2016 SALT LAKE COUNTY WATER QUALITY ANNUAL REPORT

Watershed Planning and Restoration Program

SALT LAKE COUNTY 2001 S. State St N3-120 Salt Lake City Ut, 84190

Contents

SALT LAKE COUNTY WATERSHED

1.0 JORDAN RIVER WATERSHED

1.1 Introduction

Salt Lake County Watershed Planning and Restoration (WPRP) completed this annual report as an effort to quantify and qualify the functionality of these sub-basins and, over time, track how these ecosystems respond to management practices and restoration efforts. WPRP personnel have been monitoring these sub-basins since data gaps were determined to exist in the 2009 Water Quality stewardship plan (WaQSP).

WPRP personnel collect data at 53 sites (see Assessment Reaches Section) throughout these sub-basins (see Watershed Description section) and use the same methodologies as used in the Integrated Watershed Plan (IWP) data collection efforts. These methods are summarized in the Methodologies section of the IWP. Results will be published in an annual report and discussion of results and conclusions will be provided by WPRP staff and represent the professional opinions of WPRP.

WPRP would like to thank the Salt Lake County Flood Control and Engineering division.

1.2 Watershed description

The lower Jordan River Watershed and its sub-basins drains 805.6 square miles (515,600 acres). The Watershed is bounded on the east by the Wasatch Mountains, on the west by the Oquirrh Mountains, and on the south by the Traverse Range. Approximately 370 square miles (46% of the land) in the Watershed are in rugged mountain ranges and are largely undeveloped. Approximately 134.3 square miles (16.7%) of the Wasatch Mountains are protected to ensure drinking water quality for Salt Lake City and Sandy City. As a result, water quality management concerns in Salt Lake County vary from urban runoff in populated areas to headwaters recharge area protection, wilderness management, and dispersed recreation concerns in National Forests. The following are general descriptions of the: topography and streams in the Watershed.

The lowest elevation in the Watershed is found at the Great Salt Lake, which typically has an elevation of approximately 4,200 feet, depending on climate conditions. The highest elevation in the Watershed is Twin Peaks (between Big and Little Cottonwood Canyons) at 11,330 feet. The Wasatch Range to the east of the Jordan River has the highest elevations in the Watershed reaching levels over 11,000 feet. The Oquirrh Mountains to the west of the Jordan River, reach elevations of over 9,000 feet. The land surface between these ranges consists of a series of benches and alluvial fans, each of which slope gradually away from the mountains and drop sharply to the next bench and valley floor. The Watershed is separated into two general segments that include the lower valley portion and the upper mountain portion. The valley portion is typically an urbanized area, while the mountain portion is less developed; although there has been considerable impact from mining and recreational activities.

All surface waters in the lower Jordan River watershed and its sub-basins are eventually conveyed to the Great Salt Lake either by directly entering the lake or through the Jordan River. The Jordan River initiates as an outlet from Utah Lake in Utah County and is conveyed north for 52 miles to the Great Salt Lake in Davis County. There are ten major streams from the Wasatch Mountains and seven streams from the Oquirrh Mountains. Although waters from these streams eventually discharge into the Jordan River or the Great Salt Lake, many are conveyed through urban areas by underground pipes or canal systems. Major streams range in size from less than three miles to 26 miles in length and have unique flow and water quality conditions. In addition to ecological, water quality, and social functions, these streams are identified as countywide facilities for flood control purposes and are often used to convey stormwater discharge to either the Jordan River or the Great Salt Lake.

1.3 Jordan River Watershed Climate

Seasonal extreme temperatures in the watershed range from -30° F in the winter to 110° F in the summer. Water surface evaporation in the valley averages 42 inches per year. The average frost-free season for the valley area is approximately 200 days and usually occurs between the middle of April and the end of October. As is the case with many western watersheds, annual precipitation totals vary dramatically. As a result of large differences in elevation, average annual precipitation ranges from 12 inches in the lower valleys to 50+ inches in the highest mountain areas. Snow accumulation and melt is a very significant feature in terms of the annual hydrologic cycle for this watershed.

1.4 Land use

Land use is an important factor contributing to existing and projected water quality conditions of surface waters. Analyzing existing and future land use data helps to identify where predicted changes in land use—that result in more impervious areas and less open spaces, factors that together result in more stormwater runoff—could threaten water quality the most. Increased imperviousness can impact water quality the following ways: (1) reduced groundwater recharge; (2) increased volume of stormwater discharges; (3) increased runoff into streams that could increase flood potential and erosion, thereby affecting the aquatic habitat; and (4) increased urban pollutants discharged to streams by stormwater runoff. With the expansion of urban development into previously undeveloped areas and increasing population densities, Salt Lake County expects the amount of impervious surface area throughout the county to increase.

2.0 SAMPLING AND METHODOLOGIES

The sample sites assessed for this study include areas throughout the watershed, above, below and throughout the Salt Lake County and its surrounding mountains. For QA/QC purposes, WPRP personnel reserve the right to use data collected at other sampling locations to use as comparators for this study. Data was taken at all our sampling locations (see Figure 1.3.1) Reaches were assigned codes based on their river mileage above the confluence with the Jordan River and preceded by a two letter stream code. Thus a site located 5.79 miles up from the confluence of Parley's Creek and the Jordan River would be names PC_05.79.

2.1 Sample Sites

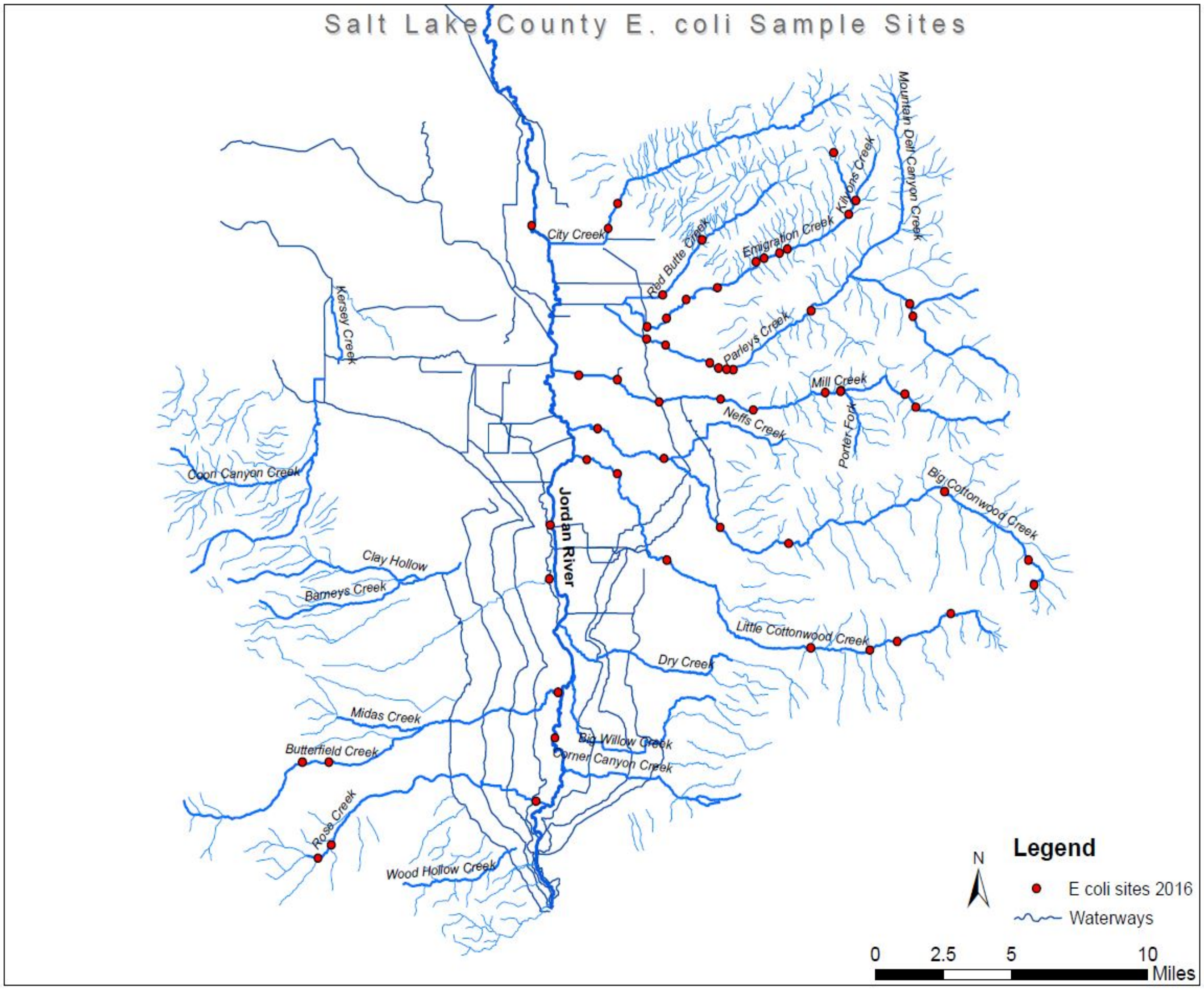


Figure 2-1 Jordan River Watershed E. coli / Chemistry Sample sites

Table 2-1 Bacteria and Chemistry Sample Sites

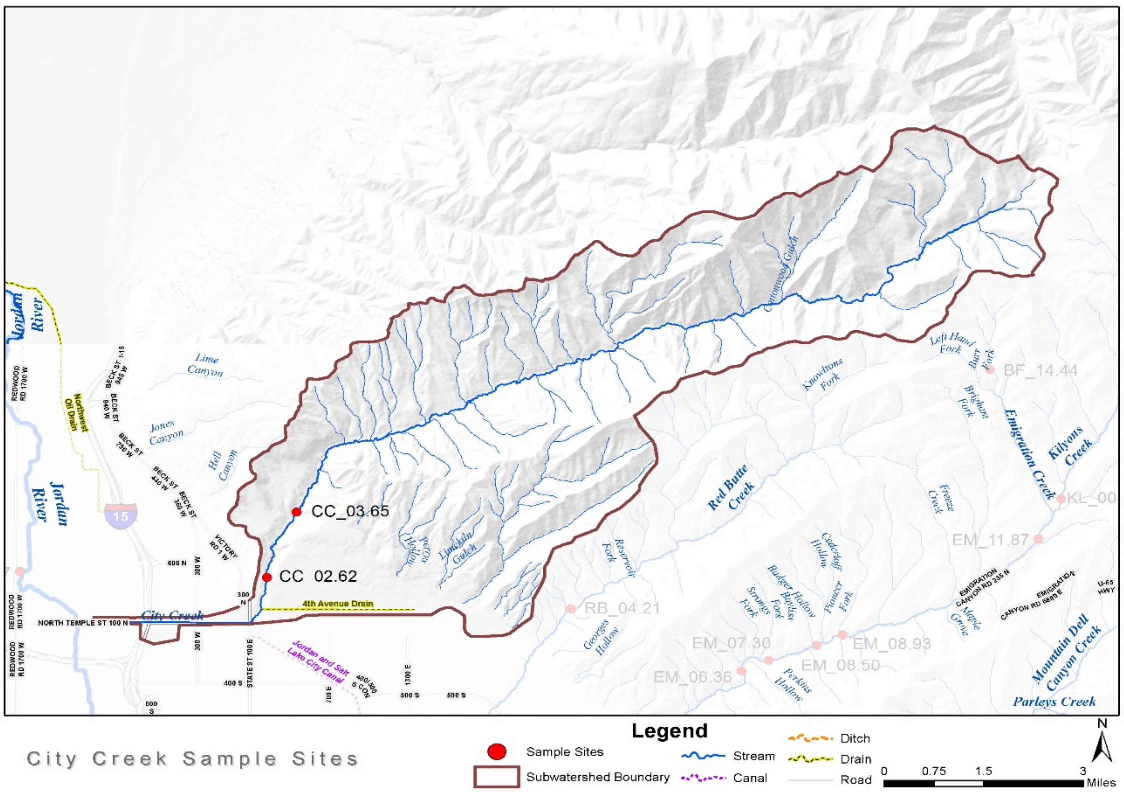
Location code	Location Description	Stream	Latitude	Longitude
BC_04.73	Creekside Park	Big Cottonwood Creek	40.66495604	-111.8448612
BC_08.83	Spencer's pond	Big Cottonwood Creek	40.6306907	-111.8053675
BC_11.99	Birches PA	Big Cottonwood Creek	40.6229936	-111.7574671
BC_19.23	Mill D/Doughnut Falls	Big Cottonwood Creek	40.64893779	-111.6487231
BC_25.97	Brighton Loop	Big Cottonwood Creek	40.60231123	-111.5852552
BG_00.22	Stream Gage	Bingham Creek	40.60492741	-111.9246599

Location code	Location Description	Stream	Latitude	Longitude
BF_14.44	Burr Fork Blue Gate	Burr Fork	40.81729004	-111.7269608
BU_04.23	Roadside at Parshall Flume	Butterfield Creek	40.51301783	-112.0775412
BU_05.29	Wild Horse Center	Butterfield Creek	40.51297	-112.09604
CC_02.62	Memory Grove	City Creek	40.77974842	-111.8844667
CC_03.65	Access Gate	City Creek	40.79158	-111.878068
EM_01.62	Westminster Campus	Emigration Creek	40.73031007	-111.8566644
EM_02.54	Wasatch Hollow	Emigration Creek	40.73473576	-111.8435727
EM_03.67	Below Bonneville Golf Course	Emigration Creek	40.744408788	-111.8298095
EM_05.17	Dog park below pond	Emigration Creek	40.74958048	-111.8101199
EM_07.30	Ruth's Parking Lot	Emigration Creek	40.76280329	-111.7810133
EM_07.79	Perkins Flat	Emigration Creek	40.76477643	-111.7751991
EM_08.50	Emigration BL	Emigration Creek	40.767507	-111.764722
EM_08.93	Emigration AB	Emigration Creek	40.769411	-111.75906
EM_11.87	Lower Pinecrest	Emigration Creek	40.78673587	-111.7163775
JR_08.77	JR at 500 N	Jordan River	40.78085471	-111.9383758
JR_23.20	JR at Winchester	Jordan River	40.631593	-111.924071
JR_32.35	JR at 12300 S	Jordan River	40.52553767	-111.9202653
KL_00.21	Middle Killyons	Killyon Creek	40.79396188	-111.7114627
LB_00.55	Lambs Restoration Site	Lambs Canyon Creek	40.73597132	-111.6711387
LC_01.98	Murray Park	Little Cottonwood Creek	40.65722817	-111.8775797
LC_06.58	Crestwood gage	Little Cottonwood Creek	40.61446127	-111.842906
LC_14.23	A Gate	Little Cottonwood Creek	40.57114542	-111.742131
LC_16.72	Tanners Flat	Little Cottonwood Creek	40.56992985	-111.7008265
LC_17.95	White Pine TRH	Little Cottonwood Creek	40.57485381	-111.6808643
LC_20.52	Alta Bypass road	Little Cottonwood Creek	40.58811572	-111.6445993
MC_02.56	Fitz Park	Mill Creek	40.70410148	-111.8778487
MC_04.56	Highland Dr	Mill Creek	40.69311188	-111.848659
MC_07.09	North of Skyline	Mill Creek	40.69452304	-111.8054642
MC_08.49	Millcreek Fee Station	Mill Creek	40.68930125	-111.7827329
MC_11.70	Above Scout Camp	Mill Creek	40.69808633	-111.7323141
MC_12.41	Burch Hollow TR	Mill Creek	40.69914024	-111.7214047
MC_15.49	Below Cabins	Mill Creek	40.69638726	-111.6746963
MC_16.17	Alexander Fork TR	Mill Creek	40.69083615	-111.6691379
MS_00.19	Stream Gage	Midas Creek	40.54851561	-111.9182316
PC_02.06	Hidden Hollow	Parleys Creek	40.72438157	-111.8568961
PC_02.88	Sugarhouse Park above pond	Parleys Creek	40.72121044	-111.8438886
PC_04.76	Dog park above grate	Parleys Creek	40.71257676	-111.8128417
PC_05.53	Dog park below pond	Parleys Creek	40.70952354	-111.8019574
PC_05.79	Suicide Rock	Parleys Creek	40.70934966	-111.7972174
PC_14.40	Upper Parleys above Lambs confluence	Parleys Creek	40.74240633	-111.6736982
PF_00.04	Porter fork just above bridge	Porter Fork	40.6988313	-111.7216908

Location code	Location Description	Stream	Latitude	Longitude
RB_01.65	Miller Park	Red Butte Creek	40.746203	-111.846363
RB_04.21	Red Butte below fence	Red Butte Creek	40.7741386	-111.818237
RC_00.41	Stream Gage	Rose Creek	40.494198	-111.933315
RC_10.58	Garbage Collection lot	Rose Creek	40.47178	-112.07568
RC_11.32	Yellow Fork Trailhead	Rose Creek	40.46523369	-112.0847253
SF_00.11	Smith Fork confluence	Smith Fork	40.73877014	-111.7423253

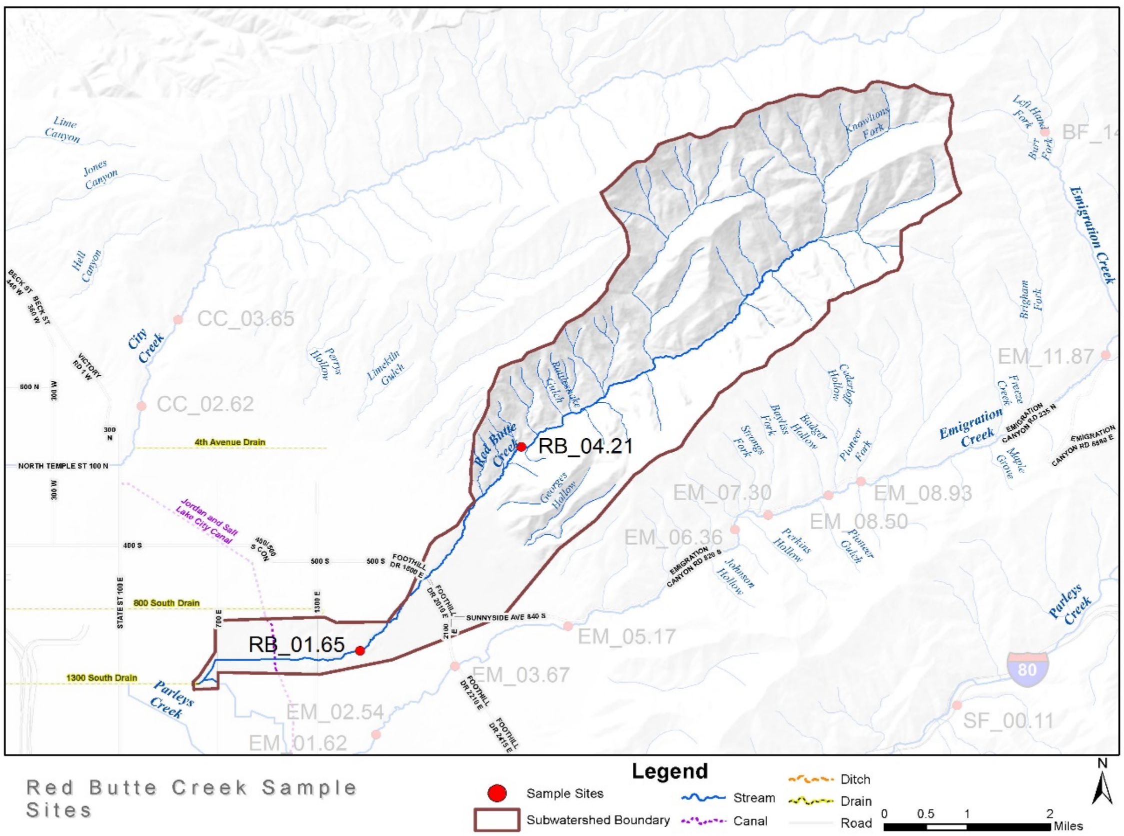
2.2 Sub-Watershed Description

Figure 2-2 City Creek subwatershed



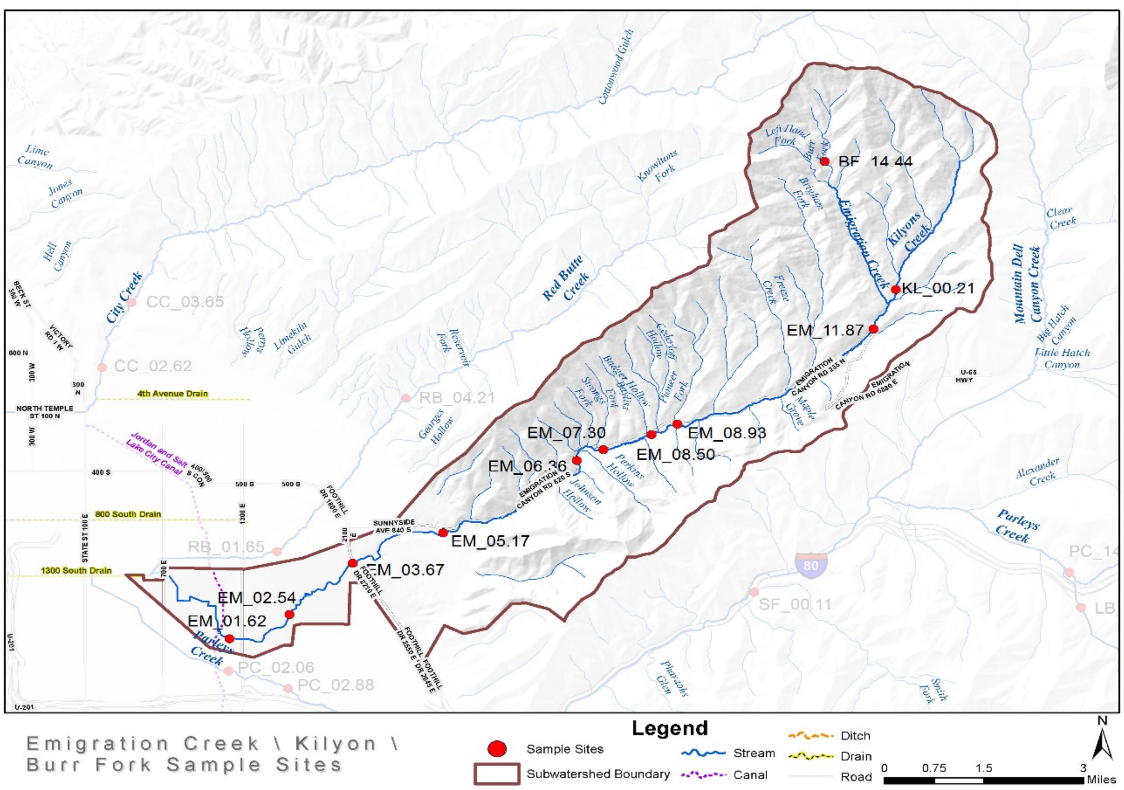
The City Creek Watershed is located in the northeast corner of Salt Lake County in the Wasatch Mountains. The upper portion of City Creek Canyon has changed little since when the first pioneers arrived in 1847. City Creek was Salt Lake City's first drinking water source, and remains a major source of potable water. The canyon is a protected watershed and is managed according to guidelines designed to protect and sustain water quality. Therefore no dwellings or overnight camping are allowed in City Creek Canyon. City Creek watershed is a highly used and coveted recreational area. In 1985, the Salt Lake City Council adopted the City Creek Canyon Master Plan, which led to its designation as a Nature Preserve and annexation of the entire Canyon into the City. In City Creek Canyon, people enjoy recreational activities such as picnicking, hiking, biking, and wildlife observation. Dogs are permitted below the City's water treatment plant in the City Creek Canyon Nature Preserve; however, they must be on leash due to the high level of multiple uses in the canyon and the protective management of the Nature Preserve. In addition to City Creek Canyon, the lower City Creek watershed includes several undeveloped gulches and an urbanized residential neighborhood on the lower mountain/valley interface. City Creek enters a pipe below Memory Grove Park that has open channel sections in the median between Canyon Road and Canyon Side Road, as well as through City Park. City Creek then enters the North Temple Conduit to the Jordan River.

Figure 2-3 Red Butte Creek subwatershed



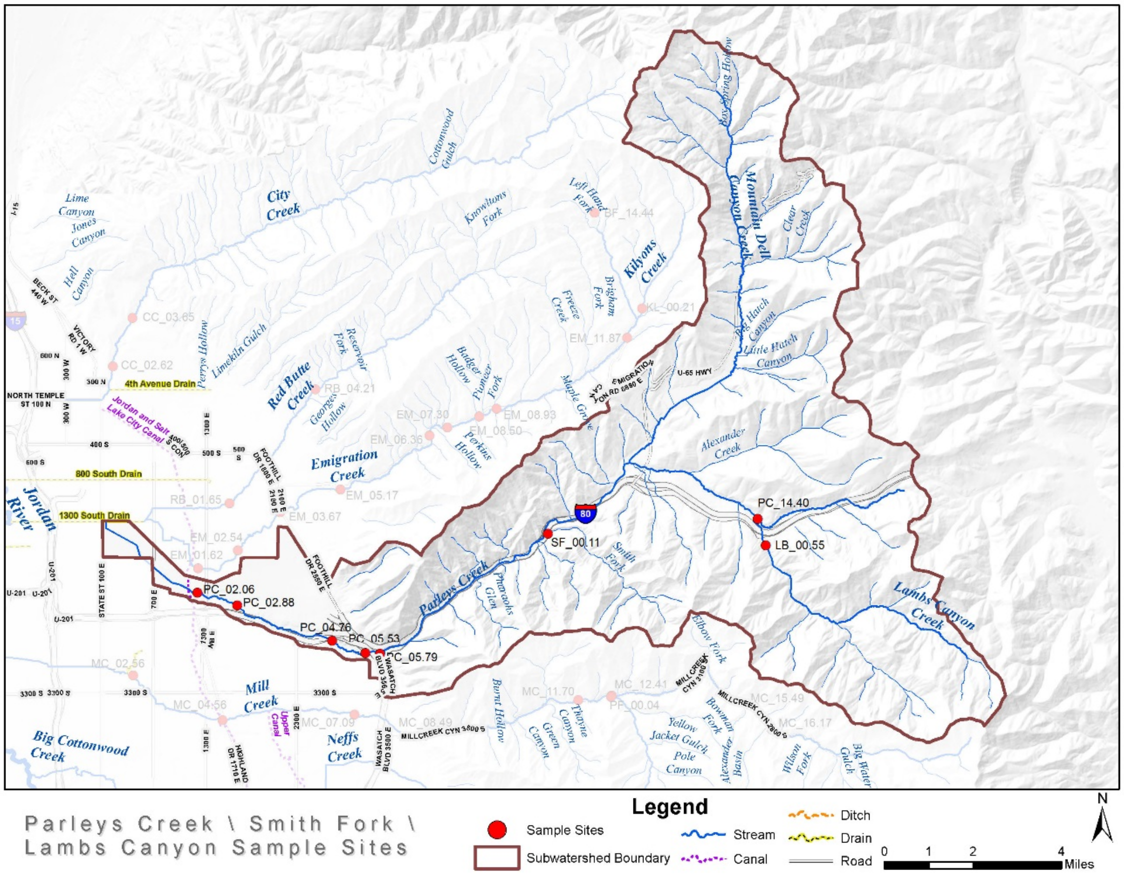
In 1862, the United States Army established Fort Douglas at the mouth of Red Butte Canyon and utilized water from the creek. The canyon was also a source of red sandstone for building construction, and some of the historic sandstone buildings can still be seen today in the canyon and at Fort Douglas. Red Butte Creek's upper watershed has remained mostly undeveloped over time. This 8.4 square mile area is comprised of moderately steep mountains slopes ranging from 5,000 to 8,200 feet in elevation. Since the creek was the primary water source for Fort Douglas, development and use was limited in the canyon to preserve water quality. The Red Butte Reservoir was built in1930 as a water supply for Fort Douglas. Fort Douglas eventually switched to the Salt Lake City municipal water supply in 1991. Ownership and management for the reservoir was transferred to the Central Utah Water Conservancy District in 2004, which has focused on providing a long-term refuge for the June Sucker, an endangered fish. In 1969, the United States Forest Service assumed responsibility for approximately 83 percent of Red Butte Canyon with the remainder owned by Salt Lake City, University of Utah, and private individuals. The Forest Service designated much of upper Red Butte Canyon (5,370 acres) as the Red Butte Research Natural Area (RNA) in 1971, which is managed for research, observation, and study with public access limited to these purposes. This designation for the upper section of Red Butte is a reason for the lack of sample sites in this area. In 1983, the University dedicated 150 acres at the mouth of the canyon as a regional botanical garden, the Red Butte Garden & Arboretum. From the canyon mouth down to the Jordan River, the lower watershed drains 2.6 square miles comprised of the mountain/valley interface area from the Wasatch Mountains. University of Utah Campus and Research Park and residential properties are the primary land uses. At approximately 1100 east, the stream known as Red Butte Creek ceases to exist. It flows into an underground closed channel system, daylights briefly in the Liberty Park Lake and then continues to the Jordan River via the1300 South Storm Drain. Due to the underground closed channel in the lower section of Red Butte Creek WPRP is unable to maintain any sample points in this area either.

Figure 2-4 Emigration Creek / Kilyon / Burr Fork subwatershed



In 1846, the Donner-Reed Party cleared a trail in Emigration Canyon on its way to California. This was the primary route used by Mormon Pioneers to enter the Salt Lake Valley in 1847. The canyon was also part of the Federal Sheep Driveway used to drive sheep through to the Rio Grande Railroad station in Salt Lake City. A railroad line ran up the canyon, built in 1907, and was used for quarrying and transportation purposes until its closure in 1917. Today, the canyon is designated as a National Historic Place. Emigration Creek is a perennial stream located in the northeast corner of Salt Lake County in the Wasatch Mountains. Headwaters commence in a small open valley at an elevation of approximately 6,000 feet. The creek receives tributary flow from Killyons and Burr Fork canyons along with several mountain springs. The upper watershed (from the canyon mouth upstream) drains 18.2 square miles with moderately steep mountain slopes ranging from 5,000 to 8,900 feet. Land use in the canyon includes primarily residential property, some National Forest land, Salt Lake County Open Space lands protected for high quality habitat (Killyon Canyon and Perkins Flat properties), and limited commercial properties. Unlike other Wasatch Front canyons in Salt Lake County, Emigration Canyon maintains a large residential population. The highway through the canyon carries considerable traffic and provides access to Parleys and East Canyons. The upper end of the canyon above Burr Fork is protected for drinking water by Salt Lake City's Department of Public Utilities. Residential development is primarily serviced by private wells and septic systems and the canyon contains a groundwater recharge zone. The Utah Division of Wildlife Resources lists the creek as a good trout fishery, with native species including Bonneville cutthroat trout and introduced rainbow trout, although it is common for the creek to run dry between Camp Kostopulous and the Emigration Drain in Rotary Glen Park during certain times of the year. Streamside vegetation includes box elder, cottonwood, maple, scrub oak, dogwood, alder, river birch, willow, grasses, mustard, clover and serviceberry. The lower watershed is primarily of residential and commercial development. Consistent with other highly urbanized areas, much of the native vegetation has been displaced due to encroachment into the floodplain and riparian zone, although in some areas box elder, gamble oak, willows, and June grass can be seen. Just west of the Westminster College campus (at approximately 1100 East) the stream flows underground into a closed channel, daylights briefly in Liberty Park Pond and then continues down to the Jordan River via the1300 South storm drain.

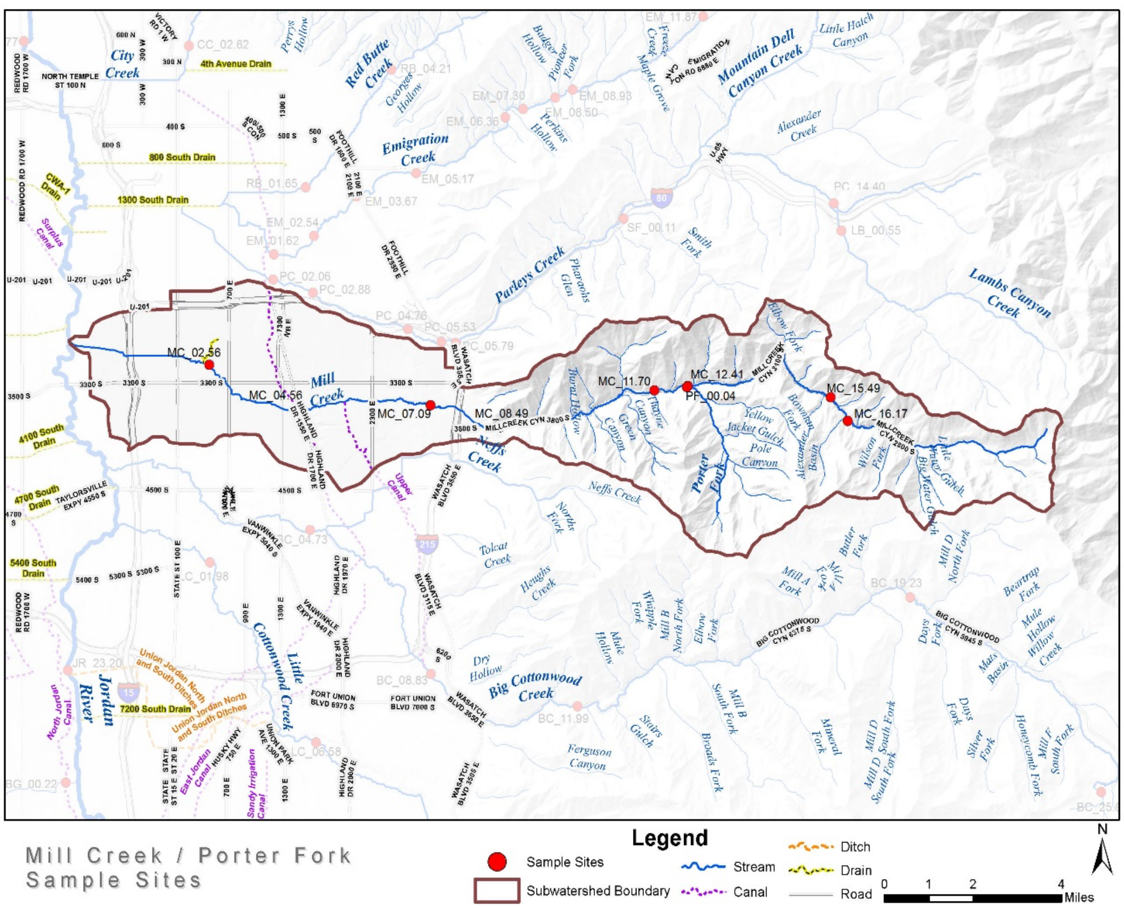
Figure 2-5 Parleys Creek / Lambs canyon / Smith Fork subwatershed



The Parleys Creek watershed is located in the northeast corner of the Wasatch Mountains and is the largest mountain drainage area near Salt Lake City. The watershed contains a total of 58.4 square miles. Initially named Big Canyon Creek by Brigham Young, the creek was renamed after Parley P. Pratt who explored the canyon for the purpose of building a toll road. Today, the canyon continues to be a major route into the Salt Lake Valley via Interstate 80. The majority (89%) of the Parleys Creek watershed is upstream from the mouth of the canyon. This upper watershed covers 51.9 square miles and is comprised of moderate to steep mountain slopes ranging from 4,800 to 9,400 feet in elevation. The headwaters are subdivided into Mountain Dell Canyon and Lambs Canyon. Much of the water from Parleys Creek is diverted and stored in Little Dell and Mountain Dell Reservoirs. These structures were initially constructed for water supply and flood control purposes and are currently managed by the Salt Lake City

Department of Public Utilities. Stored water is utilized to meet potable water and recreation needs as well as cold water fishery habitat. Land in the upper watershed is a mix of private ownership and National Forest land, and is primarily used as a transportation corridor for I-80, with homes in Mount Aire (Smith Fork) and Lambs Canyon and developed recreational facilities for golf, cross country skiing, and picnicking. R.J. Harper has operated a quarry in the lower end of the canyon, adjacent to I-80, since the early 20th century. Parleys Creek water is used primarily for culinary purposes, and a large part of the upper Parleys Creek watershed is a protected drinking water source area for Salt Lake City. The treatment plant is located below Mountain Dell Reservoir. The dam is adjacent to Mountain Dell Golf Course, which is owned and operated by Salt Lake City. The lower watershed (the portion of the watershed downstream from the canyon mouth) is 6.4 square miles of commercial development and residential neighborhoods, along with several local parks including Parleys Nature Park and Sugarhouse Park.

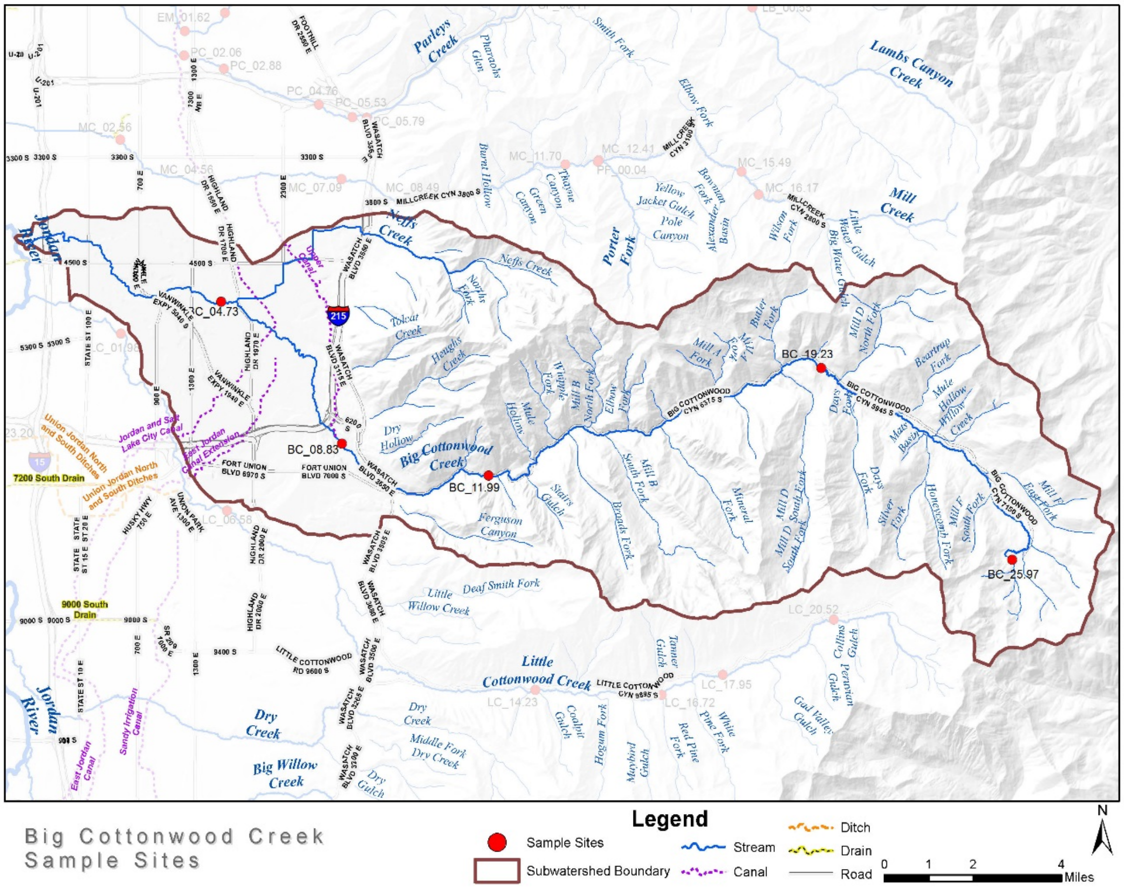
Figure 2-6 Mill Creek / Porter Fork subwatershed



At one time Mill Creek had as many as 20 mills in operation. Today the canyon is a popular recreational destination for Salt Lake Valley residents including skiing, biking, hiking, and picnicking. From the canyon mouth upstream, the upper watershed is 21.7 square miles of steep canyon slopes ranging in elevation from 5,100 to 10,200 feet in the Wasatch Mountain Range.

Millcreek Canyon is managed forest land for recreational use such as hiking, biking, picnicking, camping, fishing and cross-country-skiing. In fact, more U.S. Forest Service picnic areas are found in this canyon than any other in the Salt Lake Valley. Currently, stream water is used for irrigation and not for culinary purposes, and is therefore not regulated as a drinking water source protection area by Salt Lake City. As a result, dogs are allowed in the canyon. Prior to the 1990s, much of the canyon and the stream channel had been degraded, largely due to human activities. To address the damage from popular use, the U.S. Forest Service and Salt Lake County entered into an agreement to collect a fee for facilities repair and environmental improvement. Remediation has since been completed at several campground facilities and a fee station was installed. User fee revenues have been used for restoration and continued maintenance of the canyon and the creek's riparian zone. Porter Fork and Church Fork are the two major tributaries of Mill Creek. Porter Fork is likely named for long time farmer and logger Porter Rockwell. This narrow, north-facing canyon includes a neighborhood of private homes and an exceptional diversity of native riparian plants. Other development includes cabins above the Firs Picnic Area, two restaurants, and a Boy Scout camp. Otherwise, there is little commercial development in the canyon. The lower watershed drains 15.2 square miles of highly urbanized landscape. Increased commercial and industrial land uses are anticipated to occur on the east bench and closer to the Jordan River. High flows on Mill Creek usually come near the end of May through mid-June and rise six to 18 inches above base flow.

Figure 2-7 Big Cottonwood Creek subwatershed

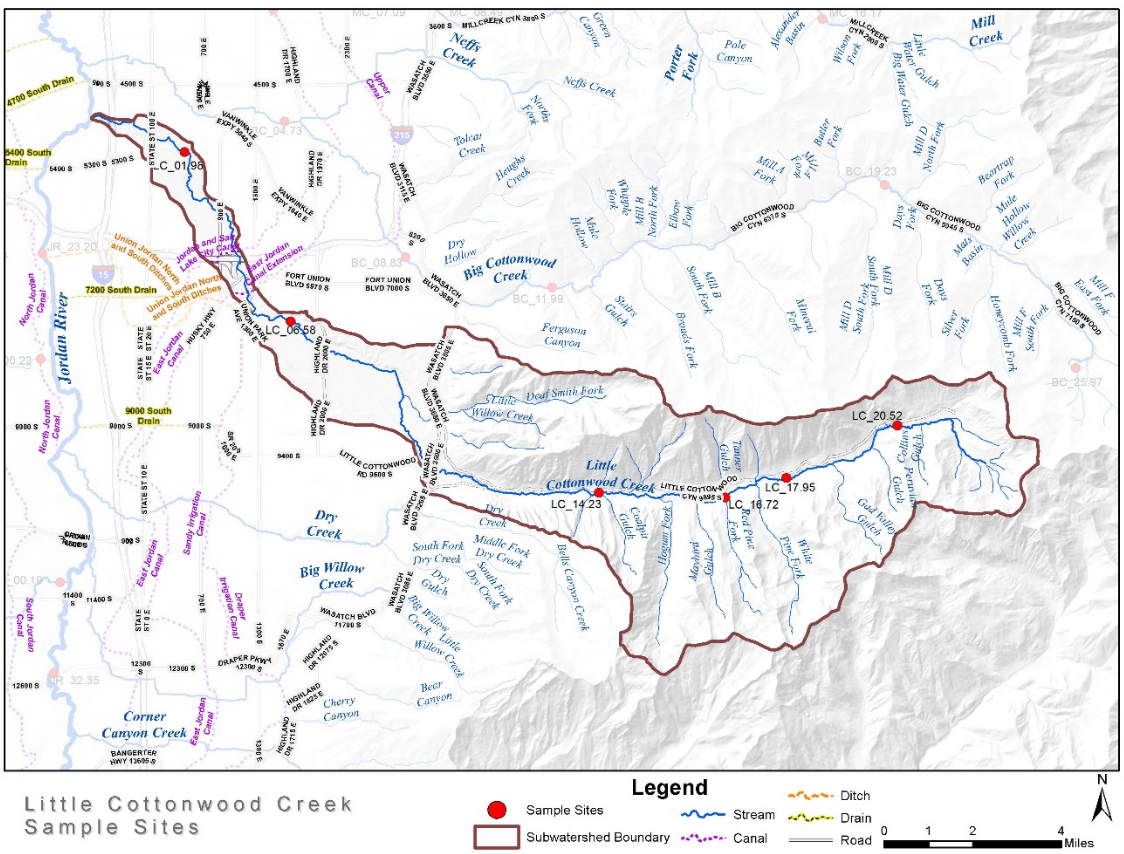


Big Cottonwood Creek Watershed is located between Mill Creek and Little Cottonwood Creek canyons and is highly used for recreational and culinary water purposes. The vast majority of upper Big Cottonwood Creek lies in unincorporated Salt Lake County, while much of the lower, urbanized stream runs through Cottonwood Heights, Murray, and Holladay cities. The upper watershed is 50 square miles with elevations ranging from 5,000 to 10,500 feet. The headwaters of the creek are located at approximately 9,600 feet in a broad, glaciated basin and the creek descends 24.3 miles before emptying into the Jordan River. With the largest flow of any adjacent Wasatch canyon stream, Big Cottonwood Creek provides the largest source of drinking water to Salt Lake City, which owns 99% of the water rights. As a result, the canyon is a regulated as a drinking water source protection area. Dogs and horses are strictly forbidden in protected watershed areas. Although most of the canyon is owned and managed by the U.S. Forest Service, significant private land-holdings exist near the headwaters. In addition to the Brighton and Solitude Ski areas, there are roughly 200 private residences in the Silver Fork area. The lower watershed drains 31.6 square miles with elevations ranging from 4,200 to 5,000 feet.

In the urban environment of the valley portion of the watershed, the stream ecosystem has been degraded by runoff from urban land uses, illegal discharges, and hydrologic modification. Increased recreation and urban development pressures stress the stream with higher levels of storm water pollution and have resulted in a reduced ability to recharge groundwater.

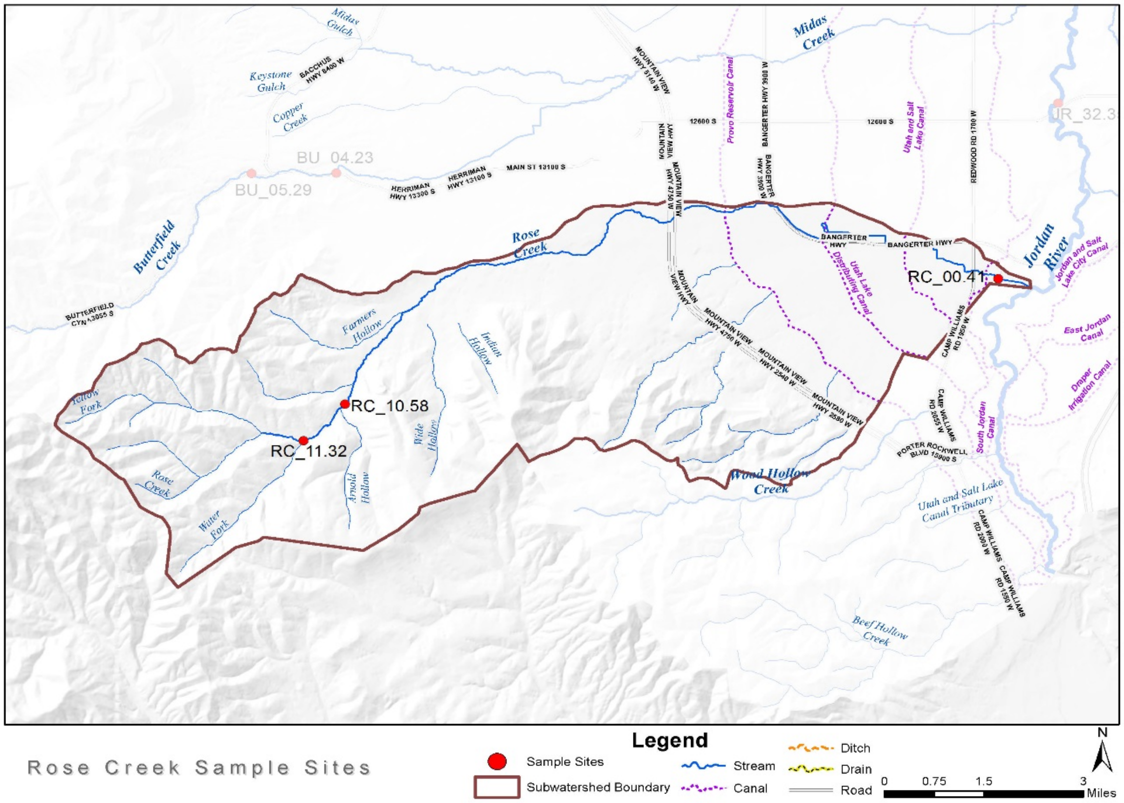
Development is primarily residential with some commercial and industrial development. Early claims to Big Cottonwood Creek water predate the growth of cities. Managing the water for modern needs has led to intricate exchange agreements between cities with junior rights and irrigators with senior rights. In exchange for its rights to lower quality Utah Lake water, Salt Lake City treats the higher quality stream water at a treatment plant at the mouth of the canyon for culinary use. This diversion seasonally dewaters four miles of the creek between the canyon mouth downstream to Cottonwood Lane. The City makes up the diverted flow with canal exchanges between April and October, but from November through March, 50% of the valley creek segment is dry. From Cottonwood Lane downstream, late Autumn-Winter instream flow originates, supporting a reproducing brown trout fishery. The source of this small flow is likely groundwater discharge.

Figure 2-8 Little Cottonwood Creek subwatershed



Little Cottonwood Creek is the second largest surface water source used by Salt Lake City for culinary purposes. As a result, the canyon is protected and managed according to city guidelines designed to protect and sustain water quality, and no dogs or horses are allowed in the canyon. Historically, sustaining water quality was not such a high priority. Mining and smelting activities occurred along Little Cottonwood Creek, historic activities that continue to impact water quality of the creek to this day. There were several hydropower operations over the years, and the stream still generates power for Murray City. Land and water managers deal with the historic mining and water rights legacies to this day. The upper watershed drains 27.2 square miles of steep canyon slopes with elevations ranging from 5,200 to 11,200 feet. The headwaters of the creek gather in Albion Basin at 9,800 feet, formed from intermittent creeks and outflow from Cecret Lake. From there the stream drops approximately 5,400 feet over 22 miles to its confluence with the Jordan River, a larger drop than any other Wasatch Front stream. It follows the canyon course carved by glaciers. Today, the primary land use is managed forest land for recreation—skiing, hiking, biking, climbing, camping, picnicking, fishing, and more. Other land uses include seasonal and year-round residences, the Town of Alta, two ski resorts, and resort-related commercial development. The lower watershed drains 12.7 square miles of a highly urbanized land, comprised of primarily residential and commercial development with increased commercial and industrial densities in the I-15 and I-215 corridors. Not unlike our other urban streams, little, if any, of the natural channel remains as Little Cottonwood Creek makes its way down to the Jordan River. In fact, when the creek crosses I-215, it is carried high above the highway in a concrete box culvert! From July through March the creek has little to no flow in the valley, due primarily to a stream diversion above the canyon mouth that pipes water out for culinary and hydropower uses. When flows are low enough, the diversion takes all of the water. Some water is brought back into the stream in the Fort Union area (upper Jordan River water brought in via canal). Groundwater and storm drains also add to streamflow, but for the most part the aquatic ecosystem in the nine-mile stretch from the diversion to the Fort Union canal is seriously impacted.

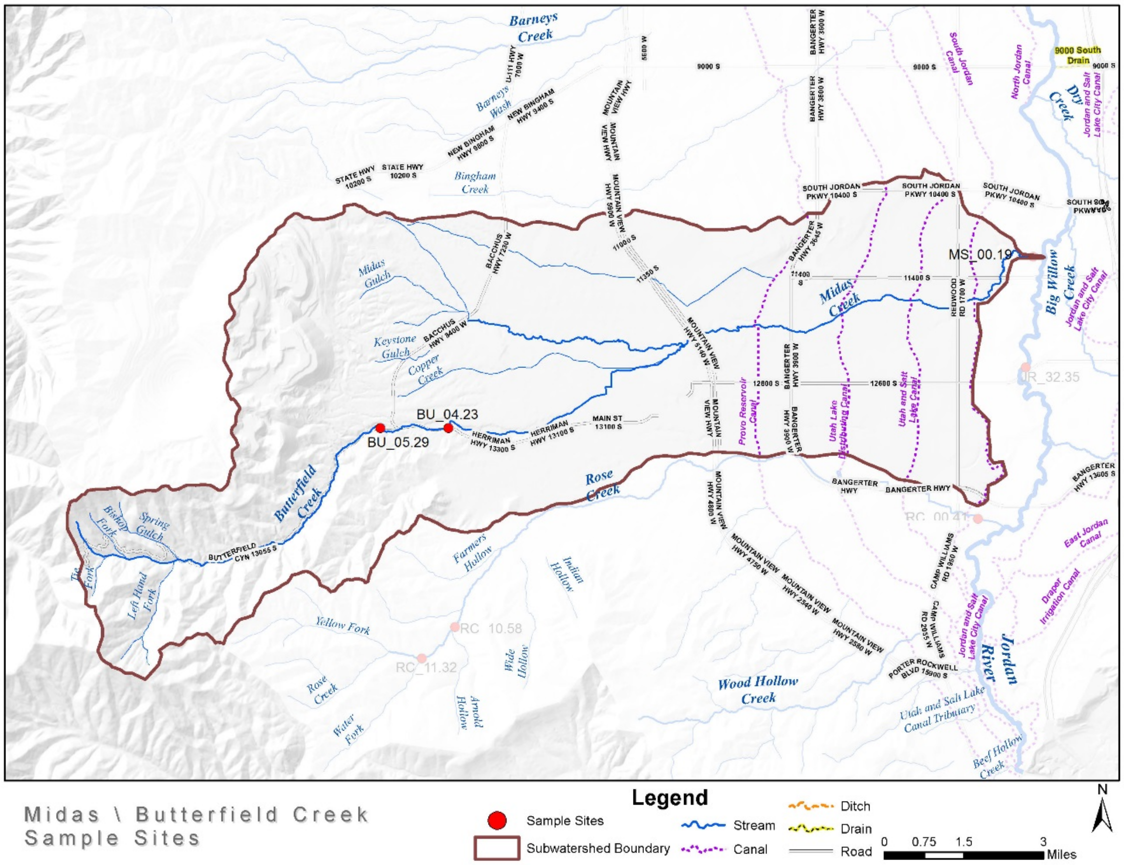
Figure 2-9 Rose Creek subwatershed



Rose Creek drains a 27.58-square mile basin with its headwaters flowing from the Oquirrh Mountains. The creek has year-round flows in the upper watershed where the land is managed for irrigation, water supply, wildlife and military use. Rose Canyon and Yellow Fork Canyon have long been recreation destinations for hikers, runners, mountain bikers, equestrian riders and birders. The 1,681-acre Rose Canyon Ranch is protected open space in the foothills of the Oquirrhs, and Yellow Fork Canyon Park offers 800 acres of parkland. The lower watershed is rapidly urbanizing, transitioning from primarily agricultural land use to residential and commercial land uses. Creek flow is intermittent in the valley section of the creek causing WPRP to have minimal sample sites in the lower section of the creek.

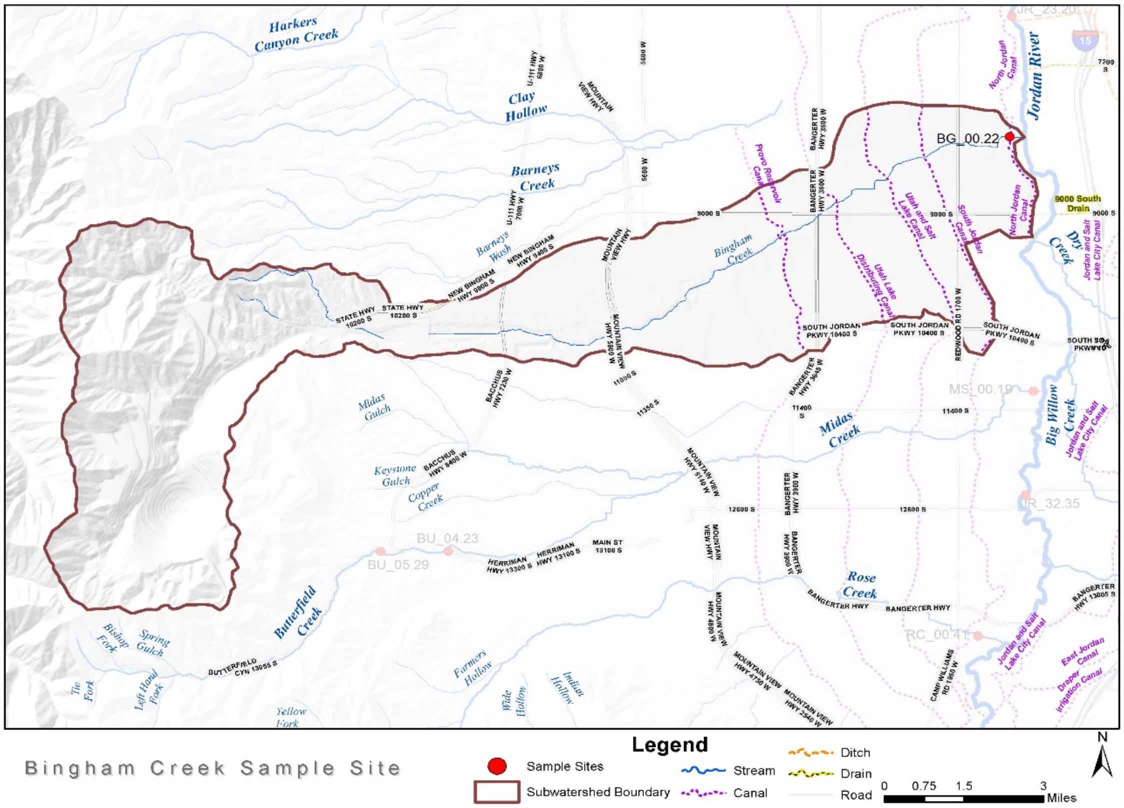
SALT LAKE COUNTY WATERSHED

Figure 2-10 Midas Creek / Butterfield Creek subwatershed



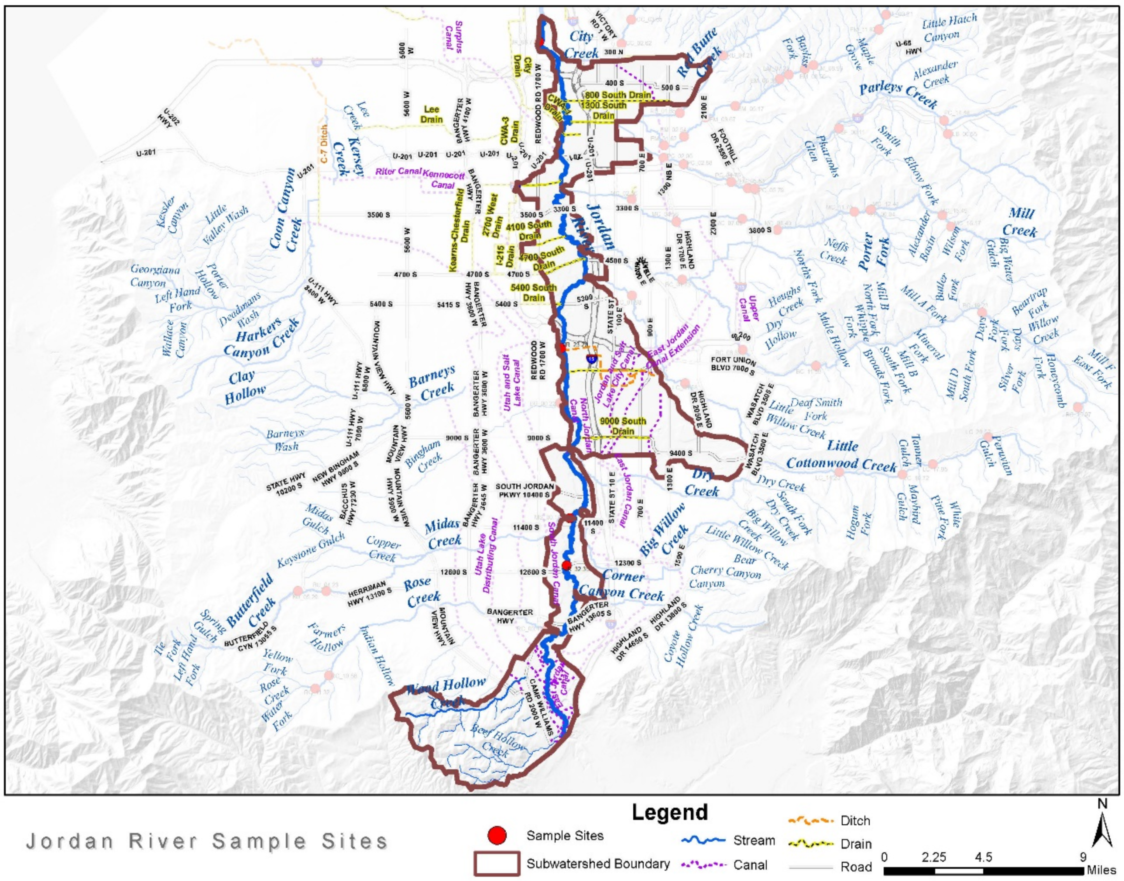
Midas Creek drains a 50.3-square mile basin, which includes Butterfield Creek and several gulches. Butterfield Creek originates in the Oquirrh Mountains and converges with Midas Creek at approximately 5100 West 12120 South. Midas Creek once drained a larger basin. Prior to excavation of the Kennecott Copper Mine, the eastern portion of the mine originally had slopes that drained into Midas Creek. As the land surface has changed, drainage patterns have changed, resulting in tributary area being routed to Bingham Creek. High levels of lead and arsenic have been found in Bingham and Butterfield Creeks due to historic mining activities. The Environmental Protection Agency and Kennecott have participated in cleanup of contaminated soils along the creeks.

Figure 2-11 Bingham Creek subwatershed



Bingham Creek drains a 36.2-square mile basin, in which much of the Kennecott Copper Mine (also known as the Bingham Canyon Mine) can be found. As one of the largest open-pit mines in the world, radical modifications to the natural drainage patterns have occurred in the upper portion of the creek watershed. What once flowed from high in the Oquirrh Mountains is now little more than a drainage ditch with highly intermittent flow. It is not until the creek reaches the Utah Distributing Canal, which crosses over the creek at approximately 3300 West 11800 south, that more regular flows are introduced into the channel. From there down to the Jordan River, canal exchange flows provide year-round water in the creek. The highest flows are seen when canal overflow reaches seasonal maximums, but this does not generally increase the creek water levels more than six inches. High levels of lead and arsenic have been found in Bingham and Butterfield Creeks due to historic mining activities. The Environmental Protection Agency and Kennecott have participated in cleanup of contaminated soils along the creeks.

Figure 2-12 Jordan River subwatershed



The Jordan River is the main water artery for the Salt Lake Valley. It flows 51 miles northward from Utah Lake to the Great Salt Lake through three counties and fifteen cities, including four of Utah's largest cities. The river drains a 3,805 square-mile basin that is one of ten regional scale watersheds in Utah, which includes the Provo River, Spanish Fork River, and Utah Lake basins. The fourteen major tributaries of the Jordan River, originating from both the Wasatch and Oquirrh mountain ranges, are all found within Salt Lake County. The Jordan River was once a meandering river with a lush ecosystem that supported a diversity of terrestrial and aquatic wildlife. It provided a source of livelihood for Native Americans and early settlers who established farms and settlements along the river. As the population of the valley increased, so did the demands on the river's water and impacts to the health of the river corridor. Dams and canals were built to satisfy increasing needs for irrigation and drinking water. Increasing development led to the river being straightened and channelized, ultimately causing it to become disconnected from its floodplain and vital wetlands. The river was heavily polluted for many years by raw sewage, agricultural runoff, and mining wastes. It was the focus of environmental legislation in the 1970s and there are two Superfund sites adjacent to its banks. Although much cleaner than it once was, the Jordan River water is currently classified as “impaired” by the Utah Division of Water Quality per the Clean Water Act. Due to the highly managed nature of the water in the Jordan River, flows vary widely throughout the year. While shallow groundwater and the tributaries do ensure some year round flow, average high and low flows are controlled by the release of water through the gates at Utah Lake. The gates are opened when the elevation of Utah Lake exceeds 4,489 feet above sea level, as per a lawsuit settled in 1985. This is known as the lake “compromise level”. When the gates are closed flows range from 15-90 cubic feet per second (cfs). When the gates are open the flow can surge up to 750-2300 cfs in a matter of minutes. That’s a rise of up to 5-6 feet! Dams at or near the Jordan Narrows (upper Jordan River) divert water to seven canals that are used for irrigation and secondary water systems in Salt Lake County. To reduce floodwaters in Salt Lake City, the Surplus Canal at 2100 South (lower Jordan River) was built in 1885. Approximately 70% of Jordan River water can be diverted to the Surplus Canal at any given time, which flows directly to the Great Salt Lake. The health of the Jordan River ecosystem is greatly impacted by urbanization. Residential and commercial development built within the floodplain, often right up to the river’s edge, has eliminated or severely impacted much of the riparian habitat along the Jordan River. Development in the flood plain also prevents the river from meandering naturally as it once did, resulting

2.3 Methodologies

The methodologies used in this study are the same ones used in the data collection protocols outlined in the Sampling and Analysis Plan (SAP) for Salt Lake County. To summarize, there were three major categories assessed in this study: Chemistry [pH, Dissolved Oxygen {DO}, Total Dissolved Solids {TDS}, Conductivity {EC}, Turbidity, Temperature and Salinity] and Bacteria levels [E. coli].

Chemistry parameters were assessed using the Oakton Multiparameter 35, Orbeco B200 Turbidometer, IN-Situ Smart Troll and the YSI ProDO DO Meter. These devices simultaneously measure13 water quality parameters using a pH/ORP probe, Conductivity probe, Dissolved Oxygen sensor and temperature probe. Technical information including device precision can be found in Salt Lake County’s SAP (Appendix C).

After measurements are taken in the field, the information is downloaded and QA/QC checked against calibration curves. All data that meets calibration requirements is logged and reported. Any data that does not meet QA/QC requirements is not entered into our database. If the data was found not fit to be entered in the database, it was not included in this report; thus the graphs occasionally are missing data from specific months due to the unreliability of that piece of data.

Bacteria levels are assessed using the EPA approved Colilert method. This method requires samplers to access the stream and pull a single 100 ml samples of stream water into sterile 120 ml vessels. A reagent is then added and samples are incubated for 24-28 hours until they are read. A

Most Probable Number (MPN) or likely concentration of E. coli organisms per 100 ml of stream water is generated by enumerating the colored cells in the reagent trays. All three replicates are entered into our database. A field blank is collected each field session for QA/QC purposes. Technical information is available in Salt Lake County's SAP (Appendix C).

2.4 Monthly Sampling

Escherichia coli (E. coli) Bacteria

Escherichia coli (*E. coli*) bacteria samples were collected and analyzed as part of Salt Lake County's expanded water quality data collection efforts. E. coli is a type of bacteria commonly found in the intestines and feces of healthy warm-blooded animals and humans. The measurement of E. coli in a waterbody is an indication of the presence of human and/or animal waste contamination and possible harmful bacteria in surface waters. Although there are multiple methods for determining the amount of E. coli, the County conducted the E. coli data analysis using the average MPN per sample tray method consistent with state water quality standard methodology. The County uses the UDWQ secondary contact recreation beneficial-use standard of 206 MPN/tray as a comparative number. However, UDWQ has set a lower standard of 126 MPN/tray for primary contact recreation (UAC R317-2-14).

pH

Readings of pH were recorded as part of Salt Lake County's expanded water quality data collection program. The pH of surface water can affect the rate of chemical solubility and toxicity of the water and the diversity of biological organisms. The standard range set by the State of Utah is 6.5 standard units (s.u.) to 9 s.u for waters in the county. Lower or higher pH readings can indicate that conditions are present to mobilize toxic constituents, an action that can harm aquatic species. Arid climates commonly have pH ranges above neutral averaging in the range of 8-8.5. Arid climates with variable source rock geochemistry including limestone can also have high alkalinity as well, which tends to resist changes to the pH level. If pH levels are observed to drop in certain locations it can be an indicator of significant water chemistry change. Known sources that can drive the pH of streams up or down are mine drainage, concrete spills or illicit dumping and industrial discharge

Dissolved Oxygen (DO)

DO is an indicator of the amount of oxygen available in the streams to support macroinvertebrates and fish populations. Low DO conditions can harm aquatic habitat by limiting the amount of oxygen available for aquatic organisms. Low DO conditions can be caused by excessive algae growth (because algae consumes the oxygen in the water), high levels of nutrients (most notably phosphorus and nitrogen), high oxygen demand (such as by biological or chemical processes or sediment characteristics), or the decay of submerged plants. The reference value of 4.5 mg/L was used by the County for comparative purposes for all sub-watersheds. The state water quality standard for minimum DO for various aquatic wildlife beneficial uses is established by UAC R317-2 and ranges between 4.0 and 9.5. No observations were made detailing Coarse Particulate Organic Matter (CPOM), Fine Particulate Organic Matter (FPOM), Organic

Nutrients or Inorganic Nutrients thus no statements about speciation of consumption/depletion of DO in the water column as a result of those processes can be made here.

Temperature

Water temperature is an important indicator due to the fact that is can affect biological activity and species diversity and populations as well as water chemistry processes. Water temperature often dictates healthy conditions for cold-water and warm-water fish, and water temperatures affect aquatic diversity, metabolism, growth, and reproduction. The rate of chemical solubility and reactions generally increase with higher temperatures. Water temperature varied seasonally across all sub-watershed creeks sampled. A reference value of 20 degrees Celsius (°C) was used by Salt Lake County, and was met for most sub-watershed creeks for most of the year. The state water quality temperature standard is set at 20°C for cold-water aquatic wildlife, with the water quality temperature standard at 27°C for warm-water and other aquatic wildlife.

Turbidity

Turbidity measures how much suspended solid is present in the water being tested. Higher levels indicate sediment entering the system through erosion, mass wasting, disturbance of the substrate, point or non-point sources or construction related activities. In natural systems streams should show low turbidity levels during low flows and high values during runoff events.

Conductivity

Conductivity values, like most rivers in the arid west, should have higher natural values during the spring months and lower values in the later summer, fall and winter months. All though these values are more dependent on water chemistry than flow, chemical and mechanical weathering of the rocks can also play a role in the streams conductivity. In the urban sections of the watershed, conductivity is much more a product of pollutants added to the water than natural decomposition. Spring flow dominated streams will also have higher conductivity as well; especially if the source rock of the streams in marlaceous limestone as is the case for a few of the eastern valley streams.

Total Dissolved Solids

Total Dissolved Solids (TDS) generally display a similar pattern to conductivity. Values are generally higher during spring months and lower during summer and fall months. Periodic excursions into higher concentrations can occur with snow events in winter months and salt application to roads. WPRP attempts to elude this phenomenon by avoiding sampling during storm events. TDS indicates the presence of minerals dissolved in water. The minerals that make up the measurement of TDS are calcium, sulfate, magnesium, sodium, potassium, and chloride; these minerals are generally referred to as salts. High TDS concentrations can affect the amount of available oxygen in the water for aquatic species and can reduce water clarity. Some sources of TDS are natural geological formations, stormwater runoff, agricultural runoff, and wastewater and septic system discharges. In the urban sections of the watershed TDS is more a product of pollutants added to the water than natural decomposition. The reference value that the County uses for TDS is different for each sub-watershed, based on the background (naturally occurring) geochemical values at the stream headwaters. It is not intended to be a regulatory standard, but as an average point to observe variance. For streams that have an agricultural beneficial use and that are not covered by a site-specific standard, the state standard is 1,200 milligrams per liter (mg/L).

Salinity

Salinity is a specialized group of TDS that is measured for and it will generally display a similar pattern to TDS and conductivity. Salinity in Utah waterways can fluctuate in readings from one sub watershed to the other due to natural and anthropogenic effects. Human land use in the canyons like mining, old mines no longer in use and residential developments including road salting during the winter months can have an effect on salinity and in the urban sections of the watershed salinity is much more a product of pollutants added to the water than natural decomposition. Source rocks, specifically carbonate rocks that are found in the canyons will also play a role in determining the creeks and rivers salinity levels.

3.0 RESULTS

The trends found in the data presented in the appendices at the end of this report will be discussed in the order they are presented in this report, bacteria (*E.coli*). Followed by the chemistry section, pH, Dissolved Oxygen (DO), Conductivity, Salinity, TDS, Turbidity and Temperature. As previously stated, missing data in any graph represents the lack of ability to calibrate that piece of data against a calibration curve, thus the data was not used.

3.1 Jordan River

E.coli

The lowest *E.coli* counts were observed during the spring months and higher counts were observed during summer and fall, actual *E.coli* counts varied from site to site. JR_08.77 (Figure 3-51) sampled June at 248.1 MPN and August at 224.4 MPN placing them both above the chronic limit. The other months tested below the chronic and acute limit. JR_23.20 (Figure 3-52) at Winchester tested highest of all the sites for E.coli. These seven months tested above the chronic limit, December at 517.02 MPN, January at 365.4 MPN, February at 325.5MPN, July ay 272.3 MPN and September at 328.2 MPN and August at 866.4 MPN above the acute limit. JR_32.35 (Figure 3-53) at Rotary Park had December at 410.6 MPN, May at 285.1 MPN and July at 524.7 MPN test above the chronic limit threshold and nothing tested above the acute limit threshold.

pH

Jordan River pH readings at all sample sites were in the normal range of 6.5 to 9.0 for streams and rivers in Utah.

Dissolved Oxygen (DO)

Observed DO levels in the Jordan River fluctuate between each site. JR_08.77 (figure 4-353) had no months at or above 100% saturation levels and had two months July at 49.1% and August at 60.6% that were both below Utah standards for the minimum DO concentrations for cold and warm water fish. JR_23.20 and JR_32.35 had a few months that were below 100% saturation but were still above the Utah standards for minimum DO concentrations for cold and warm water fish.

Conductivity / Salinity

Seasonal patterns were observed in conductivity and salinity measurements at the sample sites along the Jordan River with higher values occurring during spring months and lower values during summer and fall. Conductivity and salinity stay consistently higher than other creeks in the watershed, and JR_08.77 had a spike in conductivity to 2490 mS/cm (Figure 4-355) and Salinity to 1420 PPM (Figure 4-358) during December.

Total Dissolved Solids (TDS)

A similar pattern to conductivity and salinity was displayed in the TDS samples with higher readings during spring and decreasing over summer, fall and winter. JR_08.77 saw a spike to 1770 PPM (Figure 4-354) in December. JR_08.77 (Figure 4-354), JR_23.20 (Figure 4-361) and JR_32.35 (Figure 4-368) saw spikes in TDS during the month of august.

Turbidity

A seasonal pattern in Turbidity at JR_08.77 (Figure 4-356), JR_23.20 (Figure 4-363) and JR_32.35 (Figure 4-370) was revealed. Readings during winter were low and as spring runoff occurred the readings climbed. Starting in July at all the sites there is an increase in turbidity that continues through September.

Temperature

Water Temperature in the Jordan River reflected normal seasonal atmospheric variations, with higher temperatures during summer months and lower temps during the winter months.

3.2 East Side Creeks

Streams of the Wasatch Front have their headwaters high in the Wasatch Range. The upper sections of the east side creek sub-watersheds, generally from the canyon mouth up, are characterized by open spaces that are managed as forest land, recreational opportunities, and protection of water resources. High elevation steep mountainous terrain tends to create seasonal flow patterns such as high flows during the spring snowmelt season, which ranges from April through July depending on elevation and snowpack. Low flows tend to prevail during the later summer months and through winter; spikes in flows tend to be associated with rain events.

3.2.1 City Creek

E.coli

Sample site CC_03.65 (Figure 3-2) had no samples above the Chronic limit threshold. Site CC_02.62 (Figure 3-1) recorded four months October at 1732.9 MPN, March at 306.3 MPN, May at 980.4 MPN and August at 235.9 MPN above the chronic limit threshold with October and May going above the acute limit threshold.

pH

City Creek's pH readings at the CC_02.62 (Figure 4-1) (Figure 4-1) and CC_03.65 (Figure 4-8) (Figure 4-8) were in the normal range of 6.5 to 9.0 for streams and rivers in Utah.

Dissolved Oxygen (DO)

Observed DO levels were between 90% and 108% saturation at both CC_02.62 (Figure 4-2) (Figure 4-2) and CC_03.65 (Figure 4-9) (Figure 4-9) above Utah standards for minimum DO concentrations for cold water fish.

Conductivity / Salinity

Following patterns similar to those observed in other east side creeks conductivity and salinity at CC_02.62 (Figure 4-4, Figure 4-7) and CC_03.65 (Figure 4-10, Figure 4-14) had higher readings during spring with decreases during summer and fall. Contrary to observed values in other east side creeks, July and August in City Creek recorded rising conductivity and salinity values.

Total Dissolved Solids (TDS)

Similar patterns to conductivity and salinity were displayed in the TDS samples at CC_02.62 (Figure 4-3) and CC_03.65 (Figure 4-11). Displaying an increase in TDS during spring with a decrease during May and June followed by another increase in July August and September

Turbidity

Normal turbidity is seen at the City Creek sample sites CC_02.62 (Figure 4-6) and CC_03.65 (Figure 4-13) during low flow months and spring runoff. During the late summer months when turbidity should be decreasing with the diminishing flows the readings indicated an increase in turbidity at both CC_02.62 (Figure 4-5) and CC_03.65 (Figure 4-12).

Temperature

Water Temperature in City Creek reflected normal seasonal atmospheric variations, with higher temperatures during summer months and lower temps during the winter months.

3.2.2 Red Butte Creek

E.coli

Sample sites RB_01.65 (Figure 3-3) and RB_04.21 (Figure 3-4) along Red Butte Creek had zero samples that tested above the chronic limit threshold. Sample site RB_01.65 did display elevated levels of *E.coli* a few months out of the water year but again nothing above the chronic threshold.

pH

Red Butte Creek pH (Figures 4-15 and 4-22) readings for the sample sites were in the normal range of 6.5 to 9.0 for streams and rivers in Utah.

Dissolved Oxygen (DO)

Red Butte Creek's DO (Figures 4-16 and 4-23) levels are at saturation or right below saturation for the majority of the year. The creek does show a pattern of decreased DO during summer and fall with October being the lowest at both sites sampling at 90%. Keeping it above the states required minimum DO standards for cold water fish.

Conductivity / Salinity

Both conductivity and salinity displayed a seasonal pattern of increased conductivity during spring and a decrease during summer and fall. RB_01.65 did see a spike in conductivity (Figure 4-18) to 13180 mS/cm and salinity (Figurer 4-21) to 9220 PPM during December.

Total Dissolved Solids (TDS)

Both sites RB_01.65 (Figure 4-17) and RB_04.21 (Figure 4-24) TDS followed a similar pattern to conductivity and salinity. There was an increase in TDS with spring runoff and a decrease with during summer and fall. TDS readings at RB_01.65 (Figure 4-17) saw an increase to 9200 PPM during December.

Turbidity

A typical turbidity profile was observed at RB_01.65 (Figure 4-19) and RB_04.21 (Figure 4-26) with an increase in turbidity during spring and a decrease in turbidity during summer and fall.

Temperature

Water Temperature in the Red Butte Creek reflected normal seasonal atmospheric variations, with higher temperatures during summer months and lower temps during the winter months.

3.2.3 Emigration Creek / Kilyon / Burr Fork

Emigration

E.coli

The following sites along Emigration Creek had at least one sample that tested above the chronic limit and acute limit thresholds. EM_01.62 (Figure 3-5), EM_02.54 (Figure 02.54), EM_03.67 (Figure 3-7), EM_05.17 (Figure 3-8), EM_07.30 (Figure 3-9), EM_07.79 (Figure 3-10), EM_08.50 (Figure 3-11), EM_08.93 (3-12) and EM_11.87 (Figure 3-13). The highest concentrations of *E.coli* occurred July through September throughout Emigration Creek. The lower section of Emigration Creek EM_05.17, EM_03.62 and EM_02.54 saw higher counts of *E.coli* passing the chronic and acute threshold then the upper sites during winter.

pH

Emigration Creek pH readings were in the normal range of 6.5 to 9.0 for streams and rivers in Utah.

Dissolved Oxygen (DO)

Observed DO levels at the sample sites on Emigration Creek ranged from 90% to above 100% of saturation staying above Utah's minimum standards for DO concentrations for cold water and warm water fish.

Conductivity / Salinity

Emigration Creeks Conductivity and salinity followed a seasonal pattern with higher readings occurring during spring then decreasing through summer, fall and winter. During the later summer months into fall the upper section of the creek EM_08.93 (Figure 4-84), EM_08.50 (Figure 4-77), EM_07.79 (Figure 4-70) and EM_07.30 (FIGURE 4-63) saw a rise in salinity. Beginning in June each site was in the 400 PPM range then they started to continual rise into September where each site had climbed into the 900 PPM range, EM_07.79 had the largest sample recorded in September at 1000 PPM. Conductivity EM_08.93 (Figure 4-81), EM_08.50 (Figure 4-74), EM_07.79 (Figure 4-67) and EM_07.30 (FIGURE 4-60) followed salinity and increase from June to September, except august where a larger spike occurred. During December and January the lower section of Emigration Creek saw spikes in both salinity and conductivity. In December EM_03.67s salinity (Figure 4-49) saw a spike to 1050 PPM and the conductivity (Figure 4-46) spiked to 11090 mS/cm. EM_01.62 salinity (Figure 4-35) spiked to 2380 PPM and conductivity (Figure 4-32) spiked to 4890 mS/cm. In January EM_02.54 salinity (Figure 4-42) saw a spike to 1050 PPM and conductivity (Figure 4-39) saw a spike to 2100 mS/cm.

Total Dissolved Solids (TDS)

Following seasonal patterns like conductivity and salinity TDS exhibited higher readings during spring and decreases during summer, fall and winter. Emigration Creek samples did have distinct spikes in TDS during December and January. EM_01.62 (Figure 4-31) recorded a spike in December 3520 PPM, EM_02.54 (Figure 4-38) recorded a spike in January to 1480 PPM and EM_03.67 (Figure 4-45) recorded a spike in December to 7820 PPM.

Turbidity

Emigration Creek's turbidity followed a seasonal pattern with spring displaying an increase in turbidity and then a decrease through summer and fall. Emigration Creek read very little to no turbidity during the winter months. There was a spike in turbidity at EM_02.54 (Figure4-40) in January to 449.8 NTU.

Temperature

Water Temperature in the Emigration Creek reflected normal seasonal atmospheric variations, with higher temperatures during summer months and lower temps during the winter months.

Kilyon

E.coli

Observed E.coli samples at KL_00.21 (Figure 3-14) tested two months above the accepted levels for *E. coli*. July at 1553.1 MPN putting above the chronic and acute limit thresholds and August at 517.2 MPN placing it above the chronic limit threshold.

pH

Kilyon Creek's pH (Figure 4-92) readings at were in the normal range of 6.5 to 9.0 for streams and rivers in Utah.

Dissolved Oxygen (DO)

Readings of Dissolved oxygen (Figure 4-93) ranged from 87% to 97% of saturation for the water year keeping the DO above the minimum DO state standards for cold water fish.

Conductivity / Salinity

Kilyon creeks Conductivity (Figure 4-95) and salinity (Figure 4-98) displayed a pattern that follows the flow of the creek with higher readings in spring during runoff and decreasing through summer and fall.

Total Dissolved Solids (TDS)

Mirroring a similar pattern to conductivity and salinity TDS (Figure 4-94) in Kilyon Creek had higher readings during spring and a steady decrease through summer and fall.

Turbidity

Kilyon Creeks turbidity (Figure 4-96) in followed a seasonal pattern with increased turbidity during spring and a decrease in turbidity during summer and fall.

Temperature

Water Temperature (Figure 4-97) in Kilyon Creek reflected normal seasonal atmospheric variations, with higher temperatures during summer months and lower temps during the winter months.

Burr Fork

E.coli

One sample at BF_14.44 (Figure 3-15) tested above the chronic and acute limit threshold in September at 1119.9 MPN and another high reading in July at 191.8 MPN that was just below the chronic limit threshold.

pH

Burr Fork Creek pH readings (Figure 4-99) for the sample sites were in the normal range of 6.5 to 9.0 for streams and rivers in Utah.

Dissolved Oxygen (DO)

Samples of Dissolved oxygen (Figure 4-100) at Burr Fork had readings between 86% and 95% saturation for the water year keeping it above the states required minimum DO standards for cold water fish.

Conductivity and Salinity

Burr Forks conductivity (Figure 4-103) and salinity (Figure 4-106) displayed a pattern that followed the flow of the creek with higher readings during spring and decreasing through summer and fall. In November BF_14.44 Conductivity recorded a spike to 2920 mS/cm and salinity recorded a spike to 4170 PPM.

Total Dissolve Solids (TDS)

Following a similar pattern to conductivity and salinity TDS in Burr Fork had higher readings during spring and a steady decrease during summer and fall. BF_14.44 (Figure 4-102) did record a similar spike as conductivity and salinity in November to 2070 PPM.

Turbidity

Burr fork followed a seasonal pattern regarding turbidity (Figure 4-104) with increased turbidity during spring runoff and a decrease in turbidity during the summer and fall.

Temperature

Water Temperature (Figure 4-105) in Burr Fork reflected normal seasonal atmospheric variations, with higher temperatures during summer months and lower temps during the winter months.

3.2.4 Parleys Creek / Lambs canyon / Smith Fork

Parleys Creek

E.coli

PC_14.40 (Figure 3.21) had two months June at 1119.9 and August at 2419.6 above the acute limit threshold and two months July at 410.6 and September at 547.5 above the chronic limit threshold. PC_05.53 (Figure 3-19) and PC_05.79 (Figure 3-20) had zero samples at or above the chronic limit. PC_04.76 (Figure 3-18) had one sample June at 228.2 MPN that tested above the chronic limit threshold and one sample in August that tested at 1553.1 MPN above the acute limit threshold. PC_02.88 (Figure 3-17) had samples in December at 2419.6 MPN, July at 1203.33 MPN and August at 920.8 MPN test above the acute limit threshold. May at 261.3 MPN tested above the chronic limit threshold. PC_02.88 (Figure 3-17) had samples from December at 2419.6 MPN, July at 1203.3 MPN and August 920.8 MPN test above the acute limit threshold. June at 261.3 MPN tested above the chronic limit threshold PC_02.06 (Figure 3-16) had samples from October at 686.7 MPN, December at 2419.6 MPN and July at 2419.6 MPN test above the acute limit threshold. February at 435.2 MPN, August and 228.2 MPN and September at 435.2 MPN tested above the chronic limit threshold.

pH

Parleys Creek pH readings for the sample sites were in the normal range of 6.5 to 9.0 for streams and rivers in Utah.

Dissolved Oxygen (DO)

Parleys creek DO levels at the sampling sites ranged from 90% to above 100% saturation keeping them above the Utah's minimum standards for DO concentrations for cold water and warm water fish. PC_02.88 (Figure 4-115) dropped to 62% saturation in the July placing it below the minimum Utah standards for DO concentrations for cold and warm water fish.

Conductivity / Salinity

Conductivity measured in Parleys Creek at PC_02.06 (Figure 4-110) ranged from 766 mS/cm to 8200 mS/cm with observed spikes in December to 8200 mS/cm. PC_02.88 (Figure 4-117) ranged from 783 mS/cm to 10290 mS/cm with observed an spike December to 10290 mS/cm. PC_14.40 (Figure 4-145) ranged from 2.4 mS/cm to 7340 mS/cm with observed spikes in January to 7340 mS/cm and February to 7230 mS/cm.

Salinity Values in Parleys Creek followed similar patterns as the observed conductivity measurements with documented ranges from 111 PPM at PC_14.40 (Figure 4-148) in the upper section of the canyon to 4990 PPM at PC_02.88 (Figure 4-120) in the lower section of the creek.

Total Dissolved Solids (TDS)

Following a seasonal pattern similar to conductivity and salinity TDS had higher readings during spring and lower readings during summer and fall. TDS had sample sites that recorded higher samples during winter. PC_02.06 (Figure 4-109) had a high reading in December at 5790 PPM, PC_02.88 (Figure 4-116) had a high reading in December at 7260 PPM and PC_14.40 (Figure 4-114) saw higher readings in January at 5780 PPM and February at 5140 PPM.

Turbidity

Parleys Creek sample sites turbidity did not follow a typical seasonal pattern that would be observed along the other creeks. Turbidity at PC_02.06 (Figure 4-111), PC_02.88 (Figure 4-118), PC_04.76 (Figure 4-125), PC_05.53 (4-132), PC_05.79 (4-139), PC_14.40 (Figure 4-146) recorded increases in turbidity during spring runoff but did not follow the typical decrease in turbidity that would be expected to see during summer and fall.

Temperature

Water Temperature in Parleys Creek reflected normal seasonal atmospheric variations, with higher temperatures during summer months and lower temps during the winter months.

Lambs Canyon

E.coli

Samples for *E.coli* at LB_00.55 (Figure 3-22) had one reading in January at 214.3 above the chronic limit threshold.

pH

Lambs Canyon pH (Figure 4-149) readings for the sample sites were in the normal range of 6.5 to 9.0 for streams and rivers in Utah.

Dissolved Oxygen (DO)

Recordings of DO (Figure 4-150) at the sample site had readings from 88% to 98% saturation for the water year. Keeping them above the minimum DO state standards for cold water fish.

Conductivity / Salinity

Lambs Canyon showed a pattern in conductivity (Figure 4-152) and salinity (figure 4-155) that followed the seasonal flow of the creek with higher readings during spring and decreasing through summer and fall.

Total Dissolved Solids (TDS)

Following a similar pattern to the conductivity and salinity TDS in Lambs Canyon had higher readings during spring and a steady decrease through summer and fall. LB_00.55 (Figure 4-151) saw a spike in TDS in May to 555 PPM.

Turbidity

Lambs Canyon turbidity (Figure 4-153) in followed a seasonal pattern with increased turbidity during spring and a decrease in turbidity during the summer, fall and winter.

Temperature

Water Temperature (Figure 4-154) in Lambs canyon reflected normal seasonal atmospheric variations, with higher temperatures during summer months and lower temps during the winter months. Octobers spike in temperature above normal can be attributed to faulty equipment.

Smith Fork

E.coli

SC_00.11 (Figure 3-23) *E.coli* samples had two readings above the chronic limit threshold in July at 235.9 MPN and August at 228.2 MPN.

pH

Smith Fork pH (Figure 4-156) readings for the Smith Fork sample sites were in the normal range of 6.5 to 9.0 for streams and rivers in Utah.

Dissolved Oxygen (DO)

Observed DO (Figure 4-157) recordings at the sample site had readings from 89% to 99% saturation for the year. These readings were above the minimum DO state standards for cold water fish.

Conductivity / Salinity

Smith Forks conductivity (Figure 4-159) and salinity (Figure 4-162) readings displayed a seasonal pattern with spring exhibiting higher readings and then decreasing during summer and fall.

Total Dissolved Solids (TDS)

Following a similar pattern as conductivity and salinity TDS (Figure 4-158) readings were higher during spring then decreased during summer and fall.

Turbidity

Smith Forks turbidity (Figure 4-160) followed a seasonal pattern with increased turbidity during spring and a decrease through summer and fall.

Temperature

Water Temperature in Smith Fork reflected normal seasonal atmospheric variations, with higher temperatures during summer months and lower temps during the winter months.

3.2.5 Mill Creek / Porter Fork

Mill Creek

E.coli

MC_16.17 (Figure 3-31), MC_15.49 (Figure 3-30), MC_12.41 (Figure 3-29), MC_11.70 (Figure 328), MC_08.49 (Figure 3-27) sampled minimal amount of *E.coli* with no samples reaching the chronic limit threshold. MC_07.09 (Figure 3-26) sampled one month October at 260.3 MPN above the chronic limit threshold. MC_04.56 (Figure 3-25) had two months December at 1203.3 MPN and August at 866.4 MPN test above the acute limit threshold and two months July at 238.2 MPN and September at 307.6 MPN test above the chronic limit threshold. MC_02.56 (Figure 3-24) had eight months test above the acute limit threshold; October at 1413.6 MPN, December at 1299.7 MPN, January at 1299.7 MPN, February at 920.8 MPN, June at 686.7, July at 1553.1 MPN August at 1986.3 and September at 1299.7 MPN. MC_02.56 also had two month test above the chronic limit threshold, April at 387.3 MPN and May at 461.1 MPN.

pH

Mill Creek pH readings for the sample sites were in the normal range of 6.5 to 9.0 for streams and rivers in Utah.

Dissolved Oxygen (DO)

Observed DO levels throughout the sampling sites read between 90% to above 100% saturation, keeping the creek above the states required minimum DO standards for cold water fish.

Conductivity / Salinity

Conductivity measured in Mill Creek at MC_02.56 (Figurer 4-166) ranged from 774 mS/cm to 1675 mS/cm with observed spikes in July at 1181 mS/cm, August at 1675 mS/cm and September at 1345 mS/cm. MC_04.56 (Figure 4-173) ranged from 476 mS/cm to 1763 mS/cm with observed spikes in in July at 1181 mS/cm, August at 1763 mS/cm, September at 1973 mS/cm.

Salinity Values in Mill Creek followed similar patterns as the observed conductivity measurements with documented ranges from the lowest 229 PPM at MC_15.49 (Figure 4-211) in the upper section of the canyon to highest 944 PPM at MC_02.56 (Figure 4-164) in the lower section of the creek.

Total Dissolved Solids (TDS)

Mill Creek TDS readings had a seasonal pattern similar to conductivity and salinity with higher numbers of TDS being sampled during spring runoff than a decrease in numbers during summer and fall.

Turbidity

Following a typical seasonal pattern turbidity at the sample sites displayed an increase in turbidity during spring and decreasing over summer and fall. MC_04.56 (Figure 4-169) recorded a spike during December to 420 NTU.

Temperature

Water Temperature in Mill creek reflected normal seasonal atmospheric variations, with higher temperatures during summer months and lower temps during the winter months.

Porter Fork

E.coli

PF_00.04 (Figure 3-32) *E.coli* samples for had zero readings at or above the chronic limit threshold.

pH

Porter Fork pH readings at PF_00.04 (Figure 4-219) was in the normal range of 6.5 to 9.0 for streams and rivers in Utah.

Dissolved Oxygen (DO)

Observed DO readings at PF_00.04 (Figure 4-220) were between 87% and 97% saturation for the water year. Keeping it above the states required minimum DO standards for cold water fish.

Conductivity

A seasonal pattern in conductivity readings from PF_00.04 (Figure 4-222) displayed very minimal change throughout the year. There was a slight decrease in conductivity during summer and fall.

Salinity

Observed salinity at PF_00.04 (Figure 4-225) did not follow a seasonal pattern regarding runoff or low flows of summer and fall. Salinity sampled higher numbers during the winter but continued to stay high throughout the whole year.

Total Dissolved Solids (TDS)

Porter Forks TDS (Figure 4-221) mirrored the same pattern as conductivity following a seasonal pattern and minimal change throughout the year.

Turbidity

Readings of turbidity at PF_00.04 (Figure 4-223) displayed seasonal patterns with spring recording higher sample readings then decreasing through summer and fall.

Temperature

Water Temperature in Porter Fork (Figure 4-224) reflected normal seasonal atmospheric variations, with higher temperatures during summer months and lower temps during the winter months.

3.2.6 Big Cottonwood Creek

E.coli

BC_04.73 (Figure 3-33) had samples in October at 435.2 MPN and 547.5 MPN above the chronic limit threshold and had June at 2419.6 MPN, July at 866.4 MPN and August at 2419.6 MPN that tested above the acute limit threshold.

pH

Big Cottonwood Creek pH readings for the sample sites were in the normal range of 6.5 to 9.0 for streams and rivers in Utah.

Dissolved Oxygen (DO)

Observed DO levels at all the sampling sites ranged from 85% to over 100% of saturation. BC_25.97 (Figure 4-254) did see a decrease in September to 63% saturation staying above Utah standards for Minimum DO concentrations for cold water fish.

Conductivity / Salinity

Following a seasonal pattern conductivity and salinity had higher numbers during spring and lower ones through summer and fall. BC_04.73 conductivity (Figure 4-229) and salinity (Figure 4-232) recorded a spike in January to 3800 mS/cm and 1920 PPM.

Total Dissolved Solids (TDS)

Big Cottonwood Creek followed a similar seasonal pattern in TDS as conductivity and salinity with higher TDS numbers during spring and decreasing numbers during summer and fall. BC_04.73 (Figure 4-228) recorded a spike in January to 2540 PPM.

Turbidity

Big Cottonwood Creek followed a seasonal pattern in turbidity, with increased turbidity during spring and decreased turbidity through summer and fall.

Temperature

Water Temperature in Big Cottonwood Canyon Creek reflected normal seasonal atmospheric variations, with higher temperatures during summer months and lower temps during the winter months.

3.2.7 Little Cottonwood Creek

E.coli

A single month at LC_06.58 (Figure 3-39) tested above the chronic limit in October at 328.2 MPN. LC_01.98 (Figure 3-38) tested five months above the chronic limit threshold; December at 488.4 MPN, July at 275.5 MPN, August at 435.2 MPN and September at 435.2 MPN and October at 1119.9 MPN tested above the acute limit threshold.

pH

Little Cottonwood Creek pH readings for the sample sites were in the normal range of 6.5 to 9.0 for streams and rivers in Utah.

Dissolved Oxygen (DO)

DO fluctuates between each sample site as expected in Little Cottonwood Creek. The fluctuations appear through all the sample sites but never drop below 85% and stay well within the minimum DO range for cold water fish.

Conductivity / Salinity

Conductivity measured in Little Cottonwood Creek at LC_01.98 (Figurer 4-264) ranged from 420 mS/cm to 7760 mS/cm with observed spikes in December at 7760 mS/cm and February at 6370 mS/cm. LC_06.58 (Figure 4-271) ranged from 2.6 mS/cm to 2060 mS/cm with observed spikes in December at 1991 mS/cm, February at 2060 mS/cm, March at 1648 mS/cm and July at 1988 mS/cm. LC_16.72 (Figure 4-285) ranged from 161 mS/cm to 713 mS/cm with observed spikes in March at 687 mS/cm and April at 713 mS/cm. LC_17.95 (Figure 4-292) ranged from 187 mS/cm to 862 mS/cm with observed spikes in March at 841 mS/cm and April at 862 mS/cm.

Salinity Values in Little Cottonwood Creek followed similar patterns as the observed conductivity measurements with documented ranges from the lowest 66.5 PPM at LC_14.23 (Figure 4-281) in the upper section of the canyon to highest 4560 PPM at LC_01.98 (Figure 4-267) in the lower section of the creek.

Total Dissolved Solids (TDS)

Following a similar pattern to conductivity and salinity, TDS displayed higher readings during spring then a decrease during summer and fall. The last two sample sites LC_06.58 (Figure 4-270) and LC_01.98 (Figure 4-263) had readings that increase in TDS during winter. LC_06.58 had

February at 1460 PPM and March at 1170 PPM. LC_01.98 had December at 5520 PPM and February at 4520 PPM.

Turbidity

The sample sites displayed a seasonal pattern with little turbidity until spring runoff when readings numbers climb into summer then fell again during fall and winter. LC_01.98 (Figure 4-265) had higher turbidity readings than the other sites for most of the year.

Temperature

Water Temperature in Little Cottonwood Canyon reflected normal seasonal atmospheric variations, with higher temperatures during summer months and lower temps during the winter months.

3.3 West Side Creeks

Originating in the Oquirrh Range, the three Westside creeks featured in this report provide year-round flow (except Rose Creek) to the Jordan River. However, it is worthy of noting these streams are not entirely natural stream channels. Rather, they are historic drainage ditches that have dramatically increased in size, flow, and flow duration largely from human alteration. These alterations include conveyance of canal overflow and irrigation water to downstream water rights holders, and higher volumes of storm runoff from impervious surfaces (pavement, rooftops, etc.) as development continues. As a result, Westside stream flows do not reflect the typical spring runoff/high flow scenario observed in the previously described east side streams. Rather, they flow during irrigation season (mid-April through mid-October) and storm events, with peak flows occurring during summer downpours, not spring snow melt. Intermittent streams including Barneys, Coon, and Harkers Creeks are also found on the Westside of Salt Lake County but do not have any observed perennial reaches thus no water quality data is collected on them. None are tributaries of the Jordan River but are, of course, all part of the larger watershed.

3.3.1 Rose Creek

E.coli

During winter RC_00.41 (Figure 3-44) was dry and unable to provide any samples. During summer RC_00.41 did have enough water to conduct tests and had four months test above the acute limit threshold; June at 1986.3 MPN, July at 980.4 MPN, August at 980.4 MPN and September at 1986.3 MPN. RC_10.58 (Figure 3-45) had three months test over the chronic limit threshold; July at 579.4 MPN, August at 290.9 MPN and September at 275.5 MPN. RC_11.32 (Figure 3-46) had two months test over the chronic limit threshold; July at 344.8 MPN, September at 218.7 MPN and August at 727 MPN that tested above the acute limit threshold.

pH

Rose Creek pH at RC_00.41 (figure 4-303), RC_10.58 (Figure 4-310) and RC_11.32 (Figure 4-317) are all in the normal range for a stream in Utah. Rose Creek's pH levels were measured between, 8.3 and 8.7 for the water year.

Dissolved Oxygen (DO)

Observed DO readings at RC_00.41 (Figure 4-304), RC_10.58 (Figure 4-310) and RC_11.32 (Figure 4-318) were below 100% saturation for each sample that was collected. Despite the lower readings at each site the observed DO levels were still above the state's required minimum for cold and warm water fisheries during all sampled months.

Conductivity / Salinity

Rose Creek's conductivity and salinity values remained relatively constant through the sampled months at RC_00.41, RC_10.58 and RC_11.32. RC_00.41 conductivity (Figure 4-306) and salinity (Figure 4-309) recorded a spike in August to 2590 mS/cm and 1330 PPM.

Total Dissolve Solids (TDS)

Following a similar pattern to conductivity and salinity TDS at RC_00.41 (figure 4-305), RC_10.58 (figure 4-312) and RC_11.32 (Figure 4-319) had relatively equal readings through the months that were recorded. RC_00.41 had an increase in August to 1840 PPM following conductivity and salinity in August.

Turbidity

The upper sites RC_10.58 (Figure 4-314) had a higher sample recorded in June reaching 66.99 NTU. RC_11.32 (Figure 4-321) had a higher reading in September at 69.94 NTU compared to the other months sampled. The Lower sample site RC_00.41 (Figure 4-307) did not follow the pattern that can be seen at other creeks in the watershed. RC_00.41 actually climbed during the summer and fall months starting at 12.67 NTU in May to 105 NTU in September.

Temperature

Water Temperature in Rose Creek reflected normal seasonal atmospheric variations, with higher temperatures during summer months and lower temps during the winter months.

3.3.2 Midas Creek/ Butterfield Creek

Midas Creek

E.coli

The *E.coli* values observed at MS_00.19 (Figure 3-47) displayed high values in the samples taking, including eight months that tested above the acute limit threshold; December at 920.8 MPN, January at 1413.6 MPN February at 686.7, May at 2419.6 MPN, June at 1203.3 MPN, July 2419.6

MPN, August at 2419.6 MPN and September at 2419.6 MPN. October tested above the chronic limit threshold at 648.8 MPN.

pH

Midas Creek's pH (Figure 4-324) readings for the sample site was in the normal range of 6.5 to 9.0 for streams and rivers in Utah.

Dissolved Oxygen (DO)

Midas Creek's DO levels at MS_00.19 (Figure 4-325) were at saturation for most of the water year, only two months were below saturation when tested. October was at 94.5% and August at 96.4% well above the states required minimum DO standards for cold and warm water fish.

Conductivity / Salinity

Midas Creek conductivity (Figure 4-327) and salinity (Figure 4-330) maintained high values throughout the year and did not follow a pattern around spring runoff and the lower flows of summer and fall that is seen in other creeks around the watershed.

Total Dissolve Solids (TDS)

Displaying similar patterns to conductivity and salinity MS_00.19 (Figure 4-326) had very little movement in values throughout the water year. TDS stayed consistently high without any decreases during summer or fall or increase during spring runoff.

Turbidity

Turbidity at MS_00.19 (Figure 4-328) ranges in NTU throughout the year seeing its highest readings in December at 75.28 NTU and February at 59 NTU. Turbidity then decreases until the later months of summer and fall where it climbs again with July seeing a recording to 52.35 NTU and September to 42.24 NTU.

Temperature

Water Temperature in Midas Creek reflected normal seasonal atmospheric variations, with higher temperatures during summer months and lower temps during the winter months.

Butterfield Creek

E.coli

Butterfield Creek *E.coli* samples at BU_05.29 (Figure 3-49) had samples above the chronic limit threshold in June at 365.4 MPN, and August at 275.5 MPN. In July it sampled above the acute limit threshold at 2419.6 MPN. BU_04.23 (Figure 3-48) had one sample test above the chronic limit threshold in July at 387.3 MPN.

pH

Butterfield Creek pH readings at BU_04.23 (Figure 4-331) and BU_05.29 (Figure 4-338) were in the normal range of 6.5 to 9.0 for streams and rivers in Utah.

Dissolved Oxygen (DO)

Observed DO readings at BU_04.23 (Figure 4-332) and BU_05.29 (Figure 4-339) were from 90% to above 100% saturation for the four months sampled. Keeping them above the states required minimum DO standards for cold water and warm water fish.

Conductivity/ Salinity

During the four months that were recorded conductivity at BU_04.23 (Figure 4-334) and BU_05.29 (Figure 4-341) and salinity at BU_04.23 (Figure 4-337) and BU_05.29 (Figure 4-344) recorded rises through summer and fall when and expected decrease would be visible in the samples taken.

Total Dissolved Solids (TDS)

Displaying a similar pattern to conductivity and salinity TDS at BU_04.23 (Figure 4-333) and BU_05.29 (Figure 4-340) increased during the summer and fall months.

Turbidity

The four months that were sampled for turbidity at BU_04.23 (Figure 4-335) and BU_05.29 (Figure 4-342) exhibited a decrease through summer and fall.

Temperature

Water Temperature in Butterfield Creek reflected normal seasonal atmospheric variations, with higher temperatures during summer months and lower temps during the winter months.

3.3.3 Bingham Creek

E.coli

The *E.coli* values observed at BG_00.22 (Figure 3-50) tested five months above the acute limit threshold; December at 1986.3 MPN, January at 2149.6 MPN, February at 2419.6, July at 866.4 MPN and September at 1299.7 MPN. BG_00.22 also had three months above the chronic limit; March at 285.1MPN, May at 547.5 MPN and June at 224.7 MPN.

pH

Bingham Creek pH readings at BG_00.22 (Figure 4-345) were in the normal range of 6.5 to 9.0 for streams and rivers in Utah.

Dissolved Oxygen (DO)

Observed DO readings at BG_00.22 (Figure 4-346) indicated that the DO levels in the creek were at saturation level and above during sample readings.

Conductivity / Salinity

Bingham Creek's conductivity at BG_00.22 (Figure 4-348) and salinity (Figure 4-351) displayed higher values during the water year with slight decreases in the late spring, early summer. There was no visible trends in conductivity or salinity around spring runoff or later summer and fall months.

Total Dissolve Solids (TDS)

With similar high values as conductivity and salinity TDS and BG_00.22 (Figure 4-347) also displayed the lack of any pattern regarding spring runoff and low flow months of summer, fall and winter.

Turbidity

The observed turbidity at BG_00.22 (Figure 4-349) did not follow a normal pattern seen at other creeks in the watershed instead it stayed consistent in values until it jumped from 24.47 NTU in June to 126.9 NTU in July and stayed high until September.

Temperature

Water Temperature in Bingham Creek reflected normal seasonal atmospheric variations, with higher temperatures during summer months and lower temps during the winter months.

4.0 CONCLUSIONS

4.1 Jordan River

E.coli

The high values at JR_08.77 occurred in June and August and could be attributed to decreased flow in the river, increased human activity along and in the river and increased populations of water fowl. JR_23.20 saw higher readings in December, January, February, July, August and September. These high occurrences above the chronic limit and acute limit may be attributed to increased human activities including pets along and in the River, large amount of water fowl using the river and lower flows during summer. JR_32.35 samples above the chronic limit could be attributed to the seasonal low flow of summer and winter, increased human activity at the park and along the Jordan River trail including horseback riding and increased amount of water fowl that live in the area.

Dissolved Oxygen

The DO levels from JR_08.77 could be attributed to increased organic material entering the river and the low flow associated with summer months unable to turn over the organic material and push it through the system and the warmer waters temperatures not being able to hold as much DO.

Conductivity / Salinity

The consistently high readings found at the sample sites along the Jordan River could be attributed to increased human activities including pets in and along the Jordan River, large amounts of water fowl using the river and low flows that occur during summer, fall and winter. The spike at JR_08.77 in December could be attributed to road and residential salting during and after a winter storm and the runoff from impervious cover of the Salt Lake Valley.

Total Dissolve Solids

The Spike in TDS at JR_08.77 in December could be attributed to an increase in road and residential salting during and after a winter storm and the runoff from impervious cover. The spike at all three sample sites in August could be contributed to the irrigation canals not being used for irrigation due to the Harmful Alga Blooms (HABs) occurring in Utah Lake and the Jordan River.

Turbidity

The increase in turbidity could be attributed to increased water being released from Utah Lake, irrigation canal water reentering the river after not being used due to the HABs, increased water fowls in the river and along the riparian and the increased human activities along and in the river.

4.2 East Side Creeks

4.2.1 City Creek

E.coli

The elevated E.coli counts at CC_02.62 could be attributed to increased human activities with dogs in and along the creek, water fowl using the creek and the resident beaver in the pond above the sample site. The expected trend of higher E.coli values at the sample sites as they get closer to the Jordan River was observed at City Creek. The observed increase from CC_03.65 to CC_02.62 was more than 100% for most of the months sampled.

Conductivity / Salinity

The higher readings at CC_02.62 and CC_03.65 occurred during a popular time for recreation and visitation. Indicating that the canyons uses could be attributing to the increase in conductivity and salinity values. The expected trend of conductivity and salinity rising as the sample sites move down stream was observed at city creek. The general trend observed in the data shows a 15% increase moving down stream.

Total Dissolved Solids

The increase in TDS at CC_02.62 and CC_03.65 could be attributed to the recreational use of the City Creek canyon including hiking, biking, walking and running throughout the canyon. The expected trend in TDS of rising as the sample sites moved down stream was observed in City Creek. The observed general trend in data showed an average increase of 12% moving downstream.

Turbidity

This increase in turbidity at CC_02.62 and CC_03.65 could be attributed to increased human and pet activity in and along the creek adding to the erosion and substrate disturbance. The expected trend of turbidity rising as the sample sites moved downstream was observed in city creek. The observed general trend in data showed at least 100% increase in turbidity during the months that increase occurred.

Temperature

The variance in temperatures could be attributed to CC_02.62 location in the canyon which is in a more entrenched section of the creek causing it to receive less sunlight than the other site during the winter months.

4.2.2 Red Butte Creek

E.coli

The higher readings of E.coli at RB_01.65 could be attributed to the increased human activity through Miller Park and the large amount of urban runoff from the University of Utah and the adjacent neighborhoods and the impervious cover associated with the area. The expected trend of higher E.coli values at the sample sites as they get closer to the Jordan River was observed at Red Butte Creek. The observed increase from RB_04.21 to RB_01.65 was more than 100% for most of the months sampled except May which had a 97% decrease.

Conductivity / Salinity

This spike in conductivity and salinity at RB_01.65 could have been caused by excessive road and residential salting during a storm and the runoff from the University of Utah and the surrounding neighborhoods. The expected trend of conductivity and salinity rising as the sample sites move downstream was observed in Red Butte Creek. The general trend observed in the data shows an average of 22% increase in conductivity and an average of 14% increase in salinity while moving downstream.

Total Dissolved Solids

This spike in TDS and RB_01.65 could be attributed to excessive road and residential salting during a storm and the runoff from the University of Utah and the surrounding neighborhoods. The expected trend in TDS of rising as the sample sites moved downstream was observed in Red Butte Creek. The observed general trend in data showed an average increase of 8% moving downstream.

4.2.3 Emigration Creek / Kilyon / Burr Fork

Emigration

E.coli

The elevated E.coli values observed at the samples sites along Emigration Creek during summer and some winter months could be attributed to the decrease flows in the creek, increased activity in the canyon during summer, septic systems, wildlife such as water fowl and increased runoff

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from impervious cover and residential backyards. Downstream numbers tend to corroborate the expected trend of higher E.coli values at the sample sites as they get closer to the Jordan River.

Conductivity / Salinity

The rise in salinity and conductivity seen at EM_08.93, EM_08.50, EM_07.79 and EM_07.30 could be contributed to increased activity in the canyon, the creek and in the residential areas. EM_03.67, EM_02.54 and EM_01.62 higher samples during December and January could be attributed to road and residential salting during winter storms and the runoff from impervious cover into the creek. The expected trend of conductivity and salinity rising as the sample sites move downstream was observed in Emigration Creek. The general trend observed in the data shows an average of 7% increase in conductivity and an average of.7% increase in salinity while moving downstream.

Total Dissolved Solids

EM_01.62, EM_02.54 and EM_03.67s higher TDS readings during the winter months could be attributed to snow removal procedures, road and residential salting in the residential areas and the highway that carries considerable traffic through the canyon along Emigration Creek. The expected trend in TDS of rising as the sample sites moved down stream was observed in Emigration Creek. The observed general trend in data showed an average increase of 6% moving downstream.

Turbidity

The spike at EM_02.54 coincides with the spike in TDS, conductivity and salinity and could be attributed to the snow removal procedures, road and residential salting during a winter storm. The expected trend of turbidity rising as the sample sites moved downstream was observed in Emigration Creek. This visible trend in the data showed an average increase of 67% moving downstream.

Kilyon

E.coli

These higher samples in July and August could be attributed to lower flows in the creek, increased human activities in the canyon and increased Water fowl during the summer months.

Burr Fork

E.coli

The acute *E.coli* reading at BF_14.44 was observed during the summer and could be attributed to increased human activity in the canyon and increased waterfowl in the area during summer.

Conductivity / Salinity

The spike in conductivity and salinity in December at BF_14.44 could be attributed to snow plowing and road salting for winter storms.

Total Dissolved Solids

The spike in TDS in December at BF_14.44 could be attributed to snow plowing and road salting for winter storms.

4.2.4 Parleys creek / Lambs Canyon / Smith Fork

Parleys Creek

E. coli

The higher values observed at PC_14.40 could be attributed to the resident moose and beavers that live in the area and low flow during summer and fall. PC_04.76 high values could be attributed to the increase of dogs in Tanner Park, human activities in and along the creek during summer and increased population of water fowl. PC_02.88s high values could be attributed to the large population of water fowl that live in the park, human and dog activities throughout the park and the increased runoff from the large amounts impervious cover found in the residential areas around the creek. PC_02.06s high values could be attributed to the large population of water fowl that live in and around Sugarhouse Lake just above Hidden Hollow, human and dog activities throughout the park and the increased runoff from the large amounts impervious cover found in the residential and business areas around Hidden Hollow. The expected trend of higher *E.coli* values at the sample sites as they get closer to the Jordan River was observed at Parleys Creek except PC_14.40 which maintained higher values due to the wildlife living in the area of the sample site.

Dissolved Oxygen

This decrease at PC_02.88 in DO at this sample site could have been caused by an increase in organic material being introduced into the creek, the decreased flow during the summer months and the warmer temperature of the water not allowing it to hold DO. The expected trend of DO rising as the sample sites moved down stream was observed in Parleys Creek. The observed general trend in data showed an average increase of 3% moving downstream.

