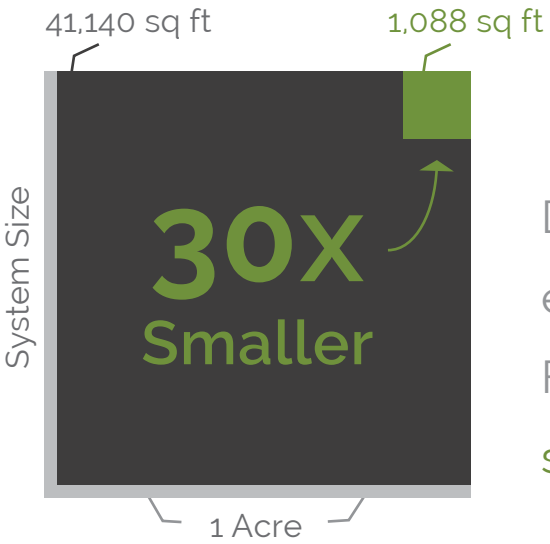
FocalPoint HPMBS vs Traditional Bioretention Soils

FocalPoint HPMBS
Traditional Bioretention

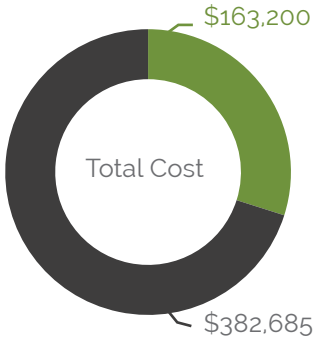
The typical economic case for the FocalPoint HPMBS is demonstrated on both the up front and life cycle cost of a recent project. Both the FocalPoint HPMBS and Traditional Bioretention system were budgeted by a contractor specializing in the installation of Low Impact Development Systems. Although the price per square foot of FocalPoint is many times higher than traditional bioretention, the efficiency of the FocalPoint High Performance Media makes the system more than 30 times smaller, per acre treated, resulting in a 50% cost savings per acre treated.

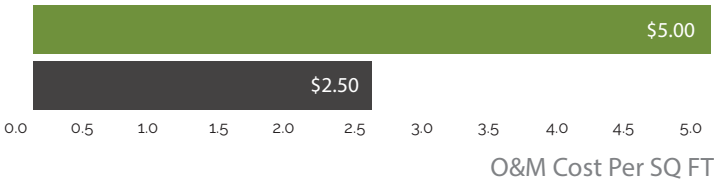


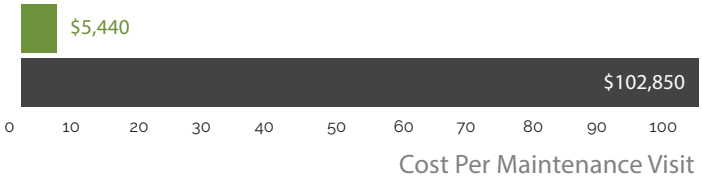




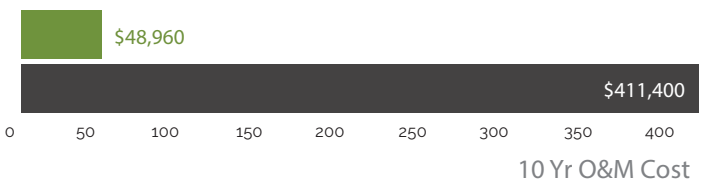
Due to the efficiency of the FocalPoint Media, scale is in its favor







Due to the size maintenance is a fraction of the cost.