Conductivity / Salinity

These higher samples of conductivity and salinity at PC_02.06, PC_02.88 and PC_14.40 could be attributed to the increased road salting along the I-80 in the upper section of Parleys and road and residential salting and runoff from impervious cover in the lower section of the creek. The expected trend of conductivity and salinity rising as the sample sites move downstream was observed in Parleys Creek. The general trend observed in the data shows an average of 7% increase in conductivity and an average of 27% increase in salinity while moving downstream.

Total Dissolved Solids

These higher readings of TDS at PC_02.06, PC_02.88 and PC_14.40 could be attributed to the increased road salting along the I-80 in the upper section of the creek and road and residential salting and runoff from impervious cover after a winter storms. The expected trend in TDS of rising as the sample sites moved down stream was observed in Parleys Creek. The observed general trend in data showed an average increase of 5% moving downstream.

Turbidity

These deviations from the seasonal pattern in turbidity could be attributed to the year-round human and pet usage of the parks that the creek runs through, waterfowl that use the creek and the runoff from the I-80, residential and business areas. The expected trend of turbidity rising as the sample sites moved down stream was observed in Parleys Creek. This visible trend in the data showed an average increase of 53% moving downstream.

Lambs Canyon

E. coli

LB_00.55 Januarys reading could be attributed to the winter low flow and human activity in the canyon.

Total Dissolved Solids

The spike in May at LB_00.55 could be attributed to erosion, wildlife and human activates in the creek

Smith Fork

E. coli

SC_00.11 two samples could be attributed to increased human activities in the canyon and lower flows.

4.2.5 Mill Creek / Porter Fork

Mill Creek

E.coli

Once Mill Creek exits the canyon it enters dense residential areas and stays above ground while crossing hundreds of backyards and multiple parks. The large E.coli values in the lower section could be attributed to the human influence from the neighborhoods including pet feces, runoff from backyard irrigation systems, increased activity in and along the creek, large populations of water fowl in the parks and low flow during summer, fall and winter. The expected trend of higher E.coli values at the sample sites as they get closer to the Jordan River was observed at Mill Creek and the downstream numbers tend to corroborate this trend.

Conductivity /Salinity

The higher recording of conductivity and salinity at MC_02.56, MC_04.56, MC_ 11.70 and MC_12.41 could be attributed to the rise in human and pet activities in and along the creek and in the canyon, at the parks and in the backyards that the creek flows through and the increased road and residential salting during winter storms. The expected trend of conductivity and salinity rising as the sample sites move downstream was observed in Mill Creek. The general trend observed in the data shows an average of 11% increase in conductivity and an average of 10% increase in salinity while moving downstream.

Turbidity

The spike at MC_04.56 could be attributed to an increase in snow plowing along the creek, road and residential salting during winter storms and larger impervious cover, urban runoff and human activity in and along the creek. The expected trend of turbidity rising as the sample sites moved down stream was observed in Mill Creek. This visible trend in the data showed an average increase of 196% moving downstream.

Porter Fork

Salinity

The higher readings in salinity could be attributed to the salting of the private road along PF_14.44 during and after winter storms.

4.2.6 Big Cottonwood Creek

E.coli

E.coli was minimal at all but one of the sample sites BC_04.73 located on Big Cottonwood Creek. BC_04.73 is located in Creekside Park which could attribute to these elevated E.coli samples with the increased activity of both humans and pets in and along the creek, the large amount of water fowl and wildlife that live and use the creek in the park. The expected trend of higher E.coli values at the sample sites as they get closer to the Jordan River was observed but only after the highest sample site BC_25.97 which had larger values than any other site in the canyon. The larger values at BC_25.97 could be attributed to the residential area around the site and wildlife in the area. The sites below BC_25.97 had the expected movement with downstream numbers tending to corroborate this trend.

Conductivity / Salinity

The spike seen at BC_04.37 could be attributed to increased road and residential salting and urban runoff from a winter storm. The Spike that is seen in BC_25.97 salinity (Figure 4-260) and conductivity (Figure 4-257) can be attributed to a technical issue with the sonde. The expected trend of conductivity and salinity rising as the sample sites move downstream was observed in Big Cottonwood Creek. The general trend observed in the data shows an average of 132% increase in conductivity and an average of 144% increase in salinity while moving down stream.

Total Dissolved Solids

The spike at BC_04.73 could be attributed to increased road / residential salting and runoff from a winter storm. The expected trend in TDS of rising as the sample sites moved downstream was observed in Big Cottonwood Creek. The observed general trend in data showed an average increase of 142% moving downstream.

Turbidity

The higher turbidity in the lower section of Big Cottonwood Canyon could be attributed to increased activity along the creek and in the parks that creek travels through, increased runoff from impervious ground cover in residential areas and the irrigation canal water that makes its way back into the creek. Turbidity as expected increased as the sample sites gain distance from the canyon getting closer to the Jordan River. The expected trend of turbidity rising as the sample sites moved down stream was observed in Big Cottonwood Creek. This visible trend in the data showed an average increase of 321% moving downstream.

Temperature

BC_08.83 (Figure 4-238) has multiple months with no readings due to it being dry and BC_25.97 (Figure 4-258) is missing months during winter due to a frozen sample site.

4.2.7 Little Cottonwood Creek

E.coli

The higher values of *E.coli* at LC_01.98 and LC_06.58s could be attributed to increased human and domestic animal activity along and in the creek, impervious cover, agriculture runoff and canal water entering the creek. The expected trend of higher *E.coli* values at the sample sites as they get closer to the Jordan River was observed at Little Cottonwood Creek and the downstream numbers tend to corroborate this trend.

Dissolved Oxygen

A majority of the lower DO readings were taking in the upper sections of the creek and could be attributed to legacy mines, water temperature variations and lower flows. The expected trend of DO rising as the sample sites moved downstream was observed in Little Cottonwood Creek. The observed general trend in data showed an average increase of 6.5% moving downstream.

Conductivity / Salinity

Conductivity and salinity show a seasonal pattern with the highest readings during spring runoff and decreasing through summer and fall. The higher readings at LC_01.98, LC_06.58, LC_16.72 and LC_17.95 could be attributed to irrigation canal water entering the creek and increased human and wildlife activity along and in the creek, increased summer activities at Alta and Snowbird resorts and in the residential areas of Alta. The expected trend of conductivity and salinity rising as the sample sites move downstream was observed in Little Cottonwood Creek. The general trend observed in the data shows an average of 77% increase in conductivity and an average of 94% increase in salinity while moving downstream.

Total Dissolve Solid

These higher readings at LC_01.98 and LC_06.58 could be attributed to human activities along the stream, increased runoff from larger non pervious urban areas and the increased amount of road and residential salting occurring during winter storms. The expected trend in TDS of rising as the sample sites moved downstream was observed in Little Cottonwood City Creek. The observed general trend in data showed an average increase of 93% moving downstream.

Turbidity

These higher readings could be attributed to the large amount of water fowl that live in the area and the increased amount of human and pet activities along and in the creek. The expected trend of turbidity rising as the sample sites moved downstream was observed in Little Cottonwood Creek. This visible trend in the data showed an average increase of 44% moving downstream.

4.3 West Side Creeks

4.3.1 Rose Creek

E. coli

The larger values of *E.coli* at the RC_10.58 and RC_11.32 with 75% of their samples above the chronic limit could be attributed to the human activities with pets and horseback riding in the canyon above the sites. The creek also runs through multiple backyards with horses and other livestock that have access to the creek. The high values at RC_00.41with 71% of the samples above the chronic limit could be attributed to agriculture in the area of and along the creek, irrigation water from the canals, urban runoff from residential areas, and low flow in the creek. The expected trend of higher E.coli values at the sample sites as they get closer to the Jordan River was observed at Rose Creek and the downstream numbers tend to corroborate this trend.

Conductivity / Salinity

Conductivity and salinity values measured at RC_00.11 could be attributed to increased irrigation water input back into the creek, increased agriculture uses in the area and human and pet activities along the creek above the sample site. The expected trend of conductivity and salinity rising as the sample sites move downstream was observed in Rose Creek. The general trend observed in the data shows an average of 110% increase in conductivity and an average of 62% increase in salinity while moving downstream.

Total Dissolved Solids

Like conductivity and salinity TDS displayed higher readings at RC_00.11. These values could be attributed to the input of irrigation water back into the creek, increased agriculture uses around the creek and human activities along the creek. The expected trend in TDS of rising as the sample sites moved downstream was observed in Rose Creek. The observed general trend in data showed an average increase of 66% moving downstream.

Turbidity

There was an occasional spike in turbidity at RC_10.58 and RC_11.32 that could be attributed to mountain biking and horseback riding that take place in the canyon above the sites. The agriculture uses along the creek in the residential areas. An increase in turbidity was observed at RC_00.41 during summer and fall that could be attributed to the input of irrigation water , agriculture uses and urban runoff. The expected trend of turbidity rising as the sample sites moved downstream was observed in Rose Creek. This visible trend in the data showed an average increase of 337% moving downstream.

4.3.2 Midas Creek / Butterfield Creek

Midas Creek

E.coli

The high E.coli values at MS_00.19 could be attributed to the agriculture that is present in the area above the sample site, inflow of canal water, water fowl and runoff from the impervious cover found throughout the residential area around the Creek.

Conductivity / Salinity

The consistent readings at MS_00.19 could be attributed to the input of irrigation water , agriculture in and along the creek, residential use of the creek above the sample site and runoff from agriculture and residential areas.

Total Dissolved Solids

The readings at MS_00.19 could be contributed to the same factors effecting conductivity and salinity, input from irrigation water, agriculture in and along the creek, residential use of the creek above the sample site and runoff from agriculture and residential areas.

Turbidity

MS_00.19s higher numbers in summer could be attributed to irrigation water from the canals, agriculture in and along the creek, residential use of the creek above the sample site and runoff from agriculture and residential backyards. The higher readings during the winter months could be attributed to snow removal procedures above the sample site, waterfowl using the sites and the agricultural areas above the site.

Butterfield Creek

E. coli

The higher values of *E.coli* at BU_05.29 and BU_04.23 could be attributed to agriculture in the area, the wild horse and burro center and human activities including pets in the canyon. The expected trend of higher E.coli values at the sample sites as they get closer to the Jordan River was not observed at Butterfield Creek. Rather the upper site had higher values then the downstream site. The higher values in the upstream site could be influenced by the wild burrow and horse center just above the site and the human activity in the canyon.

Conductivity / Salinity

The increasing trend in conductivity and salinity values at BU_04.23 and BU_05.29 during the four months that were tested could be attributed to agriculture, mining and recreation in the canyon above the sites. The expected trend of conductivity and salinity rising as the sample sites move downstream was not observed in Butterfield Creek. The general trend observed in the data shows a 4% decrease in conductivity and a 3% decrease in salinity while moving downstream.

Total Dissolved Solids

The increasing TDS trends observed at BU_04.23 and BU_05.29 during the four months that were tested could be attributed to agriculture, mining and recreation in the canyon above the sites. The expected trend of turbidity rising as the sample sites moved downstream was observed in Butterfield Creek. This visible trend in the data showed an increase of 48% moving downstream.

4.3.3 Bingham Creek

E.coli

The elevated values of *E.coli* at BG_00.22 could be attributed to the livestock operation that is located just upstream from the sample site, other agriculture in the area, irrigation water entering the creek and water fowl in the area.

Conductivity / Salinity

These high readings and lack of any seasonal trends could be caused by the agriculture, livestock and construction activates up stream as well as the irrigation water from the canals entering the creek.

Total Dissolved Solids

The TDS samples could be attributed to the livestock, construction, agriculture and the irrigation water entering the creek.

Turbidity

These rises and falls could be attributed to, construction on the road above the site, livestock in the field and in Bingham Creek turning up the substrate, increased activity in and along the creek in residential areas.

4.4 Summary

The 2016 Annual report presented by Salt Lake County Watershed Planning and Restoration Program (WPRP) was created to provide a look at bacteria and chemistry counts in the Jordan River Watershed. The process consists of field data collection, field observations, data QA/QC, data analysis and interpretation to provide the basis for developing the report of existing conditions in the watershed.

Most of the streams draining the sub-basins in the Lower Jordan Basin watershed have seasonal variations in the attributes measured by WPRP. The variations that seem to be natural in origin, like temperature fluctuation over the seasons, need to be documented but require no further investigation as long as they fall within published standards, which most do. Streams that have measured incursions beyond published state standards, however, will require additional sampling and analysis to detail how and why these incursions occur. The WPRP staff also recognized that only having 12 points of data for the whole water year is a sliver of the data that can be collected and used to draw conclusions on the Jordan River watersheds water quality. This awareness has triggered an eventual update to our collection program. We hope to add continues data collection to eight of our gaging sites to collect water quality measurements along with water quantity measurements to develop a stronger and more complete look at the water quality in these areas.

After reviewing the results of water year 2016, the following actions are required:

E.coli

E.coli Contamination can be found throughout the streams and river of the watershed especially in the lower sections of the watershed outside of the canyons. The expected trend of higher E.coli values at the sample sites as they move downstream was observed through the watershed with *E.coli* fluctuating in levels during different seasons and flows. *E.coli* readings in the waterways could benefit from increased BMP implementation along the waterways, better management practices and better public education about what E.coli is, how it occurs and why is it important to control.

Dissolved Oxygen

DO will fluctuate naturally throughout the water year but should maintain at or near 100% saturation. There were multiple samples at multiple sites that feel below the minimum dissolved oxygen concentration for cold water and warm water fish. These creeks could benefit from additional natural in stream structures being added to the water ways with a goal to change the flow patterns causing the water to overturn and flows to mingle increasing the interaction of flow regimes and gaseous exchanges.

Turbidity

Turbidity can be influenced by how and where visitors have access to the streams and river. Controlled access to limited armored sections of the stream can be a visitor amenity but uncontrolled access, as currently exists, adds suspended sediments to the water column, adds fine sediments to the substrate decreasing the ability of visual hunters to find prey and depletes DO. The simple solution is to limit access to the creek to a few pools with armored banks and limited shading.

Salinity

Salinity is determined by geochemistry and flow regime. However in the lower sections and the higher populated areas in the canyons had observed spikes in salinity during winter months. These higher readings of salinity could be better controlled with stronger BMP development and implementation during residential and road salting for winter storms including increased management practices. Public education regarding winter salting and its effects on water quality could also help.

5.0 REFERENCES

1) Utah Lake, Jordan River, Canals Algal Bloom 2016. (n.d.). Retrieved November 10, 2016, from http://deq.utah.gov/Divisions/dwq/health-advisory/harmful-algal-blooms/bloom-2016/utah-lake-jordan-river/index.htm

2) Water Quality. (n.d.). Retrieved October 10, 2016, from http://extension.usu.edu/waterquality/whats-in-your-water/do/

3) Salt Lake County Sampling and Analysis Plan 2013

4) Utah. Dept. of Administrative Services. Office of Administrative Rules. (2012, November 30). Utah Department of Administrative Services Office of Administrative Rules. Retrieved November 13, 2016, from http://www.rules.utah.gov/publicat/code/r317/r317-002.htm

5) Public-Utilities-Riparian Corridor. (n.d.). Retrieved November 26, 2016, from http://www.slcgov.com/utilities/public-utilities-ripariancorridor

6) Utah Division of Forestry, Fire & State Lands, SWCA Environmental Consultants, & CRSA (Eds.). (2017, January). Final Jordan River Comprehensive Management Plan and Record of Decision . Retrieved January, 2017, from http://www.ffsl.utah.gov/images/statelands/jordanriver/JRCMP_FINAL_Combined_20170106_Compressed.pdf

6.0 E.COLI APPENDIX

Figure 3-1 City Creek 02.62 E.coli

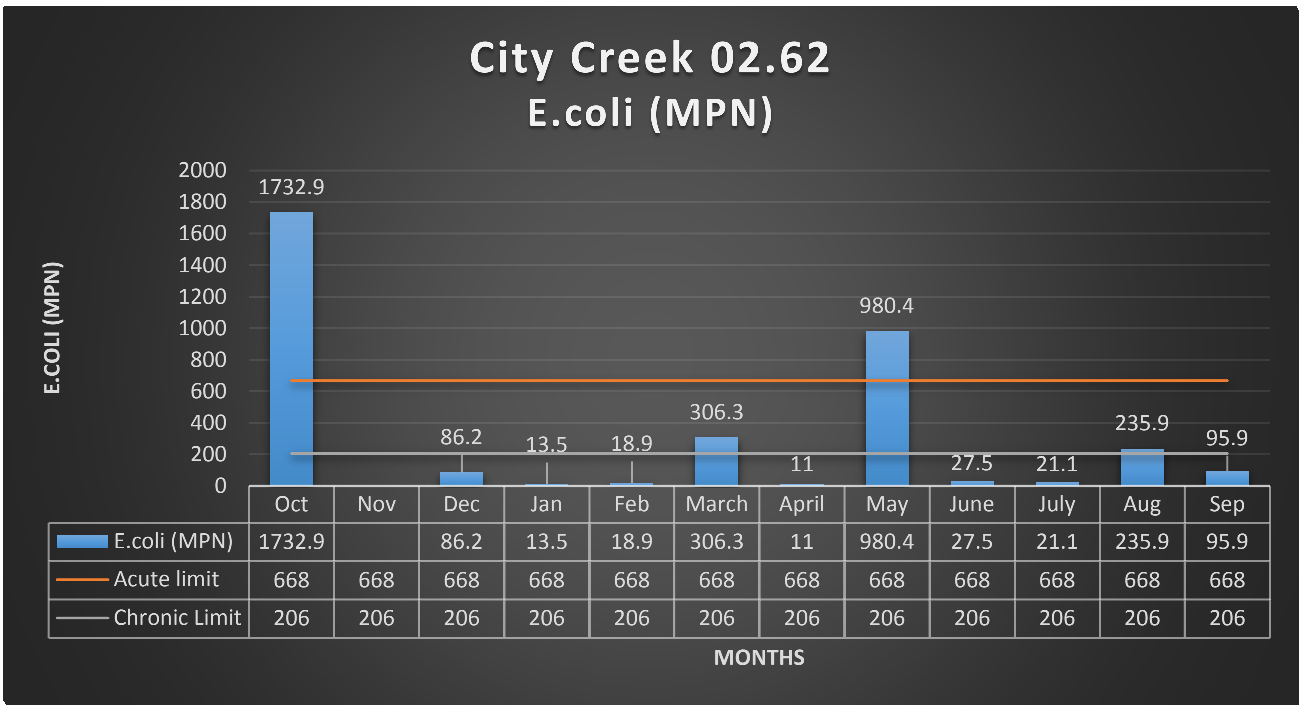
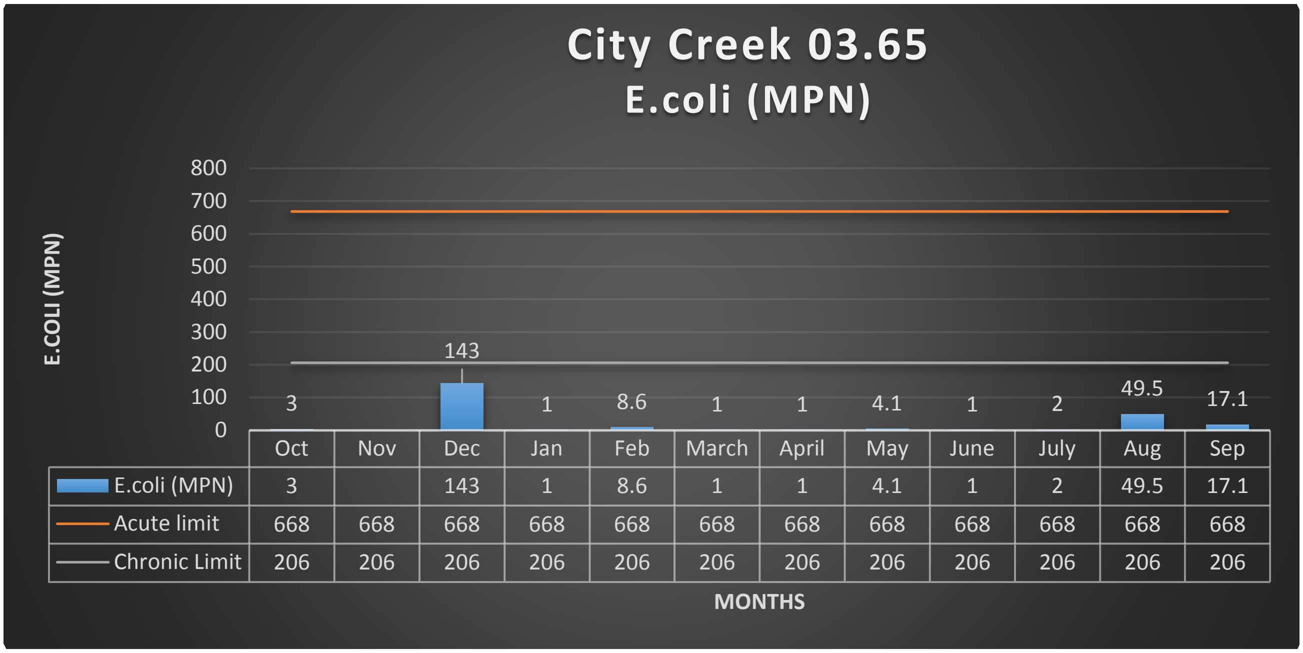
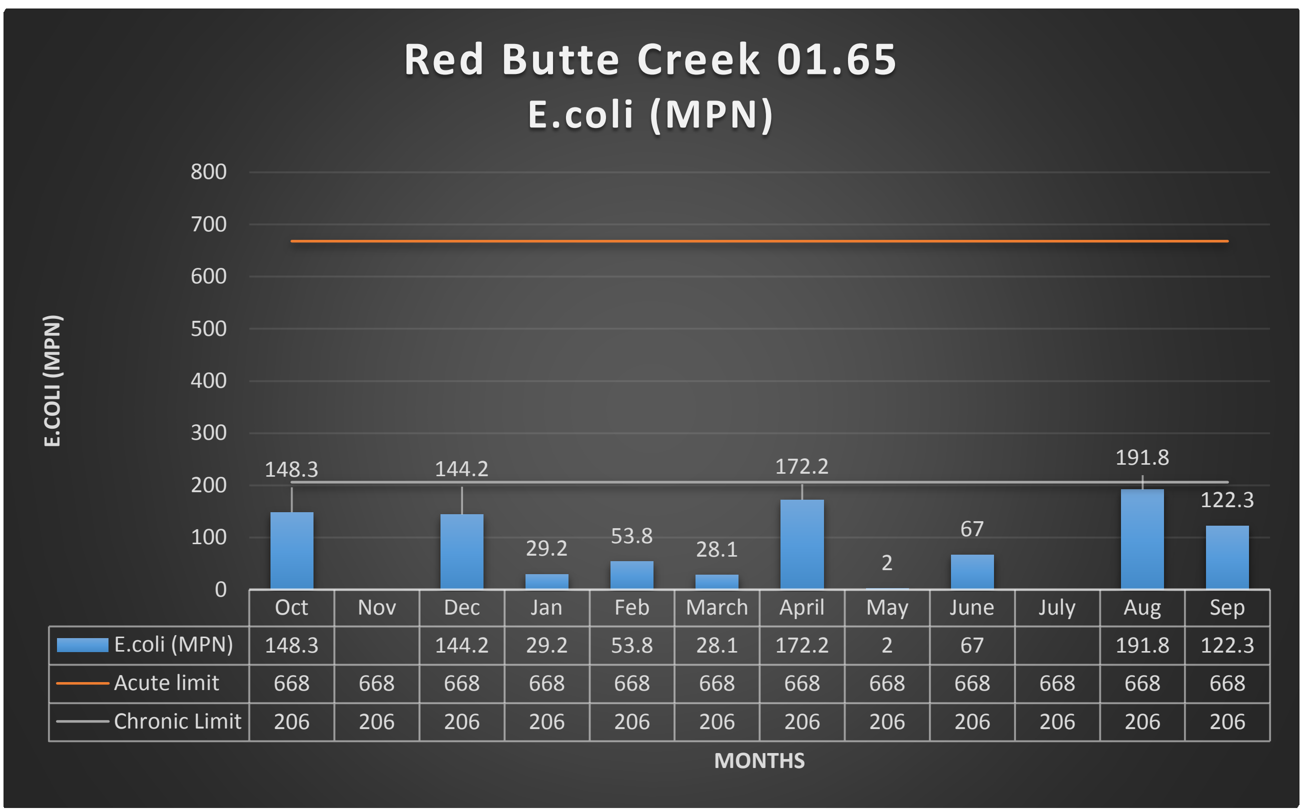


Figure 3-2 City Creek 03.65 E.coli



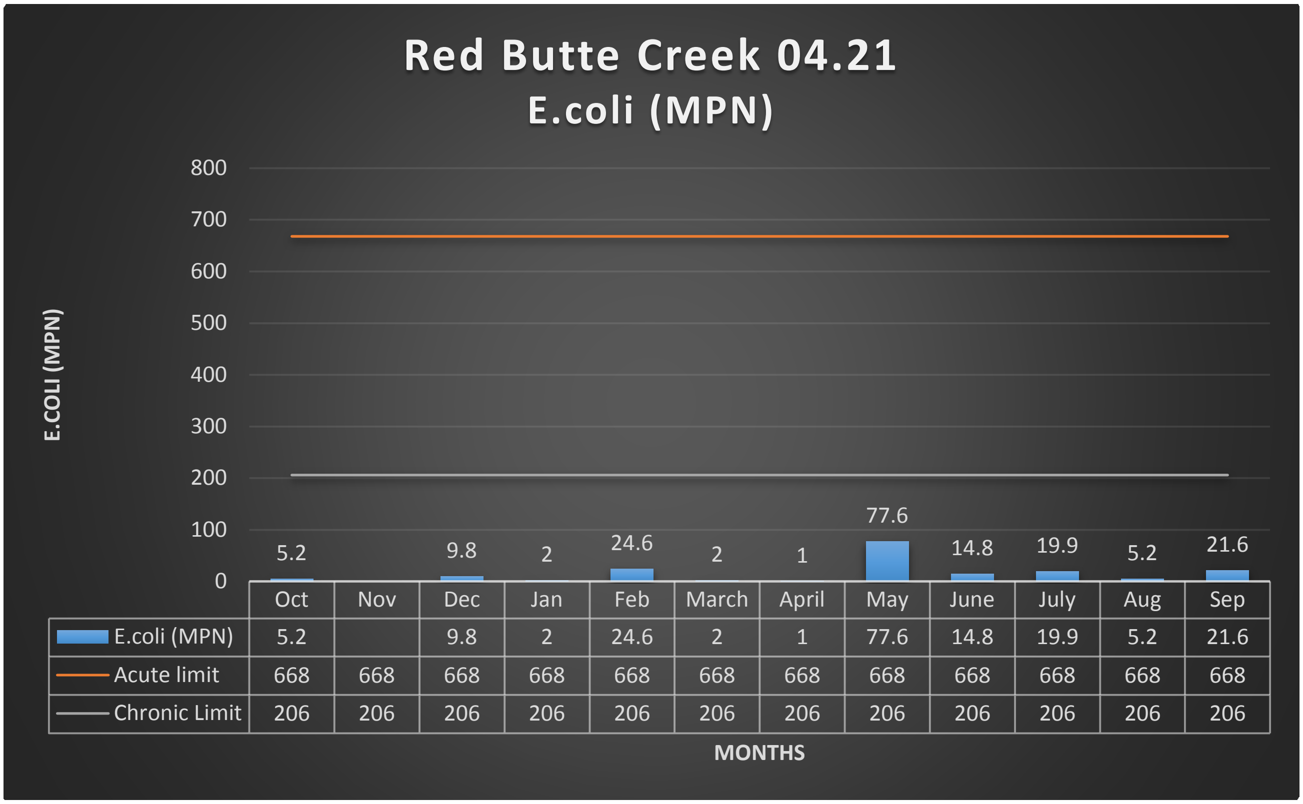
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
E.coli (MPN)	3		143	1	8.6	1	1	4.1	1	2	49.5	17.1
Acute limit	668	668	668	668	668	668	668	668	668	668	668	668
Chronic Limit	206	206	206	206	206	206	206	206	206	206	206	206

Figure 3-3 Red Butte Creek 01.65 E.coli



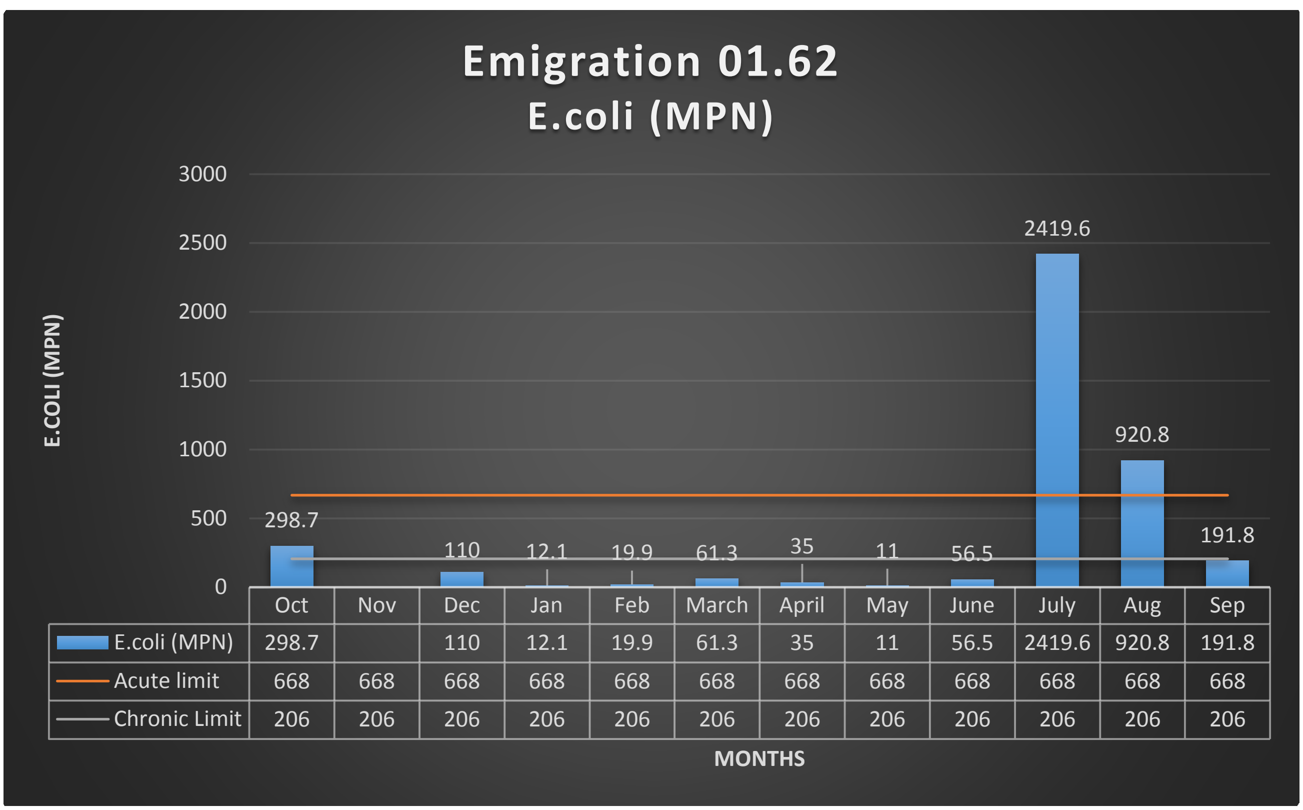
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
E.coli (MPN)	148.3		144.2	29.2	53.8	28.1	172.2	2	67		191.8	122.3
Acute limit	668	668	668	668	668	668	668	668	668	668	668	668
Chronic Limit	206	206	206	206	206	206	206	206	206	206	206	206

Figure 3-4 Red Butte Creek 04.21 E.coli



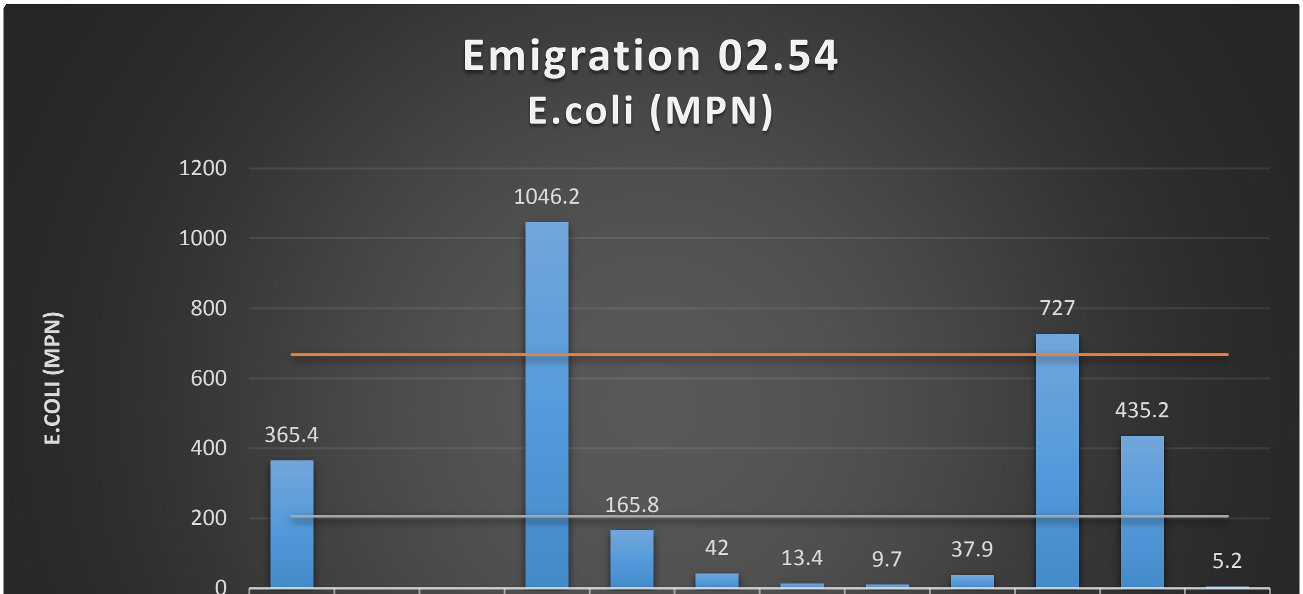
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
E.coli (MPN)	5.2		9.8	2	24.6	2	1	77.6	14.8	19.9	5.2	21.6
Acute limit	668	668	668	668	668	668	668	668	668	668	668	668
Chronic Limit	206	206	206	206	206	206	206	206	206	206	206	206

Figure 3-5 Emigration 01.62 E.coli



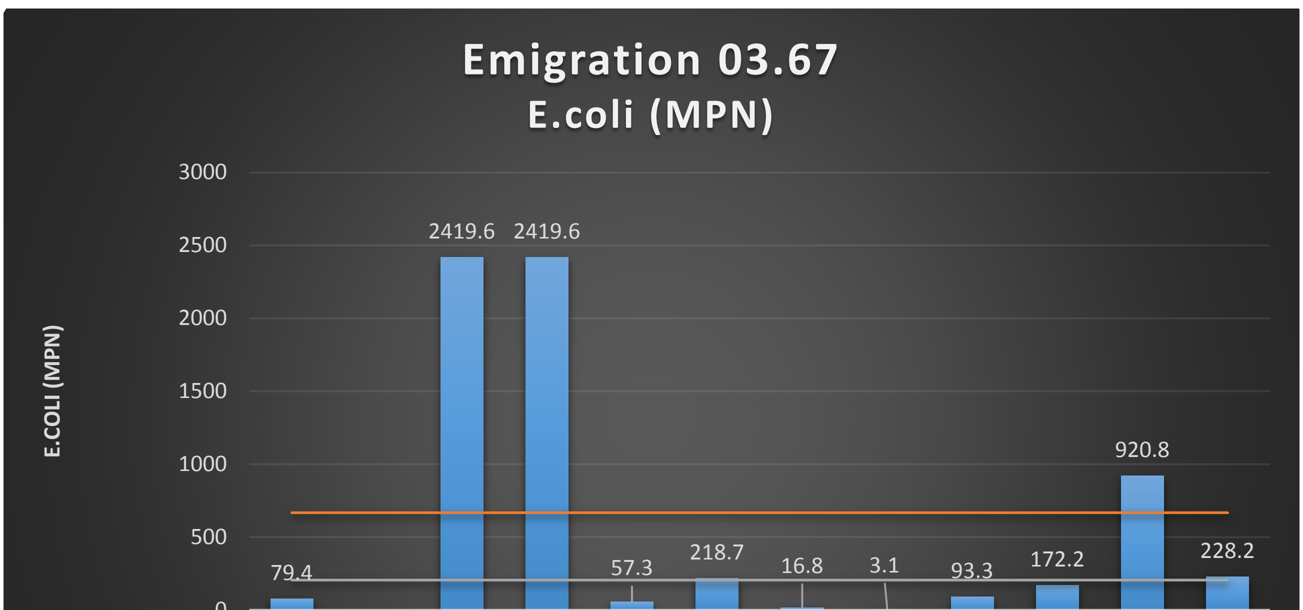
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
E.coli (MPN)	298.7		110	12.1	19.9	61.3	35	11	56.5	2419.6	920.8	191.8
Acute limit	668	668	668	668	668	668	668	668	668	668	668	668
Chronic Limit	206	206	206	206	206	206	206	206	206	206	206	206

Figure 3-6 Emigration 02.54 E.coli



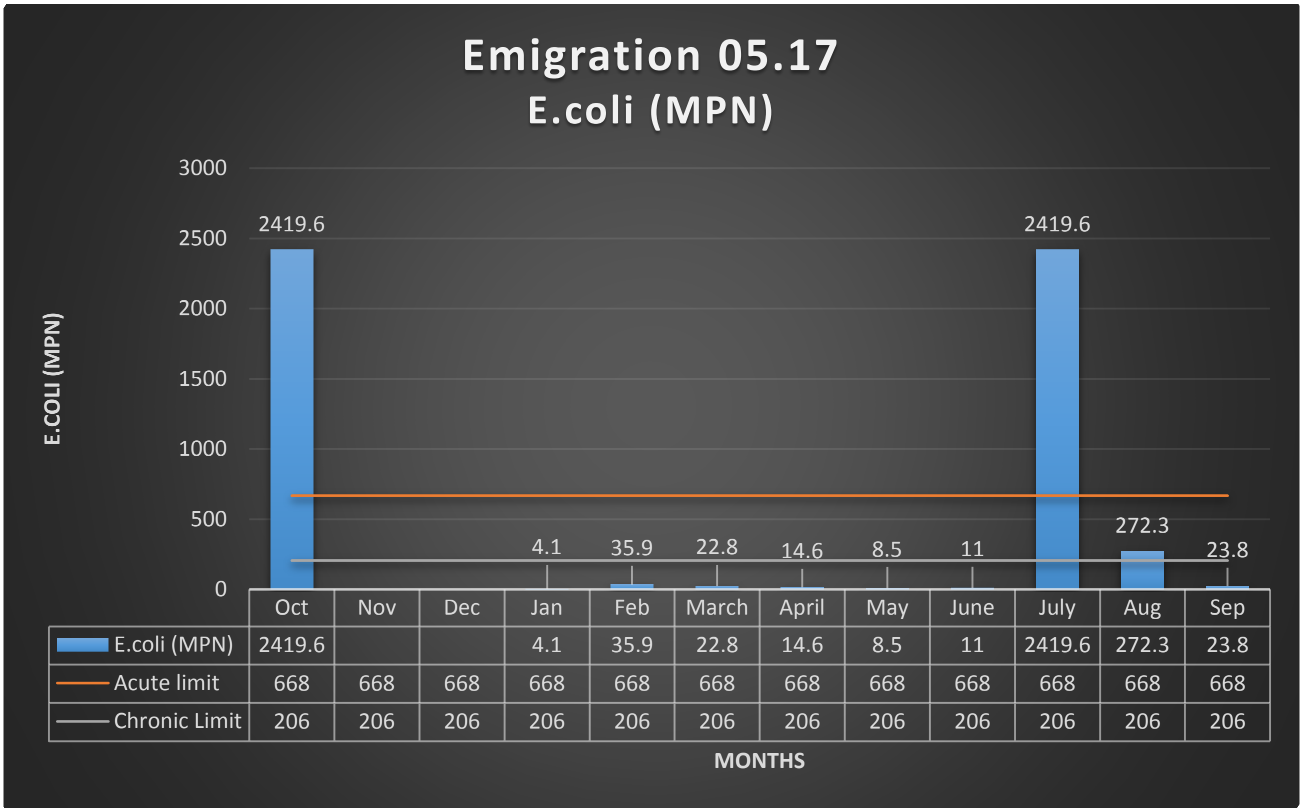
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
E.coli (MPN)	365.4			1046.2	165.8	42	13.4	9.7	37.9	727	435.2	5.2
Acute limit	668	668	668	668	668	668	668	668	668	668	668	668
Chronic Limit	206	206	206	206	206	206	206	206	206	206	206	206

Figure 3-7 Emigration 03.67 E.coli



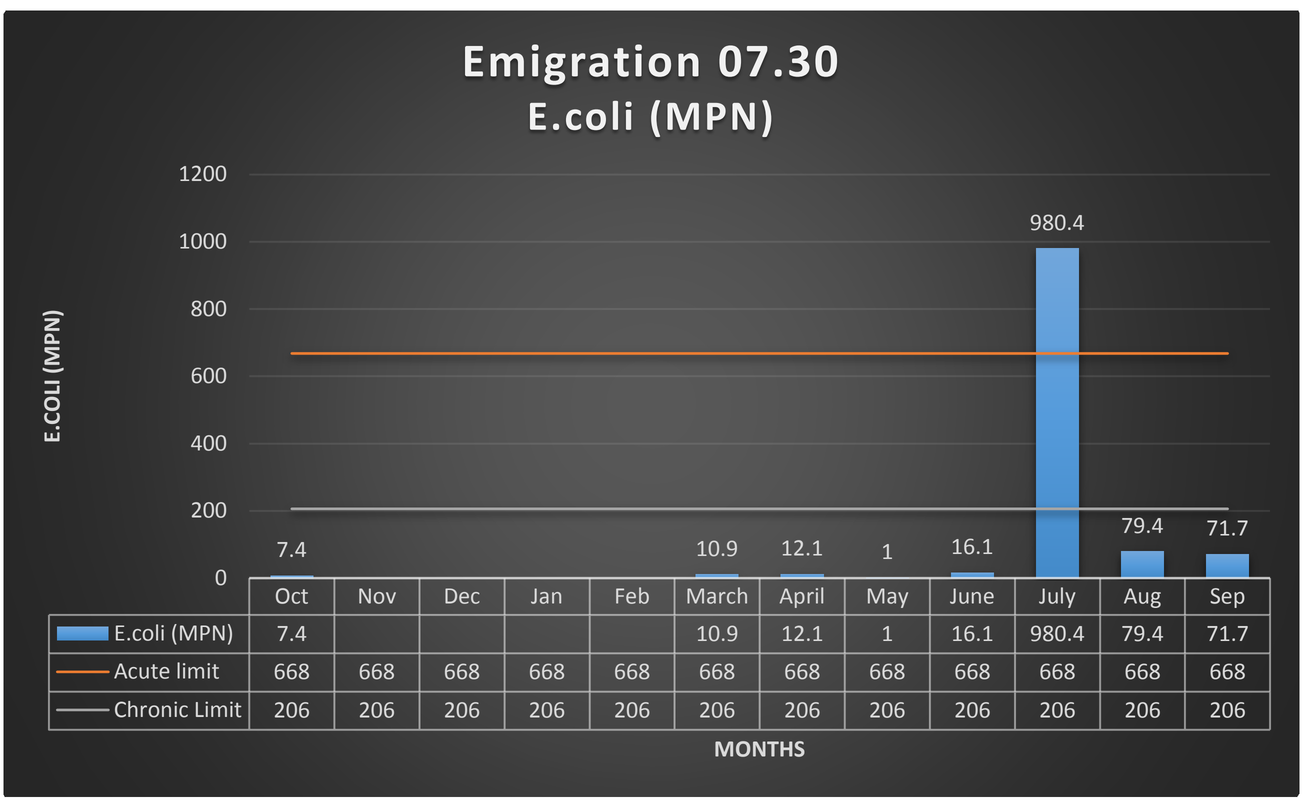
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
E.coli (MPN)	79.4		2419.6	2419.6	57.3	218.7	16.8	3.1	93.3	172.2	920.8	228.2
Acute limit	668	668	668	668	668	668	668	668	668	668	668	668
Chronic Limit	206	206	206	206	206	206	206	206	206	206	206	206

Figure 3-8 Emigration 05.17 E.coli



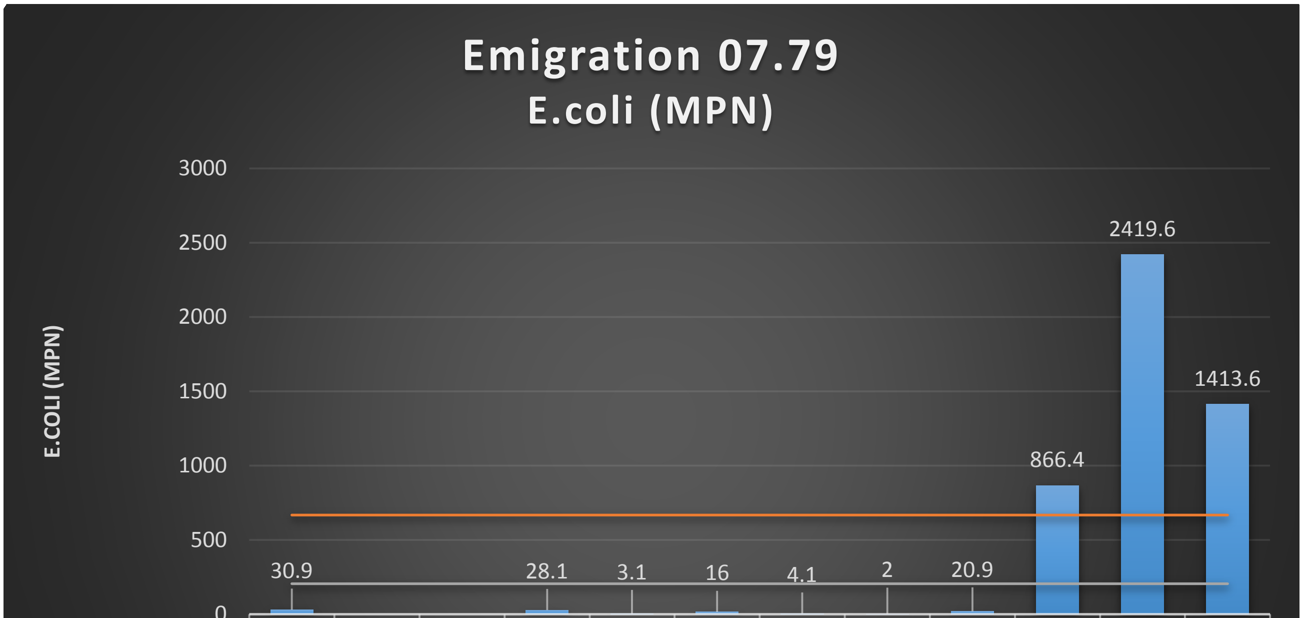
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
E.coli (MPN)	2419.6			4.1	35.9	22.8	14.6	8.5	11	2419.6	272.3	23.8
Acute limit	668	668	668	668	668	668	668	668	668	668	668	668
Chronic Limit	206	206	206	206	206	206	206	206	206	206	206	206

Figure 3-9 Emigration 07.30 E.coli



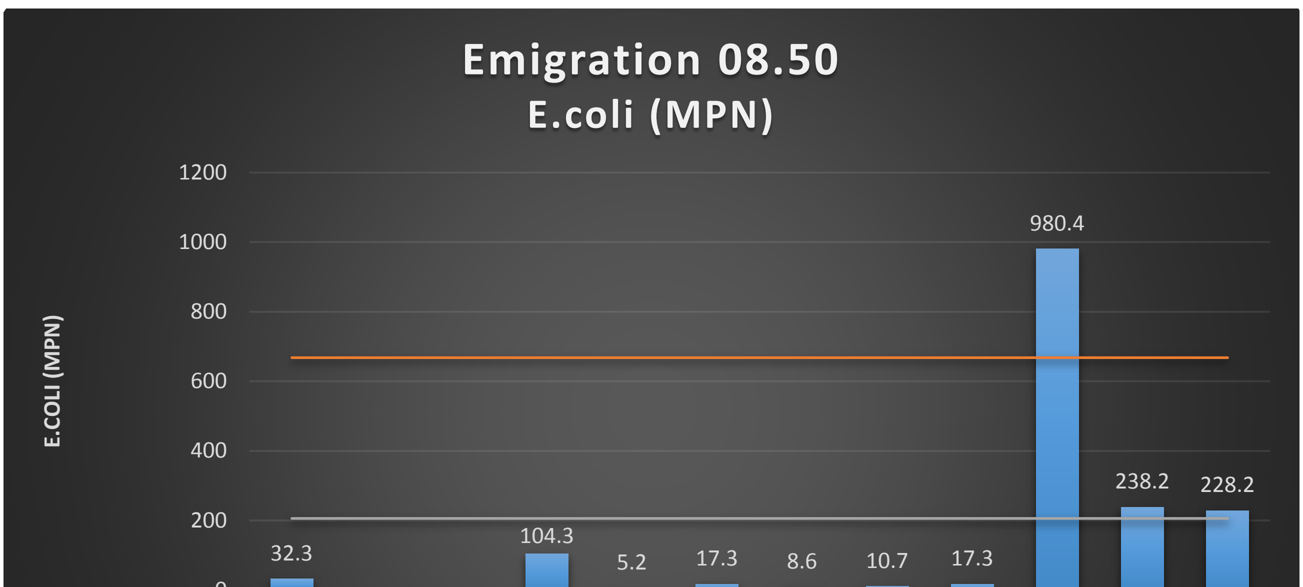
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
E.coli (MPN)	7.4					10.9	12.1	1	16.1	980.4	79.4	71.7
Acute limit	668	668	668	668	668	668	668	668	668	668	668	668
Chronic Limit	206	206	206	206	206	206	206	206	206	206	206	206

Figure 3-10 Emigration 07.79 E.coli



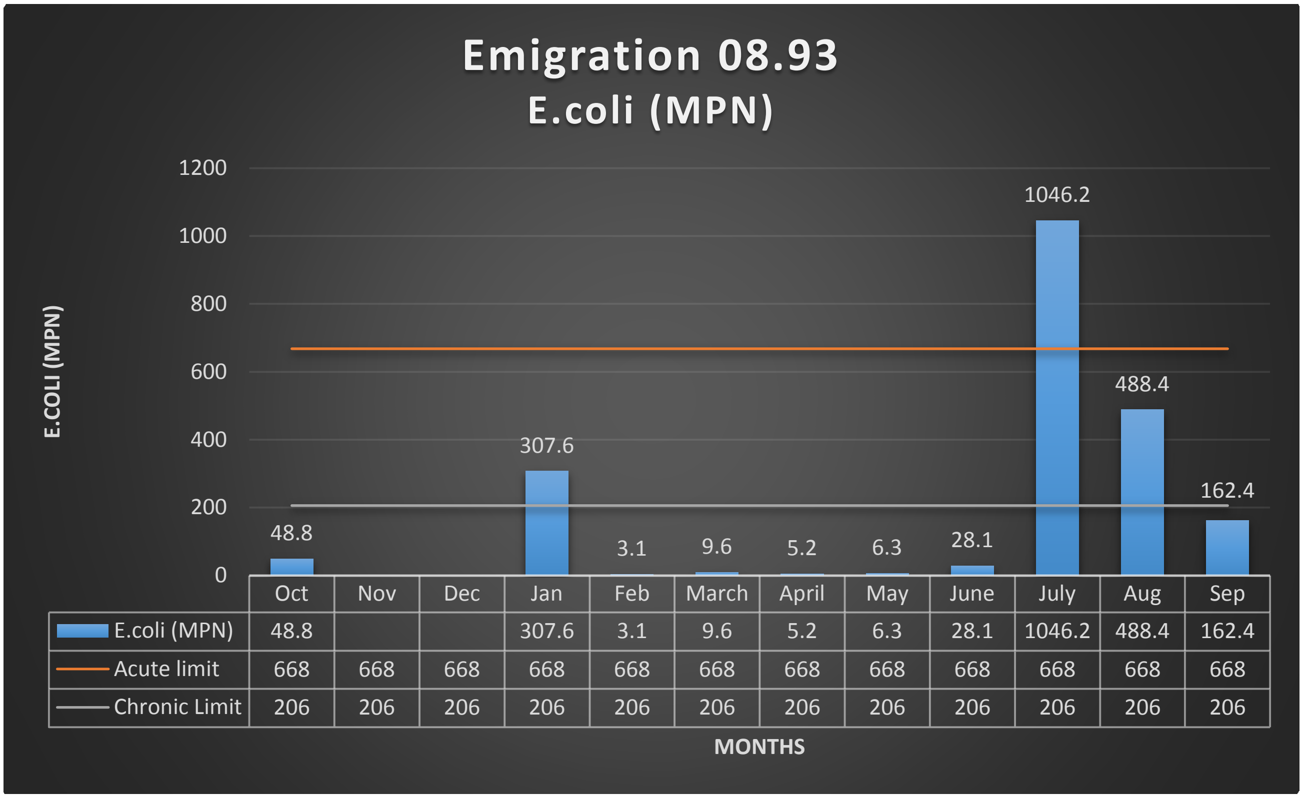
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
E.coli (MPN)	30.9			28.1	3.1	16	4.1	2	20.9	866.4	2419.6	1413.6
Acute limit	668	668	668	668	668	668	668	668	668	668	668	668
Chronic Limit	206	206	206	206	206	206	206	206	206	206	206	206

Figure 3-11 Emigration 08.50 E.coli



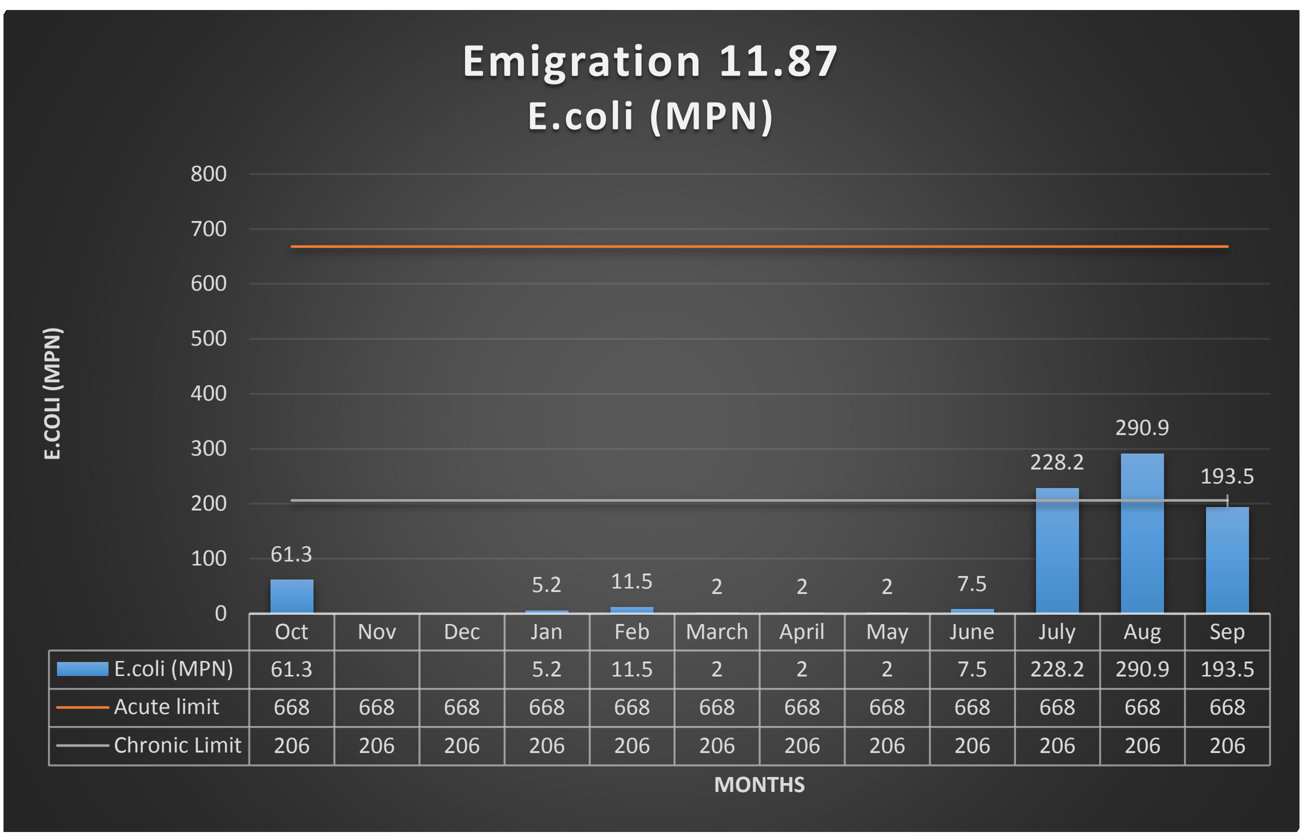
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
E.coli (MPN)	32.3			104.3	5.2	17.3	8.6	10.7	17.3	980.4	238.2	228.2
Acute limit	668	668	668	668	668	668	668	668	668	668	668	668
Chronic Limit	206	206	206	206	206	206	206	206	206	206	206	206

Figure 3-12 Emigration 08.93 E.coli



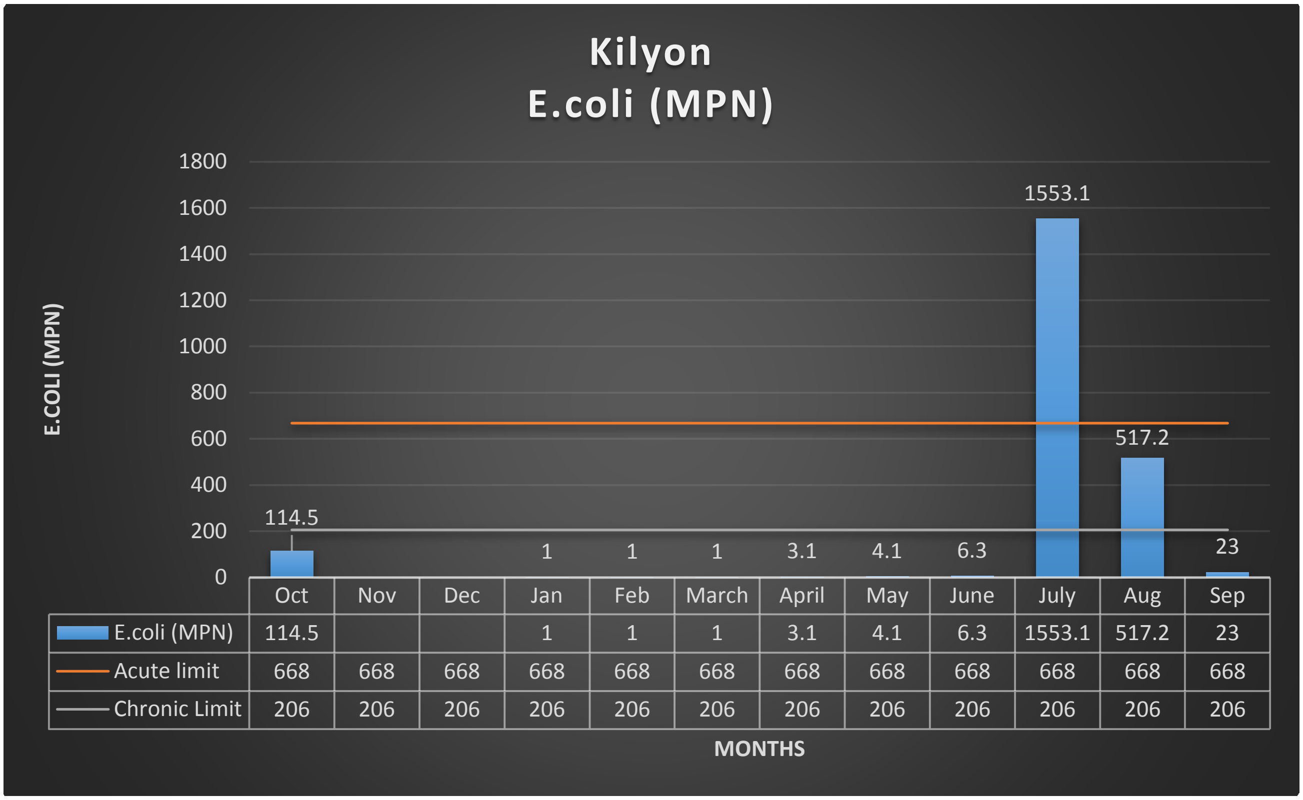
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
E.coli (MPN)	48.8			307.6	3.1	9.6	5.2	6.3	28.1	1046.2	488.4	162.4
Acute limit	668	668	668	668	668	668	668	668	668	668	668	668
Chronic Limit	206	206	206	206	206	206	206	206	206	206	206	206

Figure 3-13 Emigration 11.87 E.coli



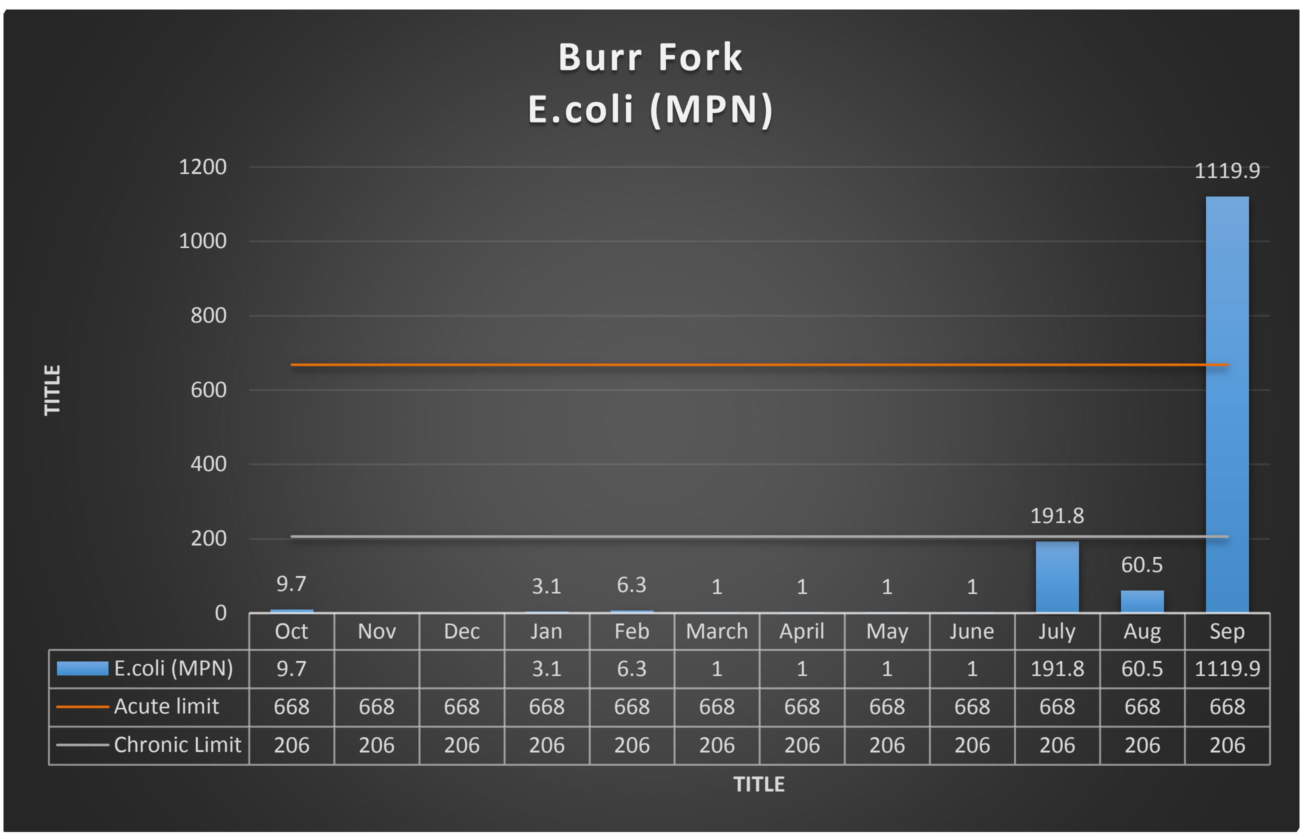
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
E.coli (MPN)	61.3			5.2	11.5	2	2	2	7.5	228.2	290.9	193.5
Acute limit	668	668	668	668	668	668	668	668	668	668	668	668
Chronic Limit	206	206	206	206	206	206	206	206	206	206	206	206

Figure 3-14 Kilyon E.coli



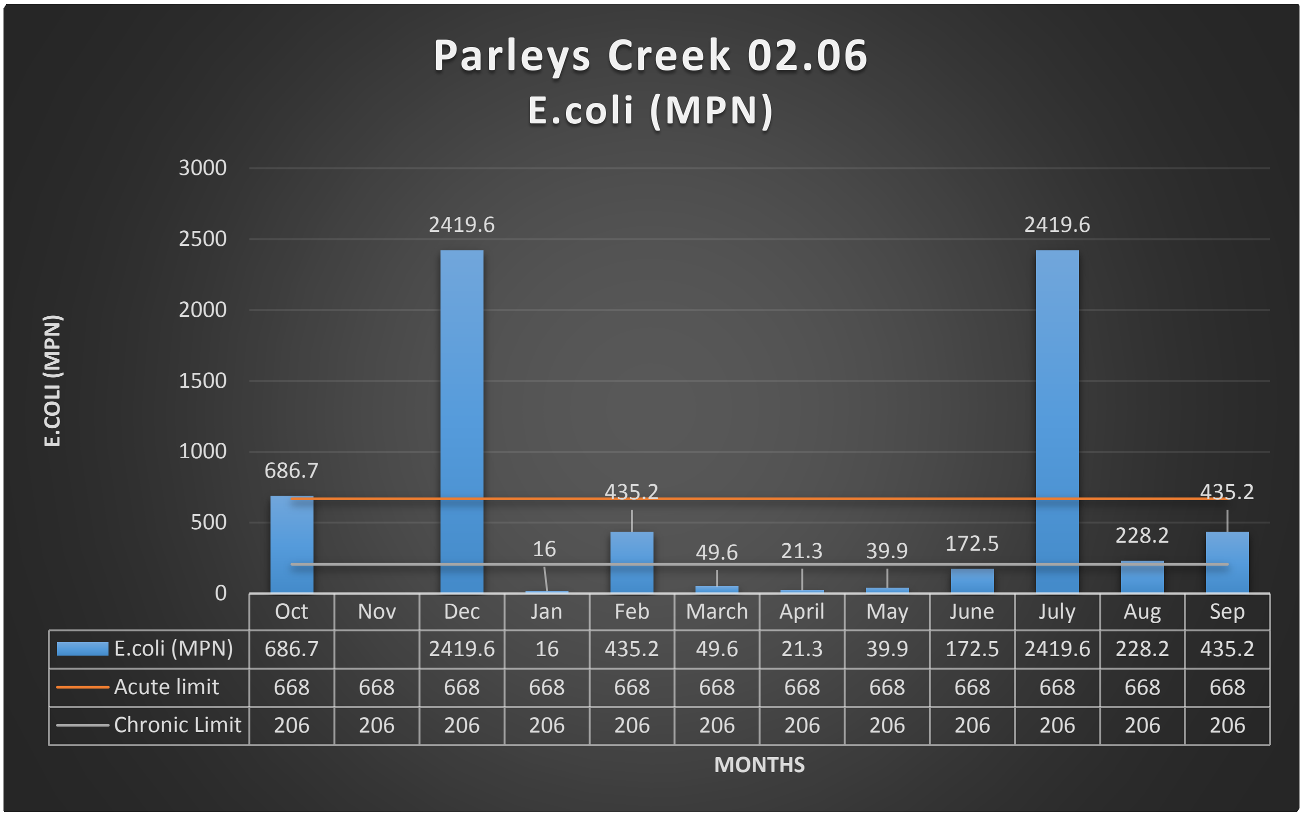
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
E.coli (MPN)	114.5			1	1	1	3.1	4.1	6.3	1553.1	517.2	23
Acute limit	668	668	668	668	668	668	668	668	668	668	668	668
Chronic Limit	206	206	206	206	206	206	206	206	206	206	206	206

Figure 3-15 Burr Fork E.coli



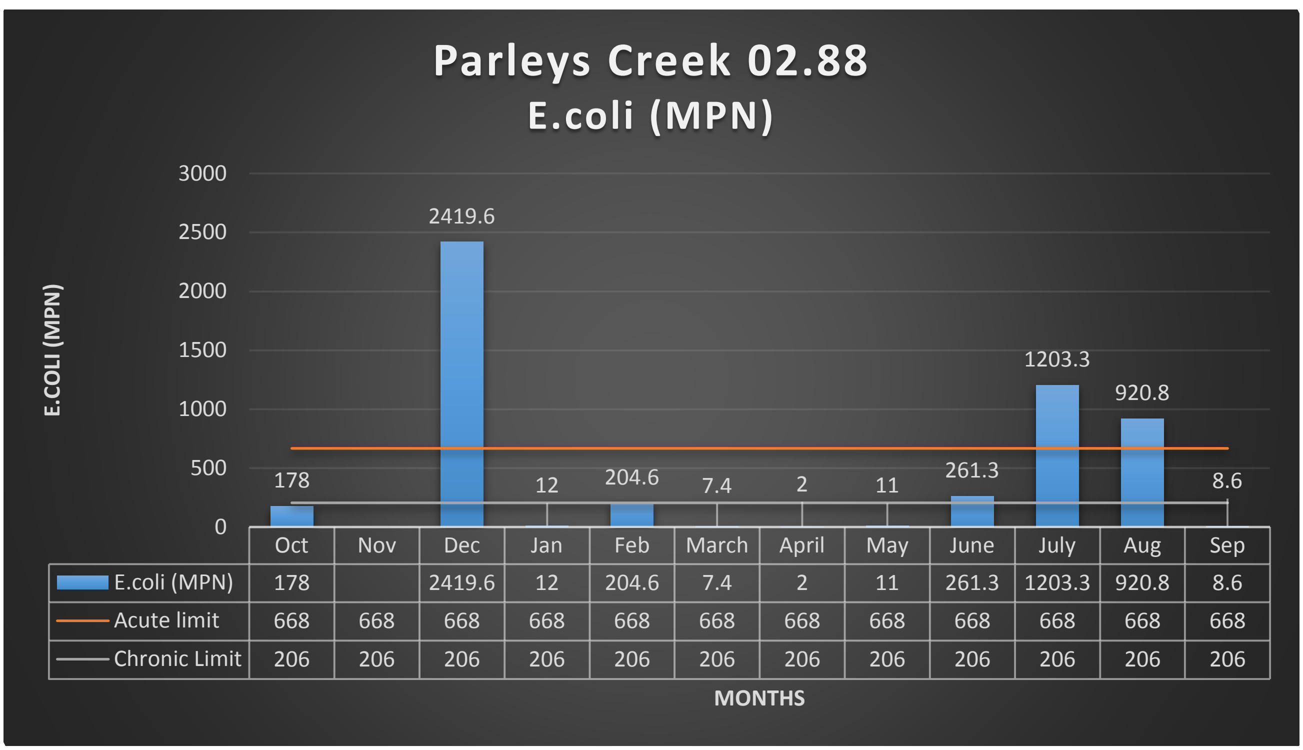
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
E.coli (MPN)	9.7			3.1	6.3	1	1	1	1	191.8	60.5	1119.9
Acute limit	668	668	668	668	668	668	668	668	668	668	668	668
Chronic Limit	206	206	206	206	206	206	206	206	206	206	206	206

Figure 3-16 Parleys 02.06 Creek E.coli



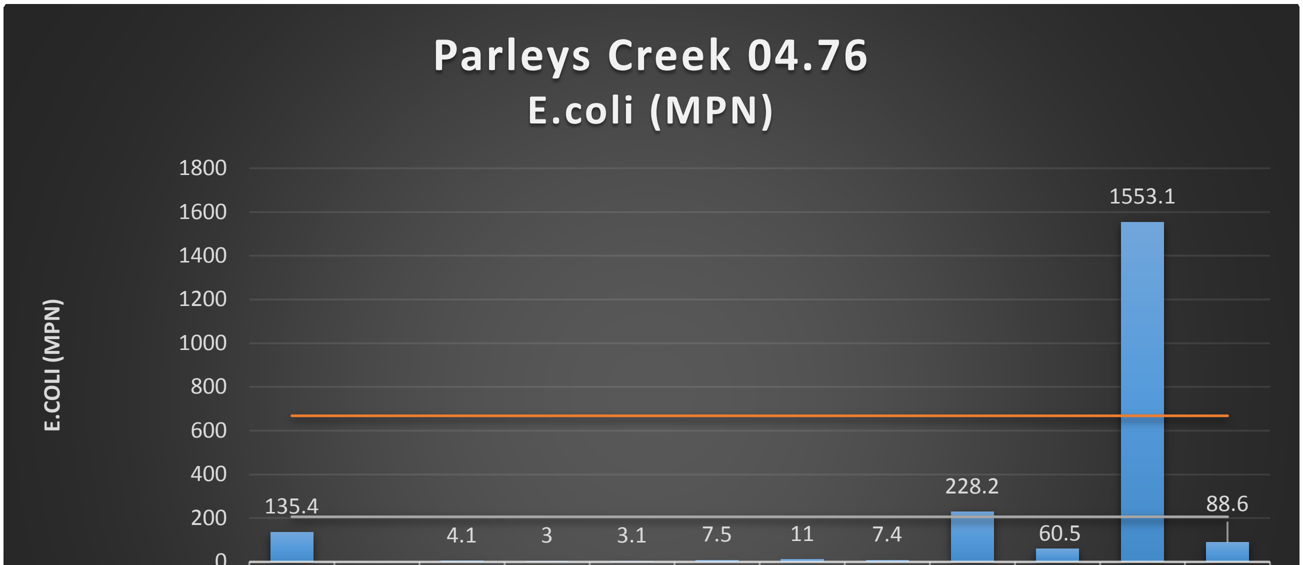
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
E.coli (MPN)	686.7		2419.6	16	435.2	49.6	21.3	39.9	172.5	2419.6	228.2	435.2
Acute limit	668	668	668	668	668	668	668	668	668	668	668	668
Chronic Limit	206	206	206	206	206	206	206	206	206	206	206	206

Figure 3-17 Parleys Creek 02.88 E.coli



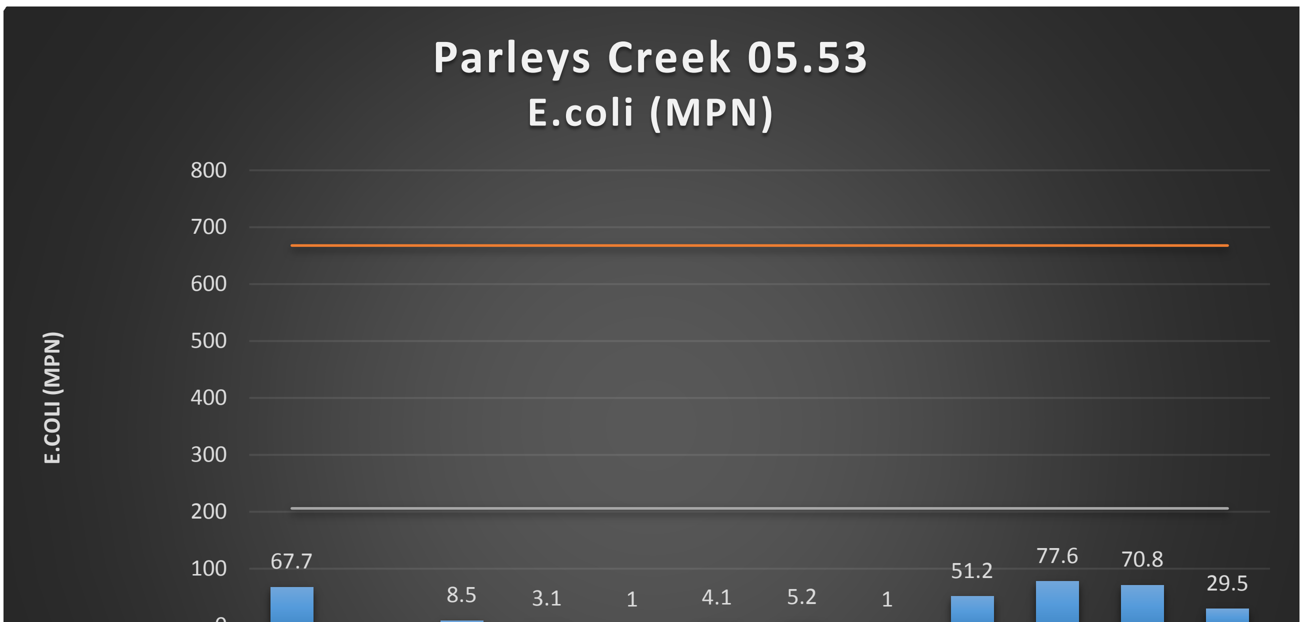
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
E.coli (MPN)	178		2419.6	12	204.6	7.4	2	11	261.3	1203.3	920.8	8.6
Acute limit	668	668	668	668	668	668	668	668	668	668	668	668
Chronic Limit	206	206	206	206	206	206	206	206	206	206	206	206

Figure 3-18 Parleys Creek 04.76 E.coli



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
E.coli (MPN)	135.4		4.1	3	3.1	7.5	11	7.4	228.2	60.5	1553.1	88.6
Acute limit	668	668	668	668	668	668	668	668	668	668	668	668
Chronic Limit	206	206	206	206	206	206	206	206	206	206	206	206

Figure 3-19 Parleys Creek 05.53 E.coli



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
E.coli (MPN)	67.7		8.5	3.1	1	4.1	5.2	1	51.2	77.6	70.8	29.5
Acute limit	668	668	668	668	668	668	668	668	668	668	668	668
Chronic Limit	206	206	206	206	206	206	206	206	206	206	206	206

SALT LAKE COUNTY WATERSHED

Figure 3-20 Parleys Creek 05.79 E.coli

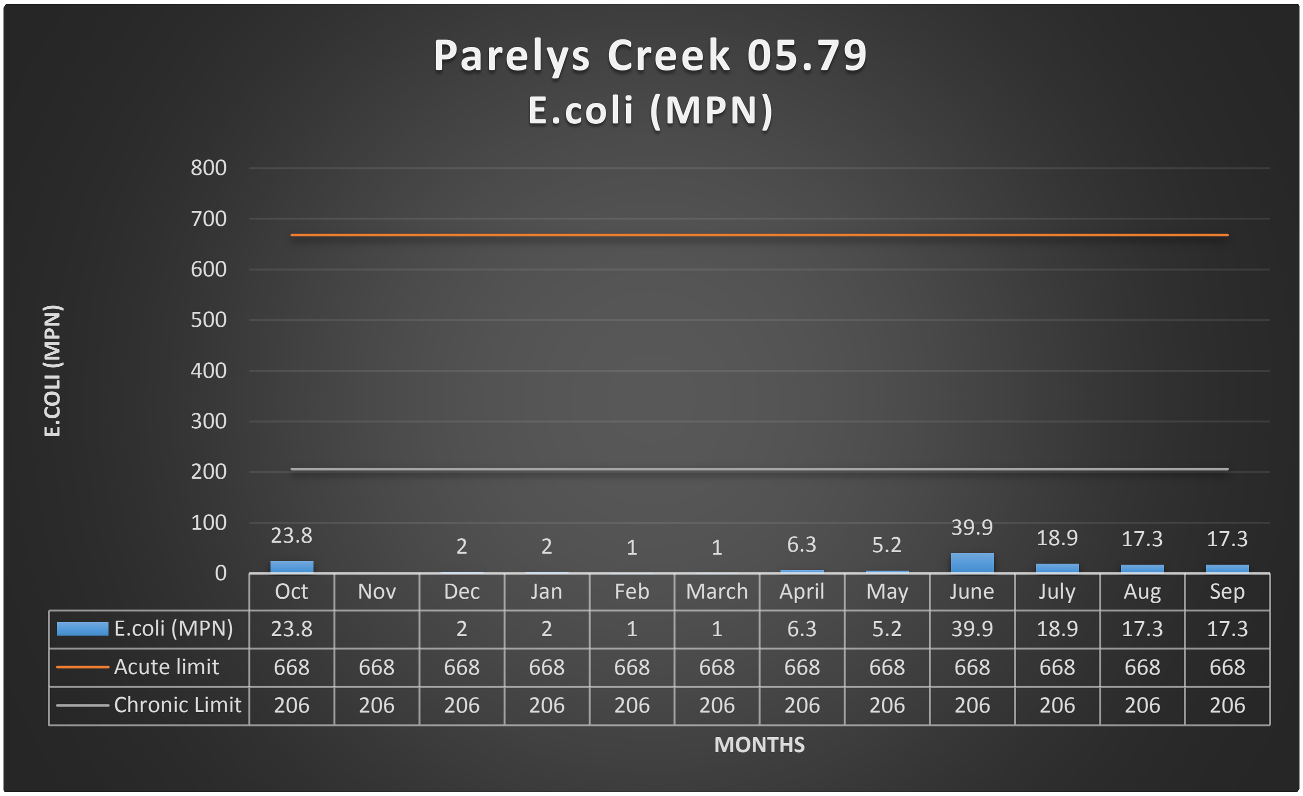


Figure 3-21 Parleys Creek 14.40 E.coli

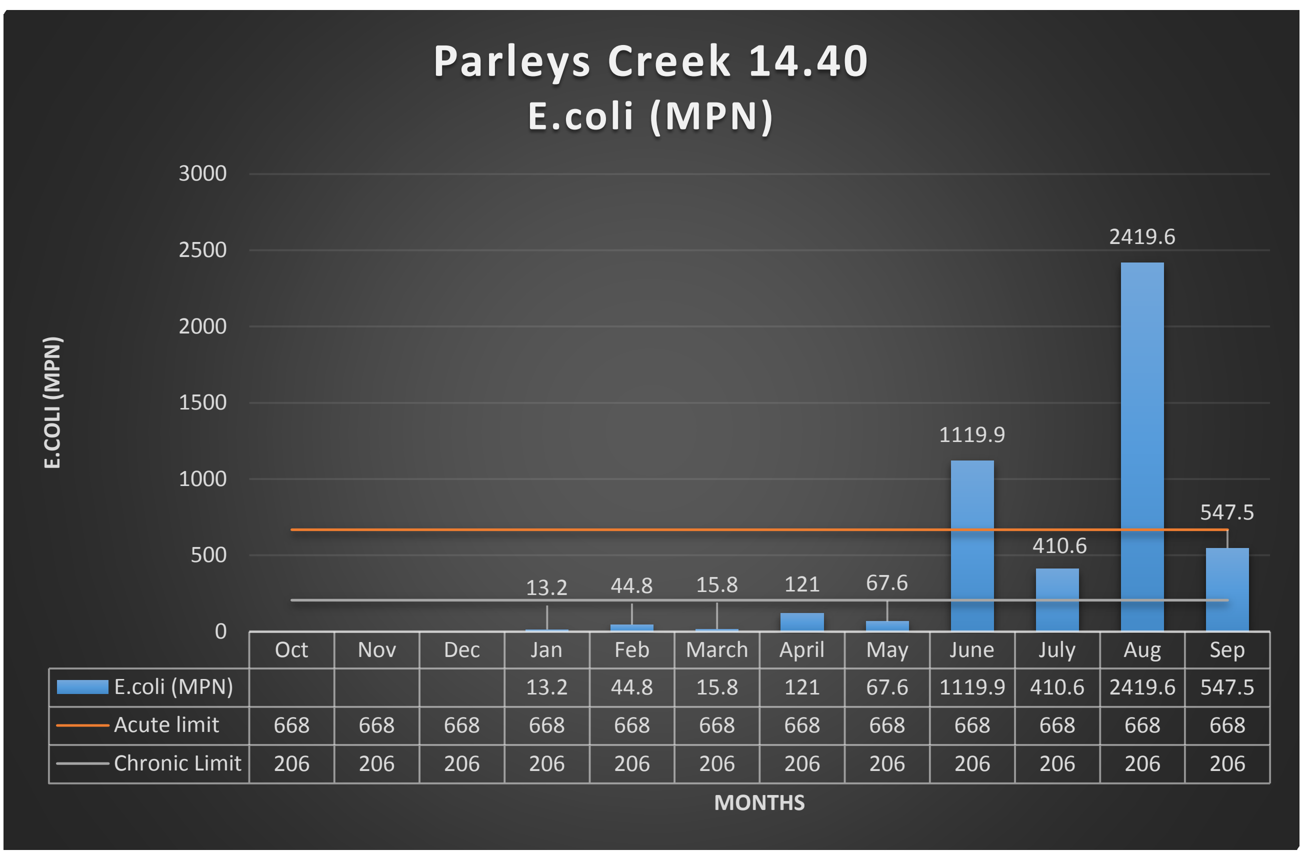
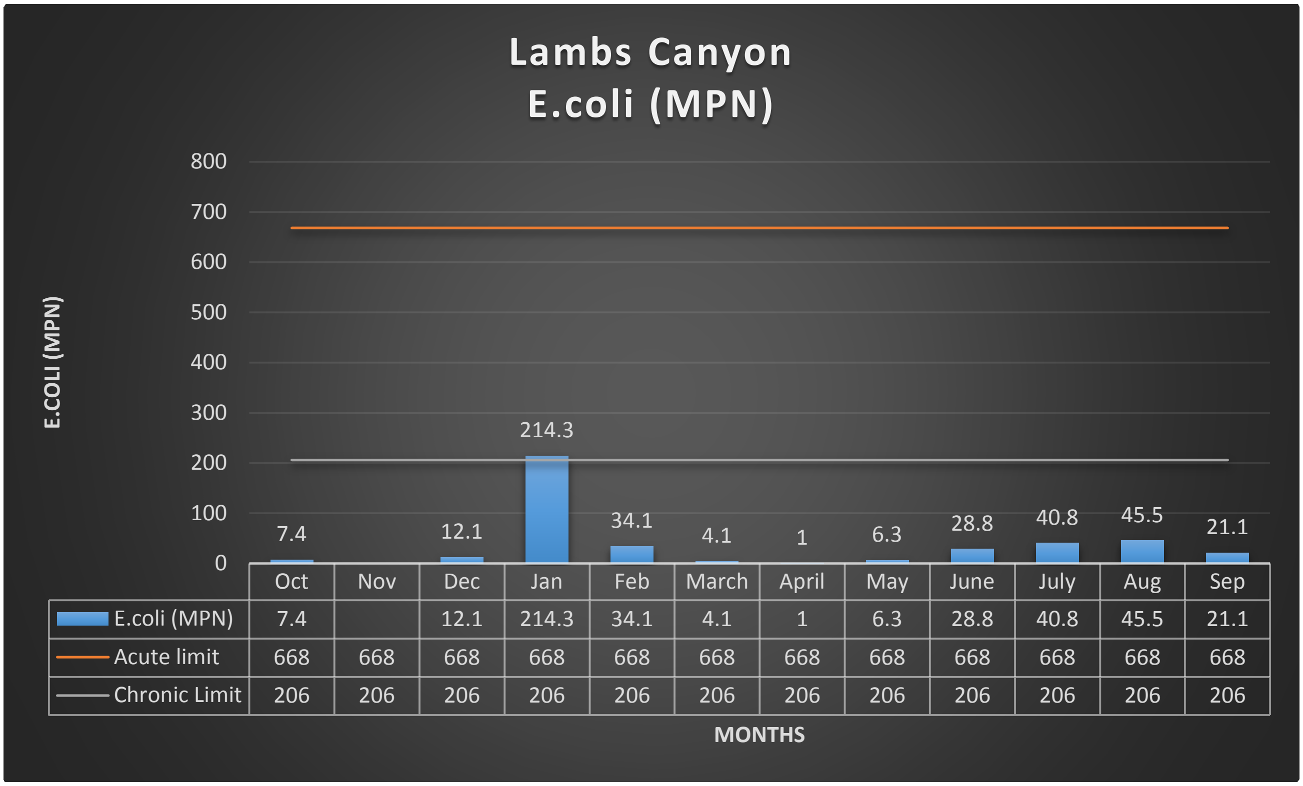
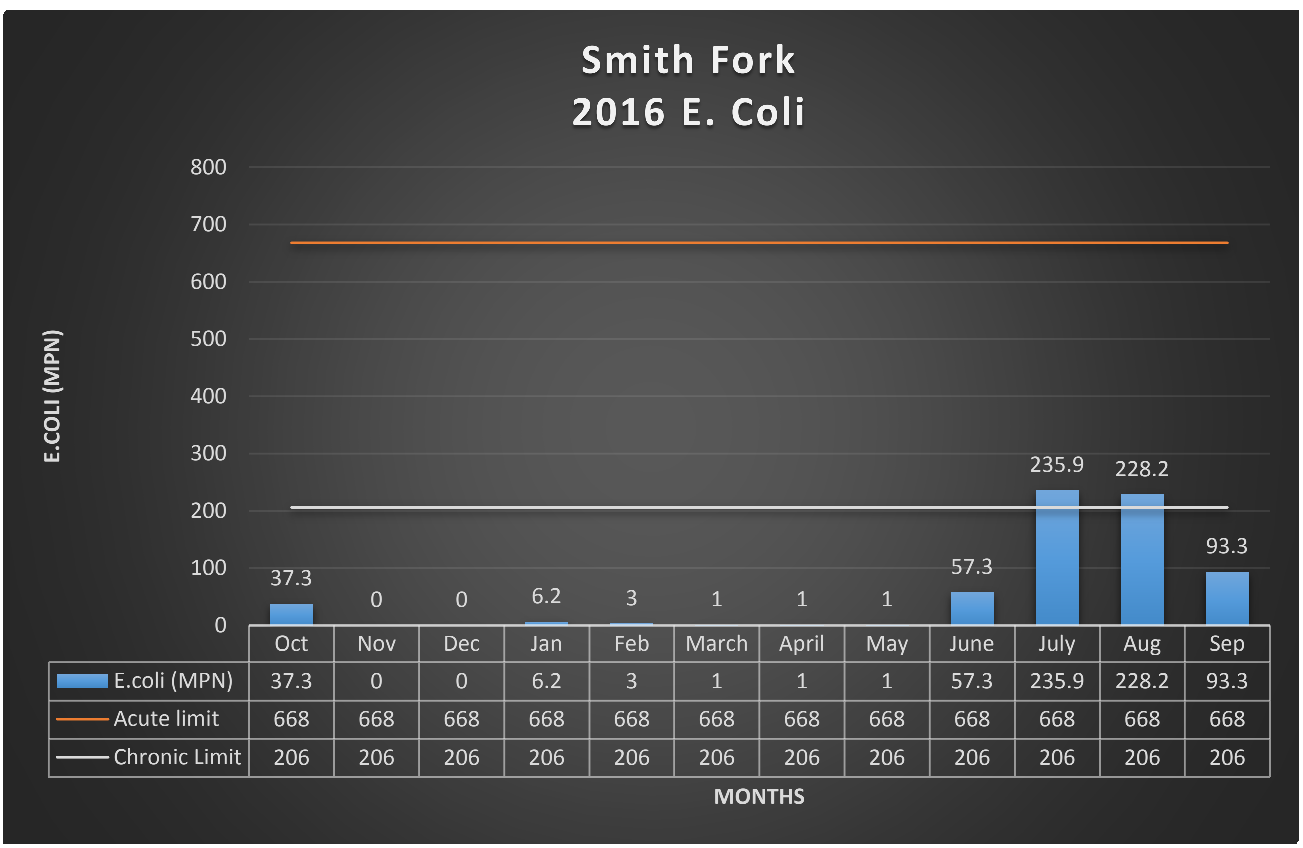


Figure 3-22 Lambs Canyon E.coli



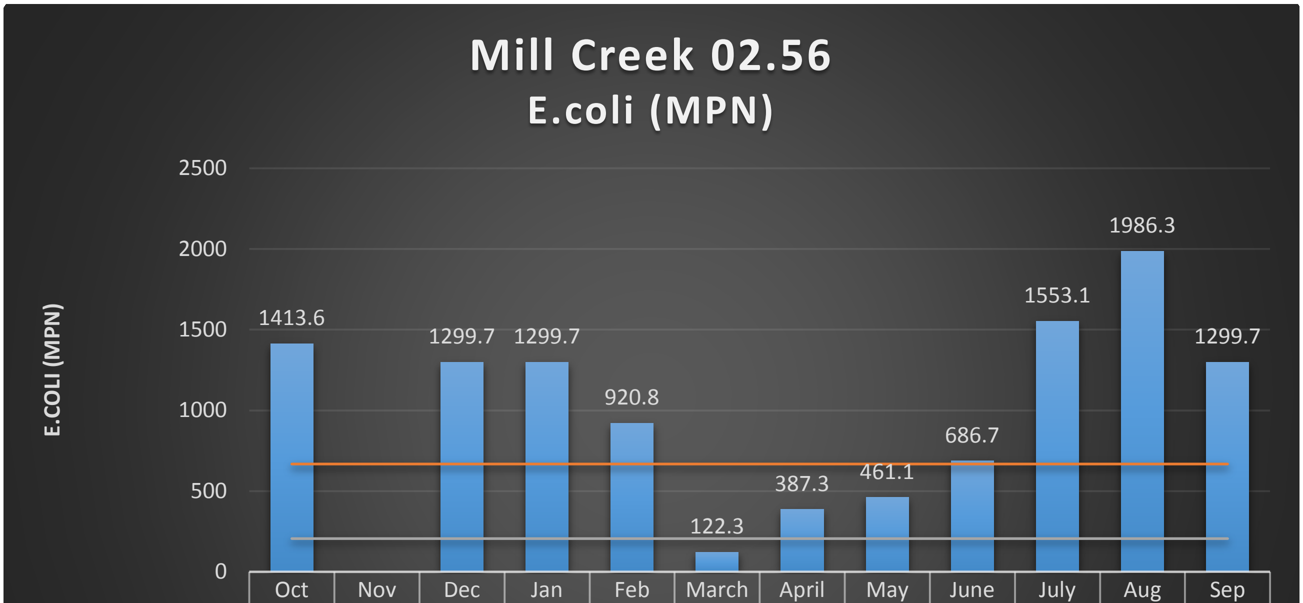
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
E.coli (MPN)	7.4		12.1	214.3	34.1	4.1	1	6.3	28.8	40.8	45.5	21.1
Acute limit	668	668	668	668	668	668	668	668	668	668	668	668
Chronic Limit	206	206	206	206	206	206	206	206	206	206	206	206

Figure 3-23 Smith Fork E.coli



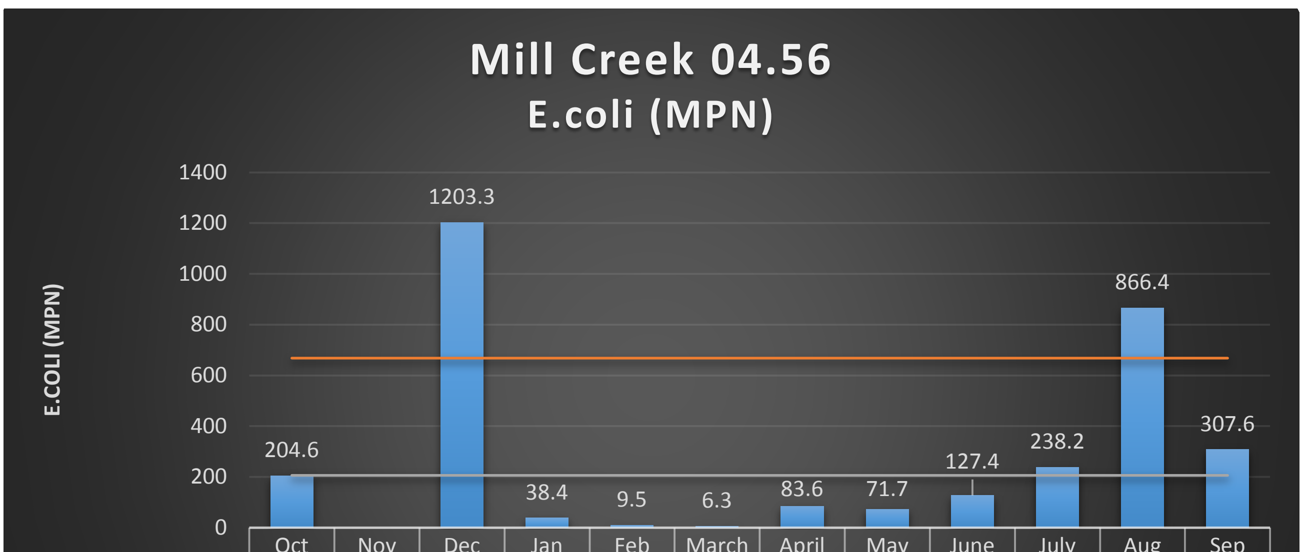
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
E.coli (MPN)	37.3	0	0	6.2	3	1	1	1	57.3	235.9	228.2	93.3
Acute limit	668	668	668	668	668	668	668	668	668	668	668	668
Chronic Limit	206	206	206	206	206	206	206	206	206	206	206	206

Figure 3-24 Mill Creek 02.56 E.coli



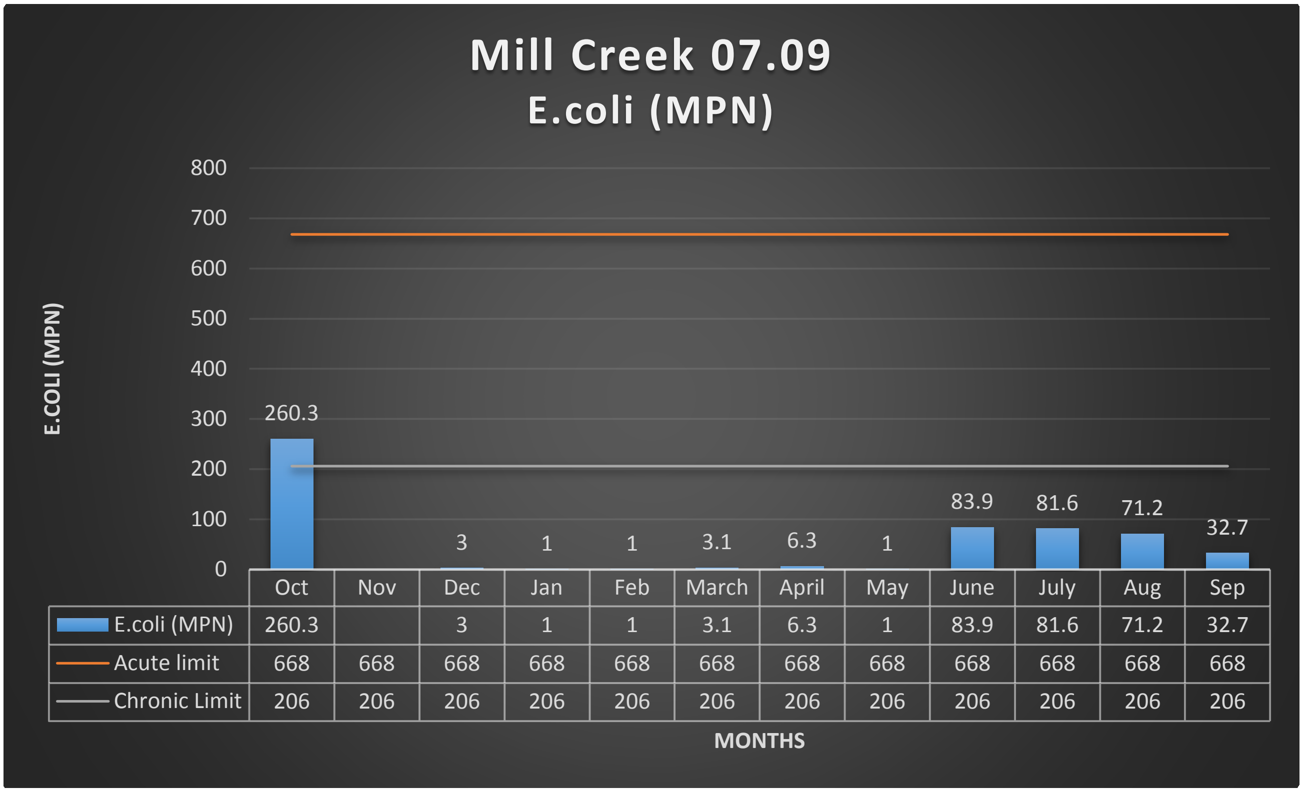
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
E.coli (MPN)	1413.6		1299.7	1299.7	920.8	122.3	387.3	461.1	686.7	1553.1	1986.3	1299.7
Acute limit	668	668	668	668	668	668	668	668	668	668	668	668
Chronic Limit	206	206	206	206	206	206	206	206	206	206	206	206

Figure 3-25 Mill Creek 04.56 E.coli



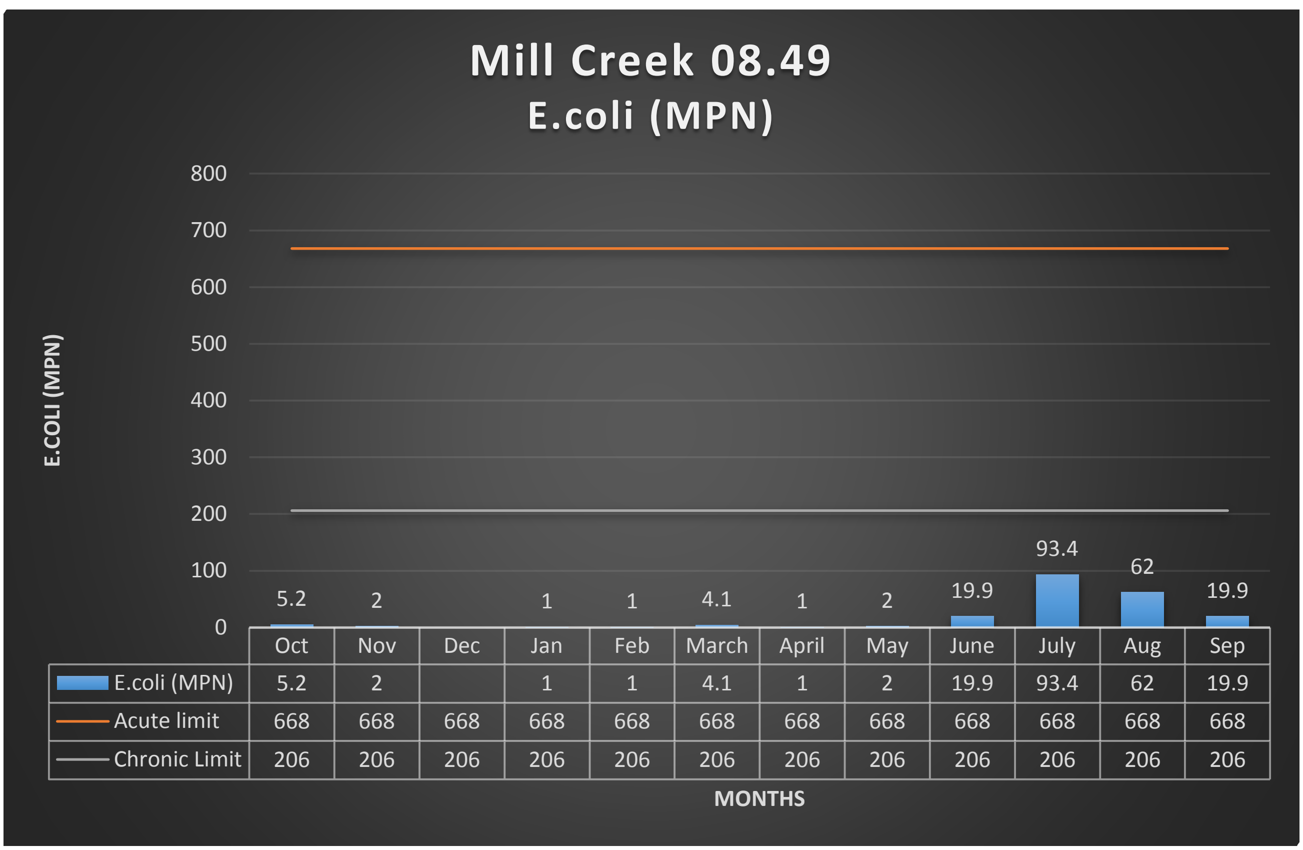
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
E.coli (MPN)	204.6		1203.3	38.4	9.5	6.3	83.6	71.7	127.4	238.2	866.4	307.6
Acute limit	668	668	668	668	668	668	668	668	668	668	668	668
Chronic Limit	206	206	206	206	206	206	206	206	206	206	206	206

Figure 3-26 Mill Creek 07.09 E.coli



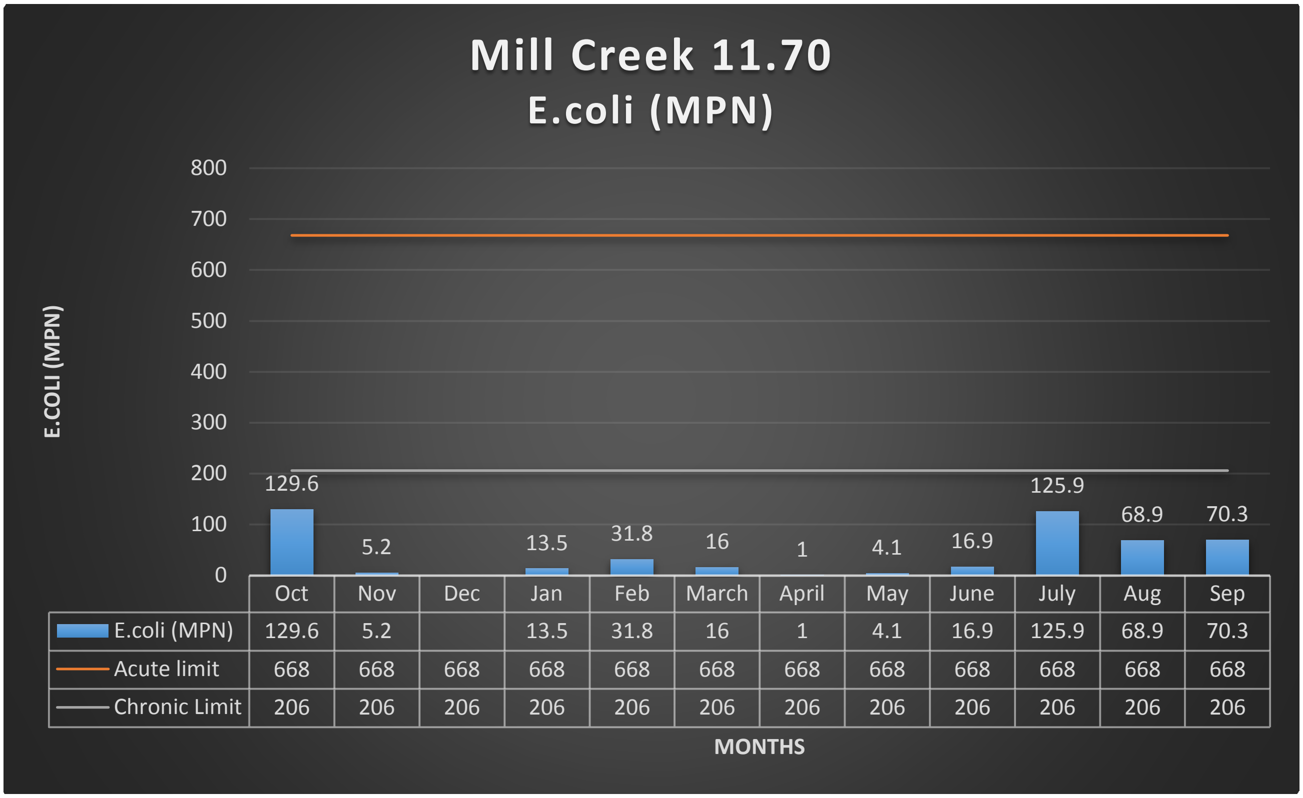
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
E.coli (MPN)	260.3		3	1	1	3.1	6.3	1	83.9	81.6	71.2	32.7
Acute limit	668	668	668	668	668	668	668	668	668	668	668	668
Chronic Limit	206	206	206	206	206	206	206	206	206	206	206	206

Figure 3-27 Mill Creek 08.49 E.coli



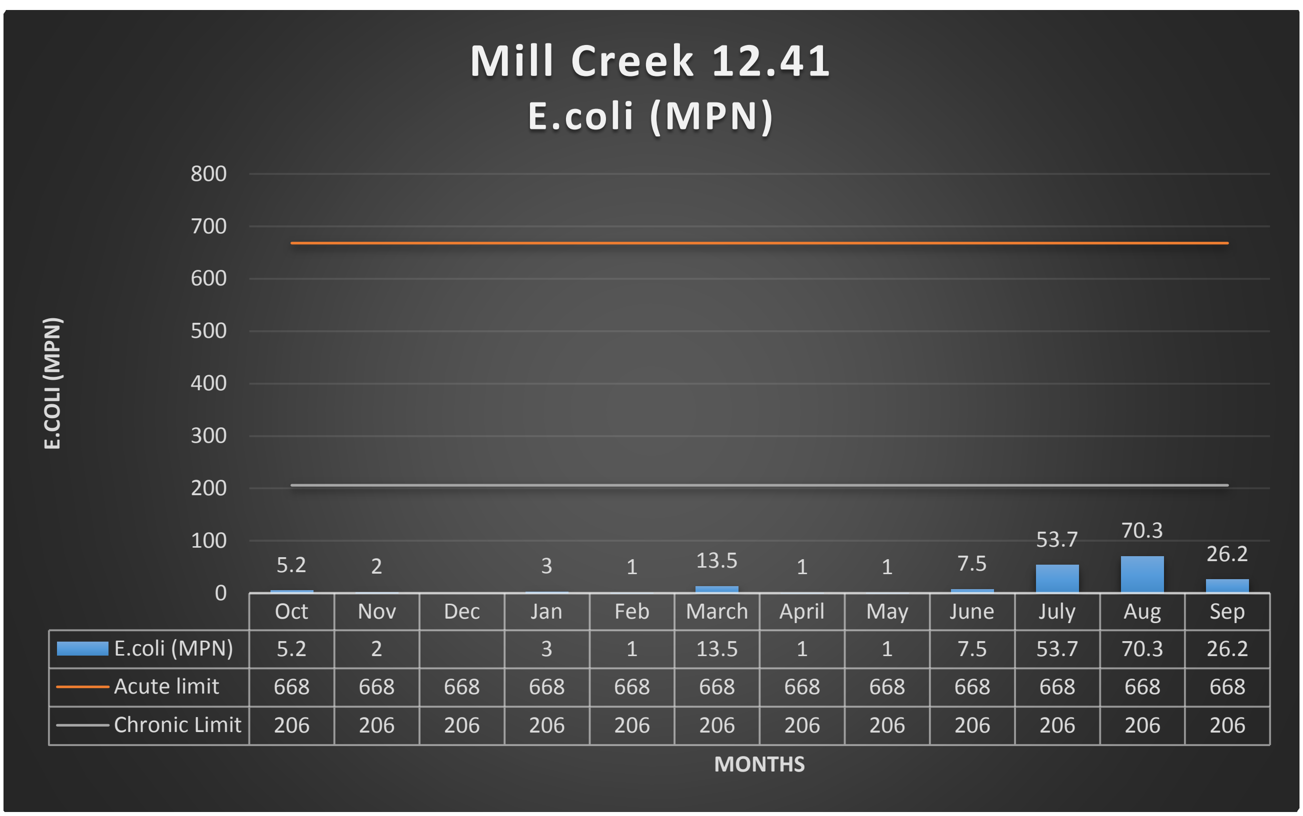
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
E.coli (MPN)	5.2	2		1	1	4.1	1	2	19.9	93.4	62	19.9
Acute limit	668	668	668	668	668	668	668	668	668	668	668	668
Chronic Limit	206	206	206	206	206	206	206	206	206	206	206	206

Figure 3-28 Mill Creek 11.70 E.coli



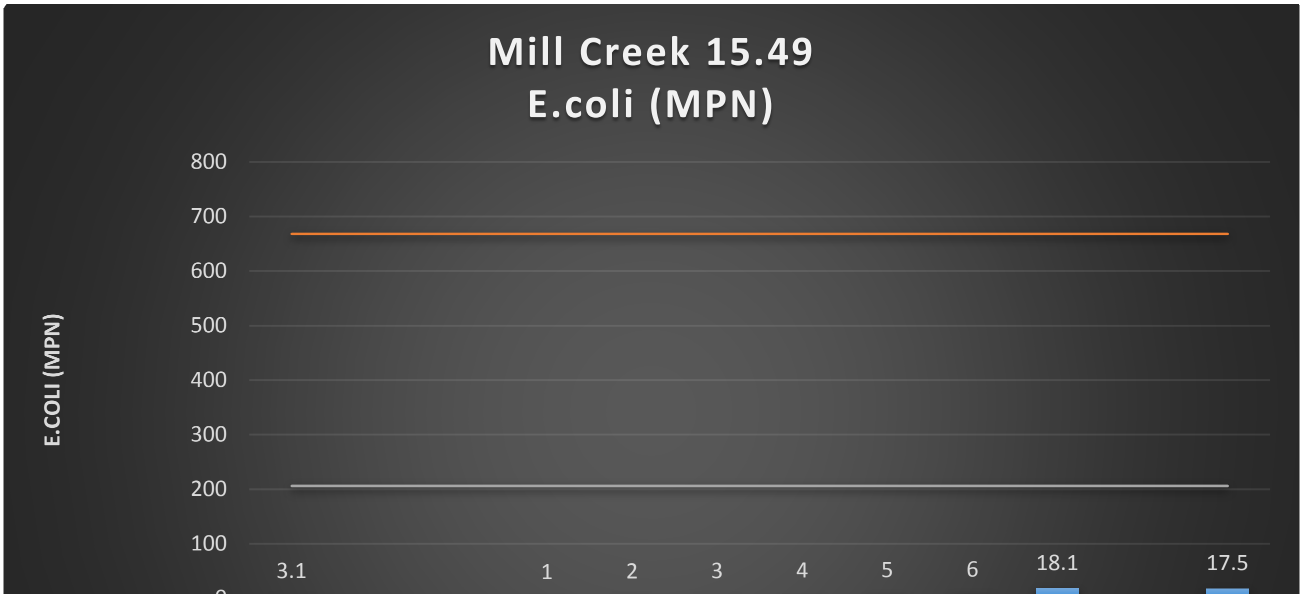
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
E.coli (MPN)	129.6	5.2		13.5	31.8	16	1	4.1	16.9	125.9	68.9	70.3
Acute limit	668	668	668	668	668	668	668	668	668	668	668	668
Chronic Limit	206	206	206	206	206	206	206	206	206	206	206	206

Figure 3-29 Mill Creek 12.41 E.coli



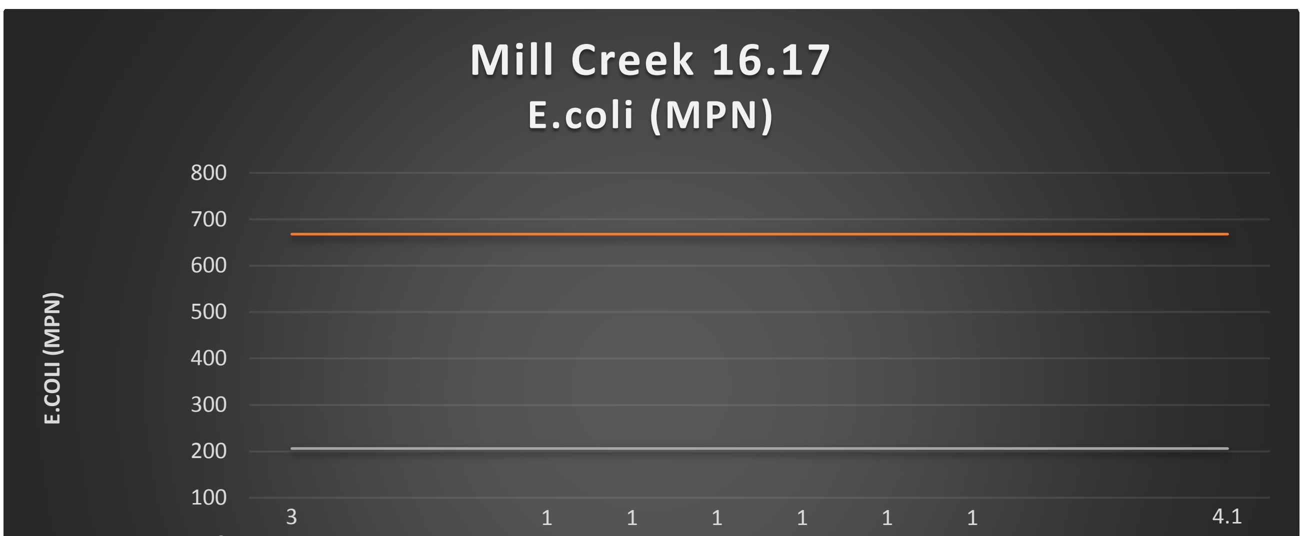
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
E.coli (MPN)	5.2	2		3	1	13.5	1	1	7.5	53.7	70.3	26.2
Acute limit	668	668	668	668	668	668	668	668	668	668	668	668
Chronic Limit	206	206	206	206	206	206	206	206	206	206	206	206

Figure 3-30 Mill Creek 15.49 E.coli



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
E.coli (MPN)	3.1			1	2	3	4	5	6	18.1		17.5
Acute limit	668	668	668	668	668	668	668	668	668	668	668	668
Chronic Limit	206	206	206	206	206	206	206	206	206	206	206	206

Figure 3-31 Mill Creek 16.17 E.coli



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
E.coli (MPN)	3			1	1	1	1	1	1			4.1
Acute limit	668	668	668	668	668	668	668	668	668	668	668	668
Chronic Limit	206	206	206	206	206	206	206	206	206	206	206	206

Figure 3-32 Porter Fork E.coli

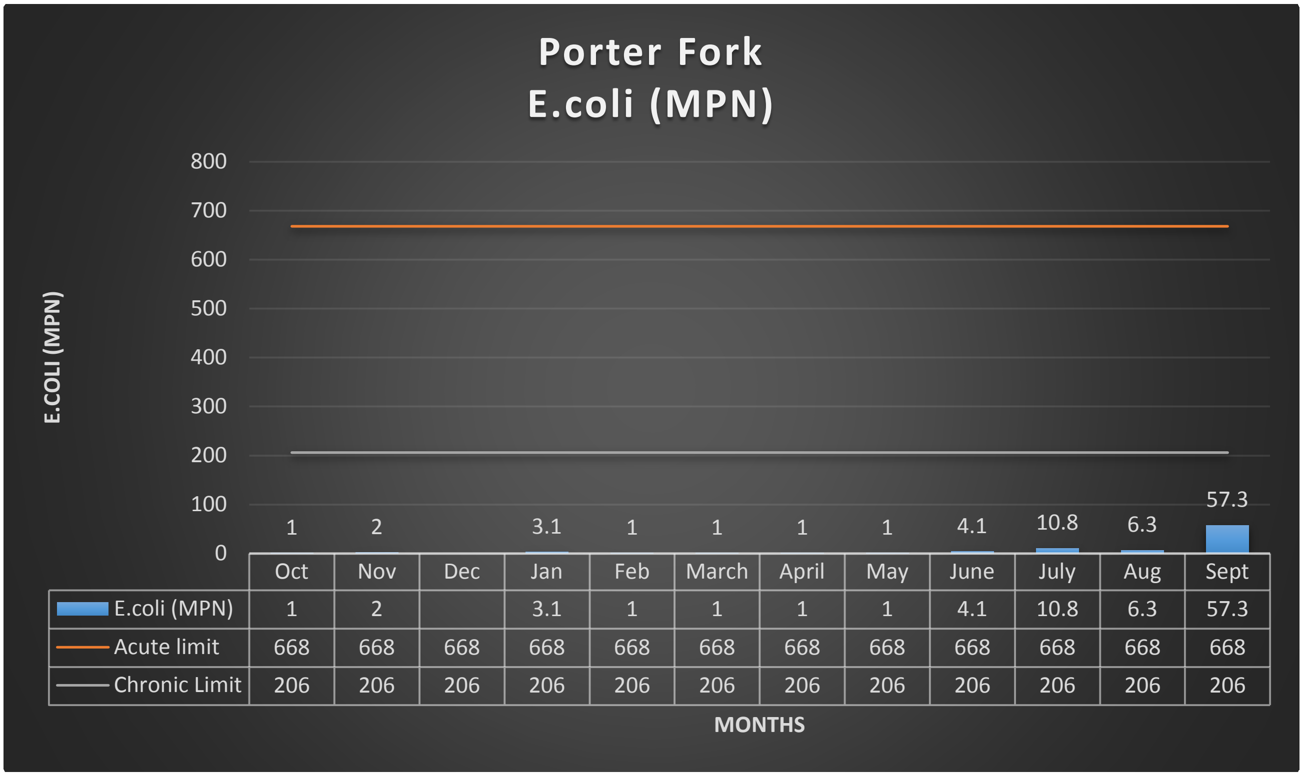
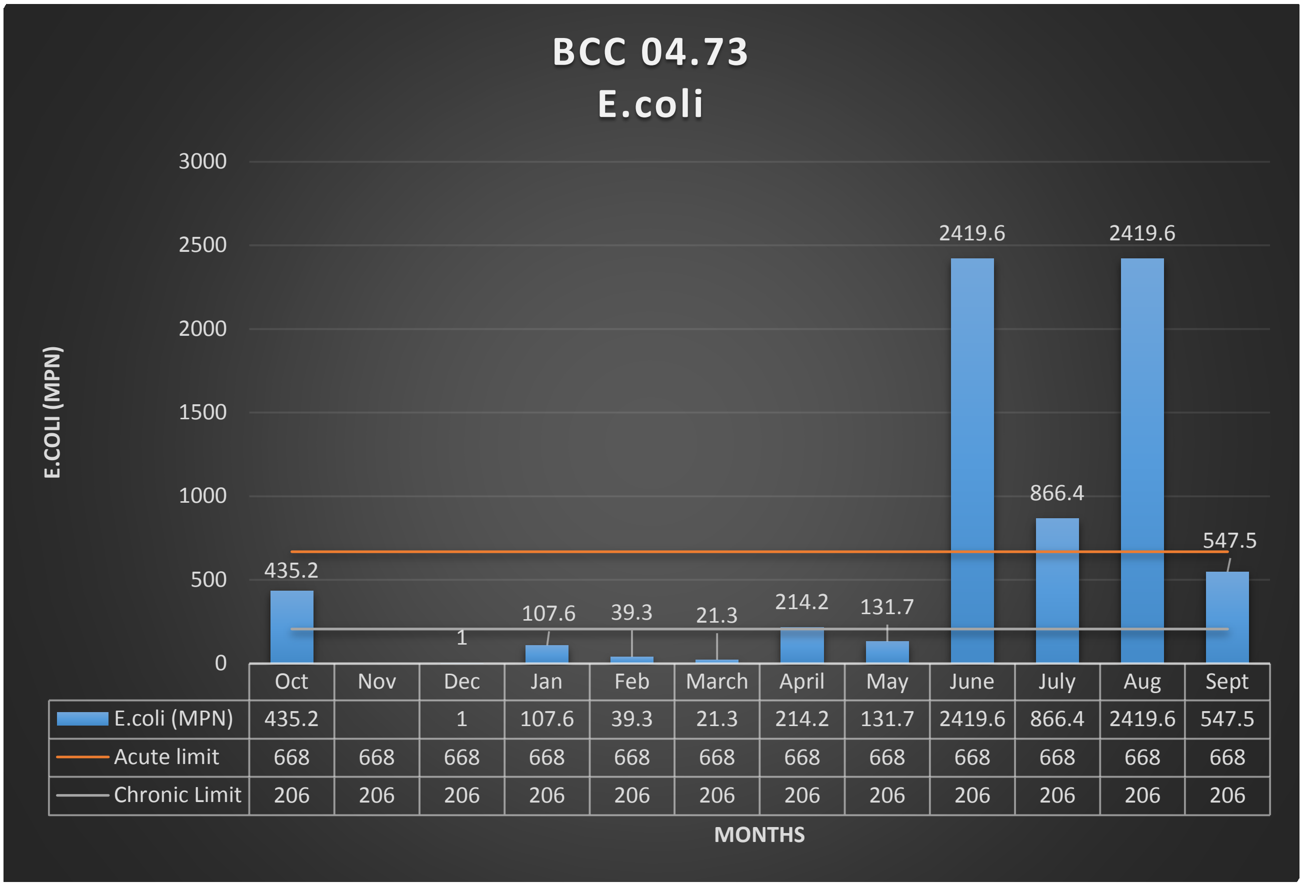
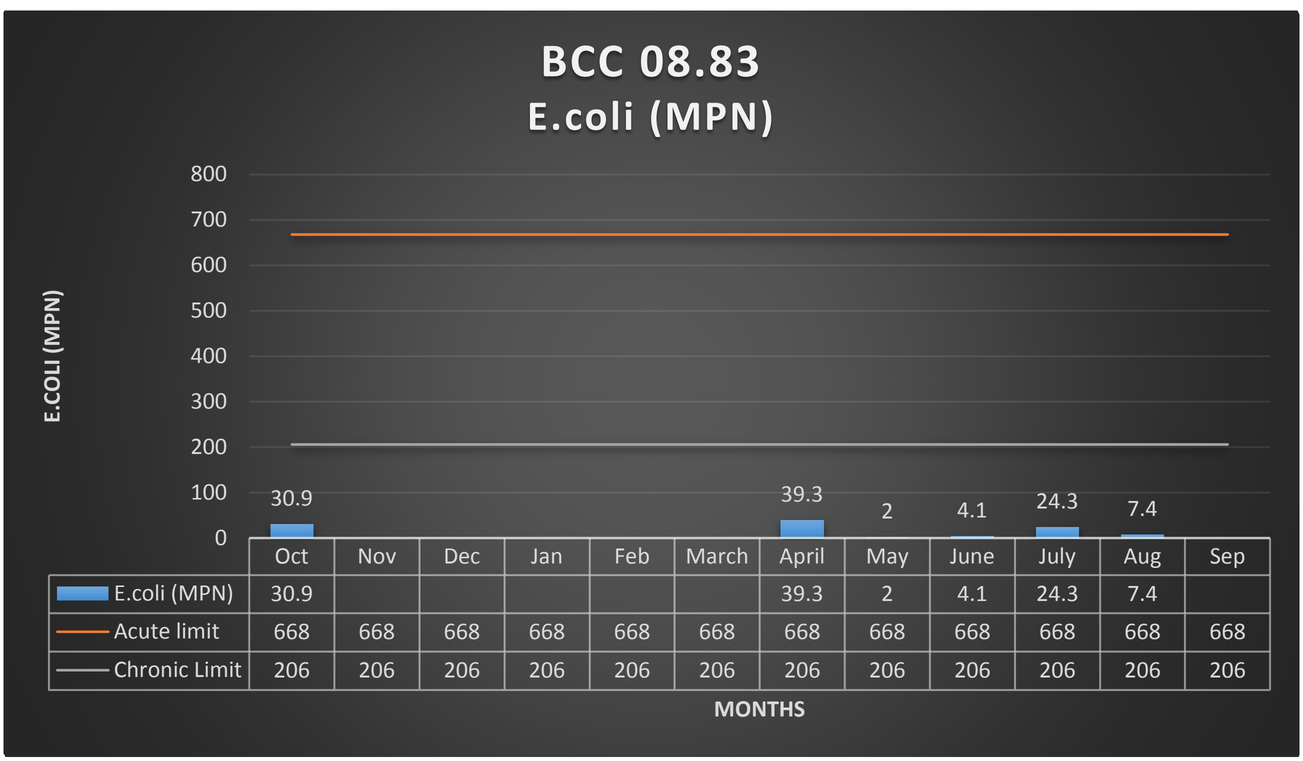


Figure 3-33 Big Cottonwood Creek 04.73 E.coli



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sept
E.coli (MPN)	435.2		1	107.6	39.3	21.3	214.2	131.7	2419.6	866.4	2419.6	547.5
Acute limit	668	668	668	668	668	668	668	668	668	668	668	668
Chronic Limit	206	206	206	206	206	206	206	206	206	206	206	206

Figure 3-34 Big Cottonwood Creek 08.83 E.coli



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
E.coli (MPN)	30.9						39.3	2	4.1	24.3	7.4	
Acute limit	668	668	668	668	668	668	668	668	668	668	668	668
Chronic Limit	206	206	206	206	206	206	206	206	206	206	206	206

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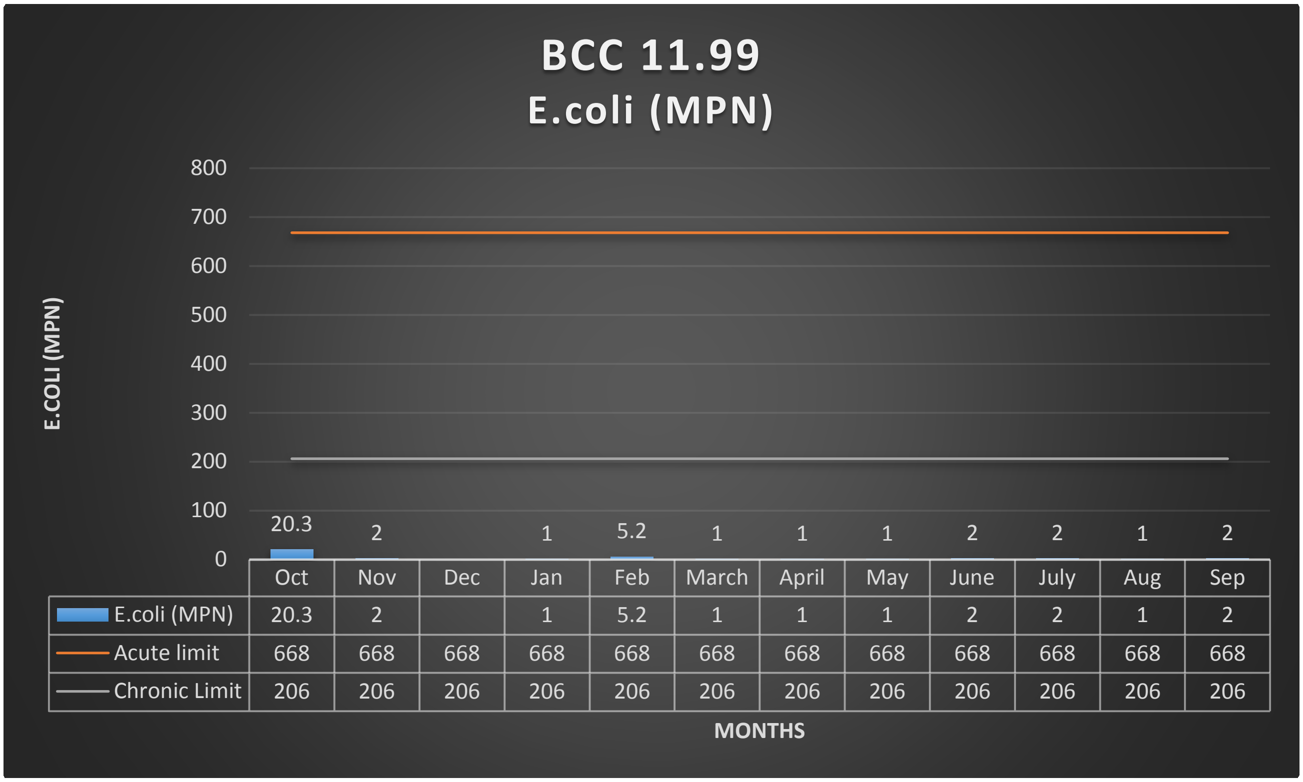
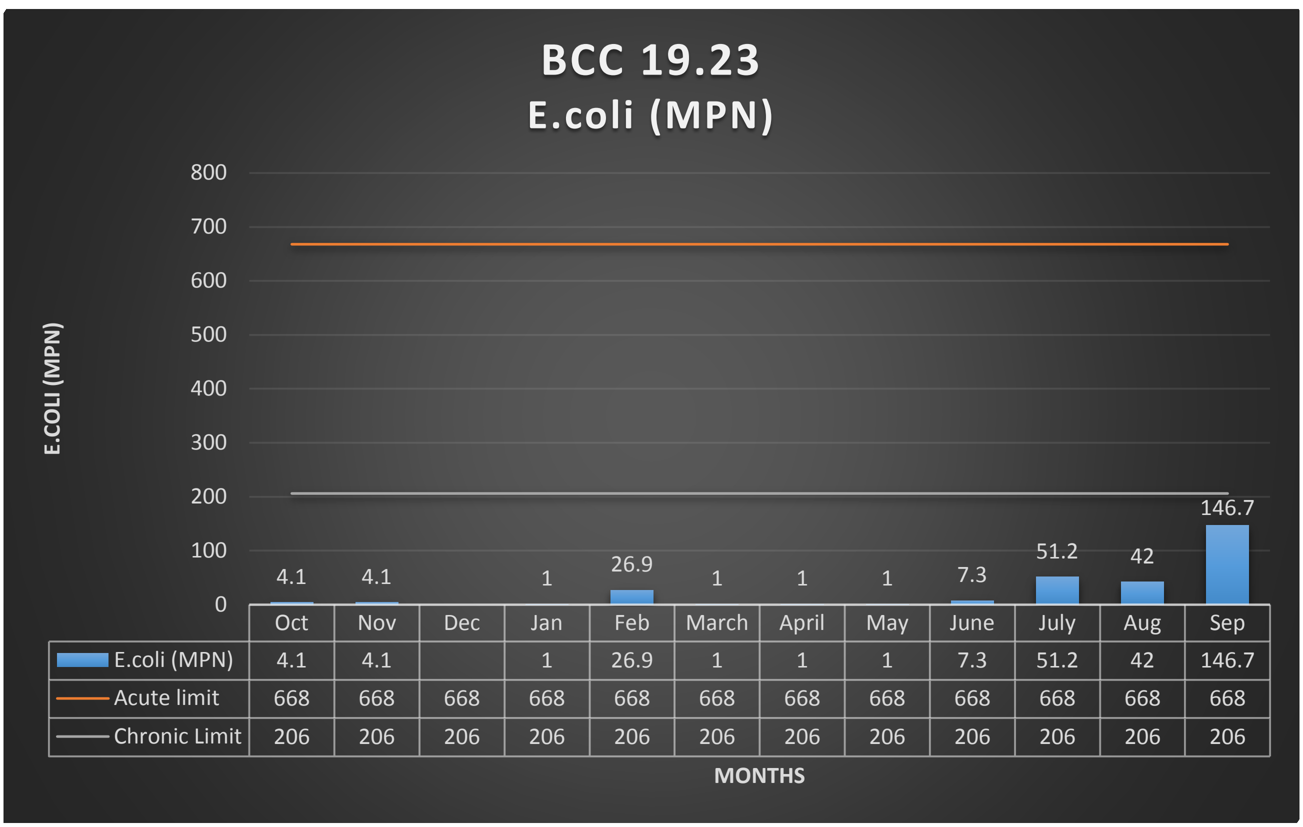
Figure 3-35 Big Cottonwood Creek 11.99 E.coli



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
E.coli (MPN)	20.3	2		1	5.2	1	1	1	2	2	1	2
Acute limit	668	668	668	668	668	668	668	668	668	668	668	668
Chronic Limit	206	206	206	206	206	206	206	206	206	206	206	206

Figure 3-36 Big Cottonwood Creek 19.23 E.coli



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
E.coli (MPN)	4.1	4.1		1	26.9	1	1	1	7.3	51.2	42	146.7
Acute limit	668	668	668	668	668	668	668	668	668	668	668	668
Chronic Limit	206	206	206	206	206	206	206	206	206	206	206	206

Figure 3-37 Big Cottonwood Creek 25.97 E.coli

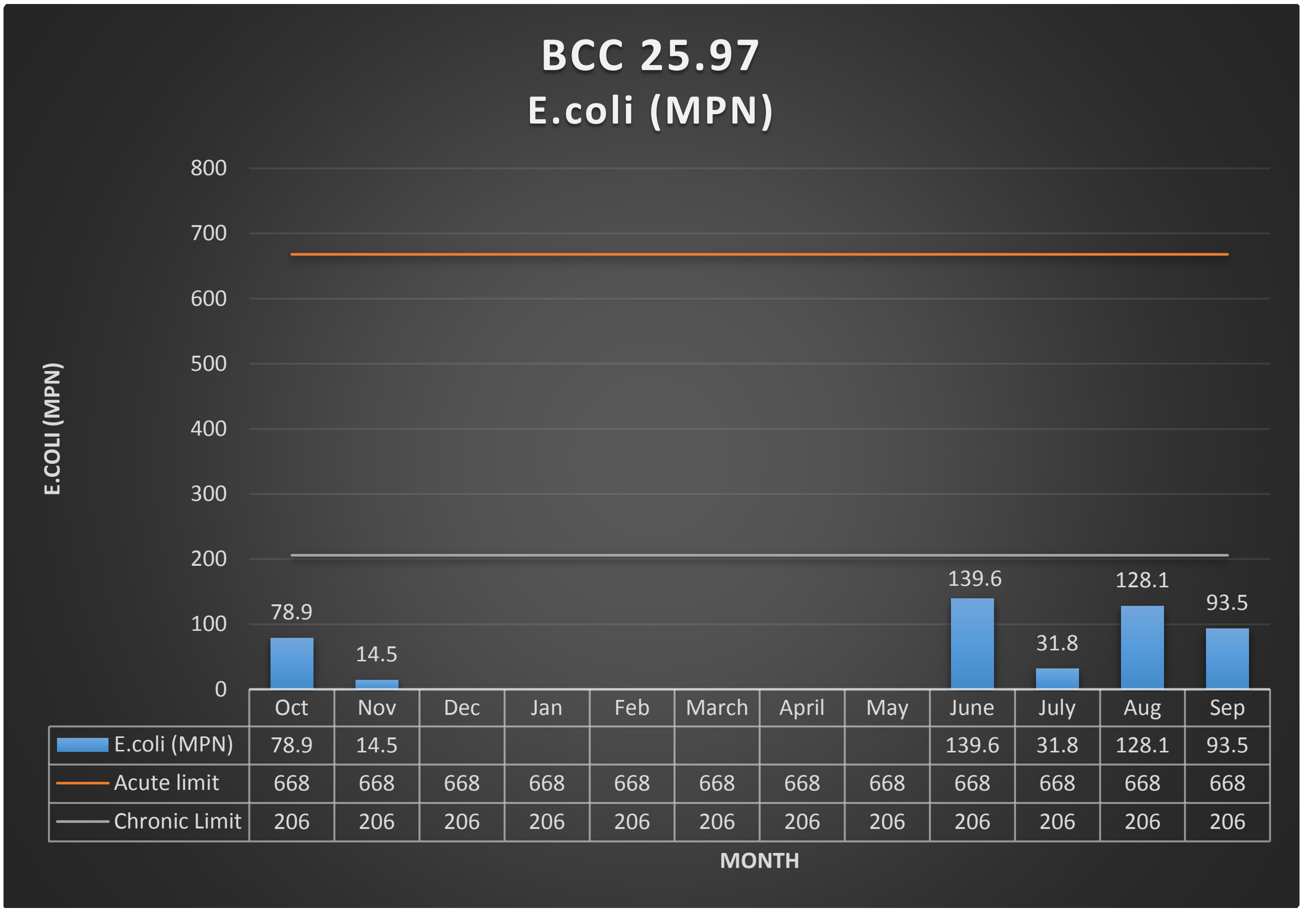
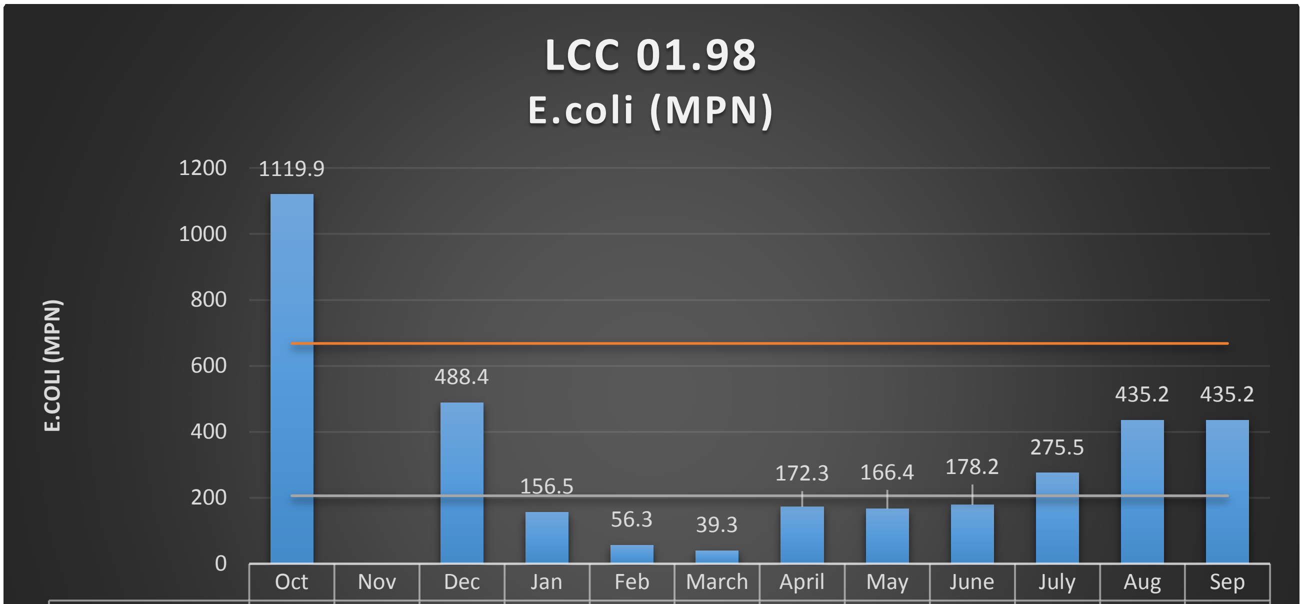
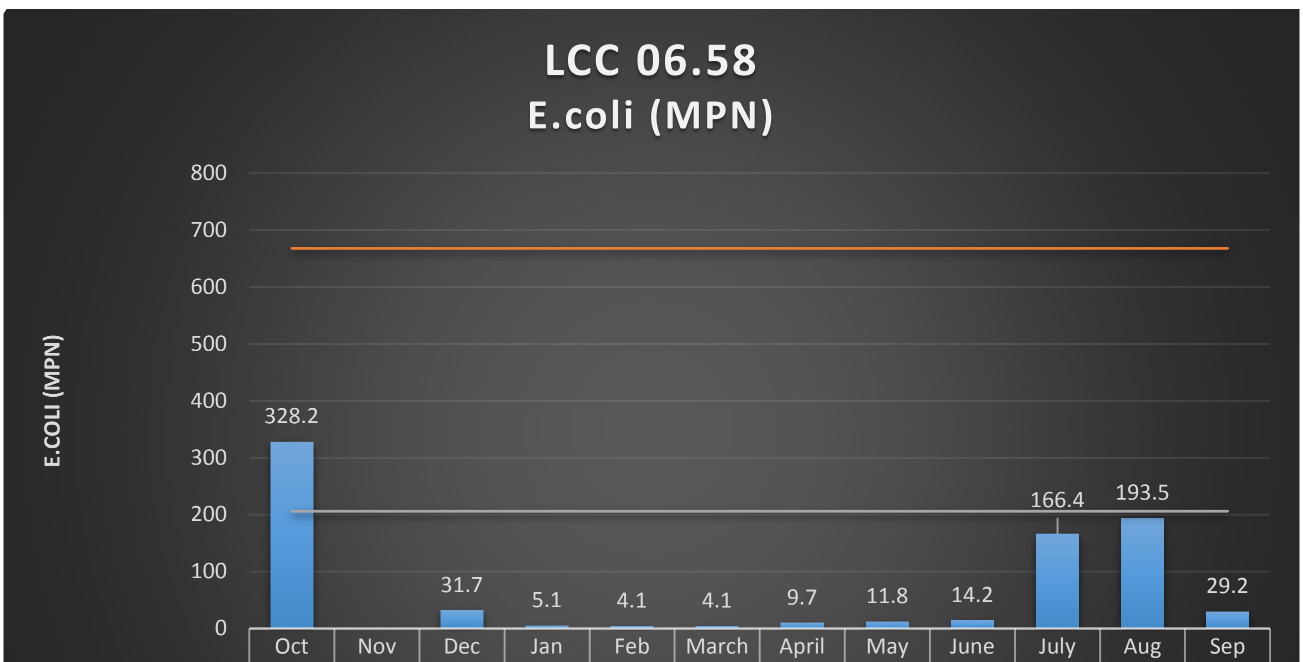


Figure 3-38 Little Cottonwood Creek 01.98 E.coli



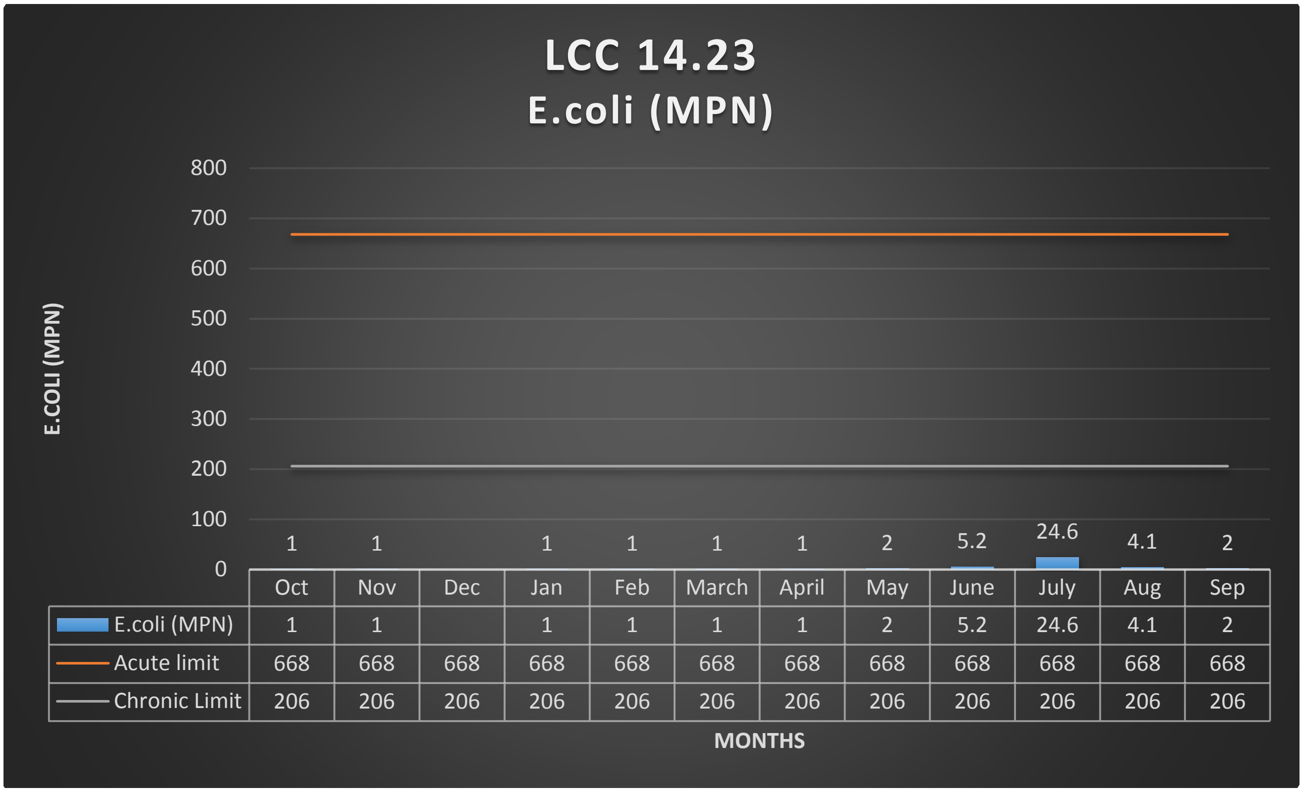
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
E.coli (MPN)	1119.9		488.4	156.5	56.3	39.3	172.3	166.4	178.2	275.5	435.2	435.2
Acute limit	668	668	668	668	668	668	668	668	668	668	668	668
Chronic Limit	206	206	206	206	206	206	206	206	206	206	206	206

Figure 3-39 Little Cottonwood Creek 06.58 E.coli



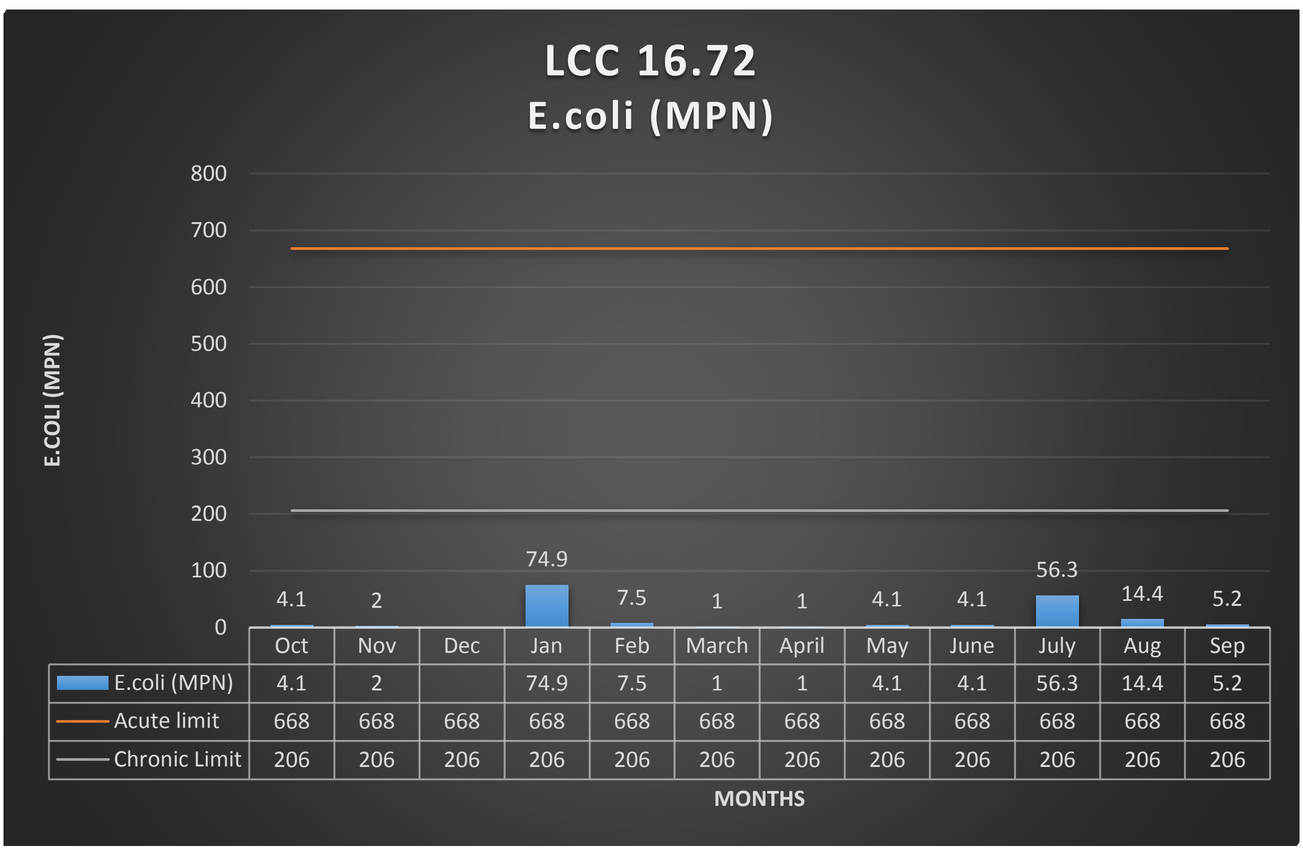
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
E.coli (MPN)	328.2		31.7	5.1	4.1	4.1	9.7	11.8	14.2	166.4	193.5	29.2
Acute limit	668	668	668	668	668	668	668	668	668	668	668	668
Chronic Limit	206	206	206	206	206	206	206	206	206	206	206	206

Figure 3-40 Little Cottonwood Creek 14.23 E.coli



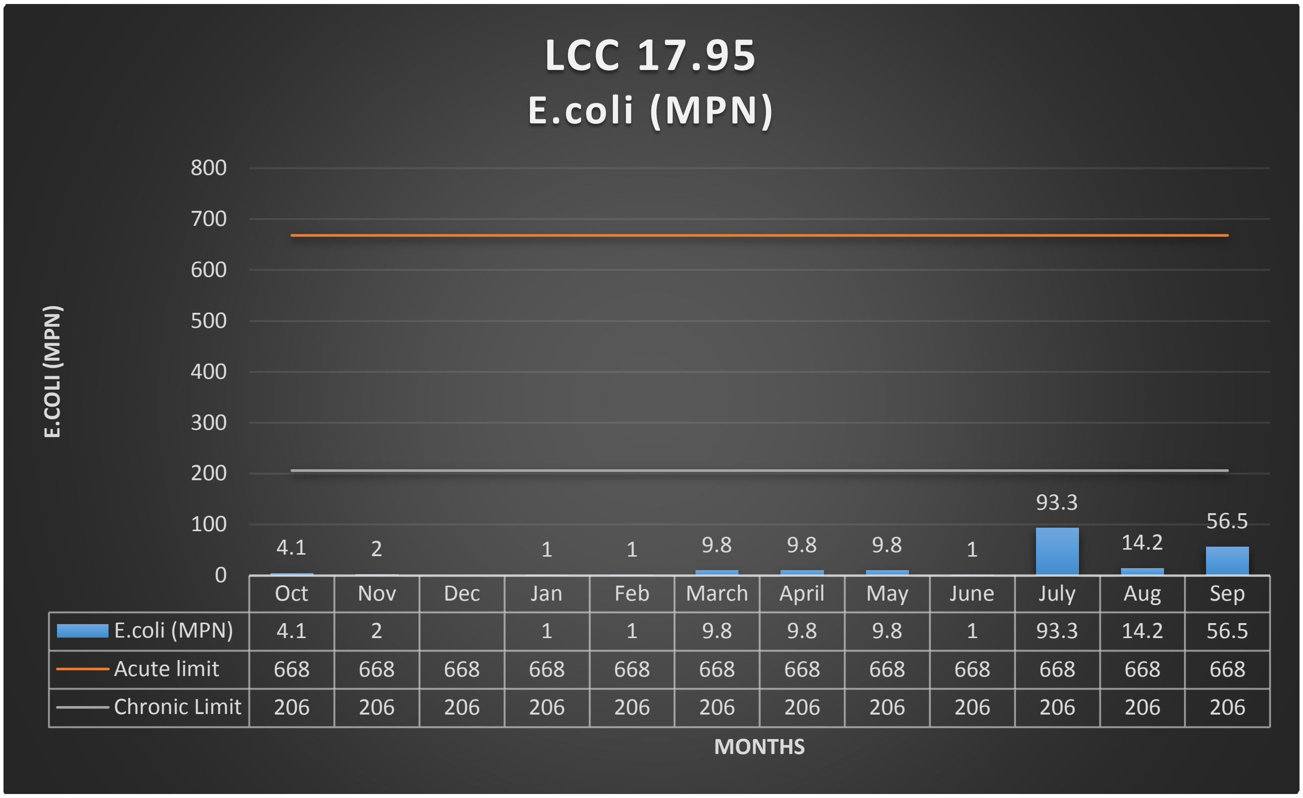
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
E.coli (MPN)	1	1		1	1	1	1	2	5.2	24.6	4.1	2
Acute limit	668	668	668	668	668	668	668	668	668	668	668	668
Chronic Limit	206	206	206	206	206	206	206	206	206	206	206	206

Figure 3-41 Little Cottonwood Creek 16.72 E.coli



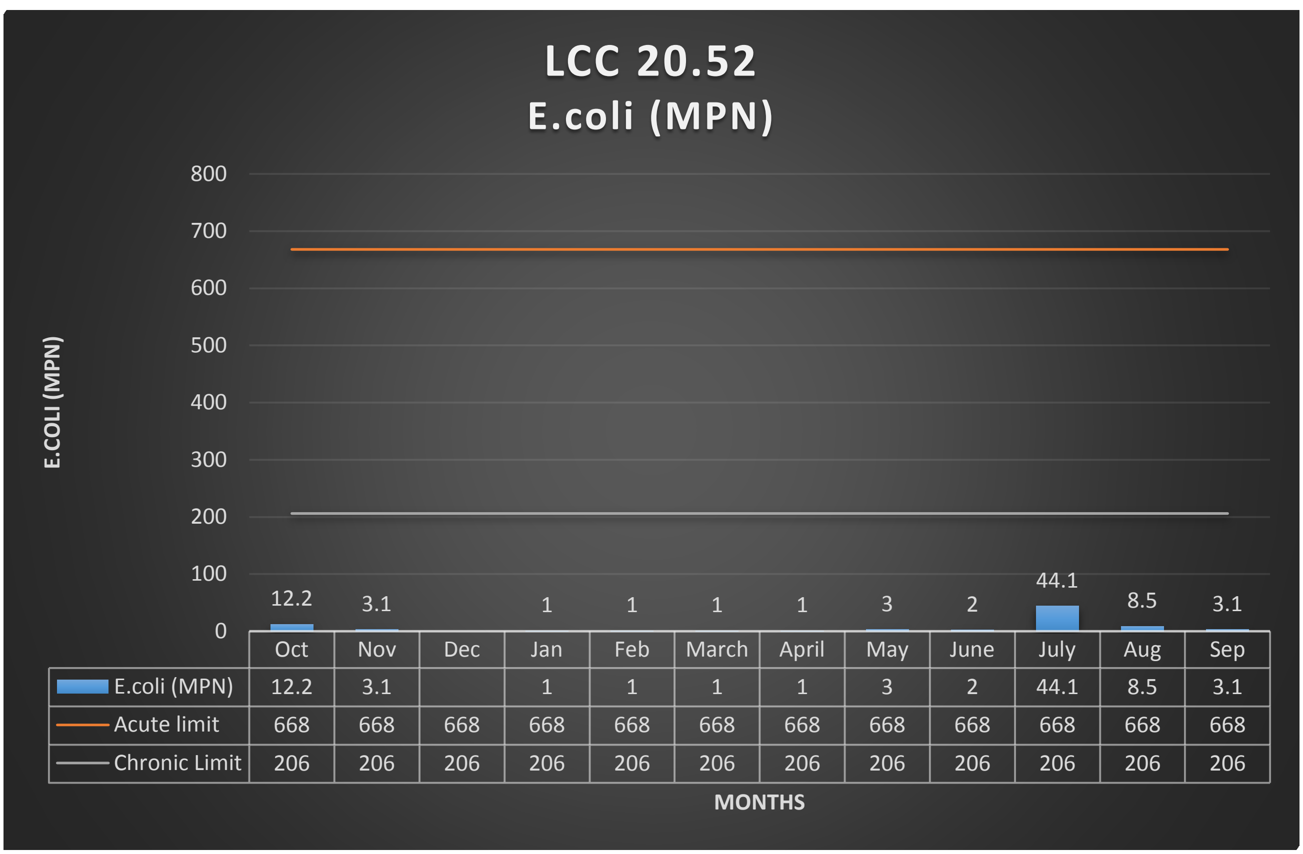
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
E.coli (MPN)	4.1	2		74.9	7.5	1	1	4.1	4.1	56.3	14.4	5.2
Acute limit	668	668	668	668	668	668	668	668	668	668	668	668
Chronic Limit	206	206	206	206	206	206	206	206	206	206	206	206

Figure 3-42 Little Cottonwood Creek 17.95 E.coli



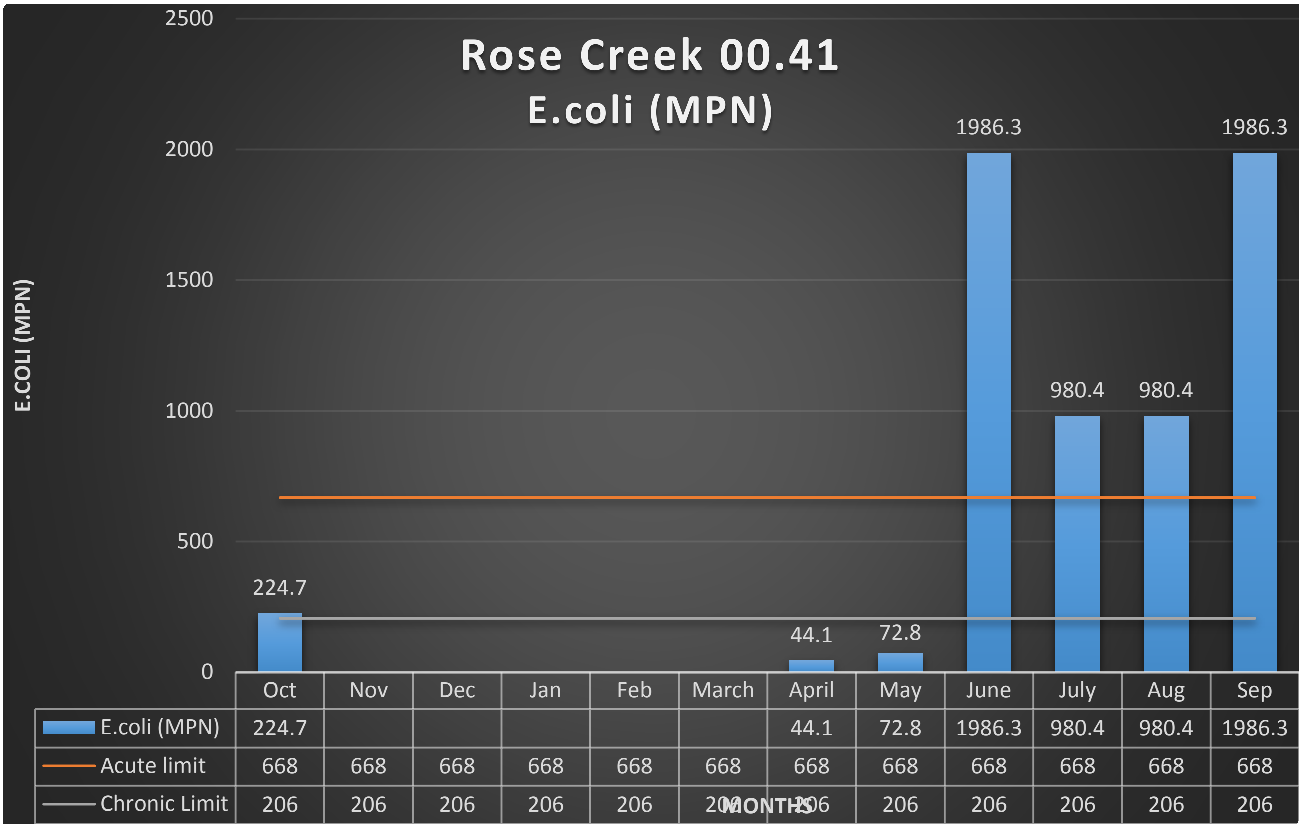
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
E.coli (MPN)	4.1	2		1	1	9.8	9.8	9.8	1	93.3	14.2	56.5
Acute limit	668	668	668	668	668	668	668	668	668	668	668	668
Chronic Limit	206	206	206	206	206	206	206	206	206	206	206	206

Figure 3-43 Little Cottonwood Creek 20.52 E.coli



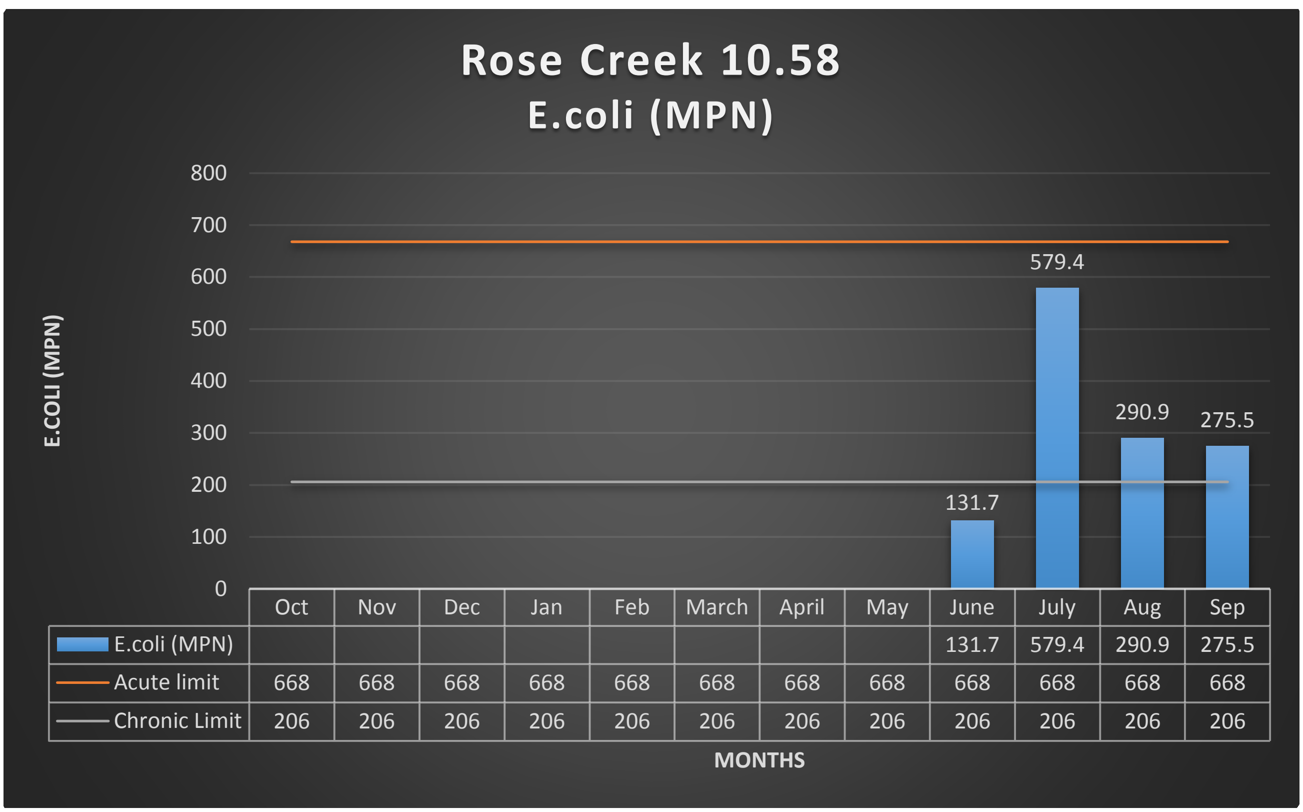
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
E.coli (MPN)	12.2	3.1		1	1	1	1	3	2	44.1	8.5	3.1
Acute limit	668	668	668	668	668	668	668	668	668	668	668	668
Chronic Limit	206	206	206	206	206	206	206	206	206	206	206	206

Figure 3-44 Rose Creek 00.41 E.coli



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
E.coli (MPN)	224.7						44.1	72.8	1986.3	980.4	980.4	1986.3
Acute limit	668	668	668	668	668	668	668	668	668	668	668	668
Chronic Limit	206	206	206	206	206	206	206	206	206	206	206	206

Figure 3-45 Rose Creek 10.58 E.coli



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
E.coli (MPN)									131.7	579.4	290.9	275.5
Acute limit	668	668	668	668	668	668	668	668	668	668	668	668
Chronic Limit	206	206	206	206	206	206	206	206	206	206	206	206

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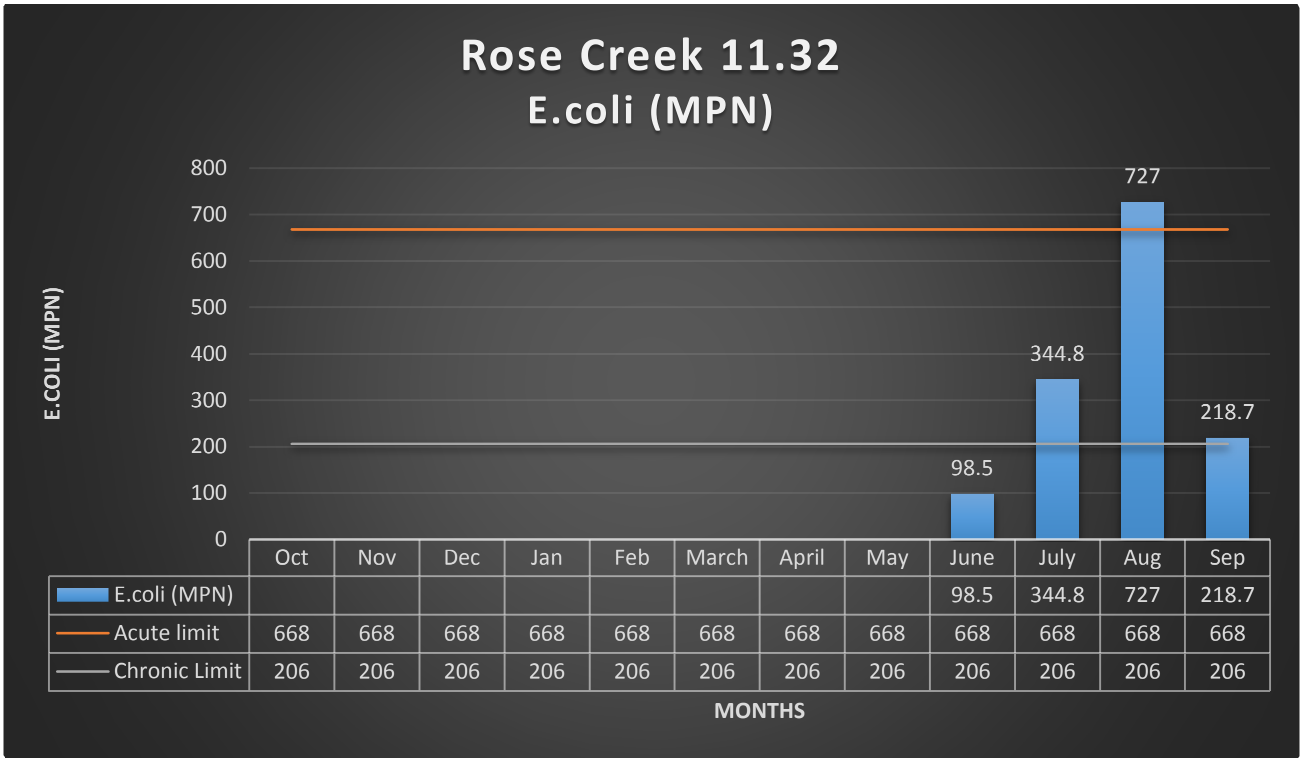
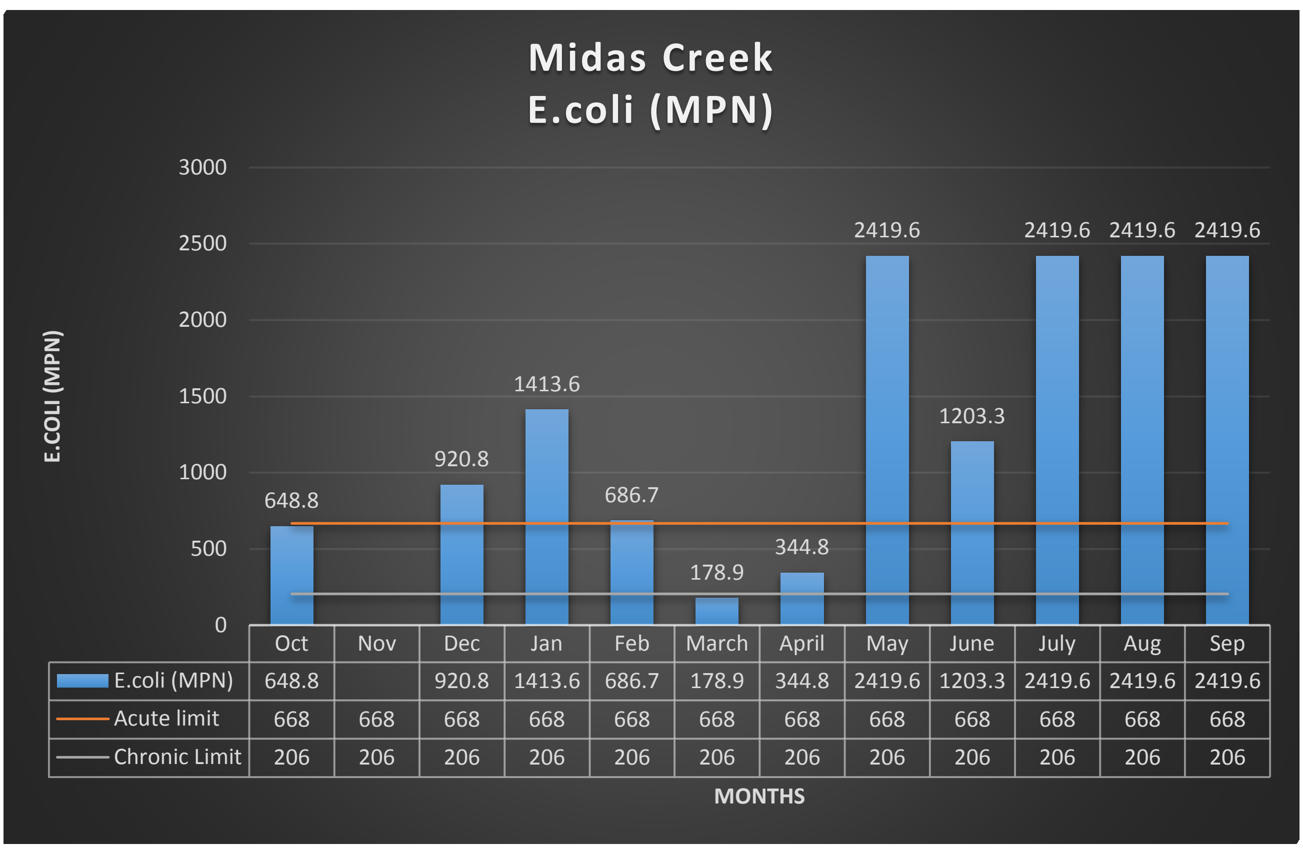
Figure 3-46 Rose Creek 11.32 E.coli



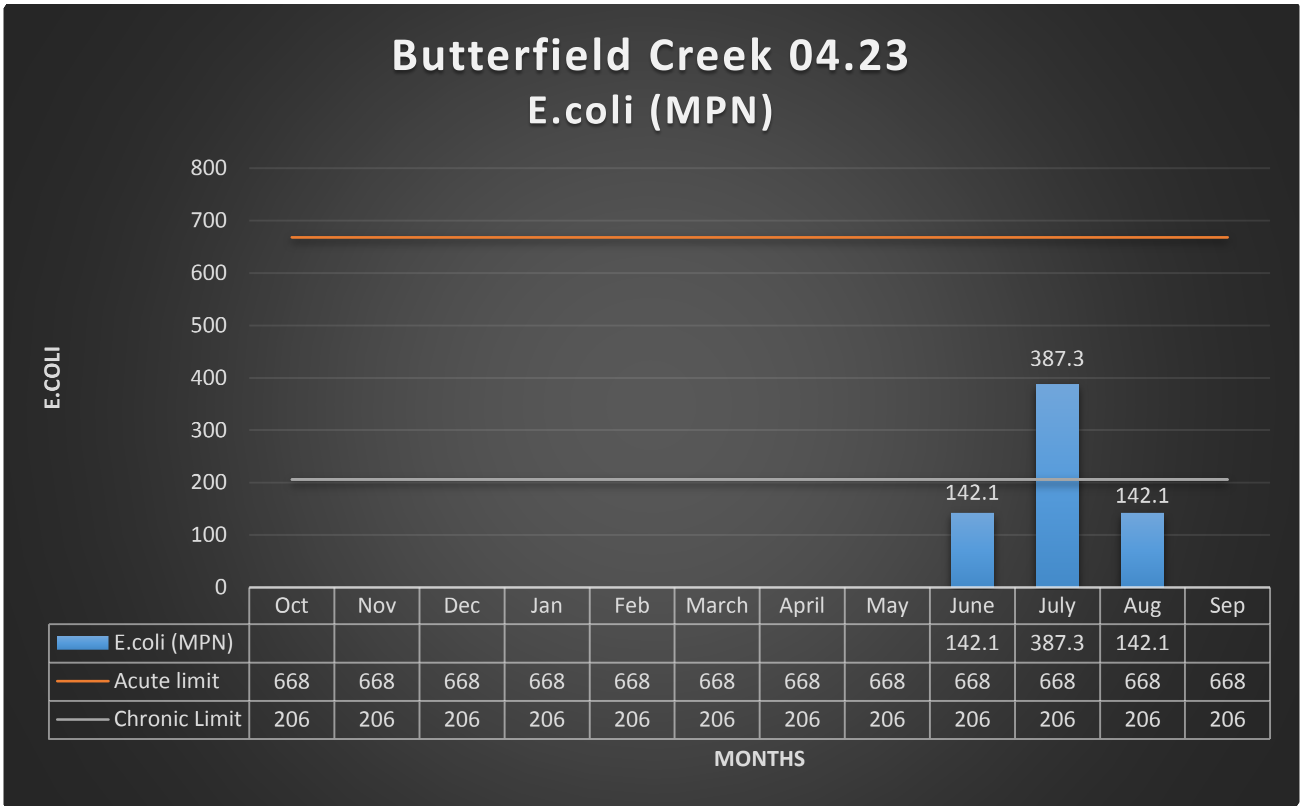
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
E.coli (MPN)									98.5	344.8	727	218.7
Acute limit	668	668	668	668	668	668	668	668	668	668	668	668
Chronic Limit	206	206	206	206	206	206	206	206	206	206	206	206

Figure 3-47 Midas Creek E.coli



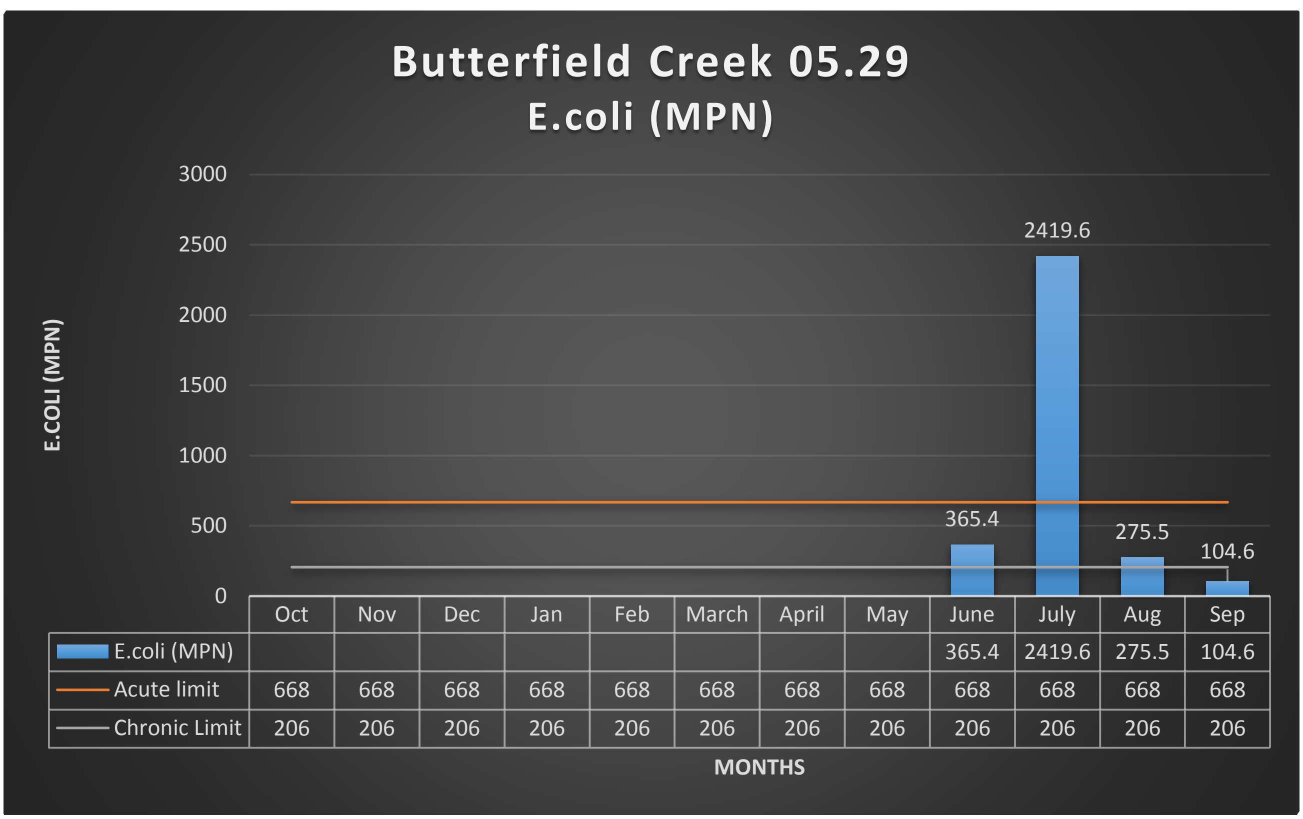
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
E.coli (MPN)	648.8		920.8	1413.6	686.7	178.9	344.8	2419.6	1203.3	2419.6	2419.6	2419.6
Acute limit	668	668	668	668	668	668	668	668	668	668	668	668
Chronic Limit	206	206	206	206	206	206	206	206	206	206	206	206

Figure 3-48 Butterfield Creek 04.23 E.coli



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
E.coli (MPN)									142.1	387.3	142.1	
Acute limit	668	668	668	668	668	668	668	668	668	668	668	668
Chronic Limit	206	206	206	206	206	206	206	206	206	206	206	206

Figure 3-49 Butterfield Creek 05.29 E.coli



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
E.coli (MPN)									365.4	2419.6	275.5	104.6
Acute limit	668	668	668	668	668	668	668	668	668	668	668	668
Chronic Limit	206	206	206	206	206	206	206	206	206	206	206	206

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Figure 3-50 Bingham Creek E.coli

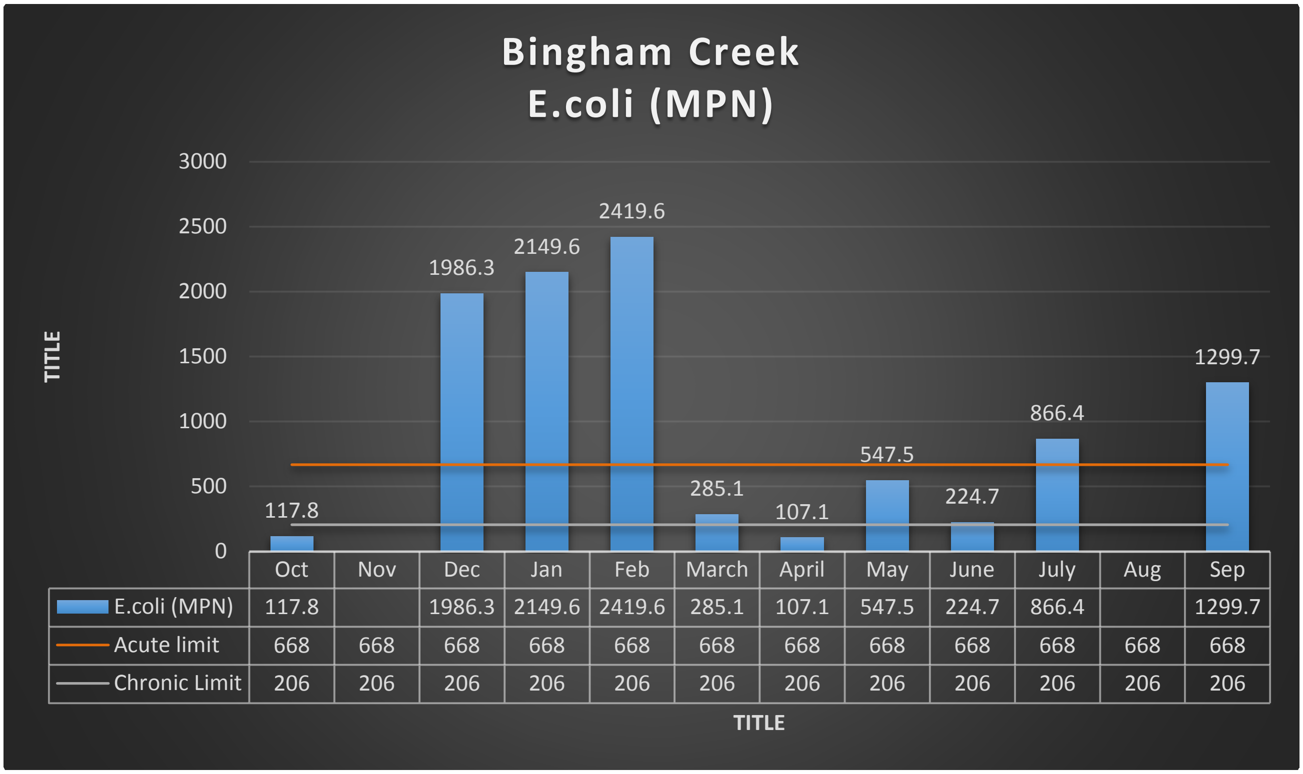


Figure 3-51 Jordan River 08.77 E.coli

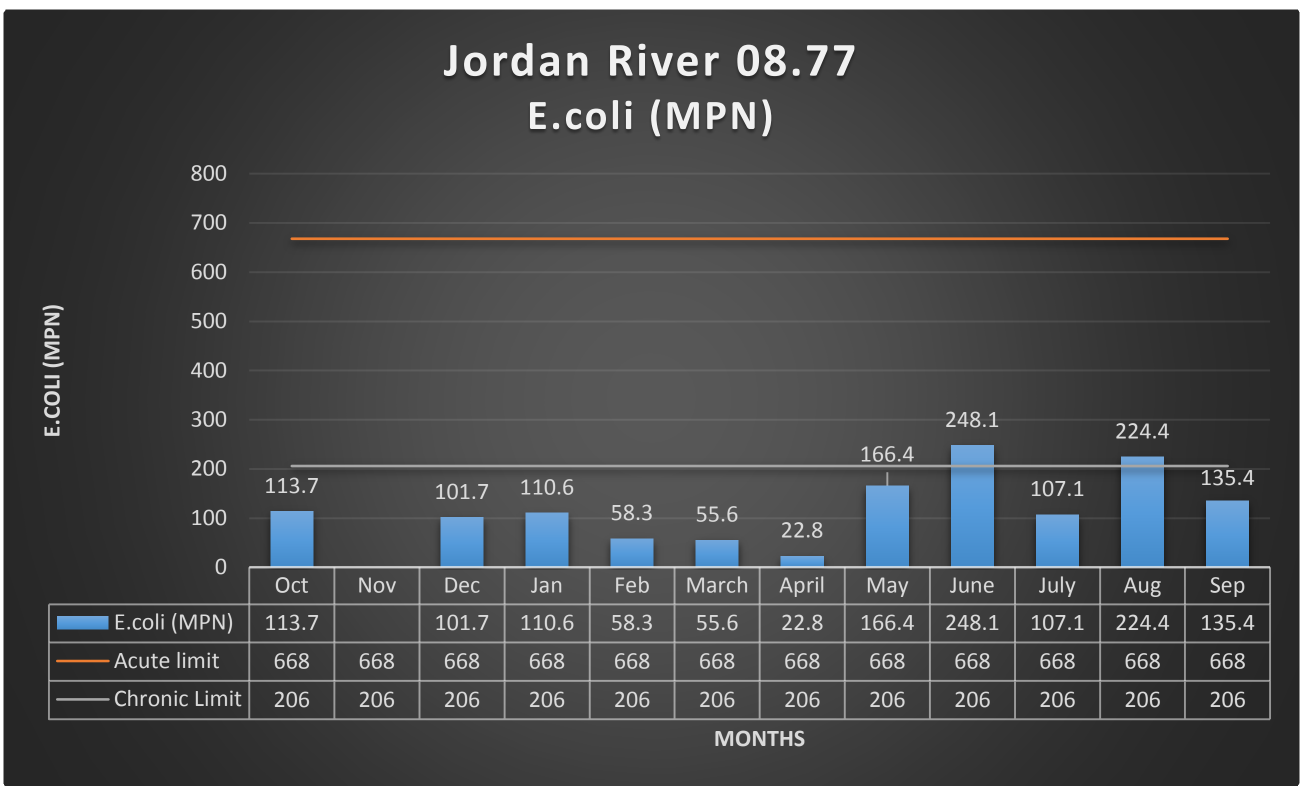
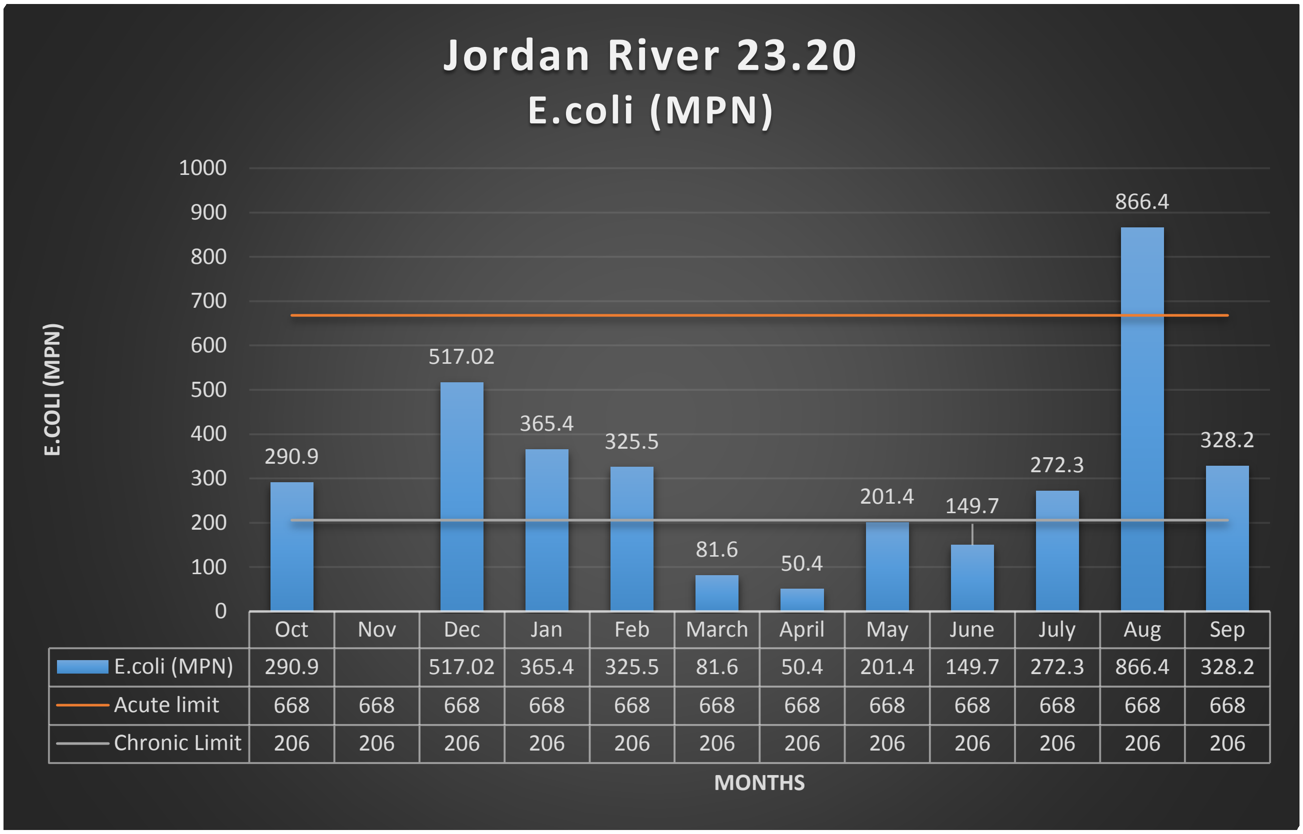
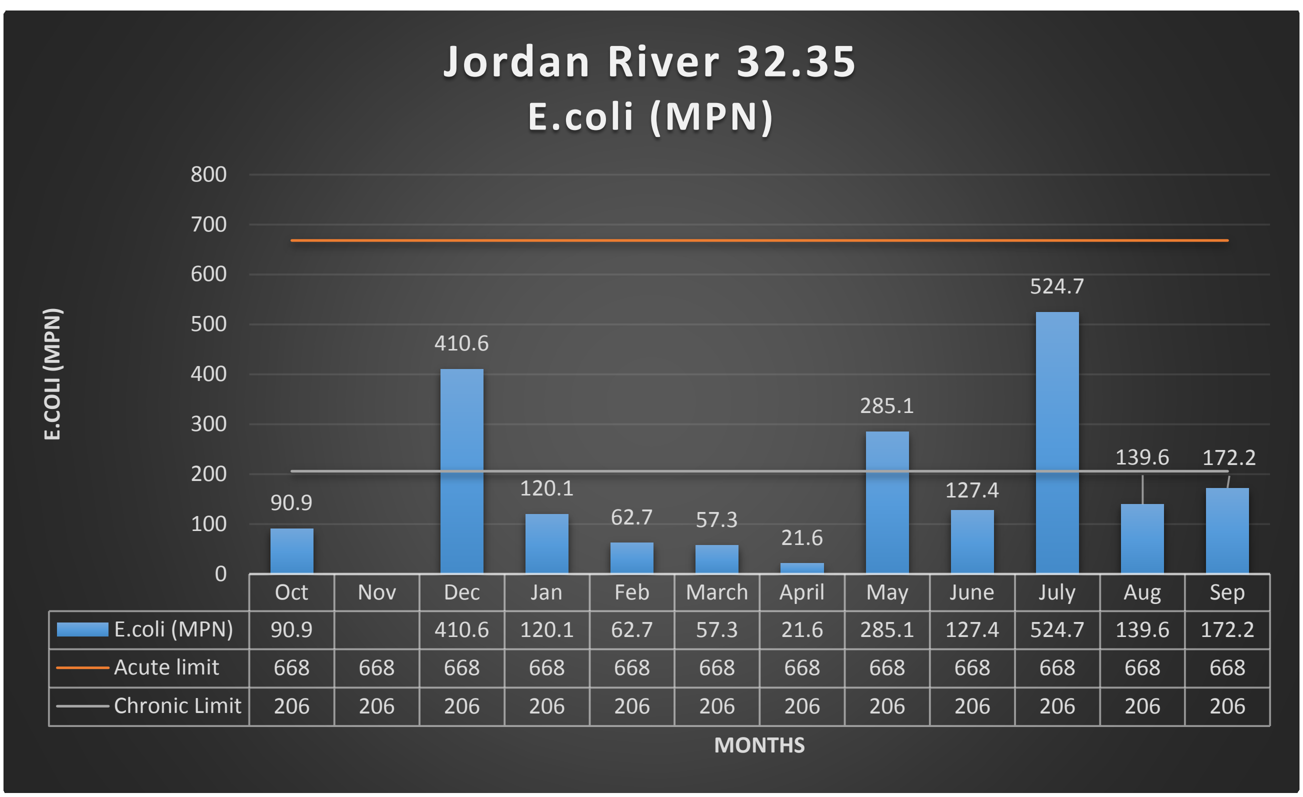


Figure 3-52 Jordan River 23.20 E.coli



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
E.coli (MPN)	290.9		517.02	365.4	325.5	81.6	50.4	201.4	149.7	272.3	866.4	328.2
Acute limit	668	668	668	668	668	668	668	668	668	668	668	668
Chronic Limit	206	206	206	206	206	206	206	206	206	206	206	206

Figure 3-53 Jordan River 32.35 E.coli



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
E.coli (MPN)	90.9		410.6	120.1	62.7	57.3	21.6	285.1	127.4	524.7	139.6	172.2
Acute limit	668	668	668	668	668	668	668	668	668	668	668	668
Chronic Limit	206	206	206	206	206	206	206	206	206	206	206	206

7.0 CHEMISTRY APPENDIX

Figure 4-1 City Creek 02.62 pH

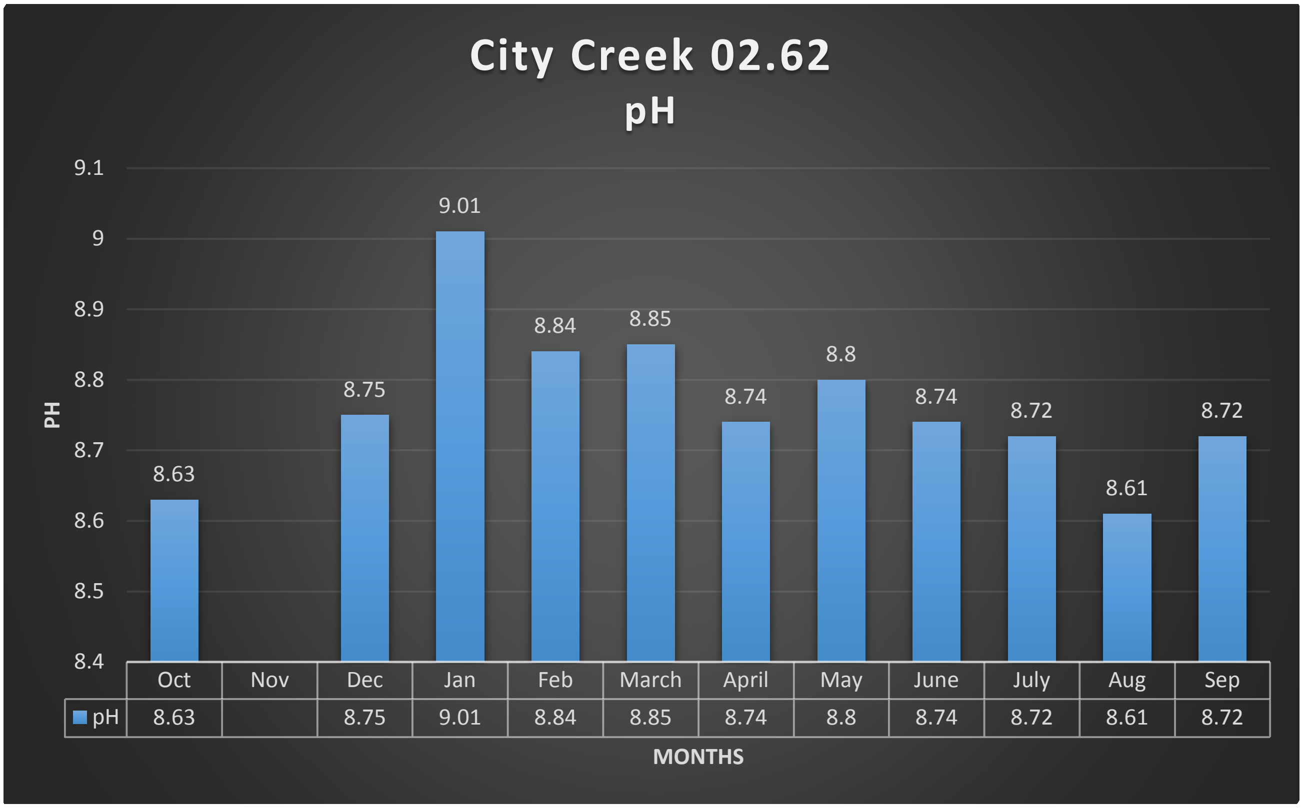


Figure 4-2 City Creek 02.62 Dissolved Oxygen

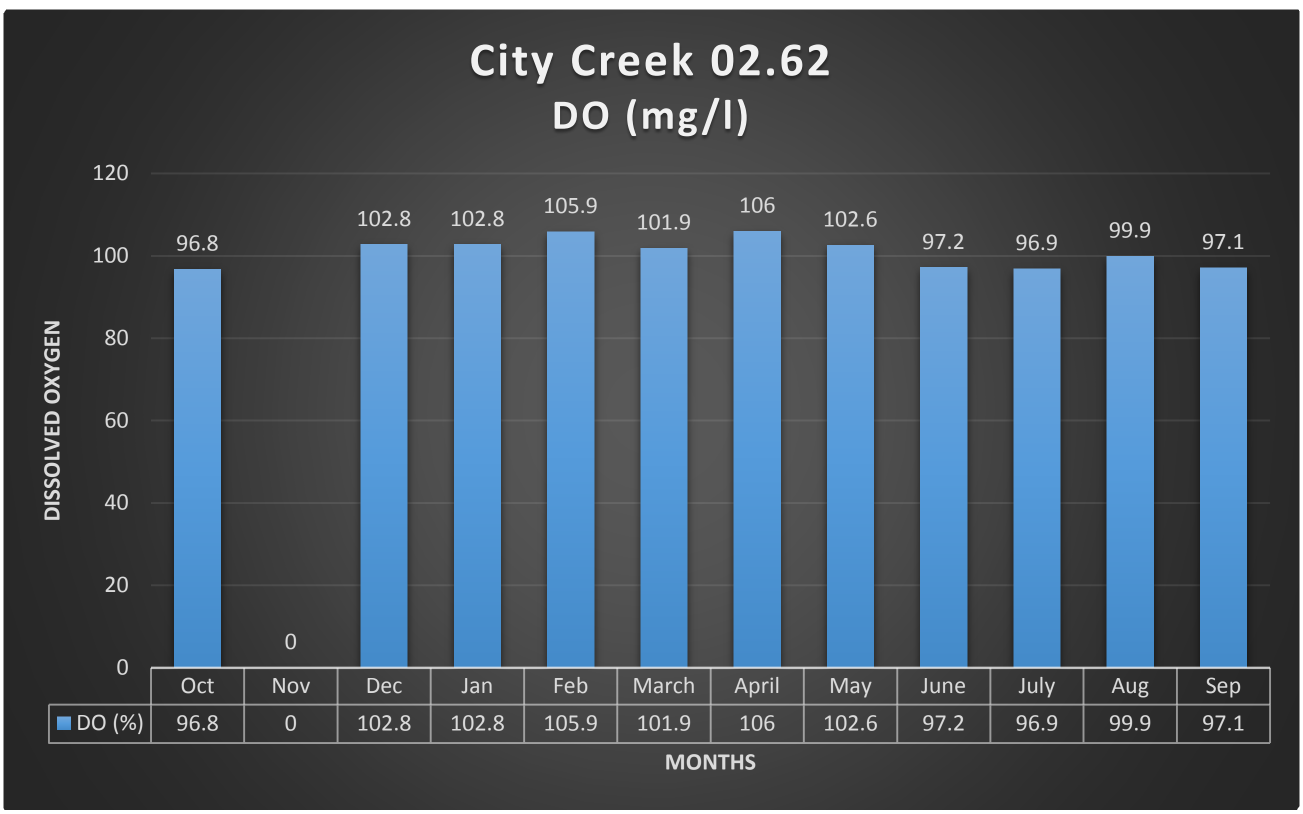


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Figure 4-3 City Creek 02.62 Total Dissolved Solids