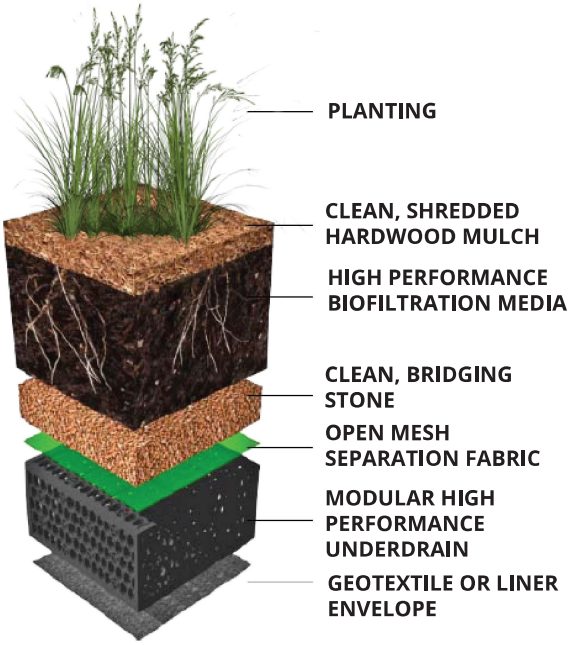


FOCALPOINT
BIOFILTRATION SYSTEM

STORMWATER MANAGEMENT

HIGH PERFORMANCE MODULAR BIOFILTRATION SYSTEM FOR FILTRATION OF STORMWATER

FocalPoint is an ultra-efficient, modular biofiltration system that treats and drains large volumes of stormwater runoff in a small footprint to meet post-construction stormwater treatment requirements. The biofiltration system utilizes the physical, chemical and biological mechanisms of a soil, plant and microbe complex to remove pollutants typically found in urban stormwater runoff. The system can be installed along the edge of a roadway behind curb lines, in landscaped stormwater basins and can be incorporated into an urban green infrastructure streetscapes. Infiltration flow rates for the system's standard media exceed 100" per hour. It is a complete, integrated system with a demanding specification that ensures functionality, performance and maintainability.



ADVANTAGES:

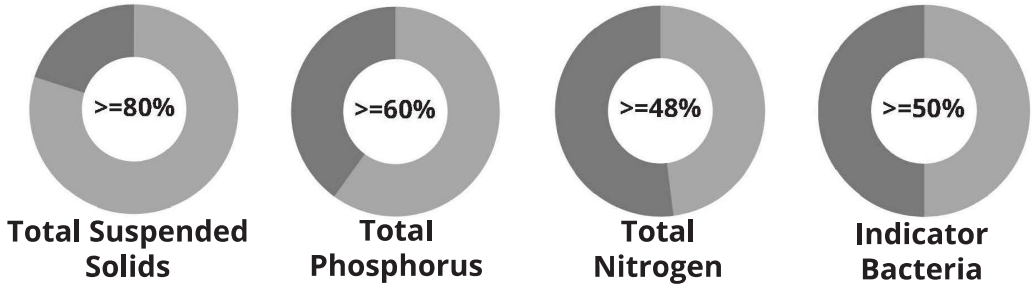
- Gain usable square footage
- Reduce material requirements and cost
- Improve property aesthetic and value
- 100"+ per hour infiltration rate
- Treat the same amount of water in <10% of the area required for traditional bioretention
- ACF provides 1st year of maintenance on system

For more information about Stormwater Management, contact Inside Sales at 800.448.3636
email at info@acfenv.com

ACF ENVIRONMENTAL

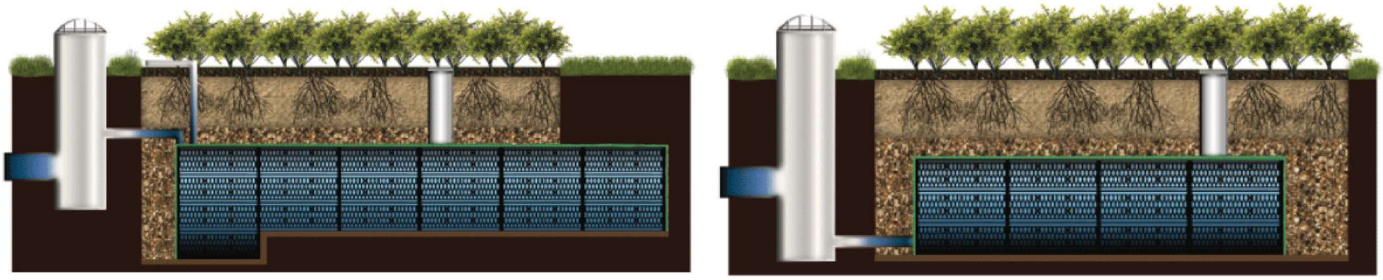
POLLUTANT REMOVAL

FocalPoint achieves pollutant removal rates consistent with traditional bioretention, and the option of increased removal characteristics for specific pollutant targets. The system is 3rd party field tested under TAPE (Technology Assessment Protocol – Ecology), independently field tested by the North Carolina State University, and has numerous agencies' approvals that meet state water quality standards for post construction BMPs.

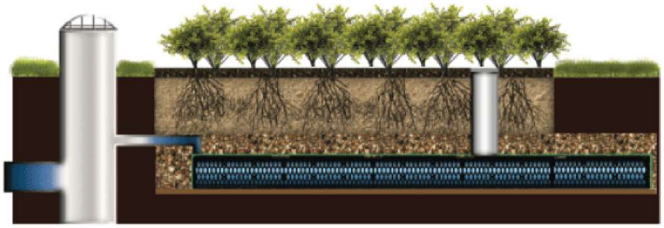


MODULAR UNDERDRAIN

FocalPoint's modular open cell underdrain system, unlike traditional underdrains, not only supports the flow rate of the media, but can be expanded beyond the footprint of the media bed to provide unlimited underground detention, infiltration and/or storage for water reuse. This can help meet channel protection, infiltration and flood control requirements.