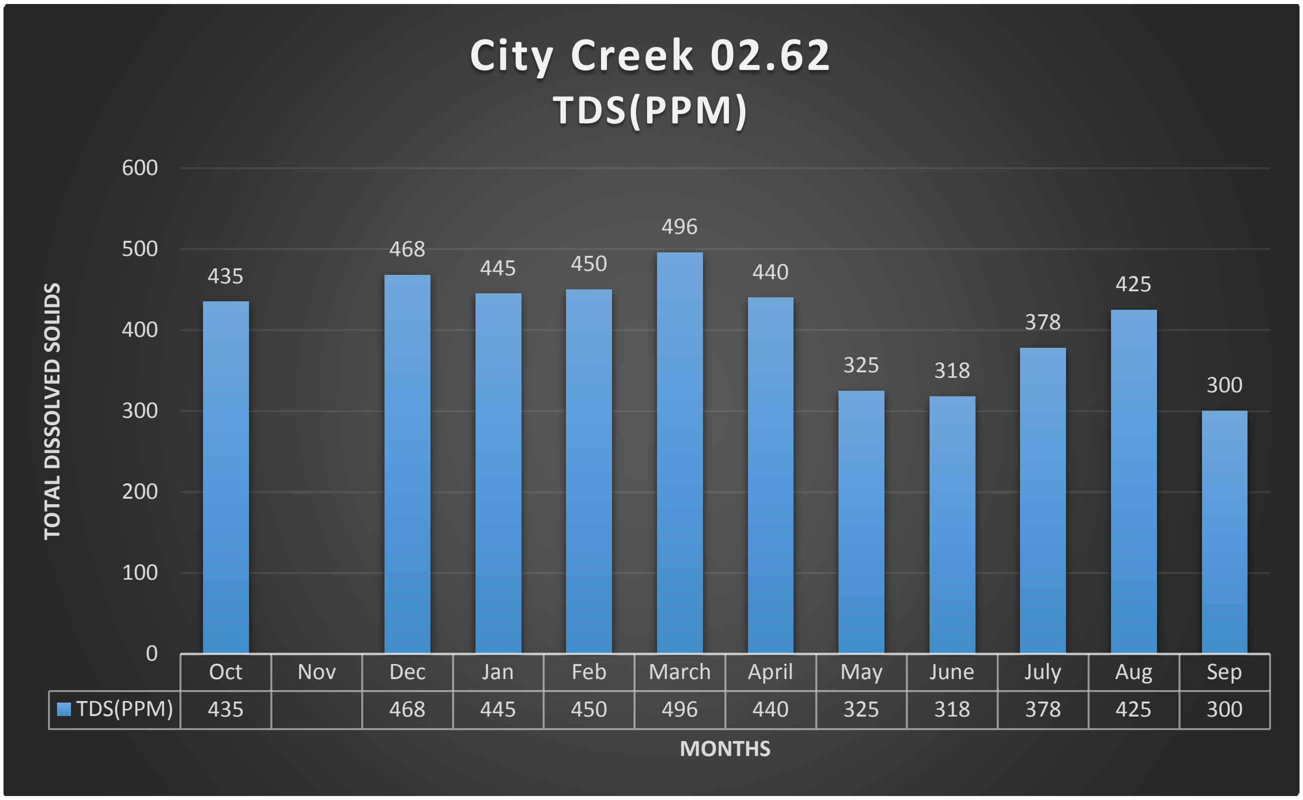


Figure 4-4 City Creek 02.62 Conductivity

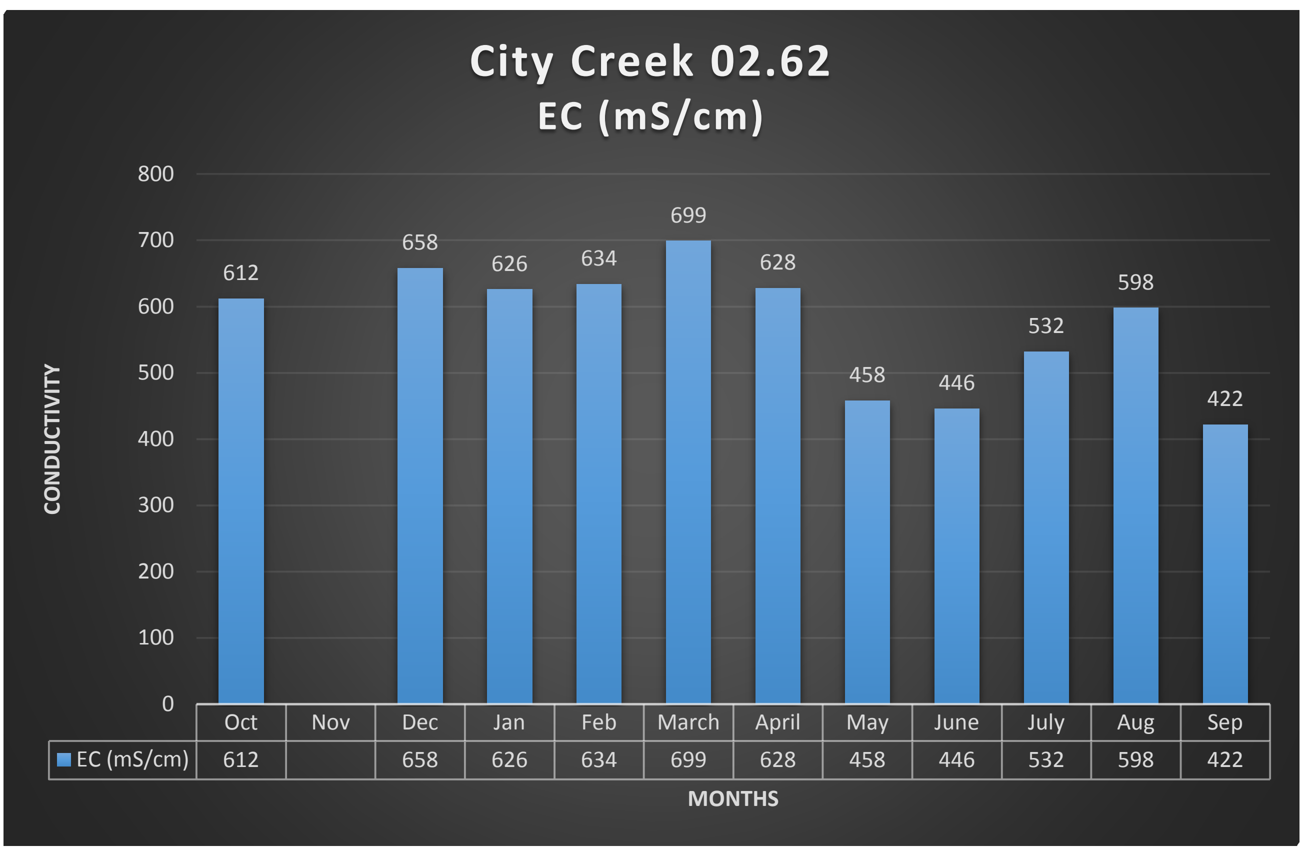


Figure 4-5 City Creek 02.62 Turbidity

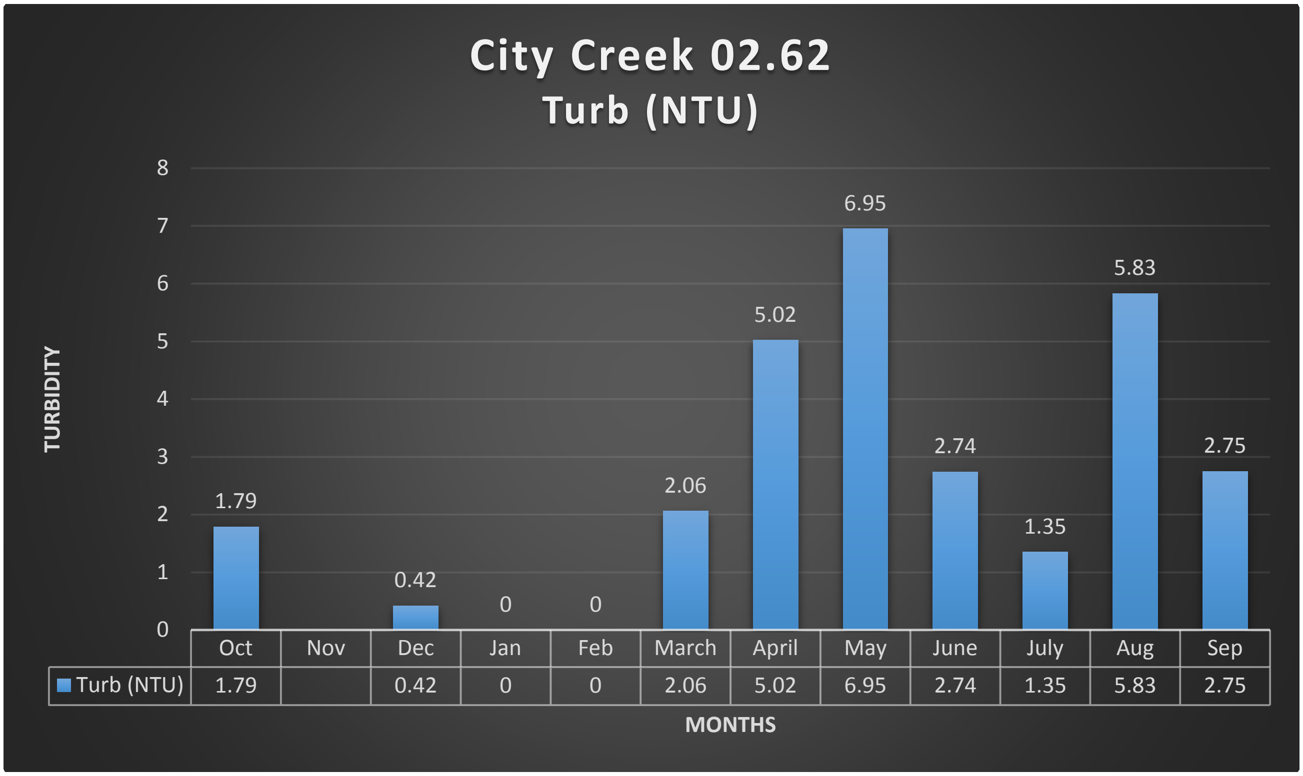


Figure 4-6 City Creek 02.62 Temperature

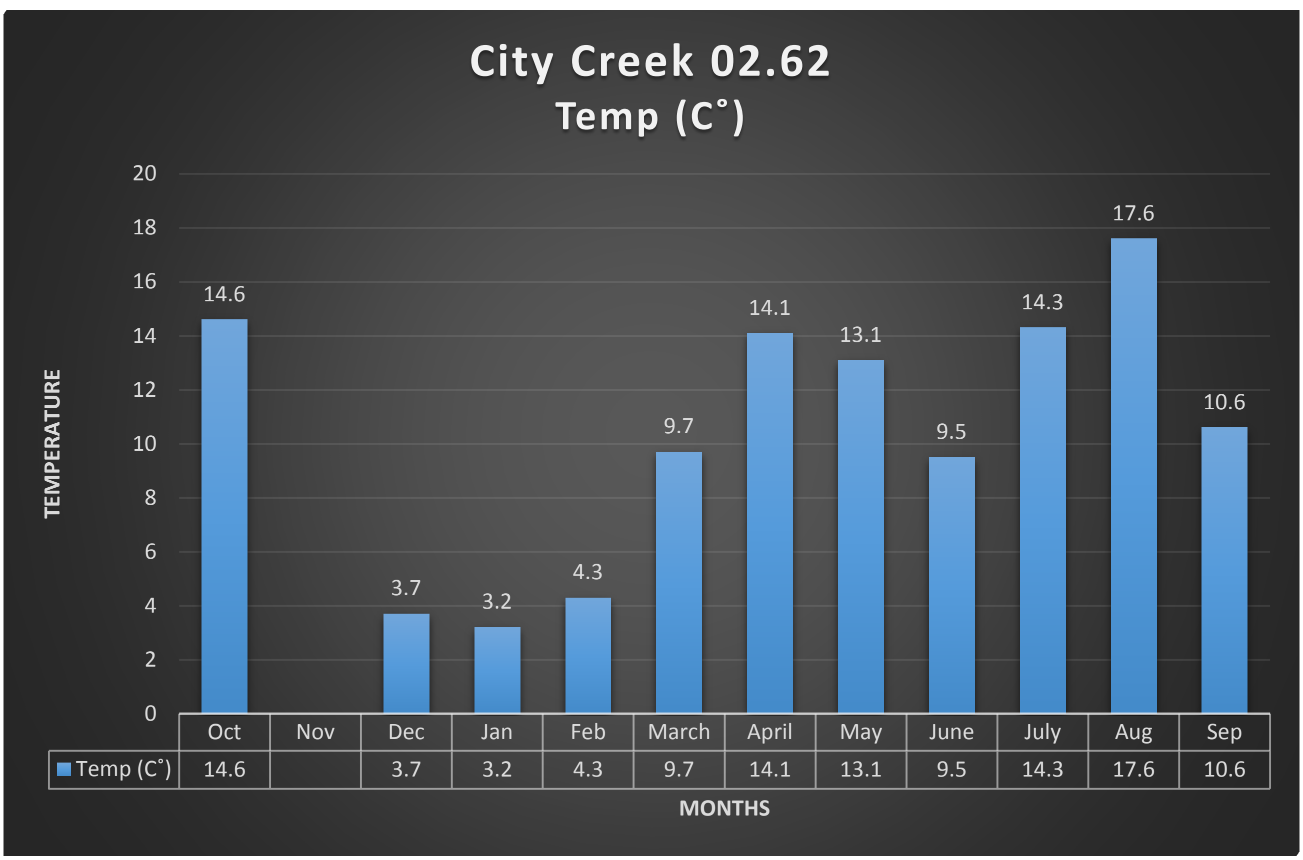


Figure 4-7 City Creek 02.62 Salinity

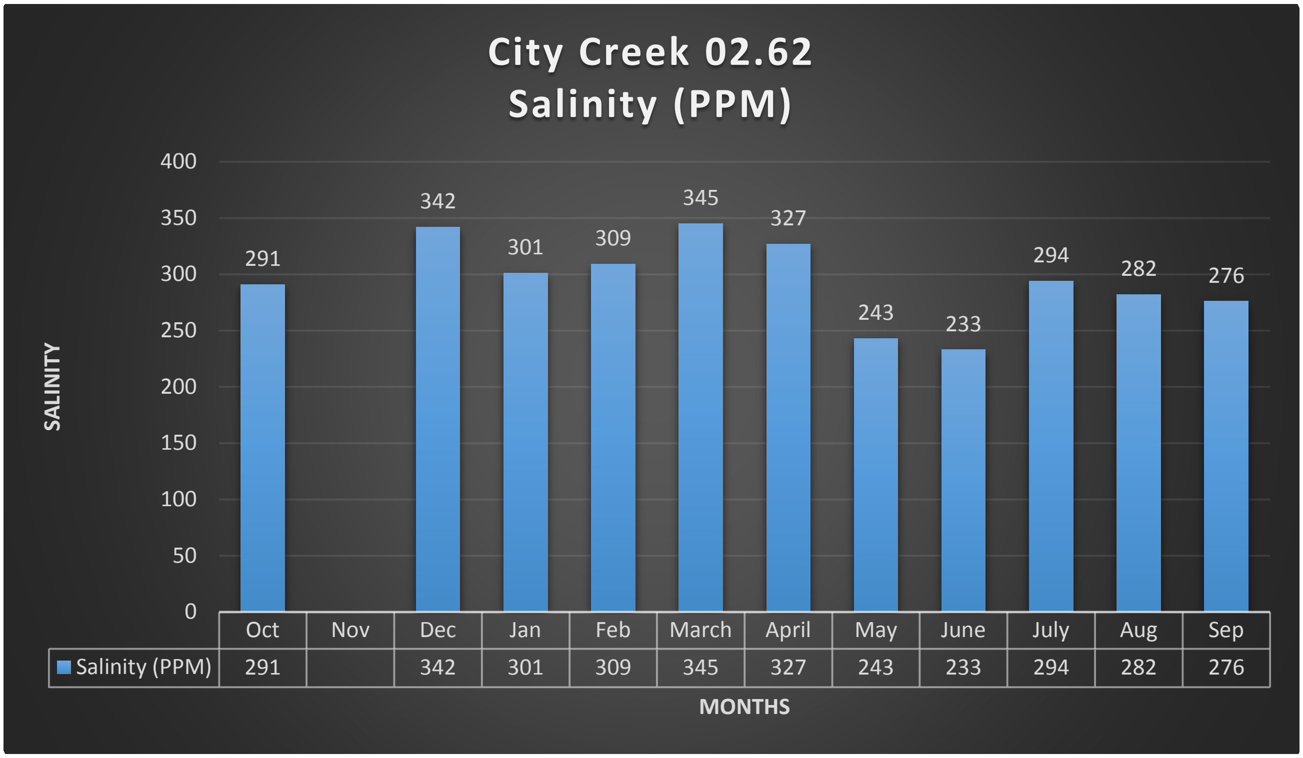


Figure 4-8 City Creek 03.65 pH

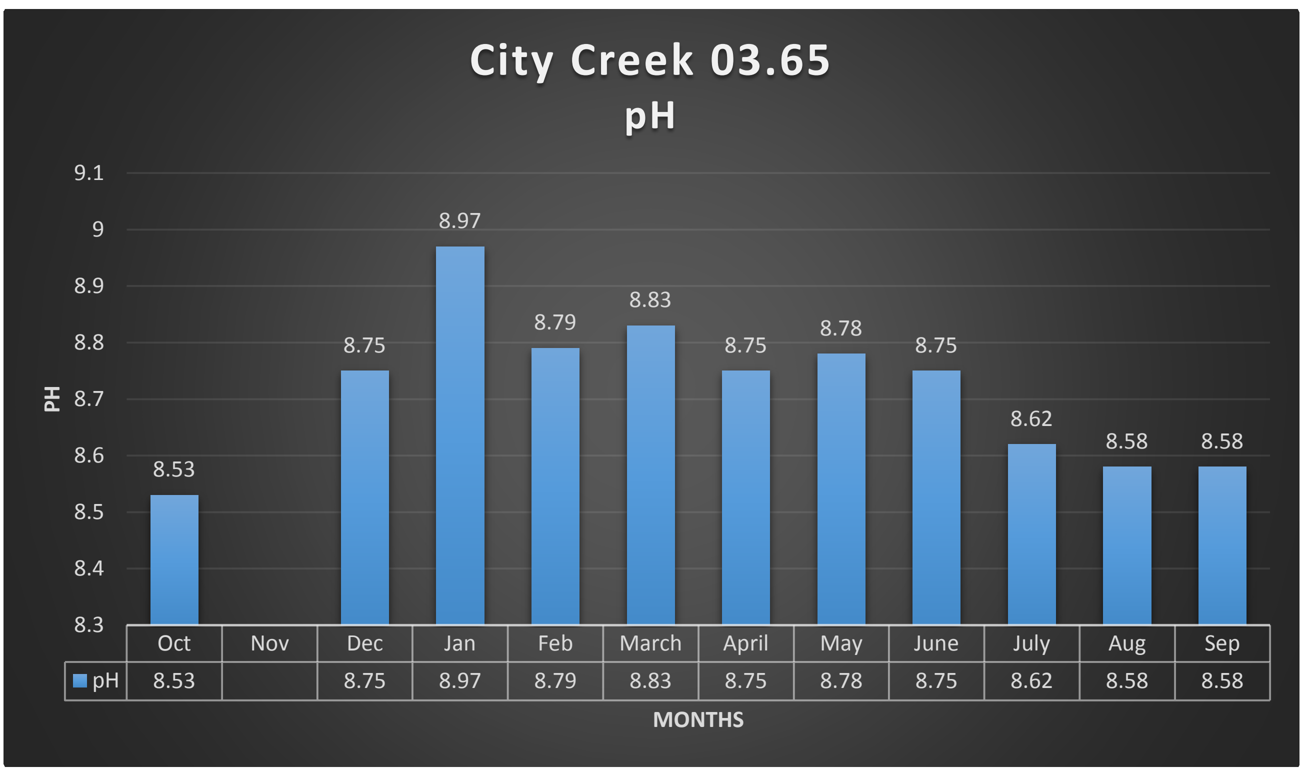


Figure 4-9 City Creek 03.65 Dissolved Oxygen

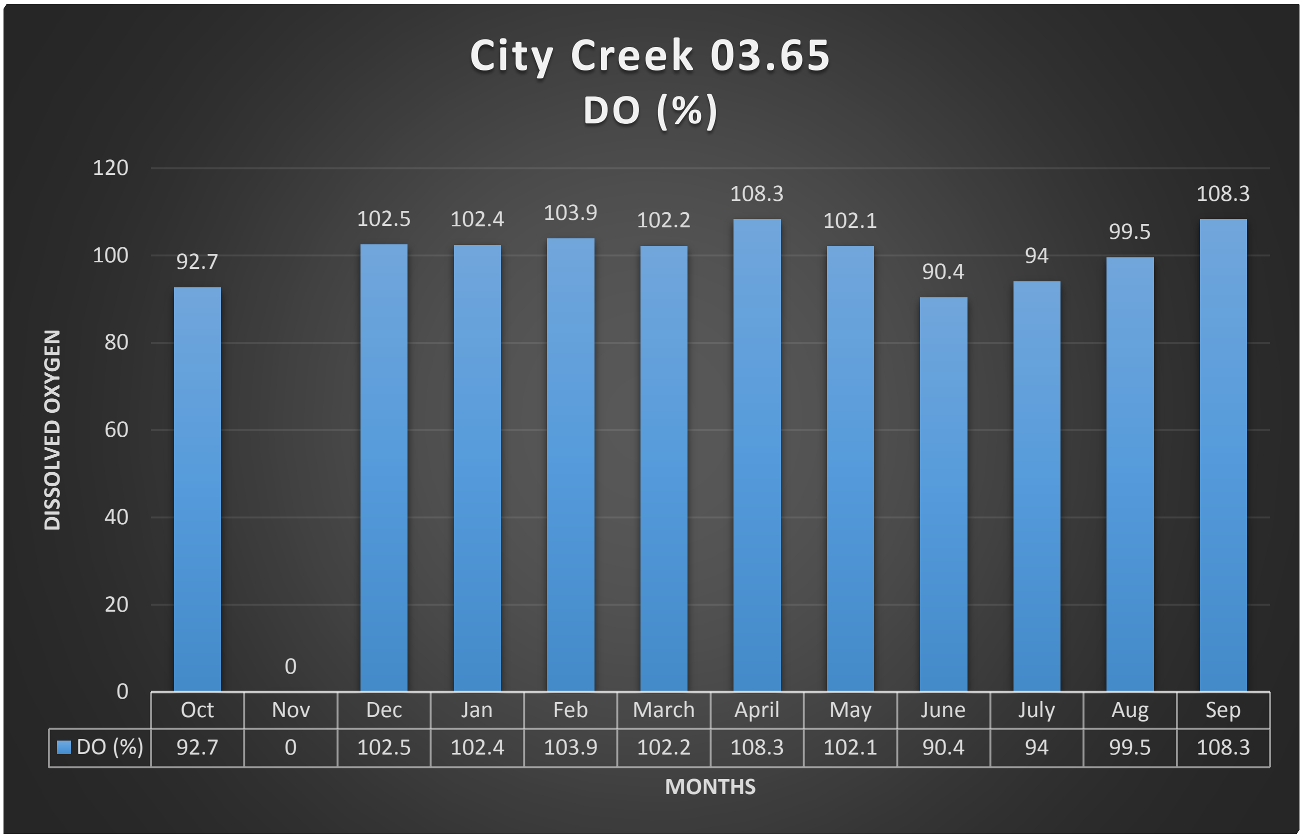


Figure 4-10 City Creek 03.65 Conductivity

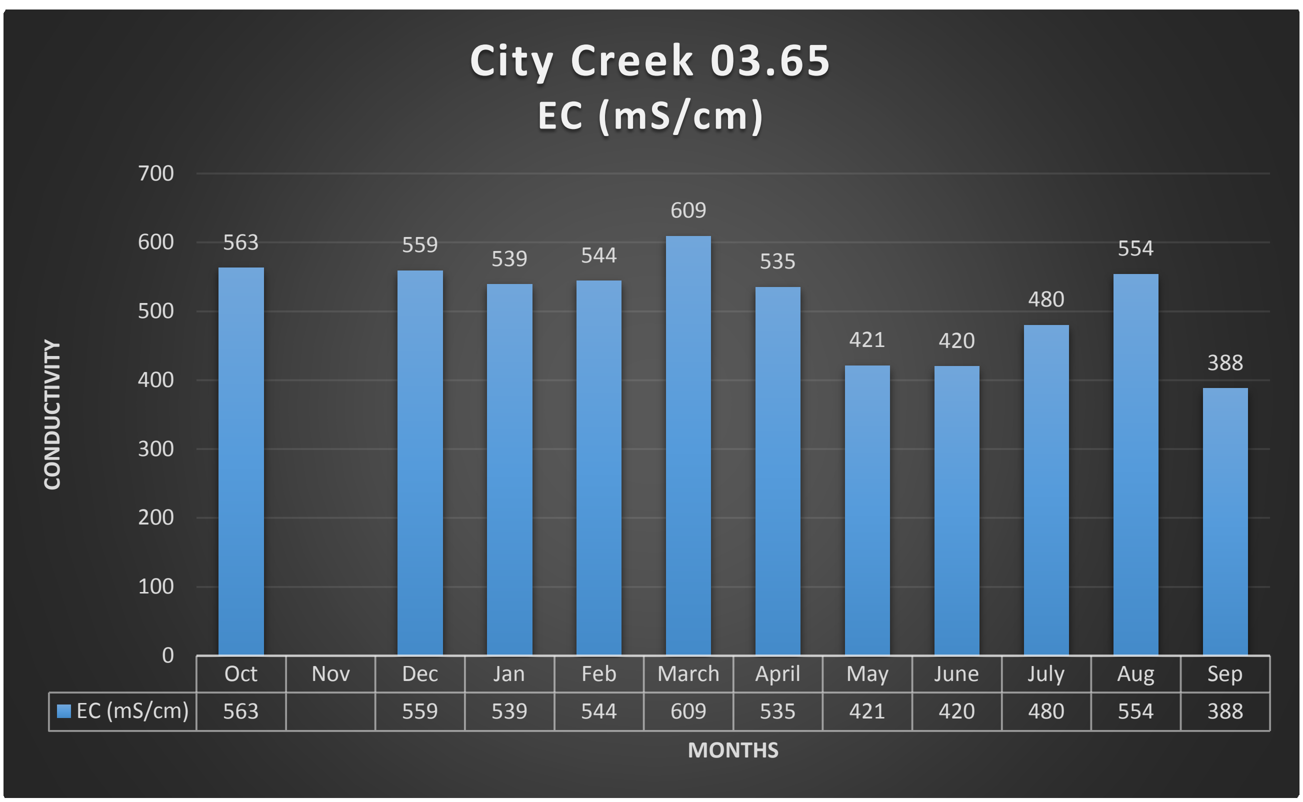


Figure 4-11 City Creek 03.65 Total Dissolved Solids

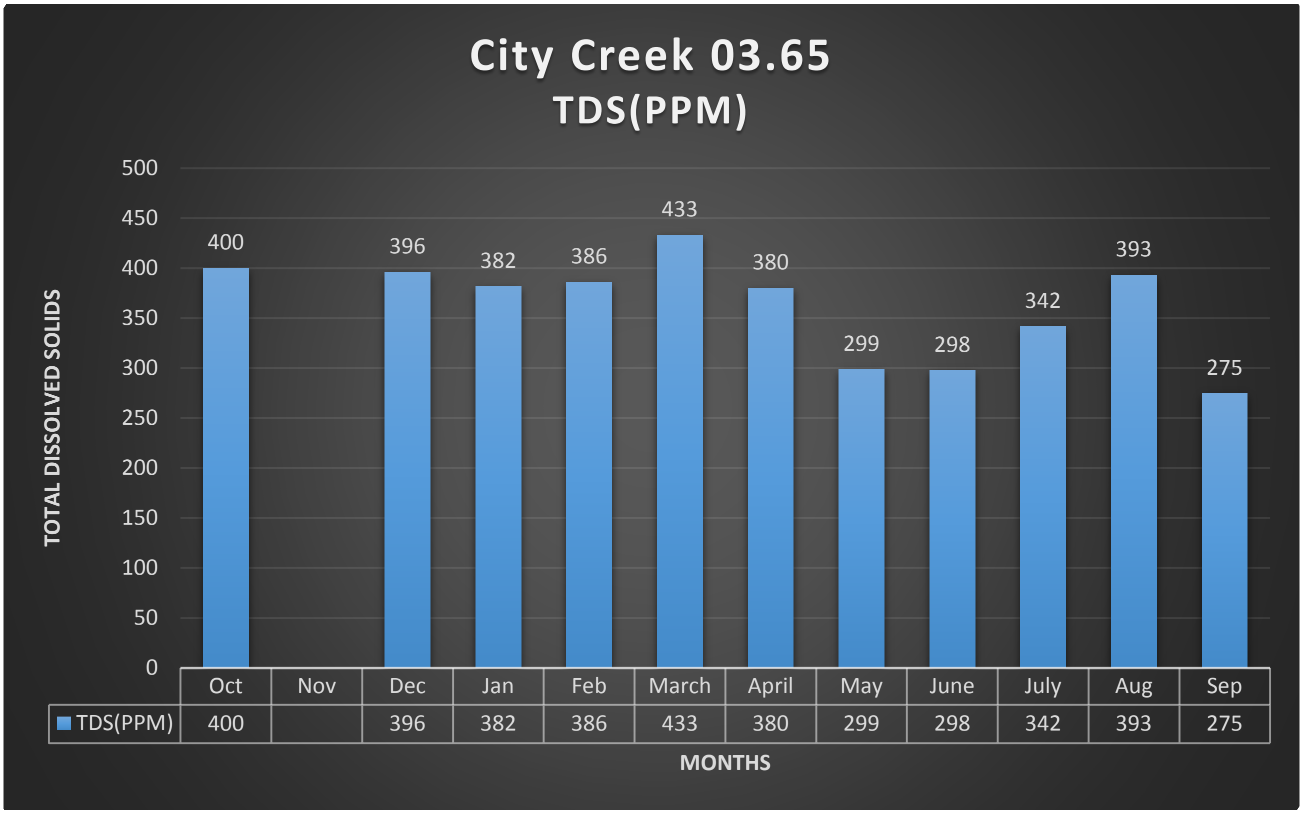


Figure 4-12 City Creek 03.65 Turbidity

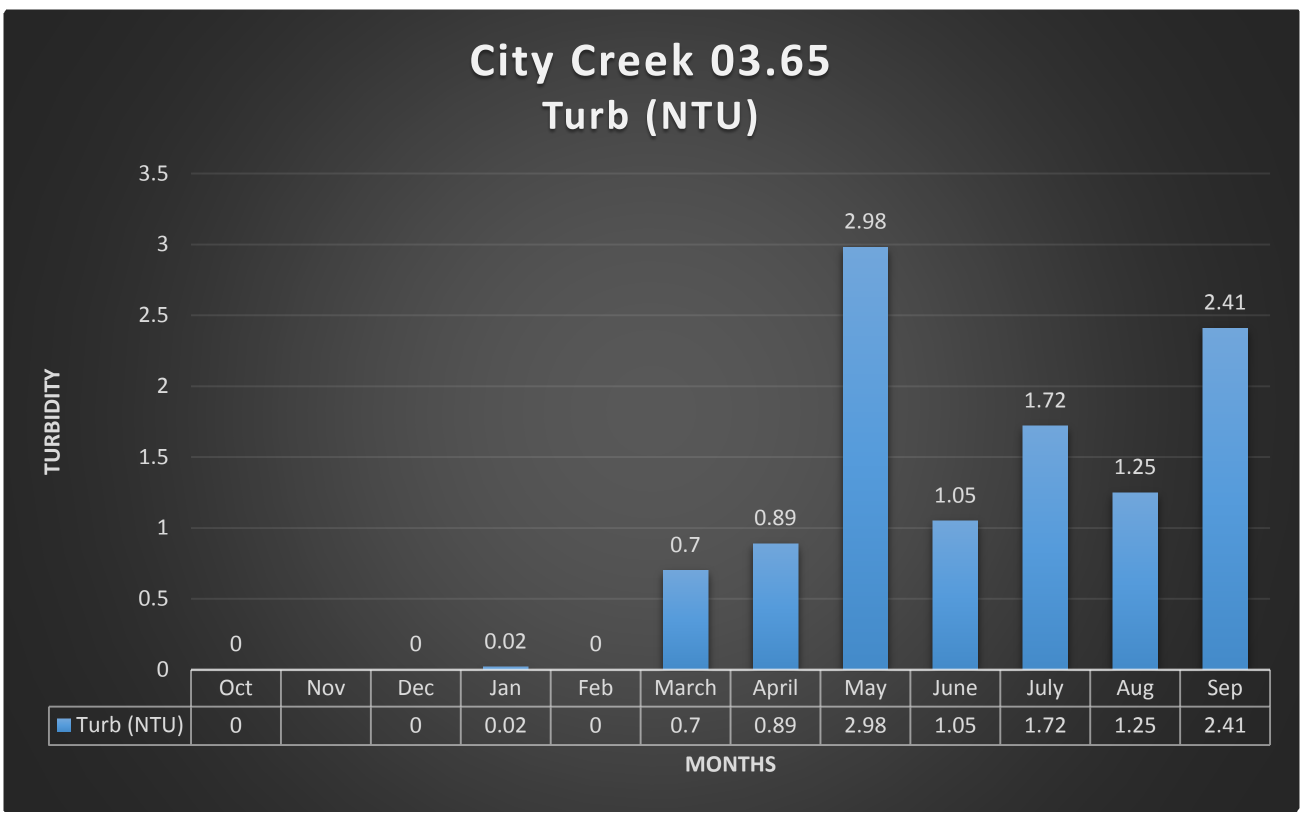


Figure 4-13 City Creek 03.65 Temperature

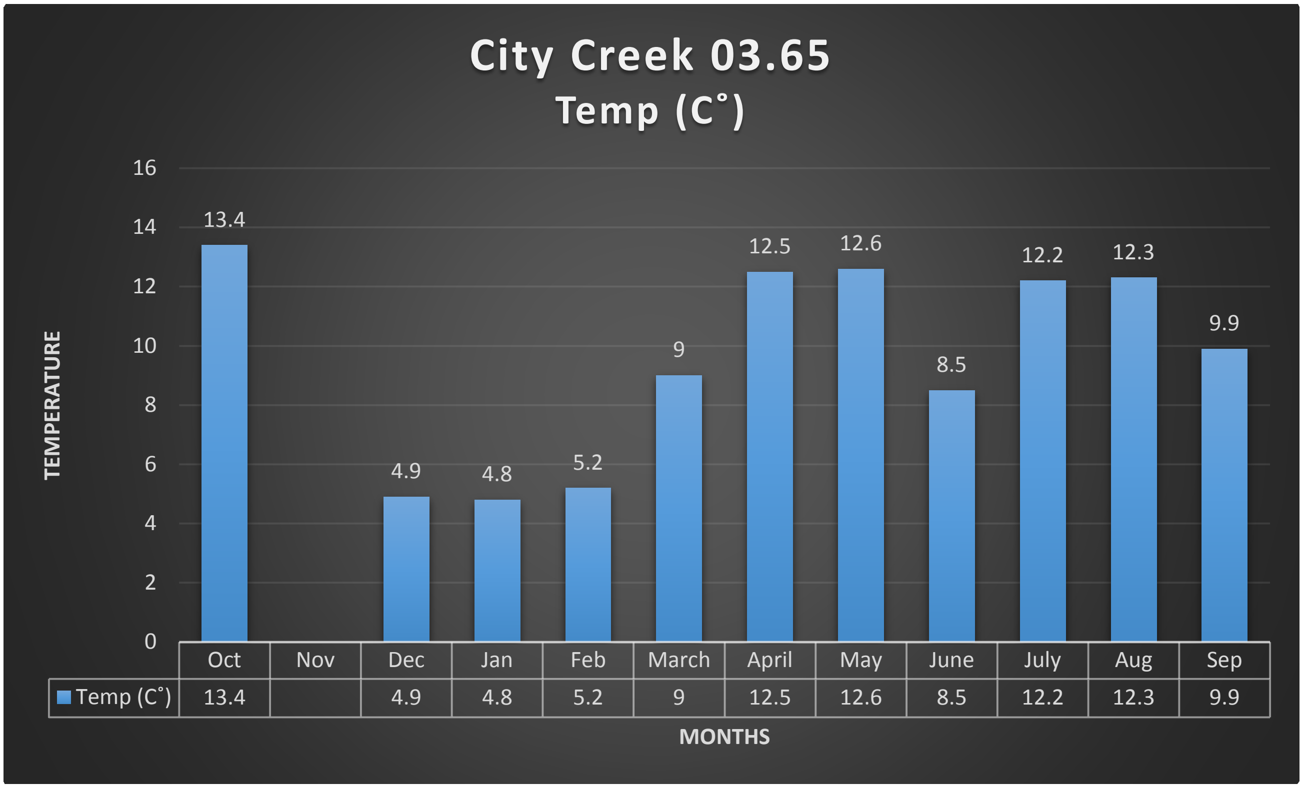


Figure 4-14 City Creek 03.65 Salinity

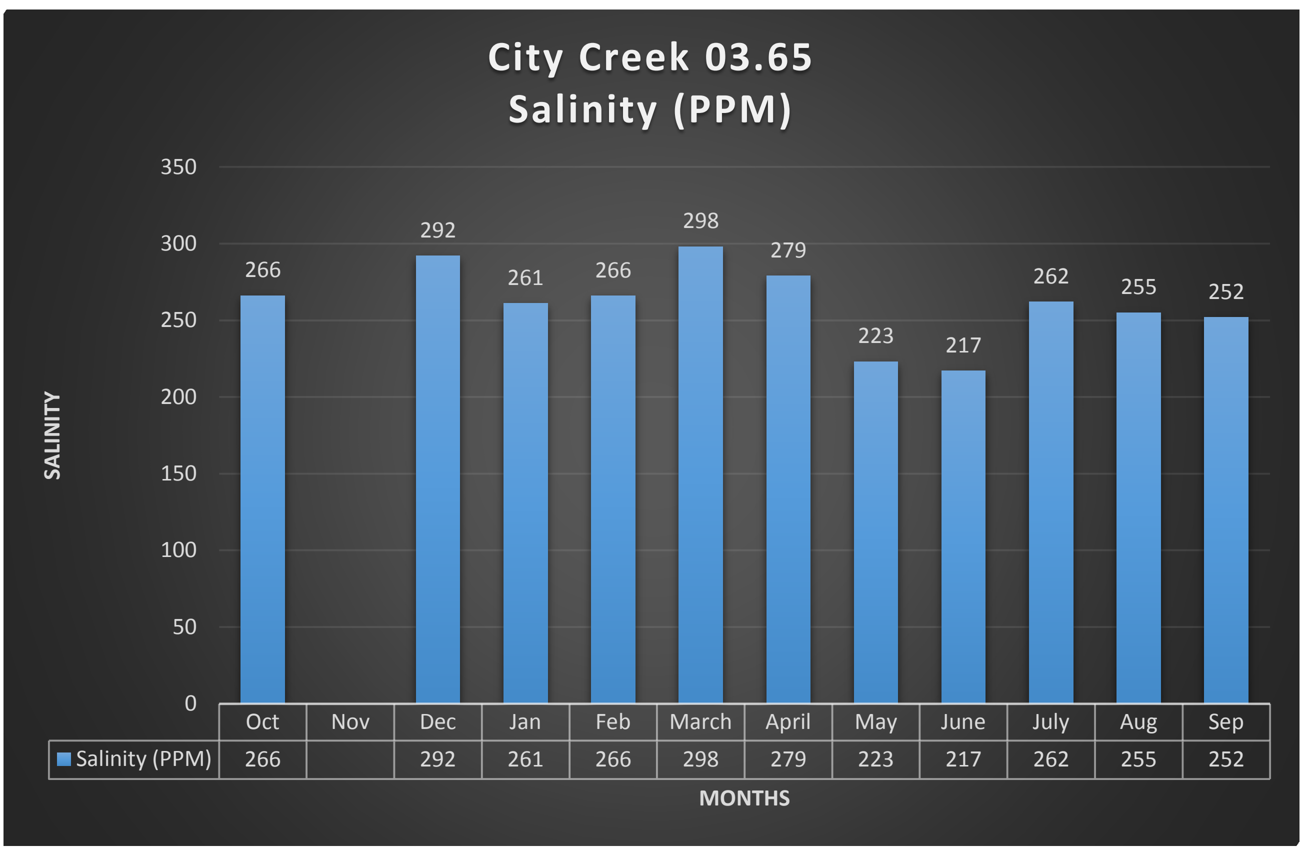


Figure 4-15 Red Butte Creek 01.65 pH

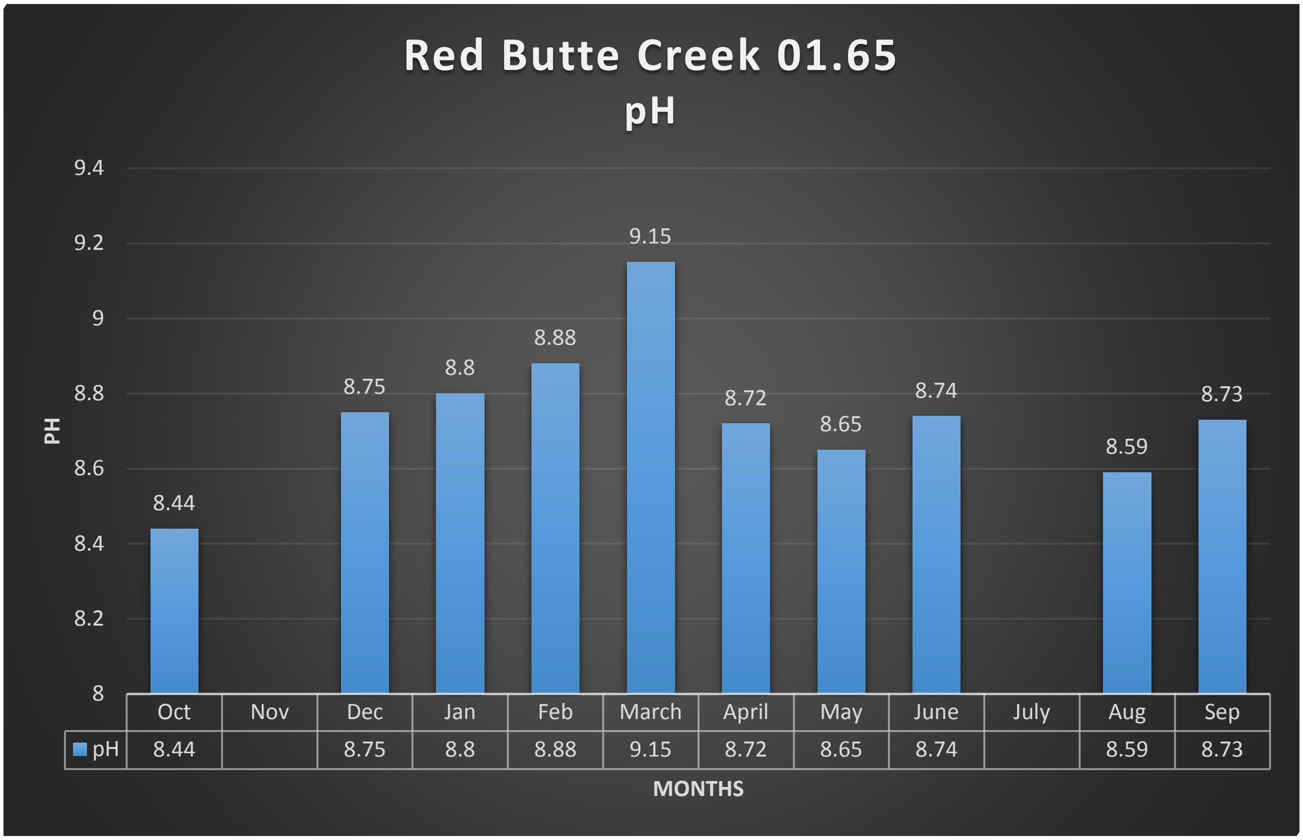


Figure 4-16 Red Butte Creek 01.65 Dissolved Oxygen

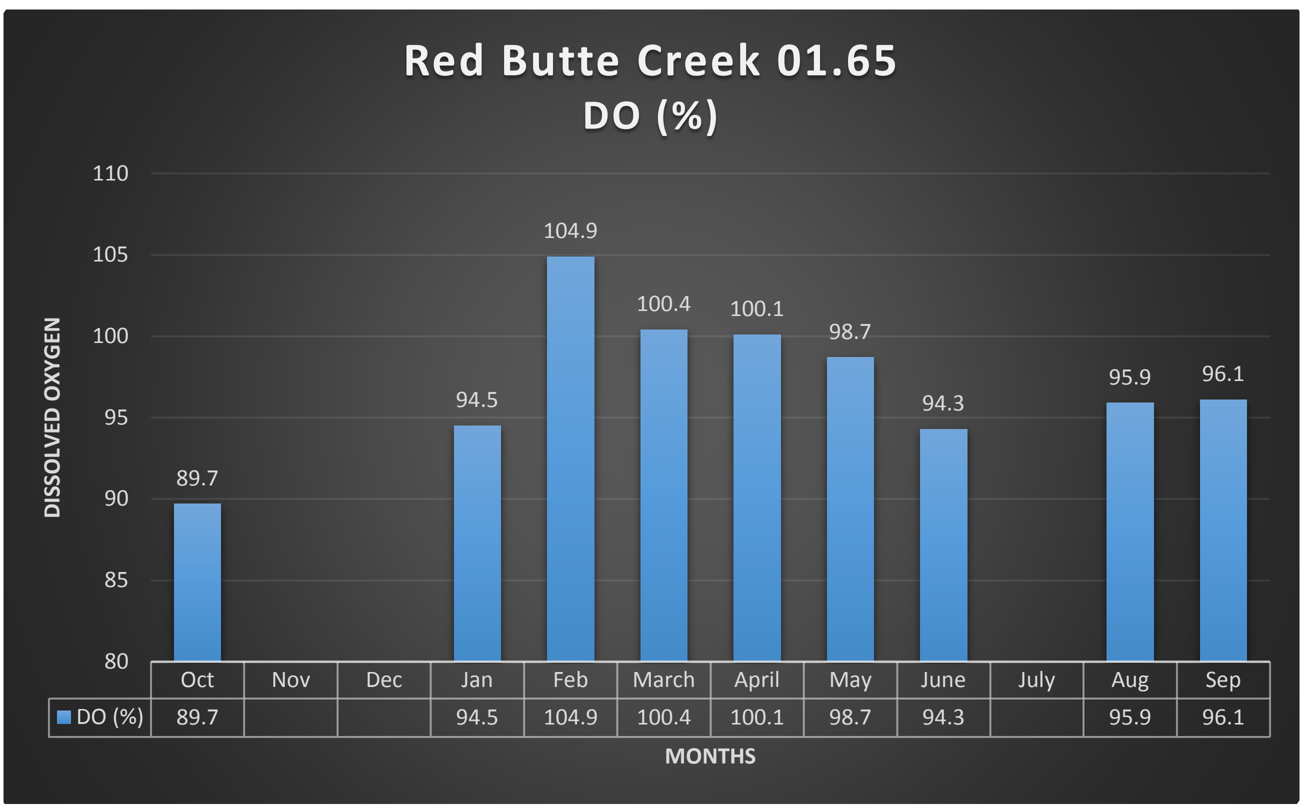
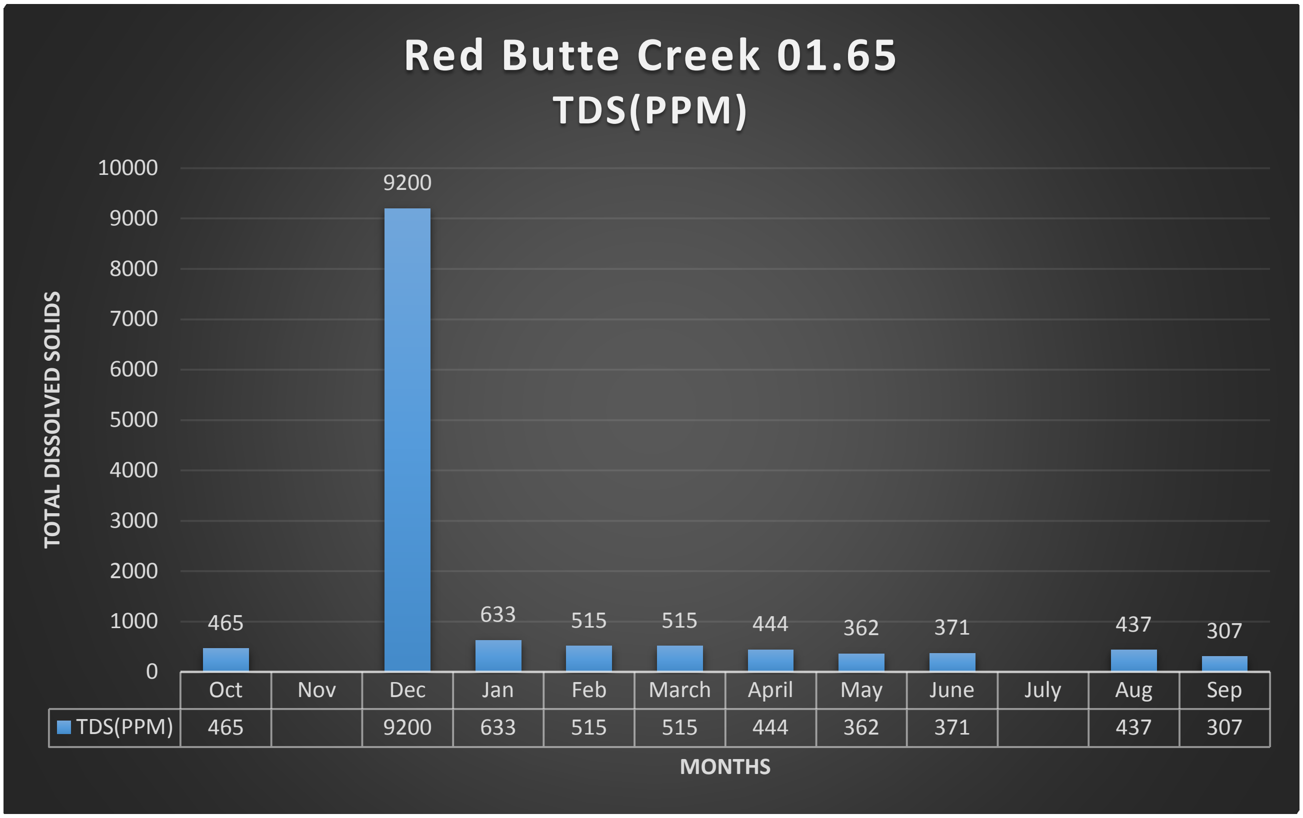
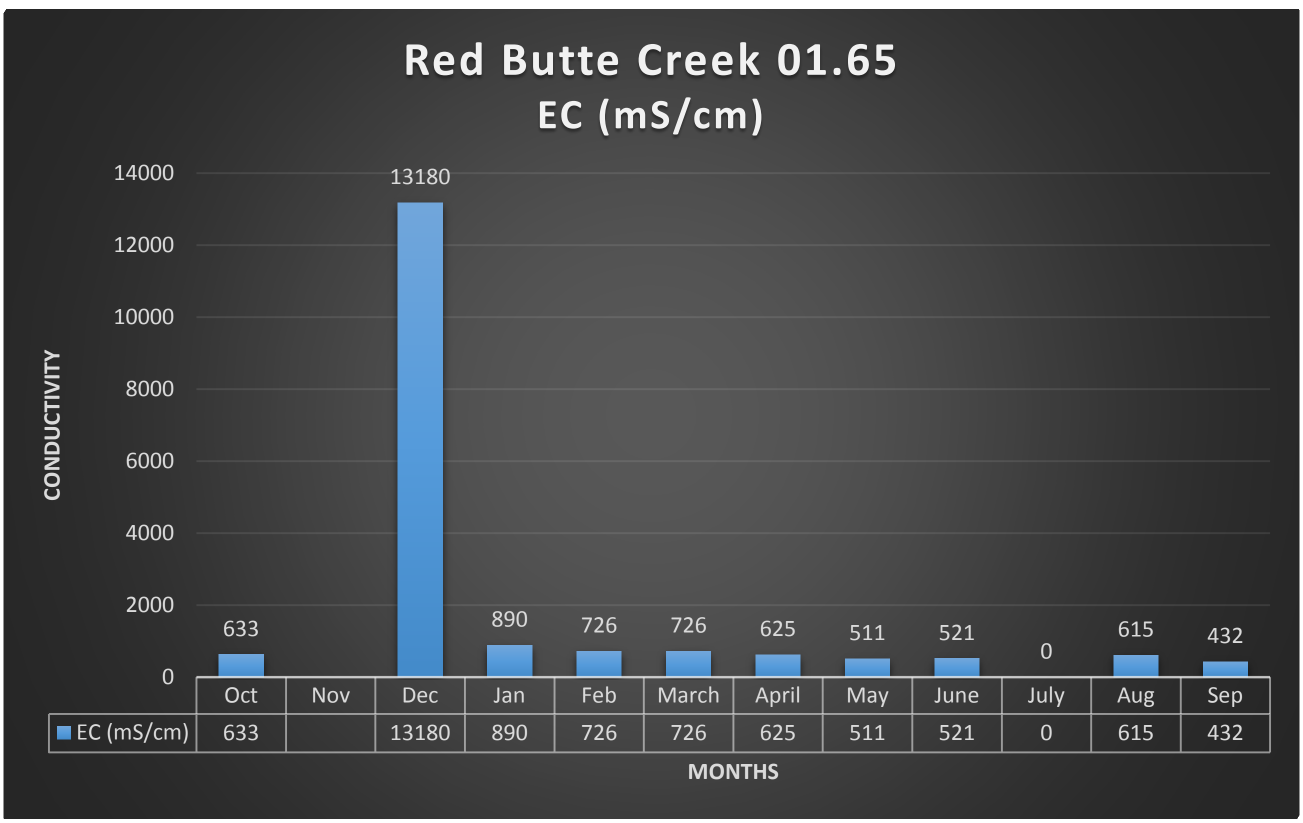


Figure 4-17 Red Butte Creek 01.65 Total Dissolved Solids



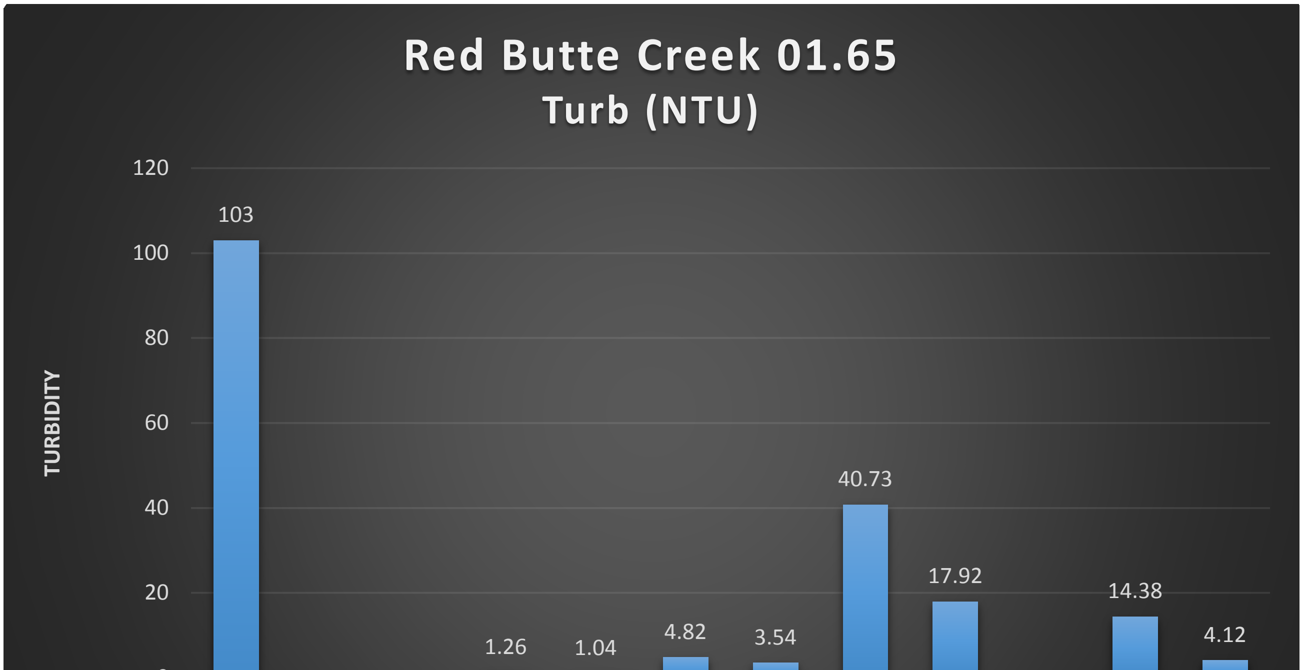
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
TDS(PPM)	465		9200	633	515	515	444	362	371		437	307

Figure 4-18 Red Butte Creek 01.65 Conductivity



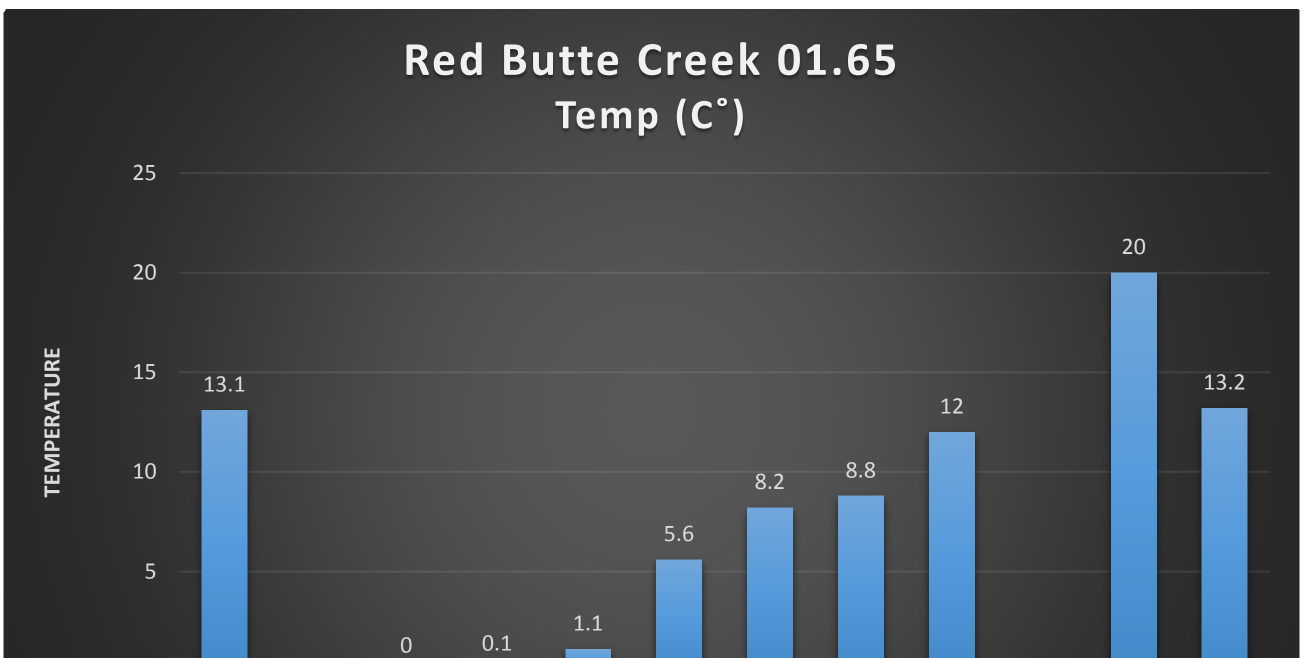
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
EC (mS/cm)	633		13180	890	726	726	625	511	521	0	615	432

Figure 4-19 Red Butte Creek 01.65 Turbidity



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Turb (NTU)	103			1.26	1.04	4.82	3.54	40.73	17.92		14.38	4.12

Figure 4-20 Red Butte Creek 01.65 Temperature



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Temp (C˚)	13.1		0	0.1	1.1	5.6	8.2	8.8	12		20	13.2

Figure 4-21 Red Butte Creek 01.65 Salinity

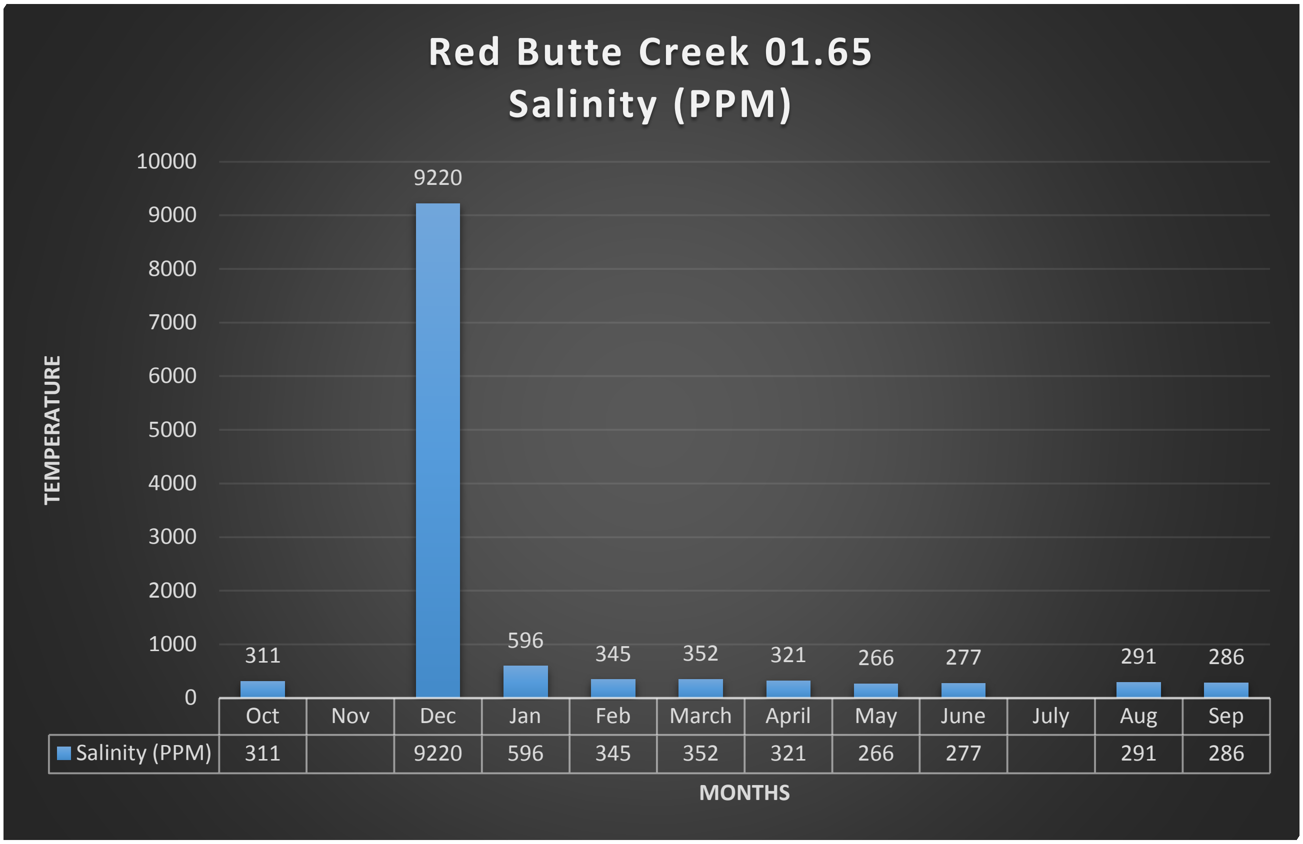


Figure 4-22 Red Butte Creek 04.21 pH

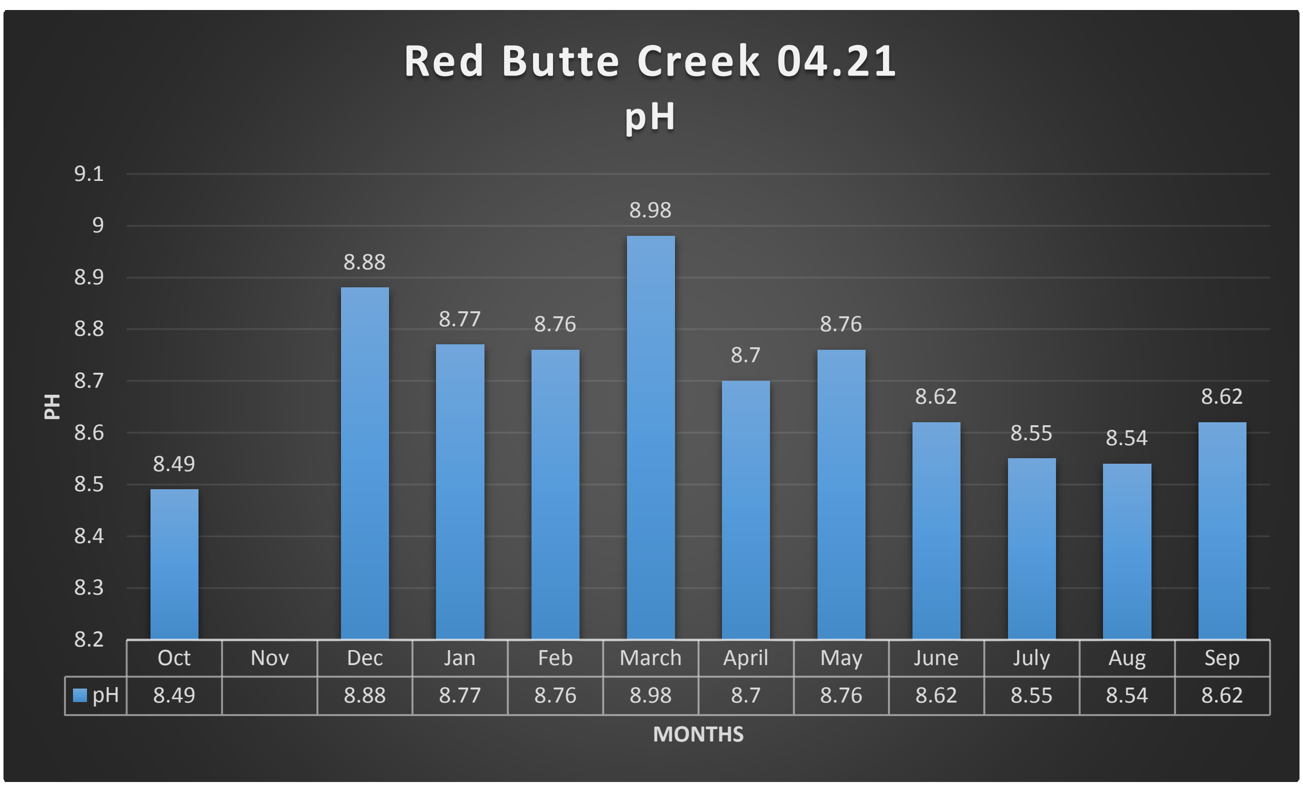


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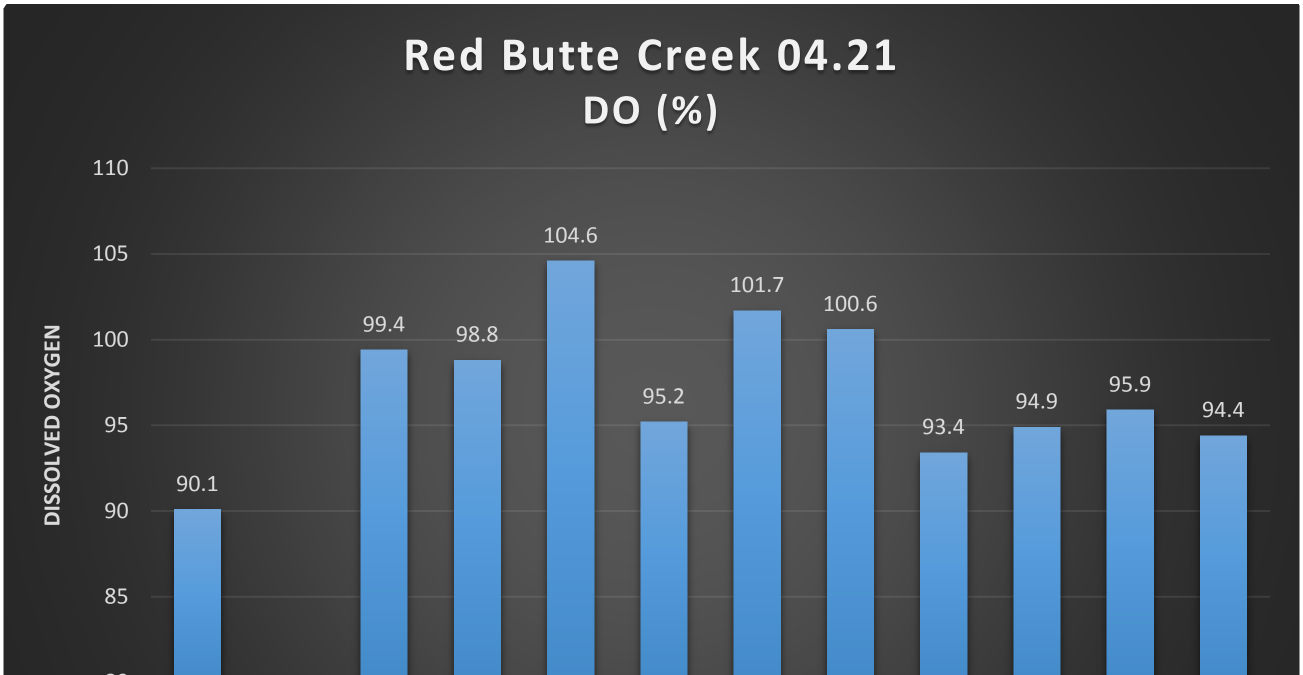
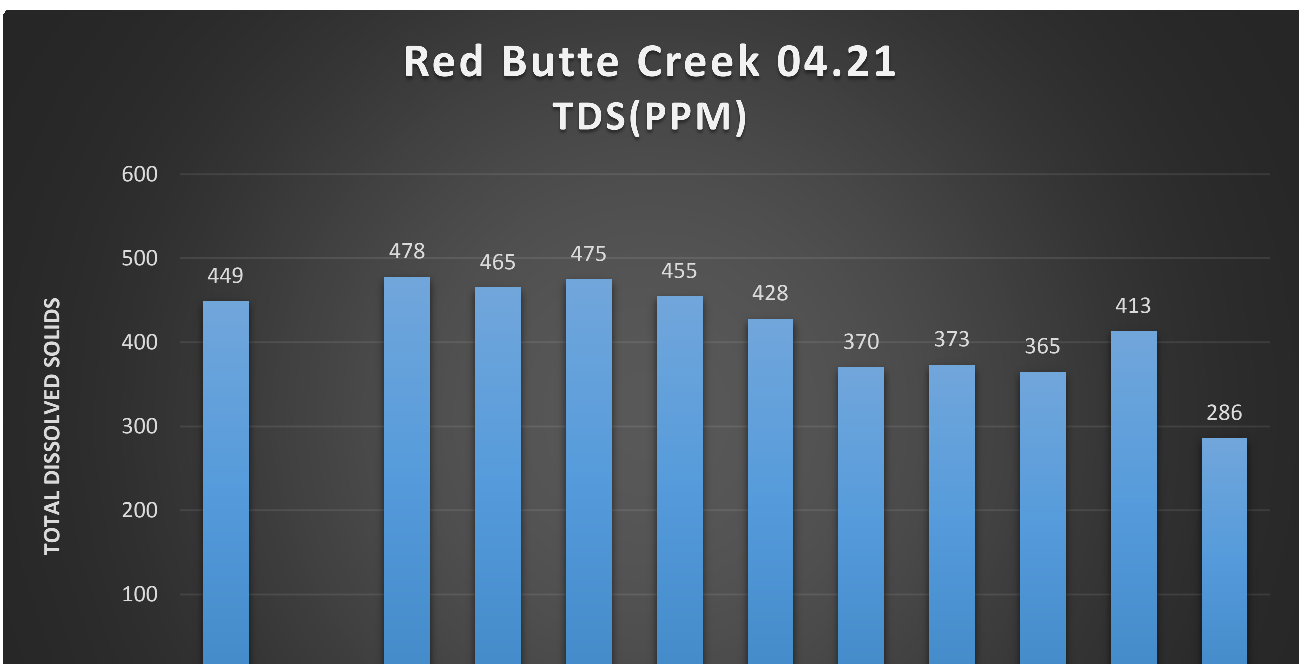
Figure 4-23 Red Butte Creek 04.21 Dissolved Oxygen



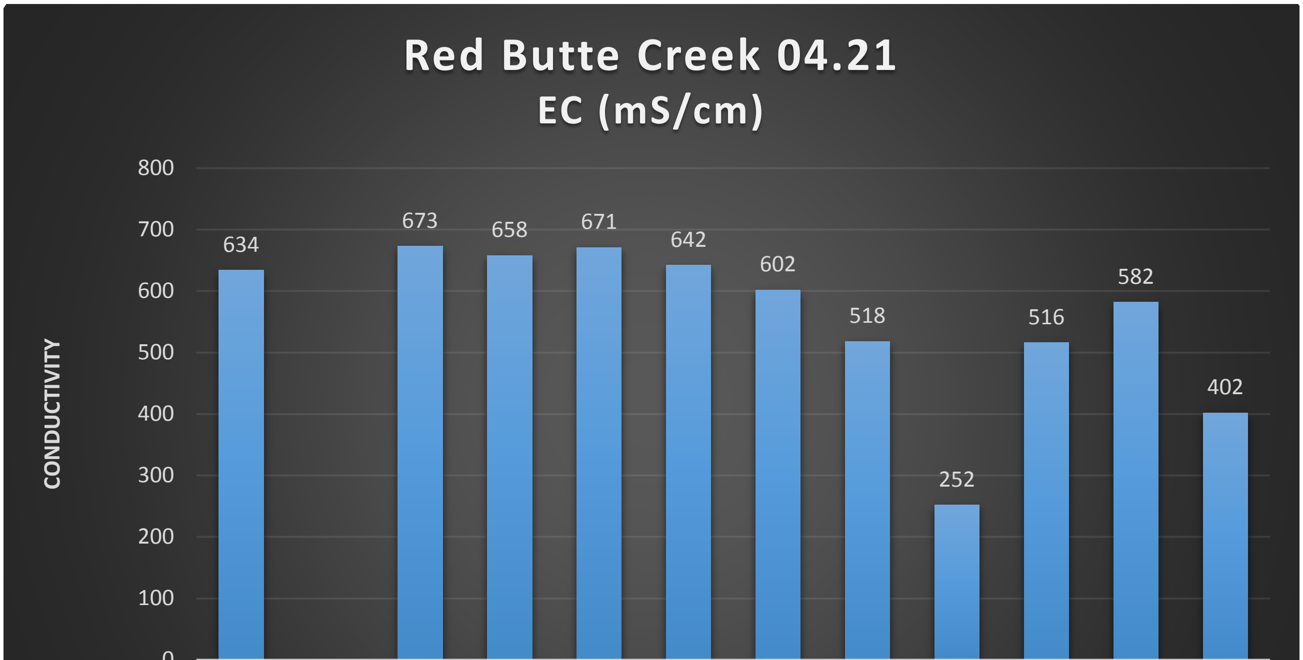
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
DO (%)	90.1		99.4	98.8	104.6	95.2	101.7	100.6	93.4	94.9	95.9	94.4

Figure 4-24 Red Butte Creek 04.21 Total Dissolved Solids



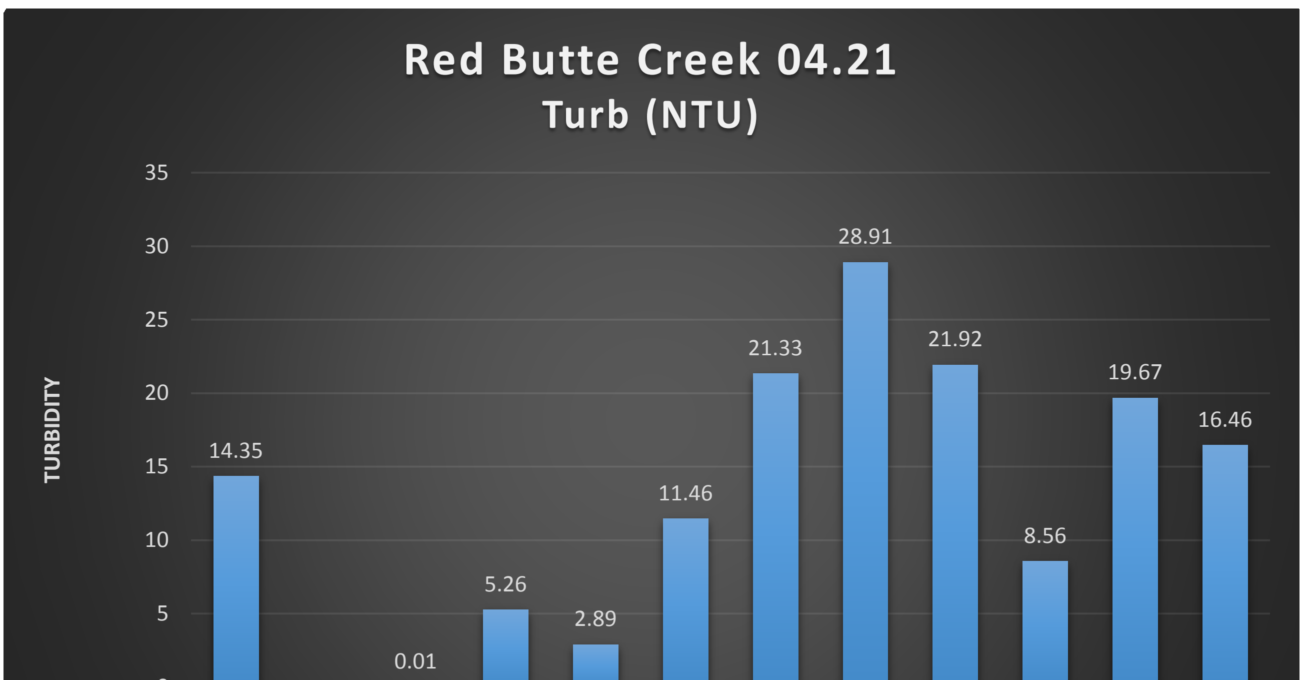
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
TDS(PPM)	449		478	465	475	455	428	370	373	365	413	286

Figure 4-25 Red Butte Creek 04.21 Conductivity



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
EC (mS/cm)	634		673	658	671	642	602	518	252	516	582	402

Figure 4-26 Red Butte Creek 04.21 Turbidity



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Turb (NTU)	14.35		0.01	5.26	2.89	11.46	21.33	28.91	21.92	8.56	19.67	16.46

Figure 4-27 Red Butte Creek 04.21 Temperature

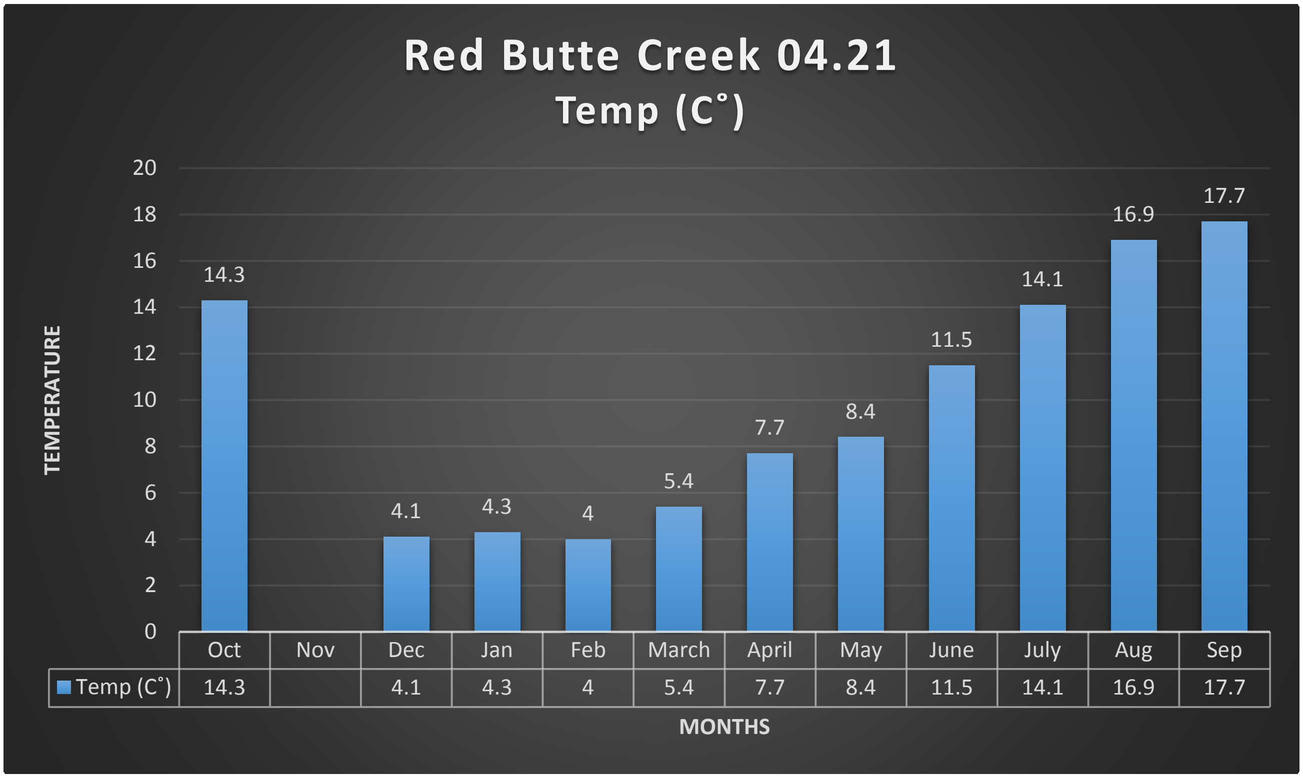


Figure 4-28 Red Butte Creek 04.21 Salinity

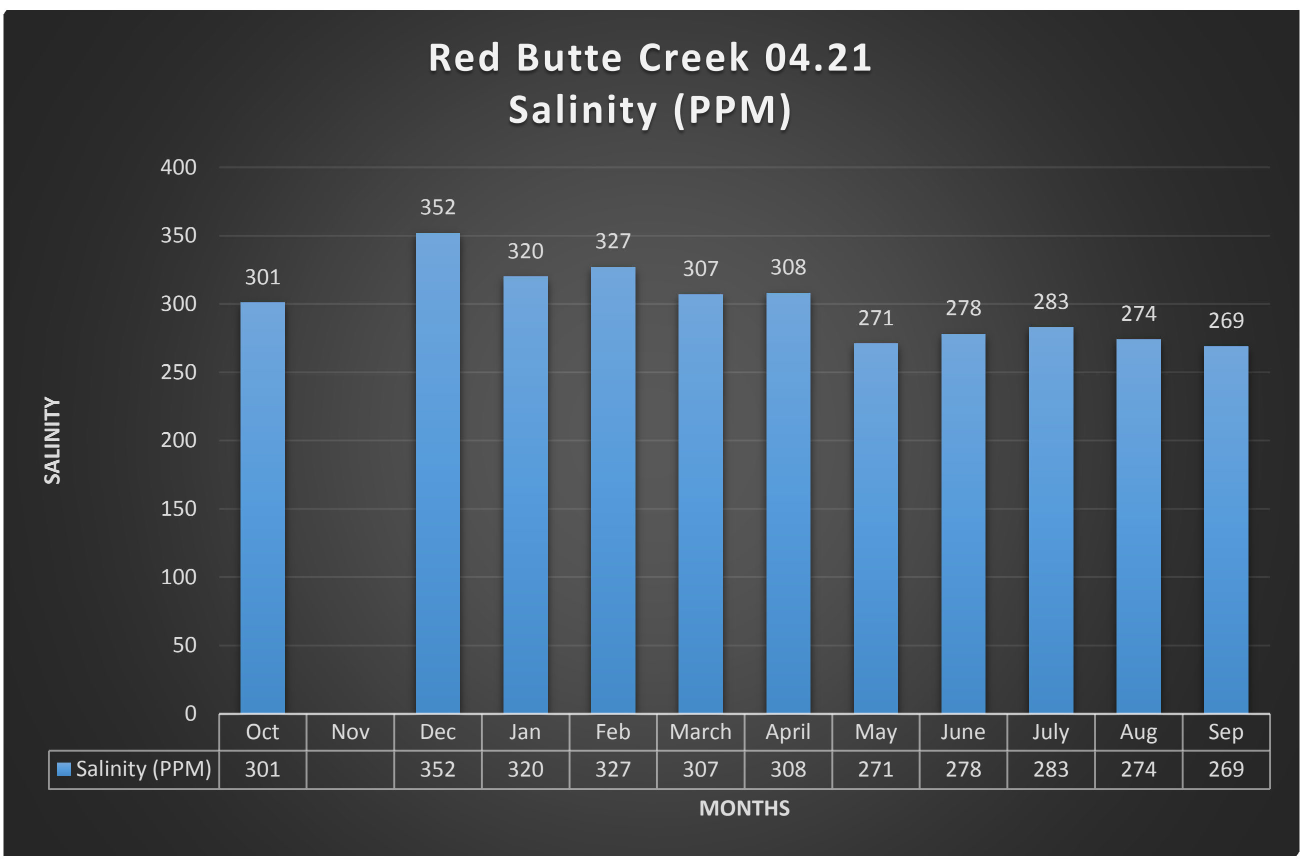
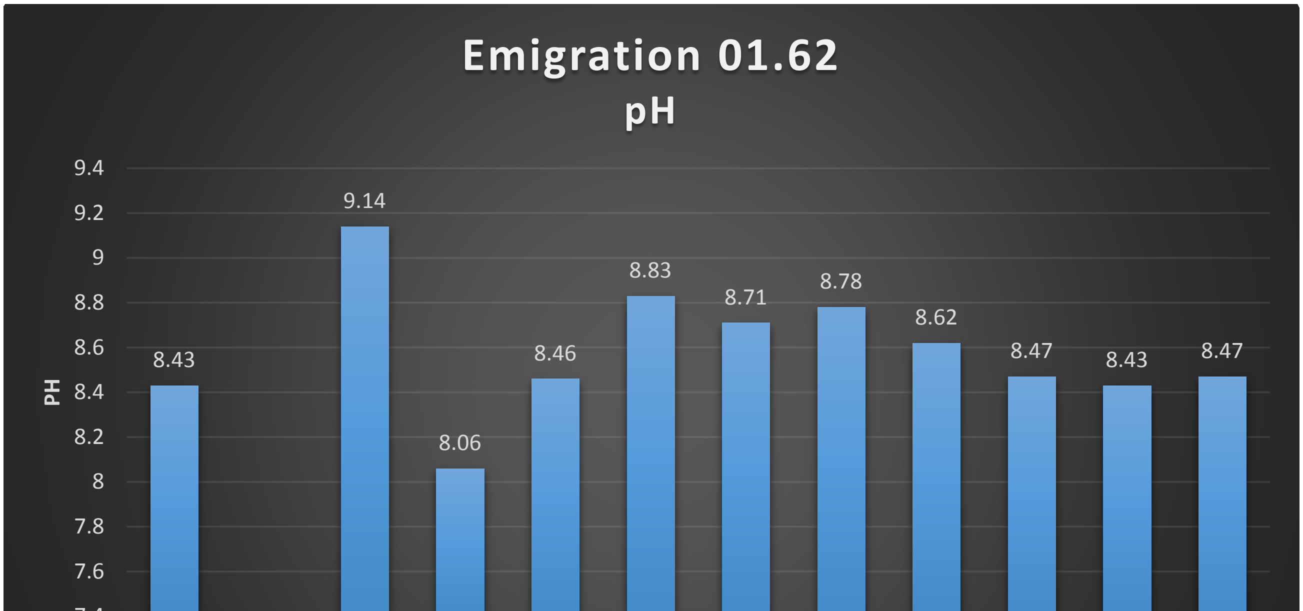
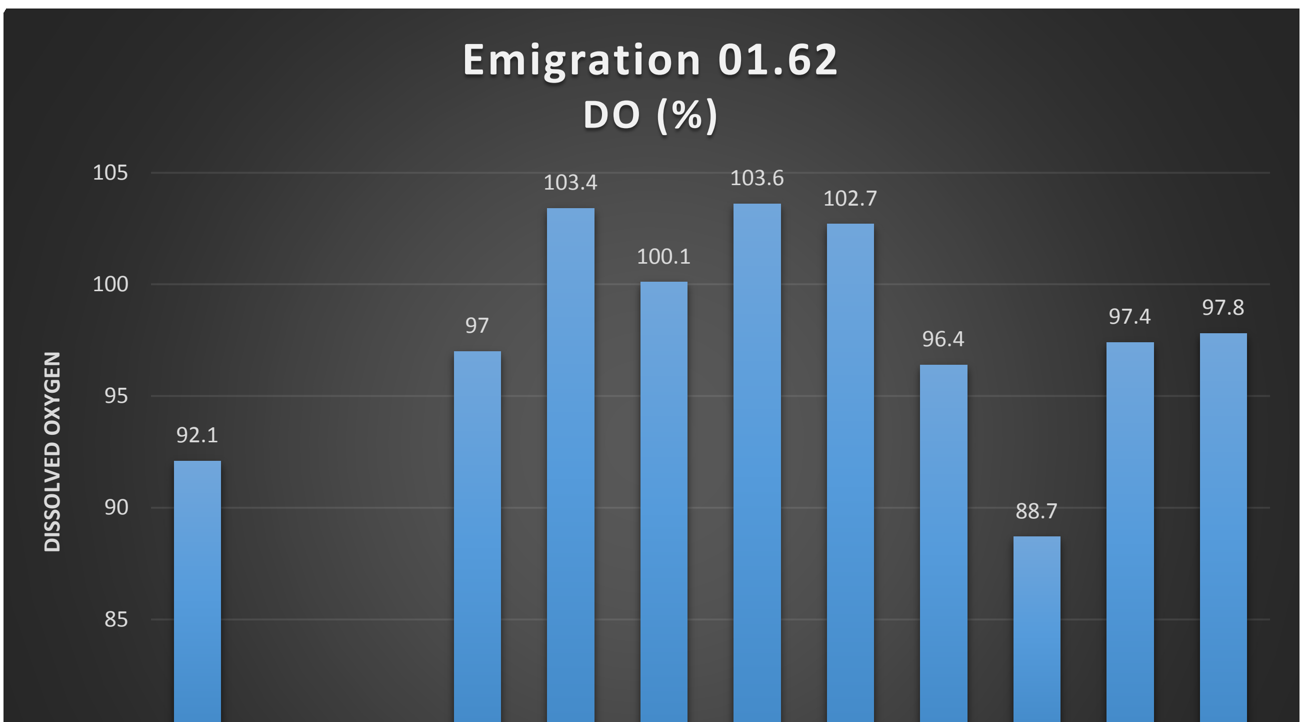


Figure 4-29 Emigration Creek 01.62 pH



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
pH	8.43		9.14	8.06	8.46	8.83	8.71	8.78	8.62	8.47	8.43	8.47

Figure 4-30 Emigration Creek 01.62 Dissolved Oxygen



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
DO (%)	92.1			97	103.4	100.1	103.6	102.7	96.4	88.7	97.4	97.8

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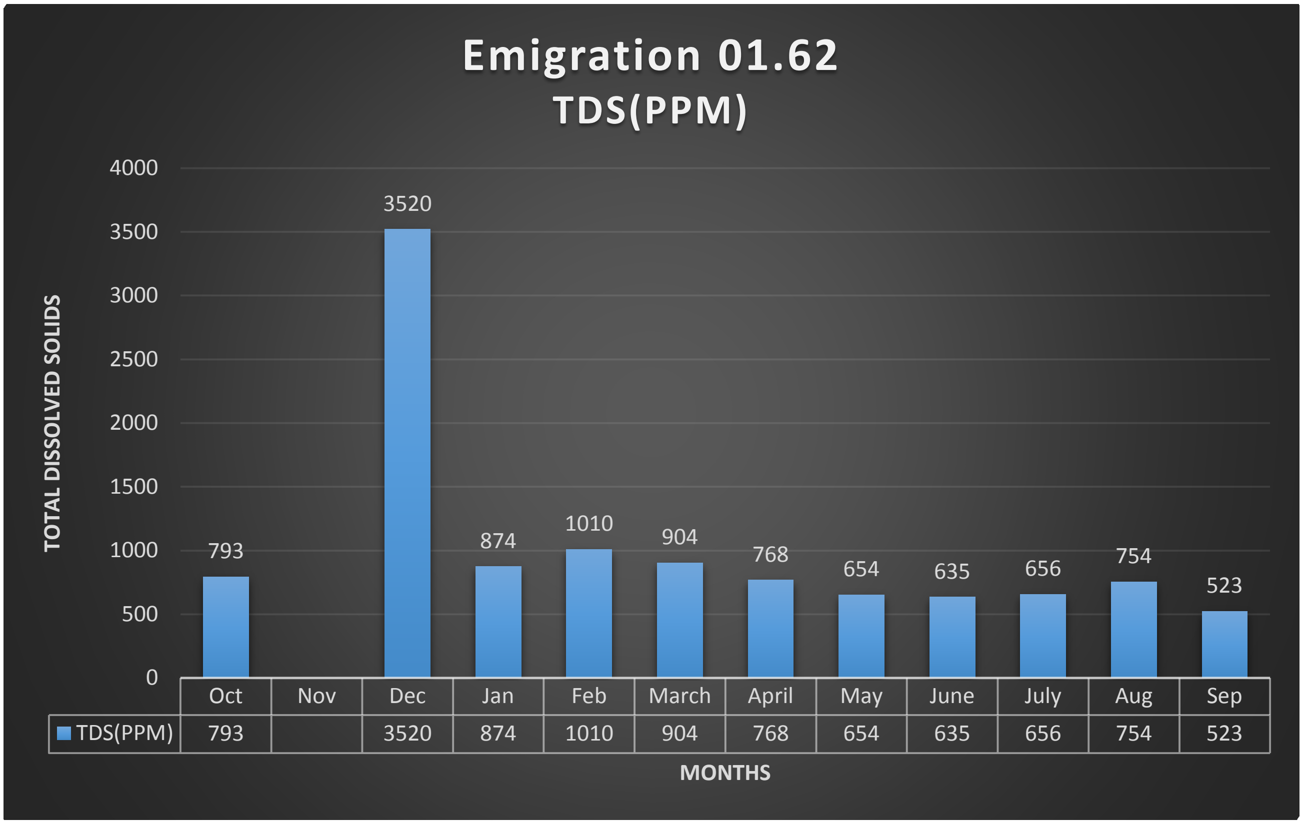
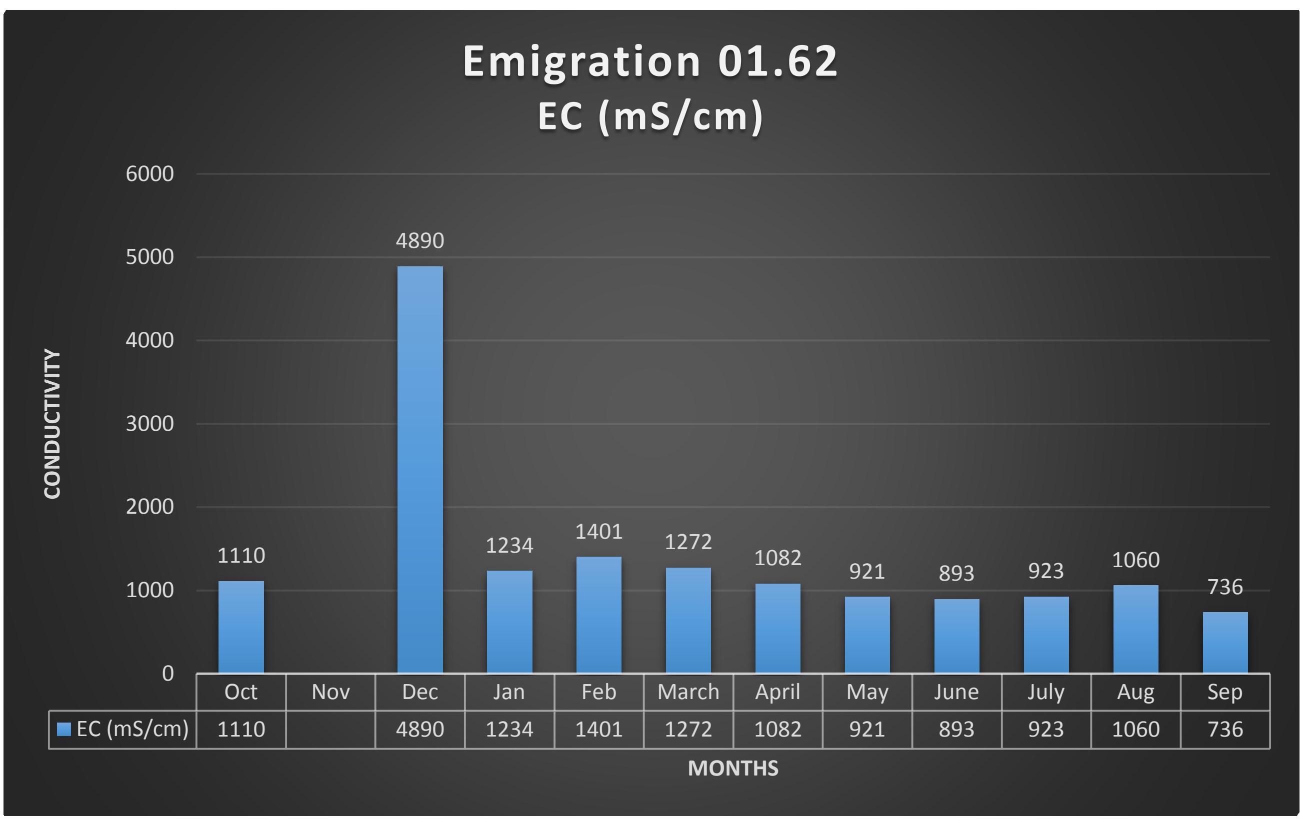
Figure 4-31 Emigration Creek 01.62 Total Dissolved Solids



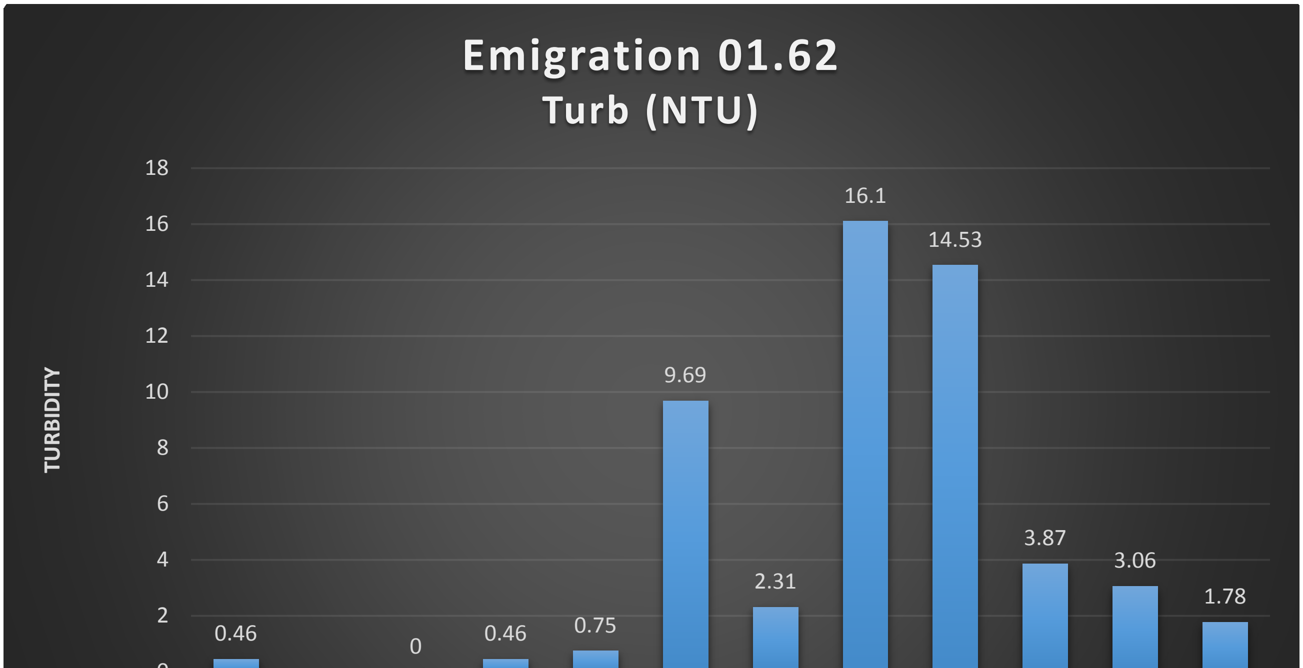
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
TDS(PPM)	793		3520	874	1010	904	768	654	635	656	754	523

Figure 4-32 Emigration Creek 01.62 Conductivity



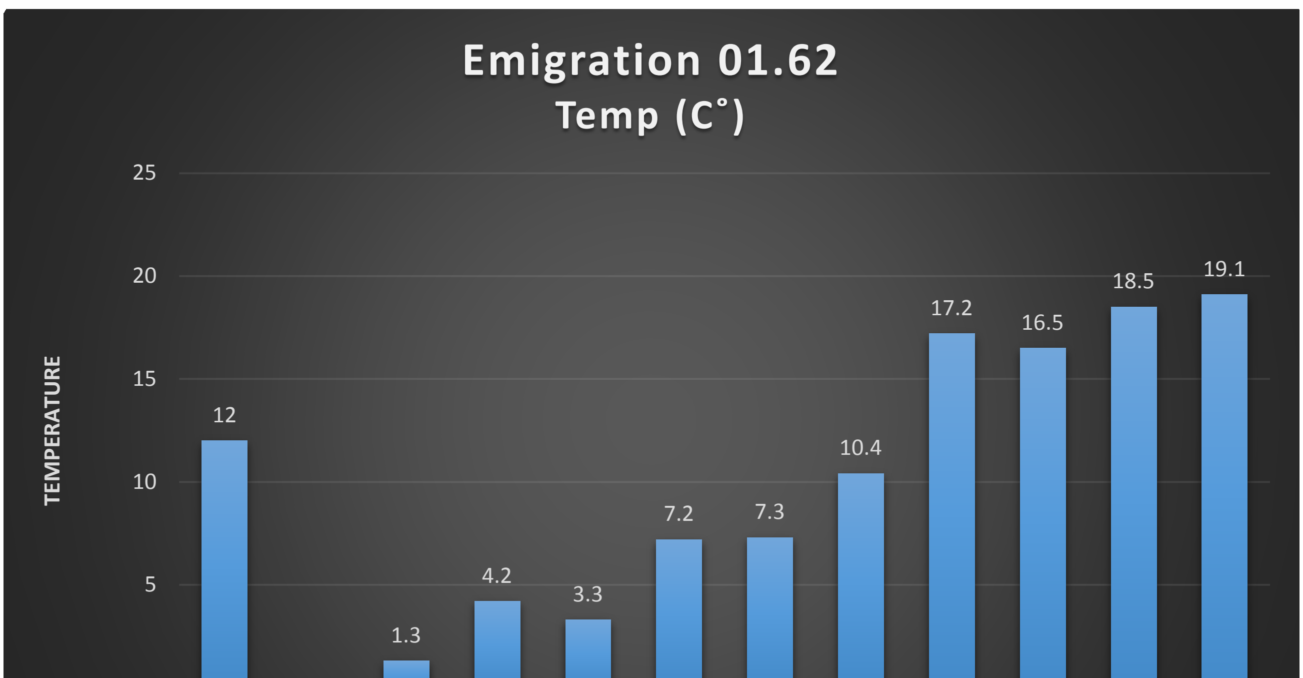
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
EC (mS/cm)	1110		4890	1234	1401	1272	1082	921	893	923	1060	736

Figure 4-33 Emigration Creek 01.62 Turbidity



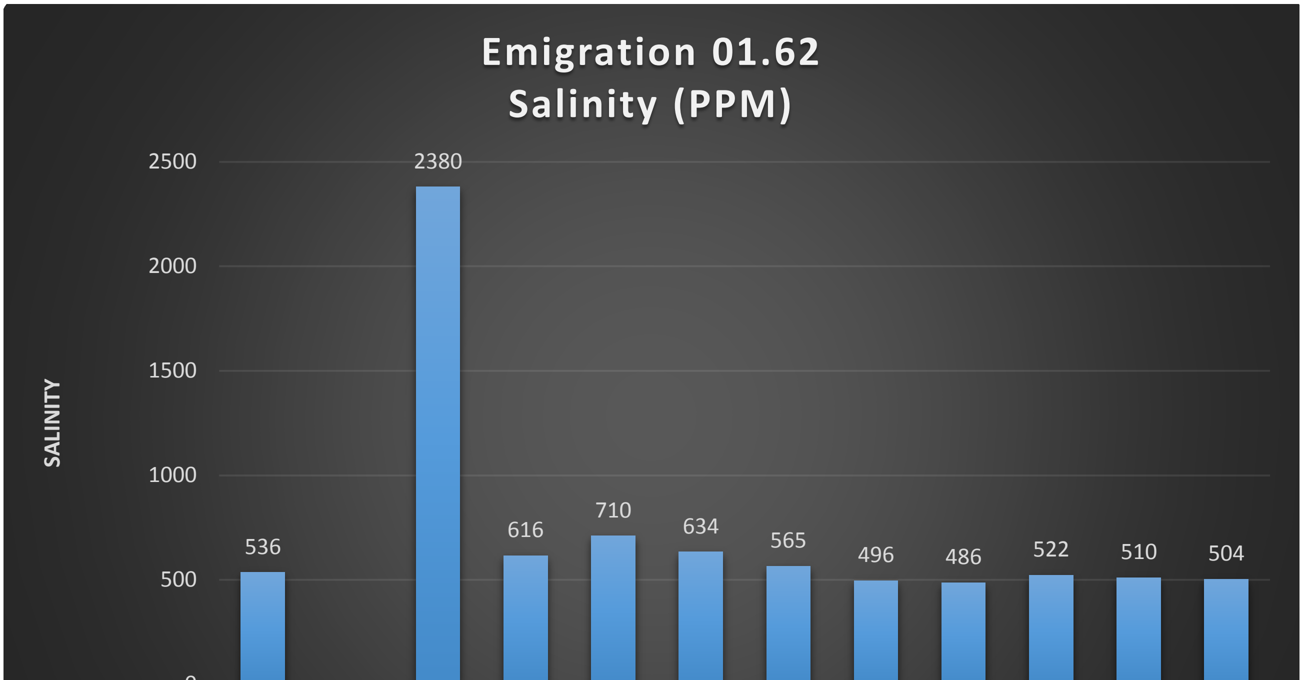
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Turb (NTU)	0.46		0	0.46	0.75	9.69	2.31	16.1	14.53	3.87	3.06	1.78

Figure 4-34 Emigration Creek 01.62 Temperature



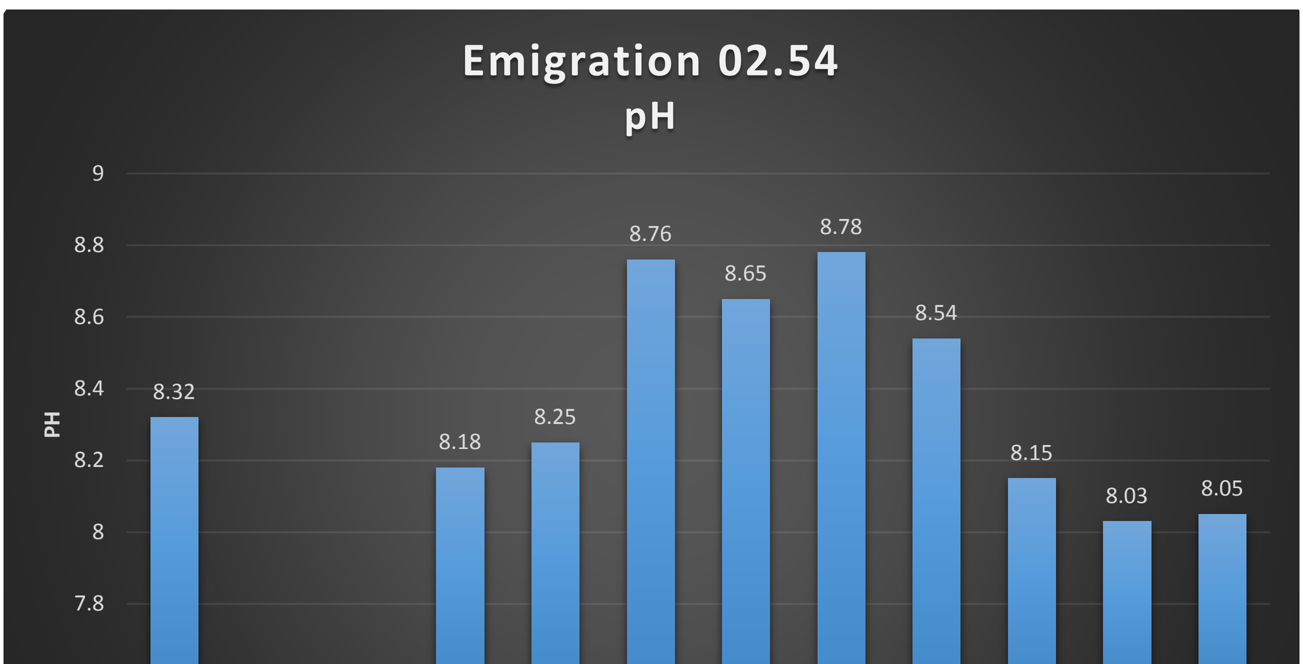
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Temp (C˚)	12		1.3	4.2	3.3	7.2	7.3	10.4	17.2	16.5	18.5	19.1

Figure 4-35 Emigration Creek 01.62 Salinity



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Salinity (PPM)	536		2380	616	710	634	565	496	486	522	510	504

Figure 4-36 Emigration Creek 02.54 pH



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
pH	8.32			8.18	8.25	8.76	8.65	8.78	8.54	8.15	8.03	8.05

Figure 4-37 Emigration Creek 02.54 Dissolved Oxygen

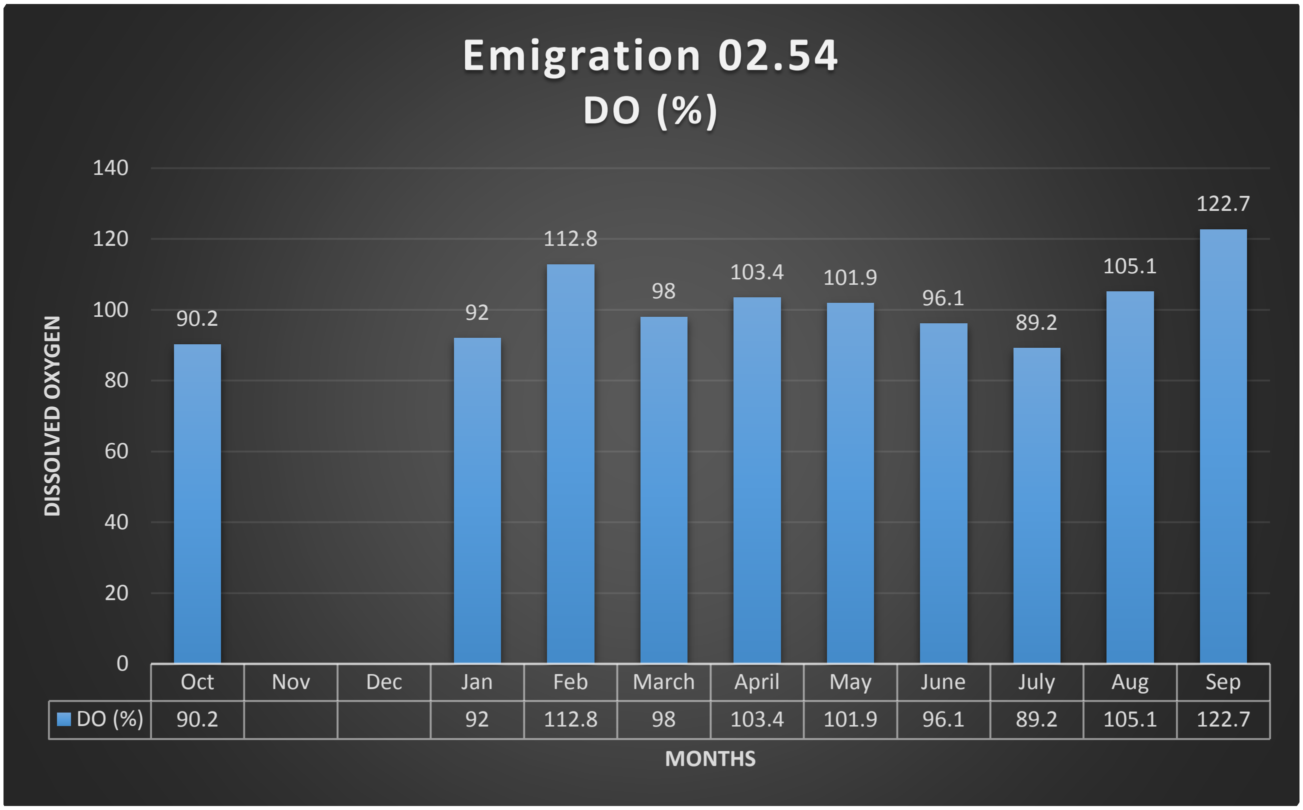


Figure 4-38 Emigration Creek 02.54 Total Dissolved Solids

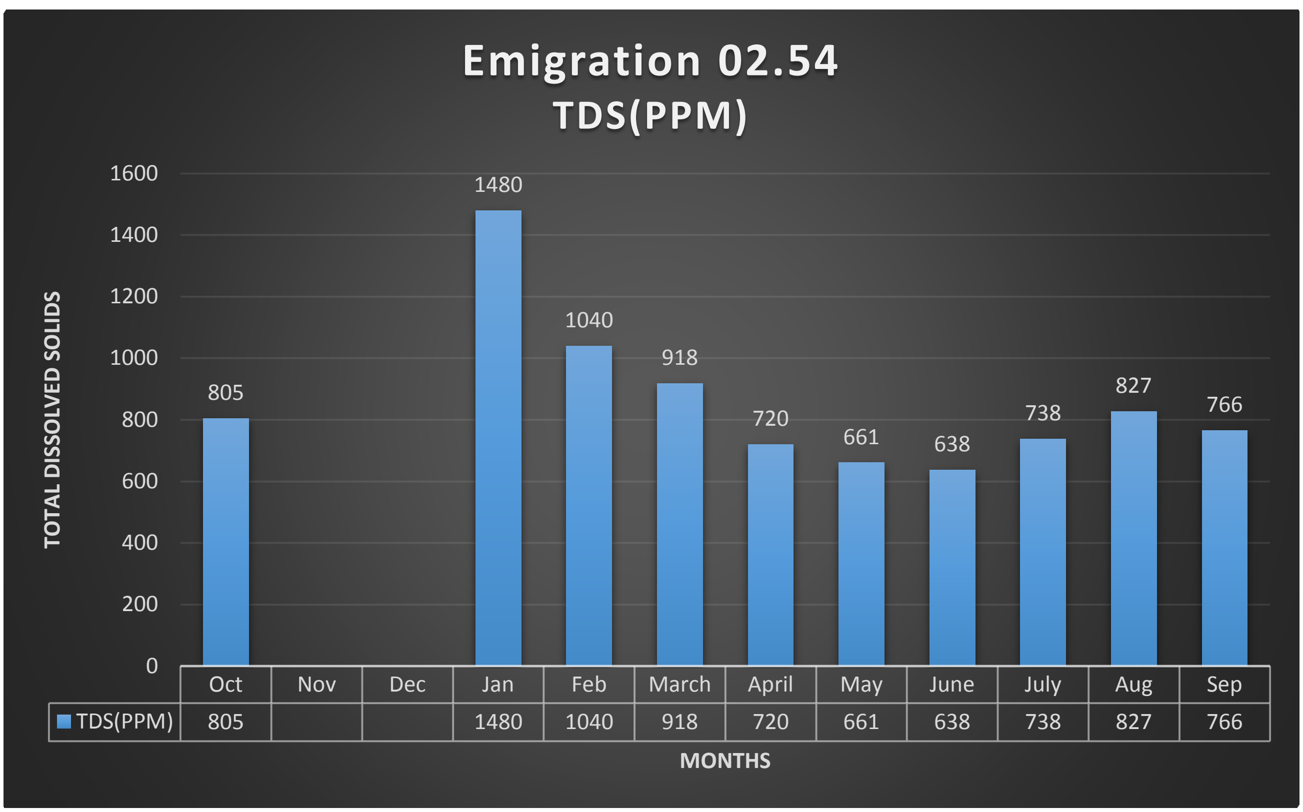


Figure 4-39 Emigration Creek 02.54 Conductivity

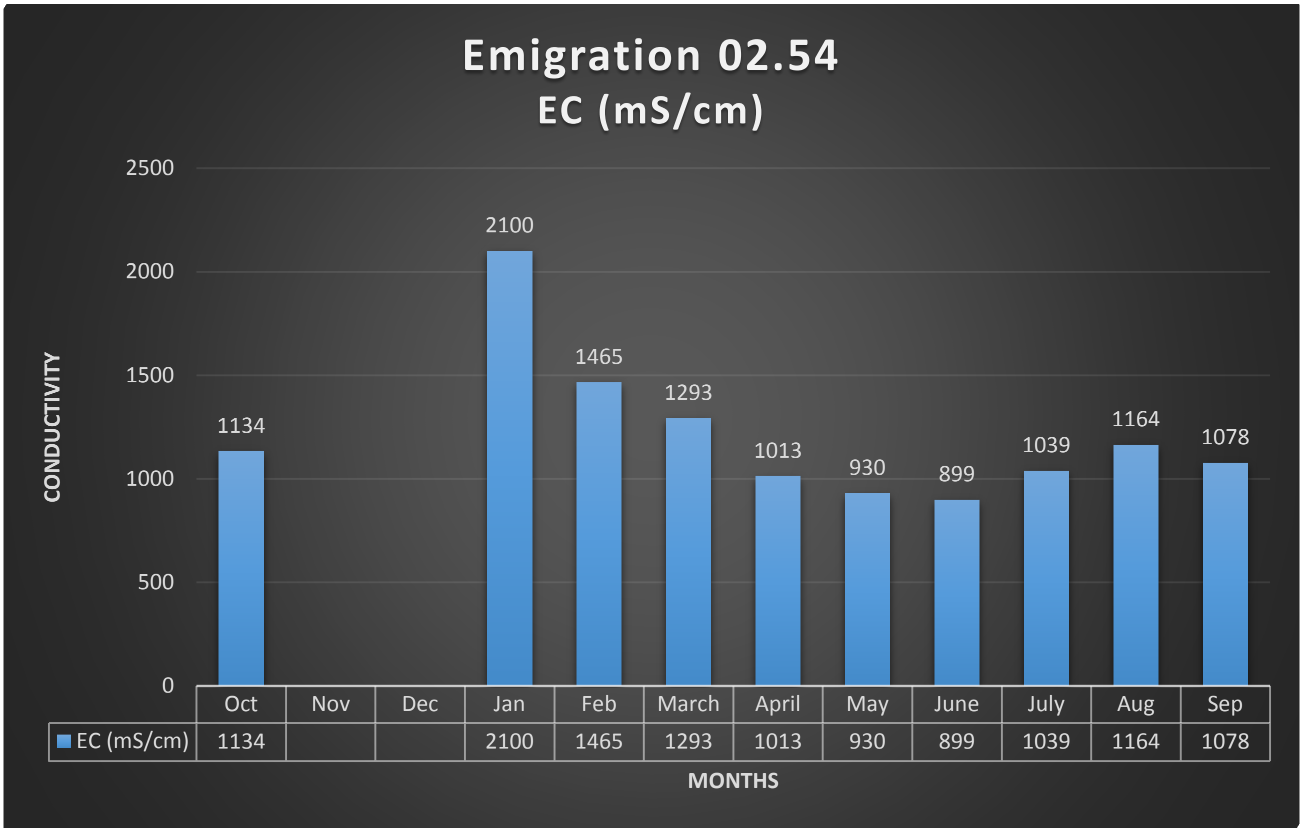


Figure 4-40 Emigration Creek 02.54 Turbidity

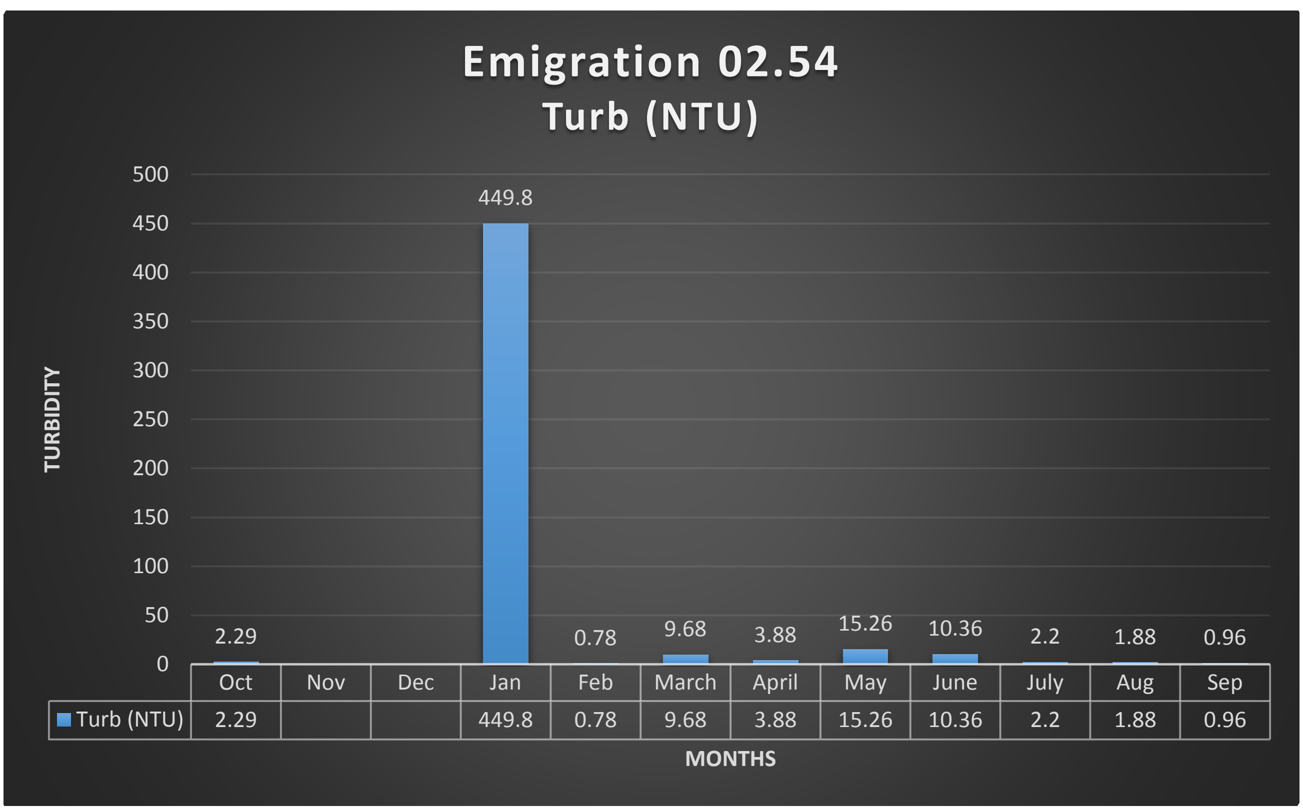
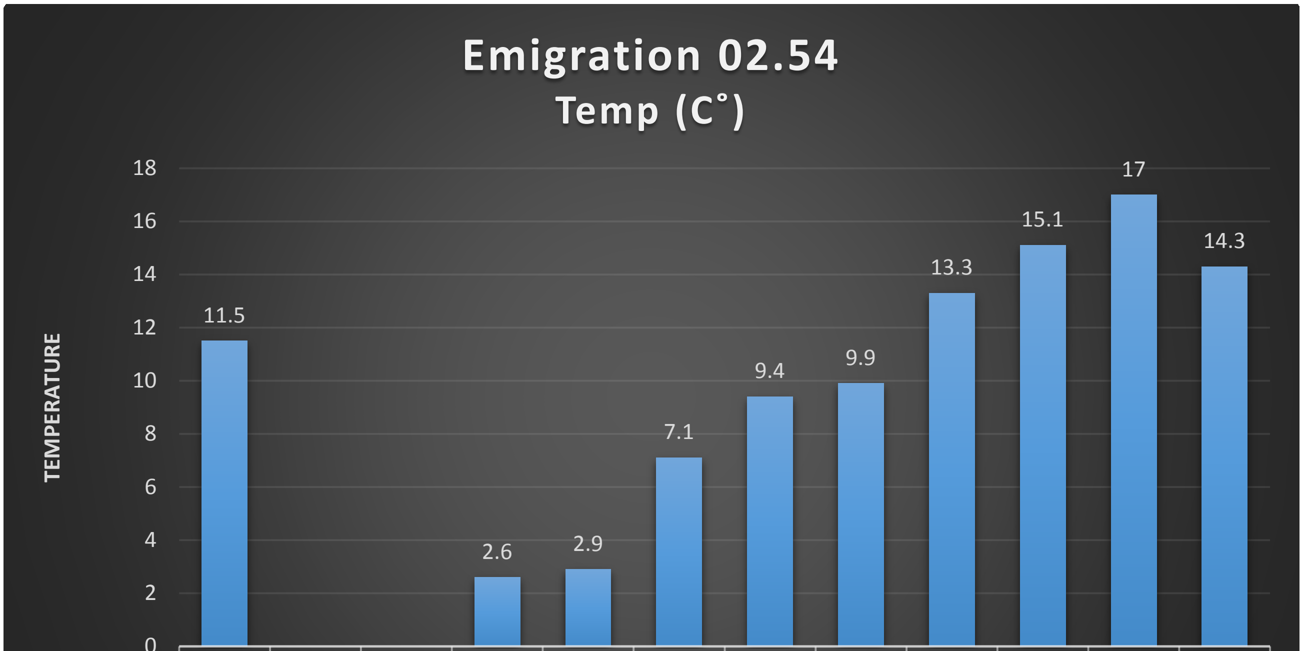
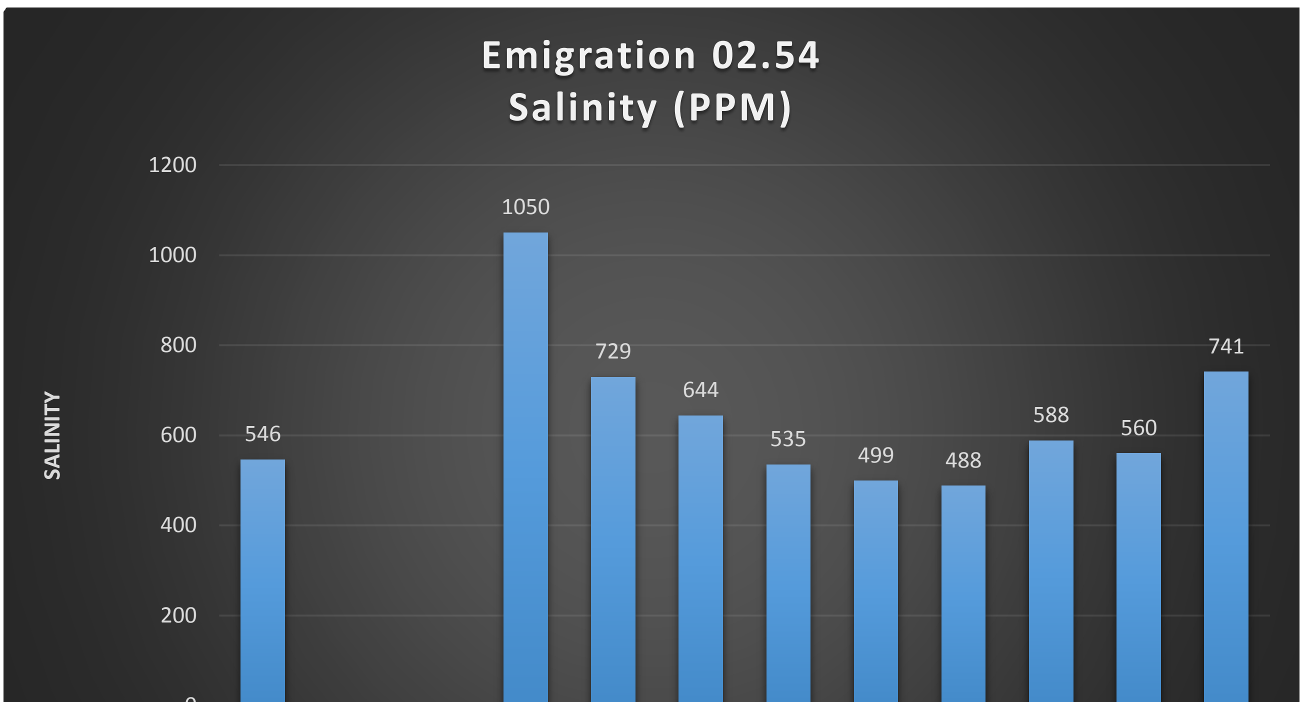


Figure 4-41 Emigration Creek 02.54 Temperature



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Temp (C˚)	11.5			2.6	2.9	7.1	9.4	9.9	13.3	15.1	17	14.3

Figure 4-42 Emigration Creek 02.54 Salinity



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Salinity (PPM)	546			1050	729	644	535	499	488	588	560	741

Figure 4-43 Emigration Creek 03.67 pH

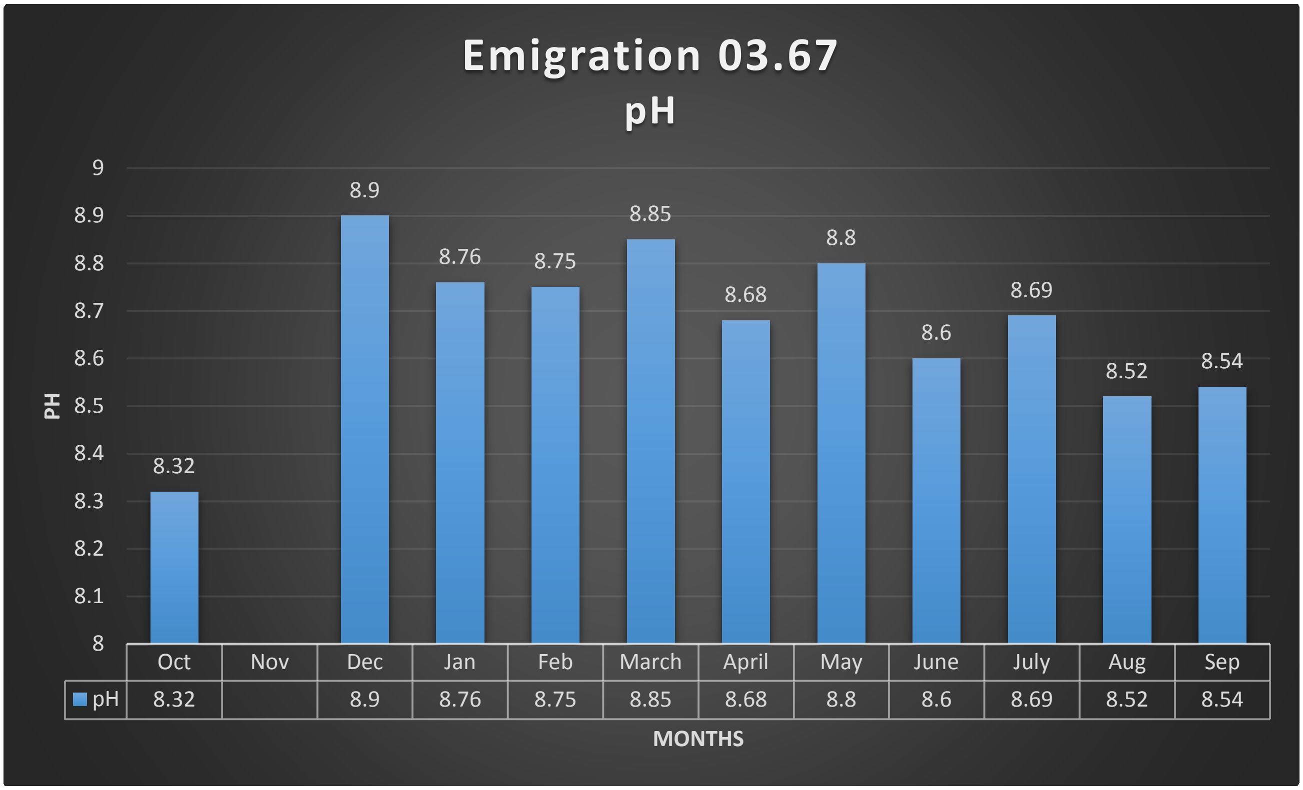


Figure 4-44 Emigration Creek 03.67 Dissolved Oxygen

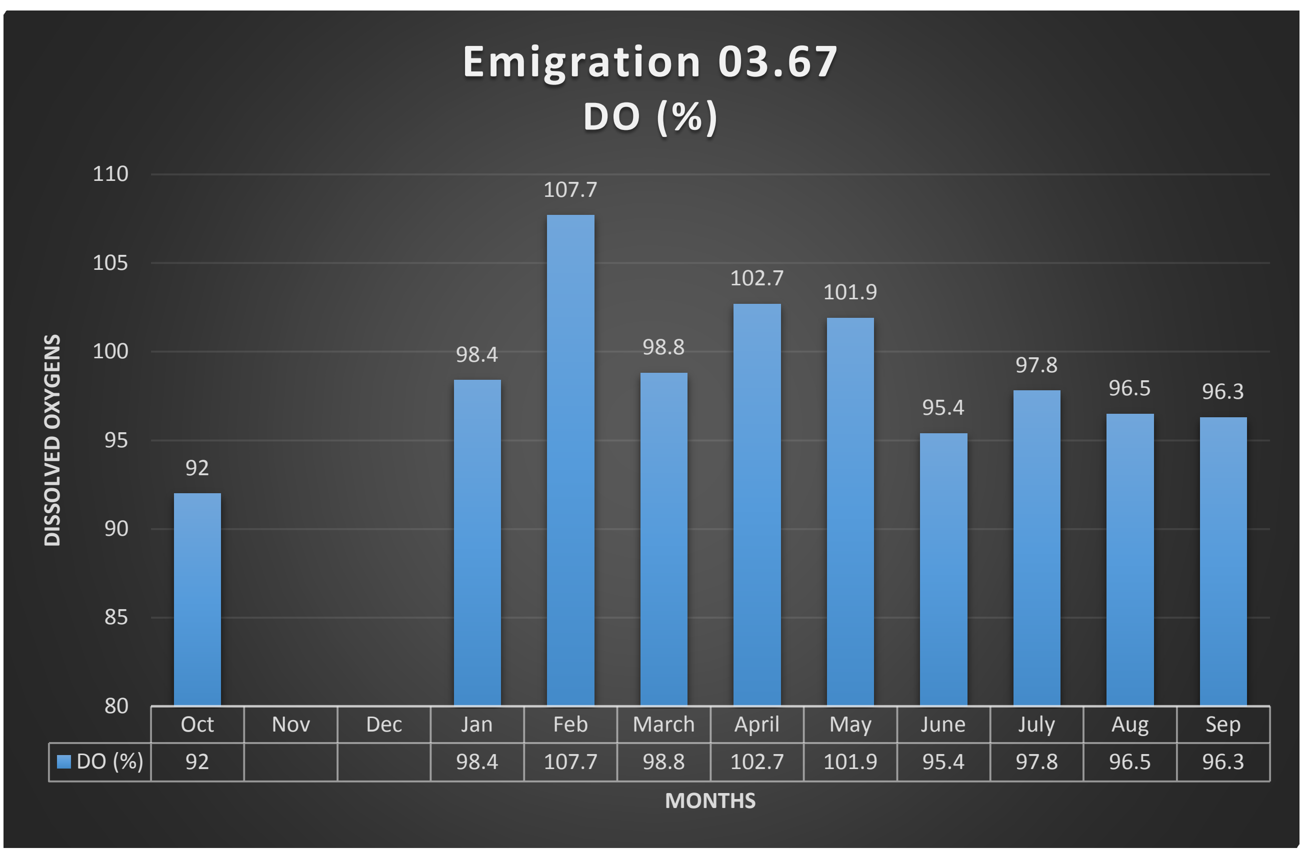
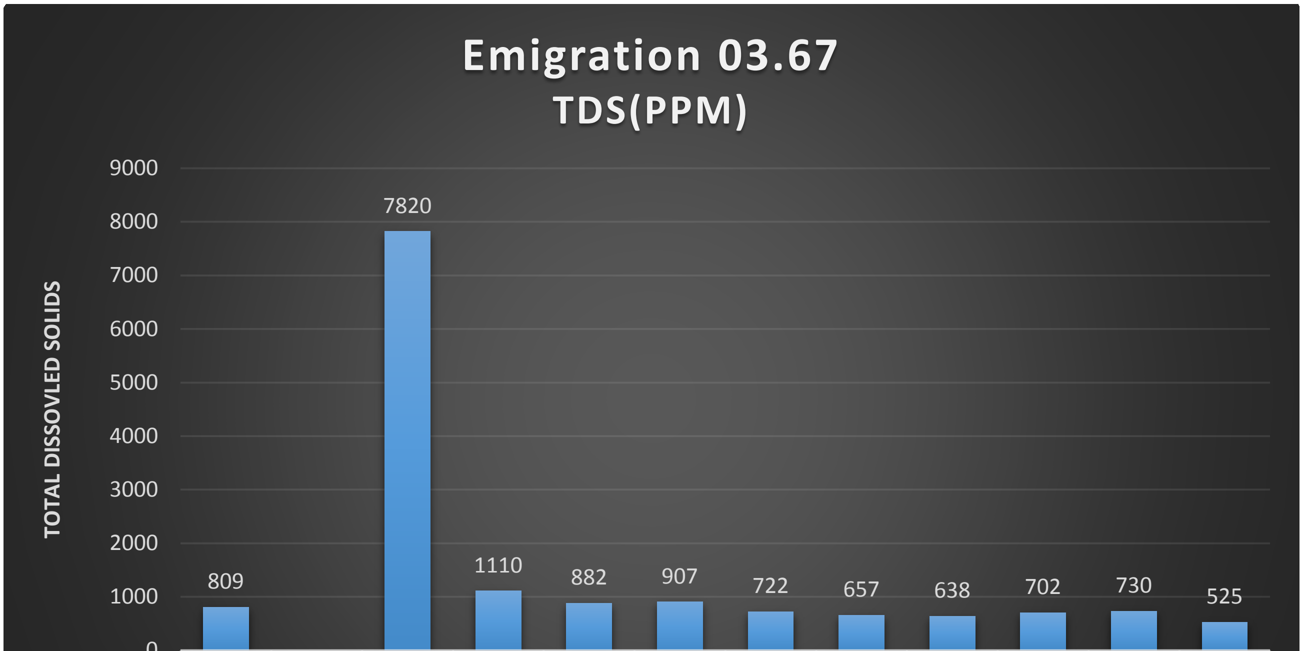
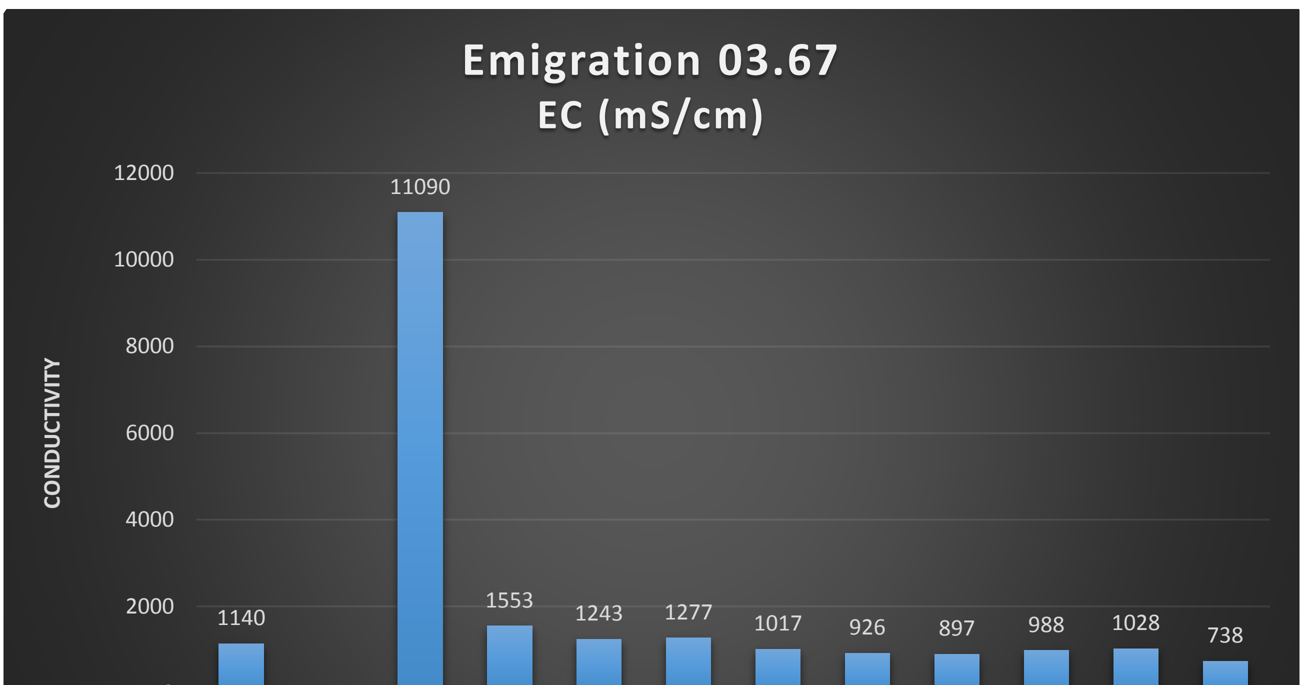


Figure 4-45 Emigration Creek 03.67 Total Dissolved Solids



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
TDS(PPM)	809		7820	1110	882	907	722	657	638	702	730	525

Figure 4-46 Emigration Creek 03.67 Conductivity



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
EC (mS/cm)	1140		11090	1553	1243	1277	1017	926	897	988	1028	738

Figure 4-47 Emigration Creek 03.67 Turbidity

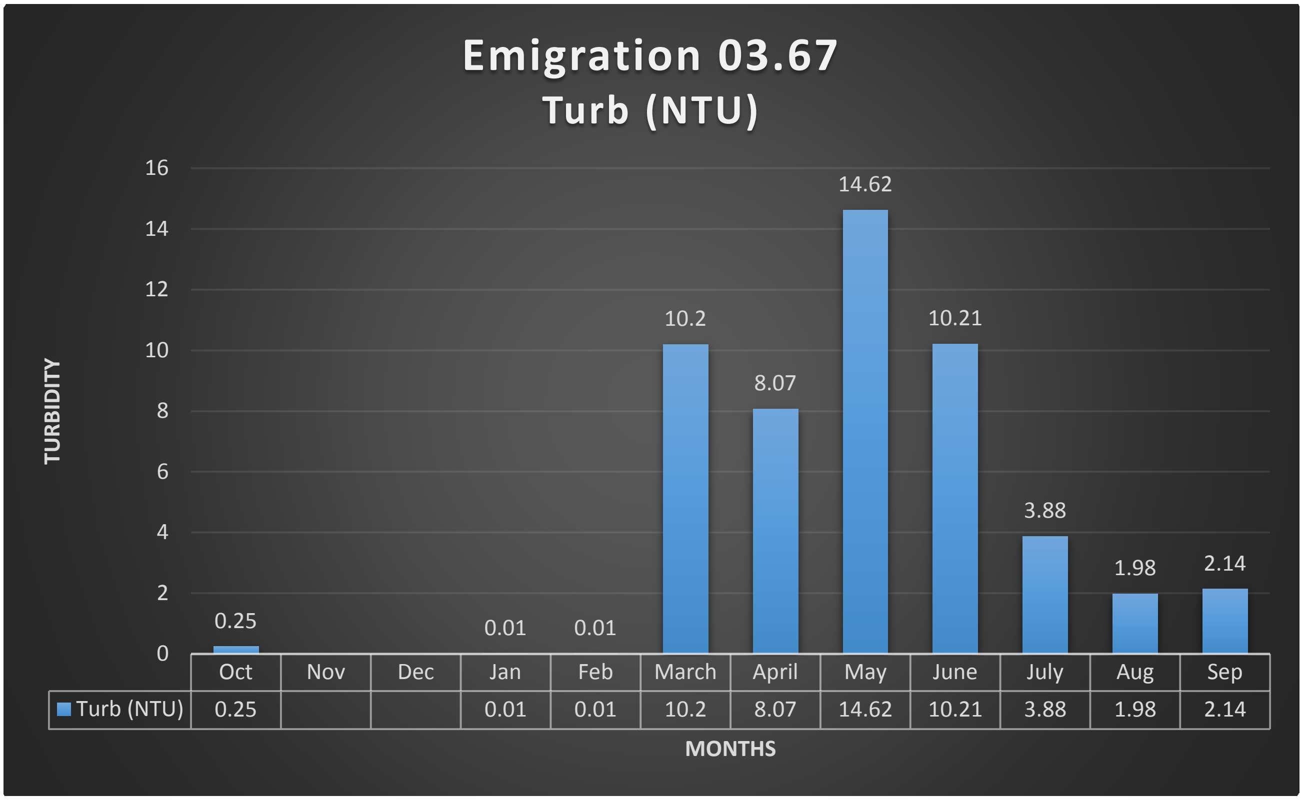


Figure 4-48 Emigration Creek 03.67 Temperature

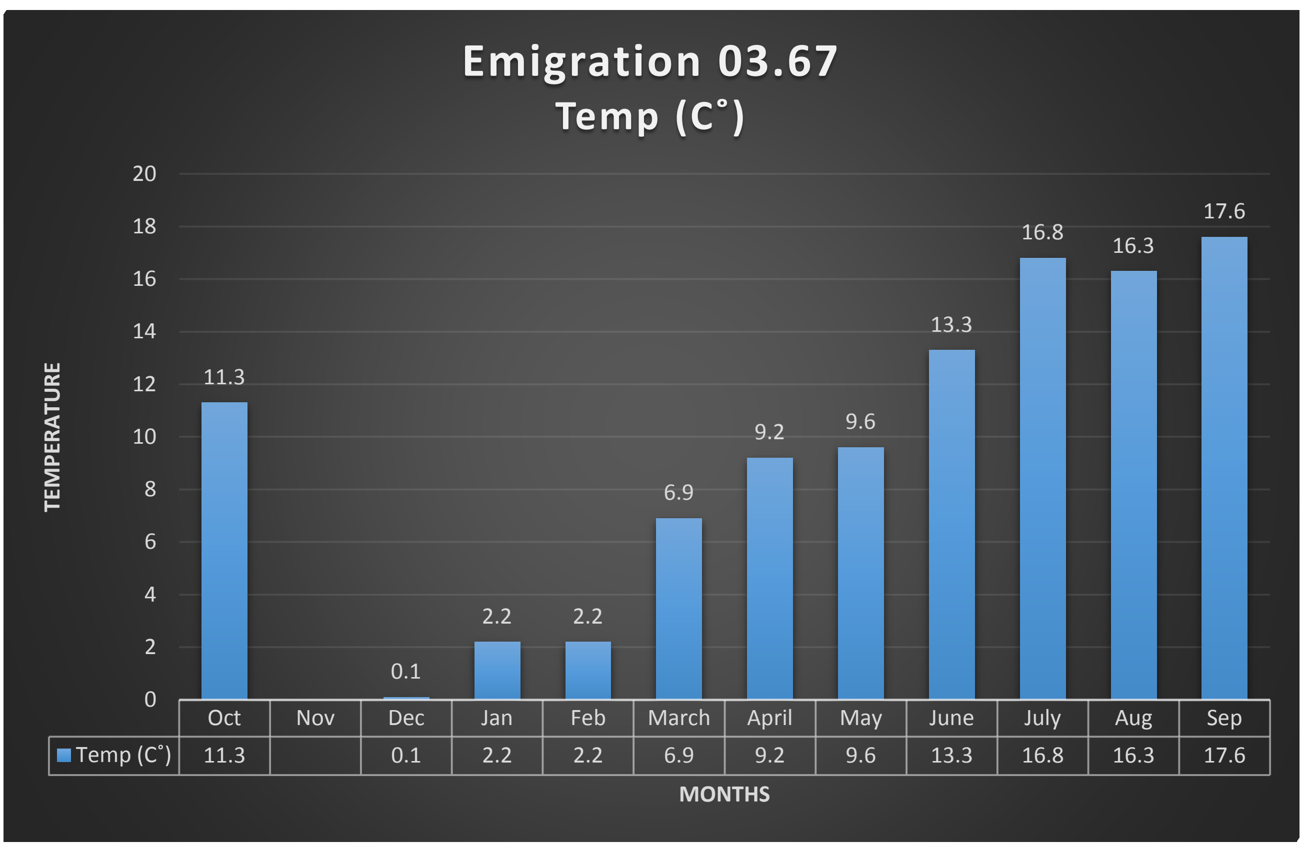
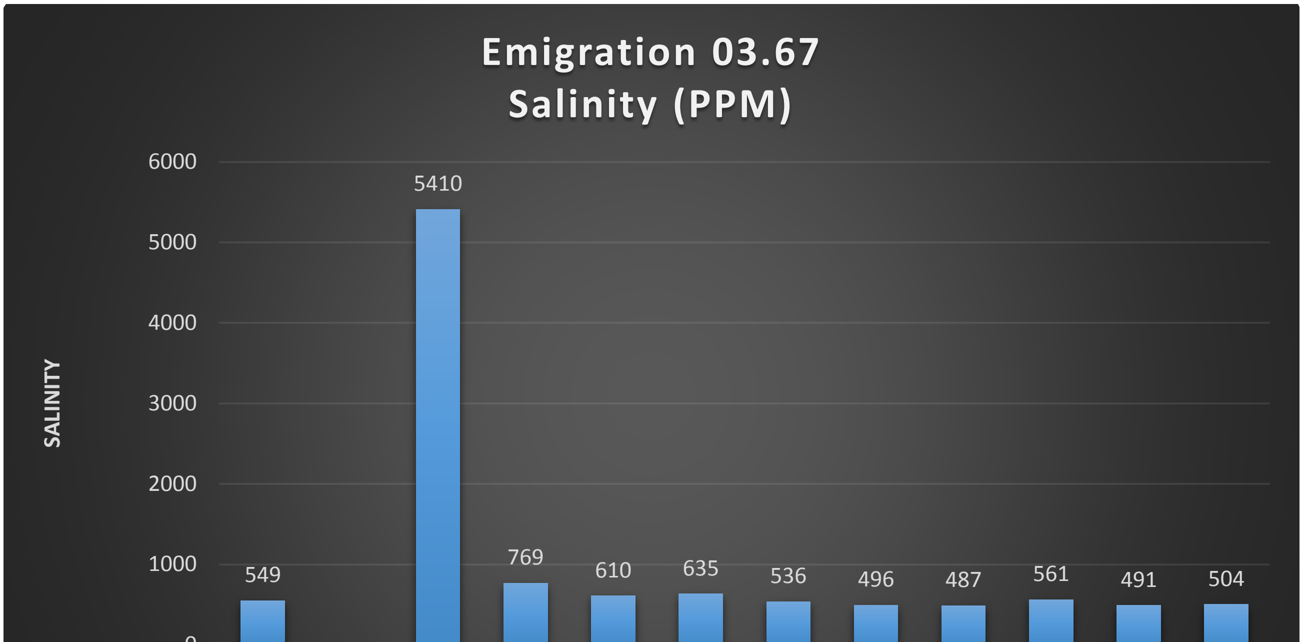
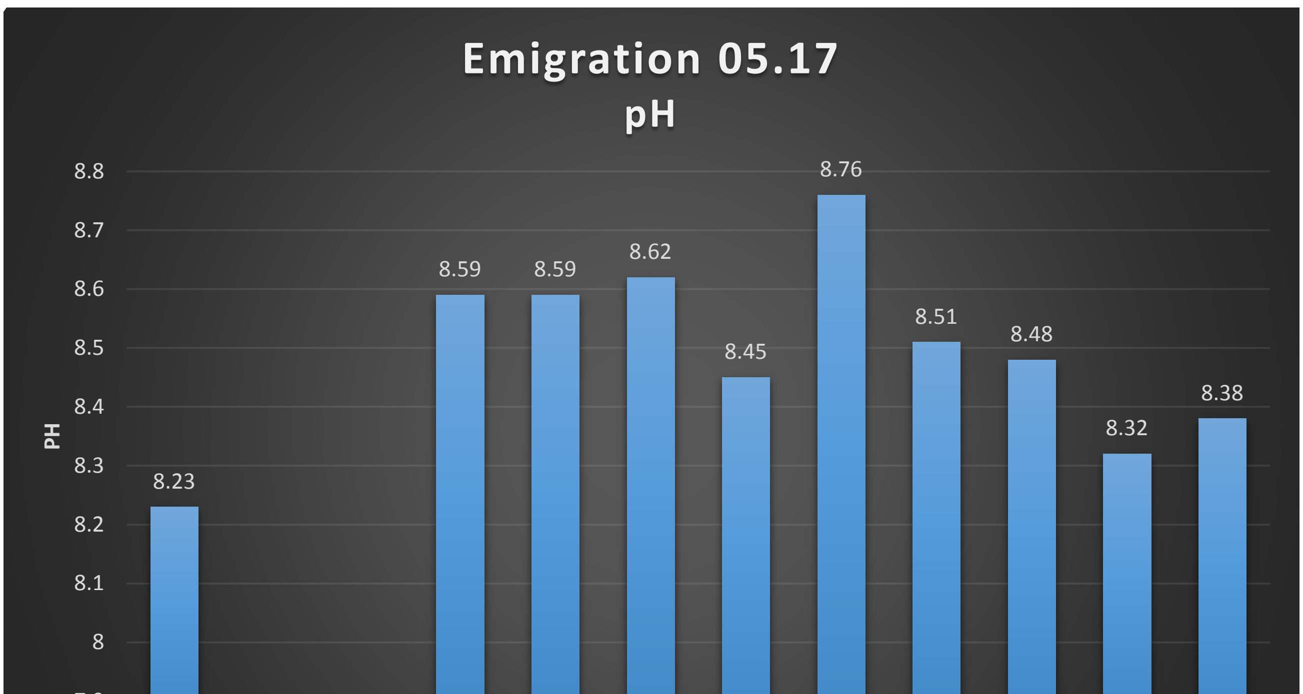


Figure 4-49 Emigration Creek 03.67 Salinity



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Salinity (PPM)	549		5410	769	610	635	536	496	487	561	491	504

Figure 4-50 Emigration Creek 05.17 pH



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
pH	8.23			8.59	8.59	8.62	8.45	8.76	8.51	8.48	8.32	8.38

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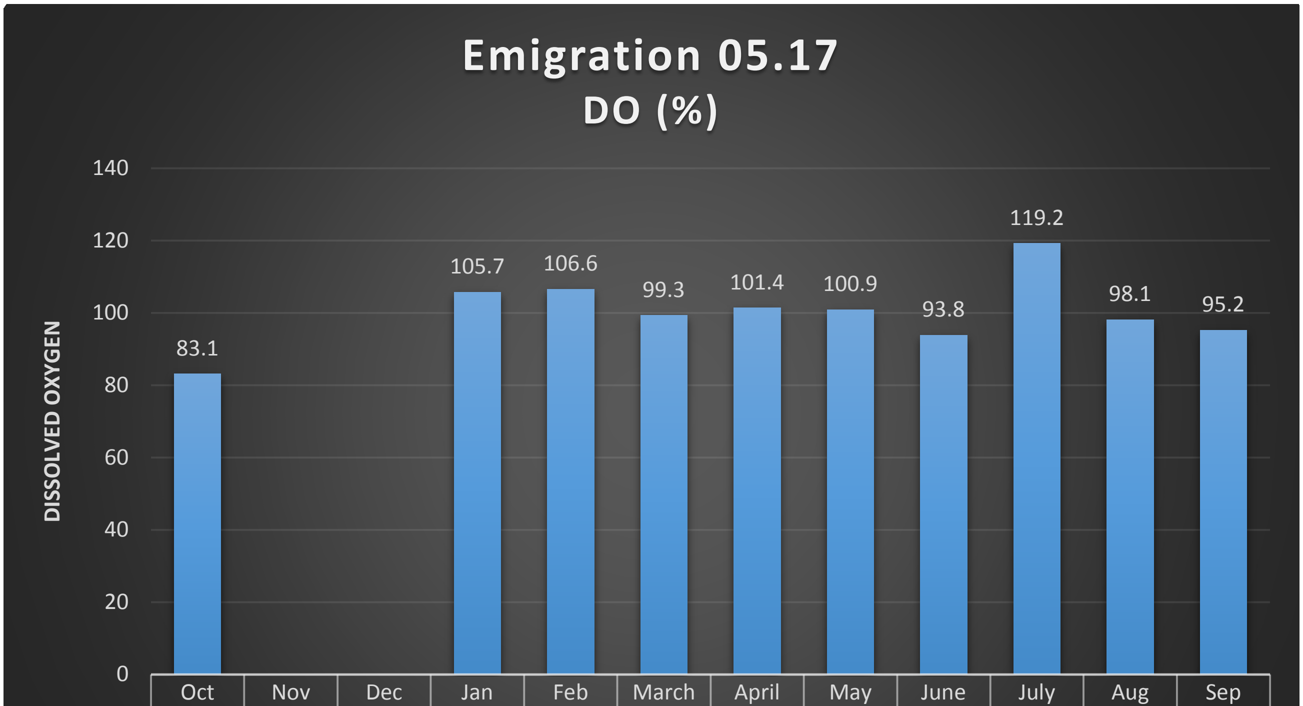
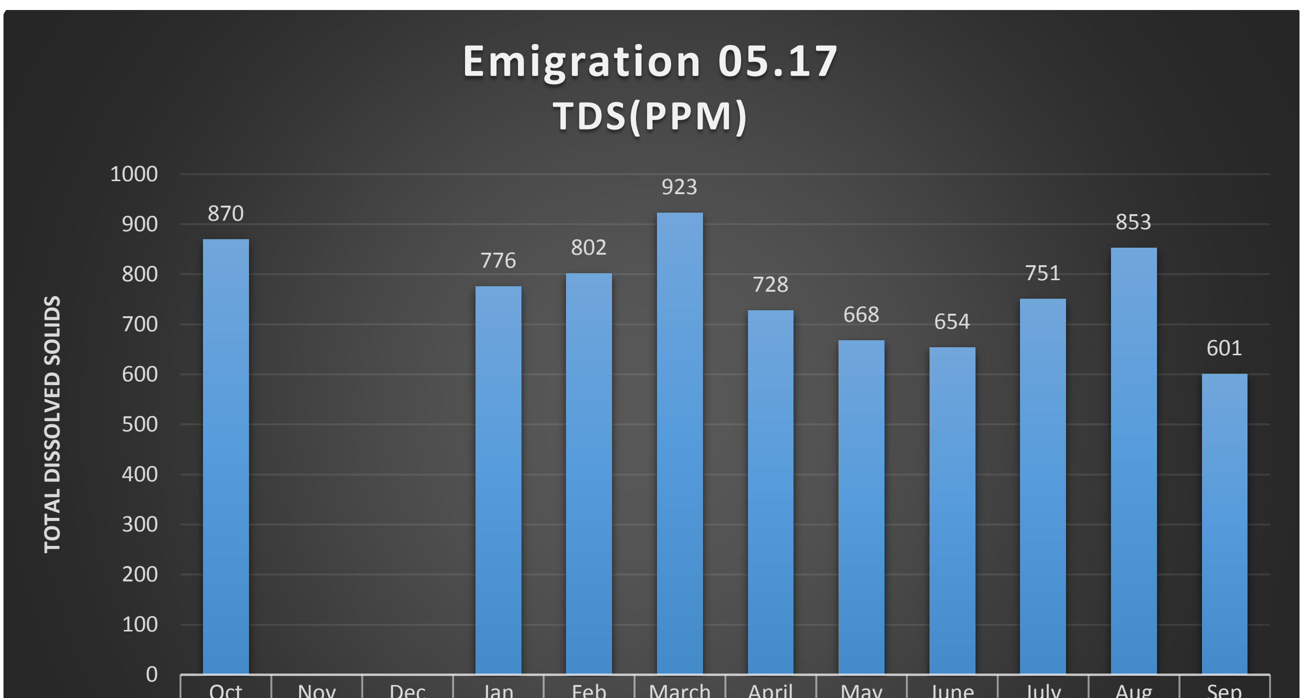
Figure 4-51 Emigration Creek 05.17 Dissolved Oxygen



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
DO (%)	83.1			105.7	106.6	99.3	101.4	100.9	93.8	119.2	98.1	95.2

Figure 4-52 Emigration Creek 05.17 Total Dissolved Solids



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
TDS(PPM)	870			776	802	923	728	668	654	751	853	601

Figure 4-53 Emigration Creek 05.17 Conductivity

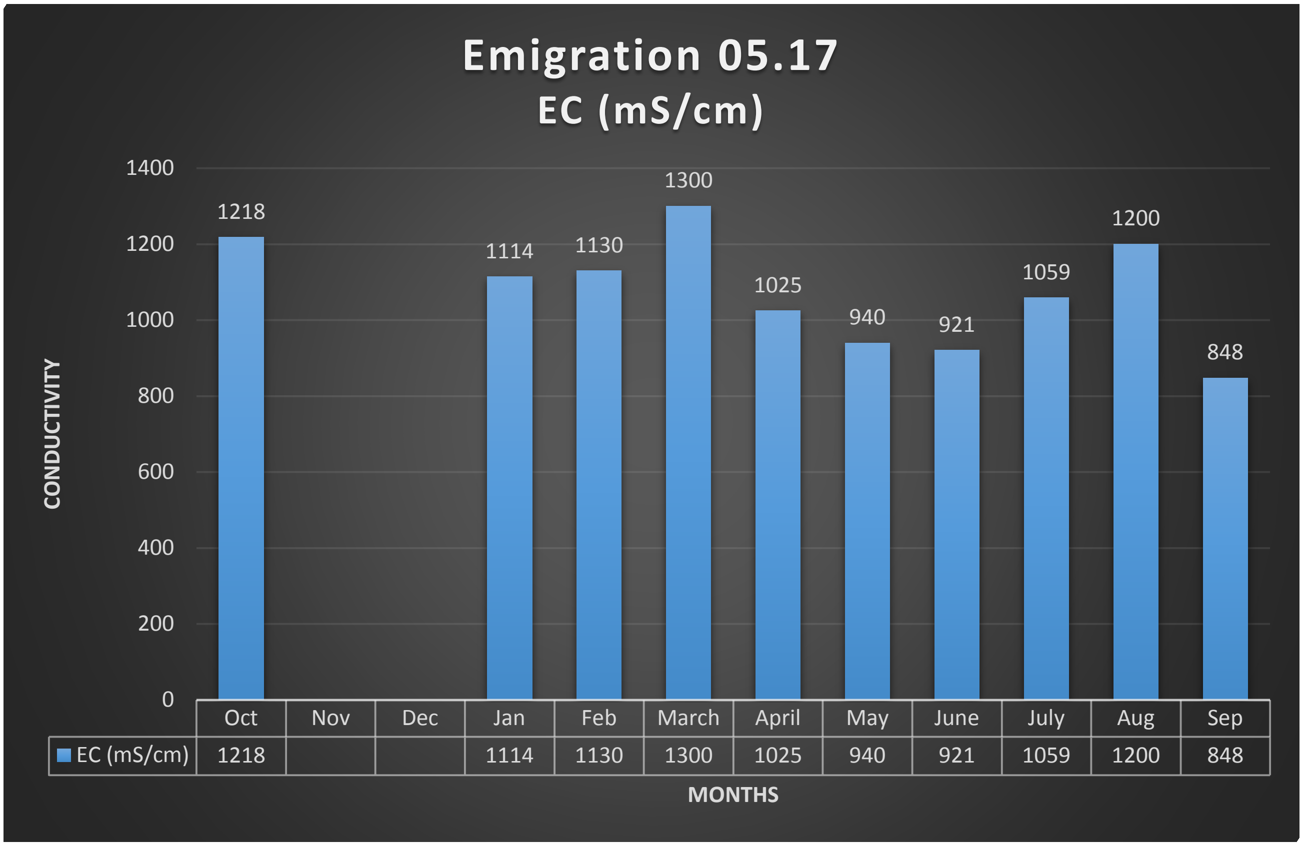
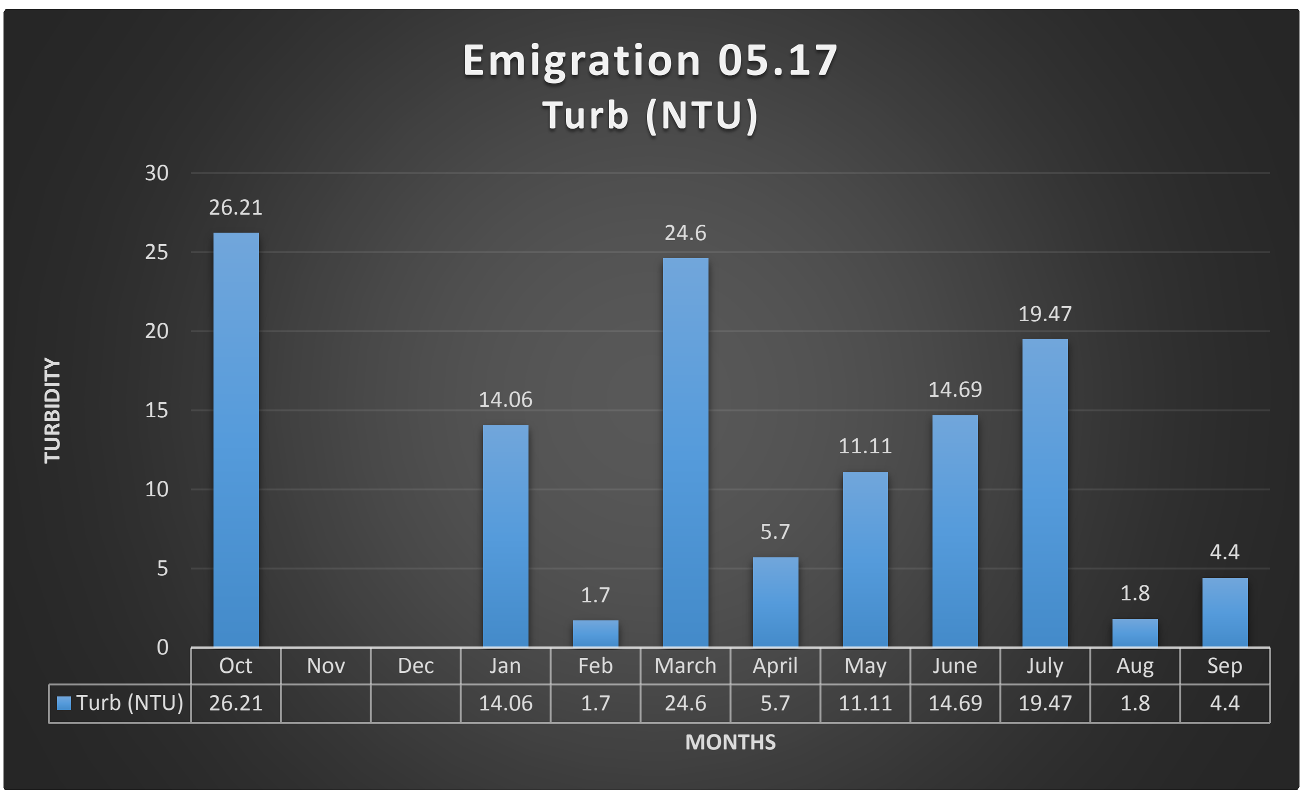
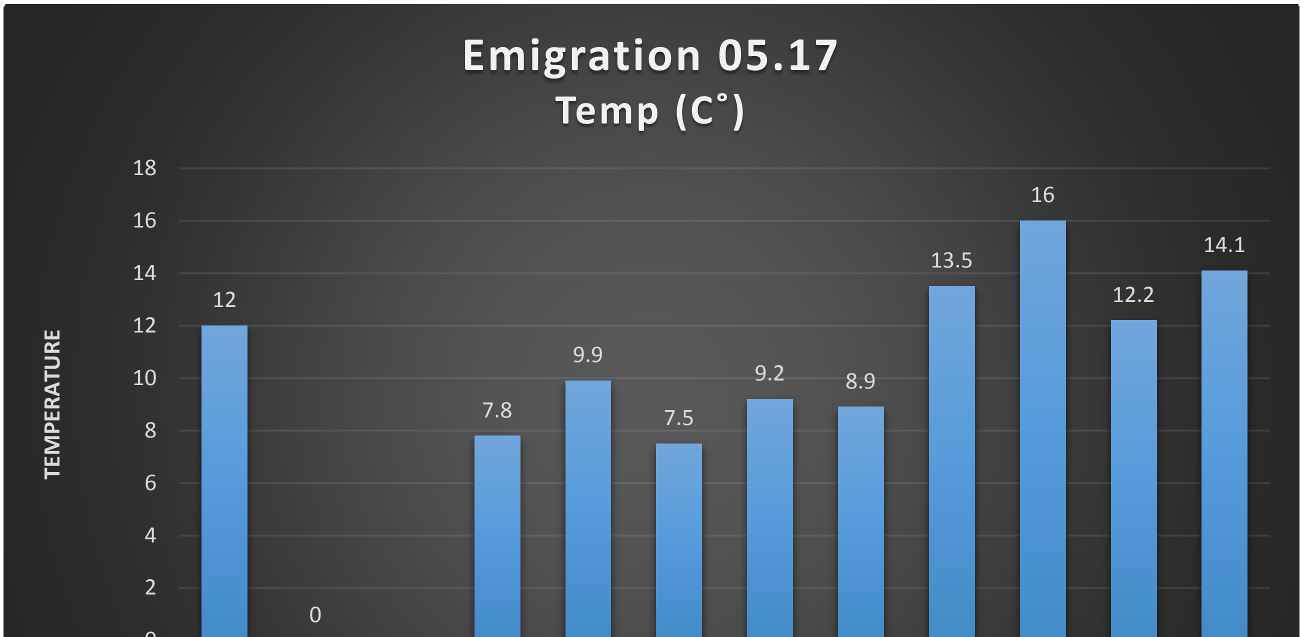


Figure 4-54 Emigration Creek 05.17 Turbidity



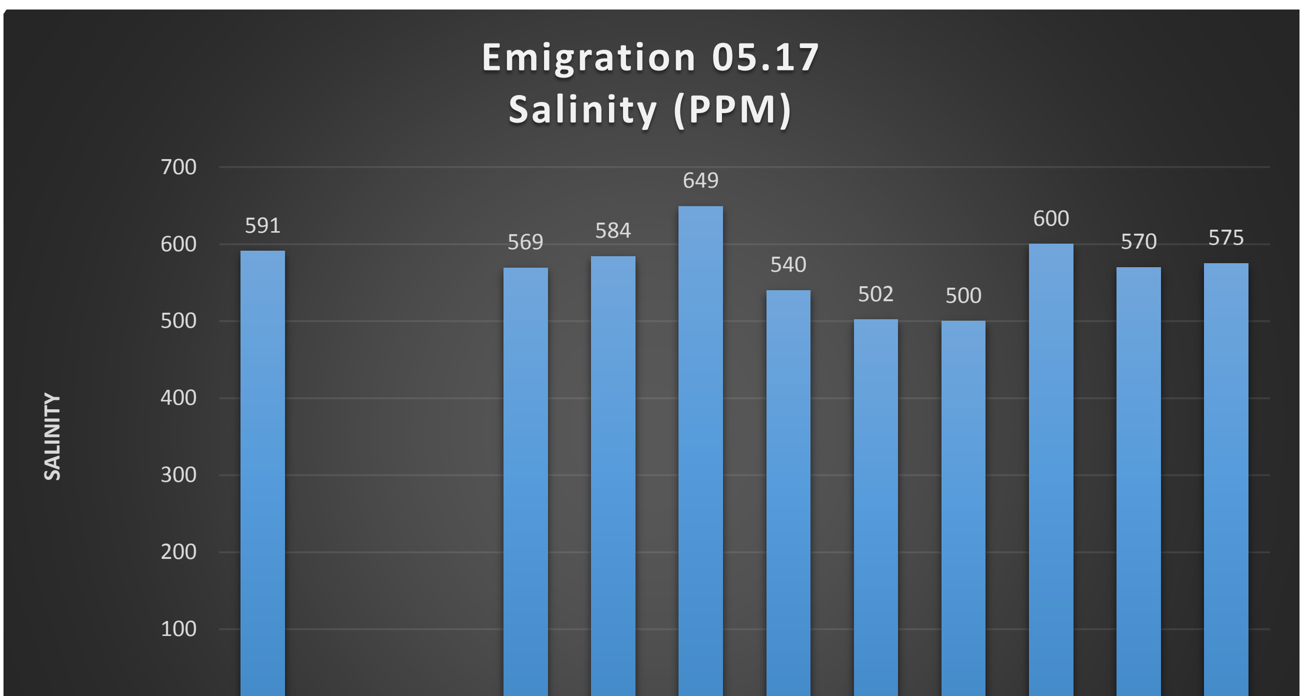
SALT LAKE COUNTY WATERSHED

Figure 4-55 Emigration Creek 05.17 Temperature



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Temp (C˚)	12	0		7.8	9.9	7.5	9.2	8.9	13.5	16	12.2	14.1

Figure 4-56 Emigration Creek 05.17 Salinity



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Salinity (PPM)	591			569	584	649	540	502	500	600	570	575

Figure 4-57 Emigration Creek 07.30 pH

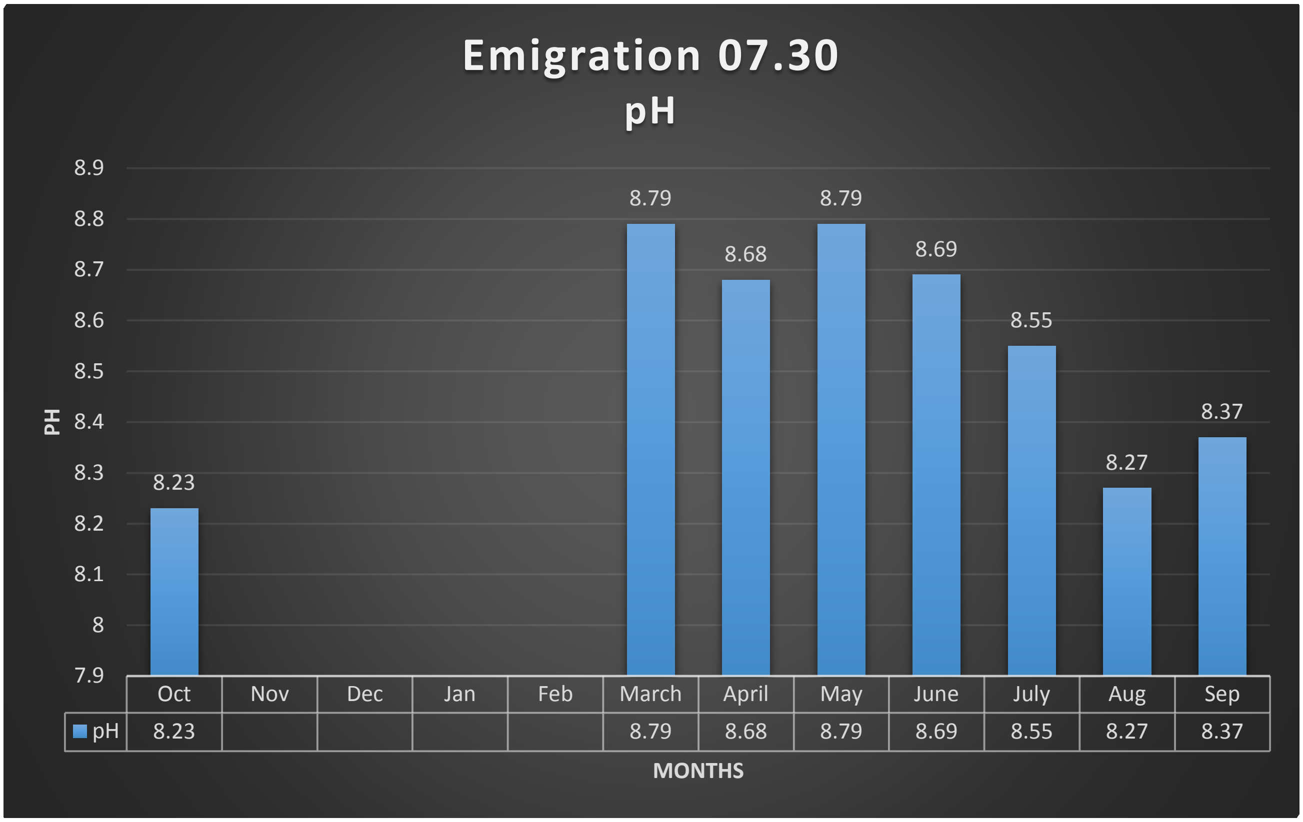


Figure 4-58 Emigration Creek 07.30 Dissolved Oxygen

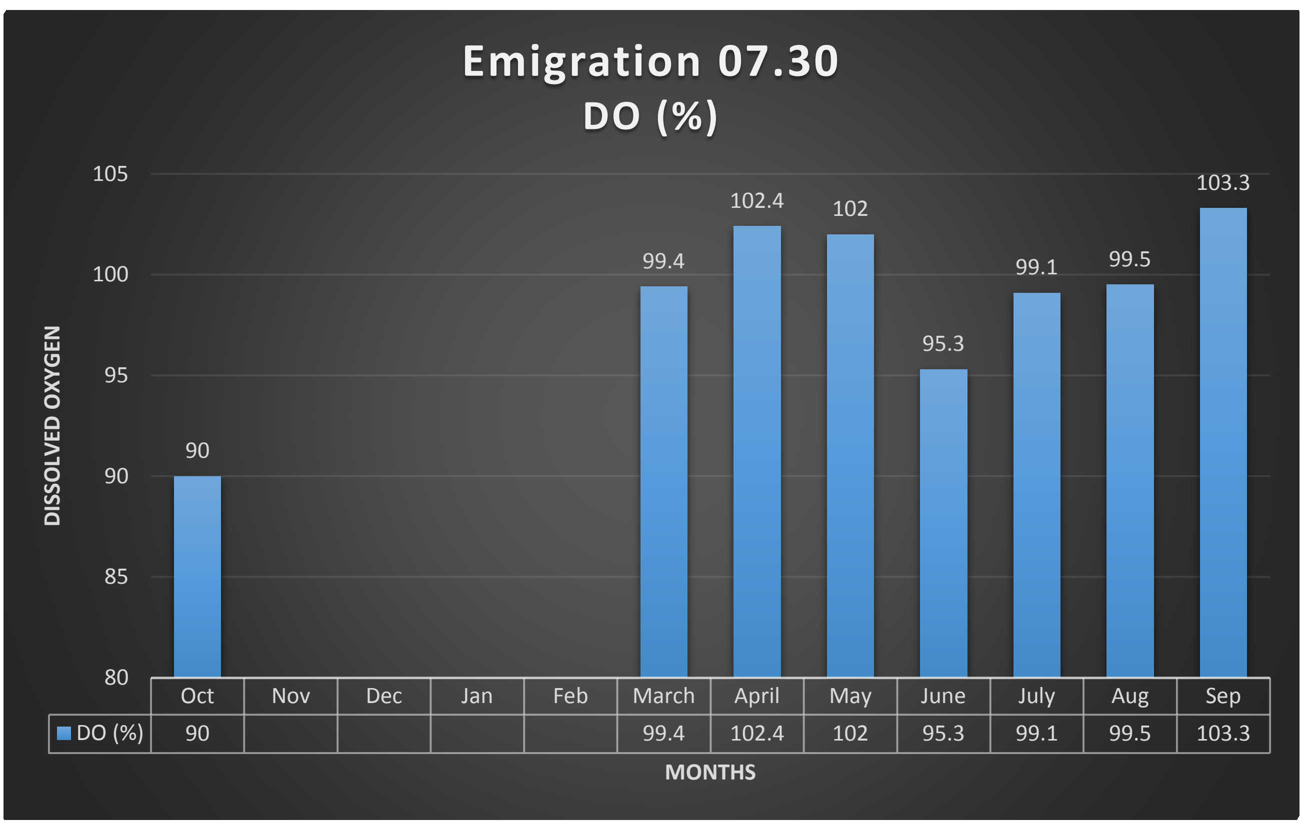
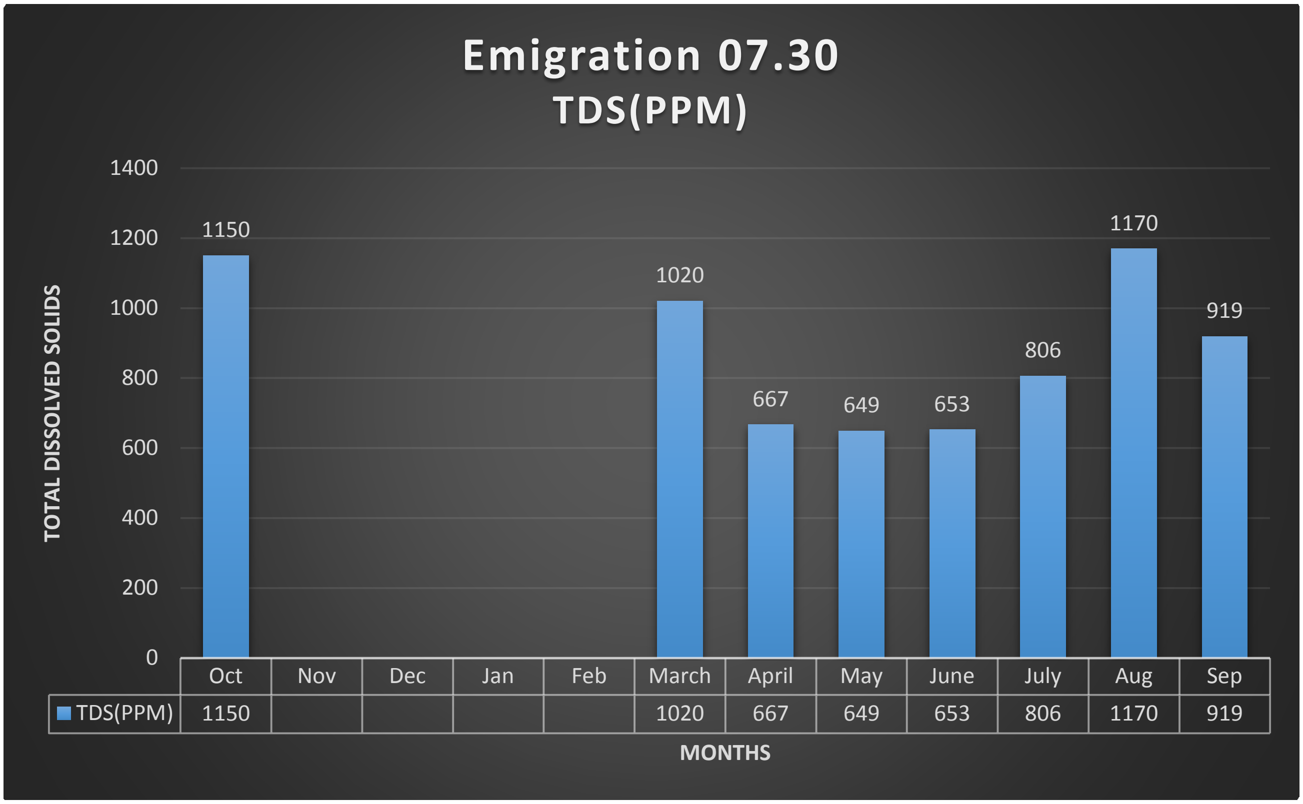
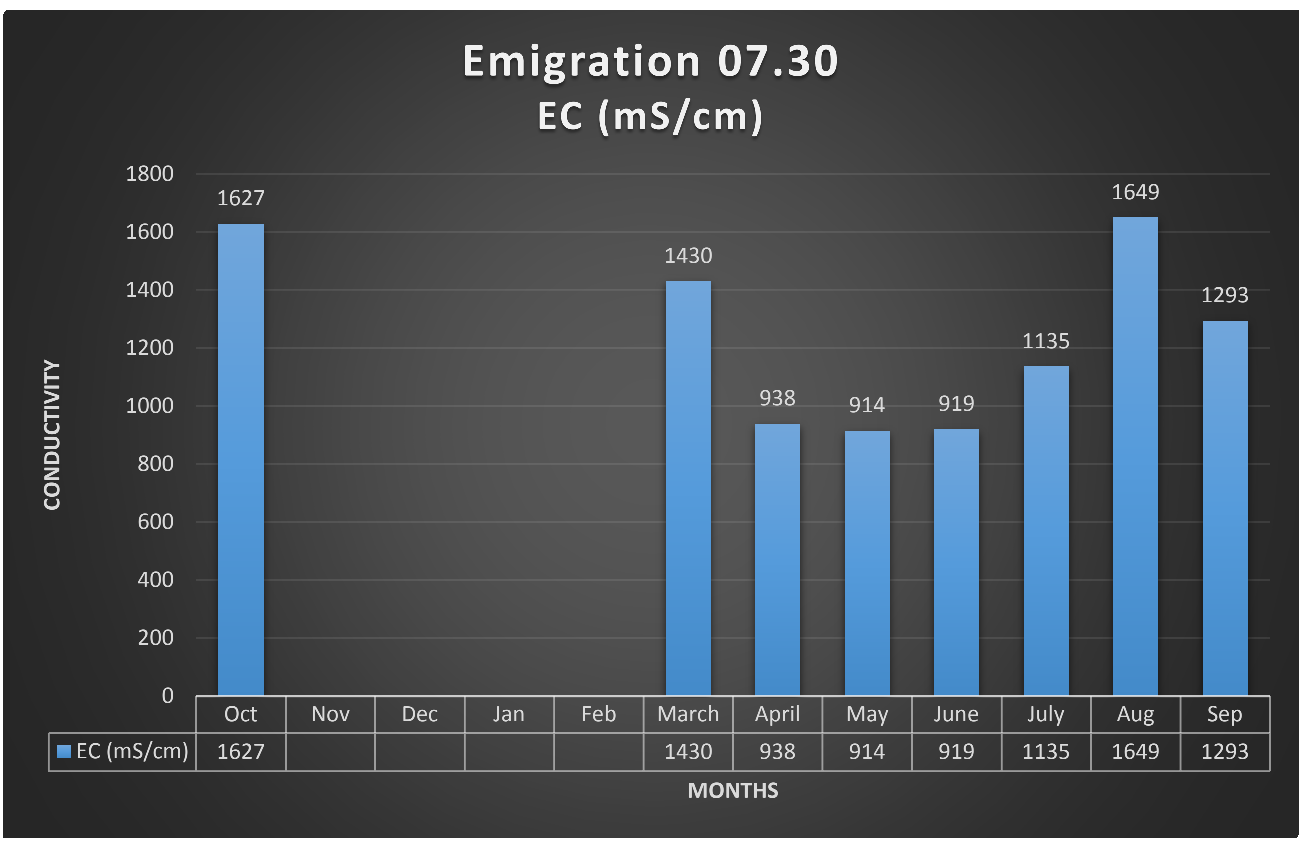


Figure 4-59 Emigration Creek 07.30 Total Dissolved Solids



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
TDS(PPM)	1150					1020	667	649	653	806	1170	919

Figure 4-60 Emigration Creek 07.30 Conductivity



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
EC (mS/cm)	1627					1430	938	914	919	1135	1649	1293

Figure 4-61 Emigration Creek 07.30 Turbidity

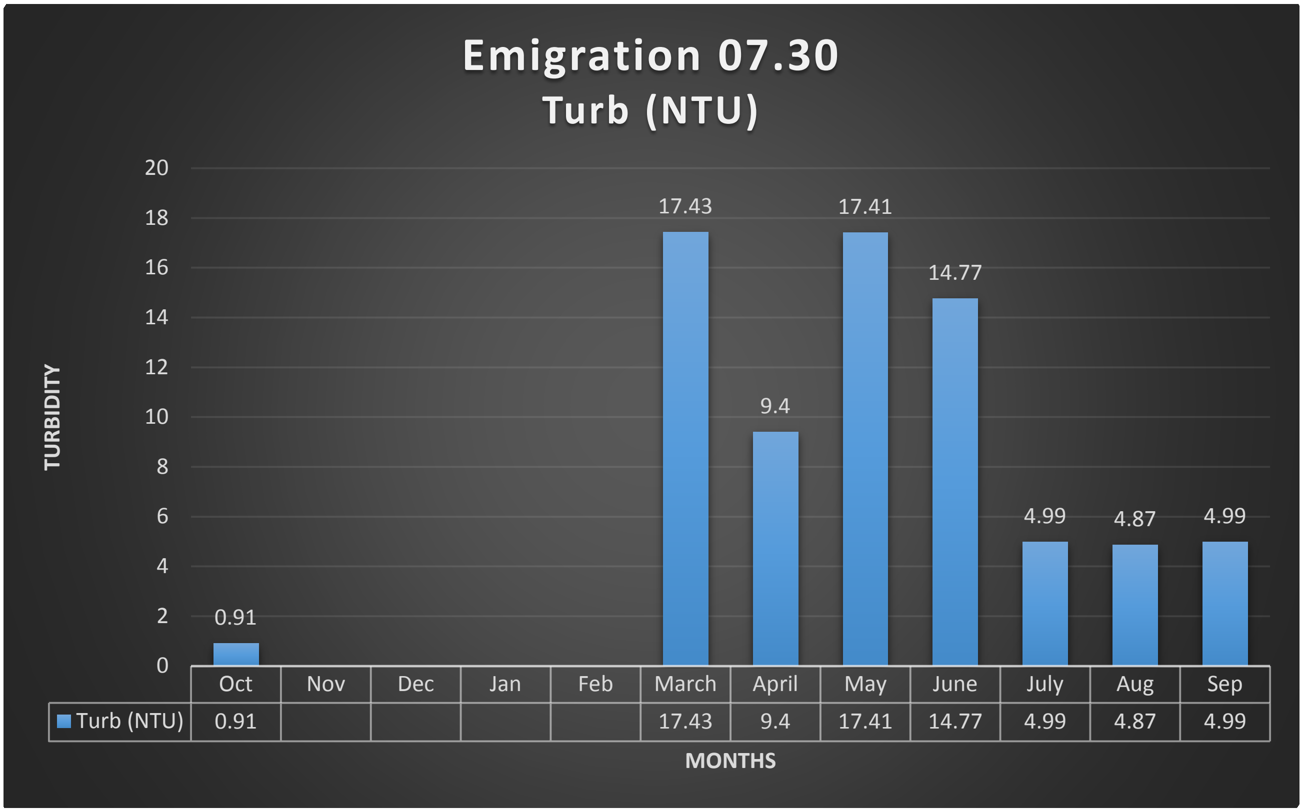


Figure 4-62 Emigration Creek 07.30 Temperature

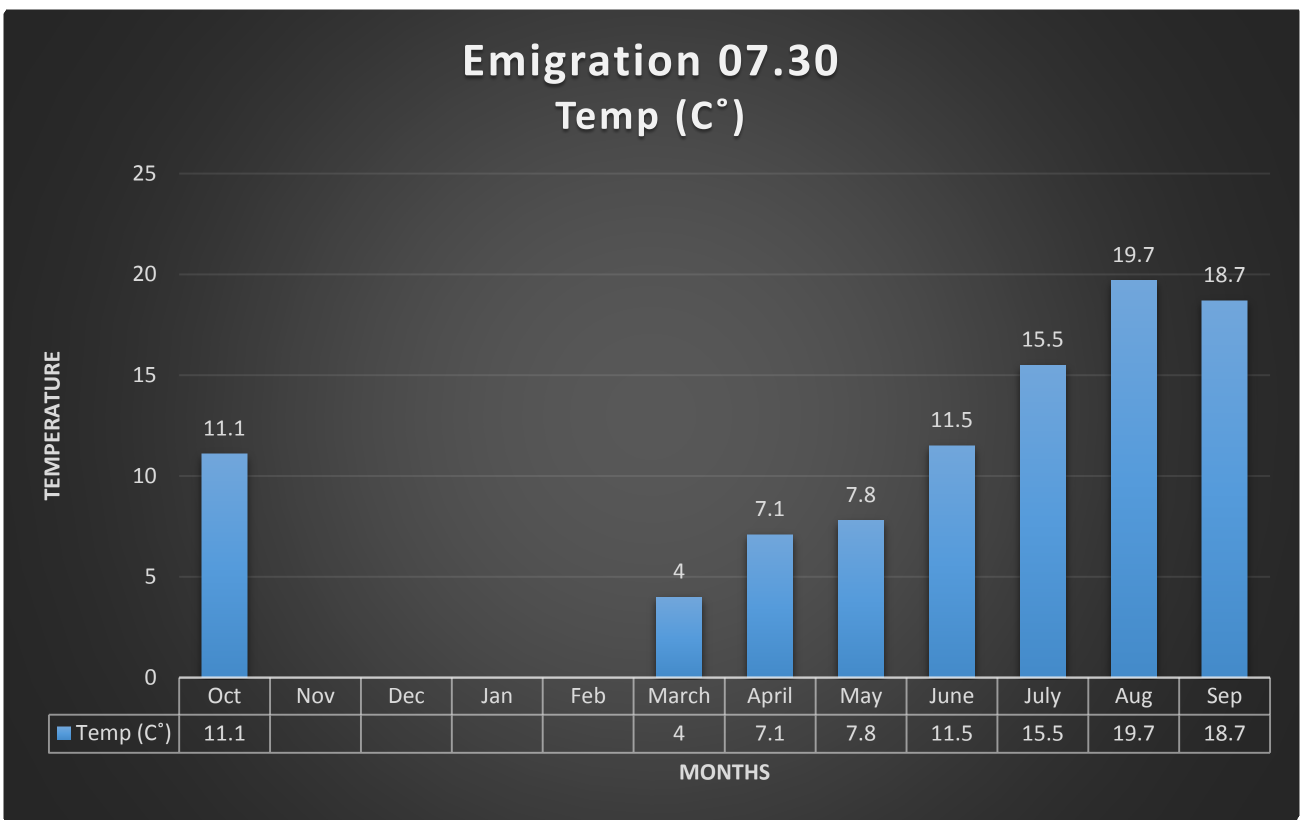
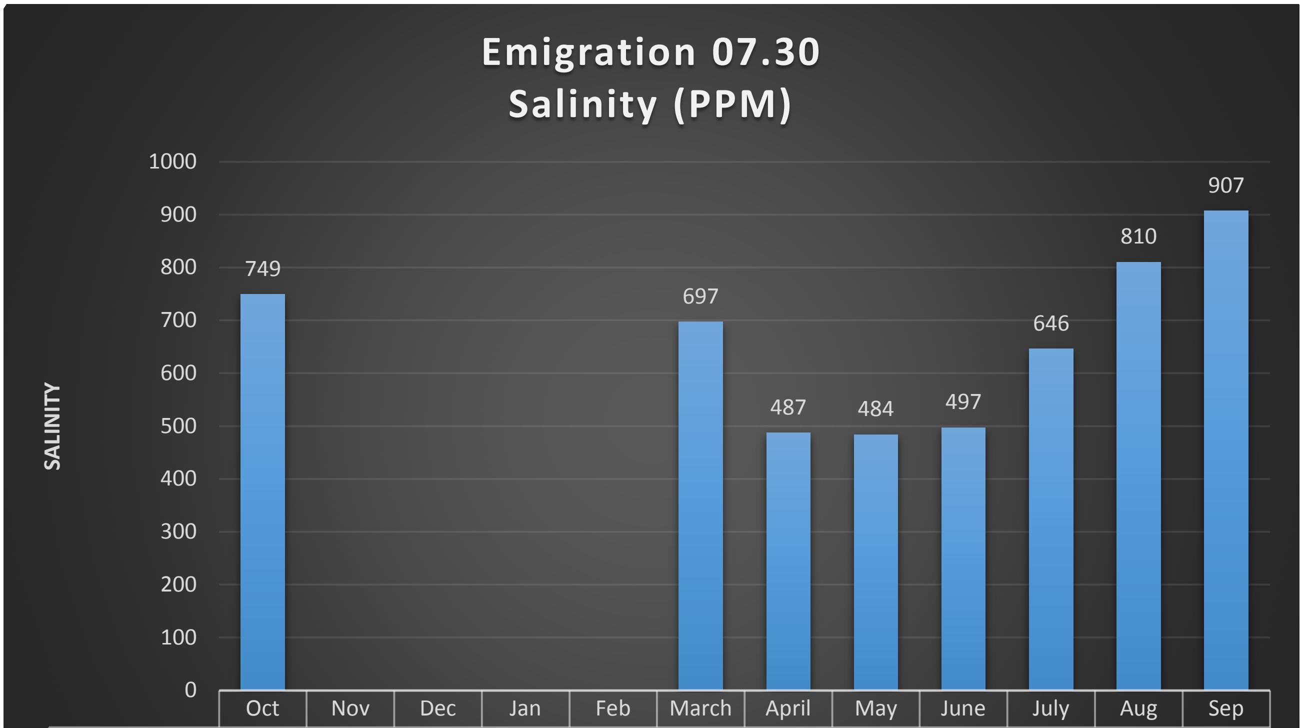
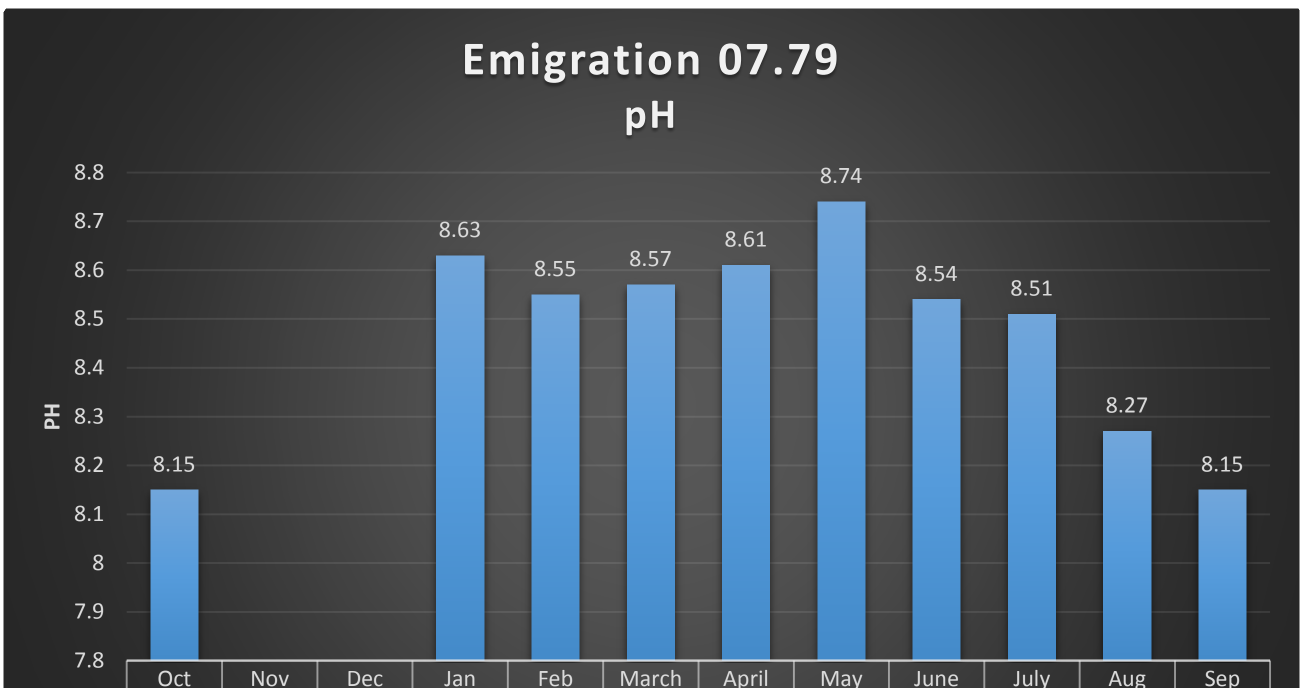


Figure 4-63 Emigration Creek 07.30 Salinity



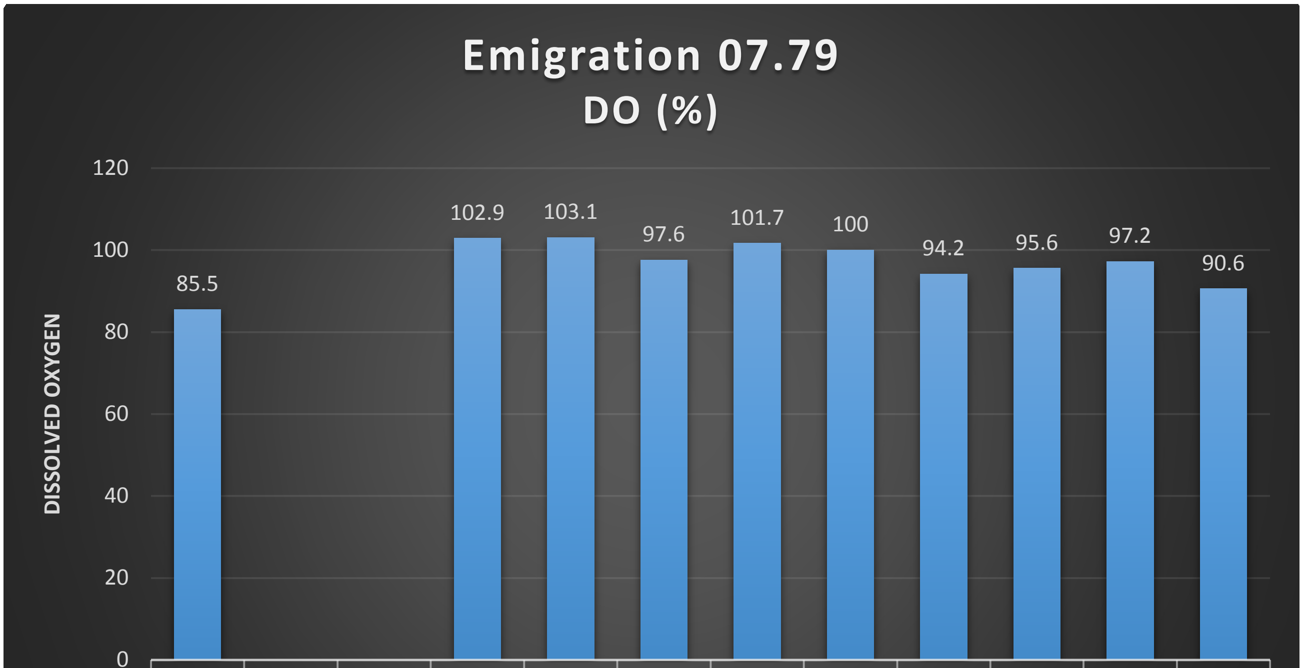
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Salinity (PPM)	749					697	487	484	497	646	810	907

Figure 4-64 Emigration Creek 07.79 pH



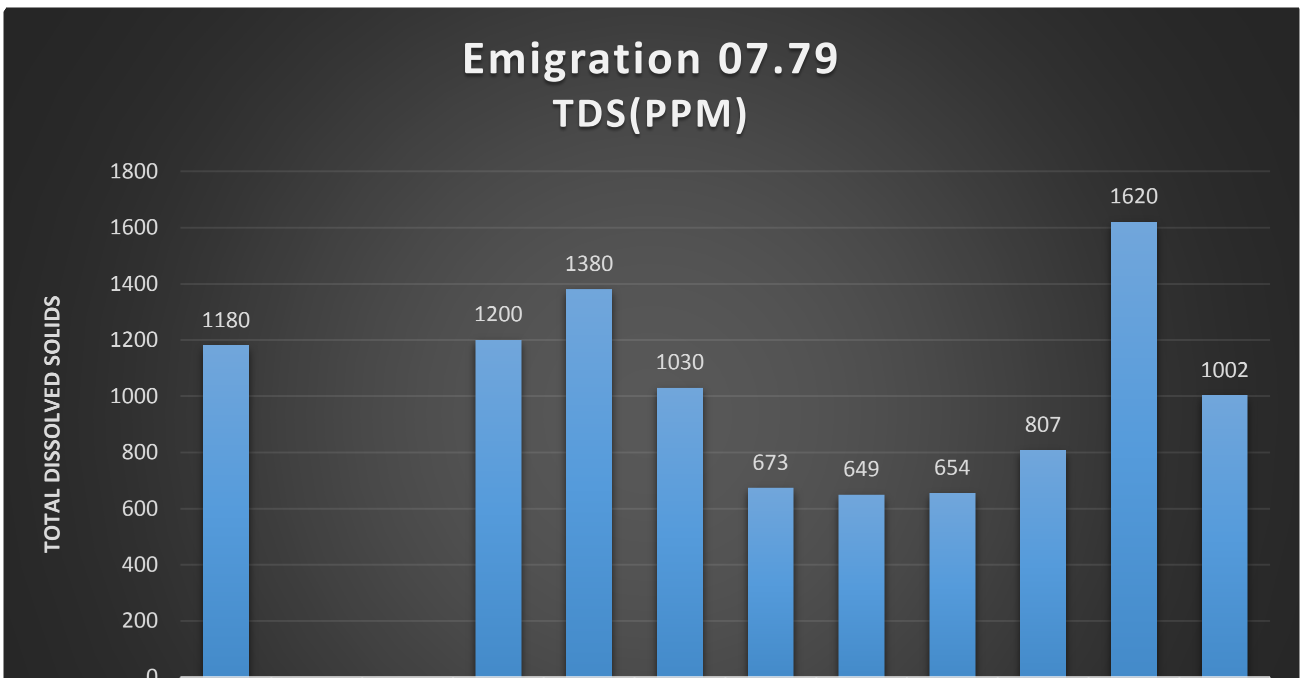
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
pH	8.15			8.63	8.55	8.57	8.61	8.74	8.54	8.51	8.27	8.15

Figure 4-65 Emigration Creek 07.79 Dissolved Oxygen



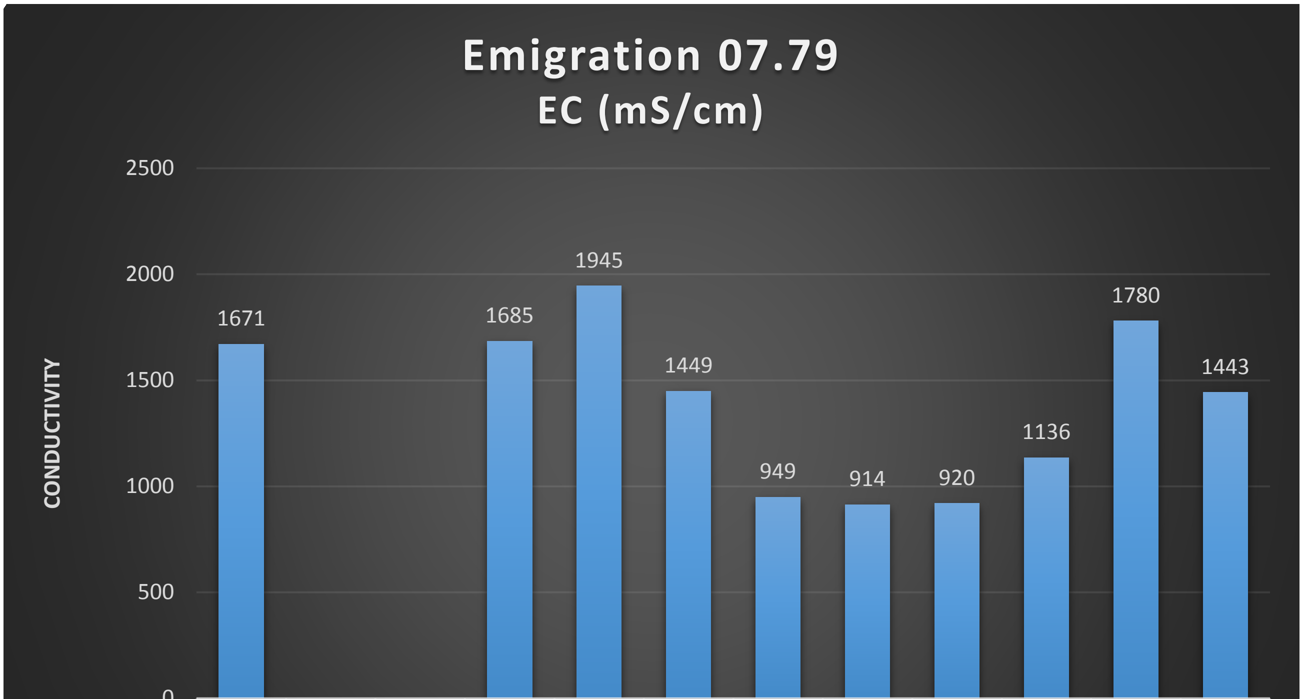
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
DO (%)	85.5			102.9	103.1	97.6	101.7	100	94.2	95.6	97.2	90.6

Figure 4-66 Emigration Creek 07.79 Total Dissolved Solids



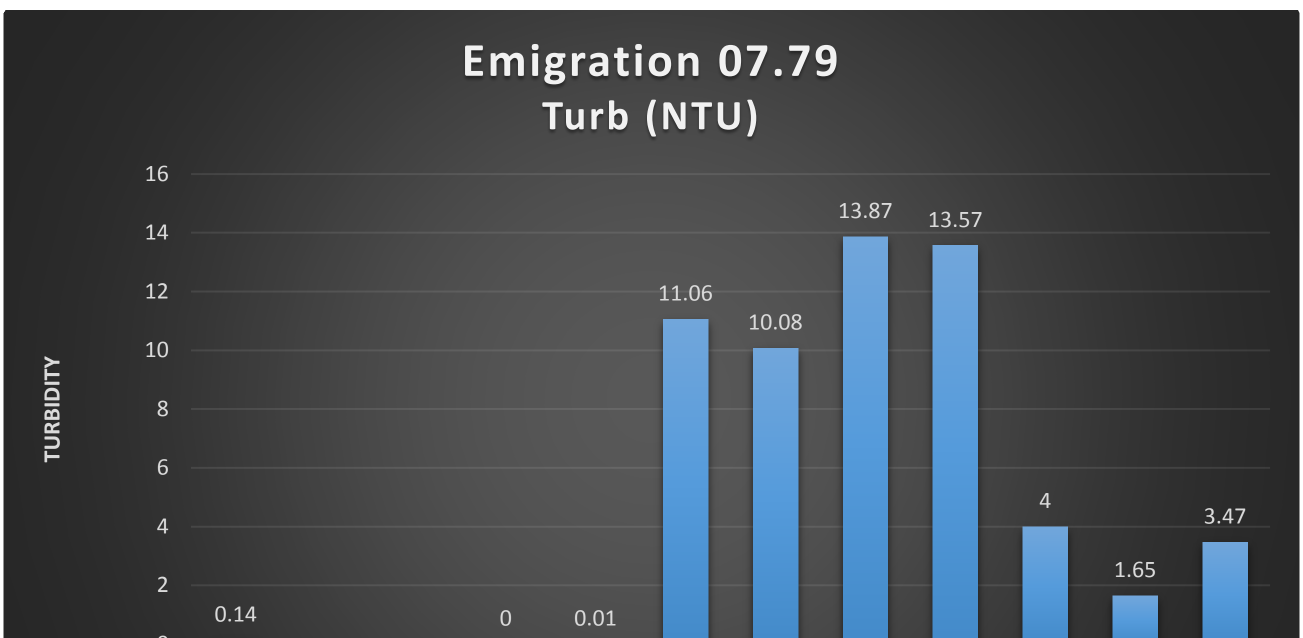
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
TDS(PPM)	1180			1200	1380	1030	673	649	654	807	1620	1002

Figure 4-67 Emigration Creek 07.79 Conductivity



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
EC (mS/cm)	1671			1685	1945	1449	949	914	920	1136	1780	1443

Figure 4-68 Emigration Creek 07.79 Turbidity



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Turb (NTU)	0.14			0	0.01	11.06	10.08	13.87	13.57	4	1.65	3.47

Figure 4-69 Emigration Creek 07.79 Temperature

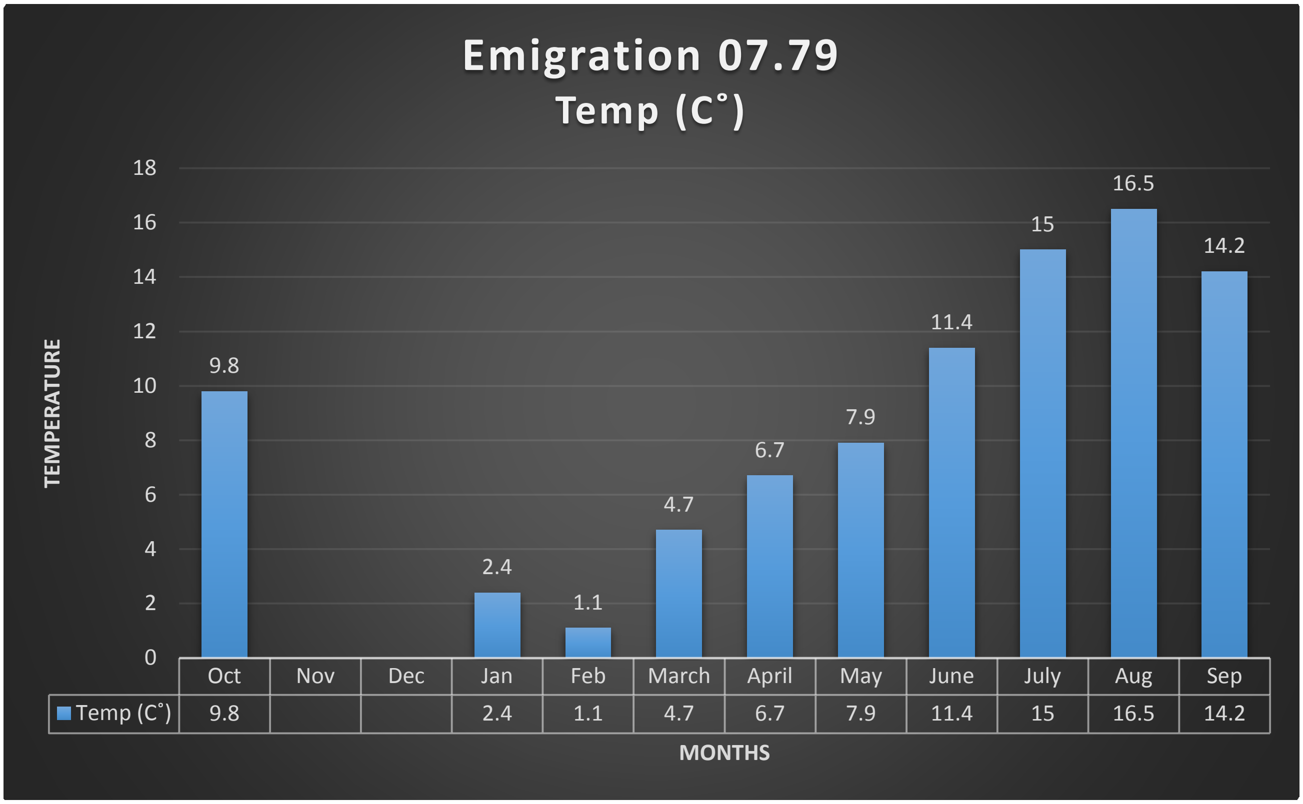


Figure 4-70 Emigration Creek 07.79 Salinity

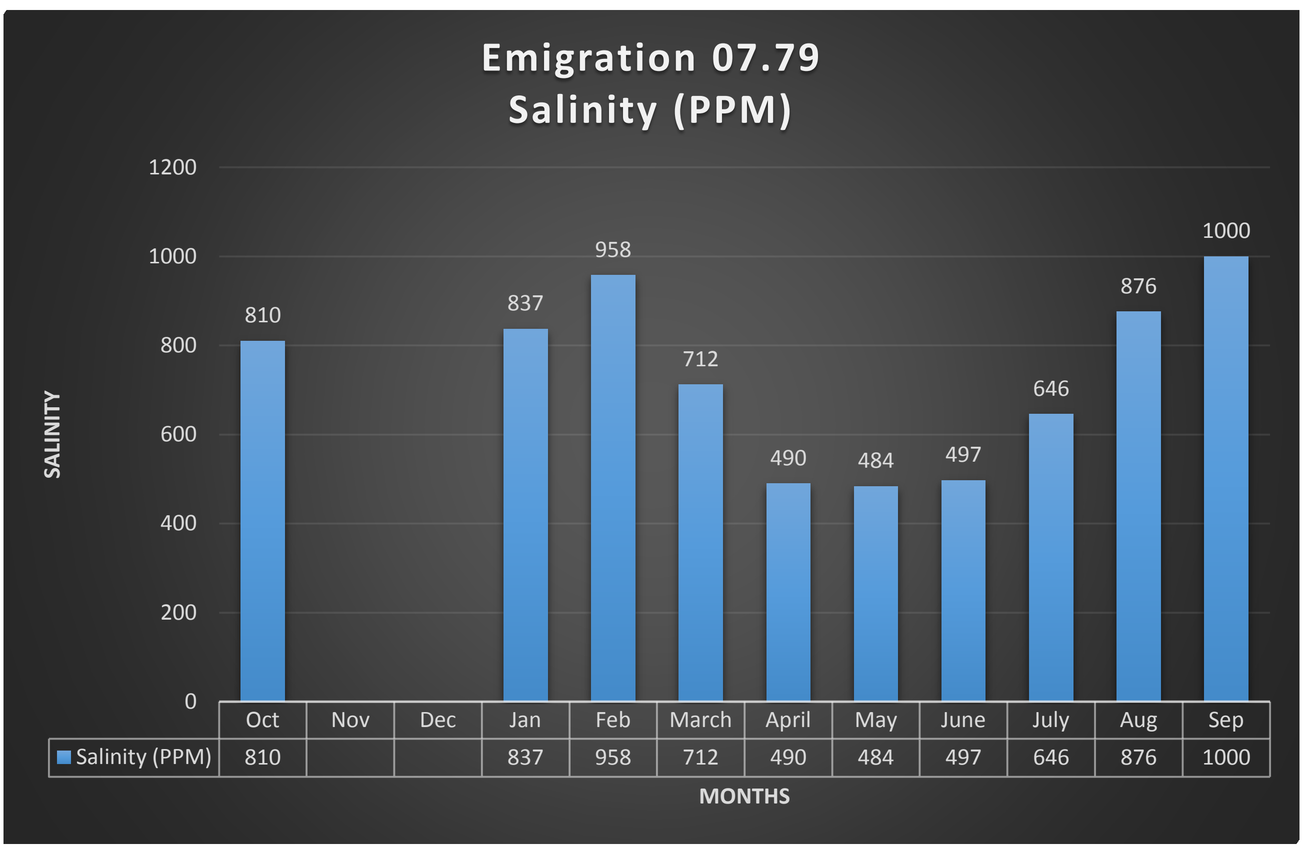
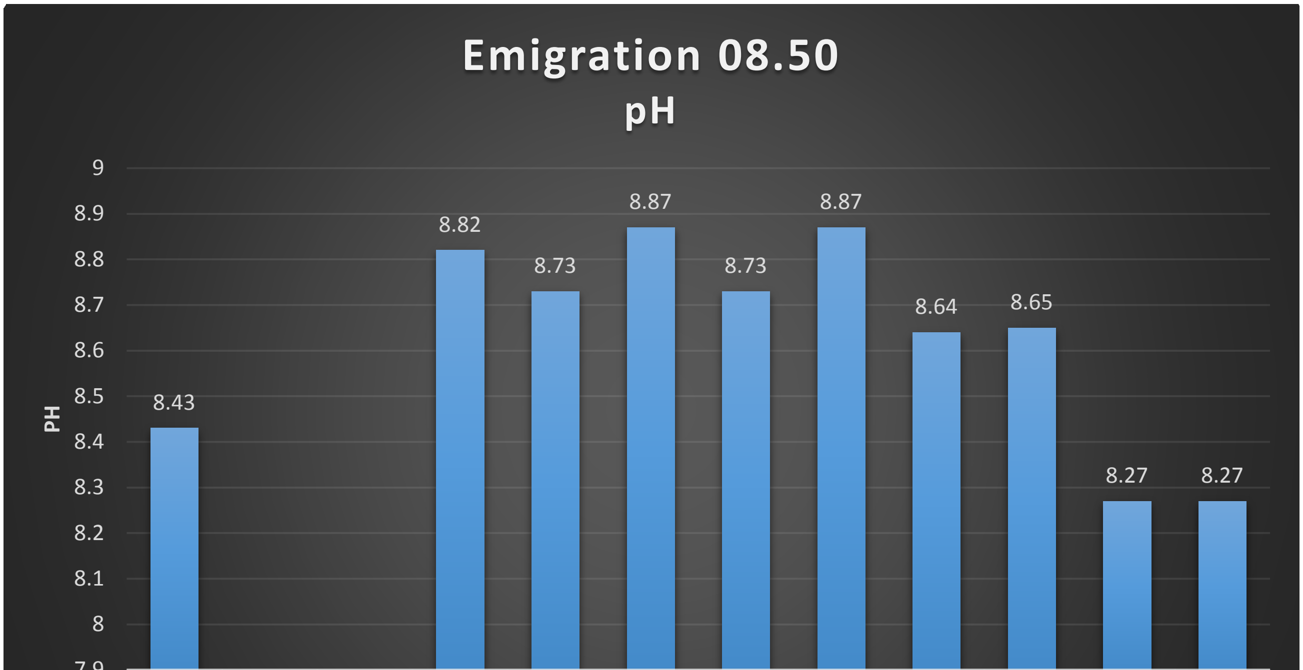
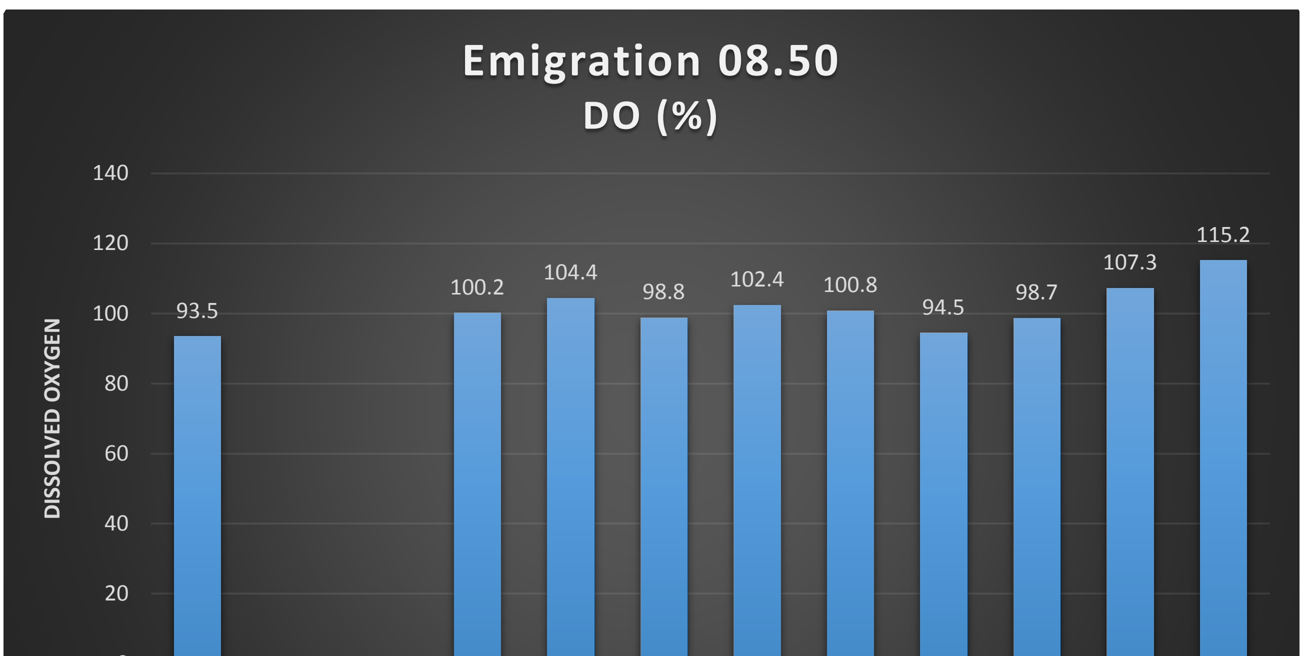


Figure 4-71 Emigration Creek 08.50 pH



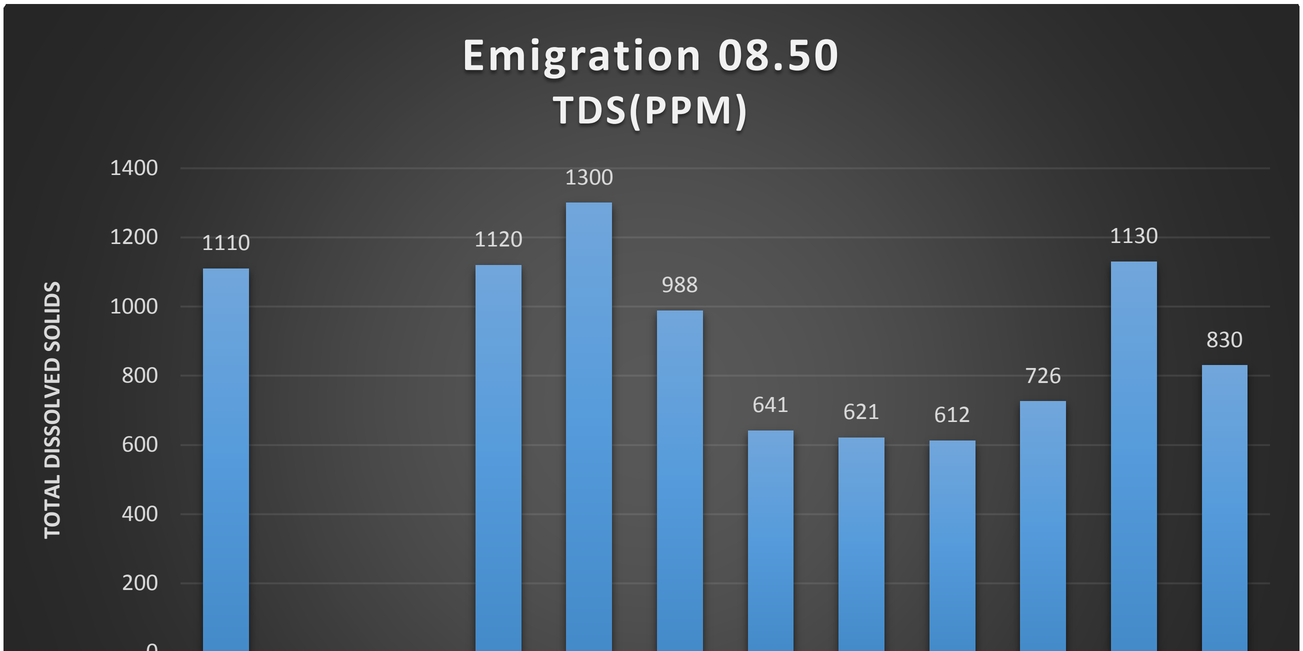
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
pH	8.43			8.82	8.73	8.87	8.73	8.87	8.64	8.65	8.27	8.27

Figure 4-72 Emigration Creek 08.50 Dissolved Oxygen



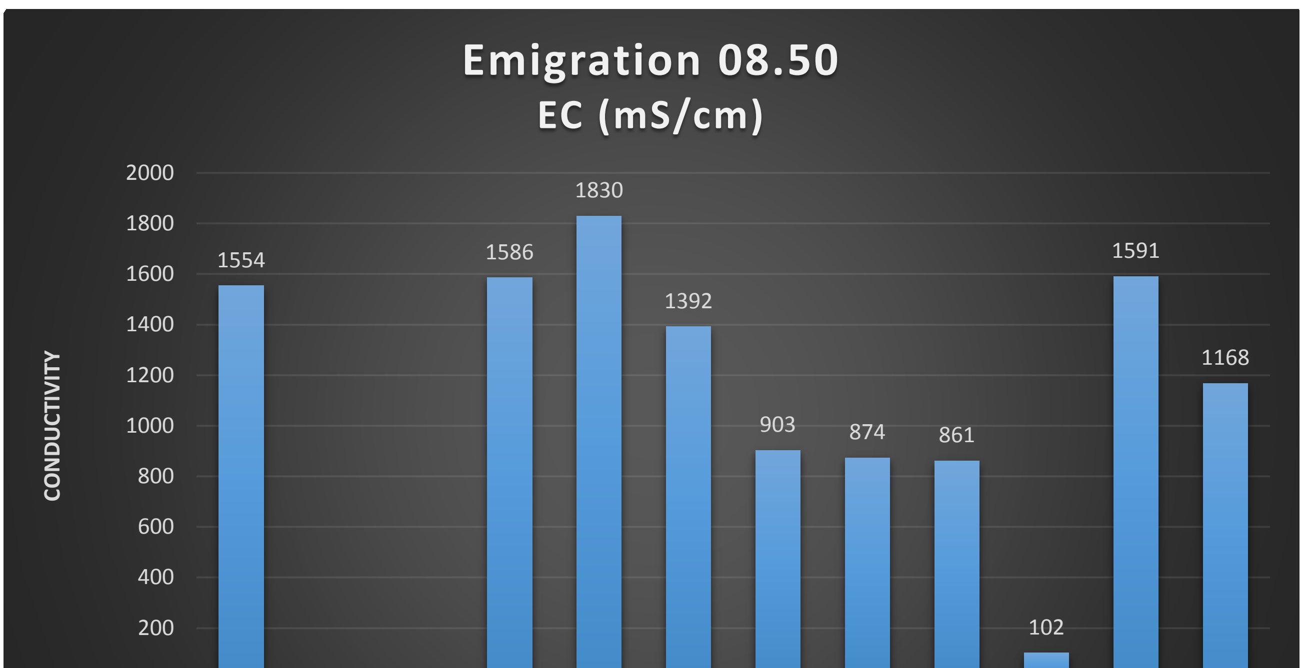
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
DO (%)	93.5			100.2	104.4	98.8	102.4	100.8	94.5	98.7	107.3	115.2

Figure 4-73 Emigration Creek 08.50 Total Dissolved Solids



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
TDS(PPM)	1110			1120	1300	988	641	621	612	726	1130	830

Figure 4-74 Emigration Creek 08.50 Conductivity



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
EC (mS/cm)	1554			1586	1830	1392	903	874	861	102	1591	1168

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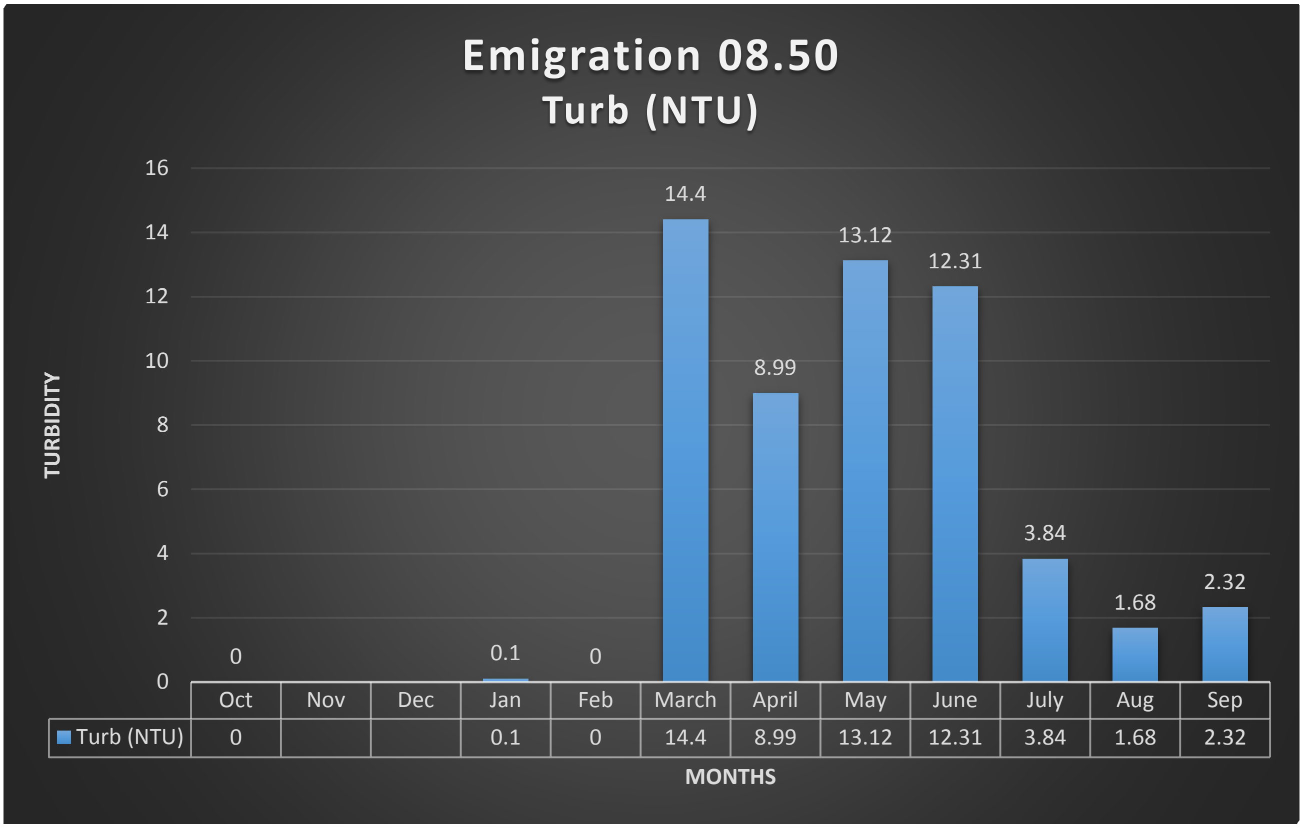
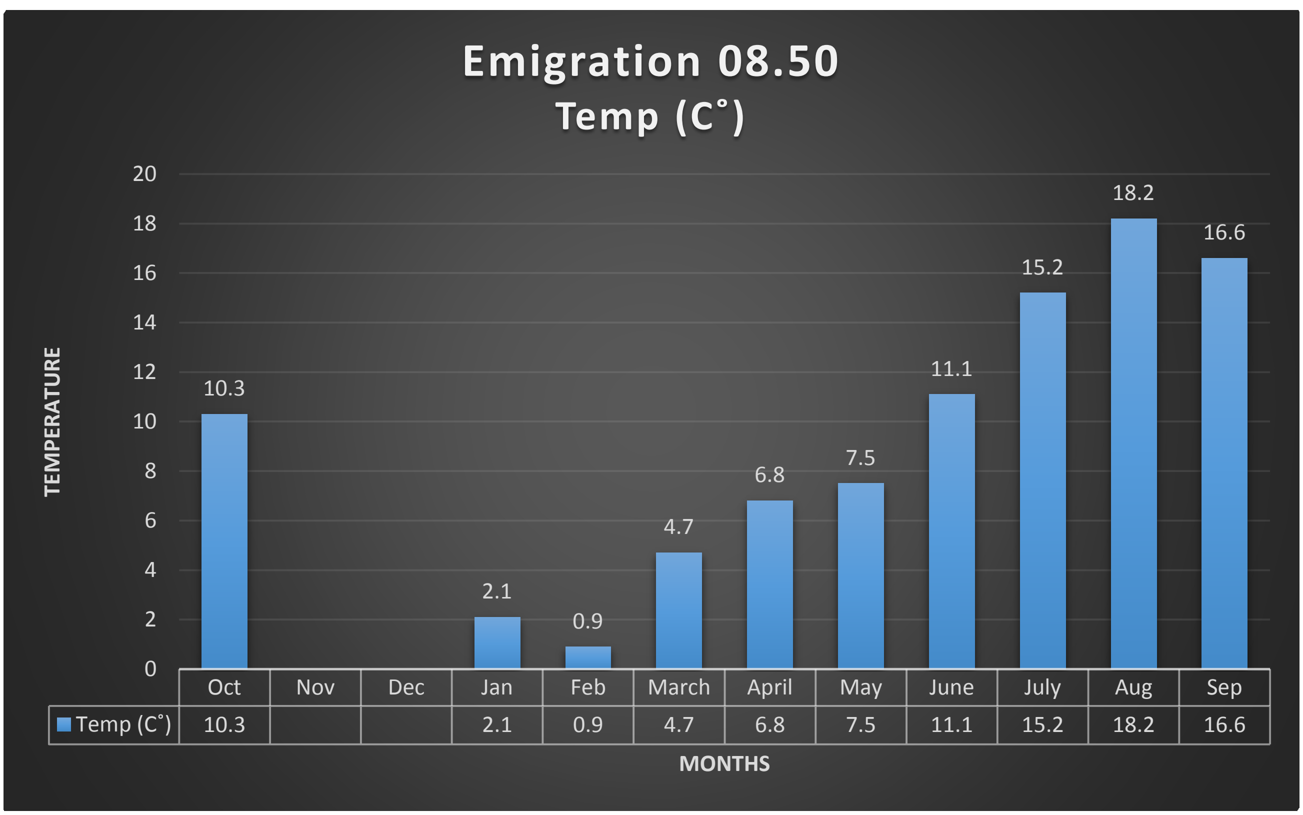
Figure 4-75 Emigration Creek 08.50 Turbidity



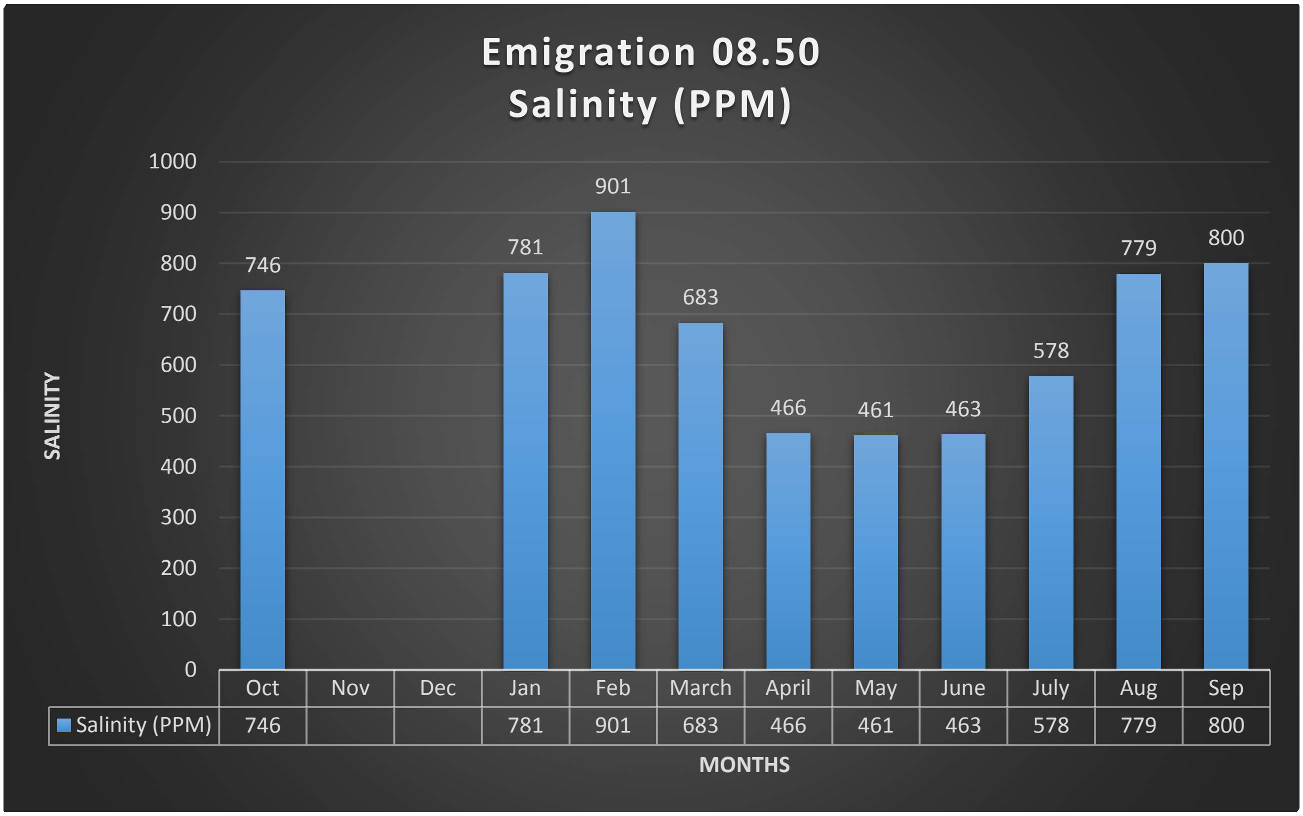
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Turb (NTU)	0			0.1	0	14.4	8.99	13.12	12.31	3.84	1.68	2.32

Figure 4-76 Emigration Creek 08.50 Temperature



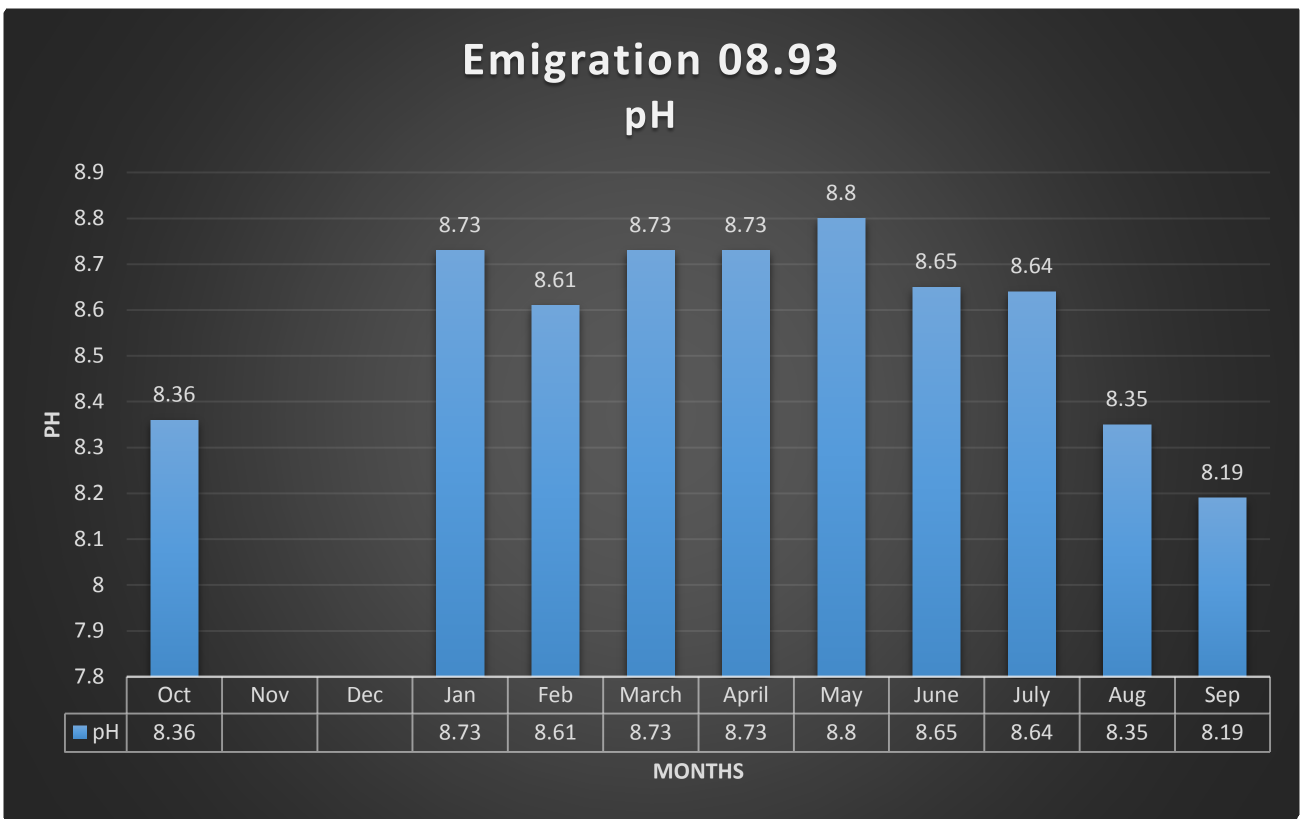
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Temp (C˚)	10.3			2.1	0.9	4.7	6.8	7.5	11.1	15.2	18.2	16.6

Figure 4-77 Emigration Creek 08.50 Salinity



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Salinity (PPM)	746			781	901	683	466	461	463	578	779	800

Figure 4-78 Emigration Creek 08.93 pH



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
pH	8.36			8.73	8.61	8.73	8.73	8.8	8.65	8.64	8.35	8.19