R-Tank underdrain can be extended beyond FocalPoint footprint as shown above



ACF ENVIRONMENTAL
LET'S GET IT DONE

800.448.3636
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ACCESSORY PRODUCTS

Beehive Overflow Filter Riser
for collection of gross solids during major storm events

Rain Guardian Turret
for curbline pretreatment and energy dissipation

GreenRoads Silver Certified

Bagby Street, Houston, TX

Midtown Redevelopment

The design teams goal for Bagby Street was to provide large street trees within the right of way while also removing pollutants such as heavy metals, floatables, sediment and oil and grease from the roadway stormwater runoff before it outfalls to nearby Buffalo Bayou. With the FocalPoint HPMBS high flow-rate engineered media, the designers didn't need to fill the entire planter box with a bioretention media and underdrain system. This allowed placing the HPMBS away from the tree roots and allowed the design team to meet their objective of having both street trees and biofiltration. The result was an award winning project.

Multi-Family Development

Queenston Manor Apartment

At Queenston Manor Apartments, all of the drainage areas are also common areas and courtyards so it was imperative that the system drain within 24 hours of a rain event. The FocalPoint HPMBS was placed at the lowest elevation in the four landscaped swale systems on site to provide a reliable drainage, detention and water quality solution. The design team was able to decrease the surface storage volume requirements enough to reclaim the land needed to build two additional apartment buildings. For the developers, the 48 additional apartment units was the difference between success and a canceled project.

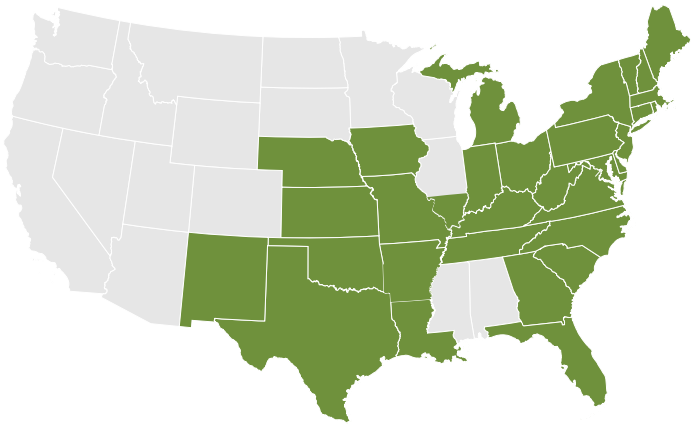
Parking Lot Retrofit

Sugarland Conference Center

A complete parking lot retrofit incorporates a combination of bioswales, FocalPoint HPMBS, and an expanded underdrain Rainwater Harvesting System. This Low Impact Development and Green Infrastructure retrofit has increased aesthetic appeal, increased time of concentration and decreased peak flows. The reuse system reduces annual potable water use by over 50% and the FocalPoint HPMBS removes more than 80% of the TSS from the discharge along with hydrocarbons, phosphorus, nitrogen and other pollutants before delivering it to the harvesting system.

VAR Connection

Changing Stormwater Systems Distribution



The Convergent Value-Added Reseller (VAR) network consists of regional organizations that focus on cost-effective answers to all manner of stormwater problems, utilizing innovative systems that deliver value that's greater than the sum of their parts.

Convergent provides its VARs with the latest technologies, guidance and innovations, and like Convergent, these VARs are firms whose value-added approach has required them to take a non-traditional path in the stormwater industry; it's a path that leads to the experience, diverse relationships and solutions orientation that is so rare and critically needed in the stormwater industry.

Convergent's VARs are locally rooted and deeply connected in the communities they serve. They know the local regulations and act as agents of beneficial change. On average, Convergent VAR firms have been in business for 21 years; old enough to know their markets well and experienced enough to recognize and respond quickly to the LID/Green Infrastructure paradigm that is remaking our industry.

Capitalizing on the power of collaborative effort VAR network firms are able to respond rapidly to changing regulations, access 'lessons learned' by network peers and respond to the opportunity to be a driving force for innovation in the stormwater marketplace.

The firms which make up this network serve in exclusive territories, and incorporate both sales and service elements (directly or indirectly) in their operations. Every VAR will provide installation, oversight, verification and maintenance for Convergent Systems. Like Low Impact Development itself, the Convergent VAR network is cumulatively powerful and can deliver more cost-effective solutions than traditional distribution.

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