Figure 4-79 Emigration Creek 08.93 Dissolved Oxygen

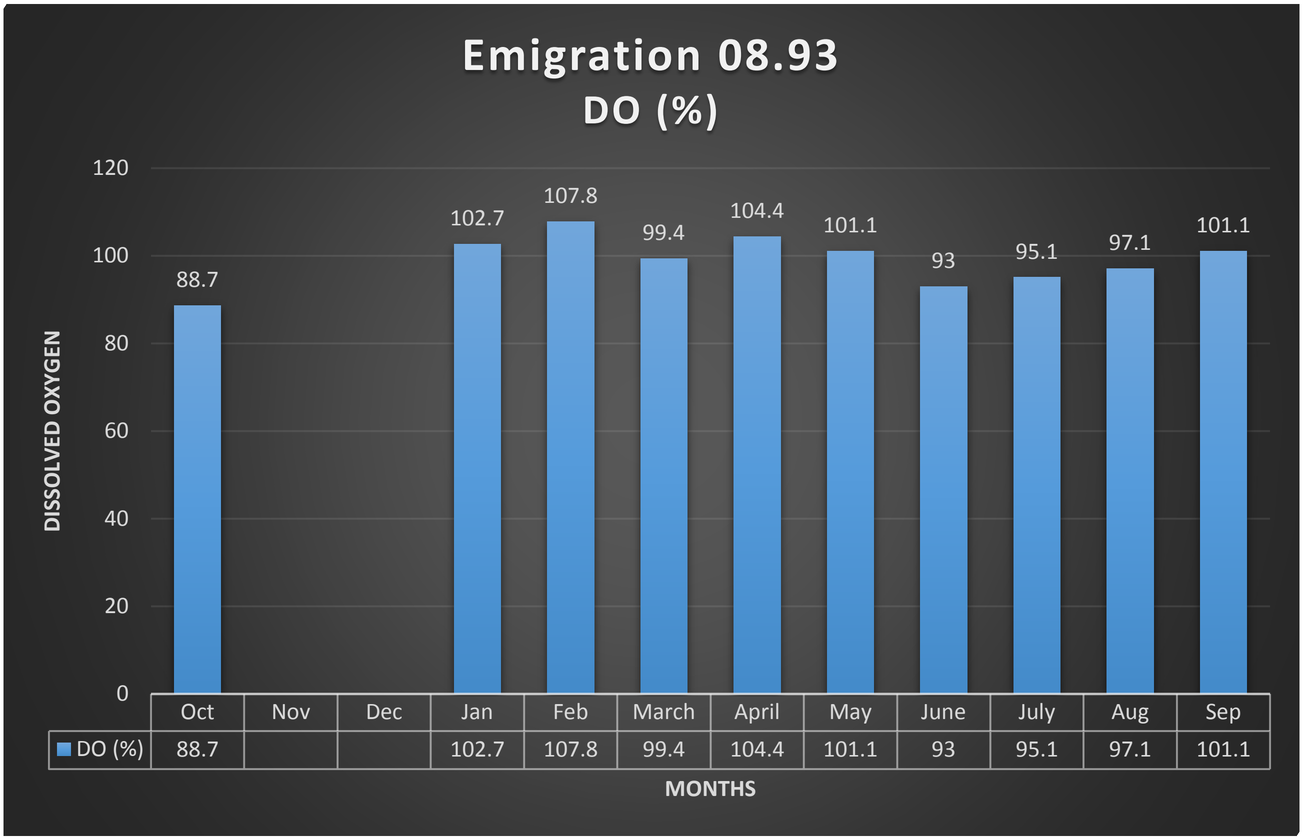


Figure 4-80 Emigration Creek 08.93 Total Dissolved Solids

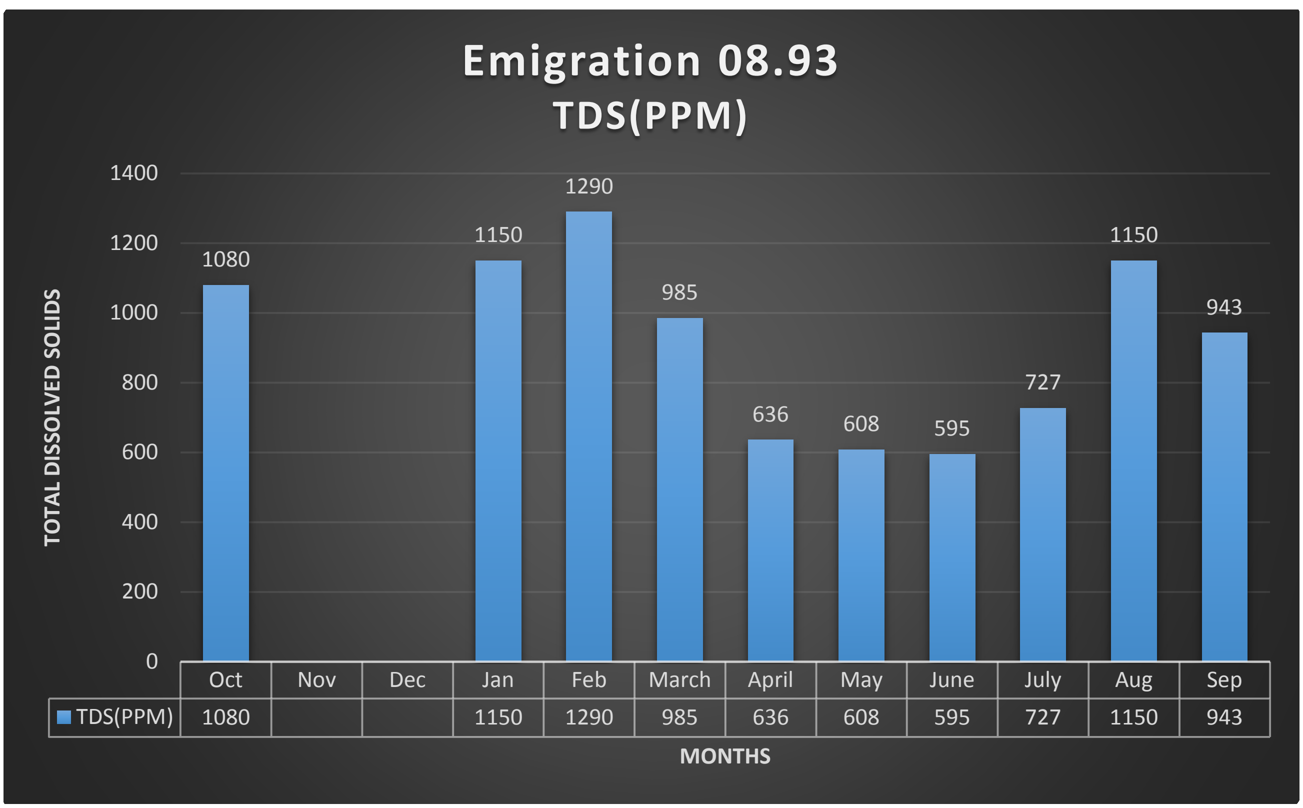


Figure 4-81 Emigration Creek 08.93 Conductivity

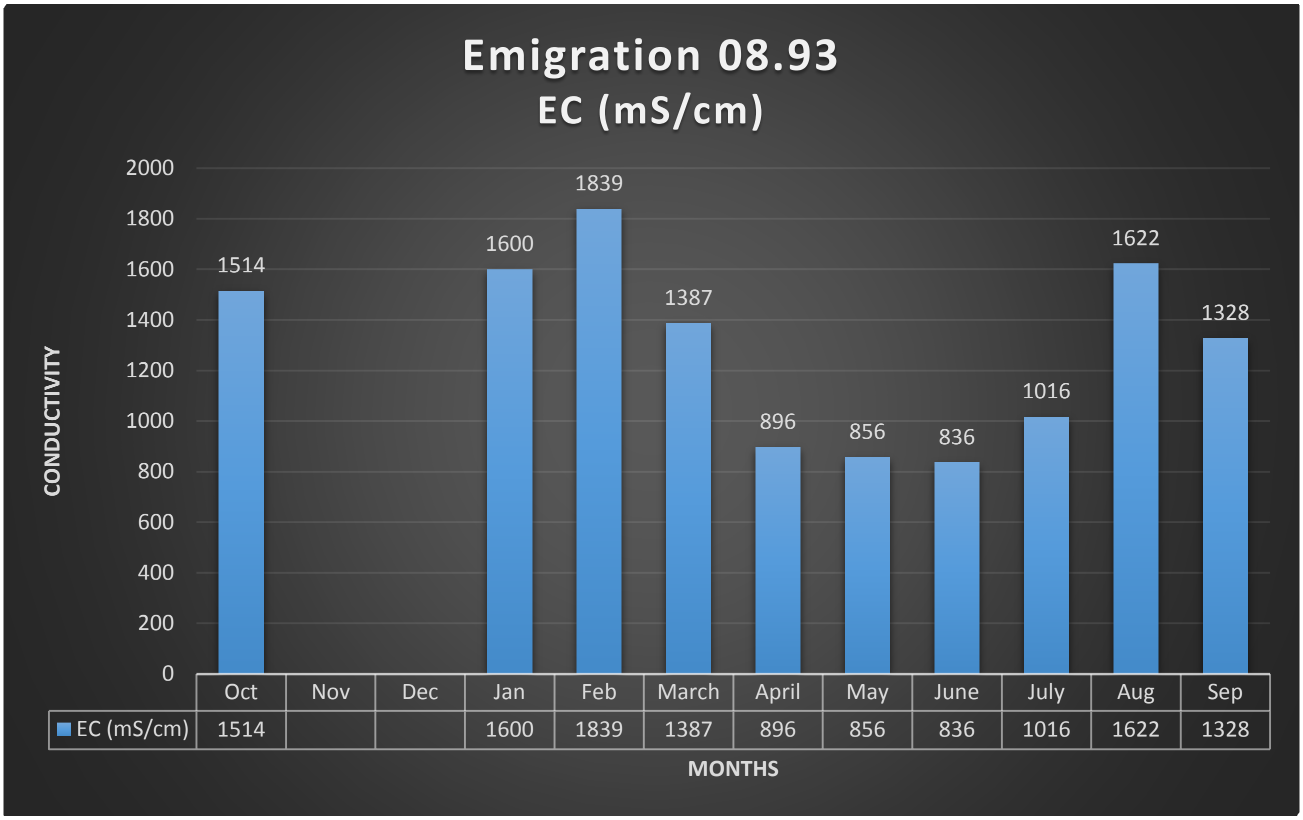


Figure 4-82 Emigration Creek 08.93 Turbidity

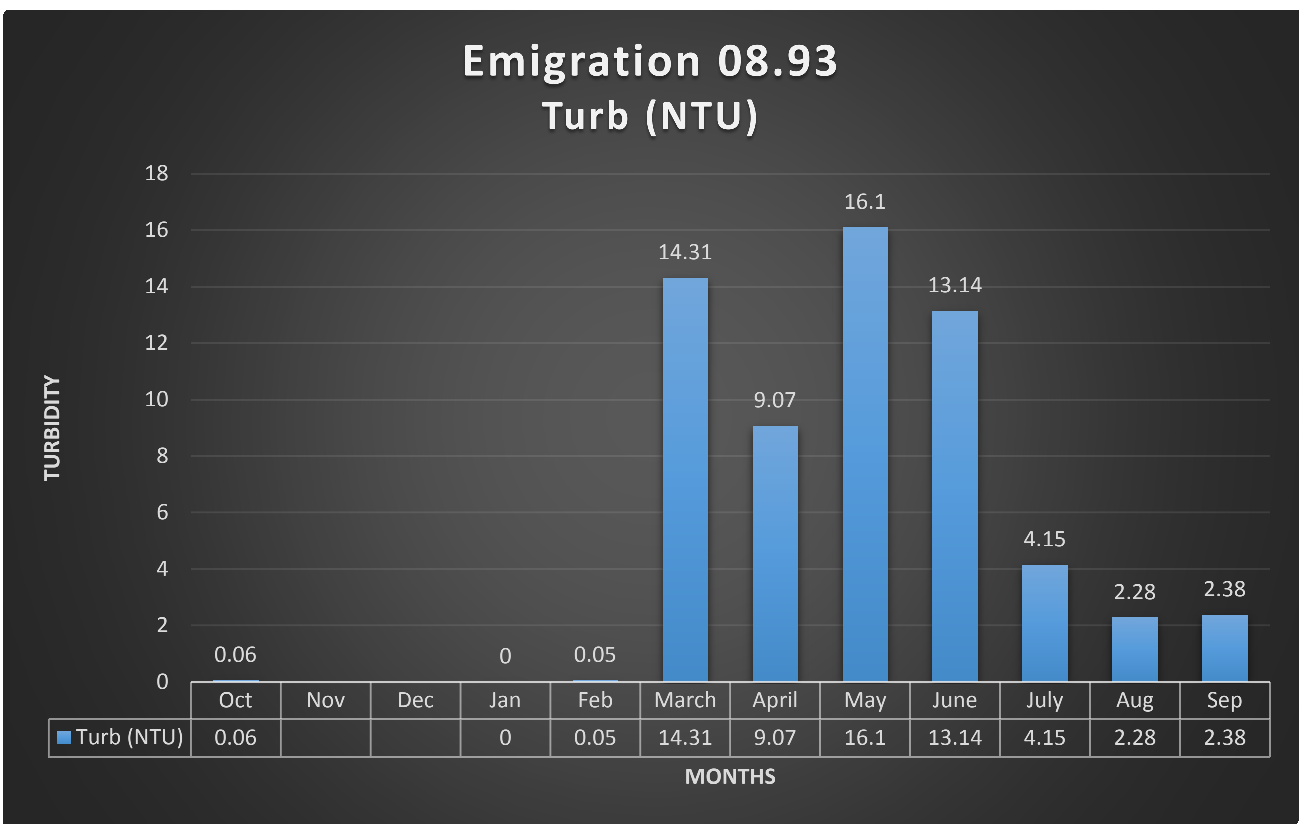


Figure 4-83 Emigration Creek 08.93 Temperature

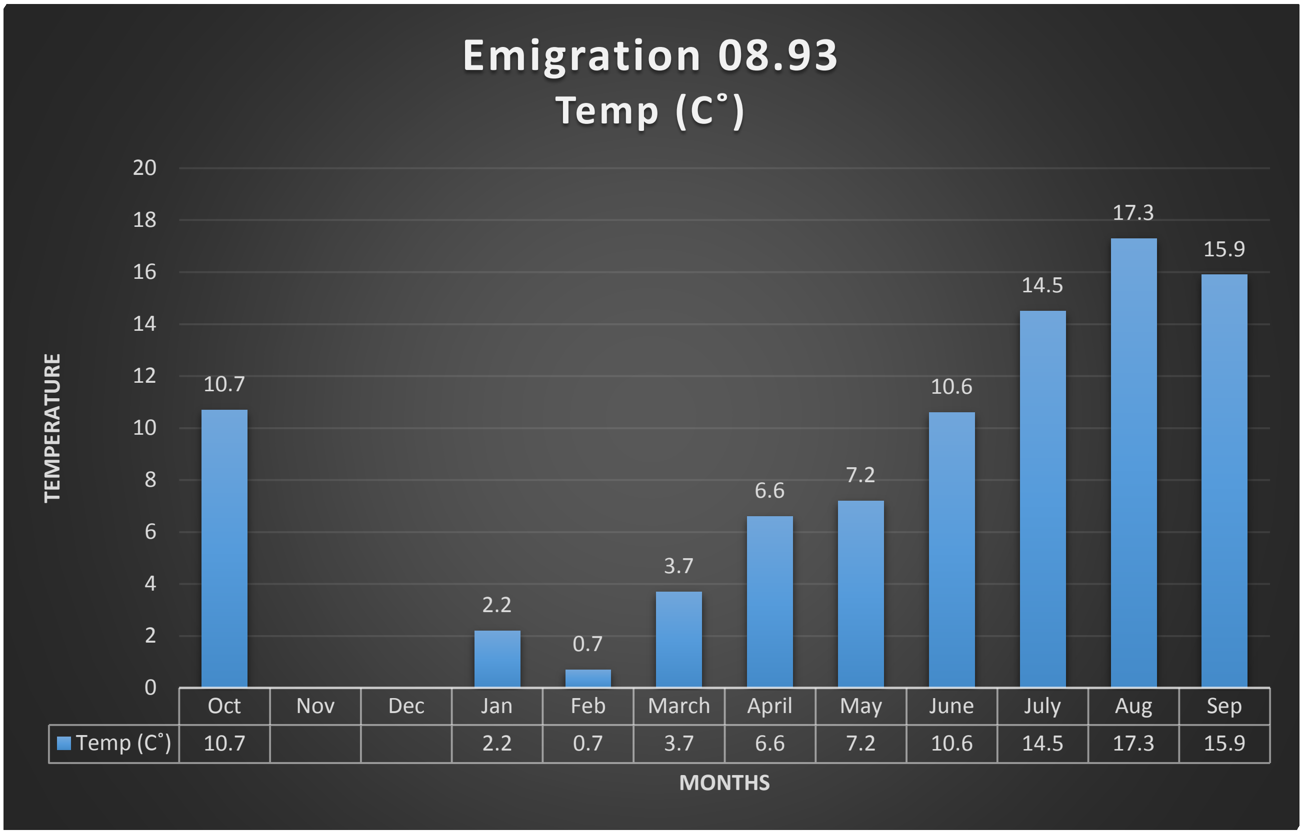


Figure 4-84 Emigration Creek 08.93 Salinity

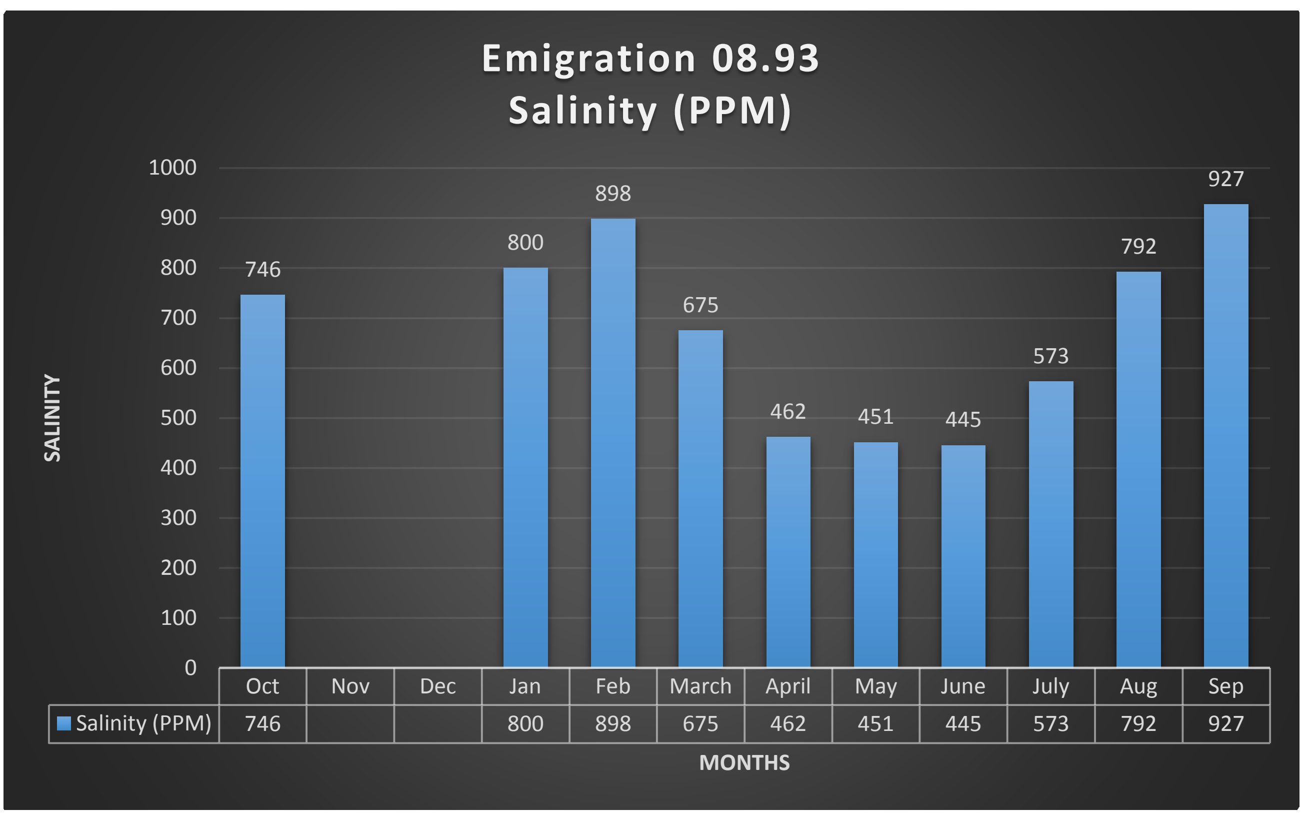


Figure 4-85 Emigration Creek 11.87 pH

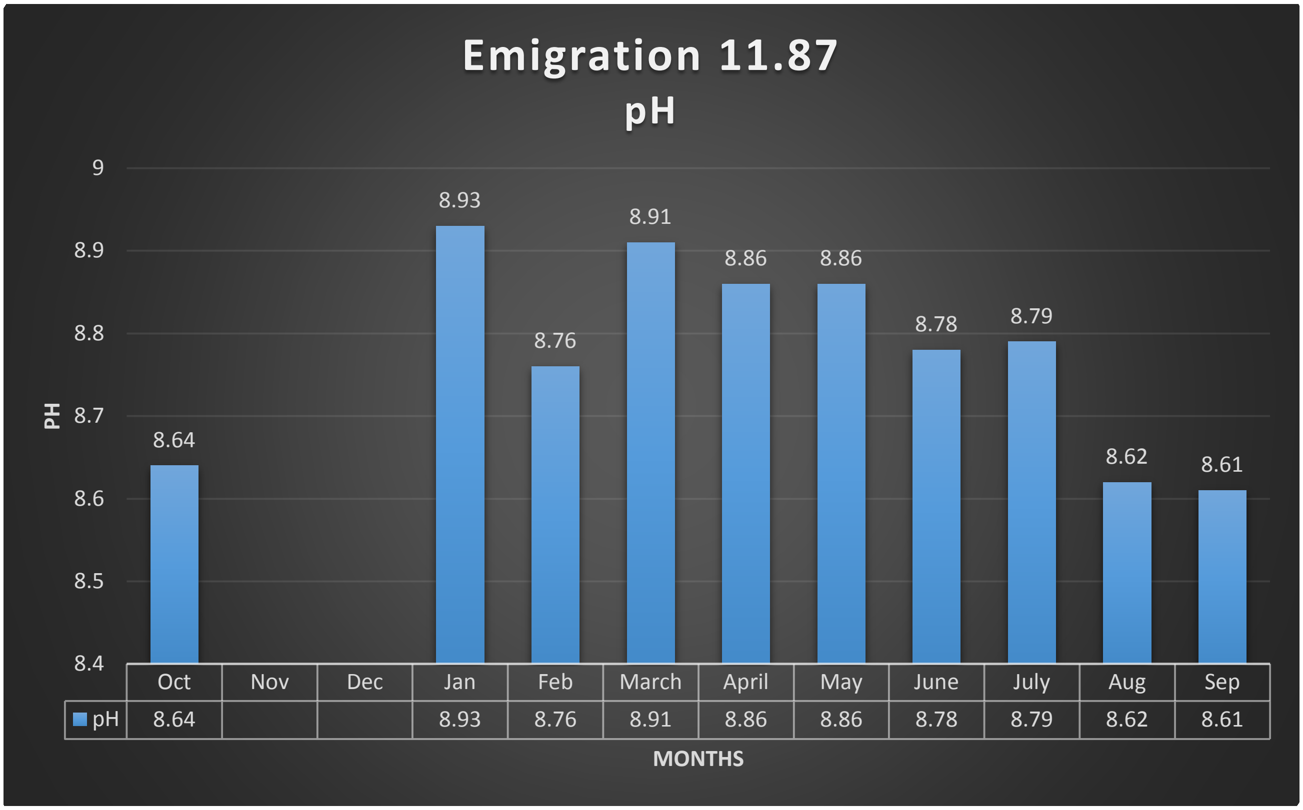


Figure 4-86 Emigration Creek 11.87 Dissolved Oxygen

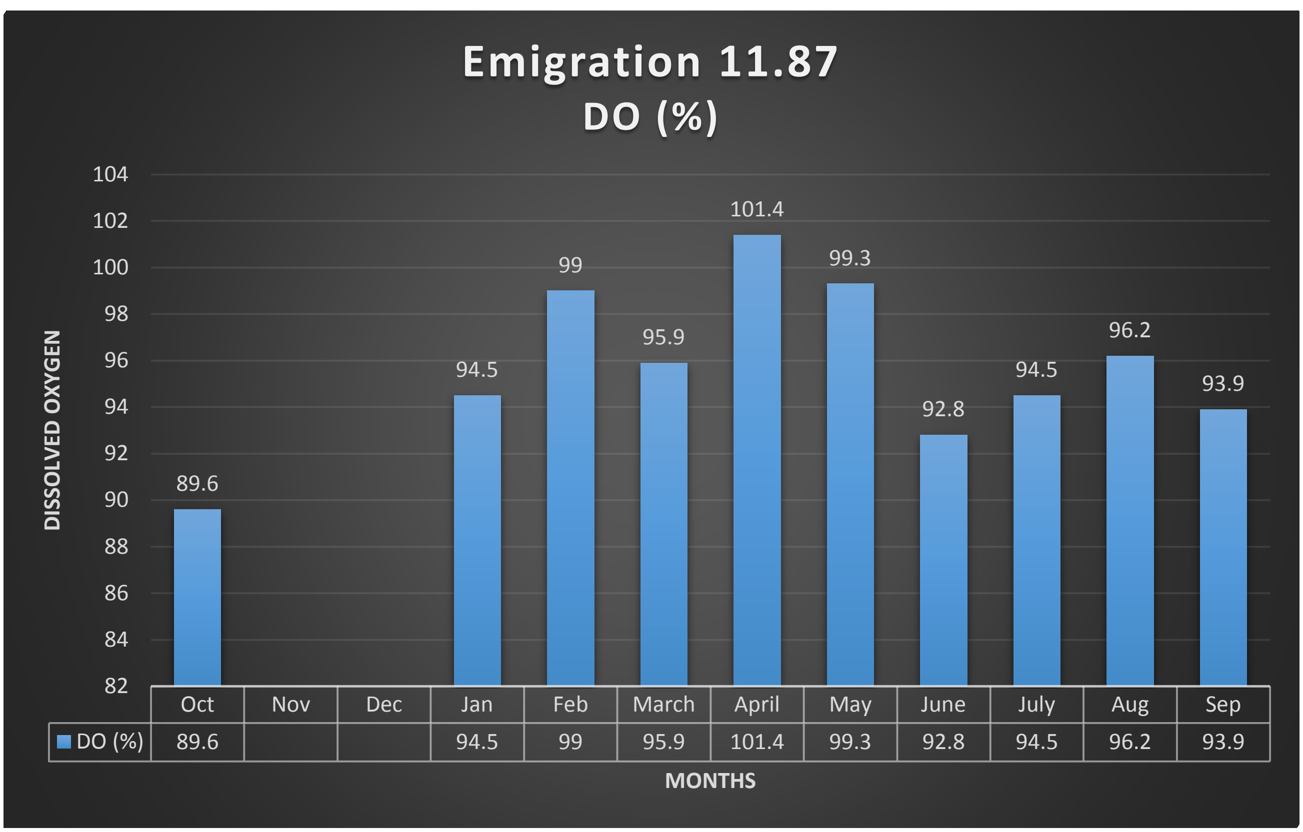


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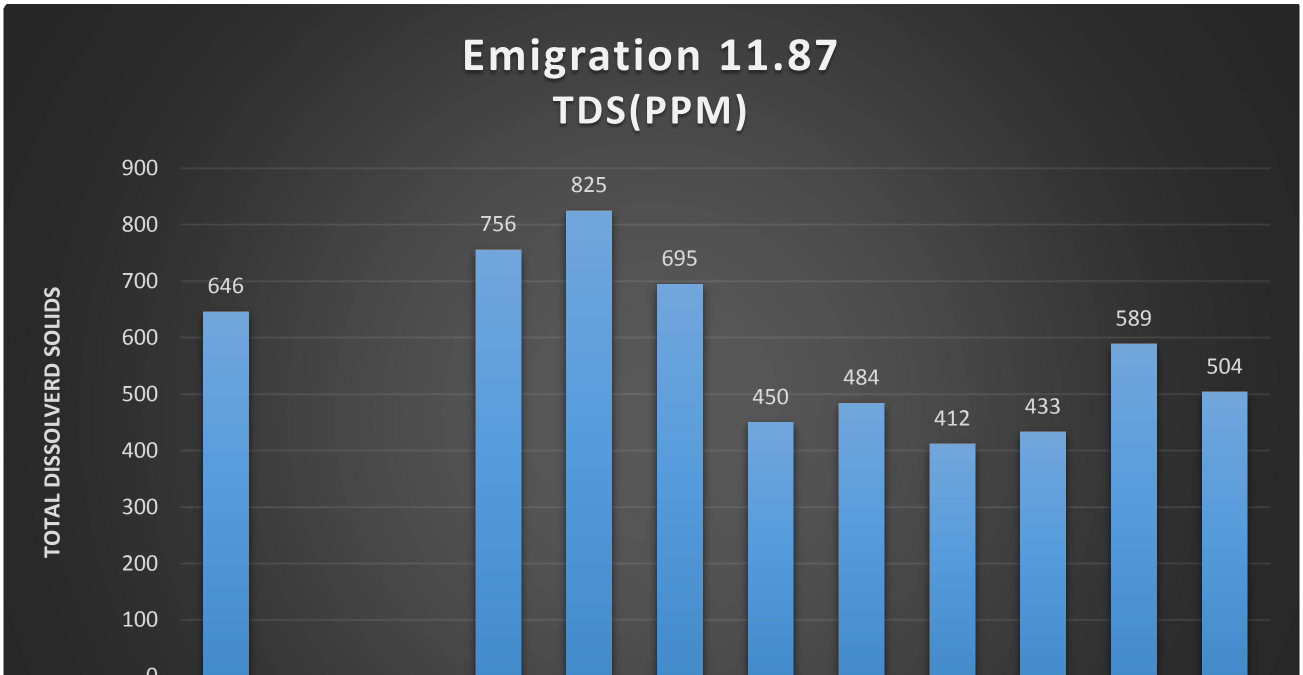
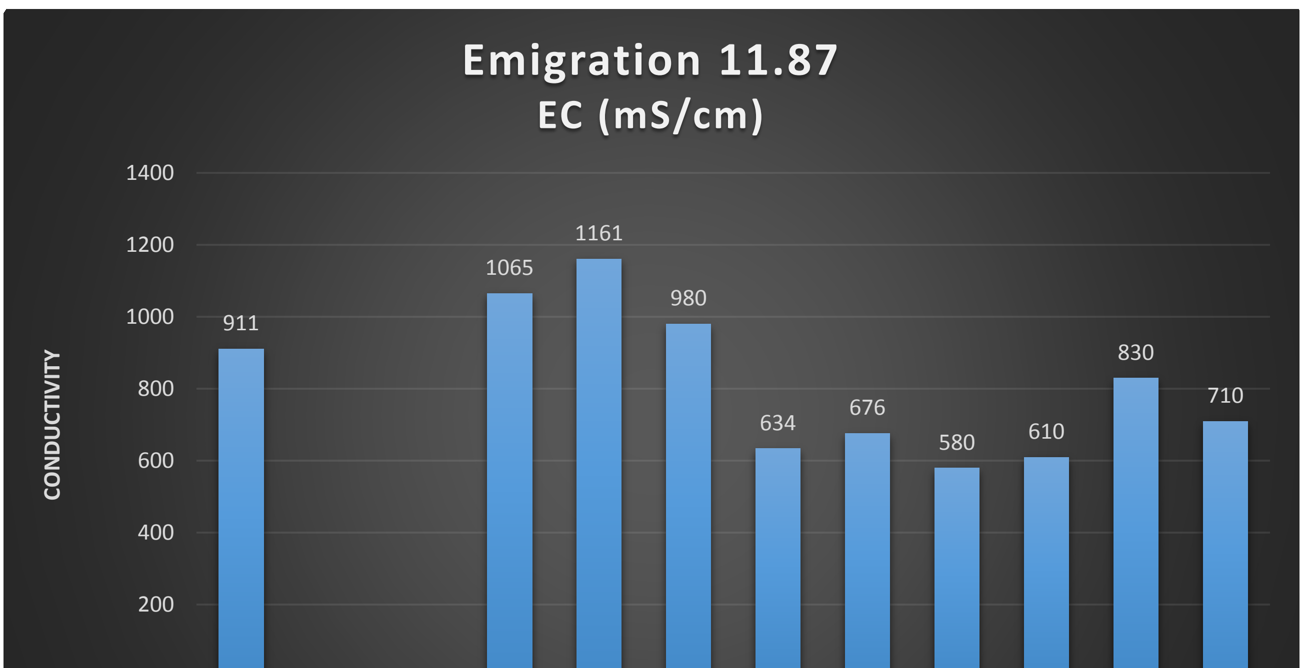
Figure 4-87 Emigration Creek 11.87 Total Dissolved Solids



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
TDS(PPM)	646			756	825	695	450	484	412	433	589	504

Figure 4-88 Emigration Creek 11.87 Conductivity



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
EC (mS/cm)	911			1065	1161	980	634	676	580	610	830	710

Figure 4-89 Emigration Creek 11.87 Turbidity

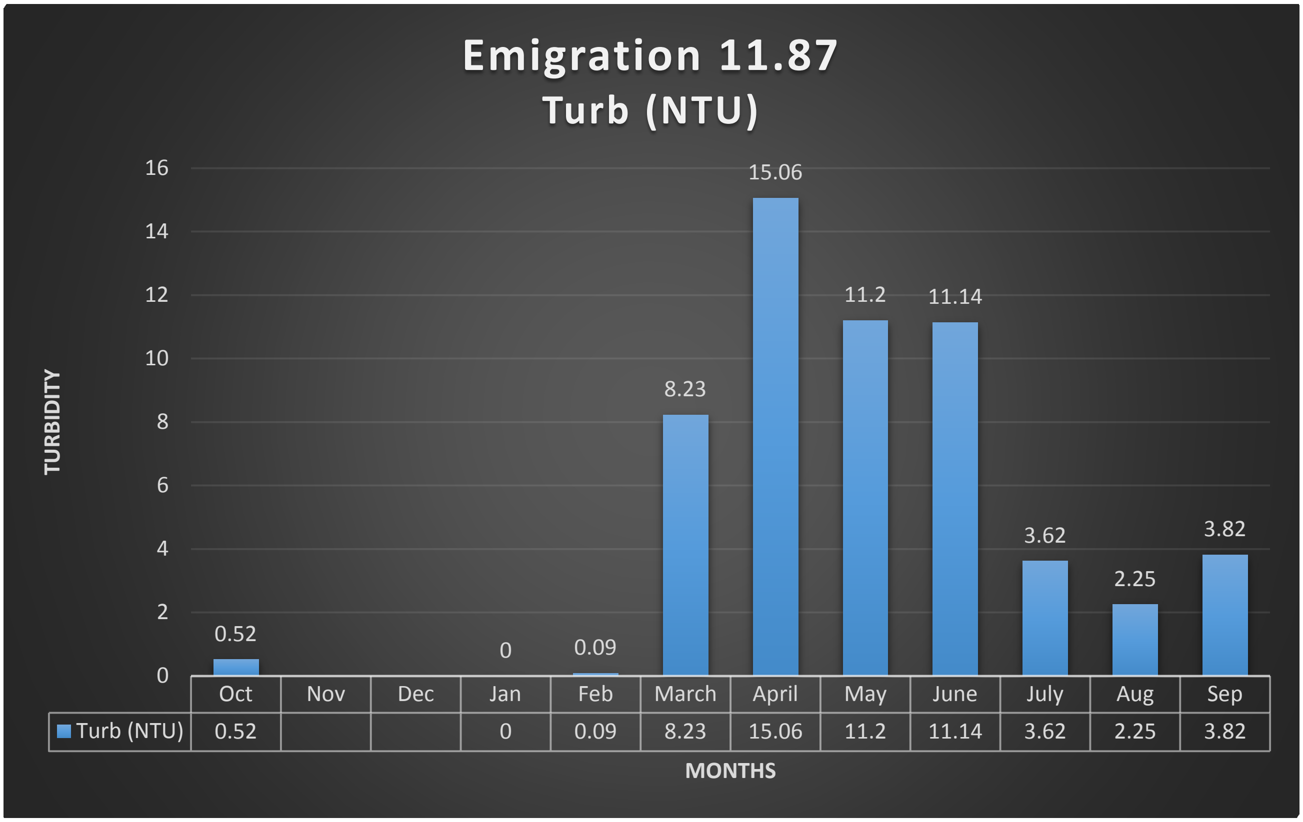


Figure 4-90 Emigration Creek 11.87 Temperature

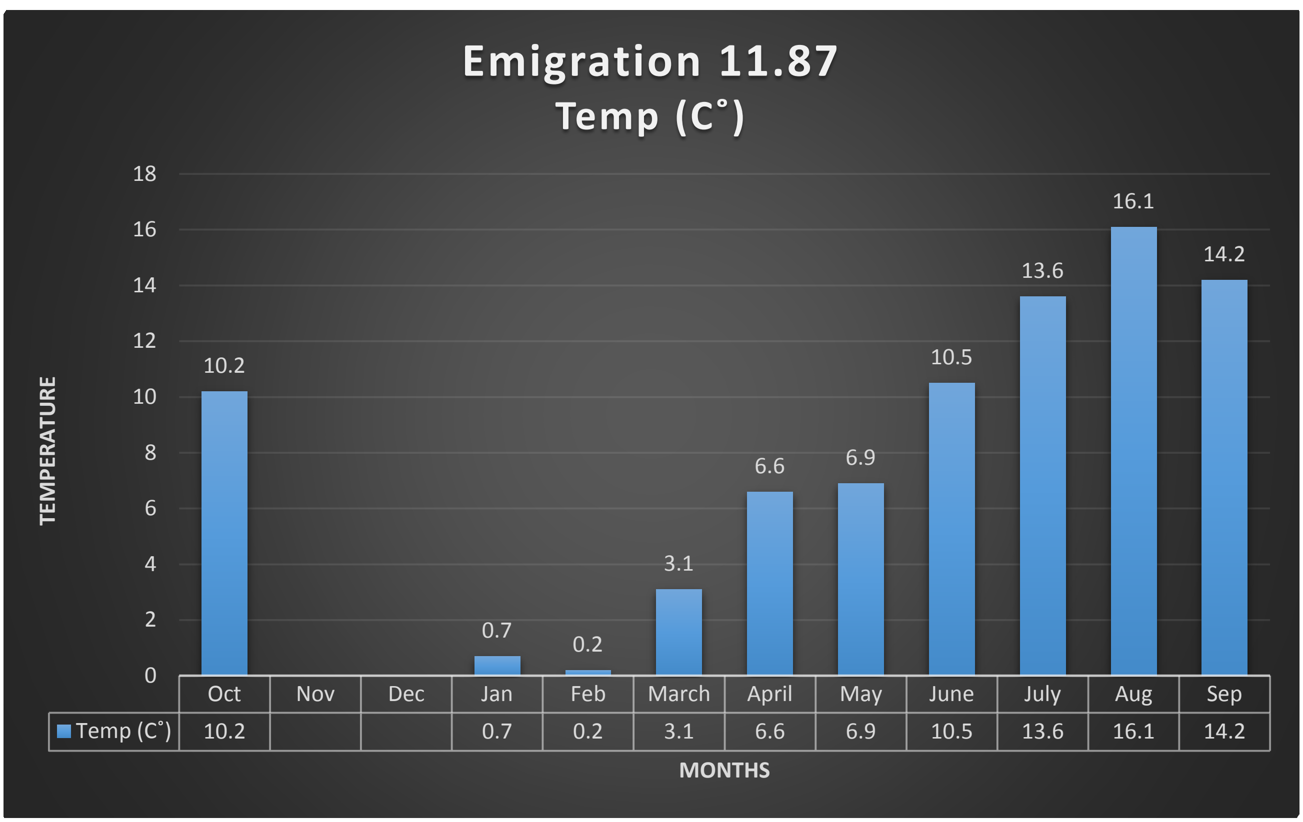
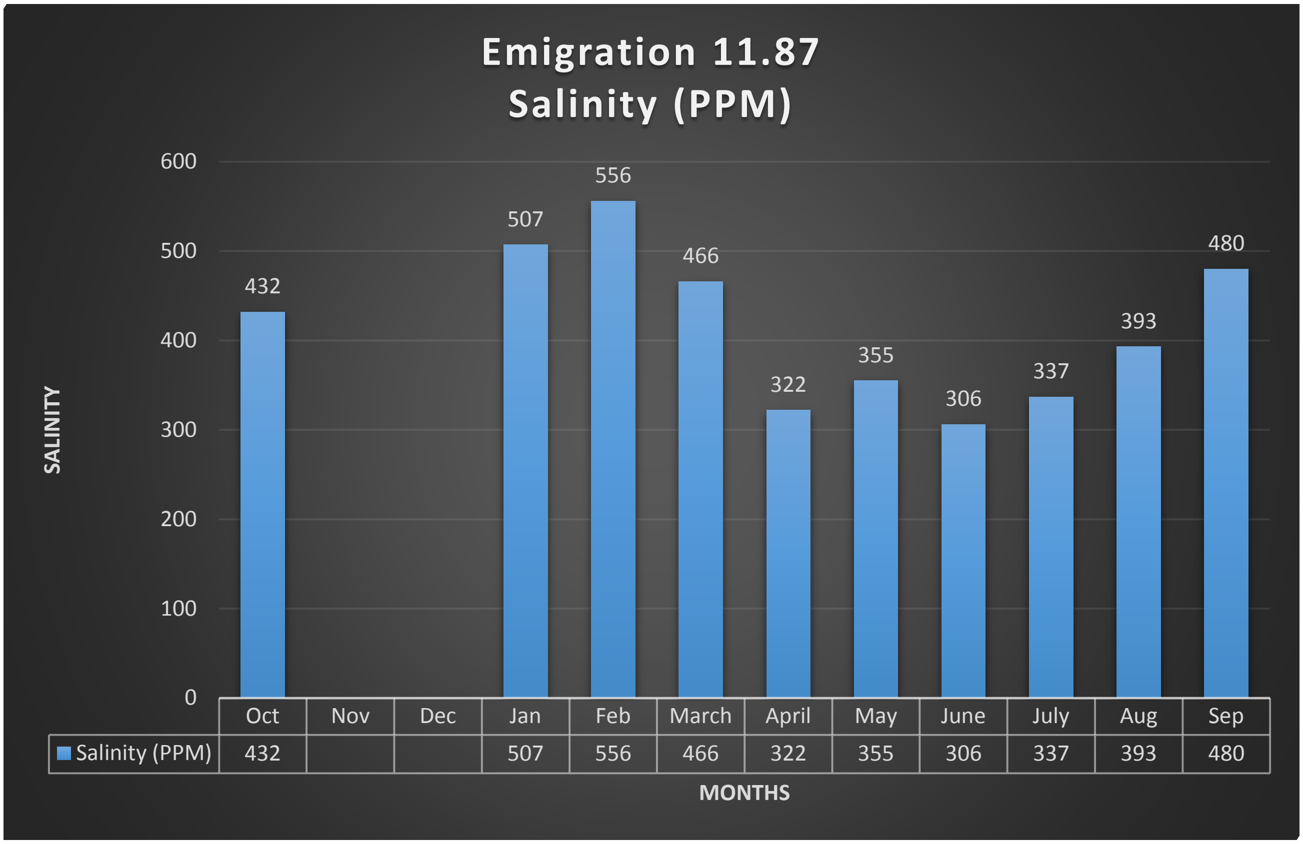
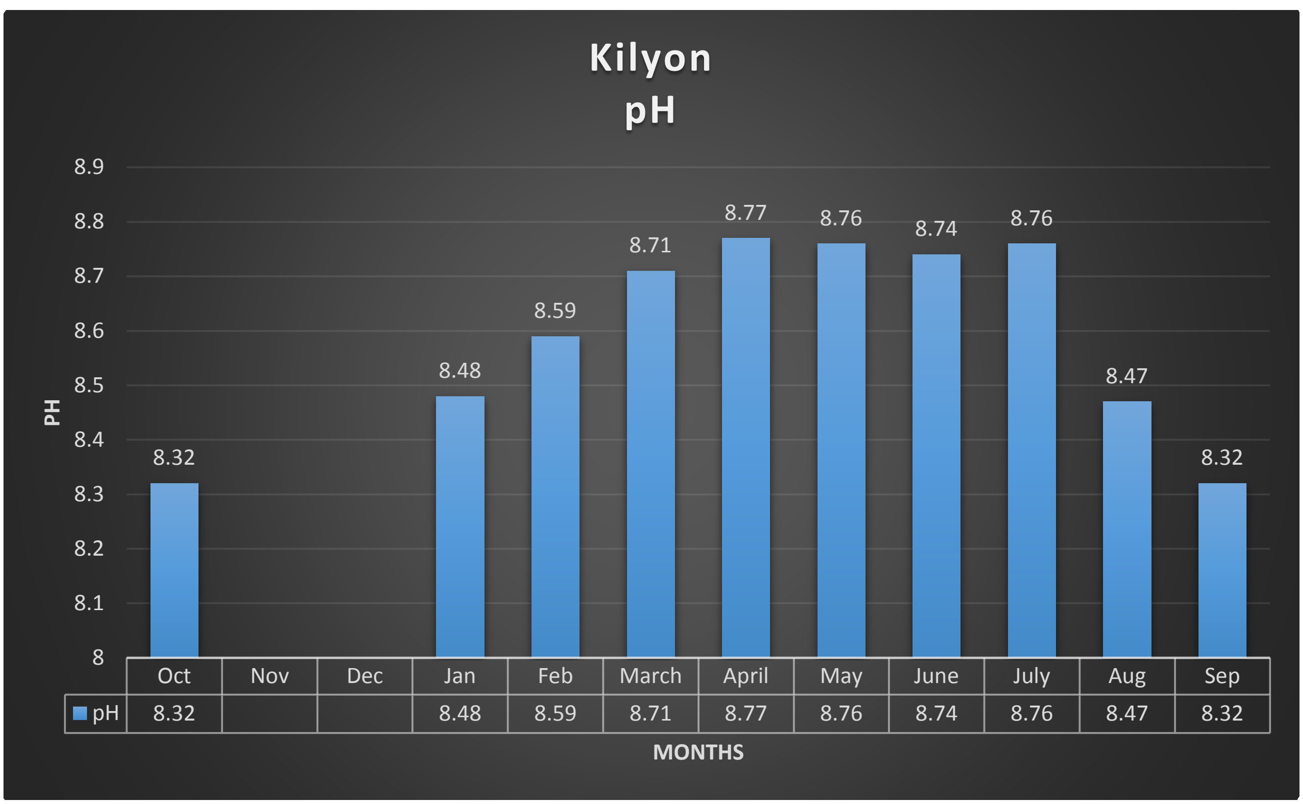


Figure 4-91 Emigration Creek 11.87 Salinity



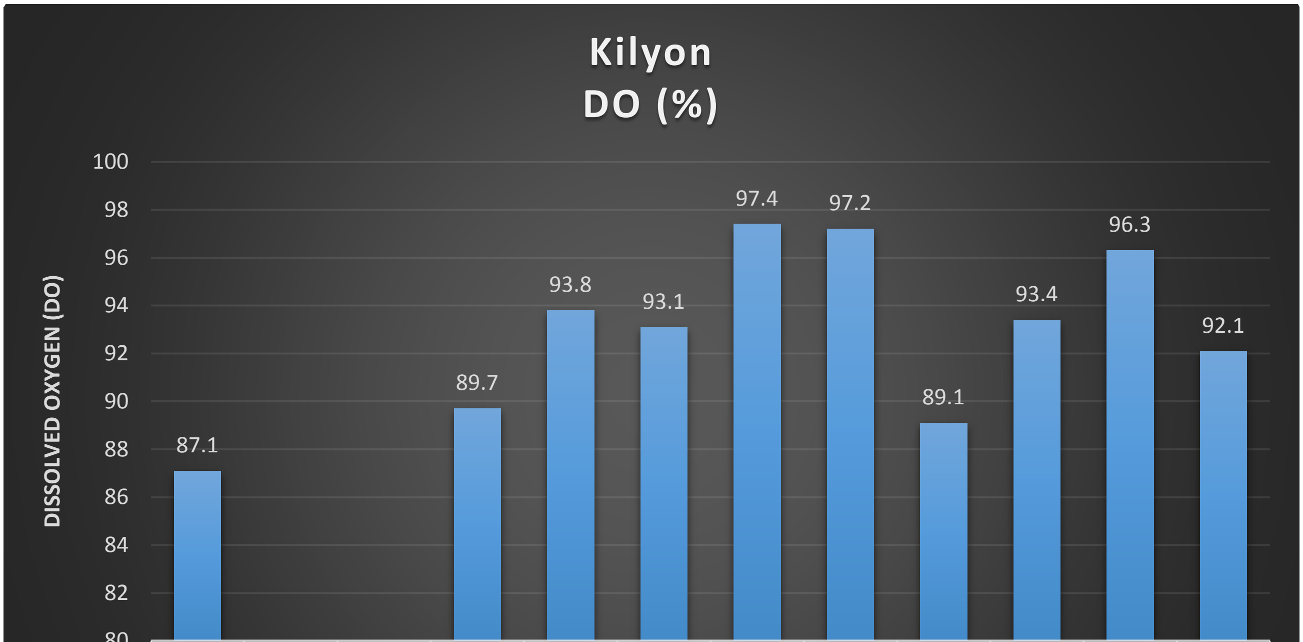
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Salinity (PPM)	432			507	556	466	322	355	306	337	393	480

Figure 4-92 Kilyon pH



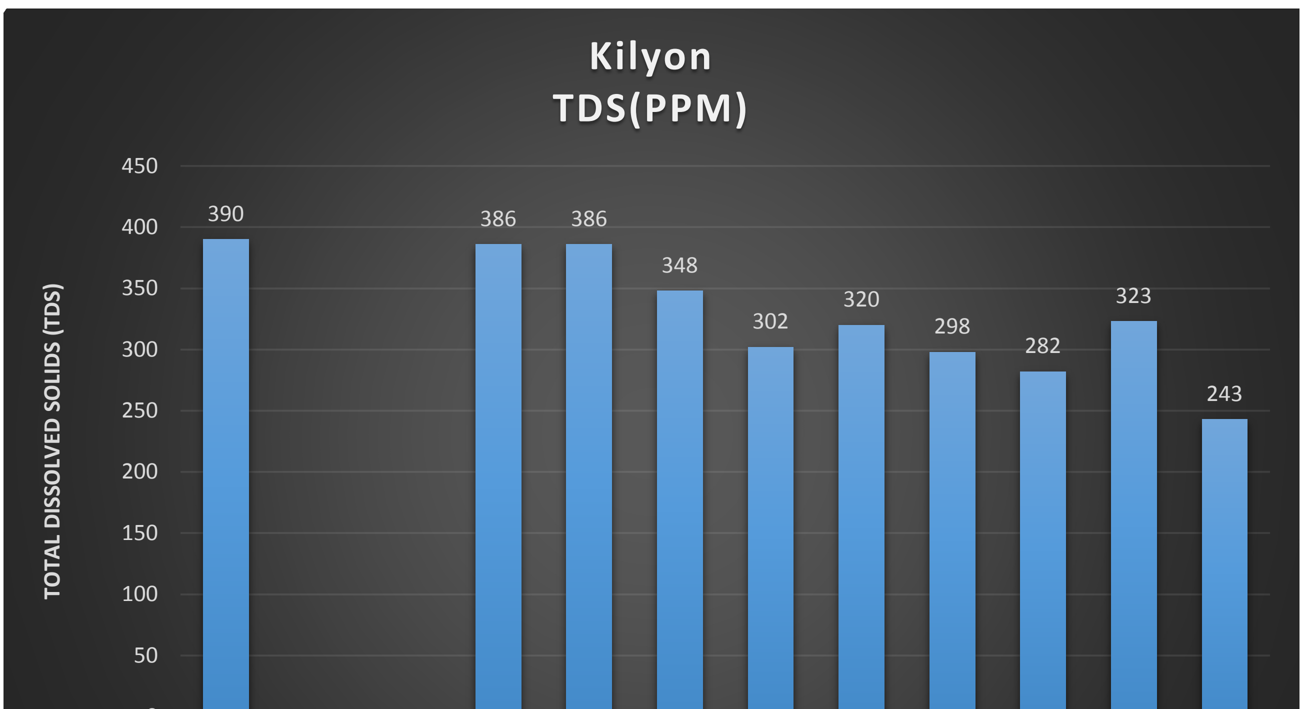
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
pH	8.32			8.48	8.59	8.71	8.77	8.76	8.74	8.76	8.47	8.32

Figure 4-93 Kilyon Dissolved Oxygen



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
DO (%)	87.1			89.7	93.8	93.1	97.4	97.2	89.1	93.4	96.3	92.1

Figure 4-94 Kilyon Total Dissolved Solids



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
TDS(PPM)	390			386	386	348	302	320	298	282	323	243

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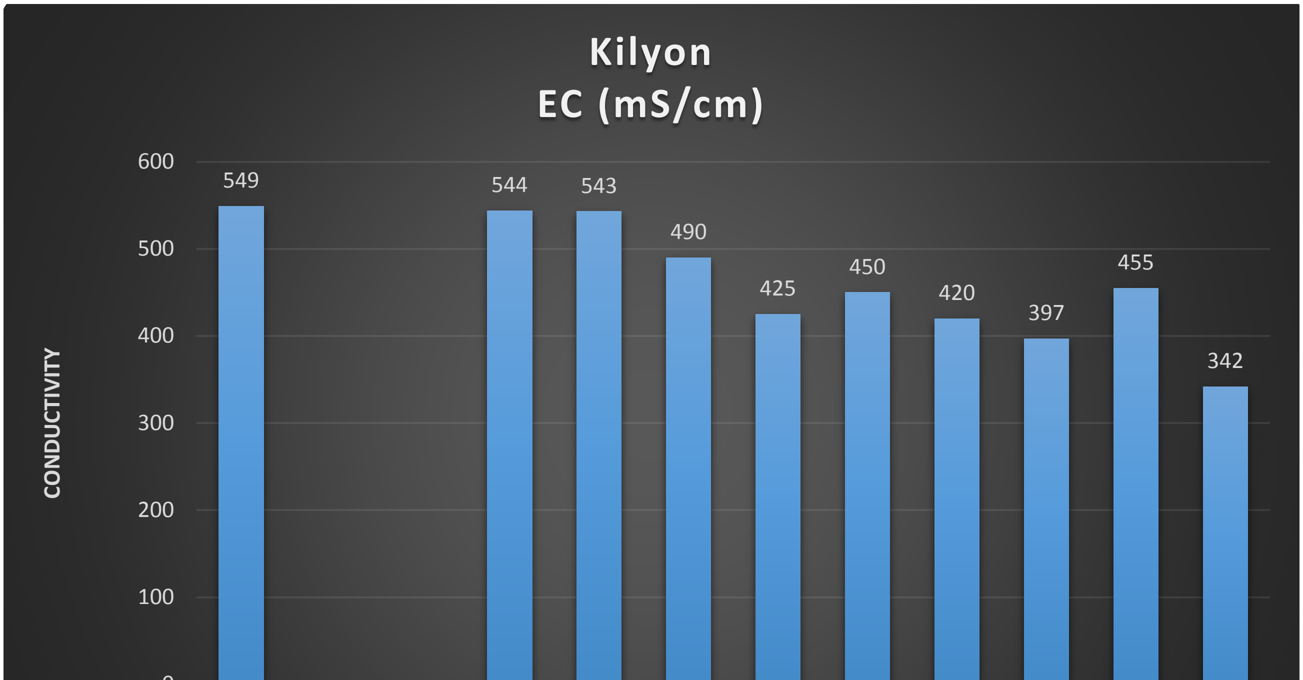
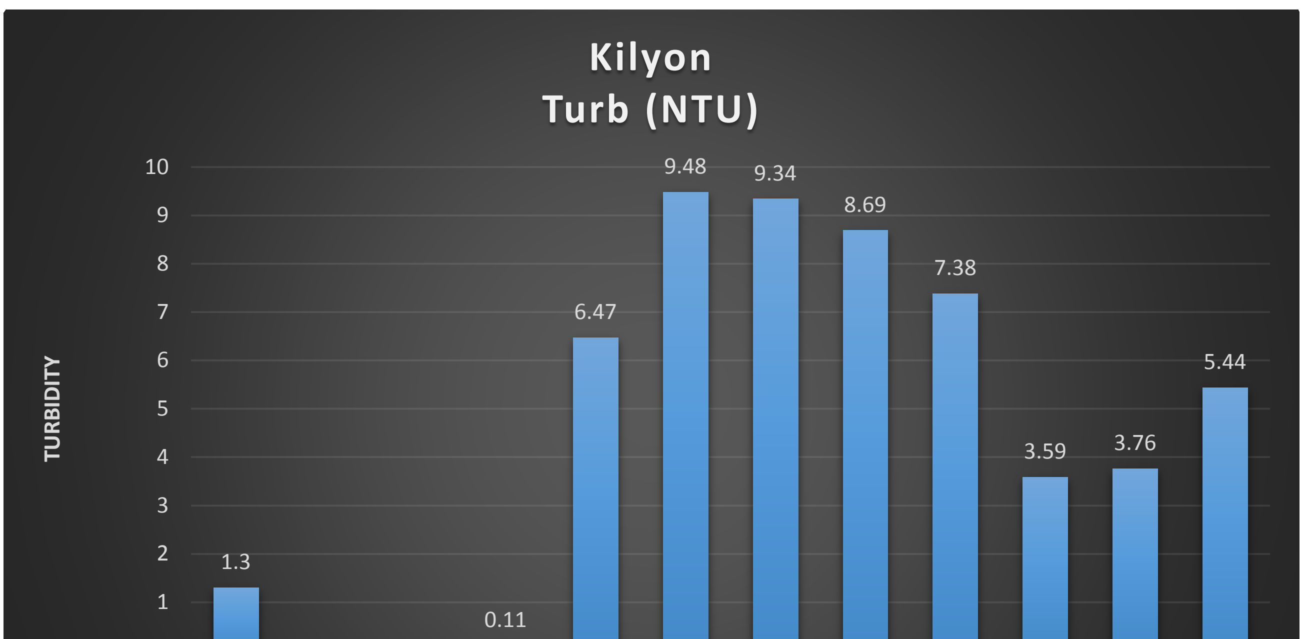
Figure 4-95 Kilyon Conductivity



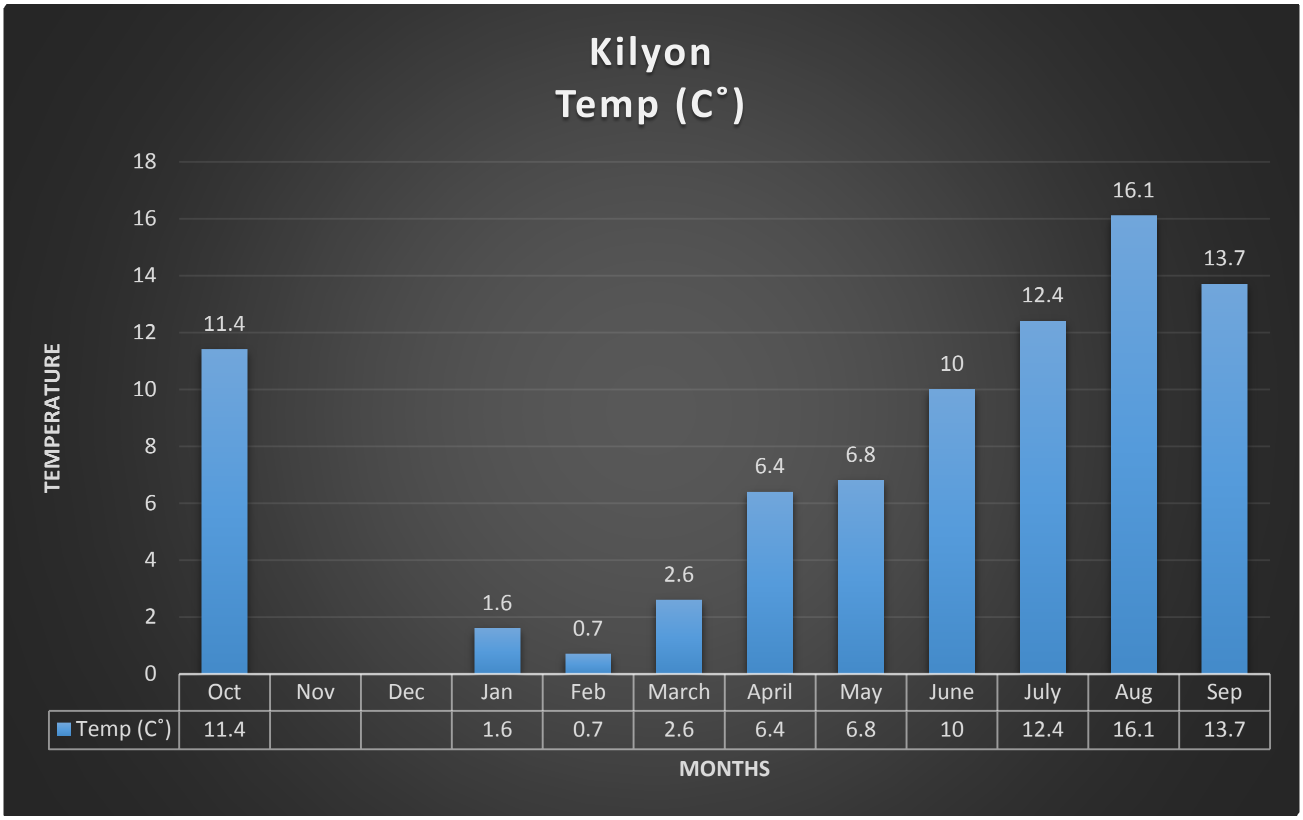
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
EC (mS/cm)	549			544	543	490	425	450	420	397	455	342

Figure 4-96 Kilyon Turbidity



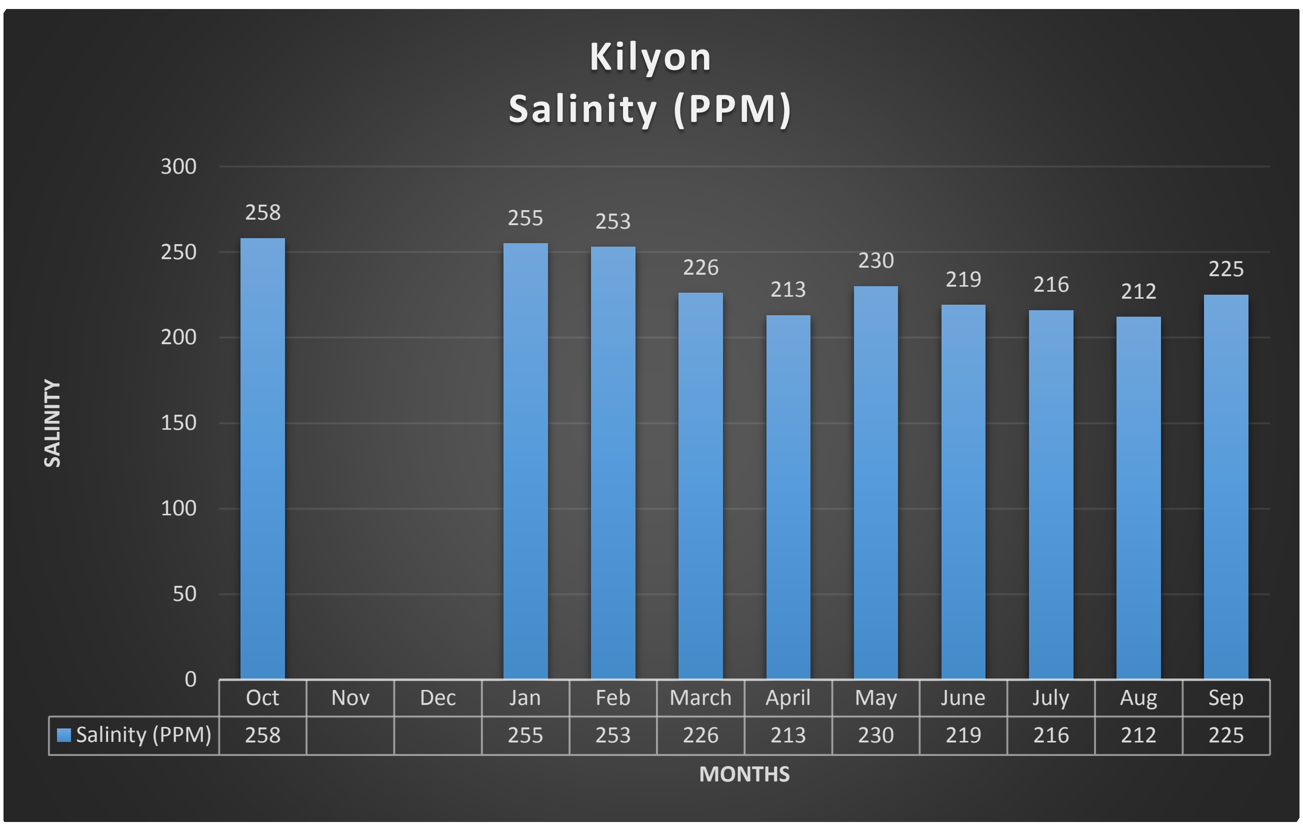
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Turb (NTU)	1.3			0.11	6.47	9.48	9.34	8.69	7.38	3.59	3.76	5.44

Figure 4-97 Kilyon Temperature



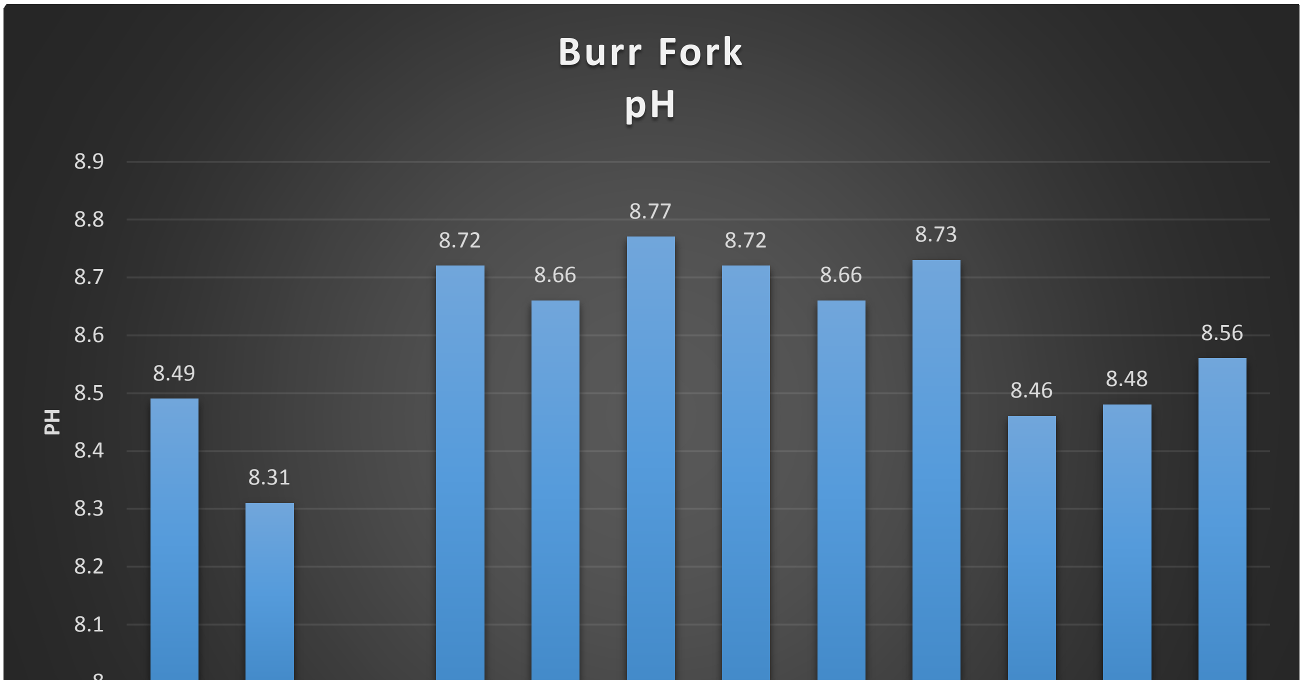
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Temp (C˚)	11.4			1.6	0.7	2.6	6.4	6.8	10	12.4	16.1	13.7

Figure 4-98 Kilyon Salinity



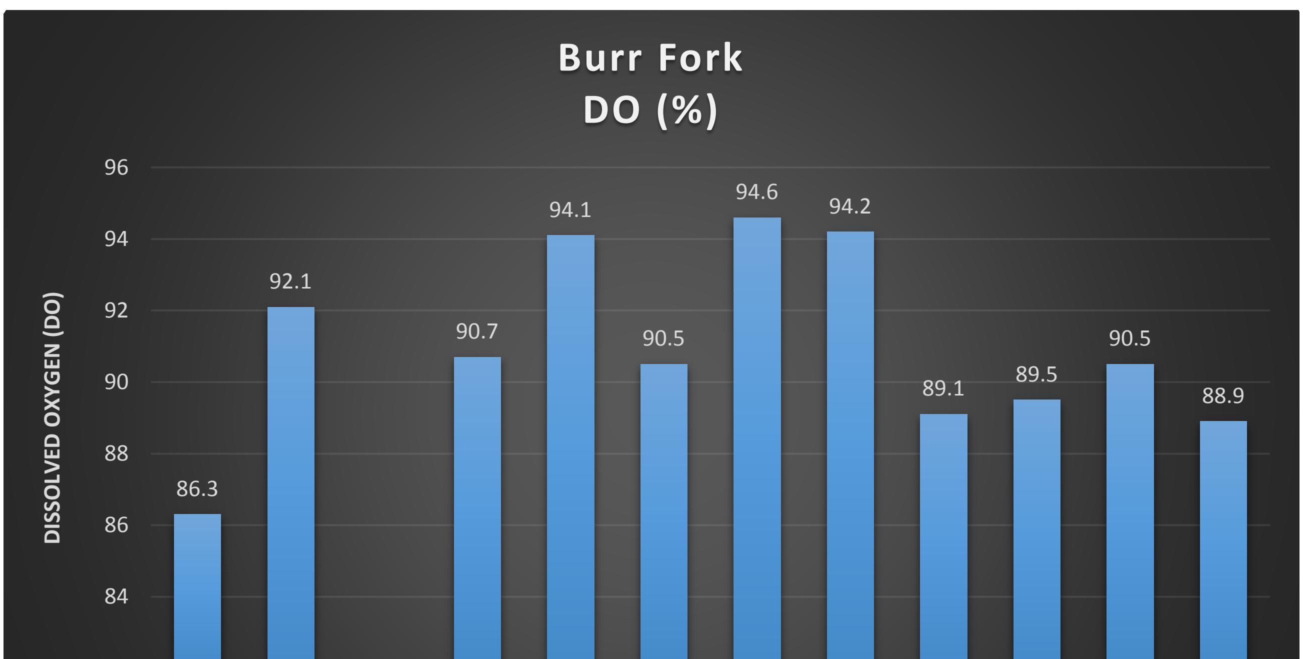
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Salinity (PPM)	258			255	253	226	213	230	219	216	212	225

Figure 4-99 Burr Fork pH



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
pH	8.49	8.31		8.72	8.66	8.77	8.72	8.66	8.73	8.46	8.48	8.56

Figure 4-100 Burr Fork Dissolved Oxygen



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
DO (%)	86.3	92.1		90.7	94.1	90.5	94.6	94.2	89.1	89.5	90.5	88.9

Figure 4-102 Burr Fork Total Dissolved Solids

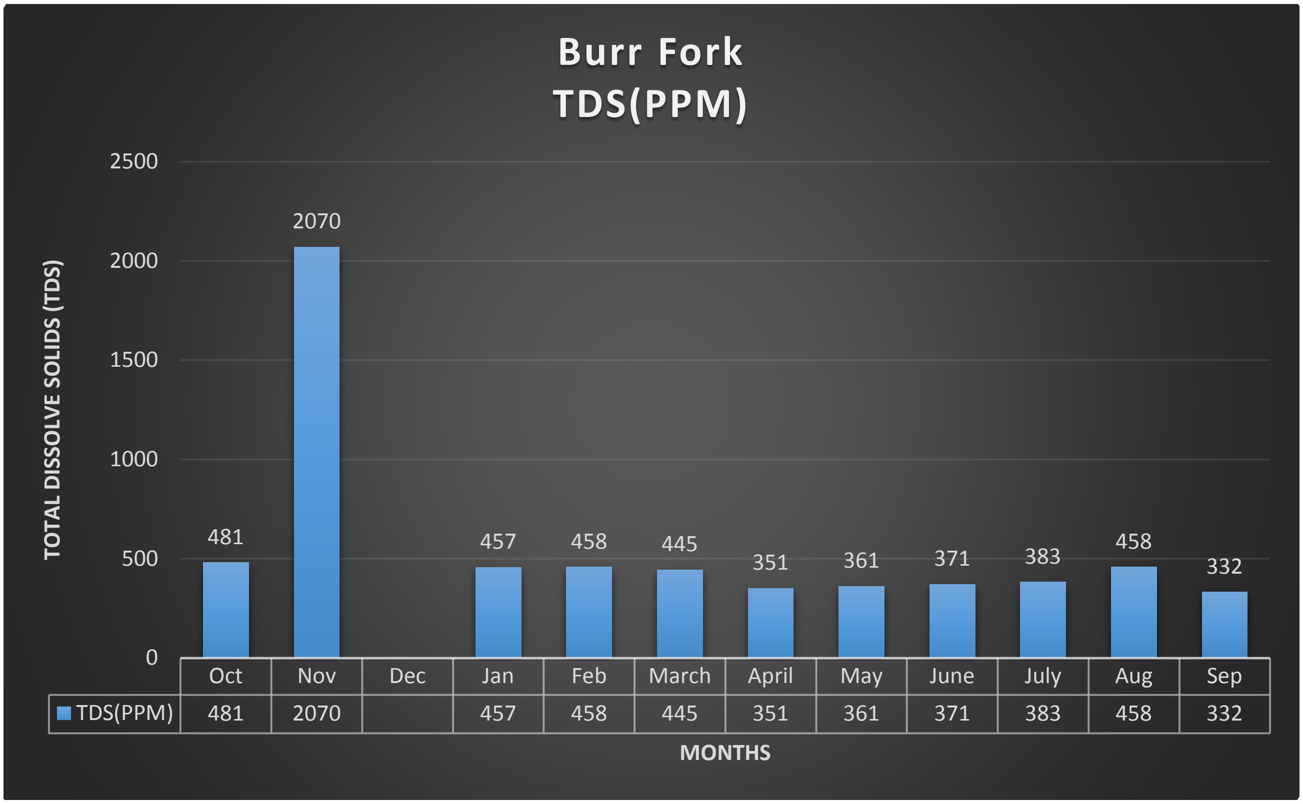


Figure 4-103 Burr Fork Conductivity

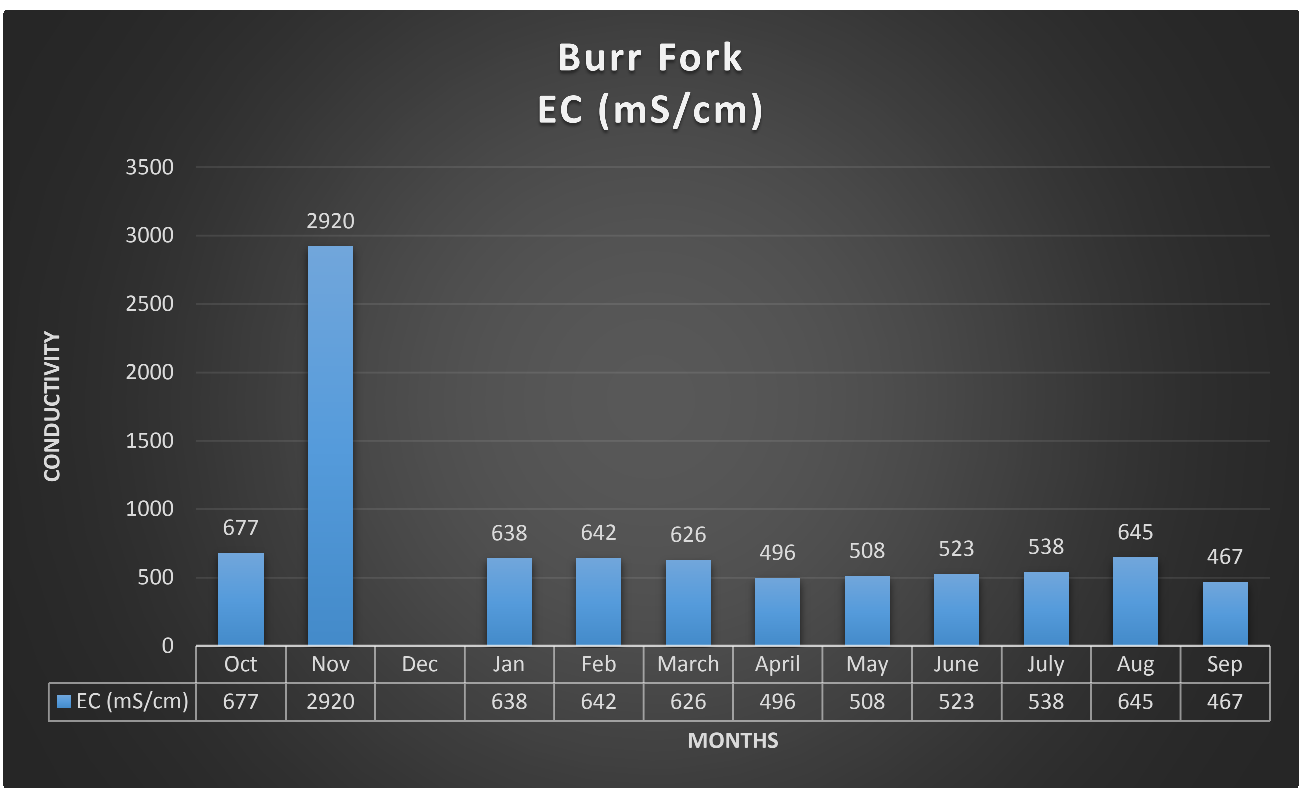


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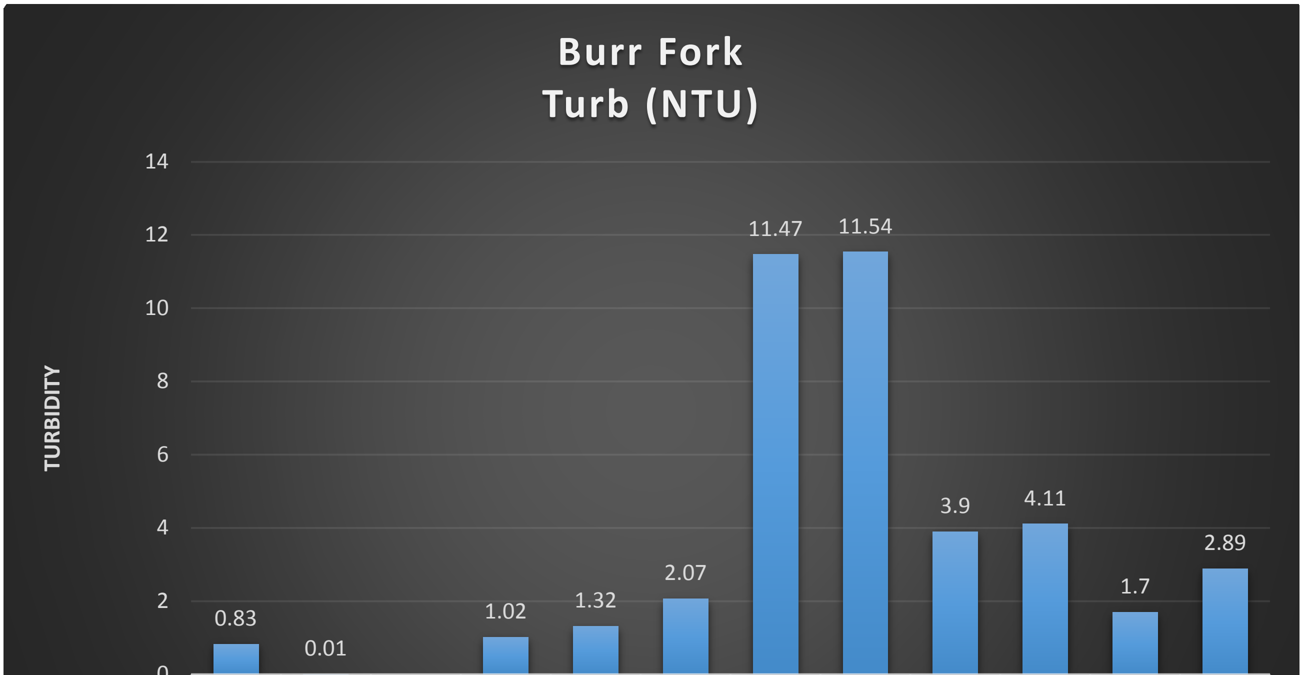
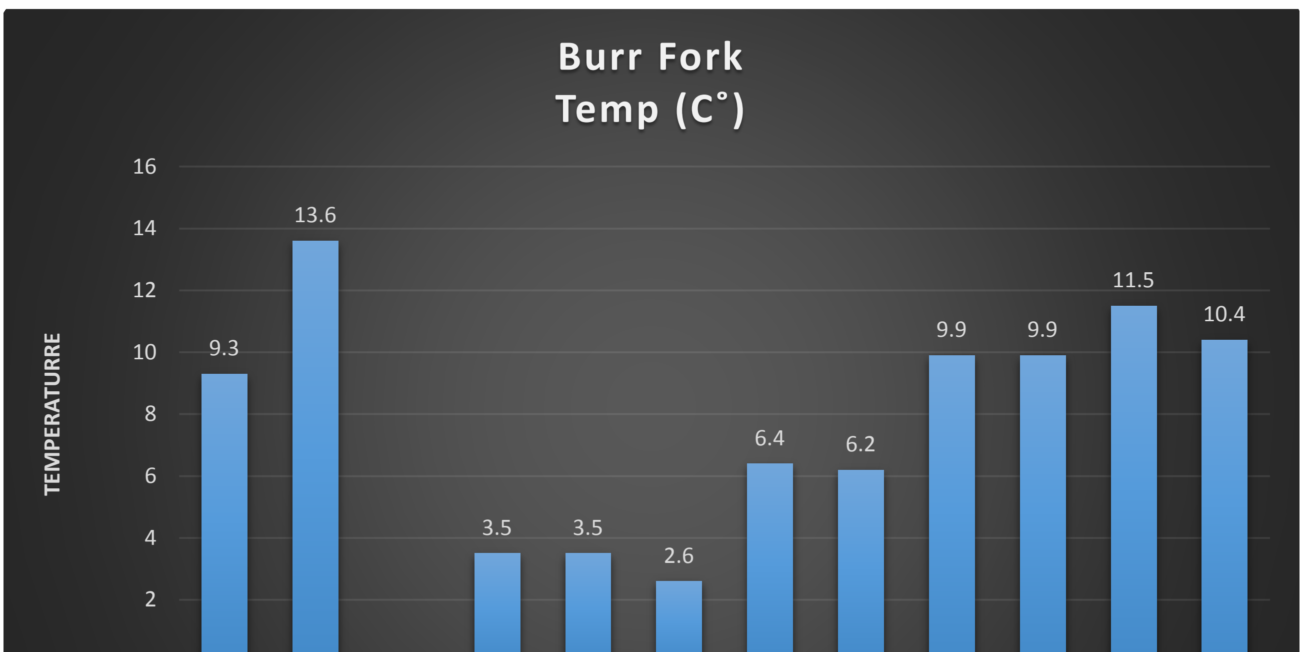
Figure 4-104 Burr Fork Turbidity



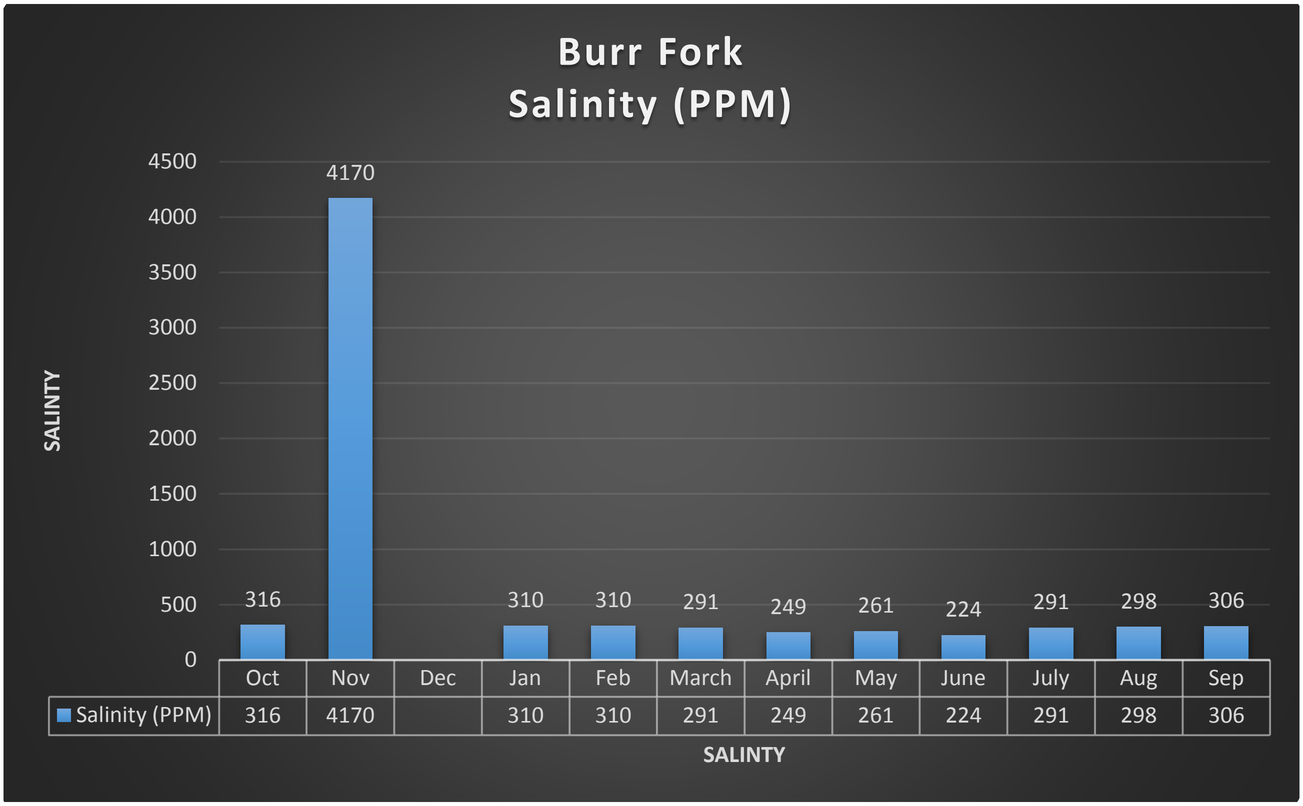
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Turb (NTU)	0.83	0.01		1.02	1.32	2.07	11.47	11.54	3.9	4.11	1.7	2.89

Figure 4-105 Burr Fork Temperature



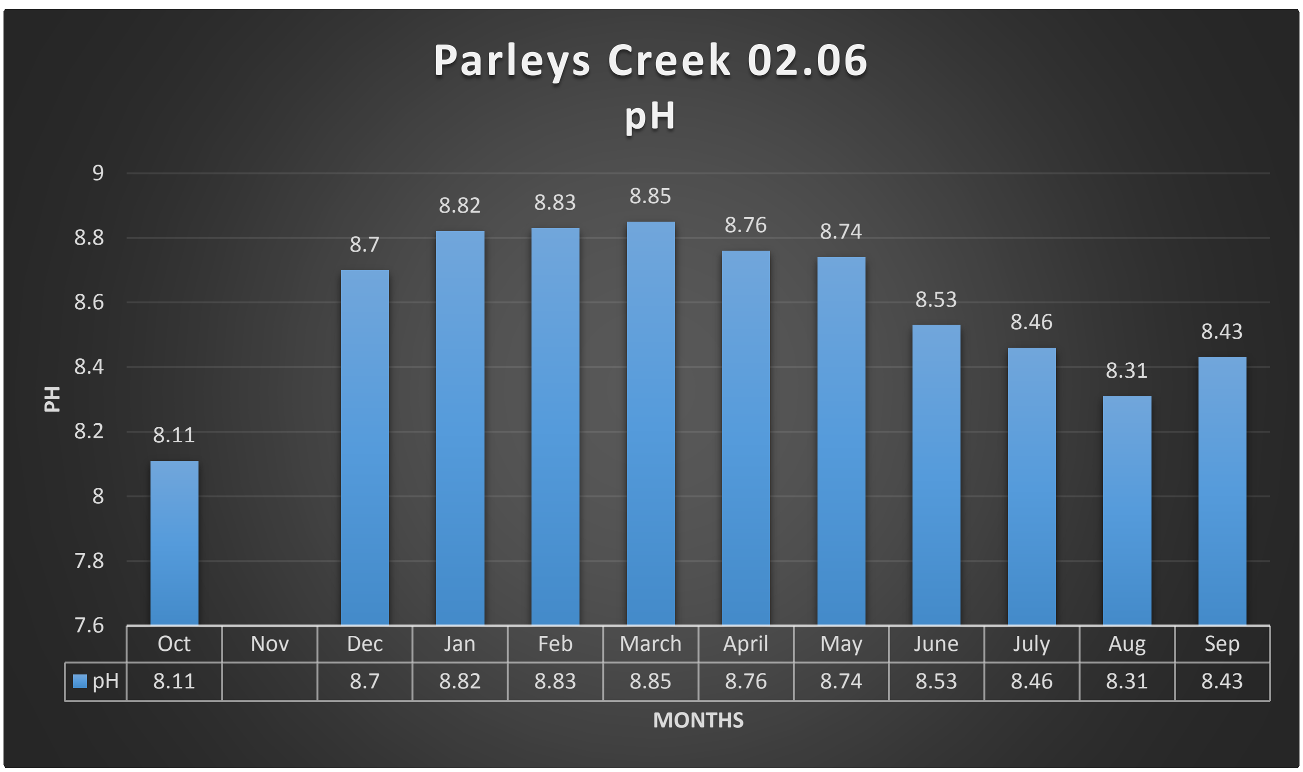
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Temp (C˚)	9.3	13.6		3.5	3.5	2.6	6.4	6.2	9.9	9.9	11.5	10.4

Figure 4-106 Burr Fork Salinity



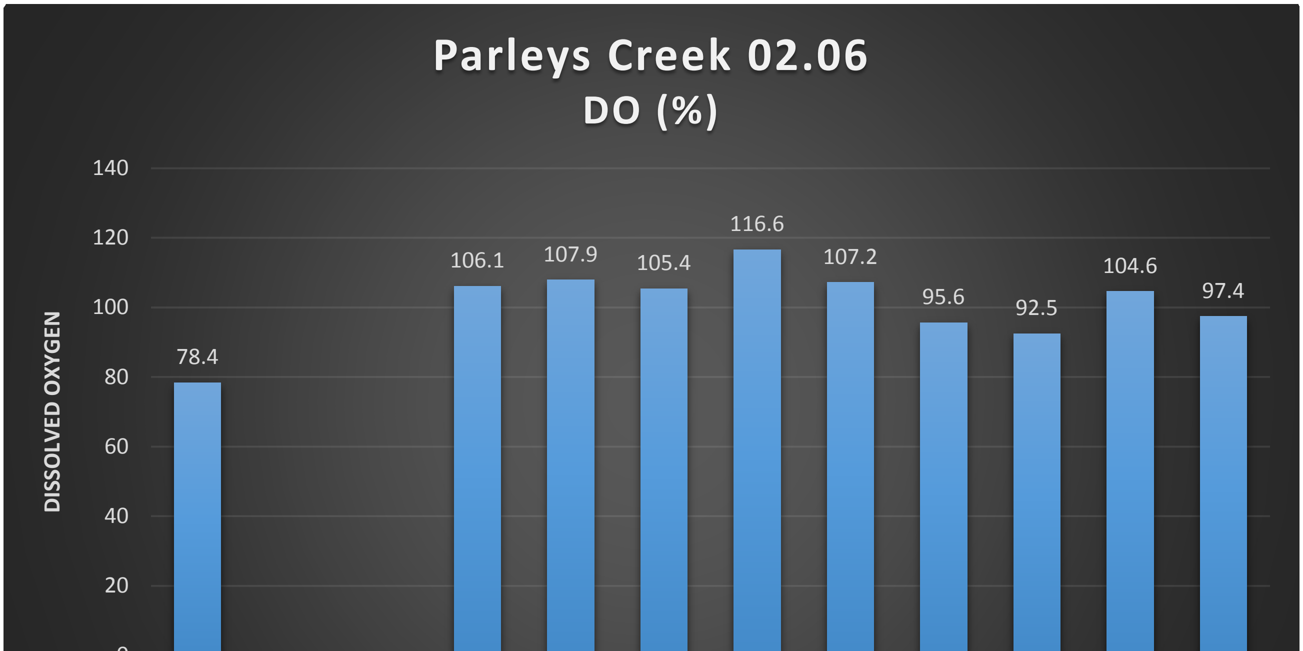
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Salinity (PPM)	316	4170		310	310	291	249	261	224	291	298	306

Figure 4-107 Parleys Creek 02.06 pH



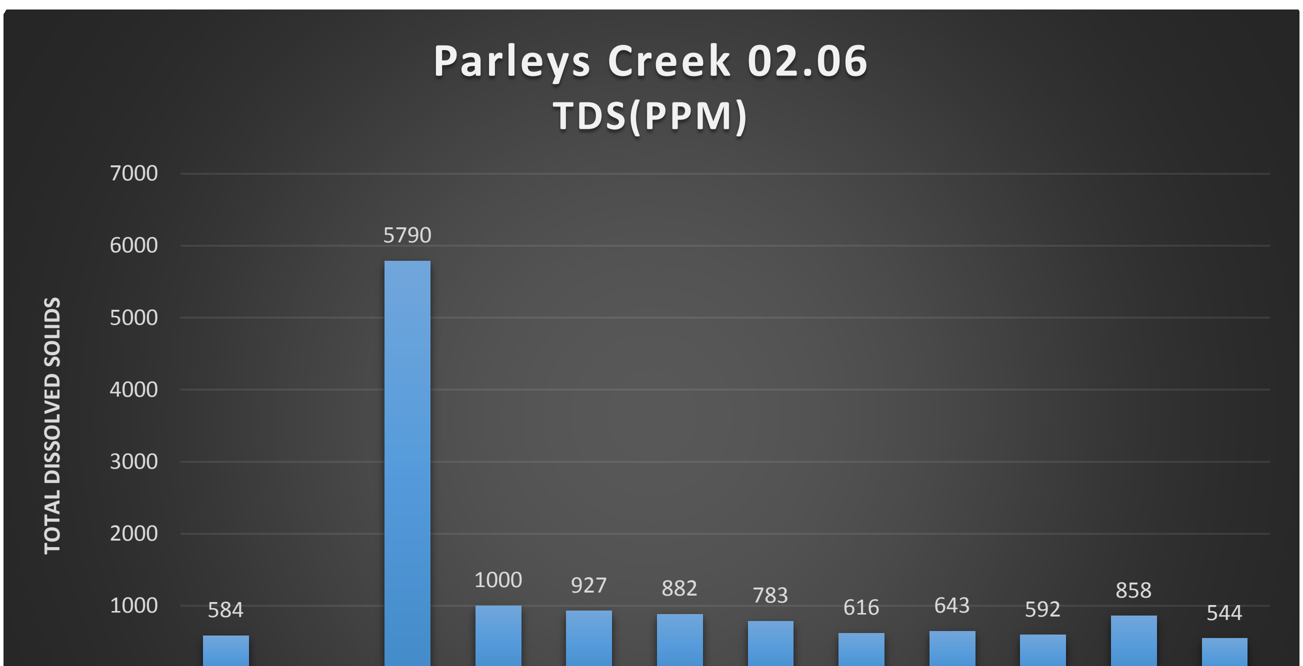
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
pH	8.11		8.7	8.82	8.83	8.85	8.76	8.74	8.53	8.46	8.31	8.43

Figure 4-108 Parleys Creek 02.06 Dissolved Oxygen



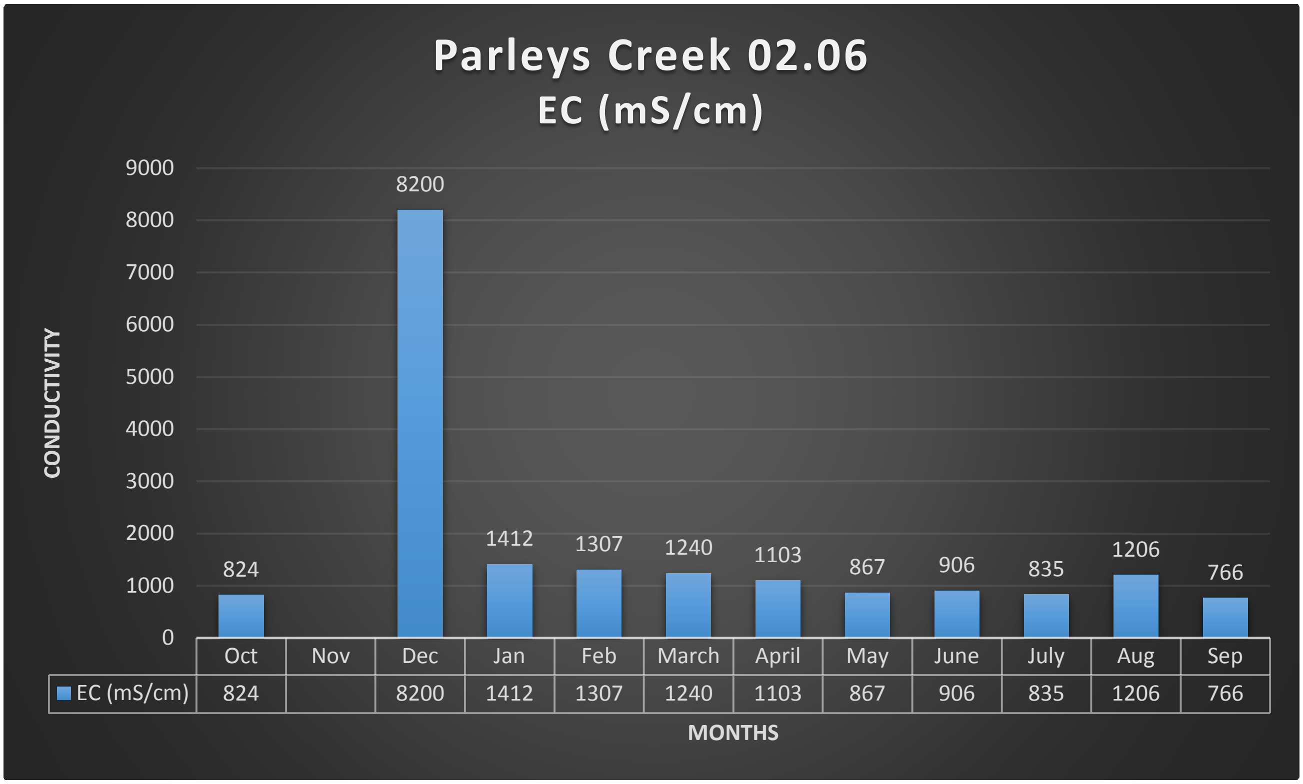
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
DO (%)	78.4			106.1	107.9	105.4	116.6	107.2	95.6	92.5	104.6	97.4

Figure 4-109 Parleys Creek 02.06 Total Dissolved Solids



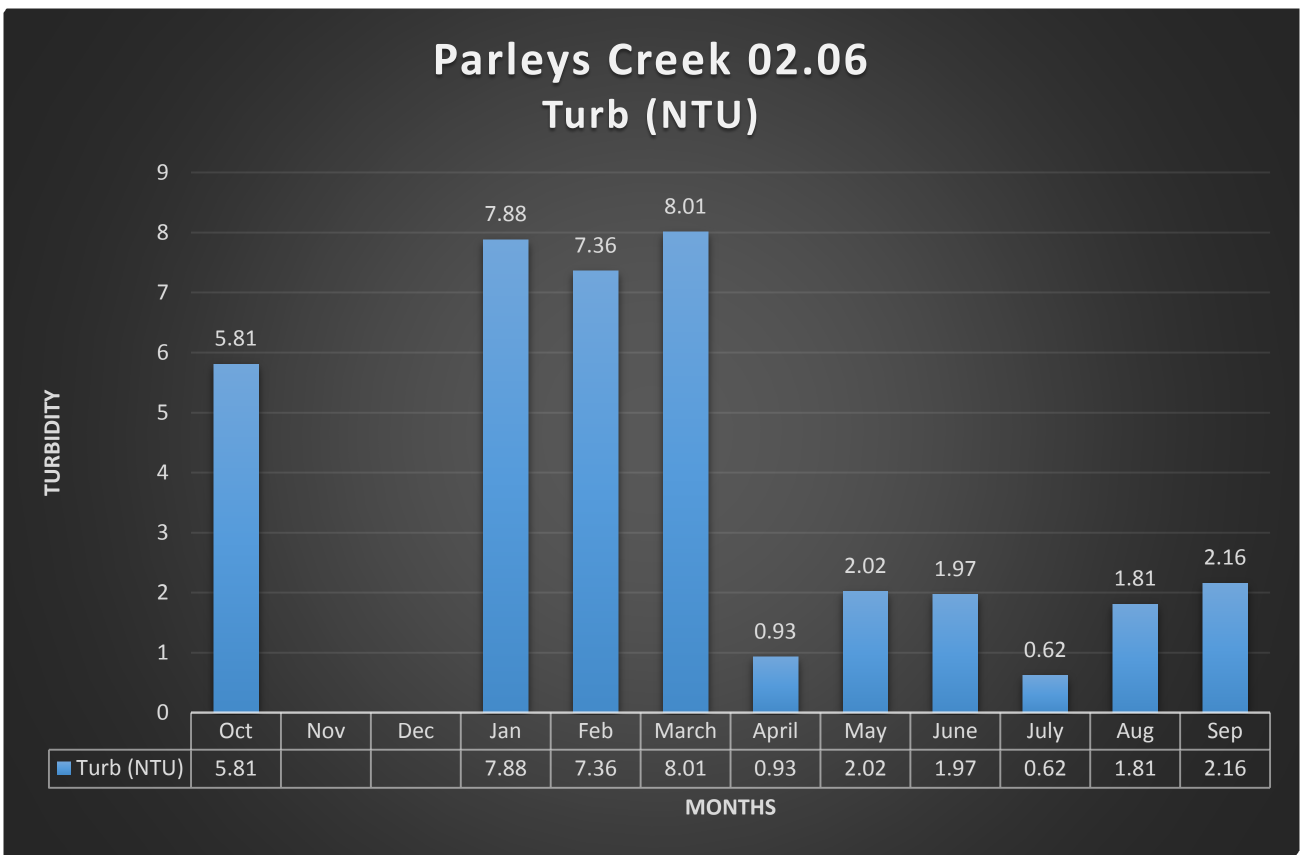
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
TDS(PPM)	584		5790	1000	927	882	783	616	643	592	858	544

Figure 4-110 Parleys Creek 02.06 Conductivity



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
EC (mS/cm)	824		8200	1412	1307	1240	1103	867	906	835	1206	766

Figure 4-111 Parleys Creek 02.06 Turbidity



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Turb (NTU)	5.81			7.88	7.36	8.01	0.93	2.02	1.97	0.62	1.81	2.16

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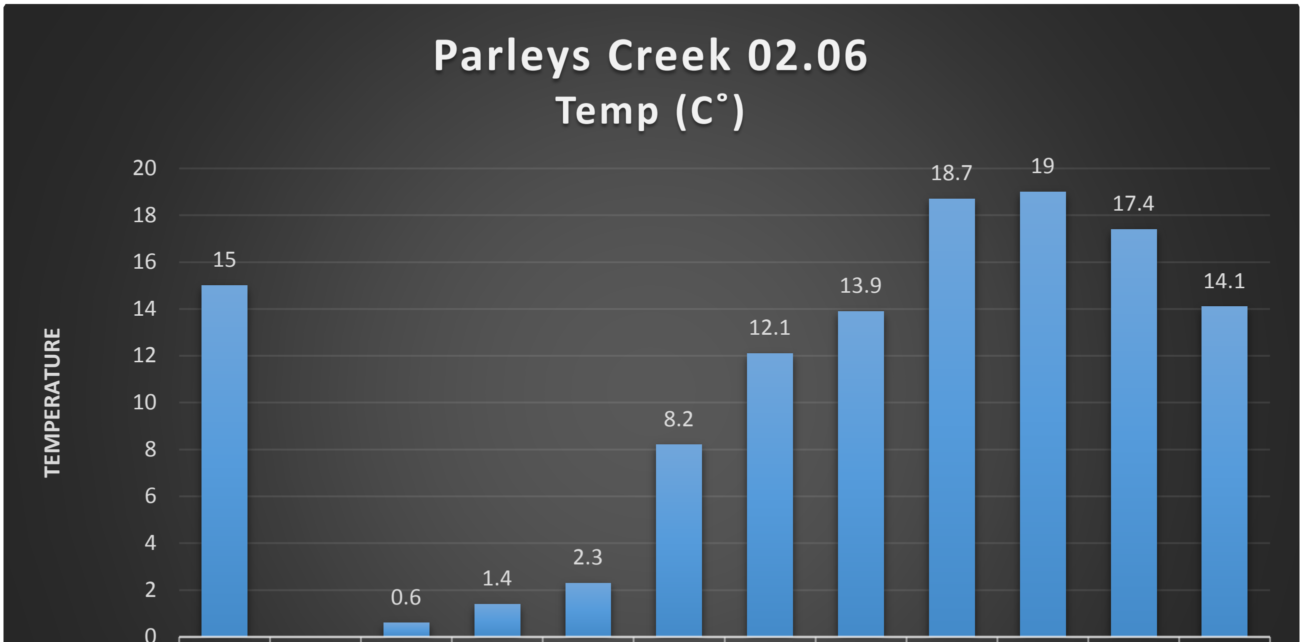
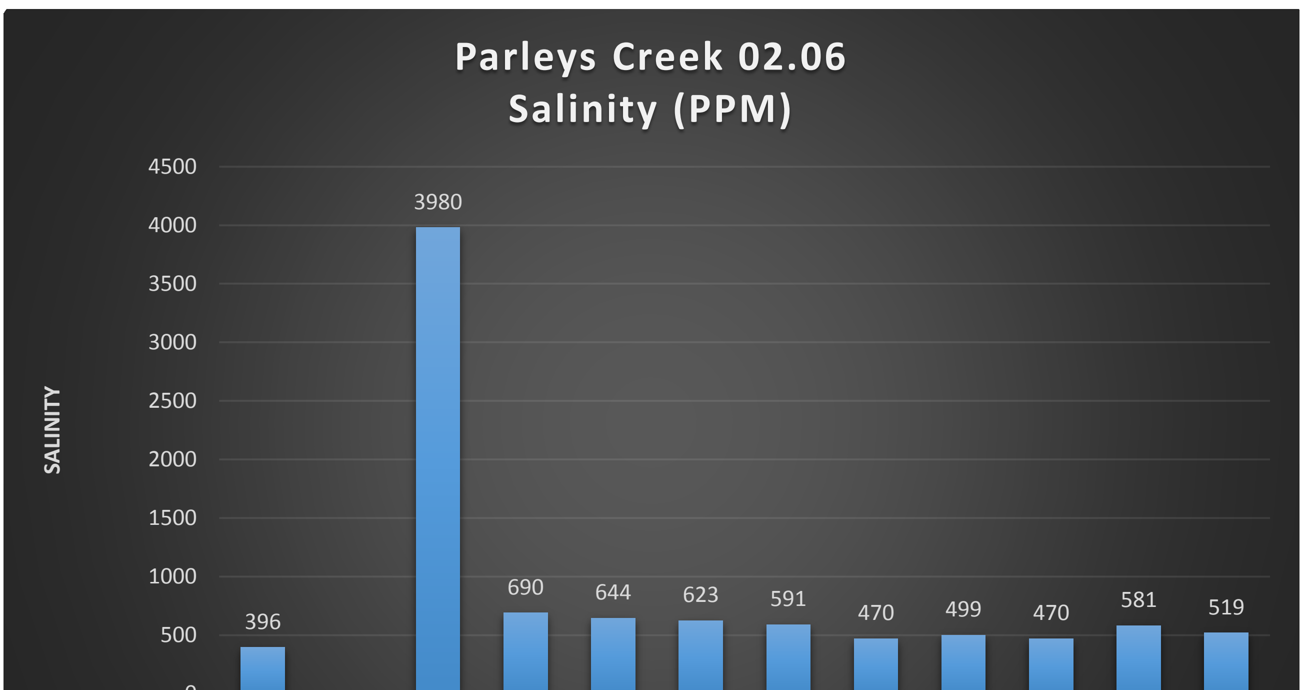
Figure 4-112 Parleys Creek 02.06 Temperature



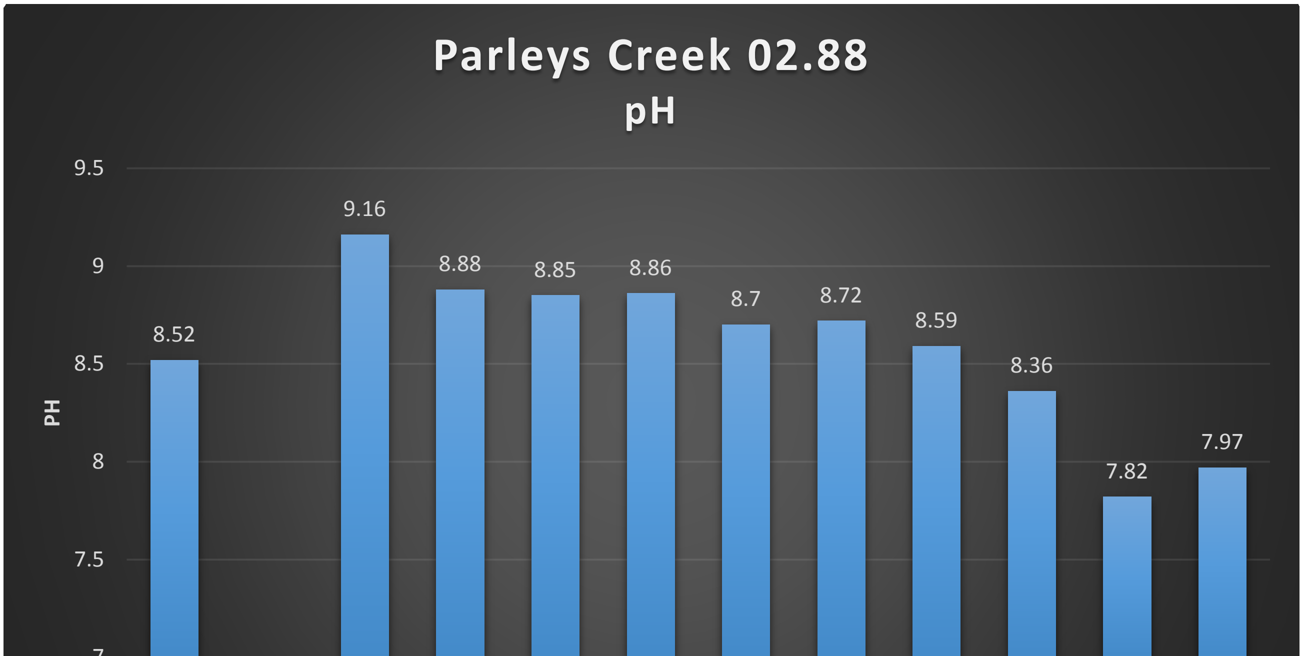
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Temp (C˚)	15		0.6	1.4	2.3	8.2	12.1	13.9	18.7	19	17.4	14.1

Figure 4-113 Parleys Creek 02.06 Salinity



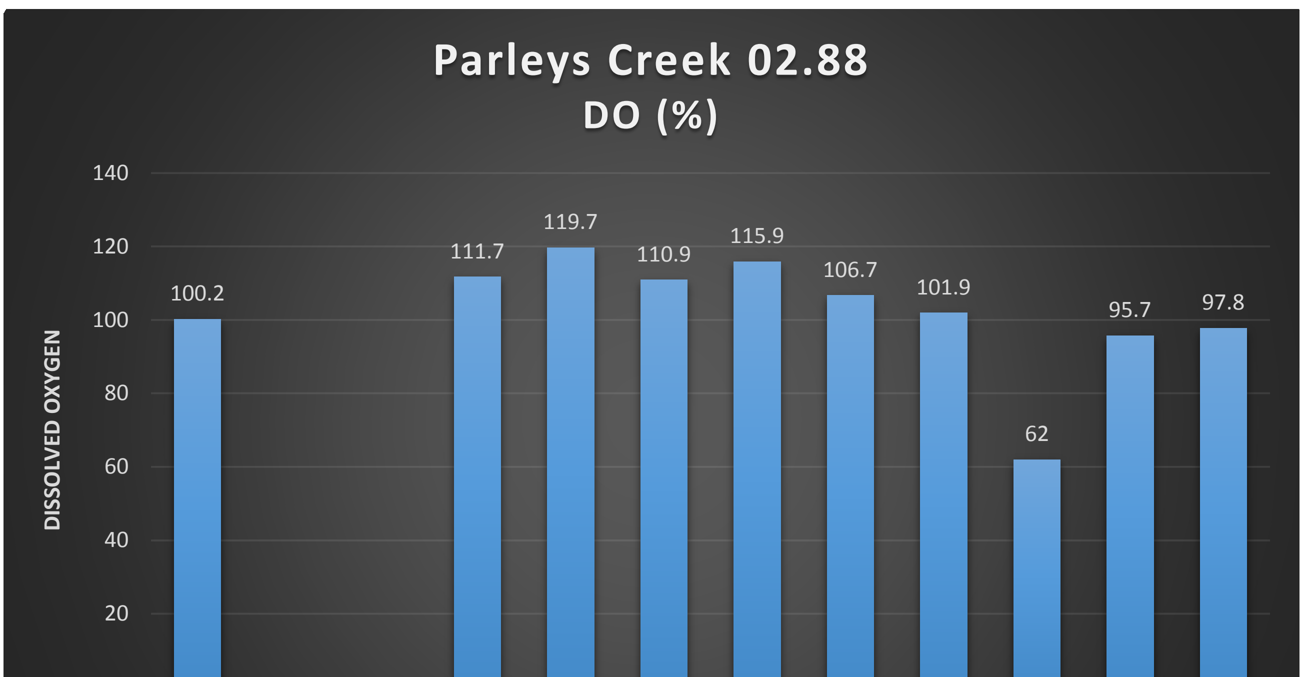
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Salinity (PPM)	396		3980	690	644	623	591	470	499	470	581	519

Figure 4-114 Parleys Creek 02.88 pH



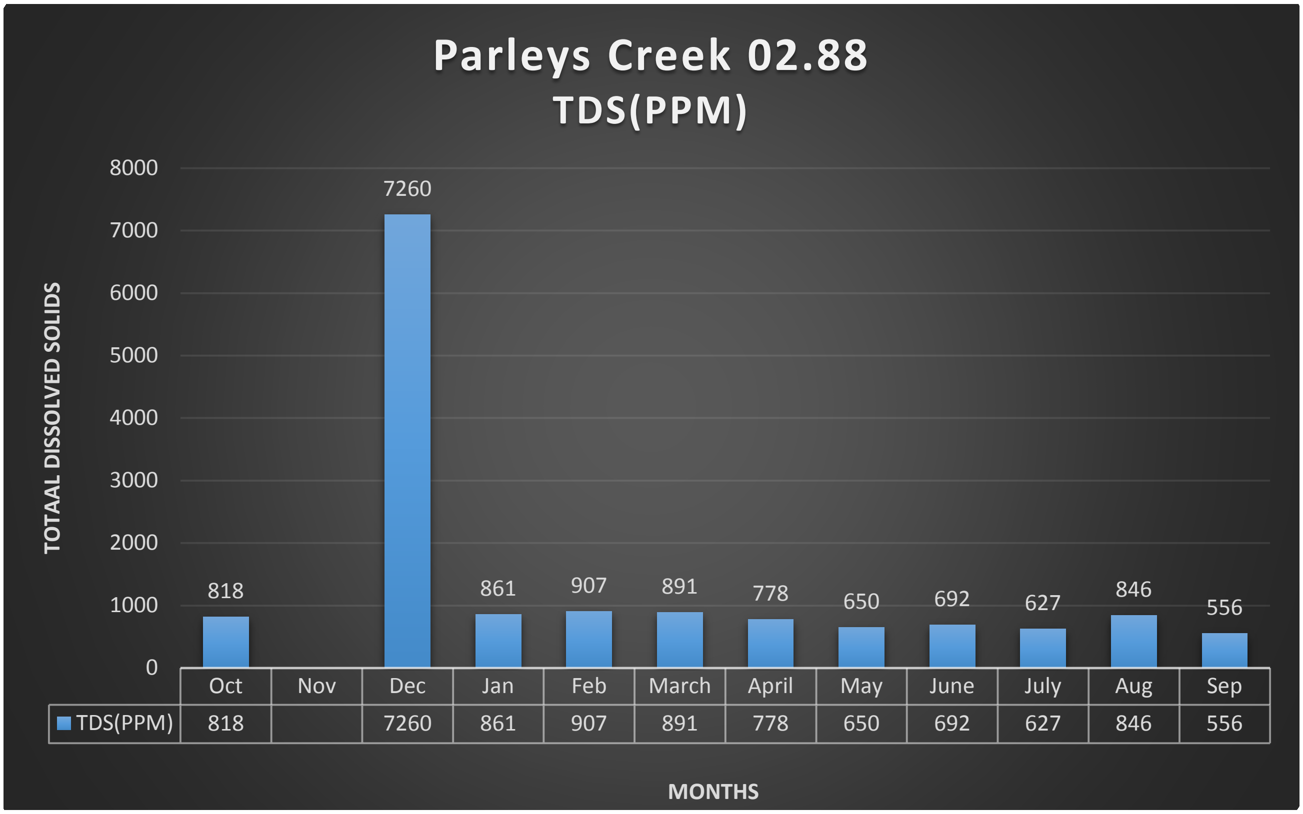
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
pH	8.52		9.16	8.88	8.85	8.86	8.7	8.72	8.59	8.36	7.82	7.97

Figure 4-115 Parleys Creek 02.88 Dissolved Oxygen



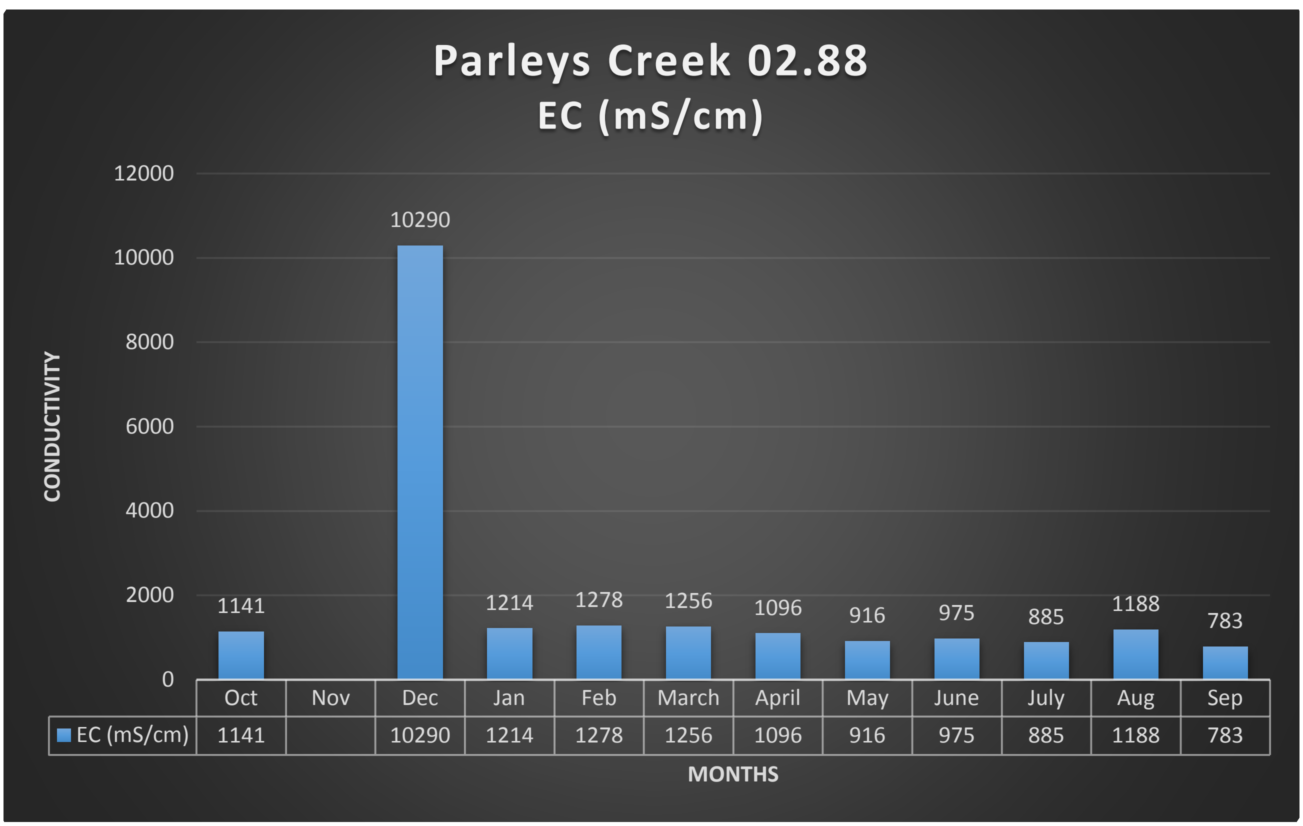
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
DO (%)	100.2			111.7	119.7	110.9	115.9	106.7	101.9	62	95.7	97.8

Figure 4-116 Parleys Creek 02.88 Total Dissolved Solids



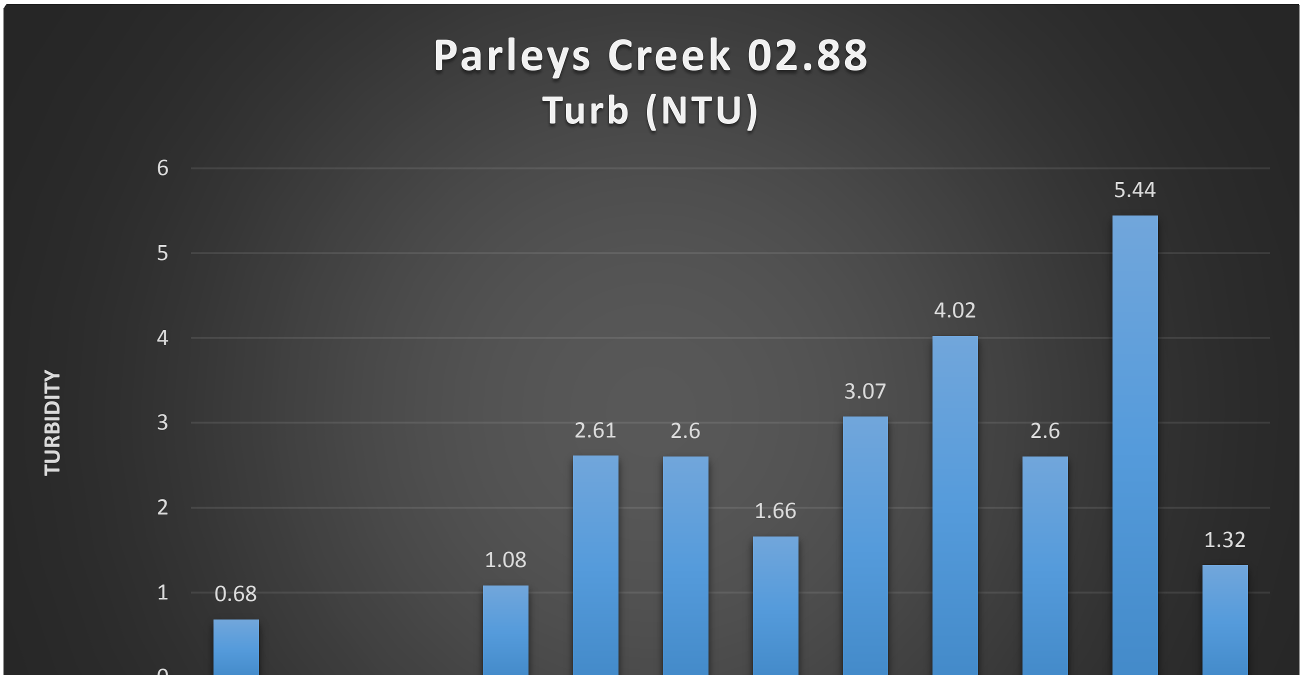
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
TDS(PPM)	818		7260	861	907	891	778	650	692	627	846	556

Figure 4-117 Parleys Creek 02.88 Conductivity



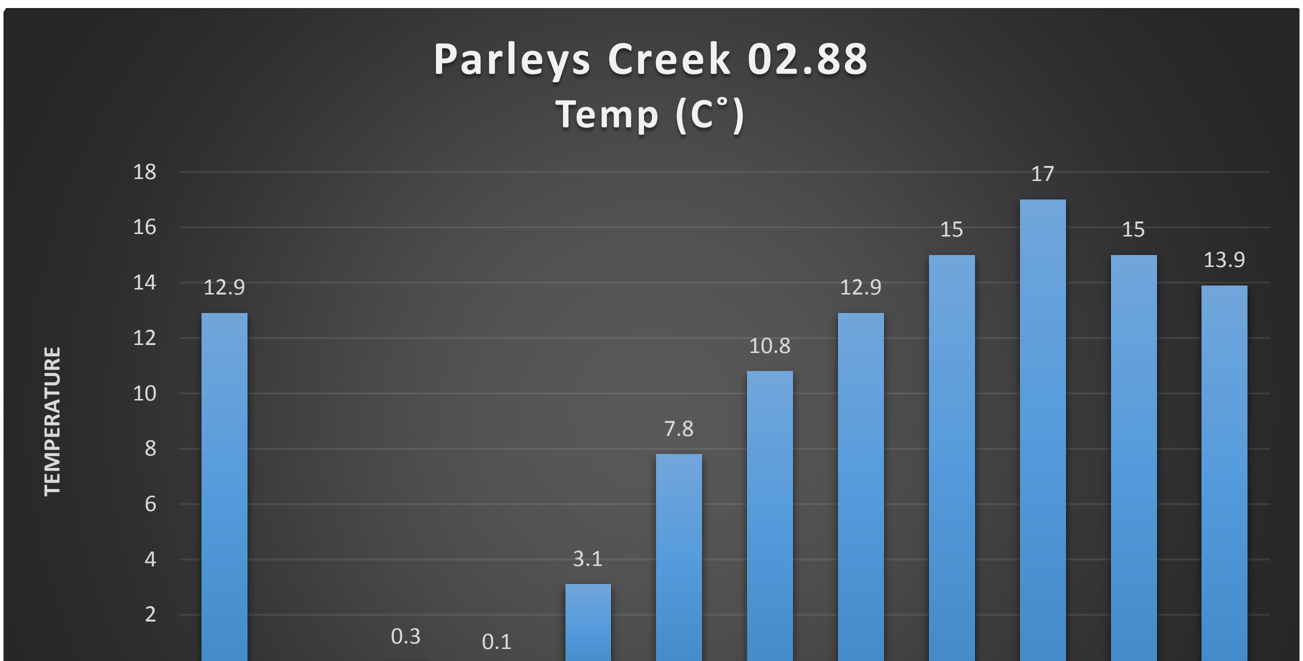
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
EC (mS/cm)	1141		10290	1214	1278	1256	1096	916	975	885	1188	783

Figure 4-118 Parleys Creek 02.88 Turbidity



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Turb (NTU)	0.68			1.08	2.61	2.6	1.66	3.07	4.02	2.6	5.44	1.32

Figure 4-119 Parleys Creek 02.88 Temperature



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Temp (C˚)	12.9		0.3	0.1	3.1	7.8	10.8	12.9	15	17	15	13.9

Figure 4-120 Parleys Creek 02.88 Salinity

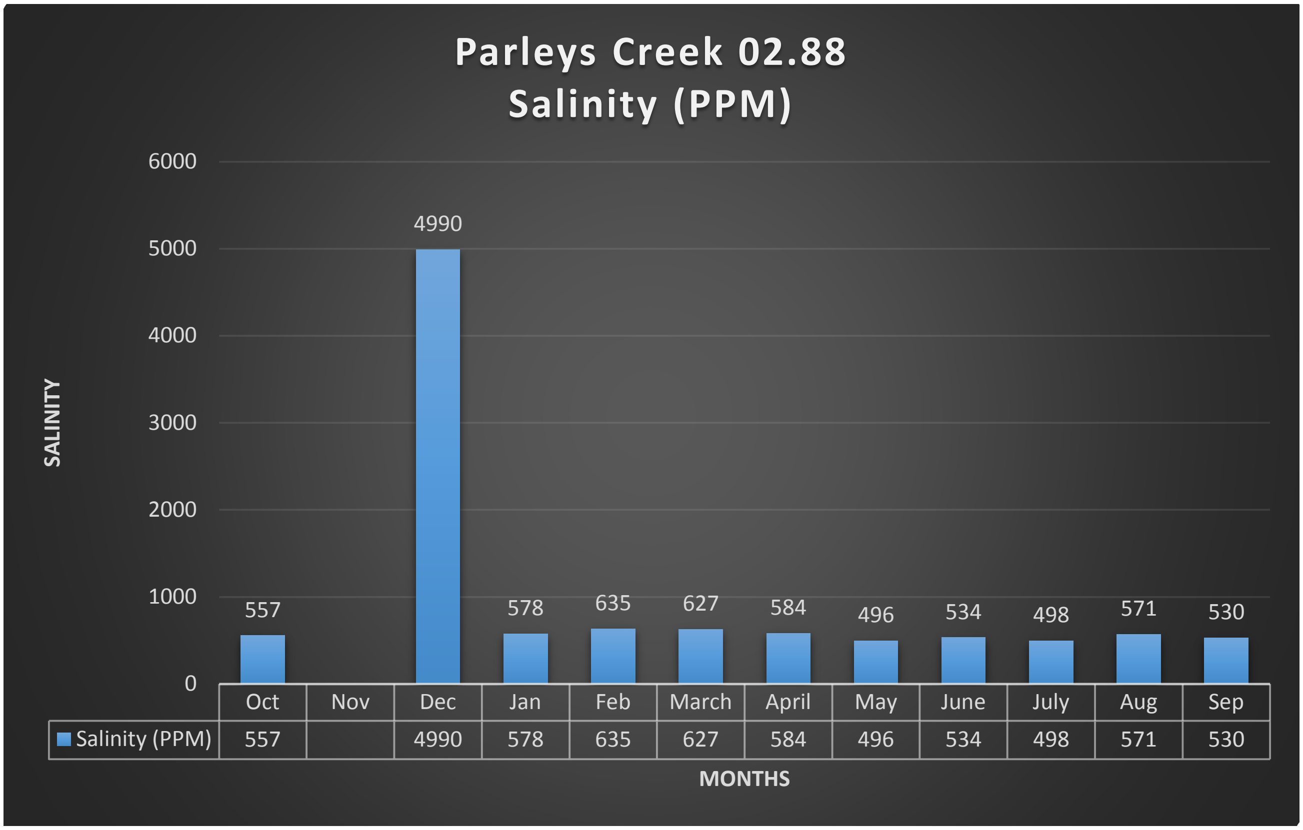


Figure 4-121 Parleys Creek 04.76 pH

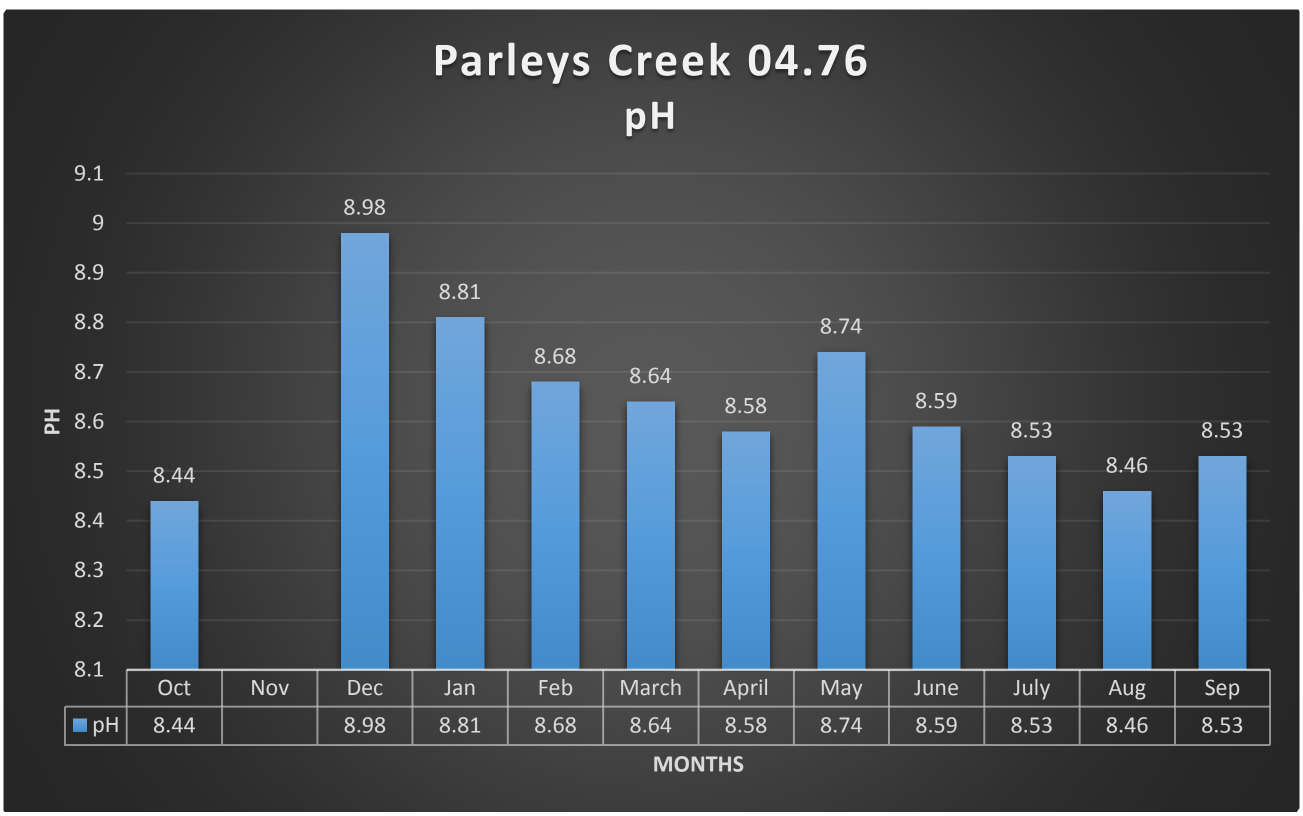


Figure 4-122 Parleys Creek 04.76 Dissolved Oxygen

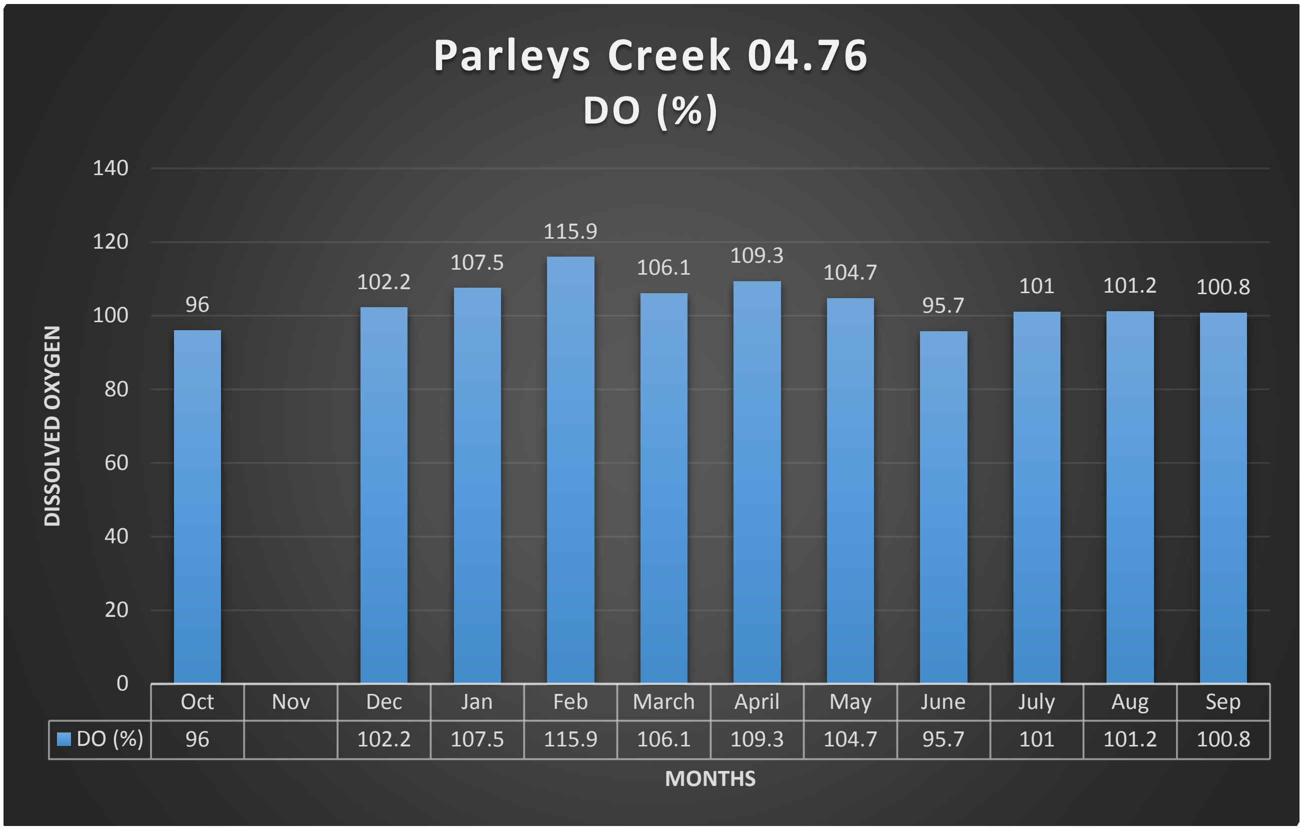


Figure 4-123 Parleys Creek 04.76 Total Dissolved Solids

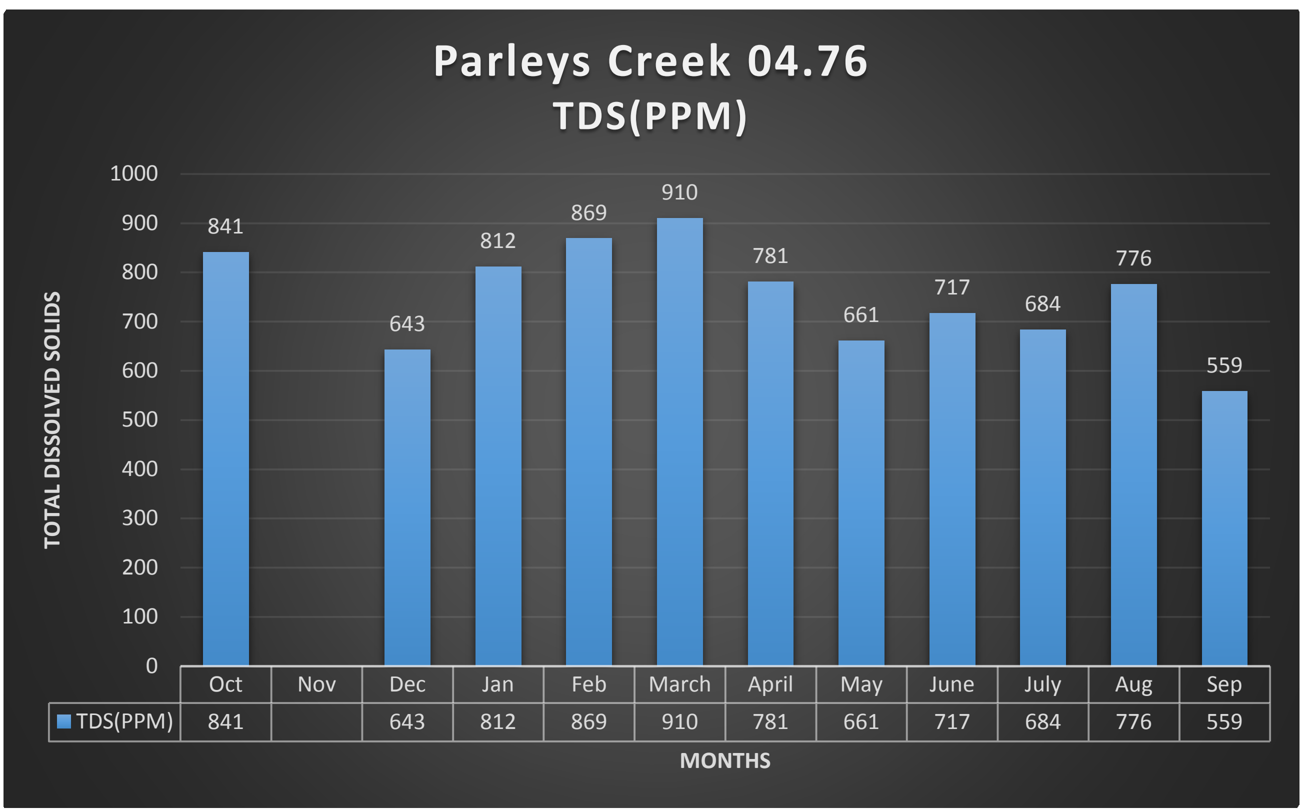


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Figure 4-124 Parleys Creek 04.76 Conductivity

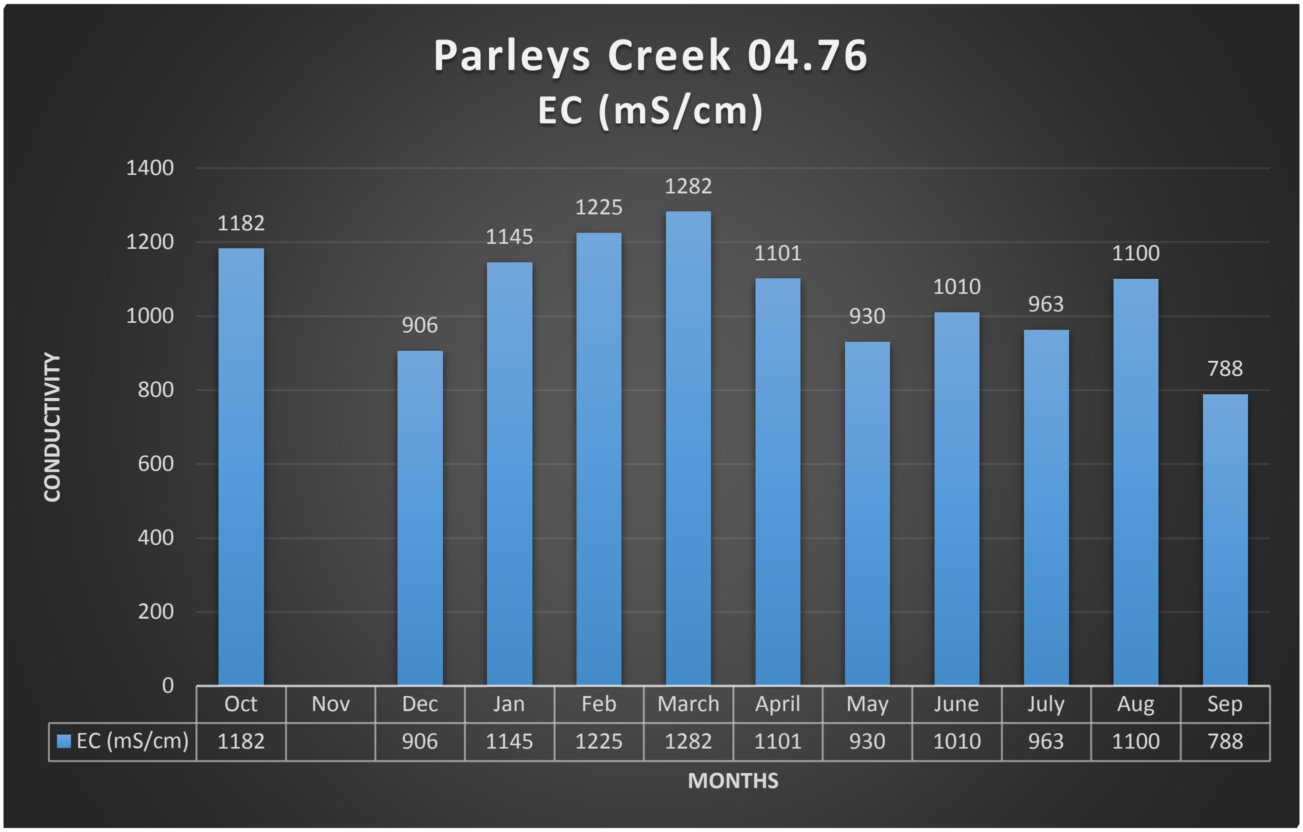


Figure 4-125 Parleys Creek 04.76 Turbidity

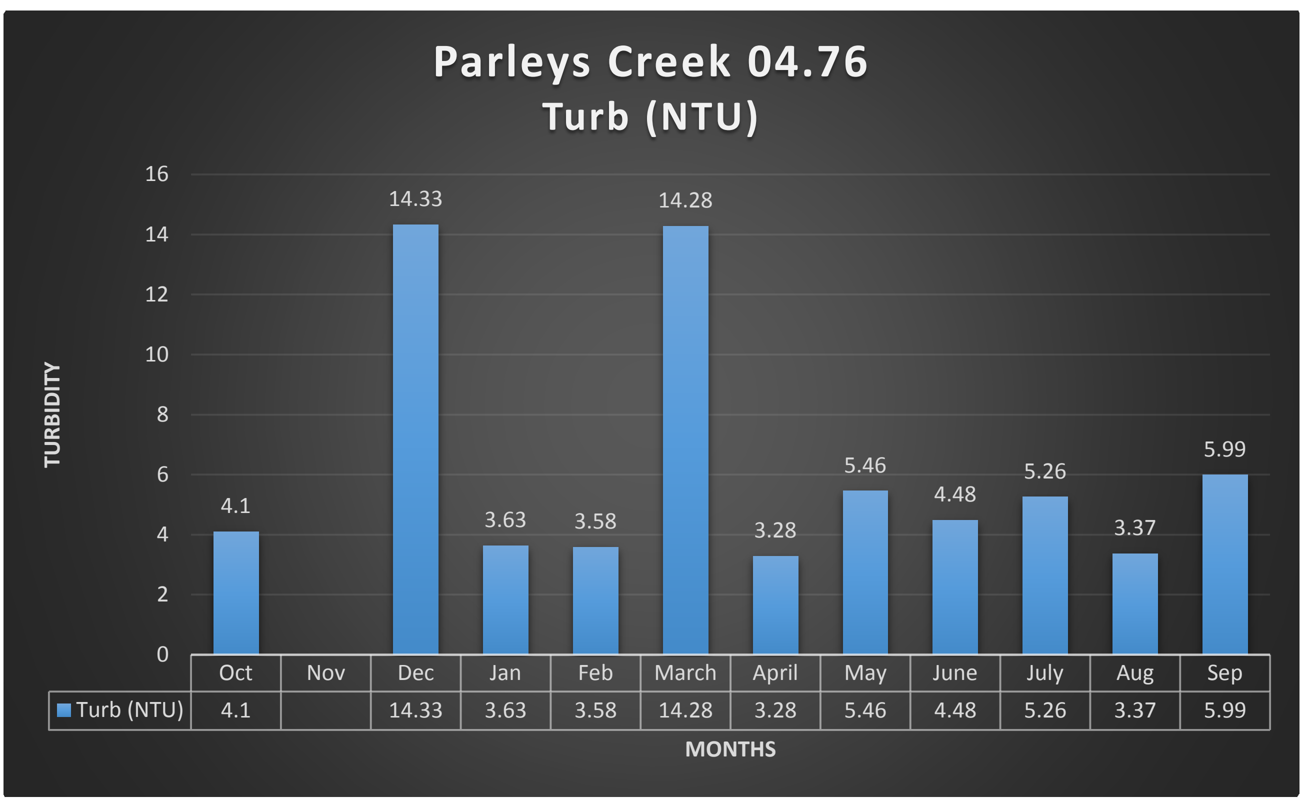


Figure 4-126 Parleys Creek 04.76 Temperature

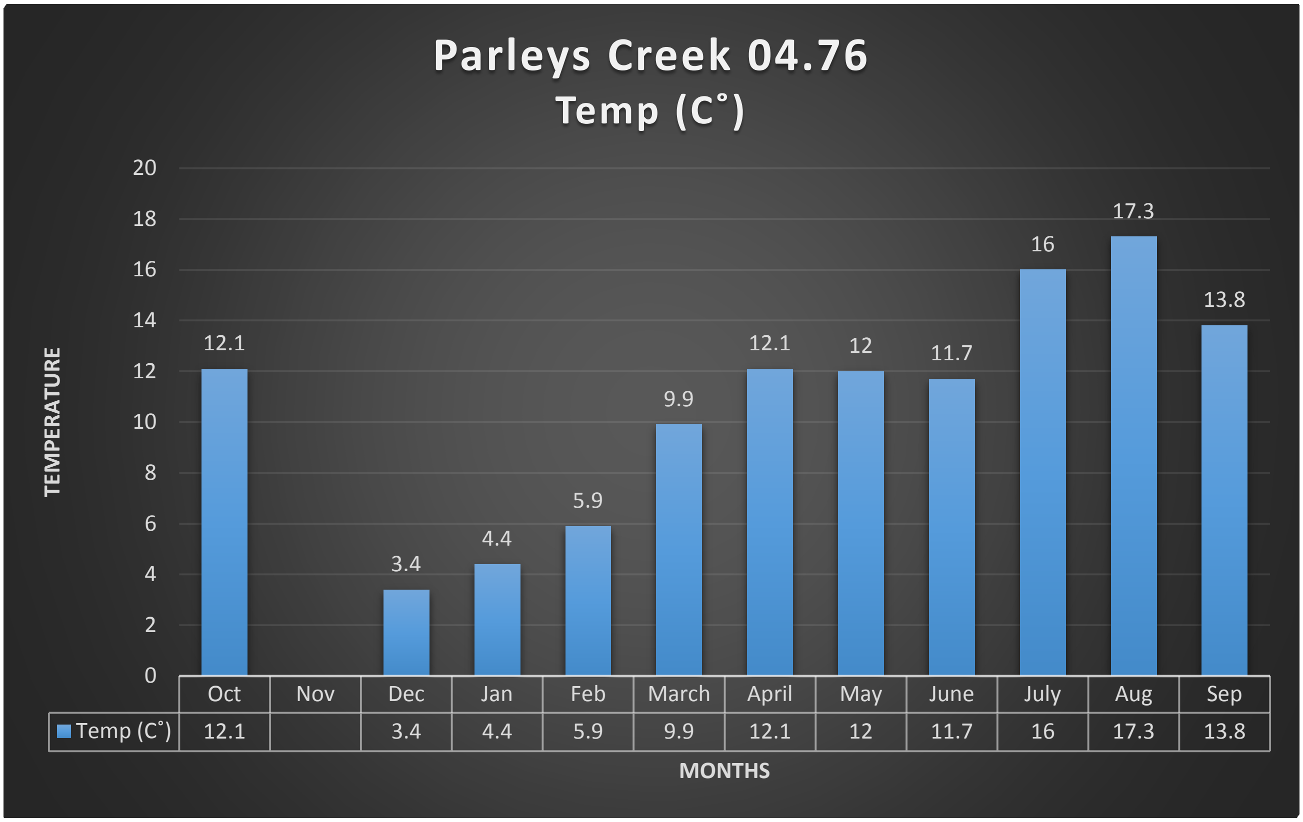


Figure 4-127 Parleys Creek 04.76 Salinity

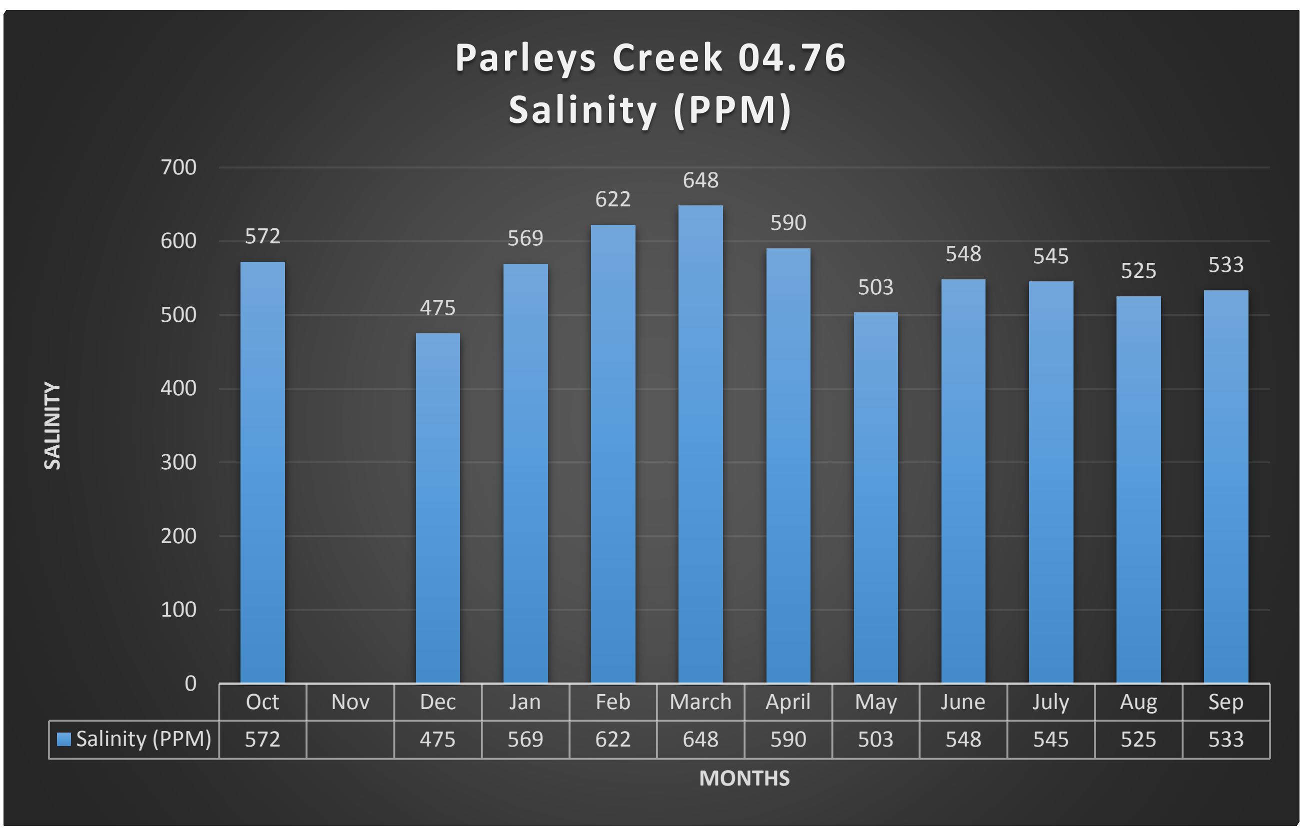


Figure 4-128 Parleys Creek 05.53 pH

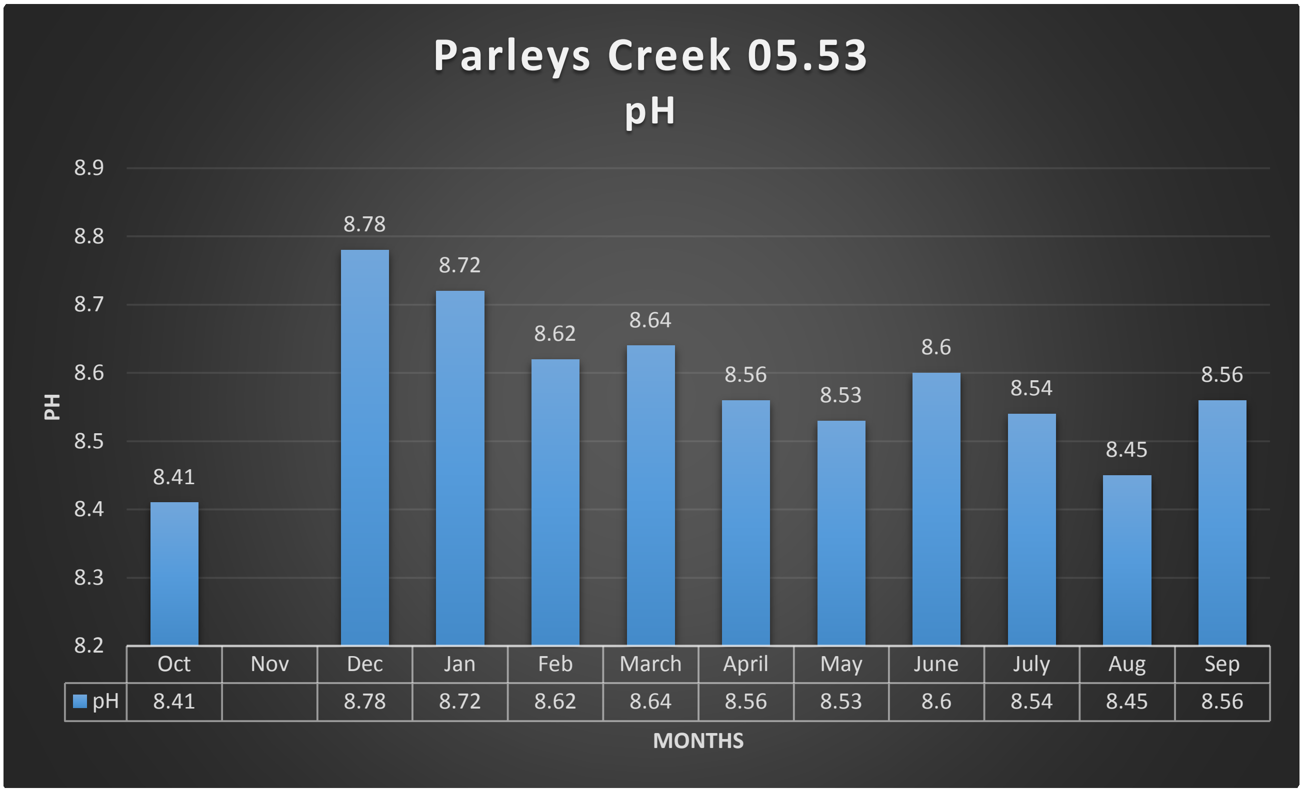


Figure 4-129 Parleys Creek 05.53 Dissolved Oxygen

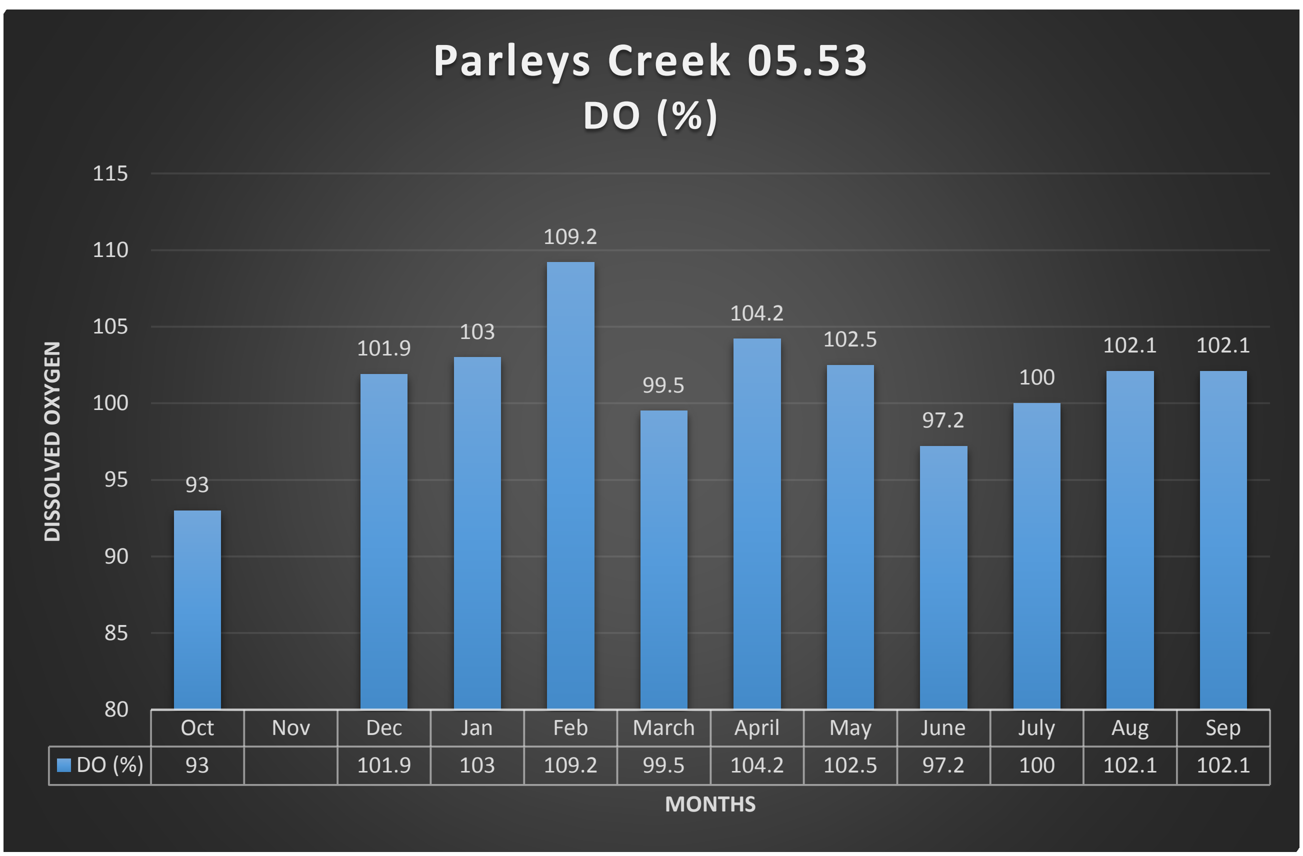
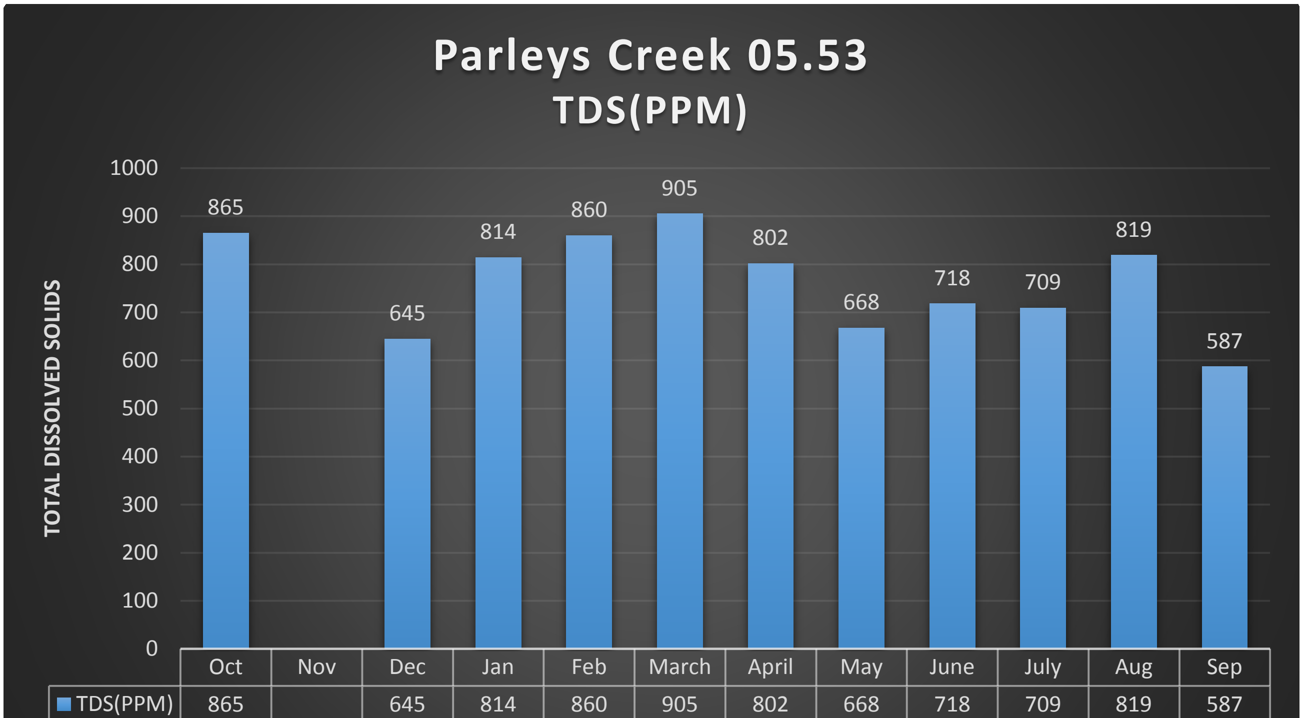
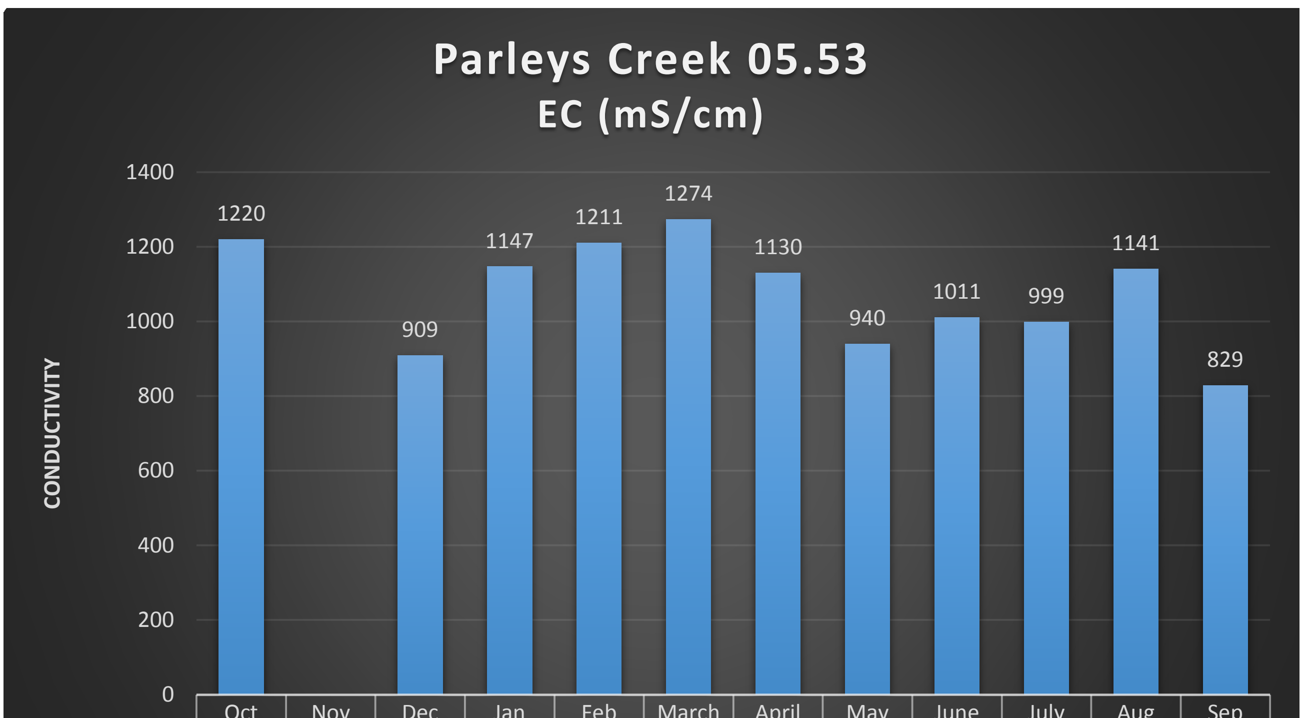


Figure 4-130 Parleys Creek 05.53 Total Dissolved Solids



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
TDS(PPM)	865		645	814	860	905	802	668	718	709	819	587

Figure 4-131 Parleys Creek 05.53 Conductivity



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
EC (mS/cm)	1220		909	1147	1211	1274	1130	940	1011	999	1141	829

Figure 4-132 Parleys Creek 05.53 Turbidity

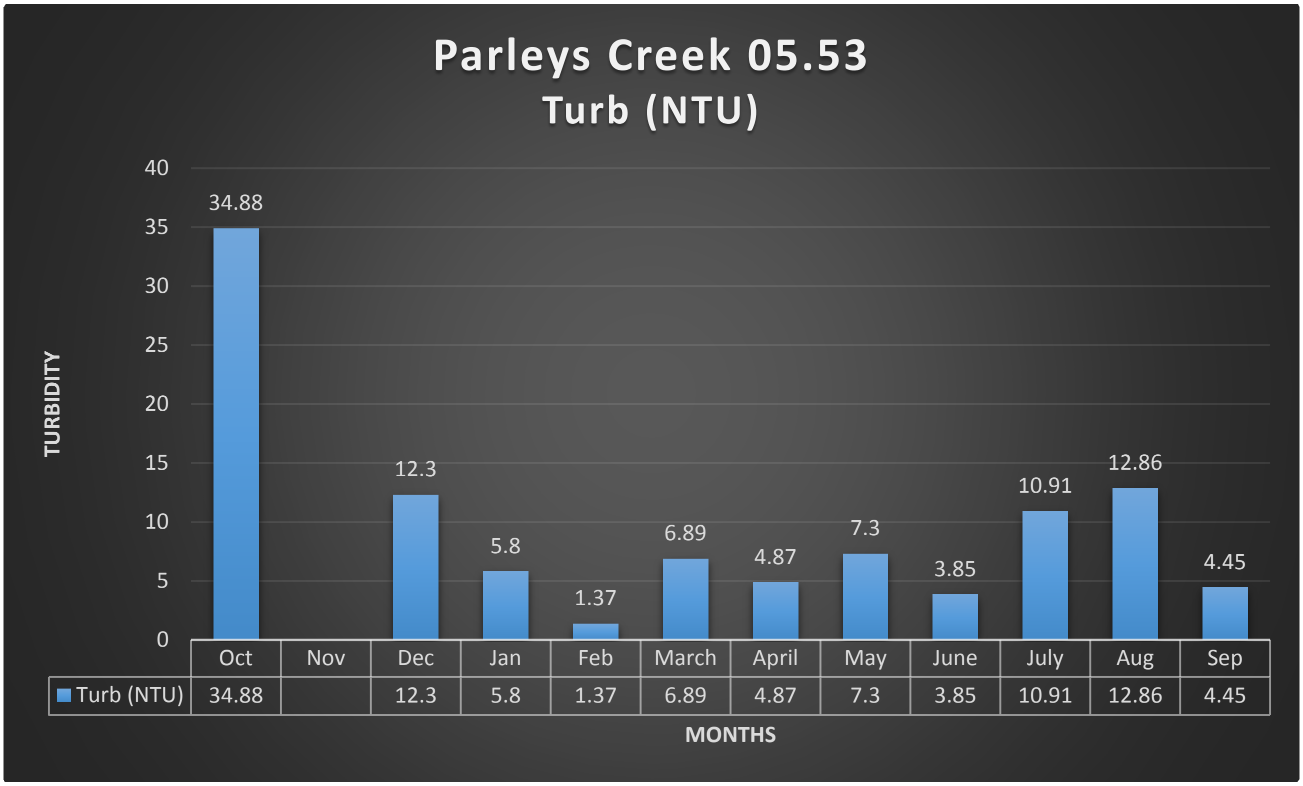


Figure 4-133 Parleys Creek 05.53 Temperature

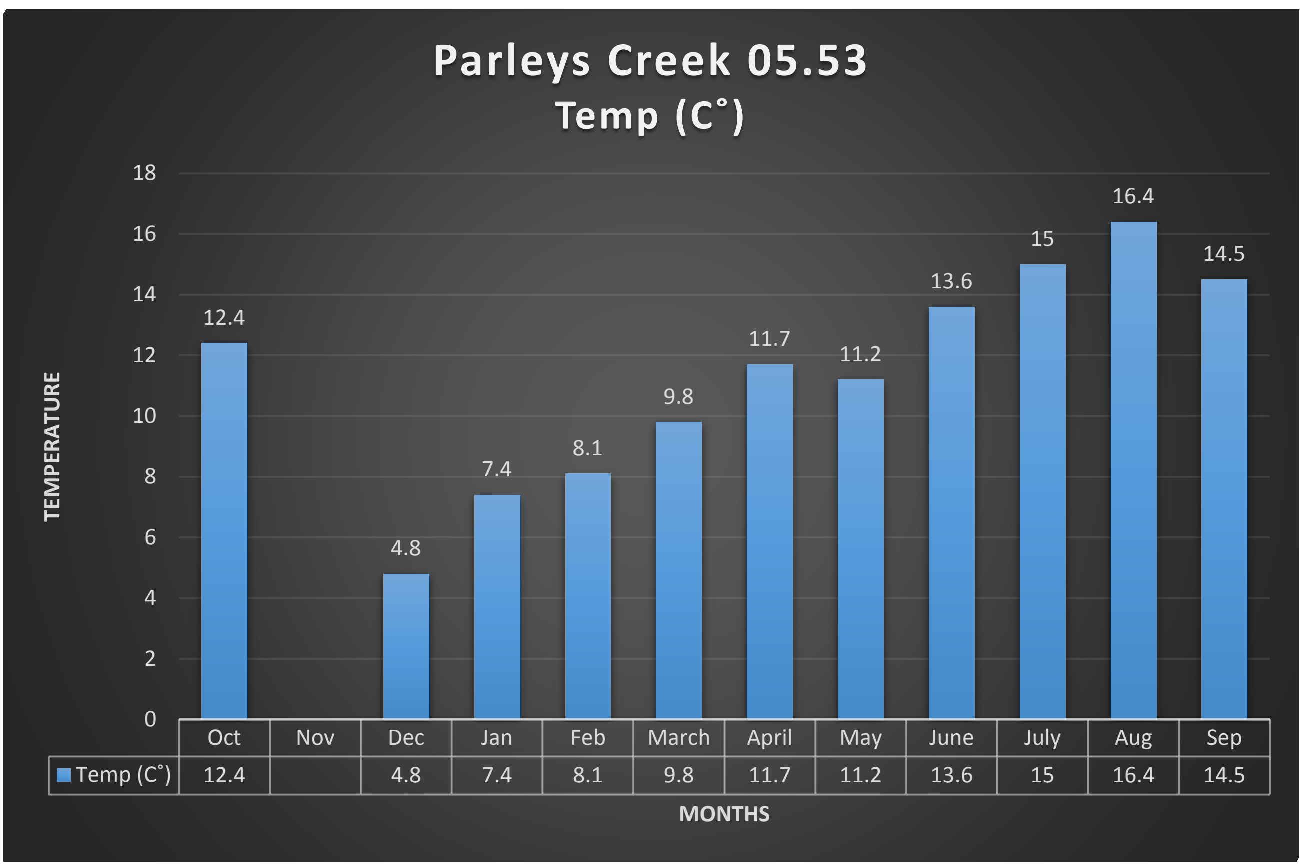
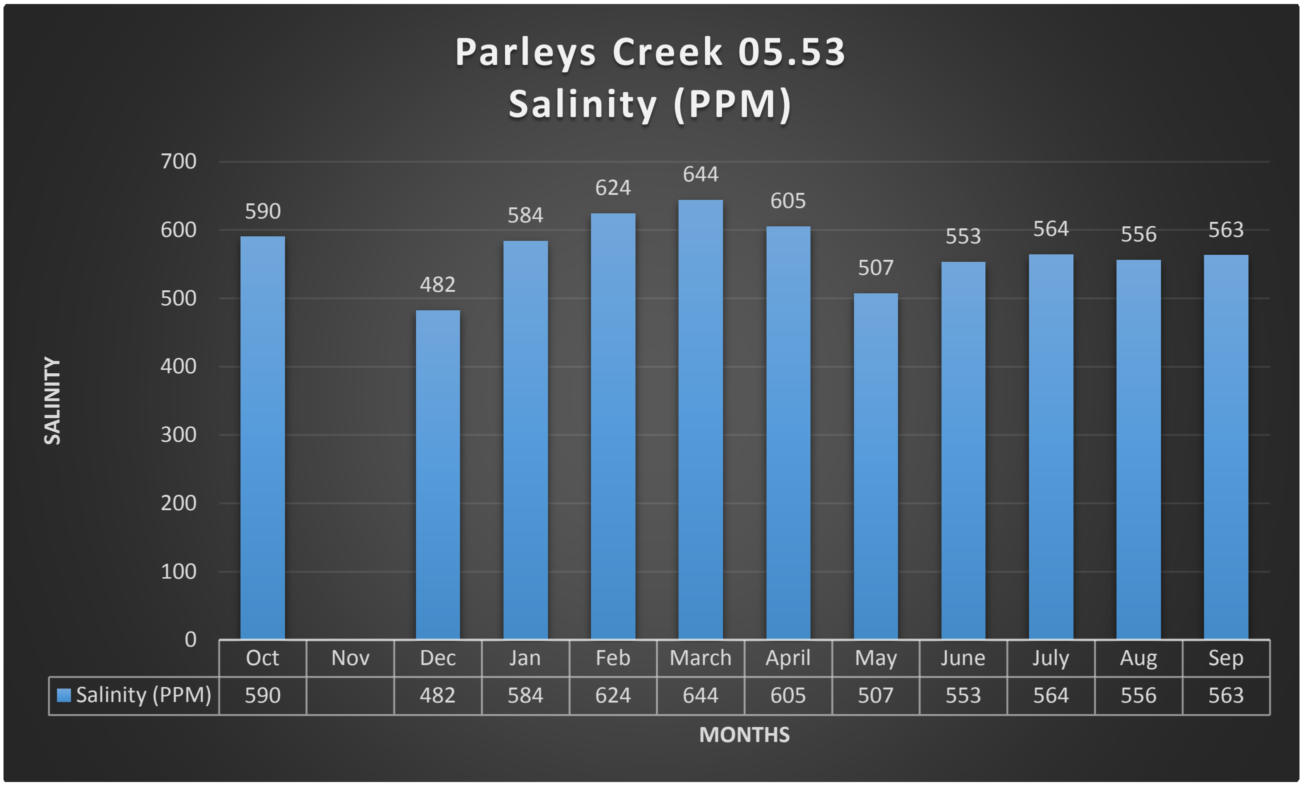
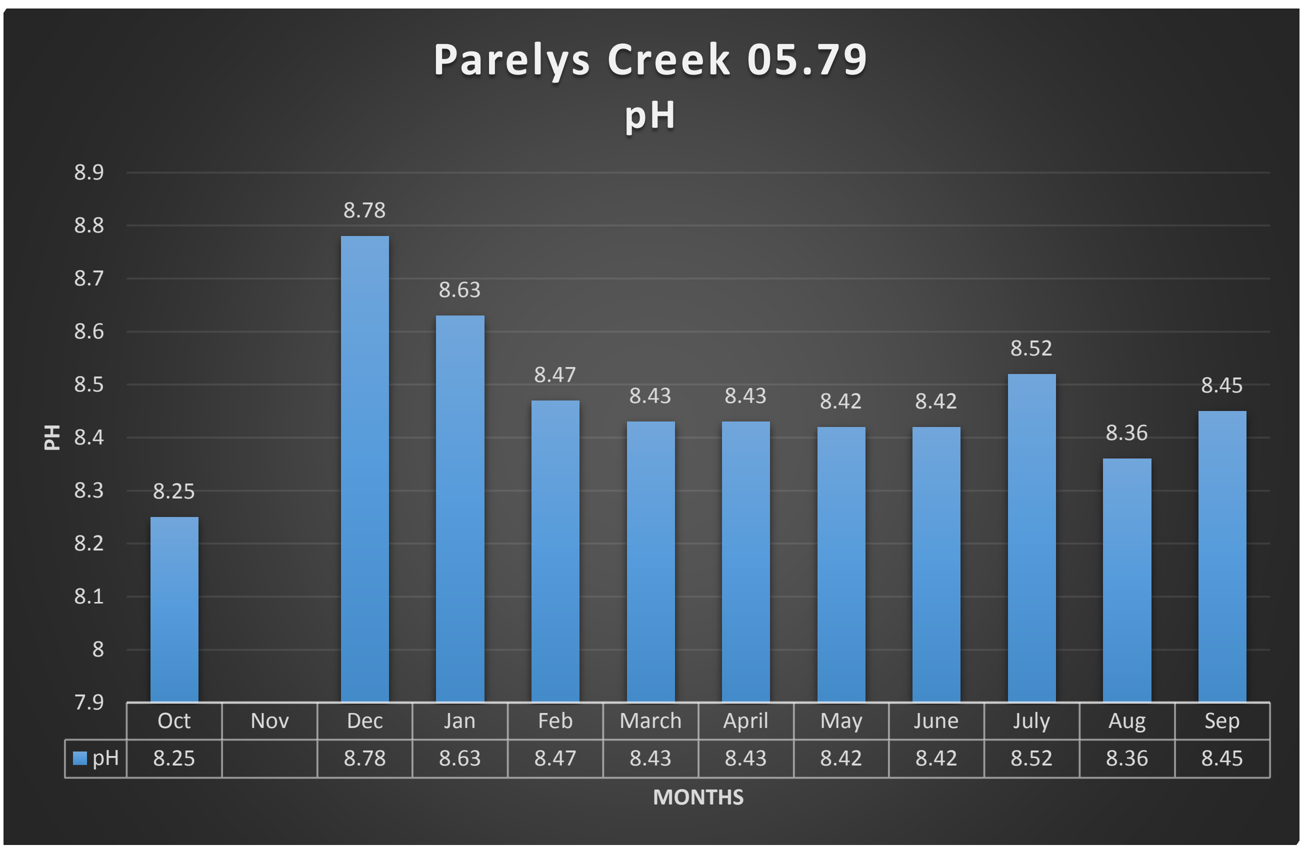


Figure 4-134 Parleys Creek 05.53 Salinity



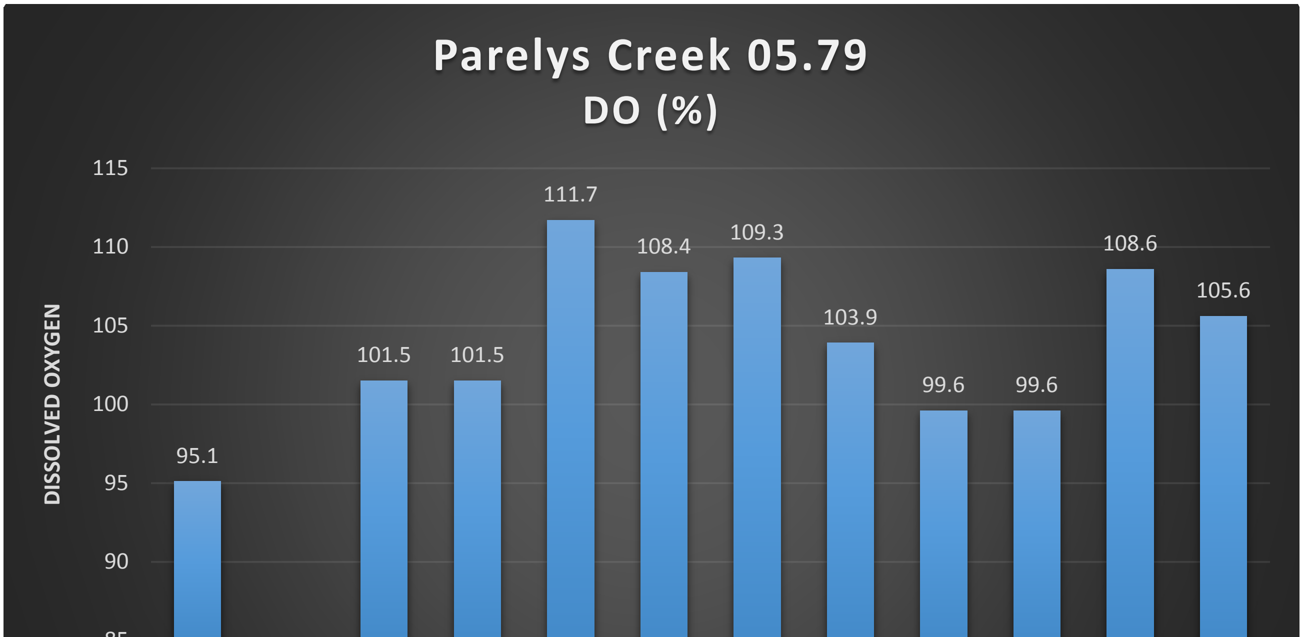
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Salinity (PPM)	590		482	584	624	644	605	507	553	564	556	563

Figure 4-135 Parleys Creek 05.79 pH



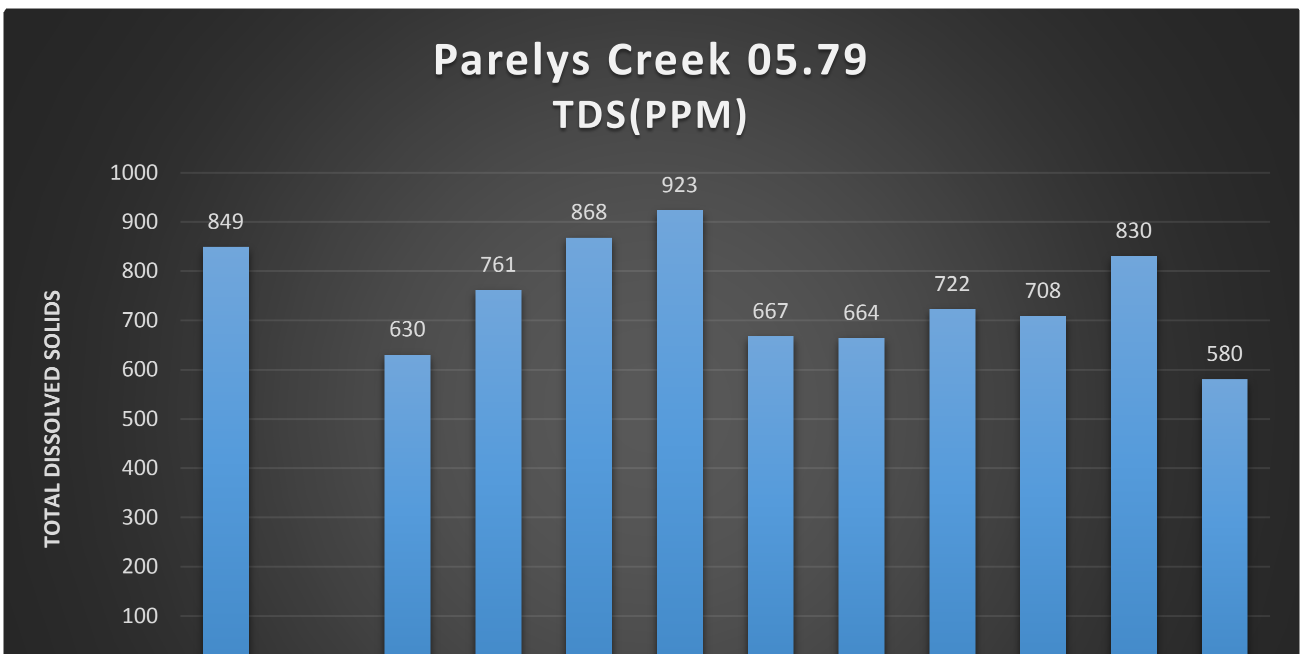
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
pH	8.25		8.78	8.63	8.47	8.43	8.43	8.42	8.42	8.52	8.36	8.45

Figure 4-136 Parleys Creek 05.79 Dissolved Oxygen



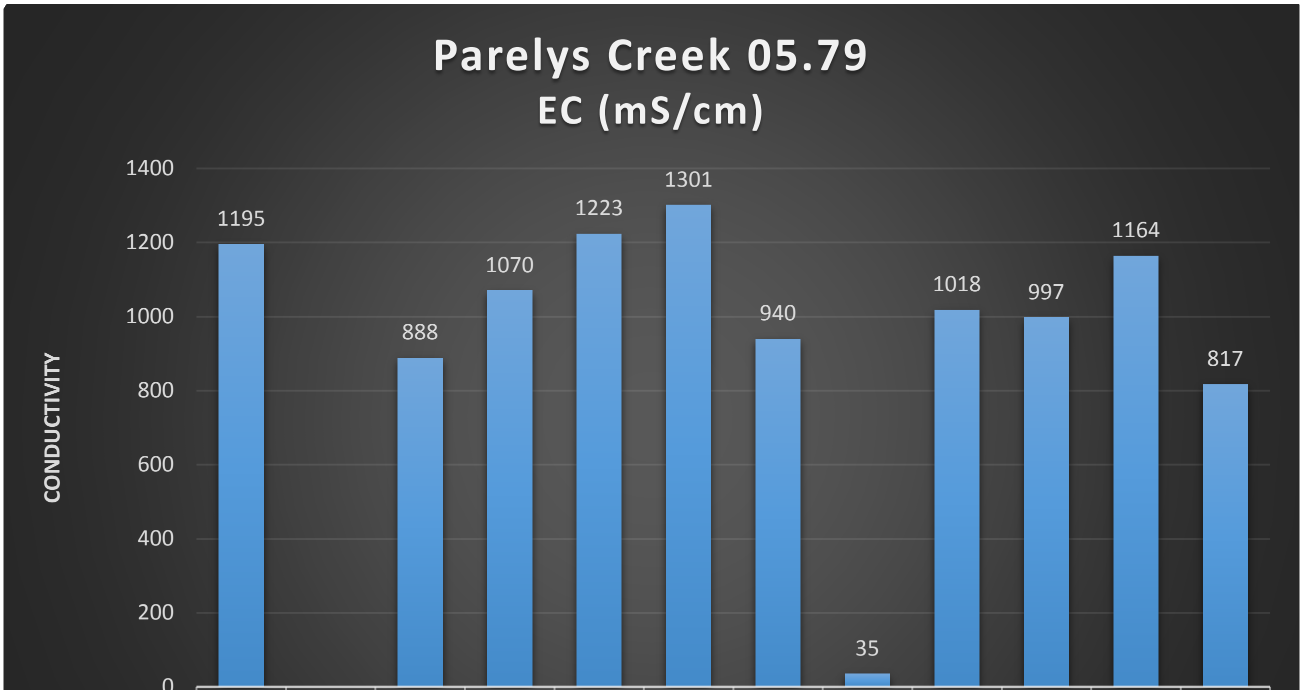
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
DO (%)	95.1		101.5	101.5	111.7	108.4	109.3	103.9	99.6	99.6	108.6	105.6

Figure 4-137 Parleys Creek 05.79 Total Dissolved Solids



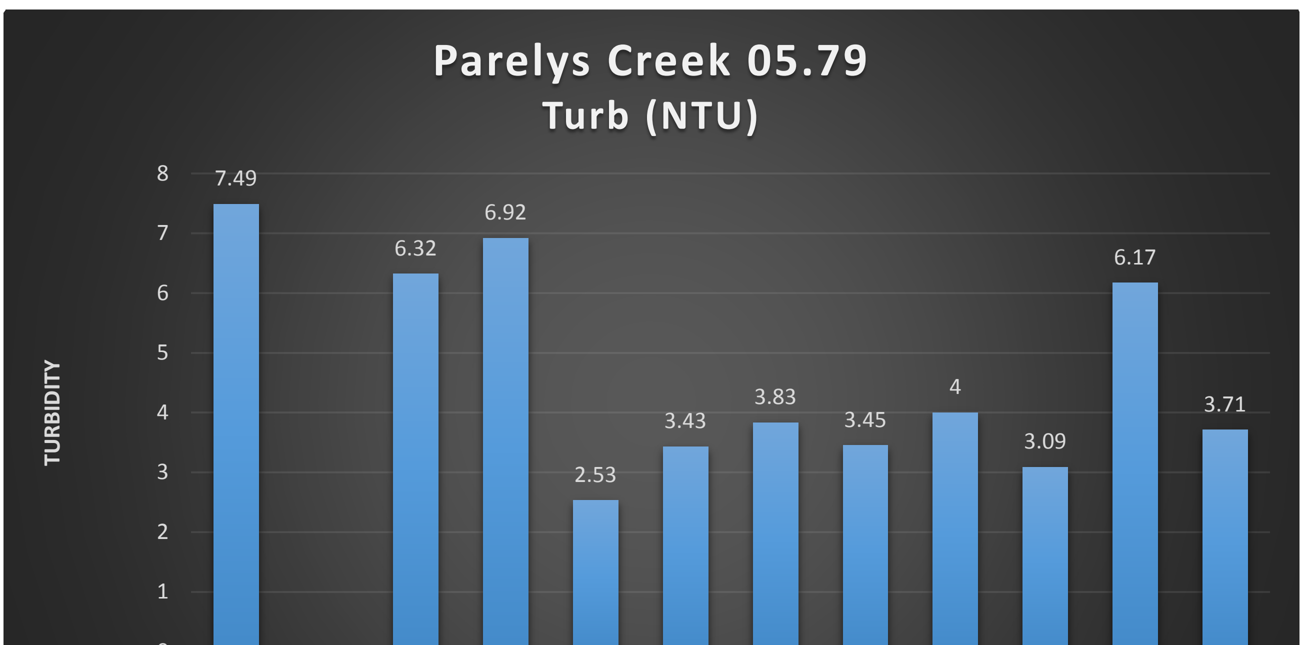
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
TDS(PPM)	849		630	761	868	923	667	664	722	708	830	580

Figure 4-138 Parleys Creek 05.79 Conductivity



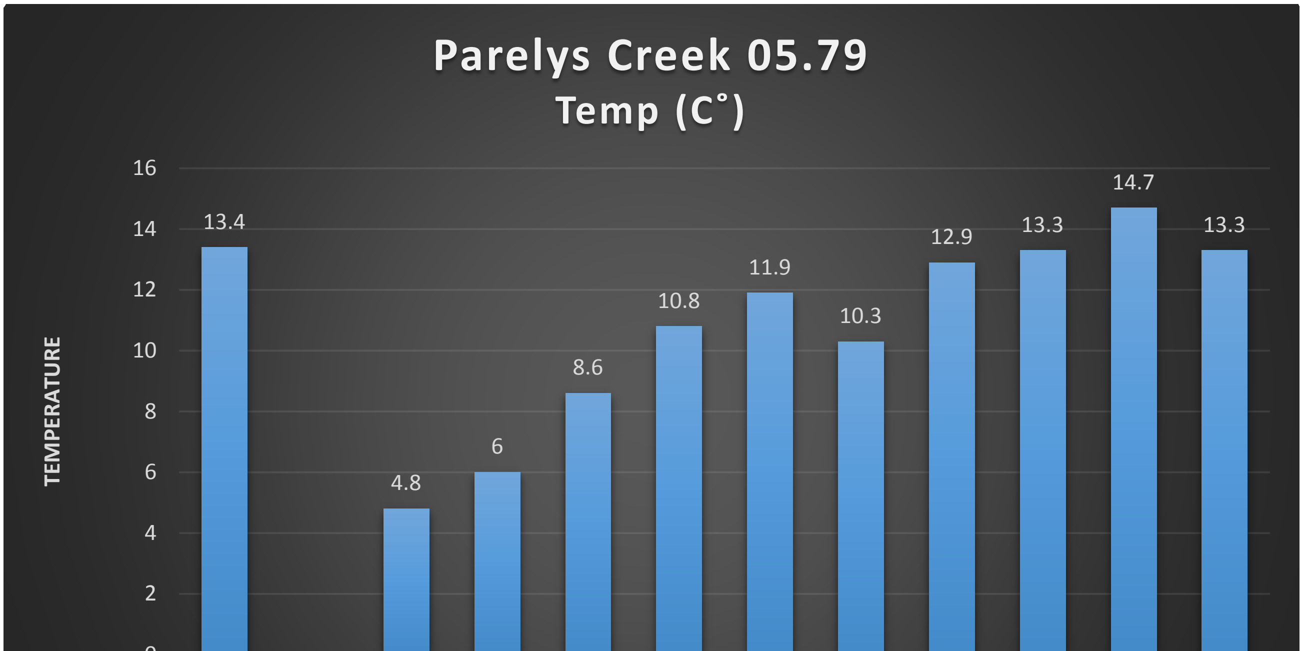
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
EC (mS/cm)	1195		888	1070	1223	1301	940	35	1018	997	1164	817

Figure 4-139 Parleys Creek 05.79 Turbidity



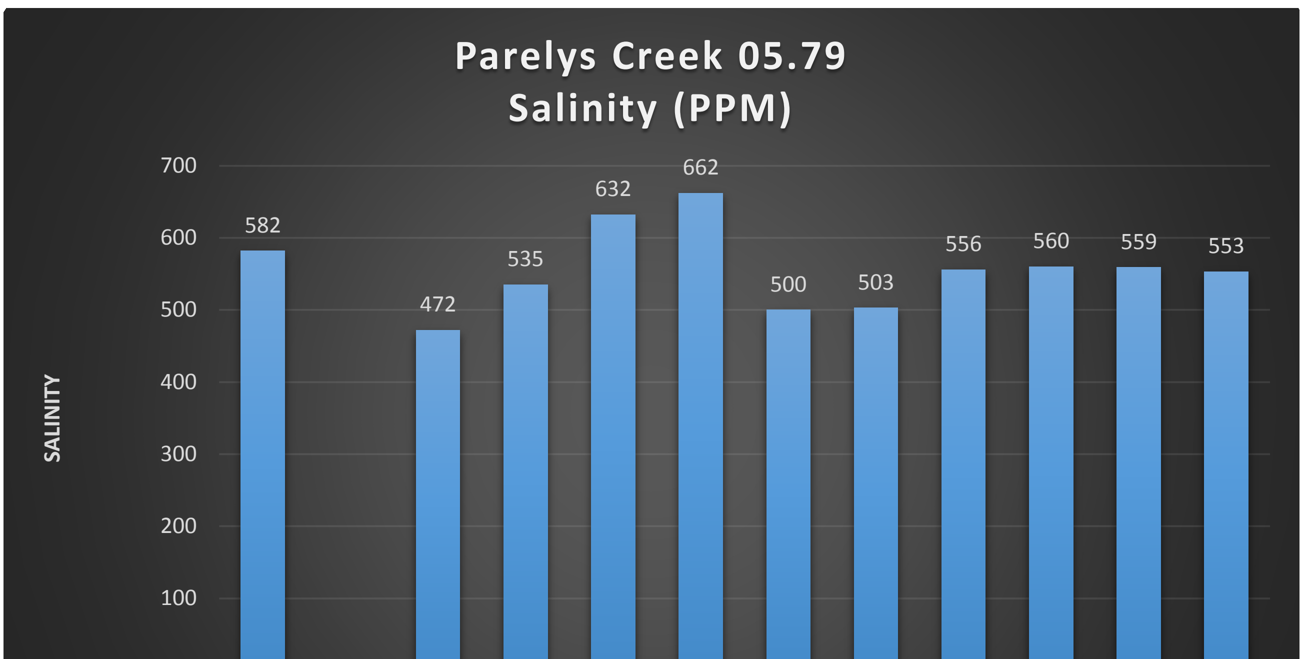
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Turb (NTU)	7.49		6.32	6.92	2.53	3.43	3.83	3.45	4	3.09	6.17	3.71

Figure 4-140 Parleys Creek 05.79 Temperature



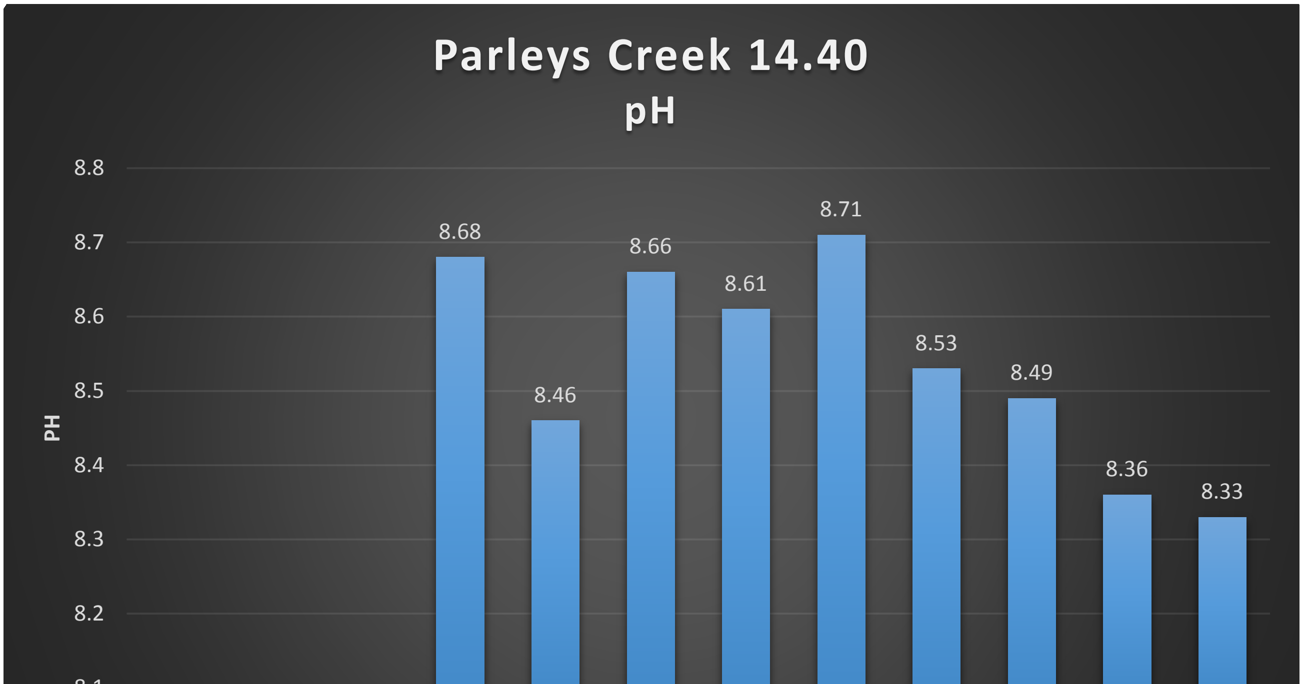
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Temp (C˚)	13.4		4.8	6	8.6	10.8	11.9	10.3	12.9	13.3	14.7	13.3

Figure 4-141 Parleys Creek 05.79 Salinity



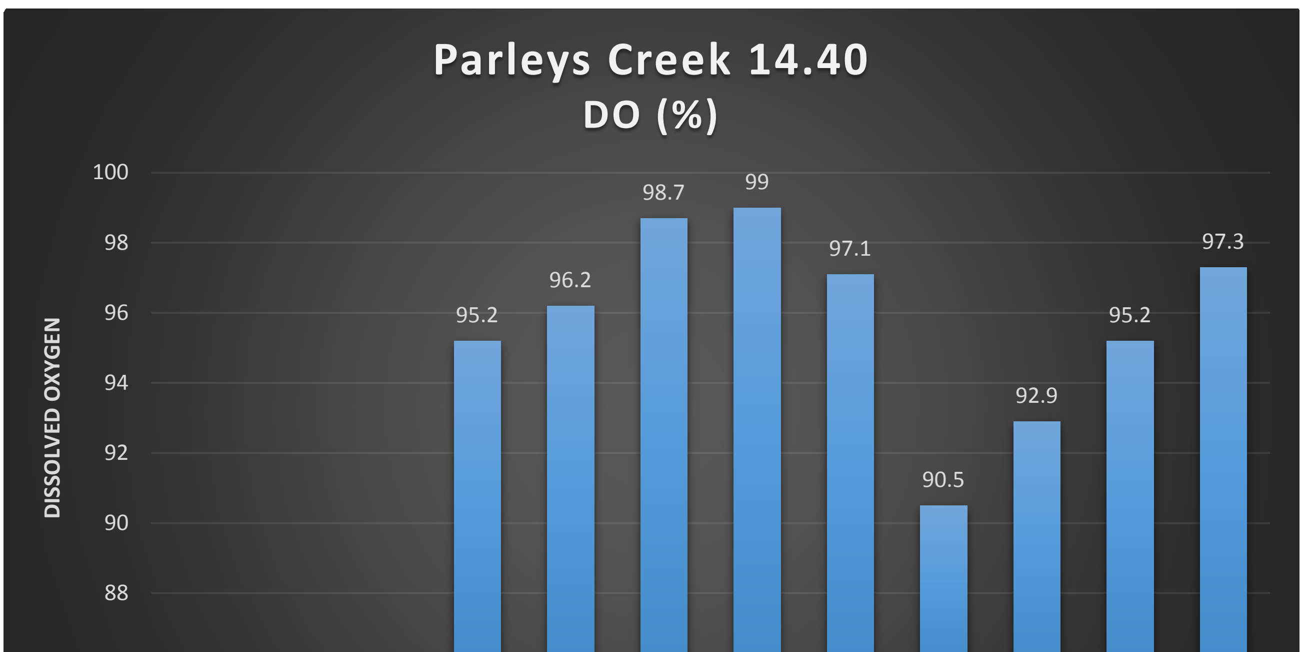
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Salinity (PPM)	582		472	535	632	662	500	503	556	560	559	553

Figure 4-142 Parleys Creek 14.40 pH



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
pH				8.68	8.46	8.66	8.61	8.71	8.53	8.49	8.36	8.33

Figure 4-143 Parleys Creek 14.40 Dissolved Oxygen



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
DO (%)				95.2	96.2	98.7	99	97.1	90.5	92.9	95.2	97.3

Figure 4-144 Parleys Creek 14.40 Total Dissolved Solids

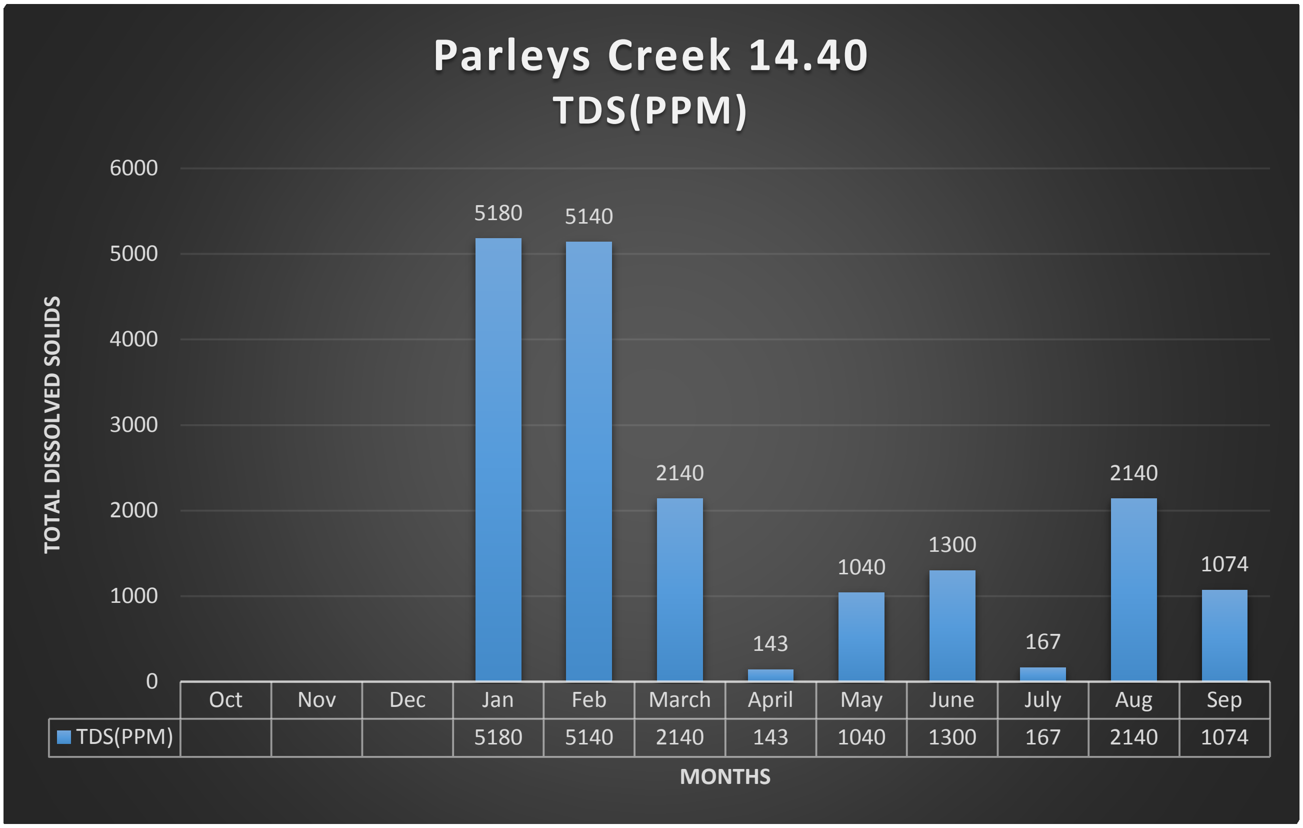


Figure 4-145 Parleys Creek 14.40 Conductivity

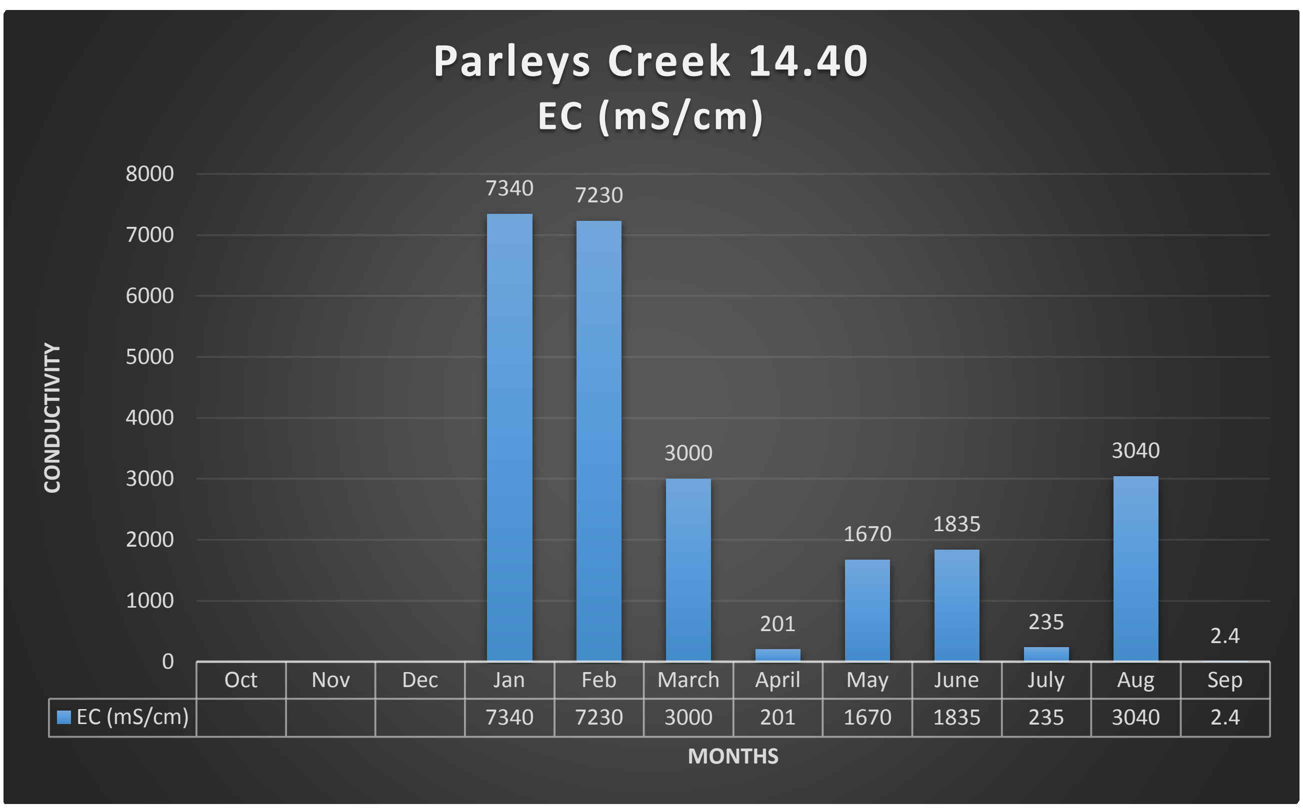
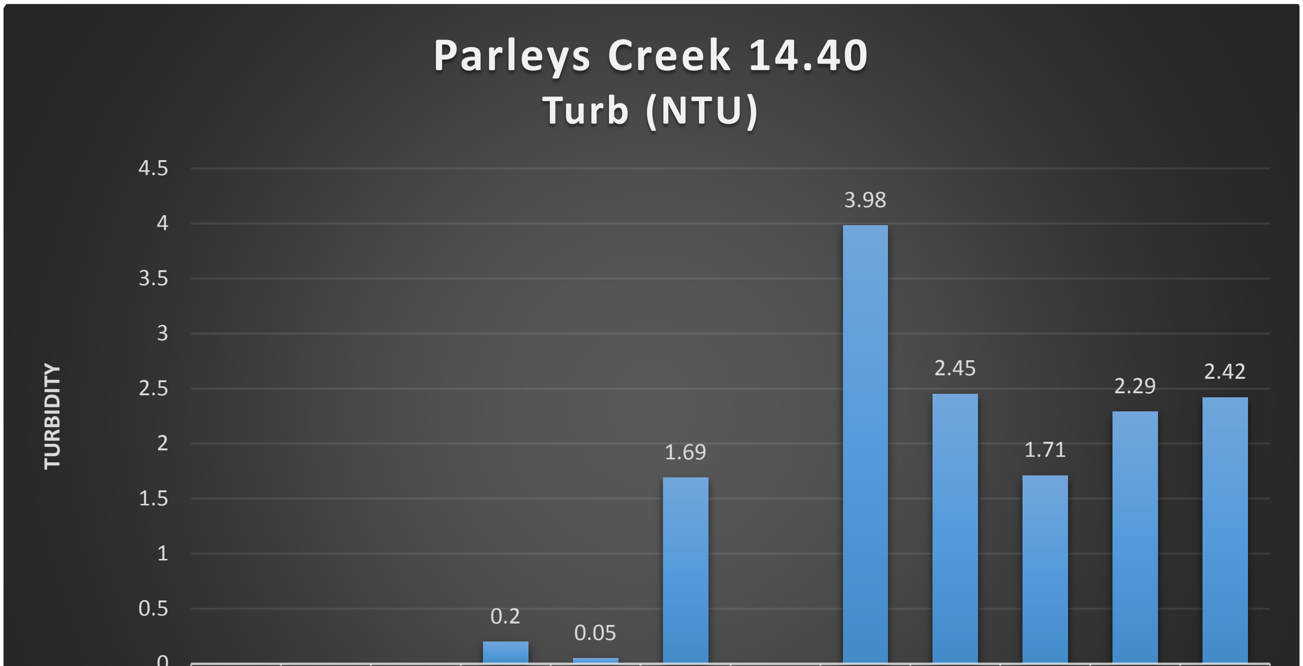
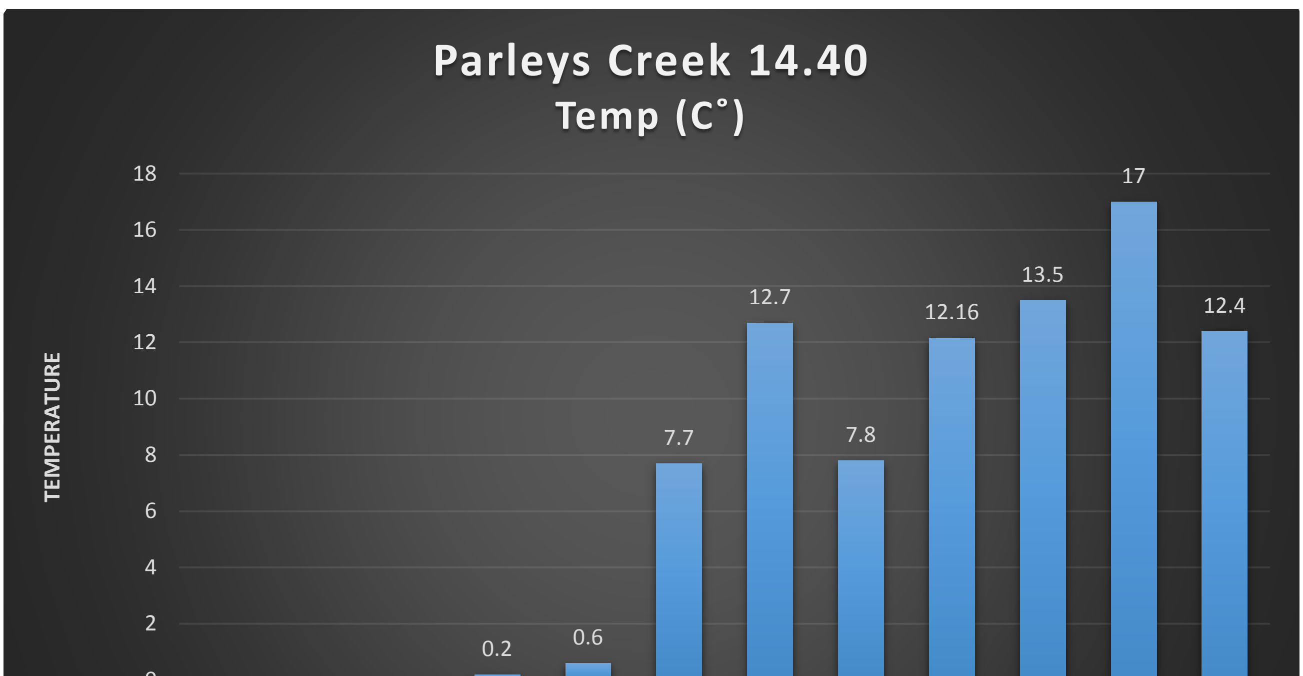


Figure 4-146 Parleys Creek 14.40 Turbidity



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Turb (NTU)				0.2	0.05	1.69		3.98	2.45	1.71	2.29	2.42

Figure 4-147 Parleys Creek 14.40 Temperature



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Temp (C˚)				0.2	0.6	7.7	12.7	7.8	12.16	13.5	17	12.4

Figure 4-148 Parleys Creek 14.40 Salinity

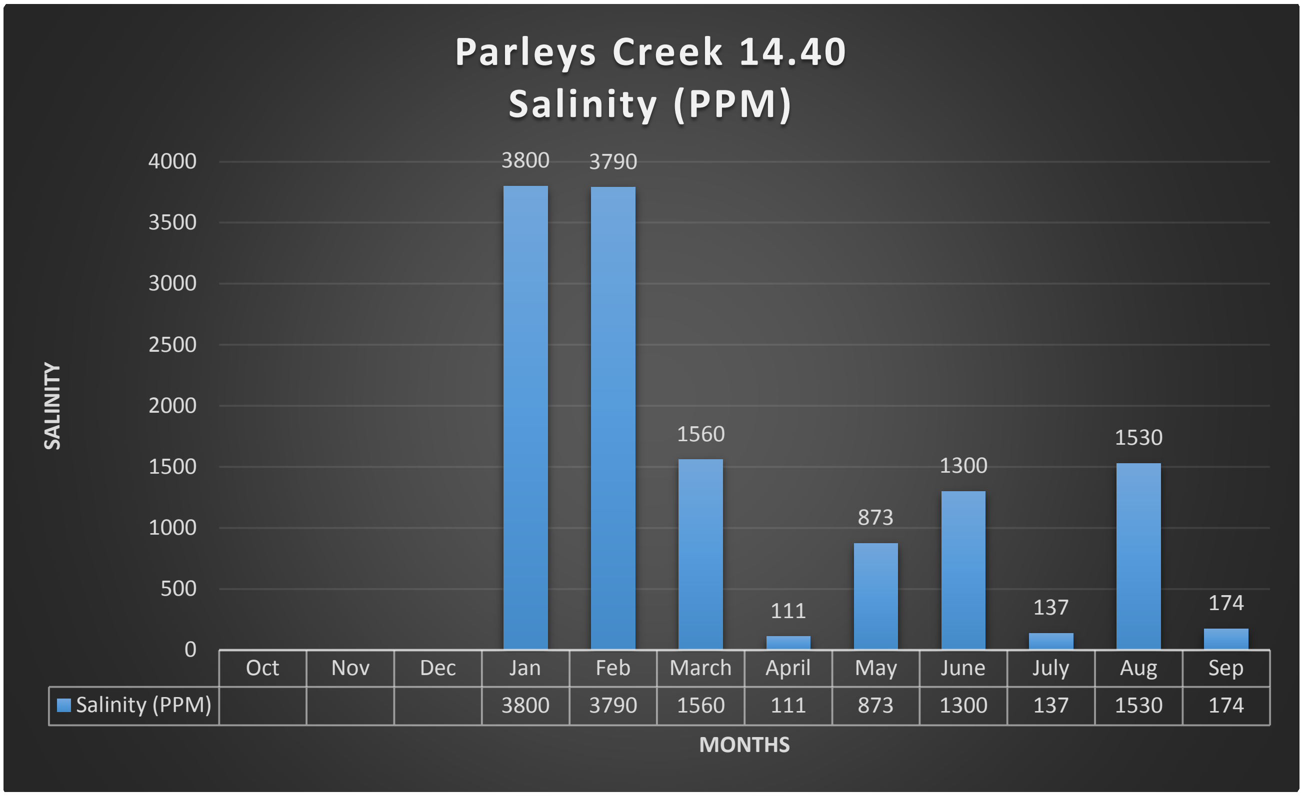


Figure 4-149 Lambs Canyon pH

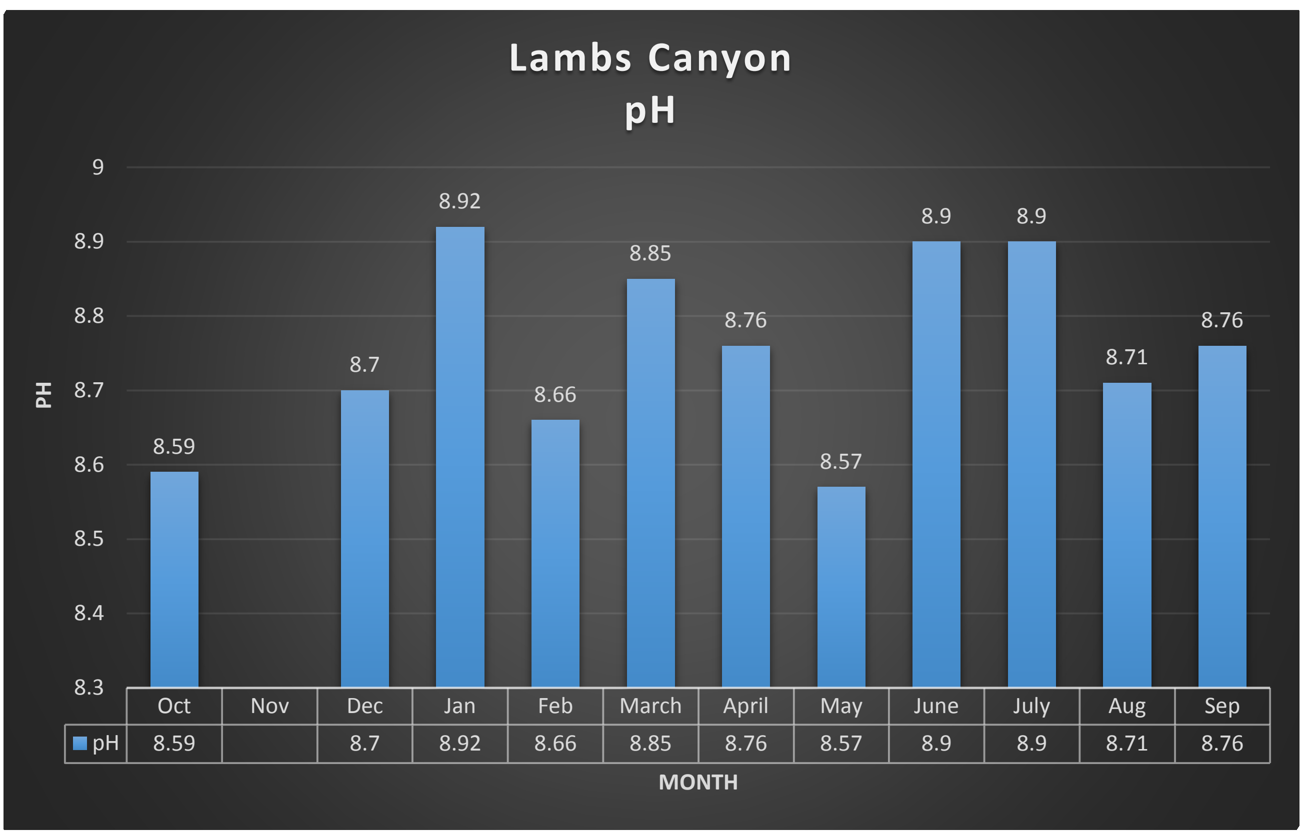


Figure 4-150 Lambs Canyon Dissolved Oxygen

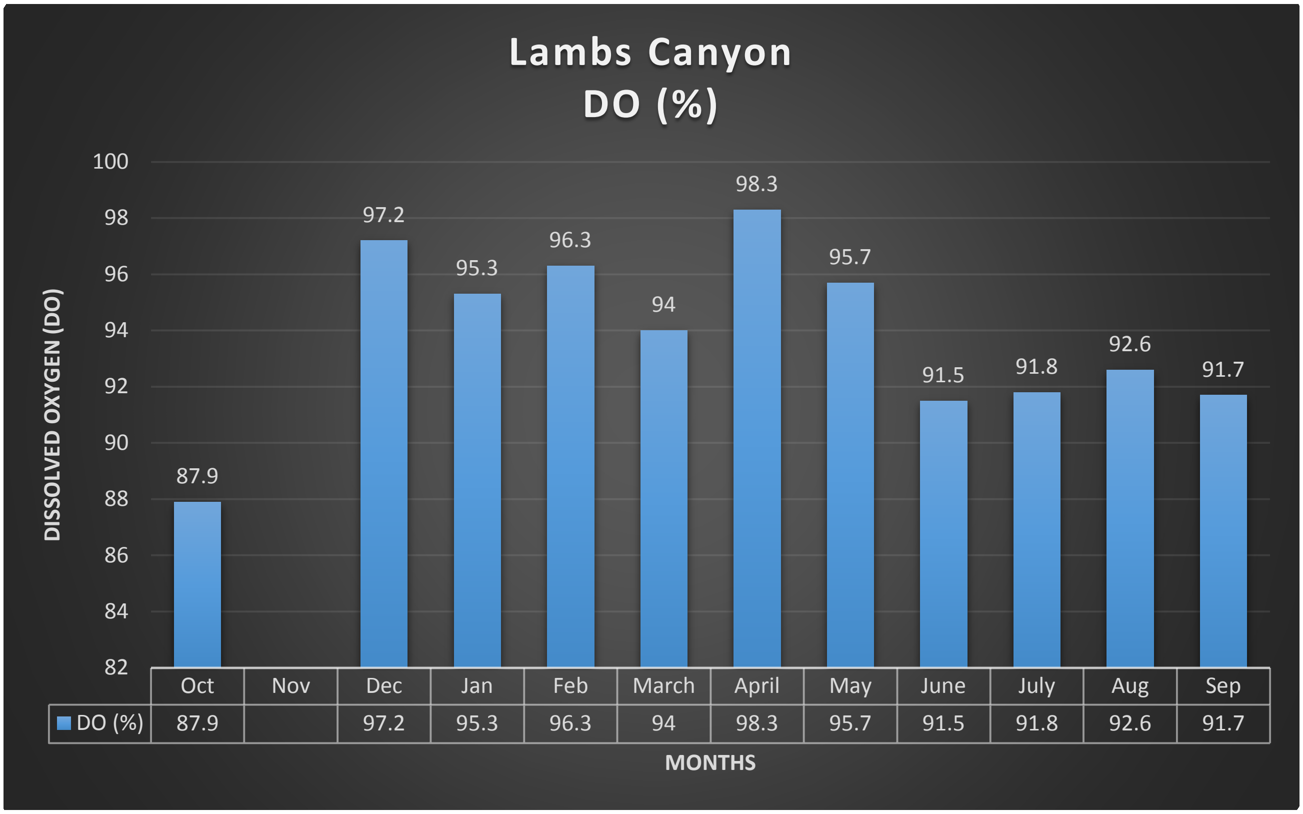


Figure 4-151 Lambs Canyon Total Dissolved Solids

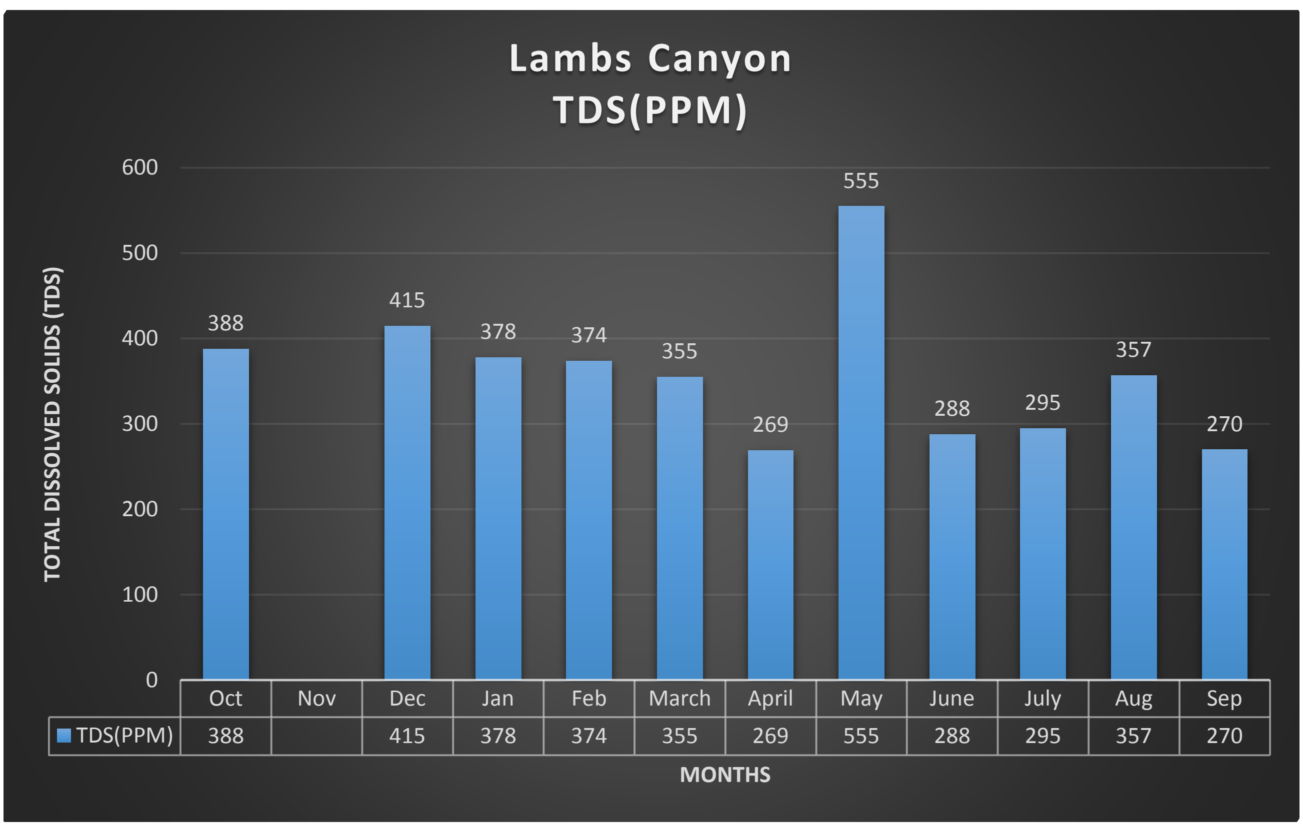


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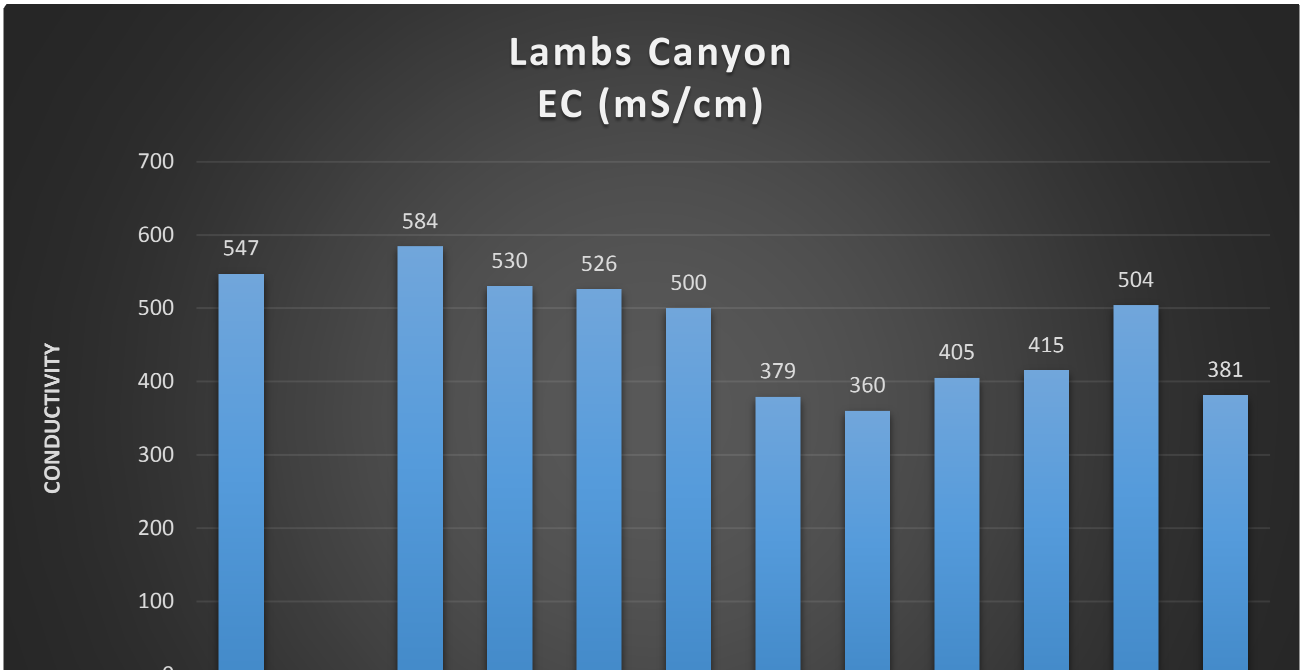
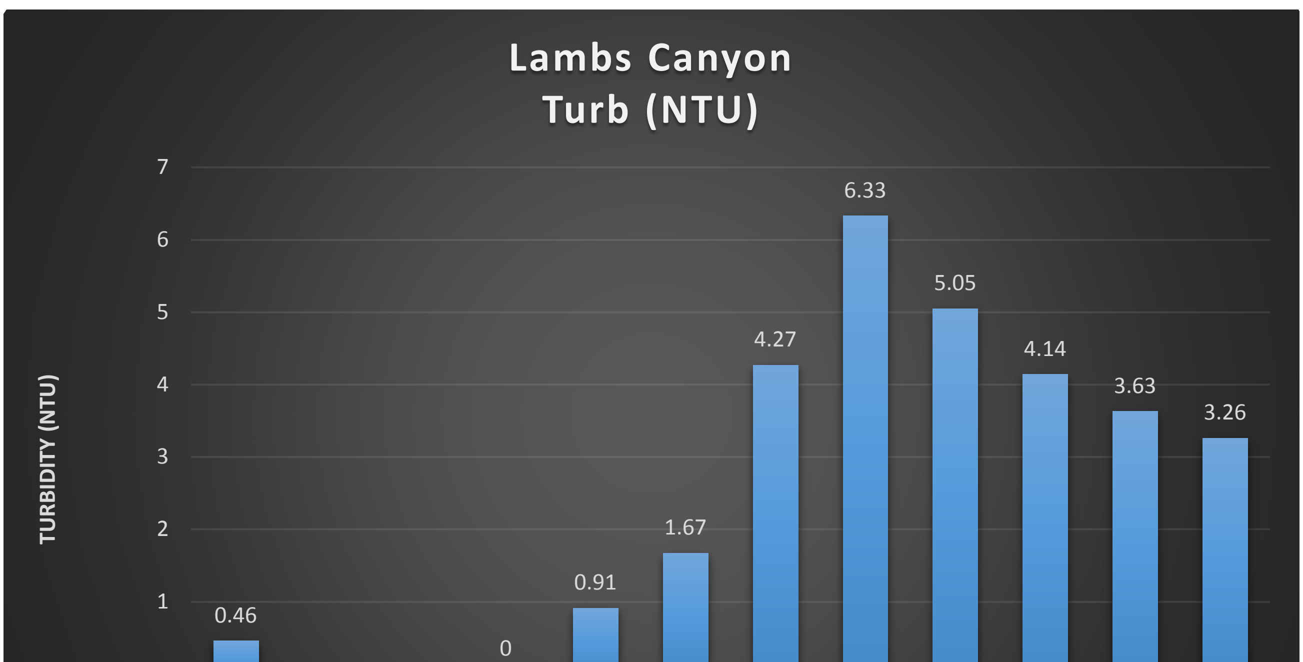
Figure 4-152 Lambs Canyon Conductivity



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
EC (mS/cm)	547		584	530	526	500	379	360	405	415	504	381

Figure 4-153 Lambs Canyon Turbidity



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Turb (NTU)	0.46			0	0.91	1.67	4.27	6.33	5.05	4.14	3.63	3.26

Figure 4-154 Lambs Canyon Temperature

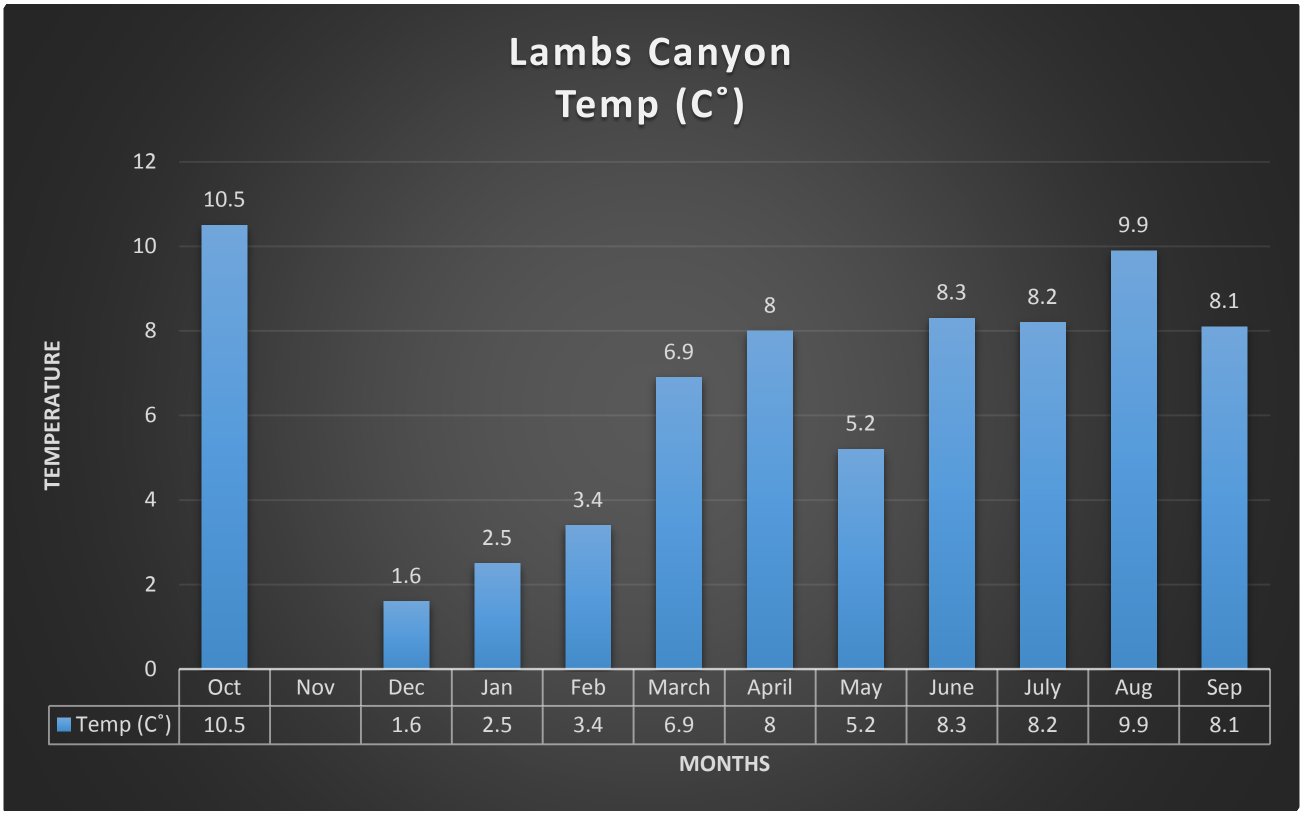


Figure 4-155 Lambs Canyon Salinity

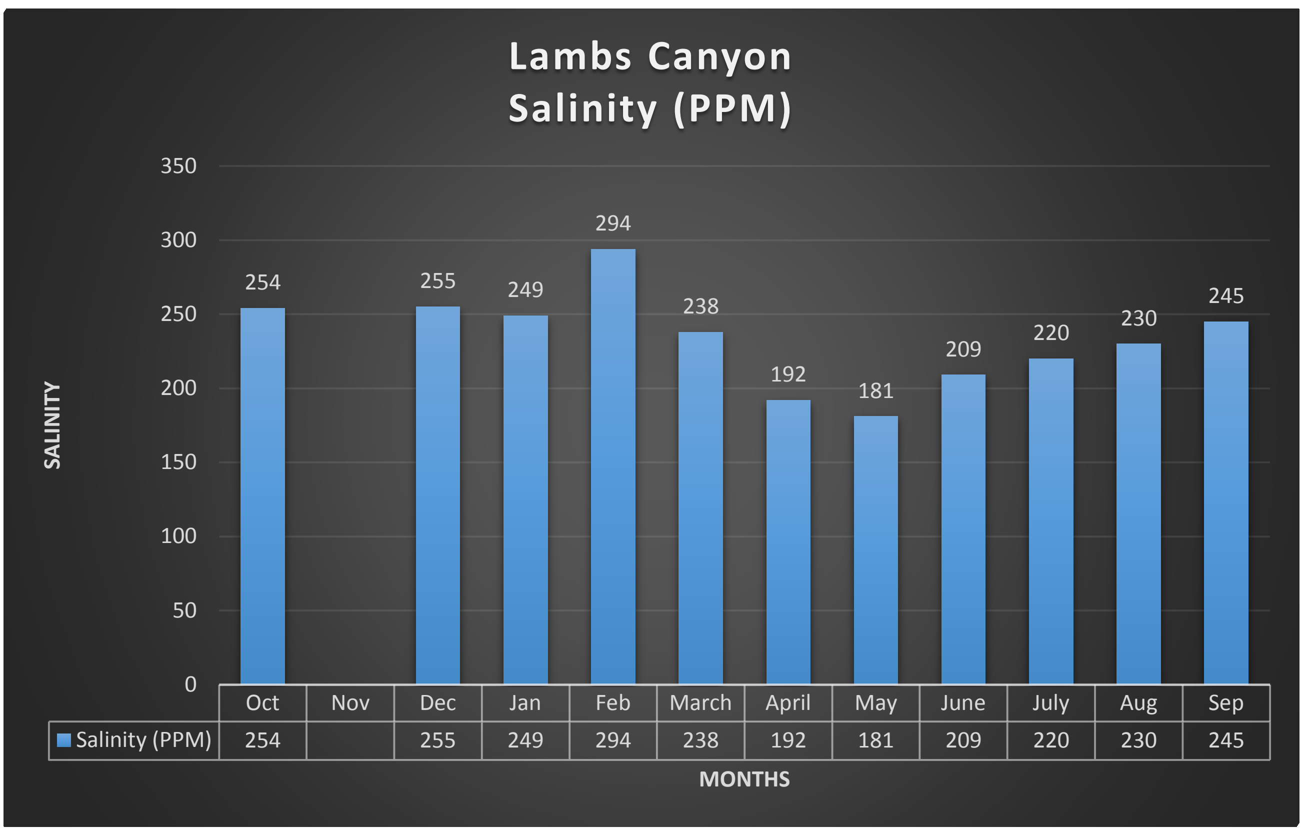


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Figure 4-156 Smith Fork pH

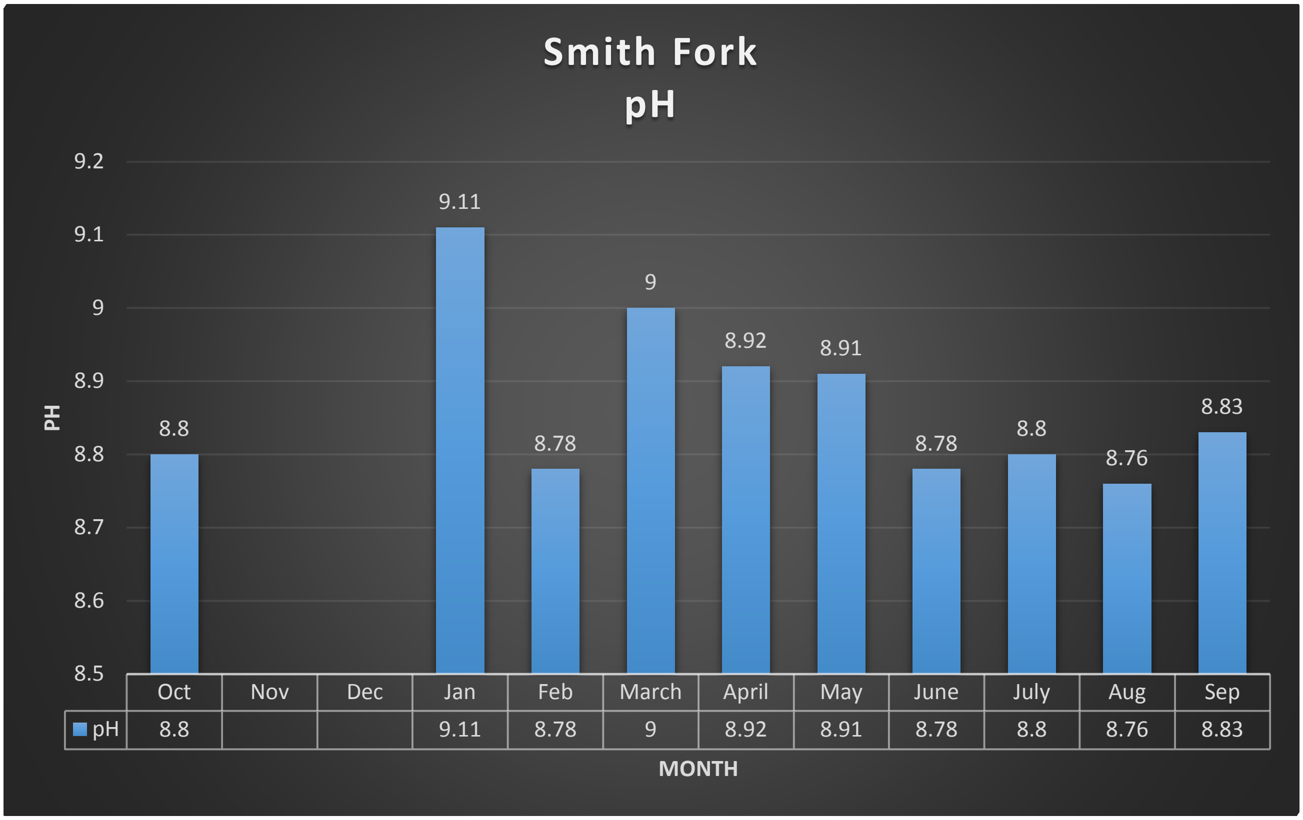


Figure 4-157 Smith Fork Dissolved Oxygen

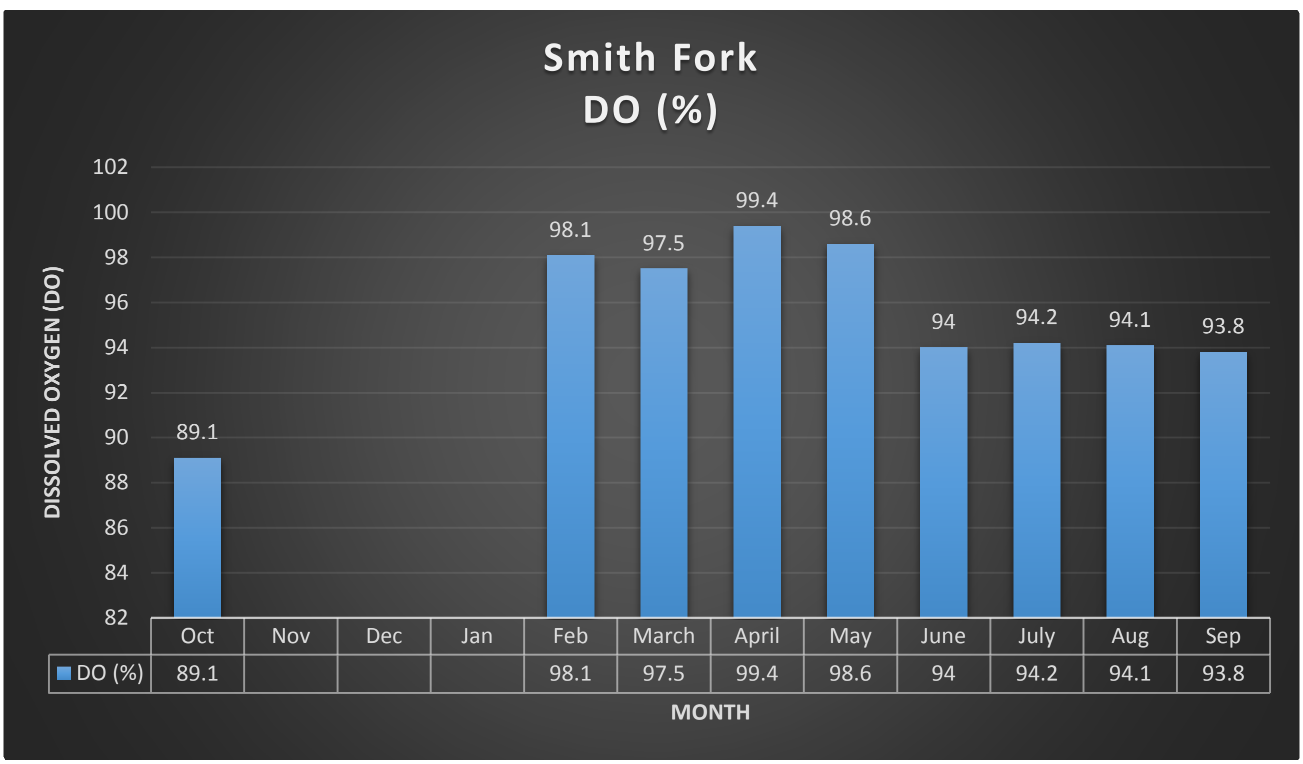
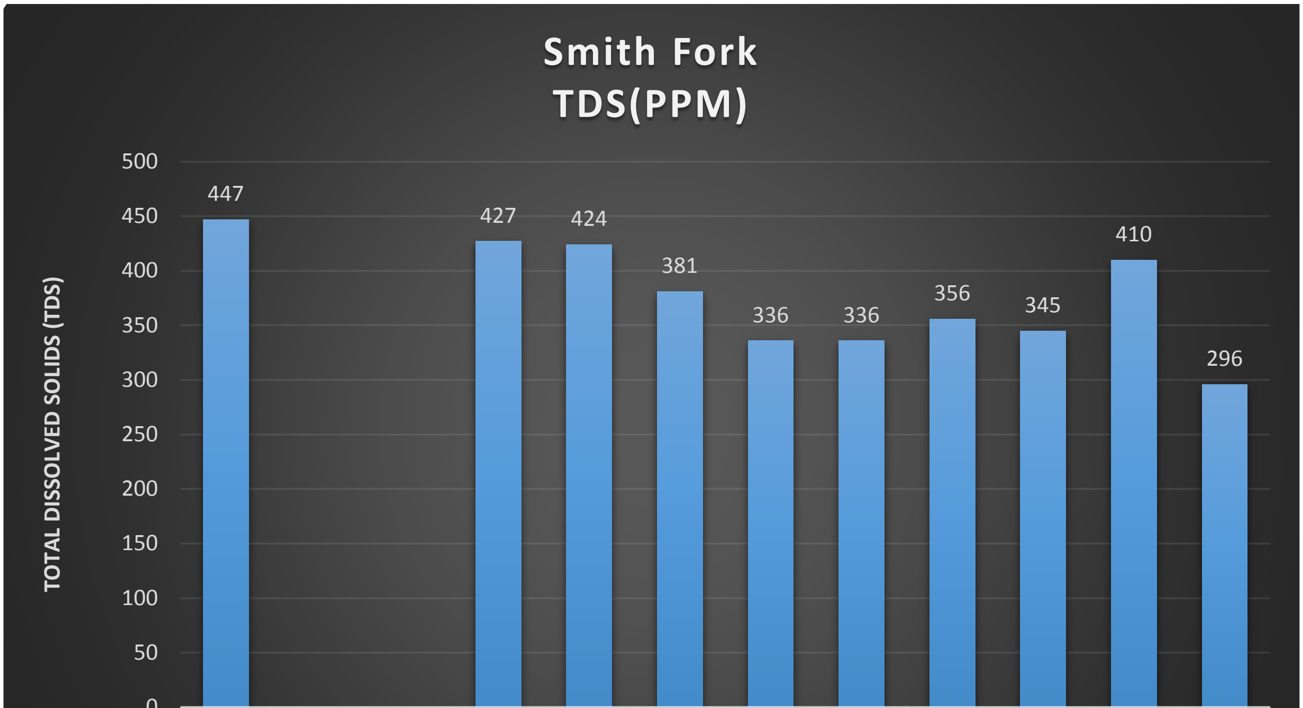
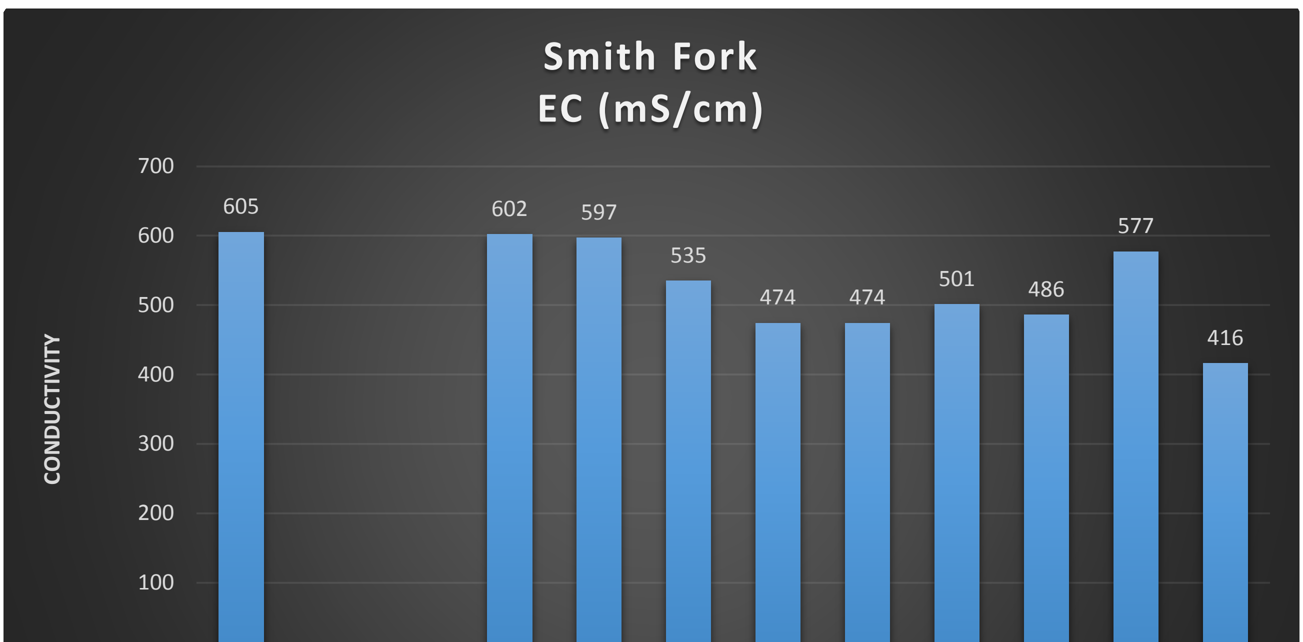


Figure 4-158 Smith Fork Total Dissolved Solids



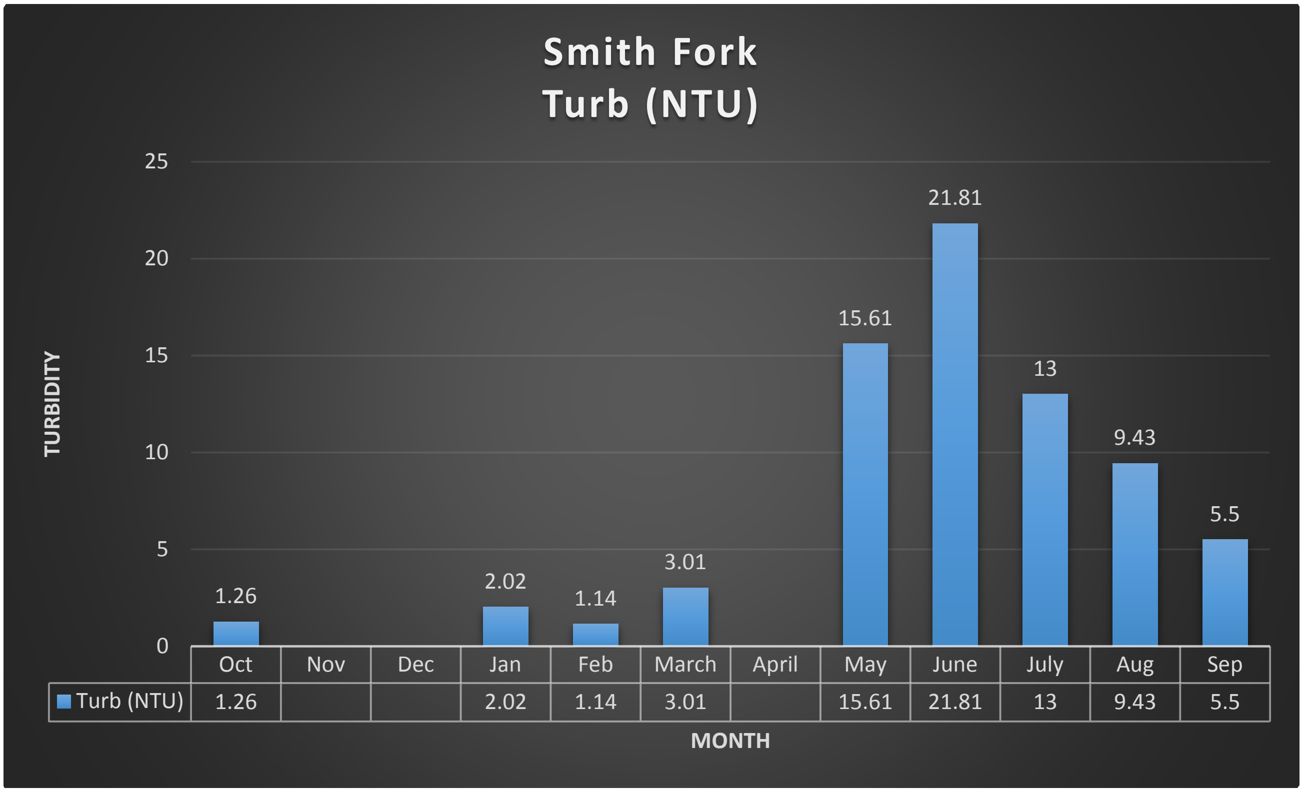
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
TDS(PPM)	447			427	424	381	336	336	356	345	410	296

Figure 4-159 Smith Fork Conductivity



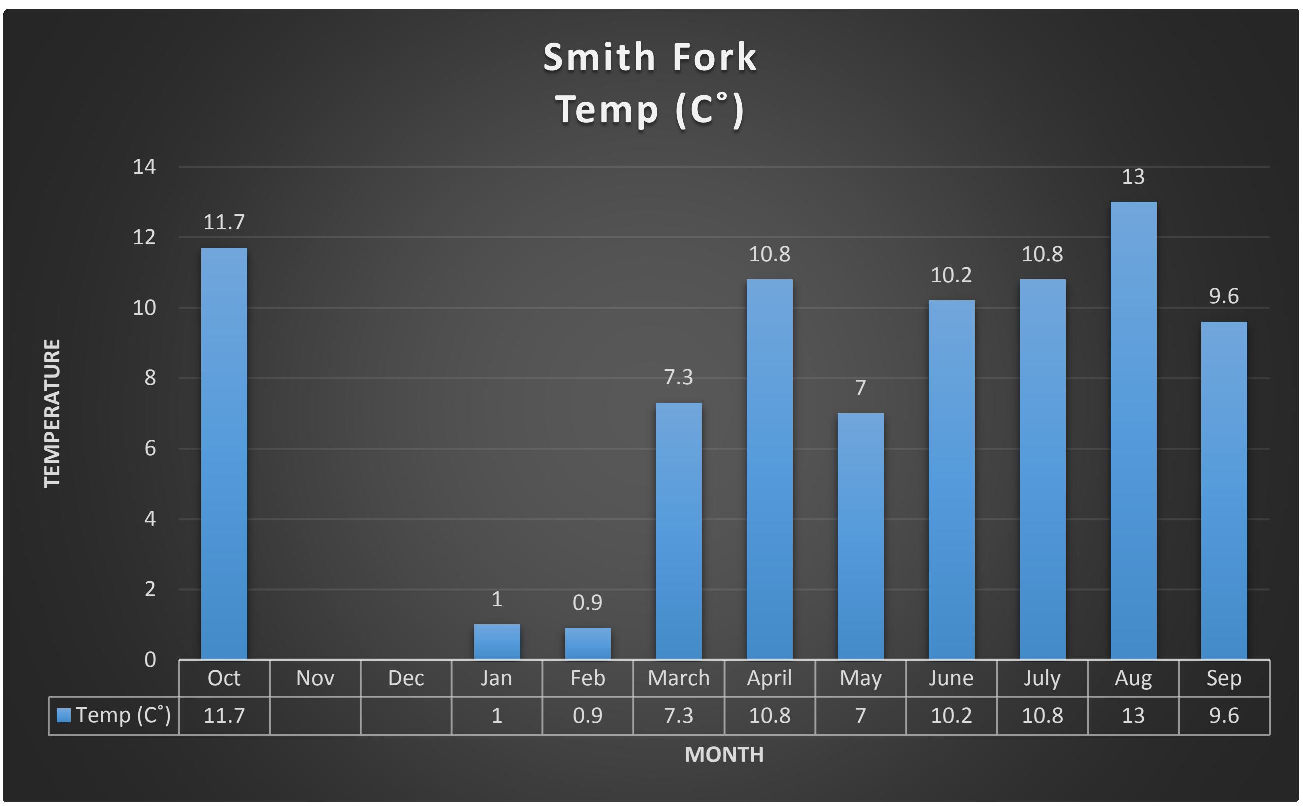
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
EC (mS/cm)	605			602	597	535	474	474	501	486	577	416

Figure 4-160 Smith Fork Turbidity



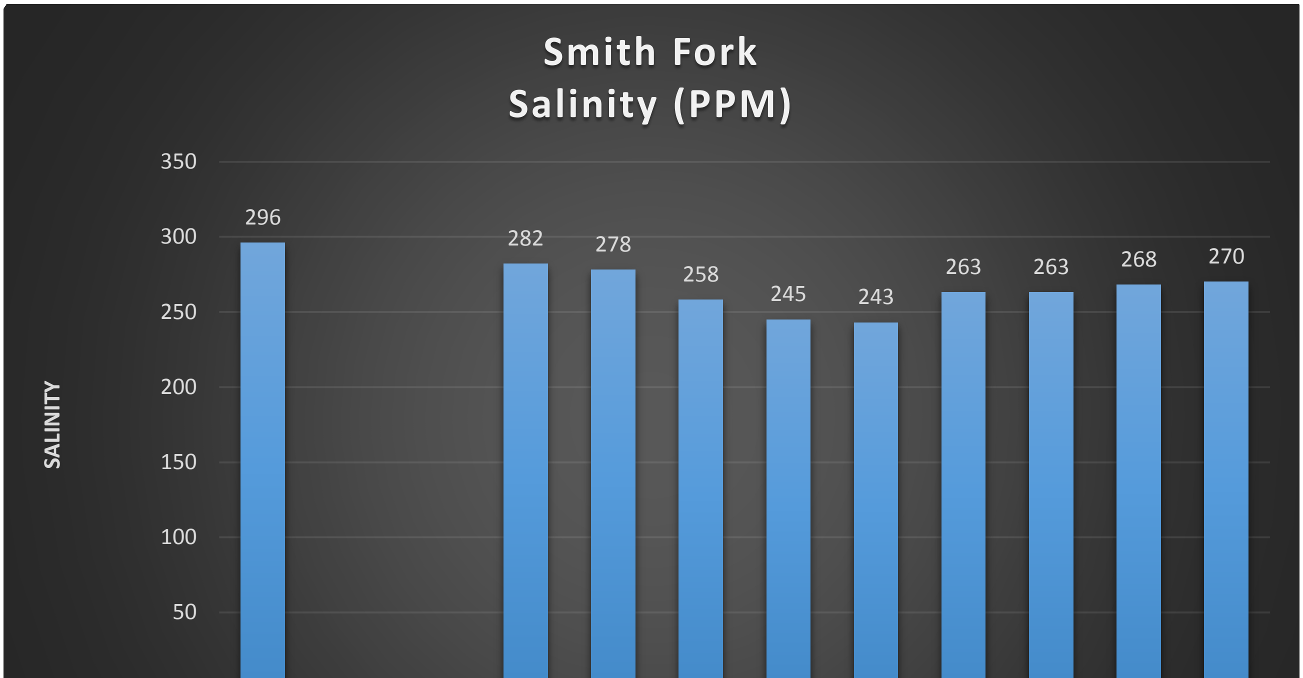
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Turb (NTU)	1.26			2.02	1.14	3.01		15.61	21.81	13	9.43	5.5

Figure 4-161 Smith Fork Temperature



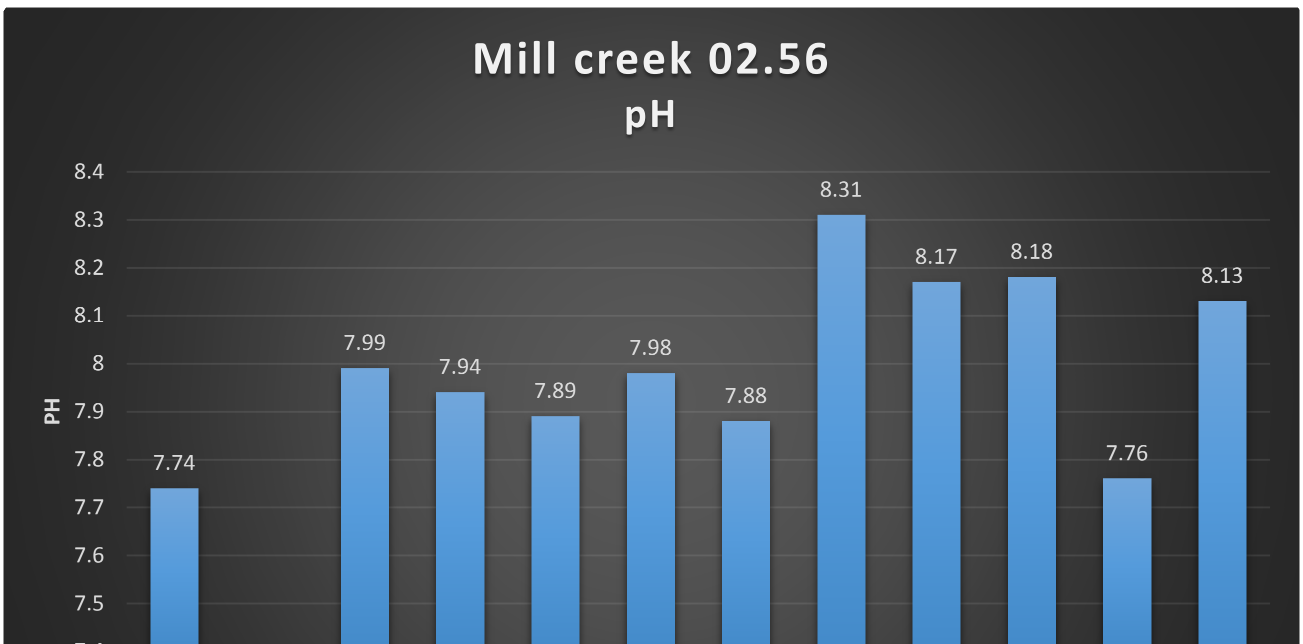
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Temp (C˚)	11.7			1	0.9	7.3	10.8	7	10.2	10.8	13	9.6

Figure 4-162 Smith Fork Salinity



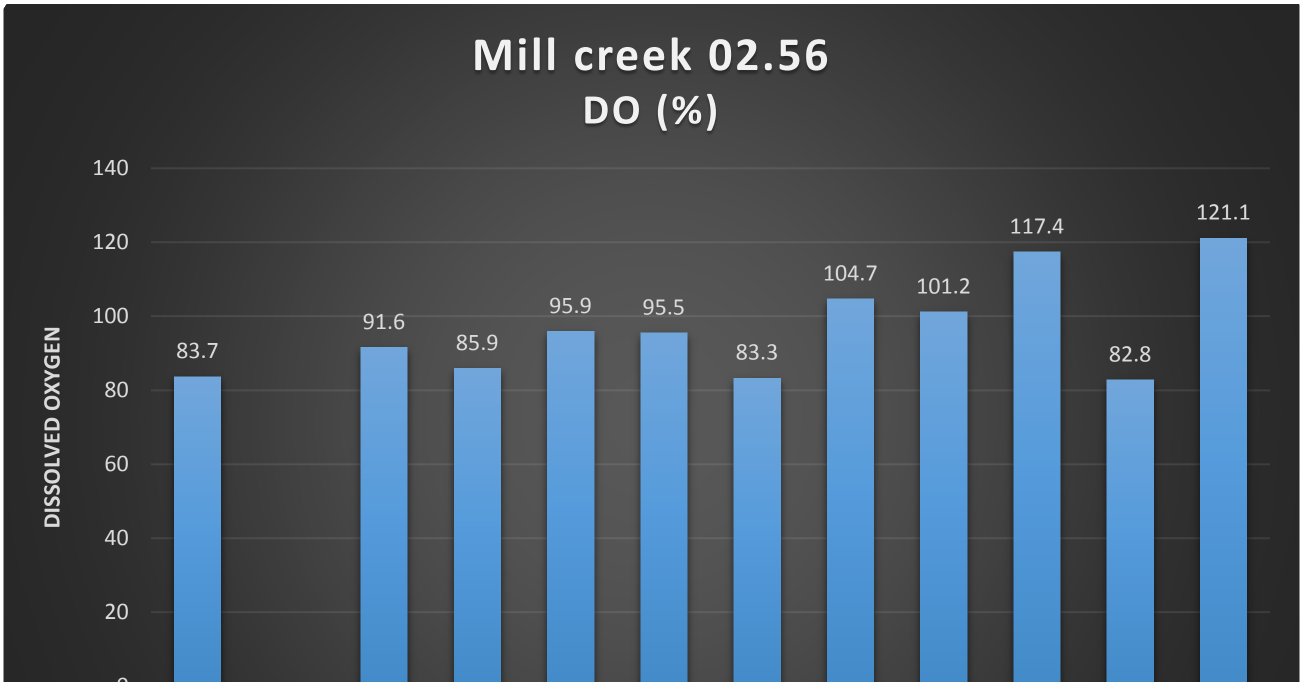
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Salinity (PPM)	296			282	278	258	245	243	263	263	268	270

Figure 4-163 Mill Creek 02.56 pH



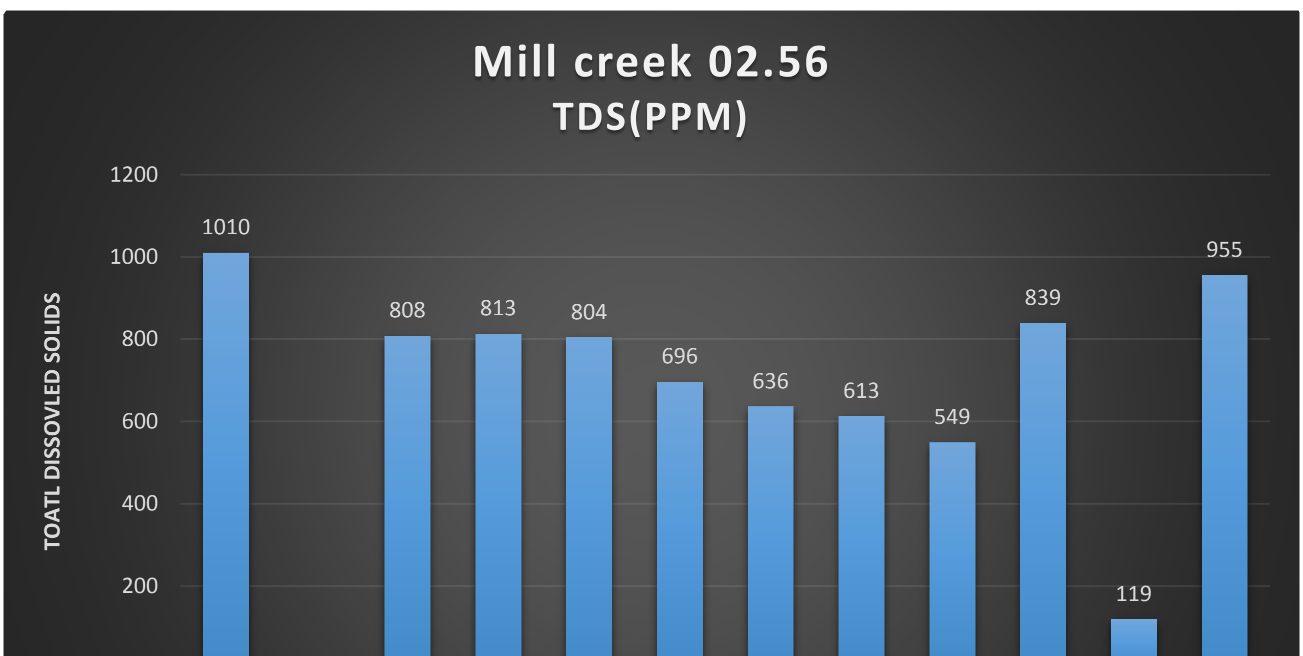
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
pH	7.74		7.99	7.94	7.89	7.98	7.88	8.31	8.17	8.18	7.76	8.13

Figure 4-164 Mill Creek 02.56 Dissolved Oxygen



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
DO (%)	83.7		91.6	85.9	95.9	95.5	83.3	104.7	101.2	117.4	82.8	121.1

Figure 4-165 Mill Creek 02.56 Total Dissolved Solids



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
TDS(PPM)	1010		808	813	804	696	636	613	549	839	119	955

Figure 4-166 Mill Creek 02.56 Conductivity

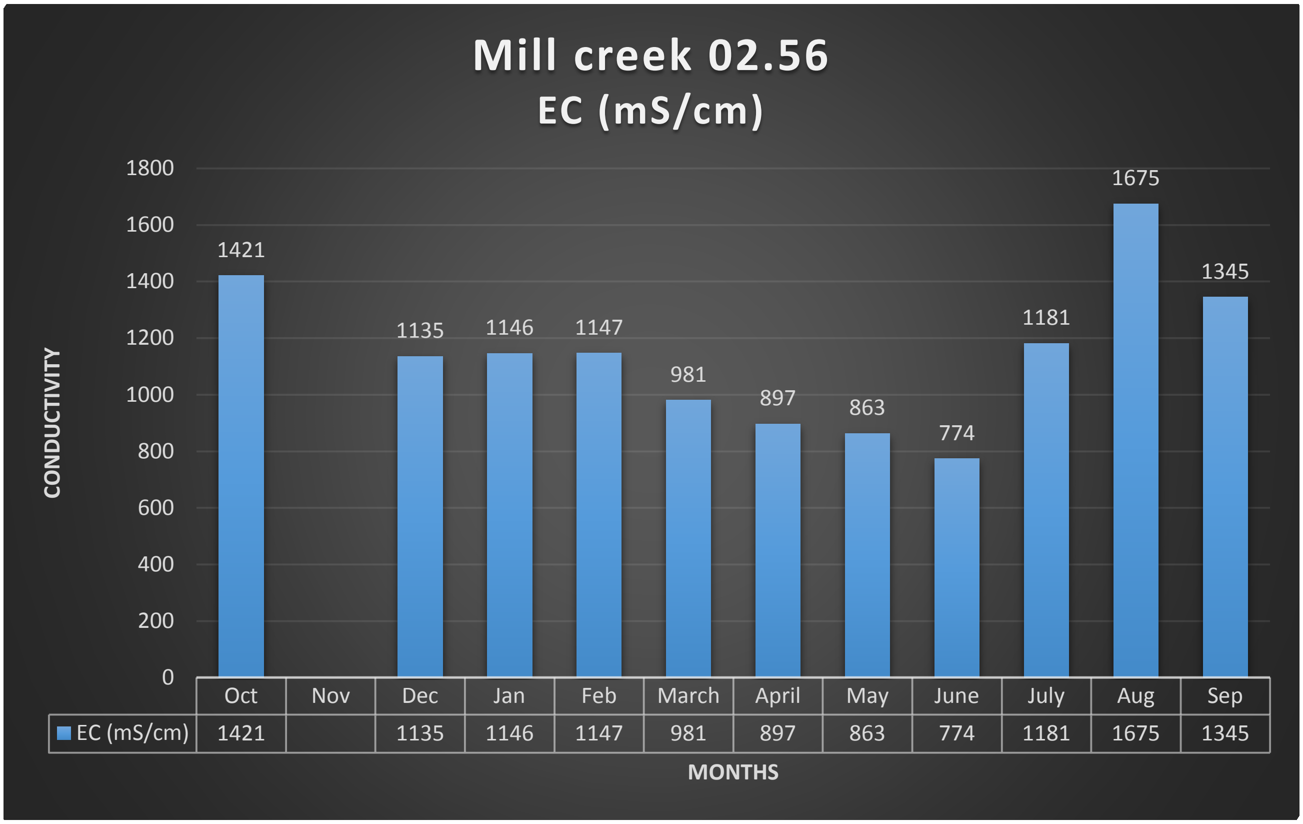


Figure 4-167 Mill Creek 02.56 Turbidity

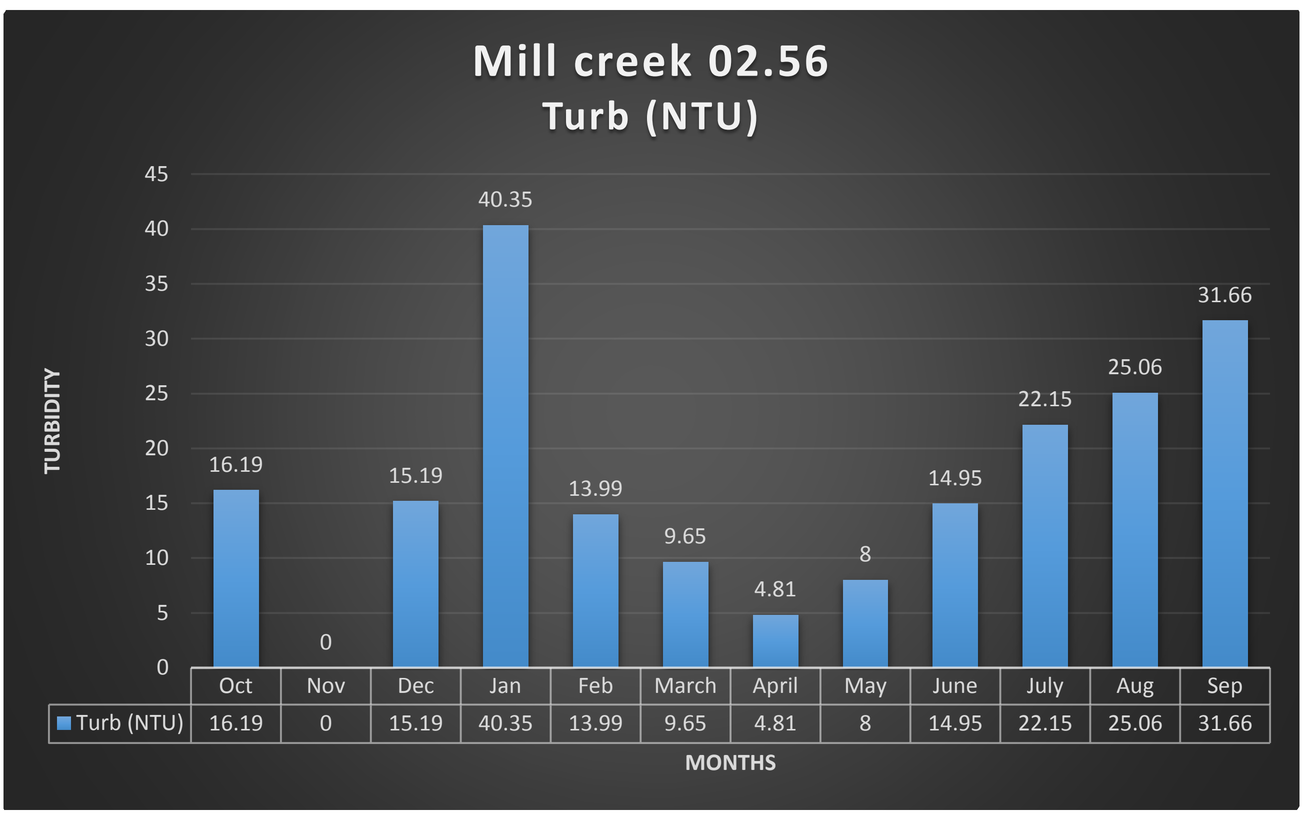
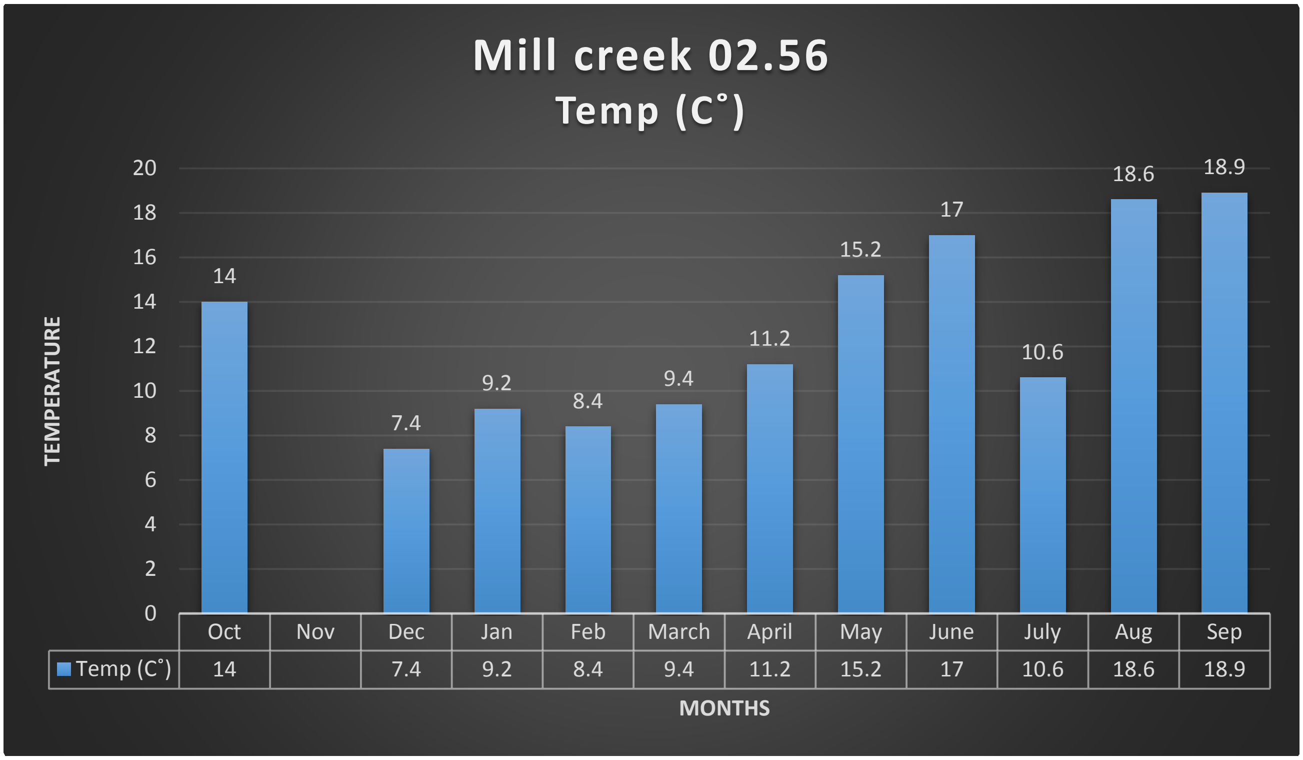
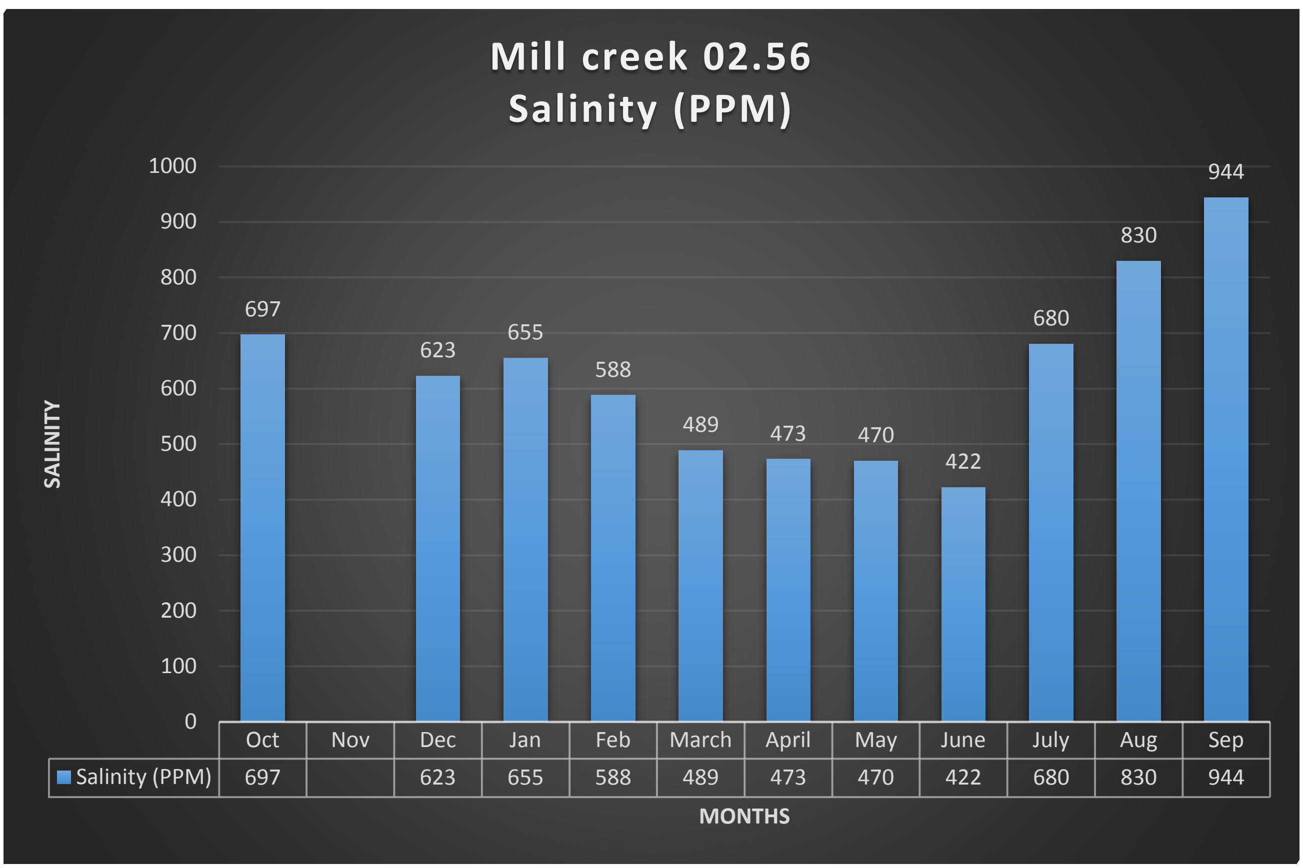


Figure 4-168 Mill Creek 02.56 Temperature



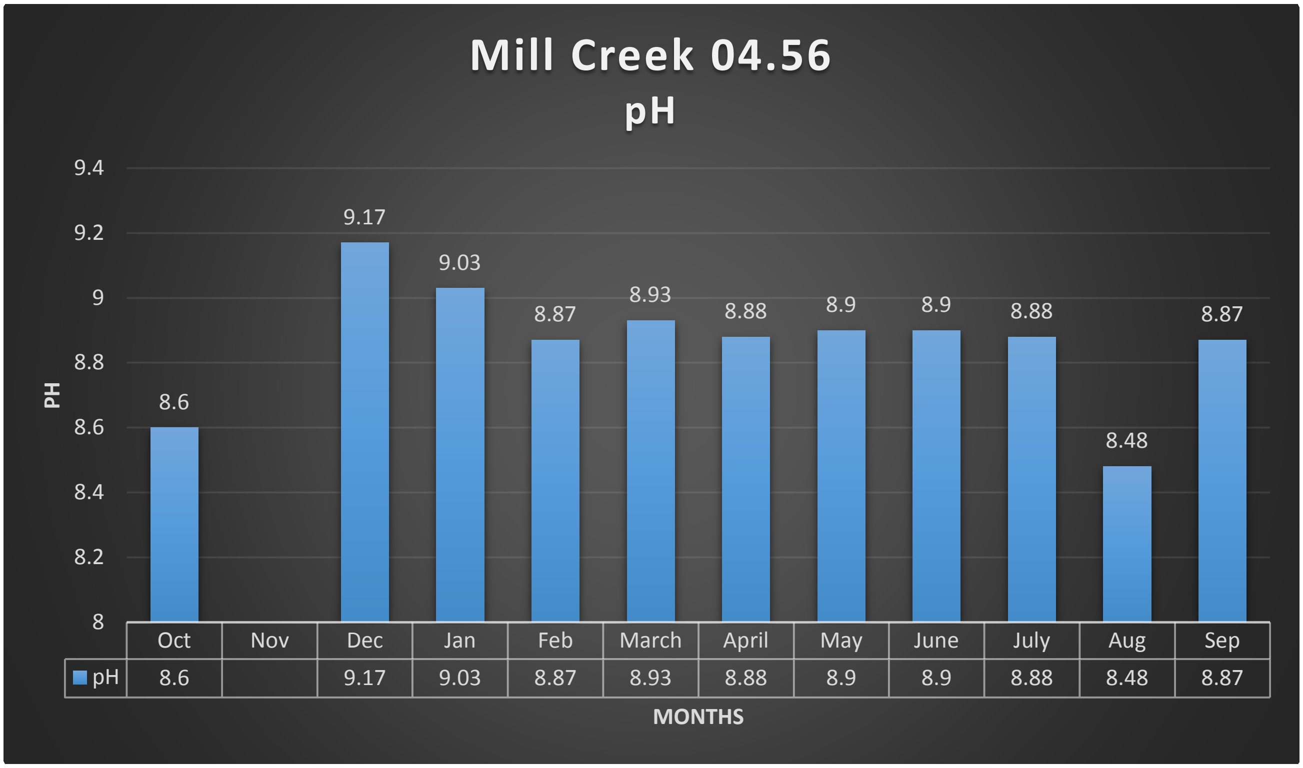
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Temp (C˚)	14		7.4	9.2	8.4	9.4	11.2	15.2	17	10.6	18.6	18.9

Figure 4-169 Mill Creek 02.56 Salinity



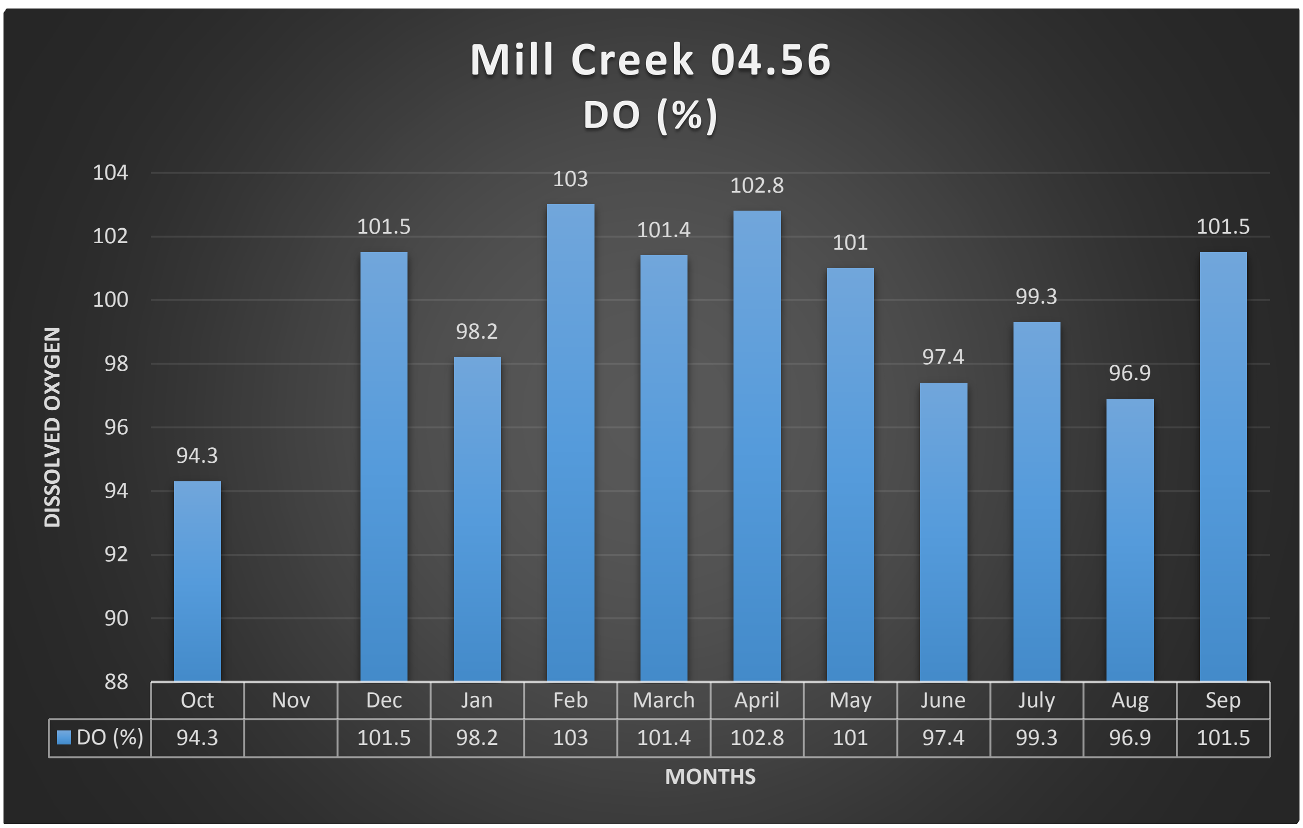
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Salinity (PPM)	697		623	655	588	489	473	470	422	680	830	944

Figure 4-170 Mill Creek 04.56 pH



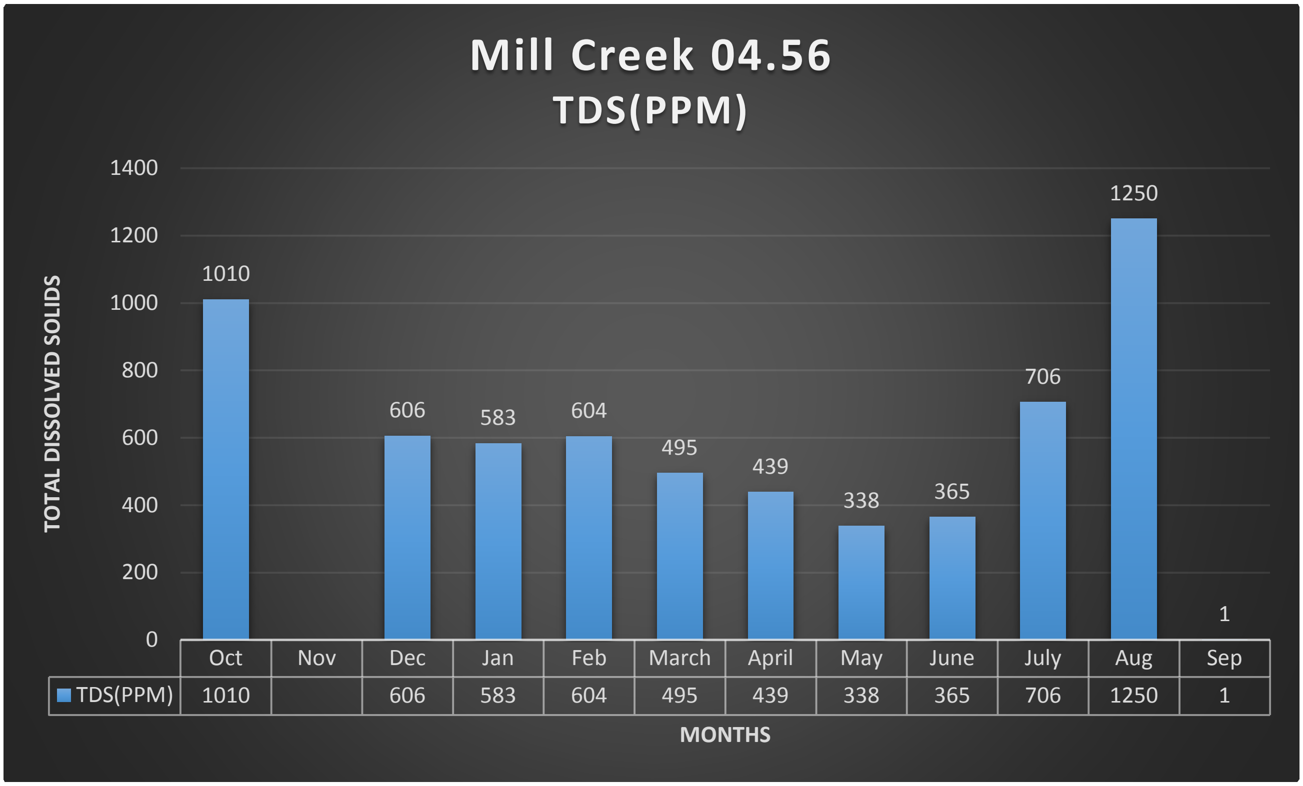
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
pH	8.6		9.17	9.03	8.87	8.93	8.88	8.9	8.9	8.88	8.48	8.87

Figure 4-171 Mill Creek 04.56 Dissolved Oxygen



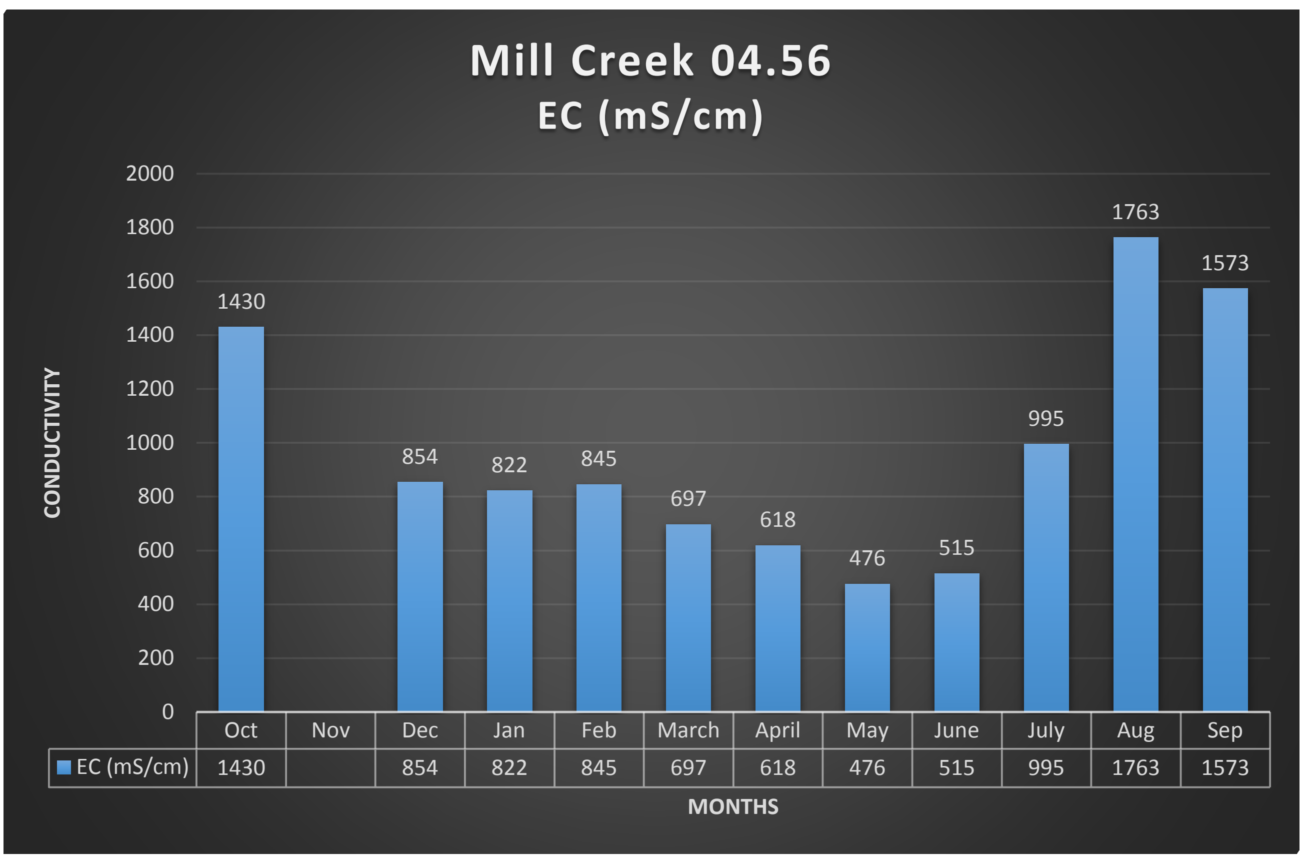
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
DO (%)	94.3		101.5	98.2	103	101.4	102.8	101	97.4	99.3	96.9	101.5

Figure 4-172 Mill Creek 04.56 Total Dissolved Solids



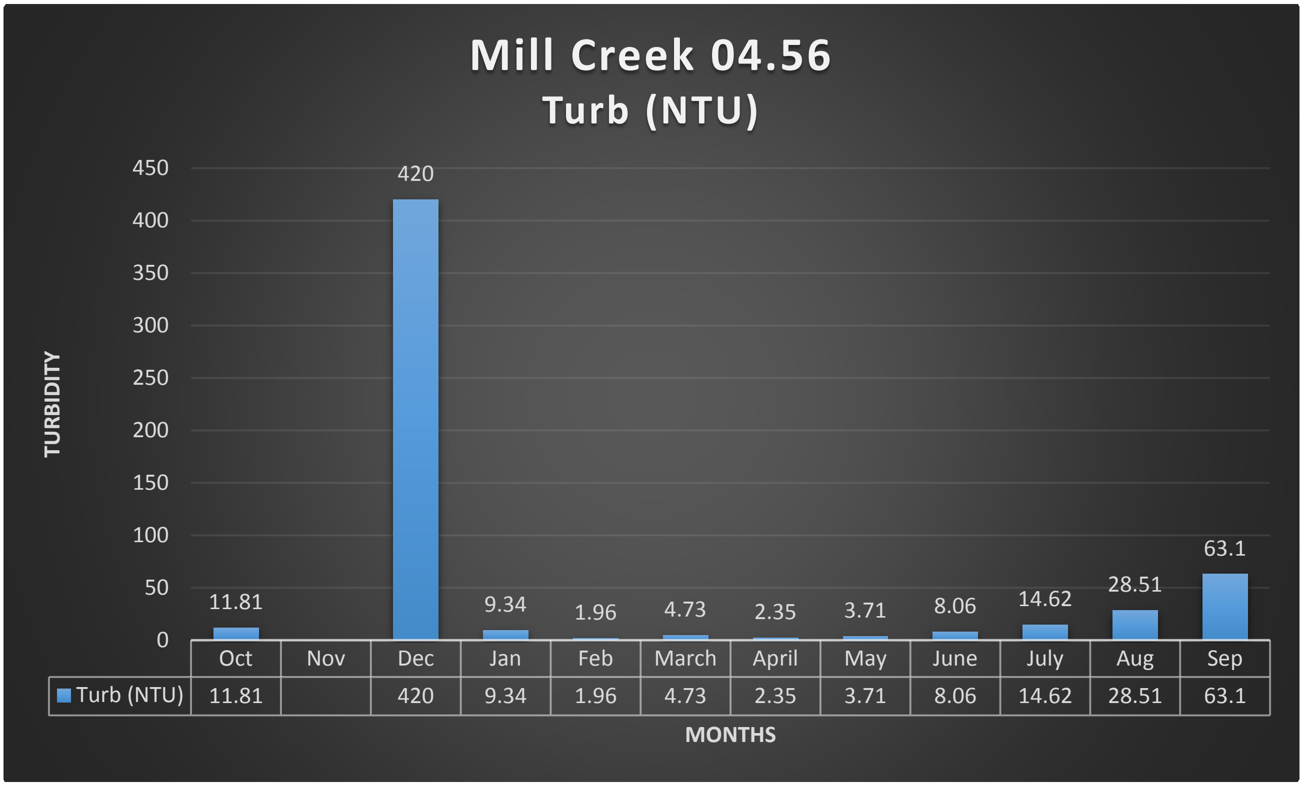
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
TDS(PPM)	1010		606	583	604	495	439	338	365	706	1250	1

Figure 4-173 Mill Creek 04.56 Conductivity



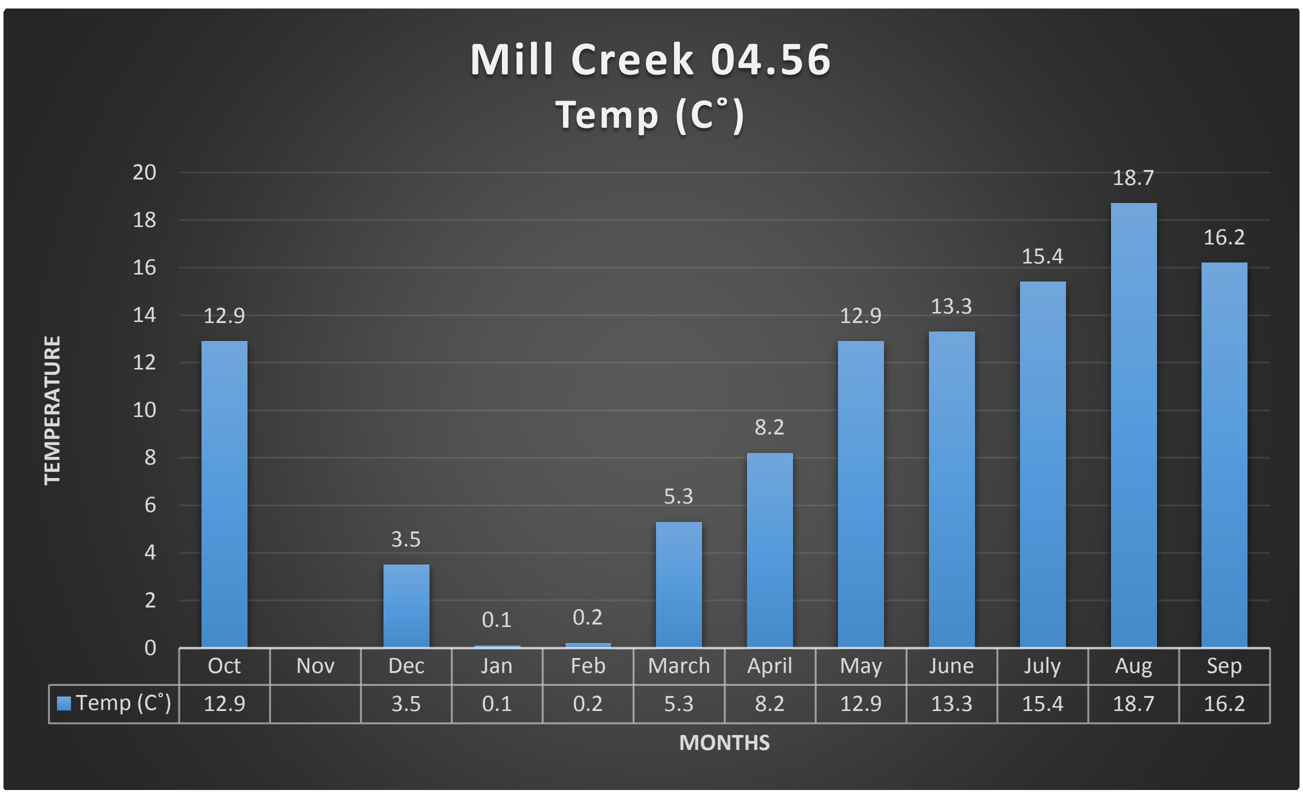
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
EC (mS/cm)	1430		854	822	845	697	618	476	515	995	1763	1573

Figure 4-174 Mill Creek 04.56 Turbidity



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Turb (NTU)	11.81		420	9.34	1.96	4.73	2.35	3.71	8.06	14.62	28.51	63.1

Figure 4-175 Mill Creek 04.56 Temperature



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Temp (C˚)	12.9		3.5	0.1	0.2	5.3	8.2	12.9	13.3	15.4	18.7	16.2

Figure 4-176 Mill Creek 04.56 Salinity

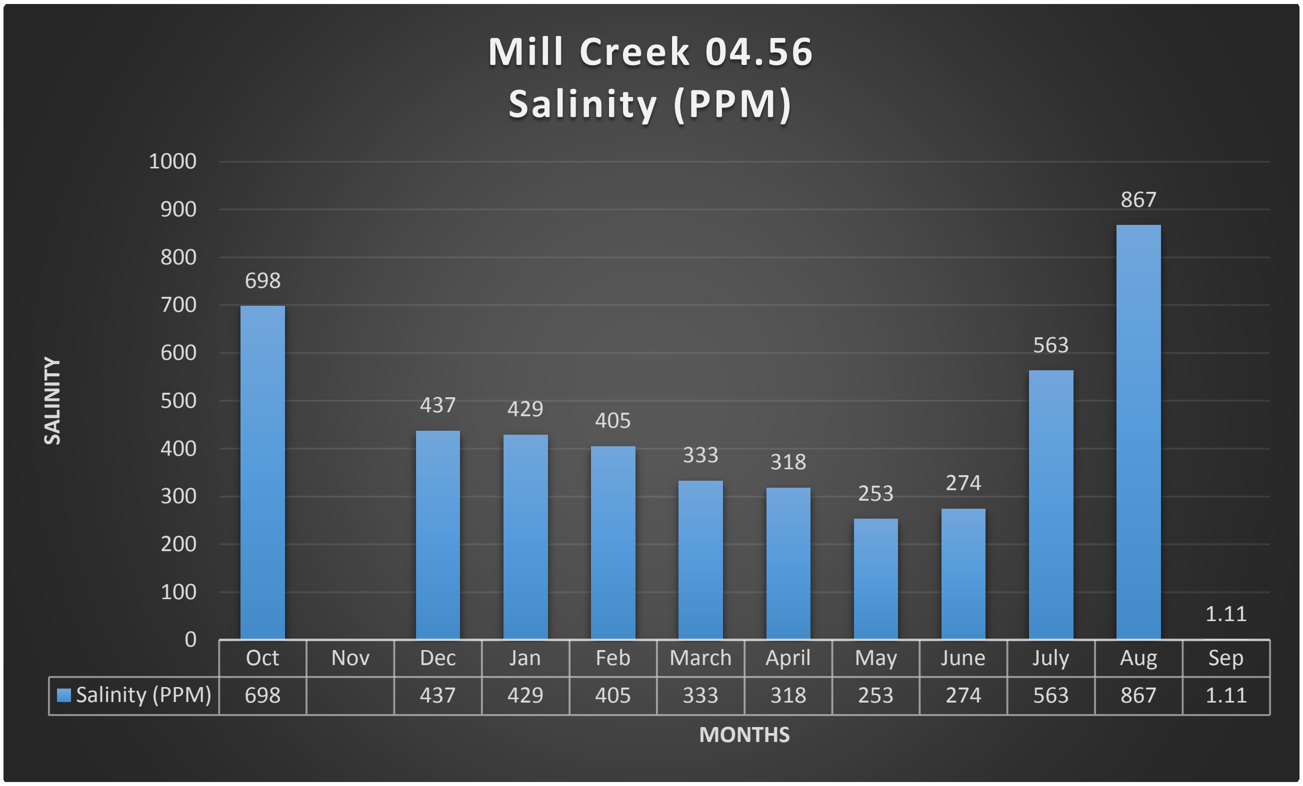


Figure 4-177 Mill Creek 07.09 pH

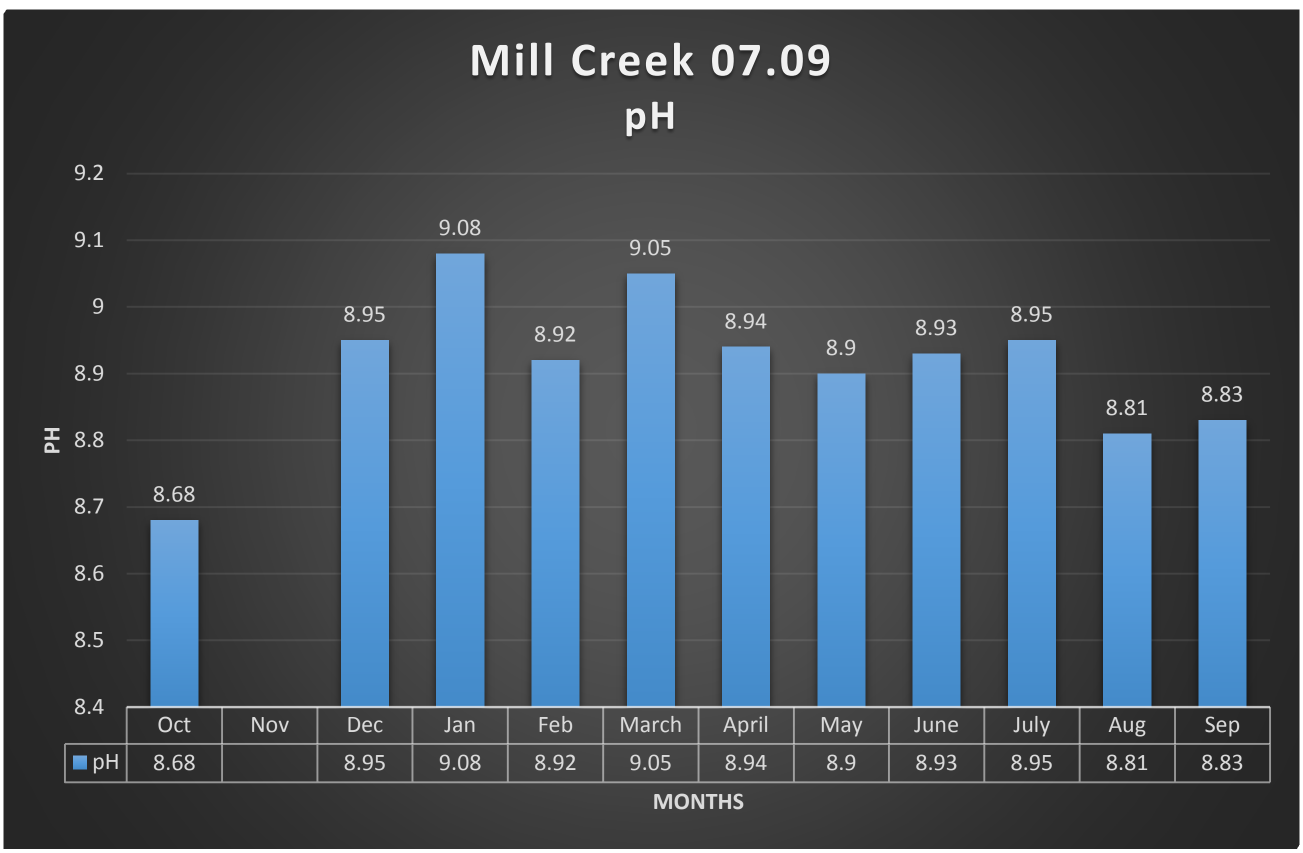


Figure 4-178 Mill Creek 07.09 Dissolved Oxygen

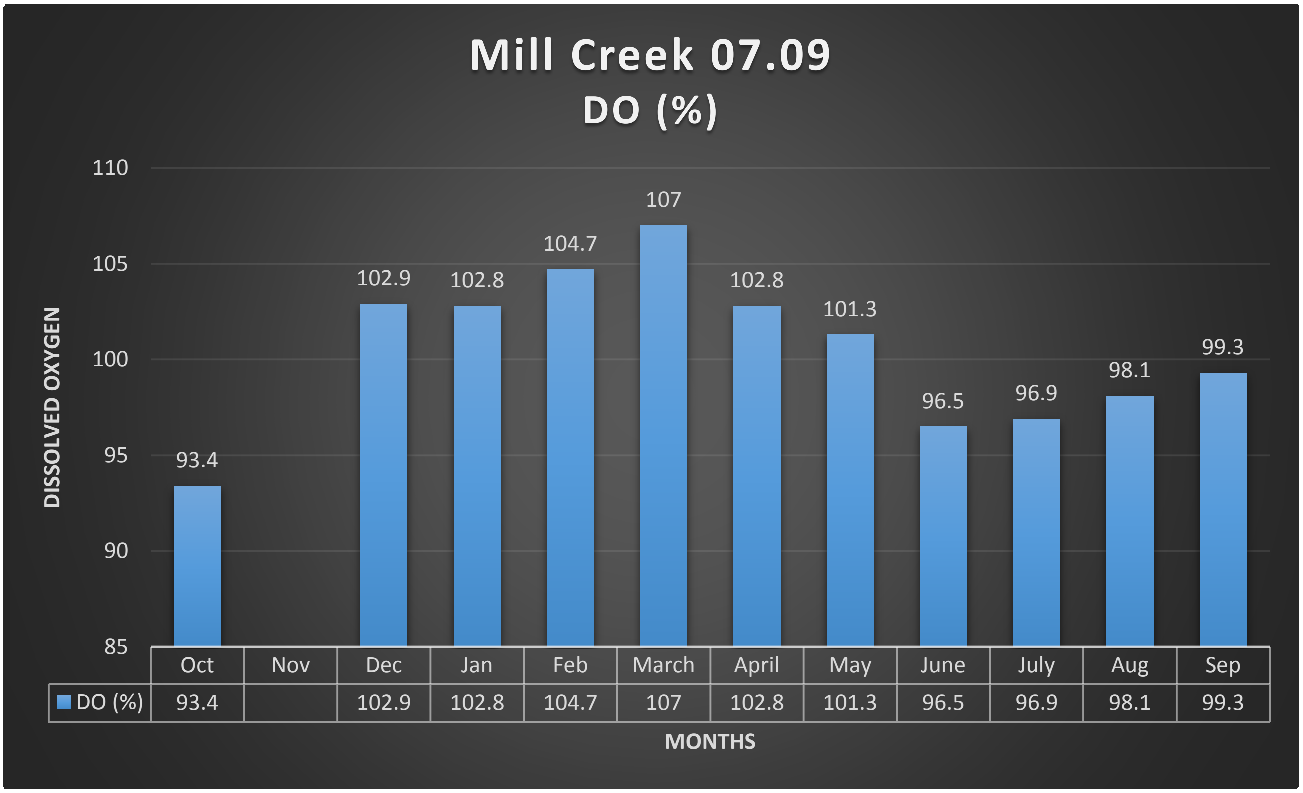


Figure 4-179 Mill Creek 07.09 Total Dissolved Solids

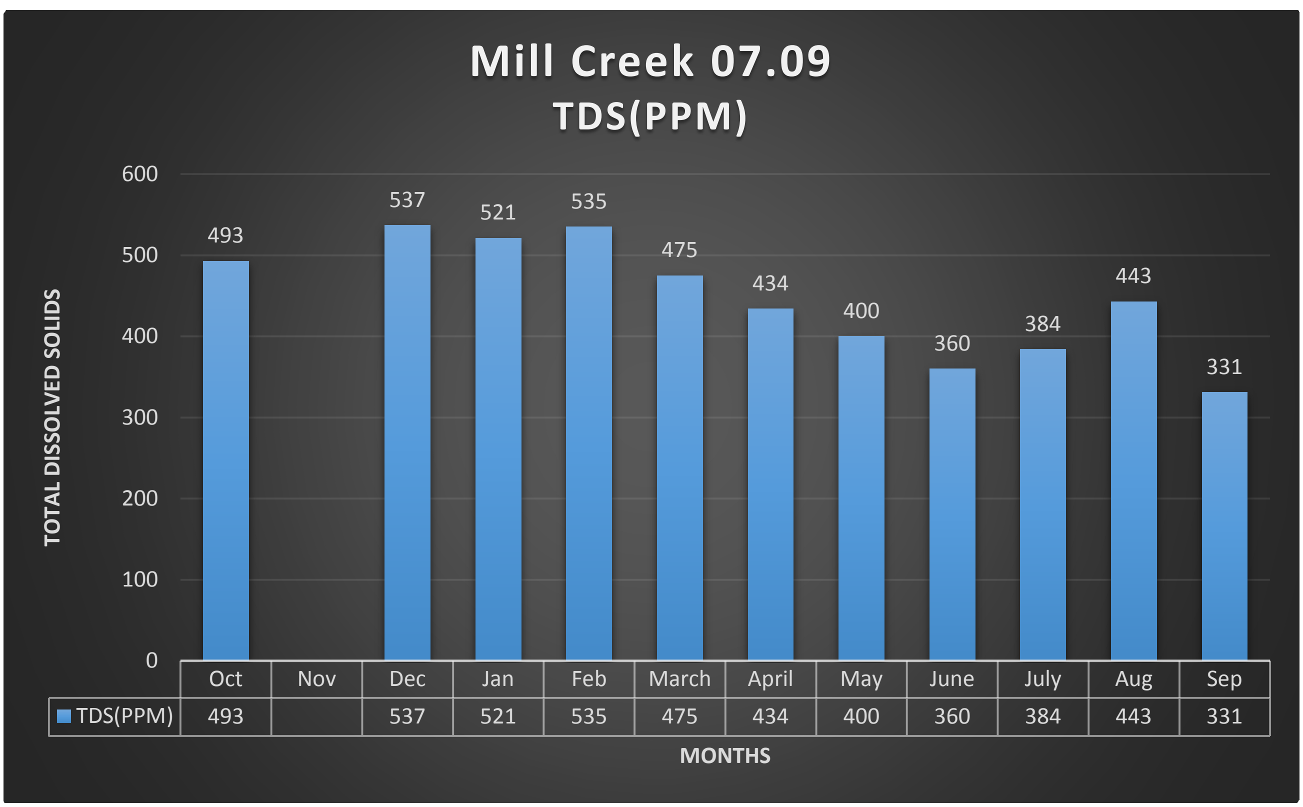


Figure 4-180 Mill Creek 07.09 Conductivity

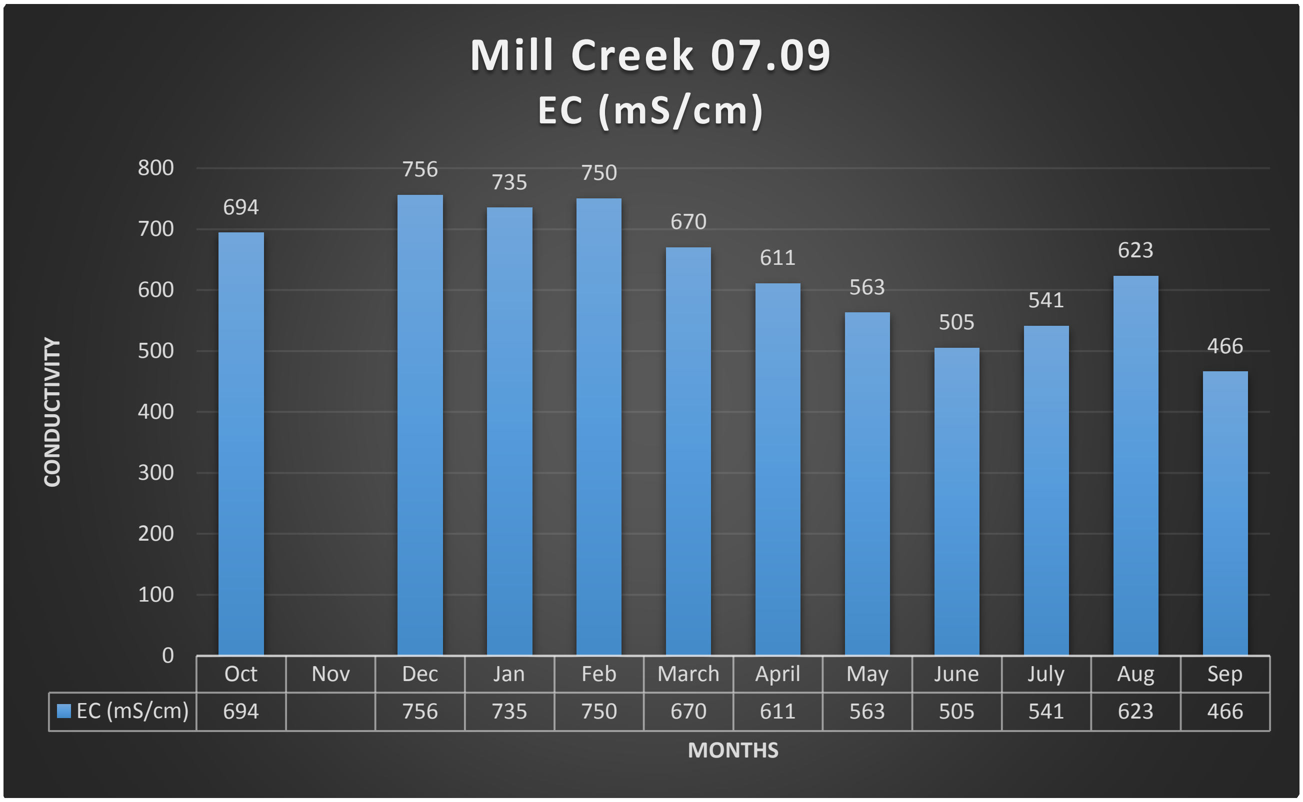


Figure 4-181 Mill Creek 07.09 Turbidity

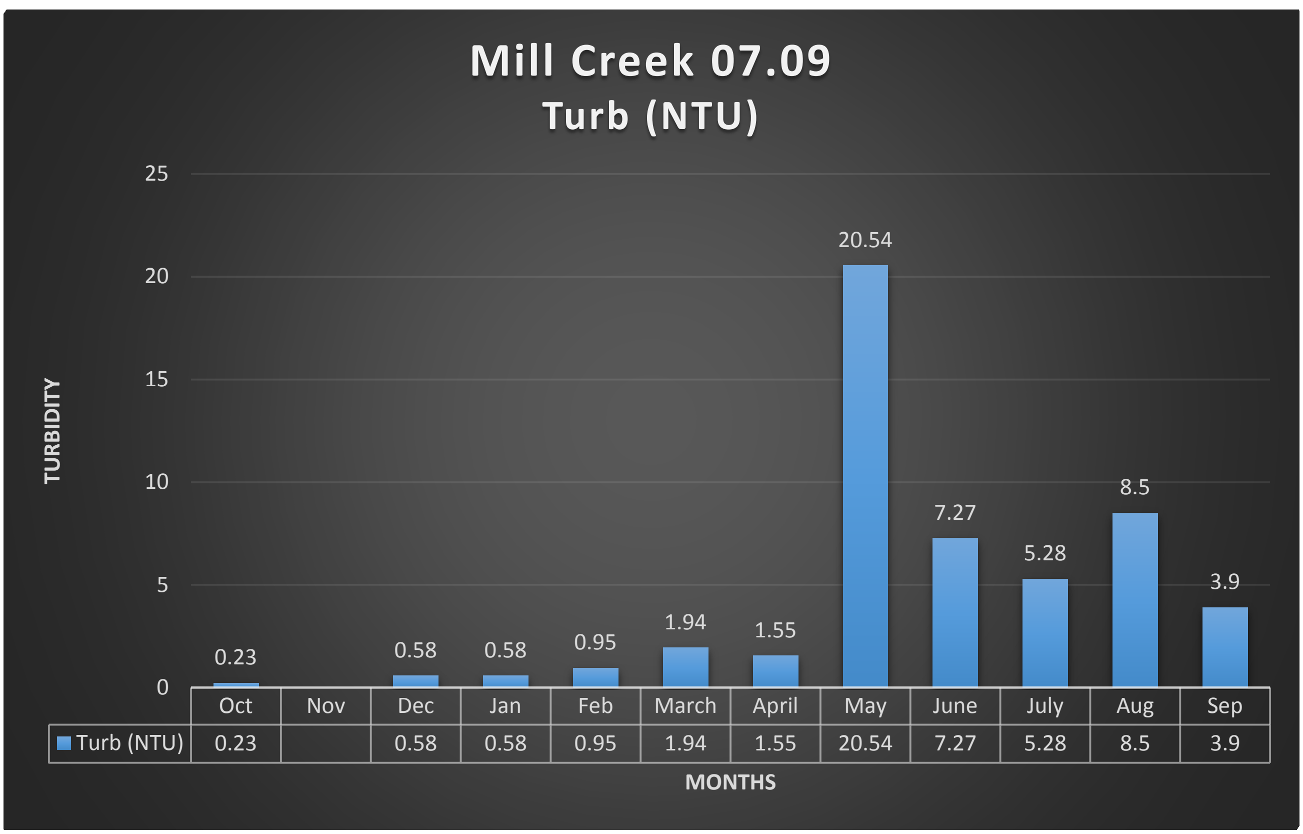


Figure 4-182 Mill Creek 07.09 Temperature

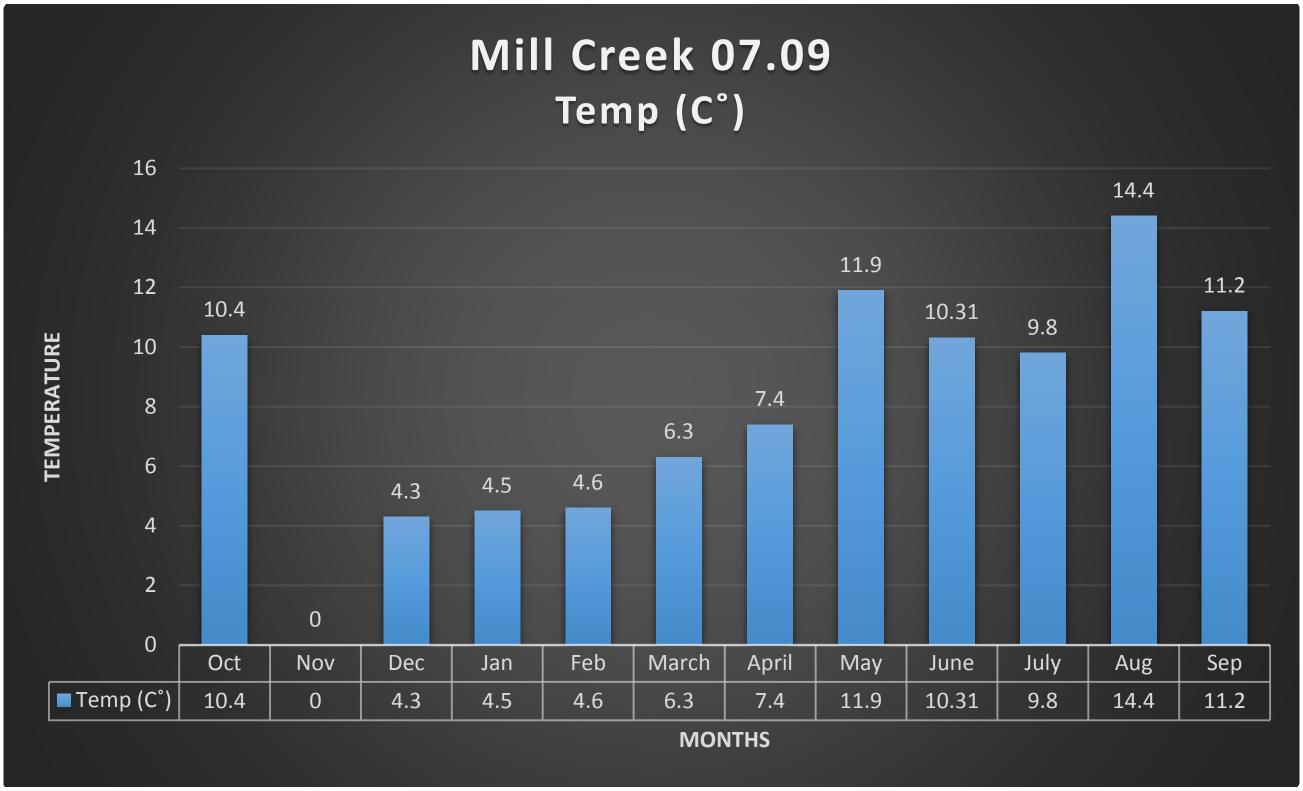


Figure 4-183 Mill Creek 07.09 Salinity

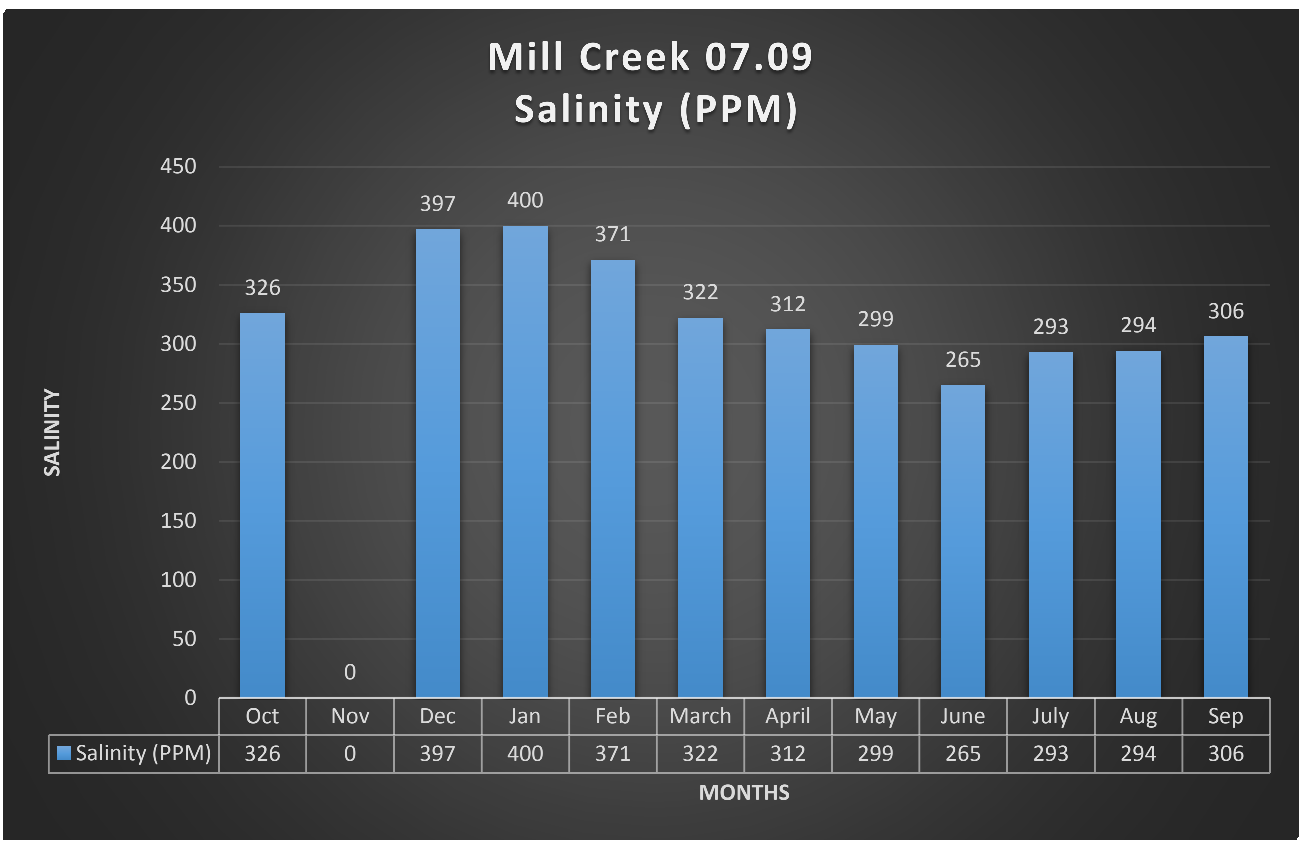
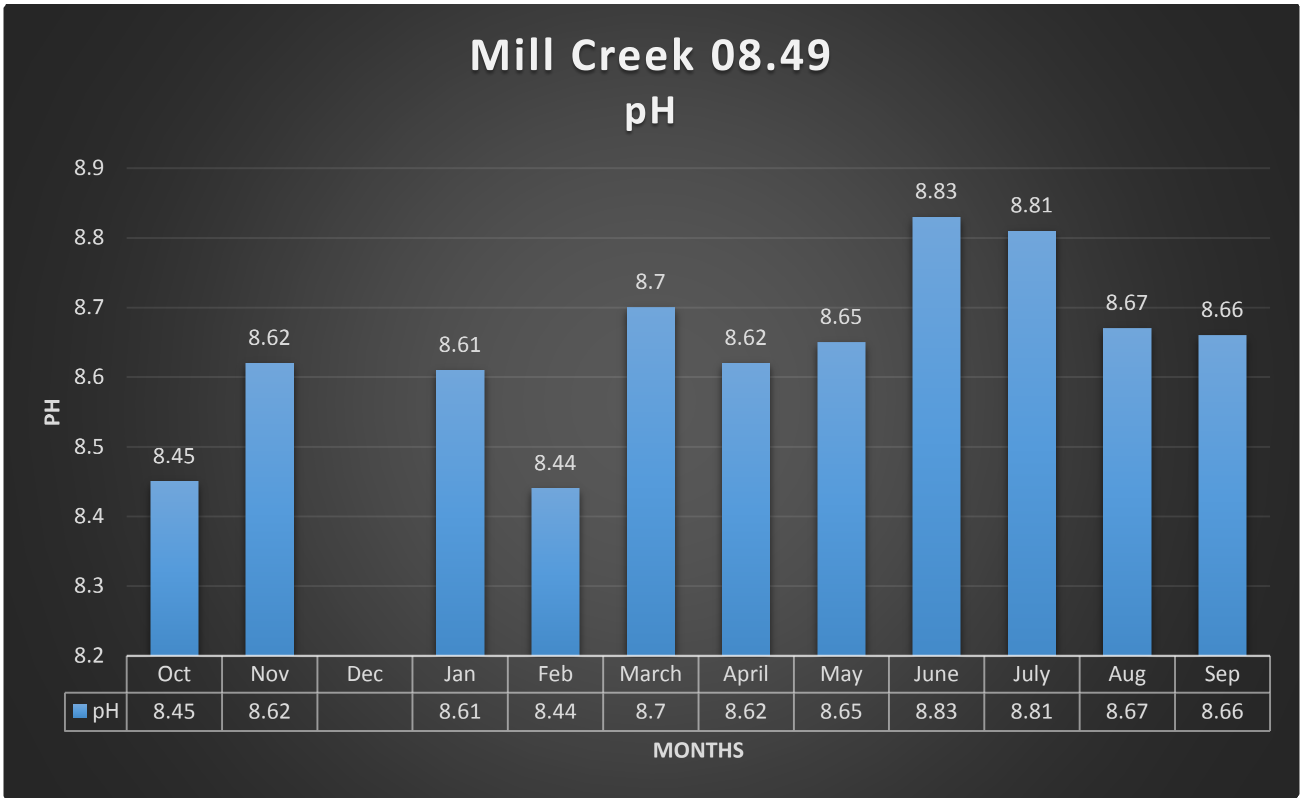
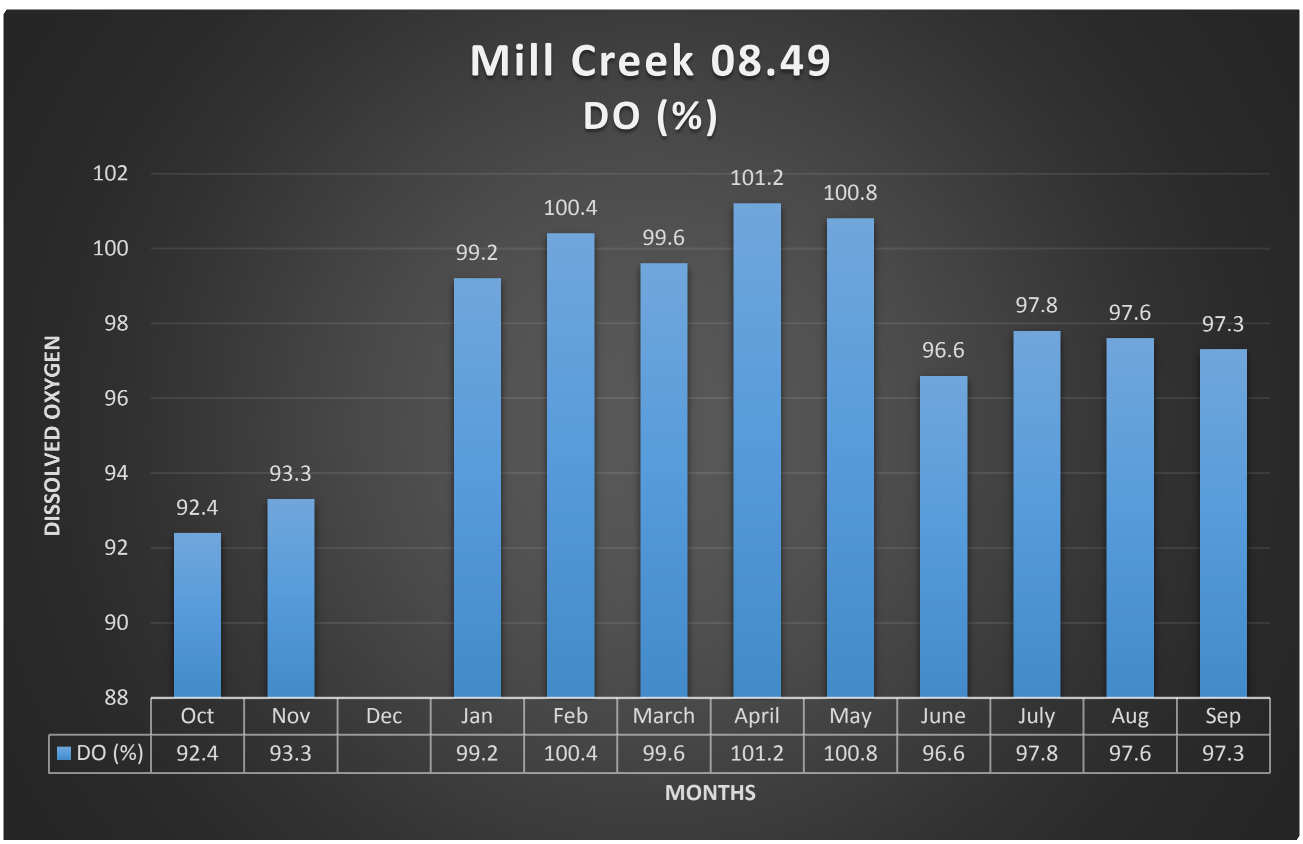


Figure 4-184 Mill Creek 08.49 pH



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
pH	8.45	8.62		8.61	8.44	8.7	8.62	8.65	8.83	8.81	8.67	8.66

Figure 4-185 Mill Creek 08.49 Dissolved Oxygen



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
DO (%)	92.4	93.3		99.2	100.4	99.6	101.2	100.8	96.6	97.8	97.6	97.3

Figure 4-186 Mill Creek 08.49 Total Dissolved Solids

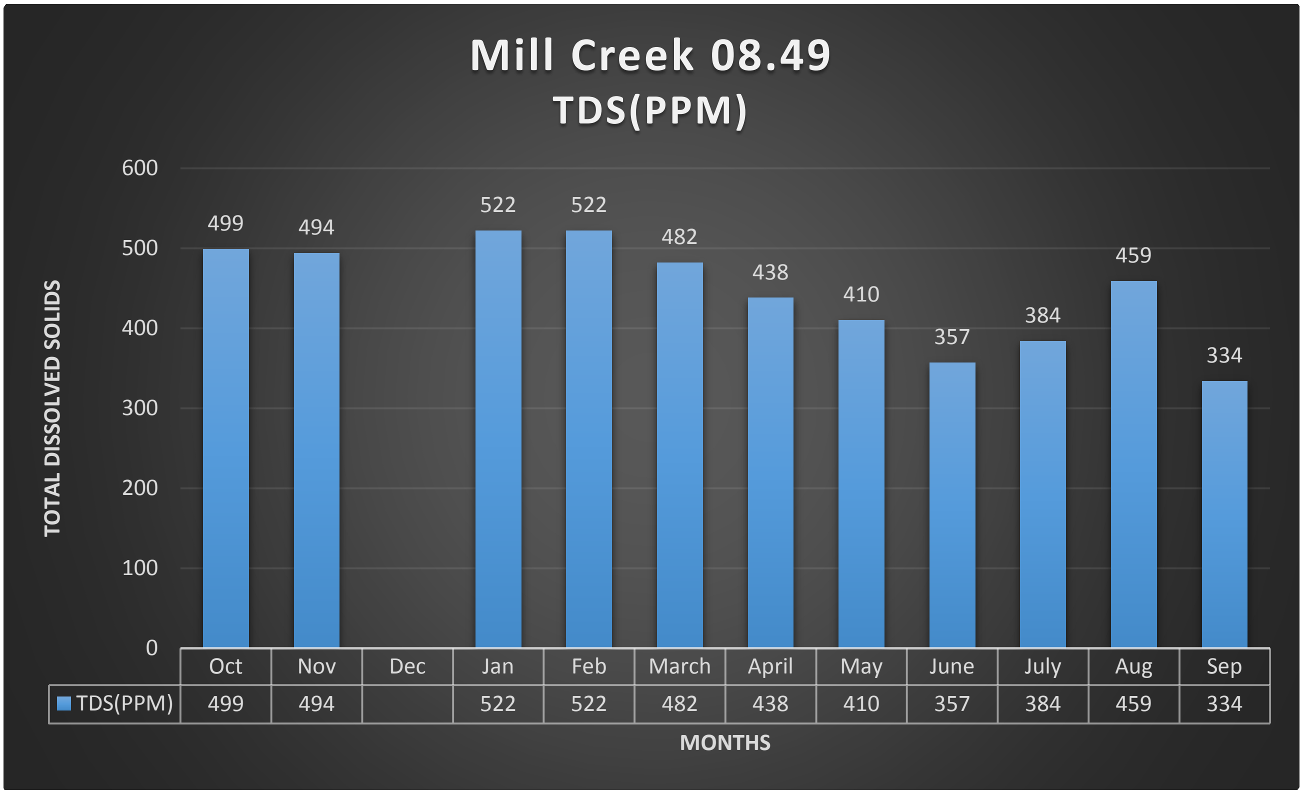


Figure 4-187 Mill Creek 08.49 Conductivity

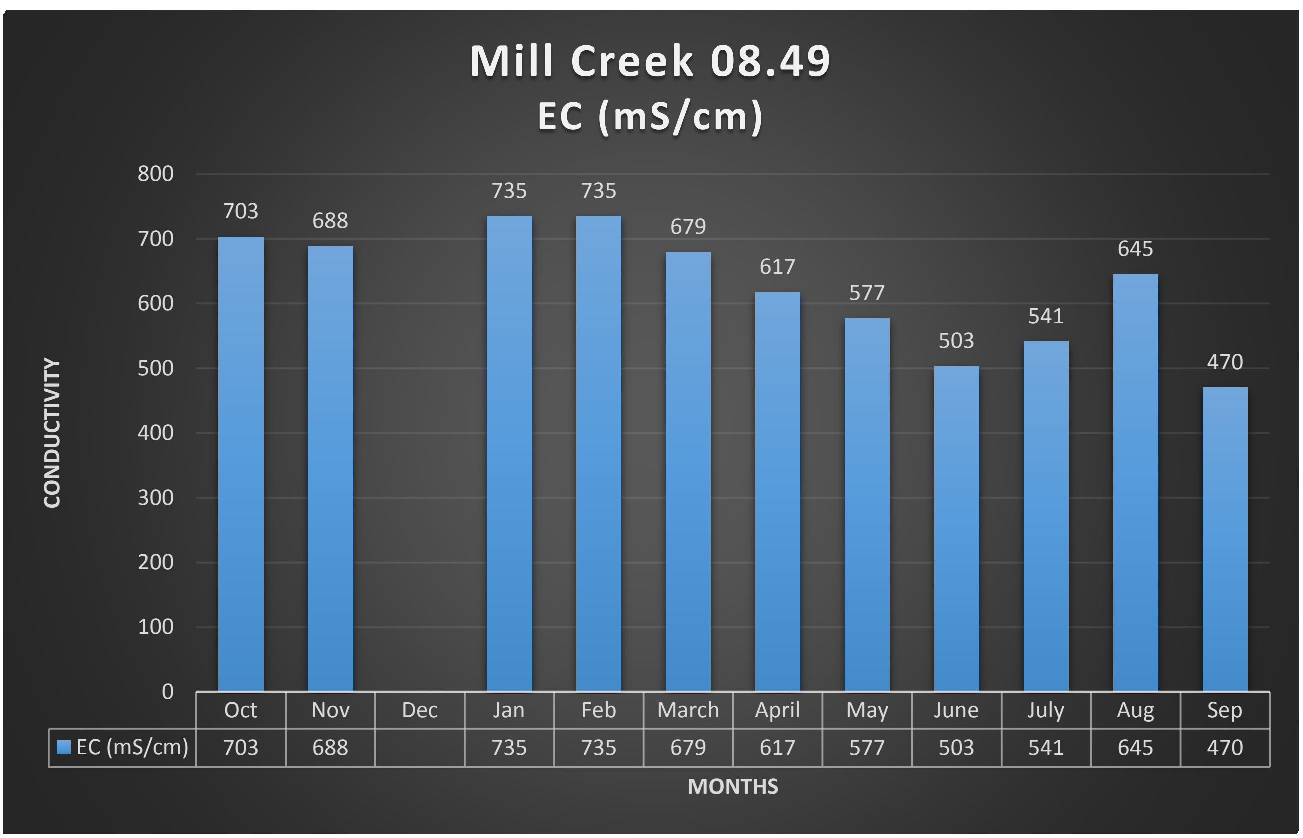
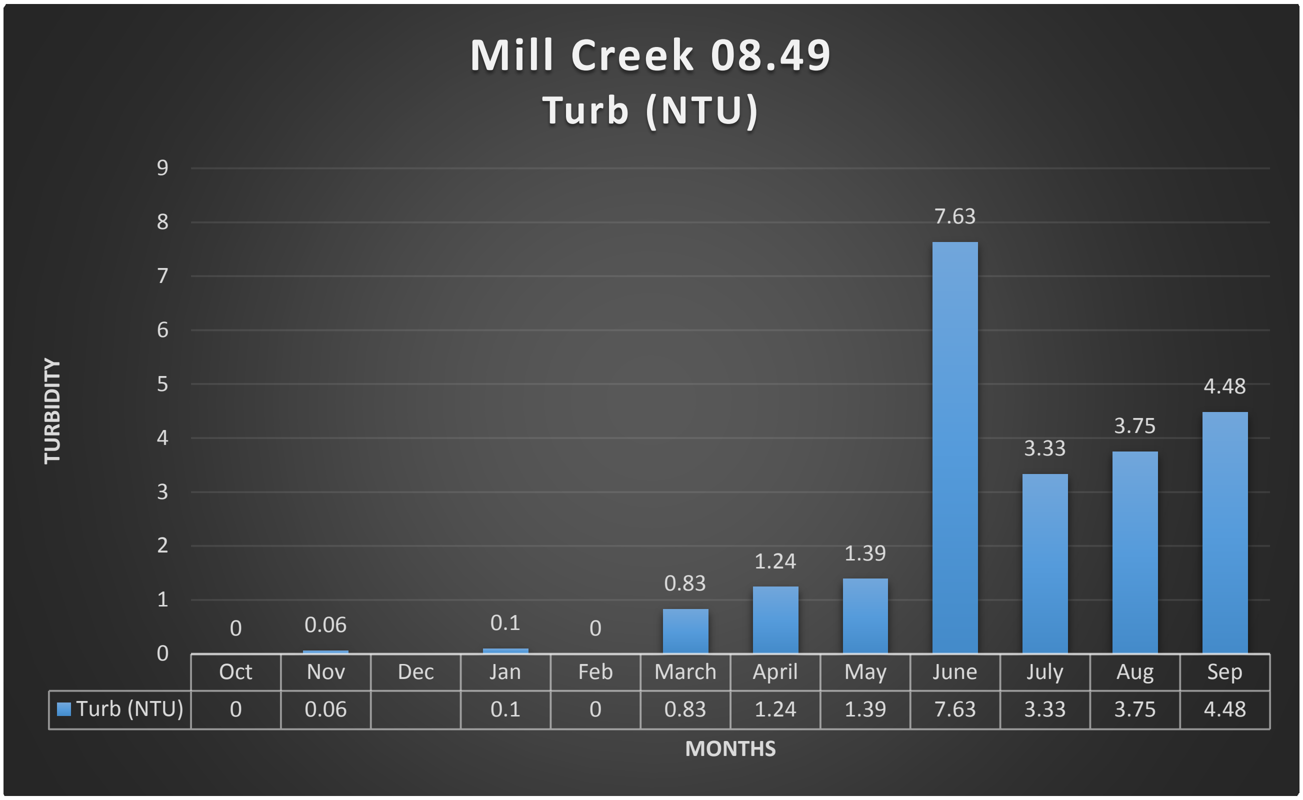
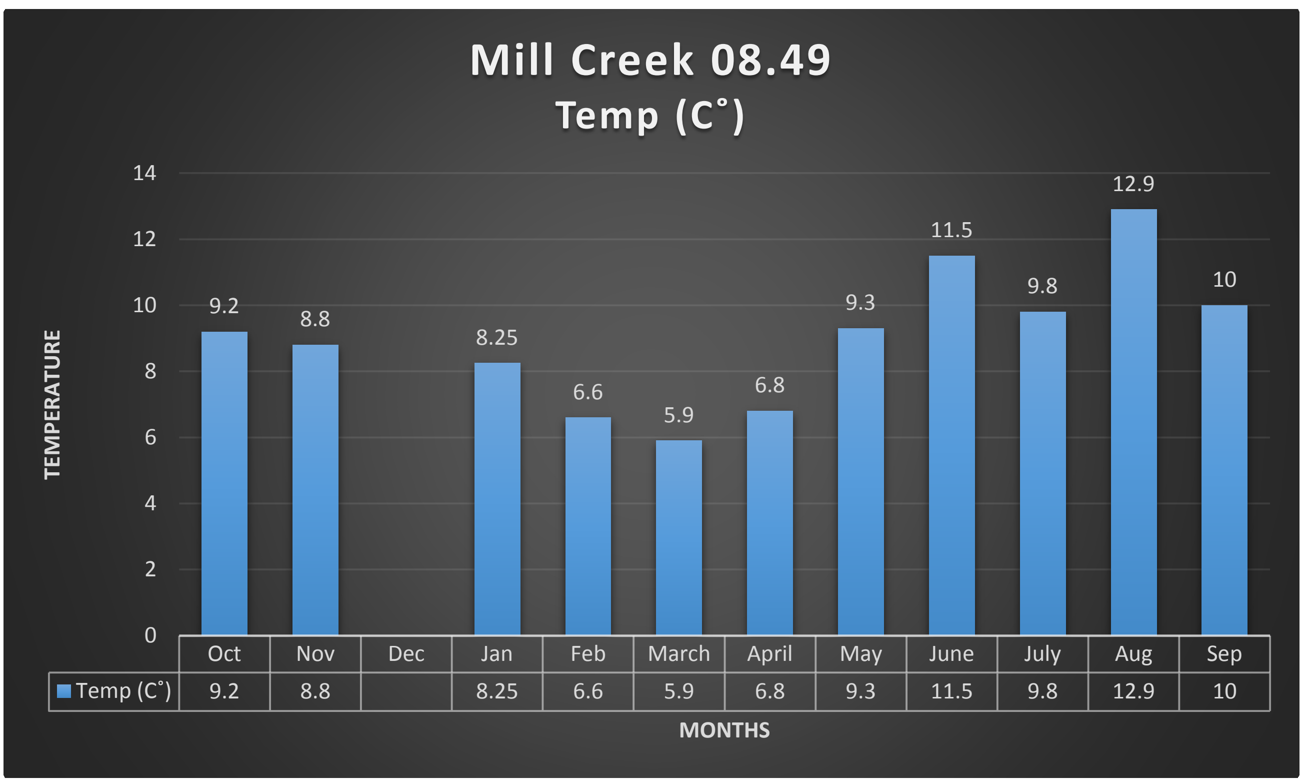


Figure 4-188 Mill Creek 08.49 Turbidity



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Turb (NTU)	0	0.06		0.1	0	0.83	1.24	1.39	7.63	3.33	3.75	4.48

Figure 4-189 Mill Creek 08.49 Temperature



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Temp (C˚)	9.2	8.8		8.25	6.6	5.9	6.8	9.3	11.5	9.8	12.9	10

Figure 4-190 Mill Creek 08.49 Salinity

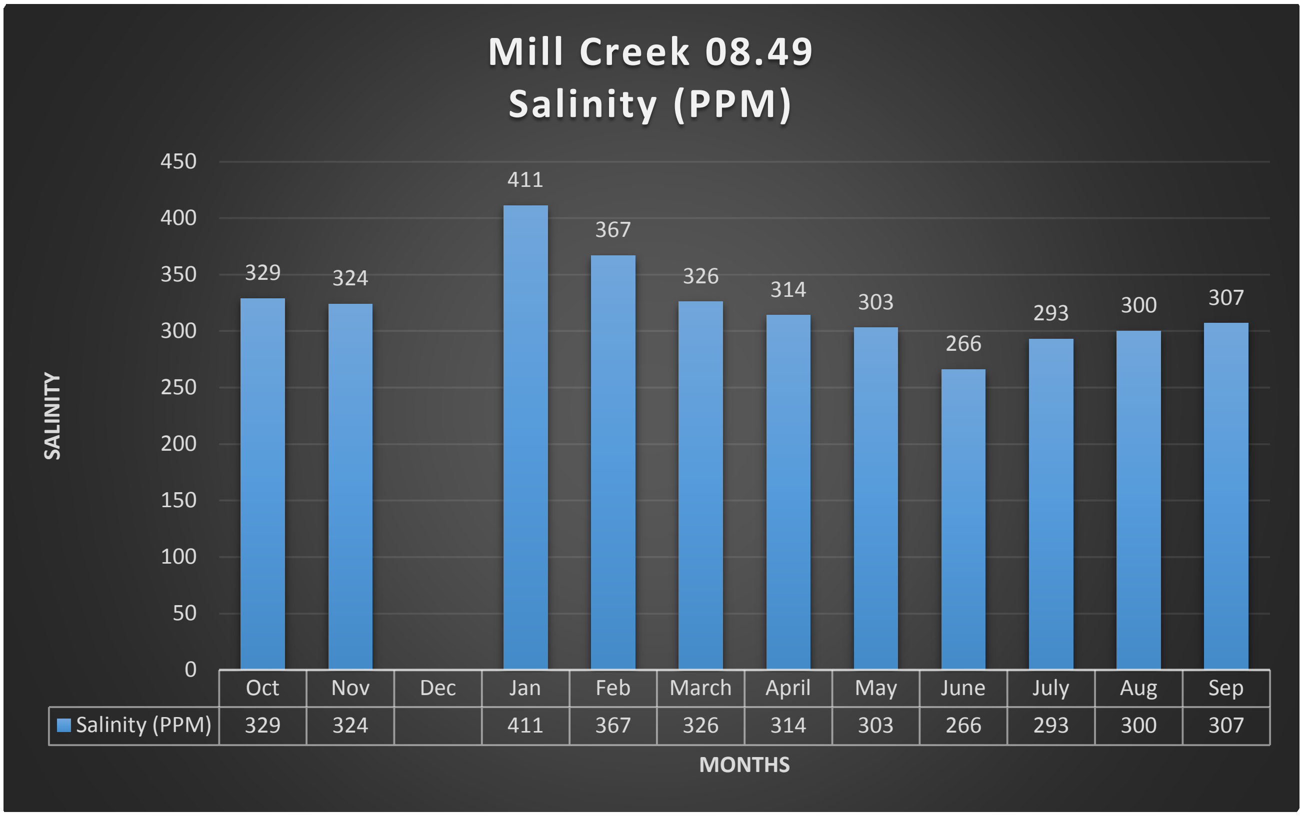


Figure 4-191 Mill Creek 11.70 pH

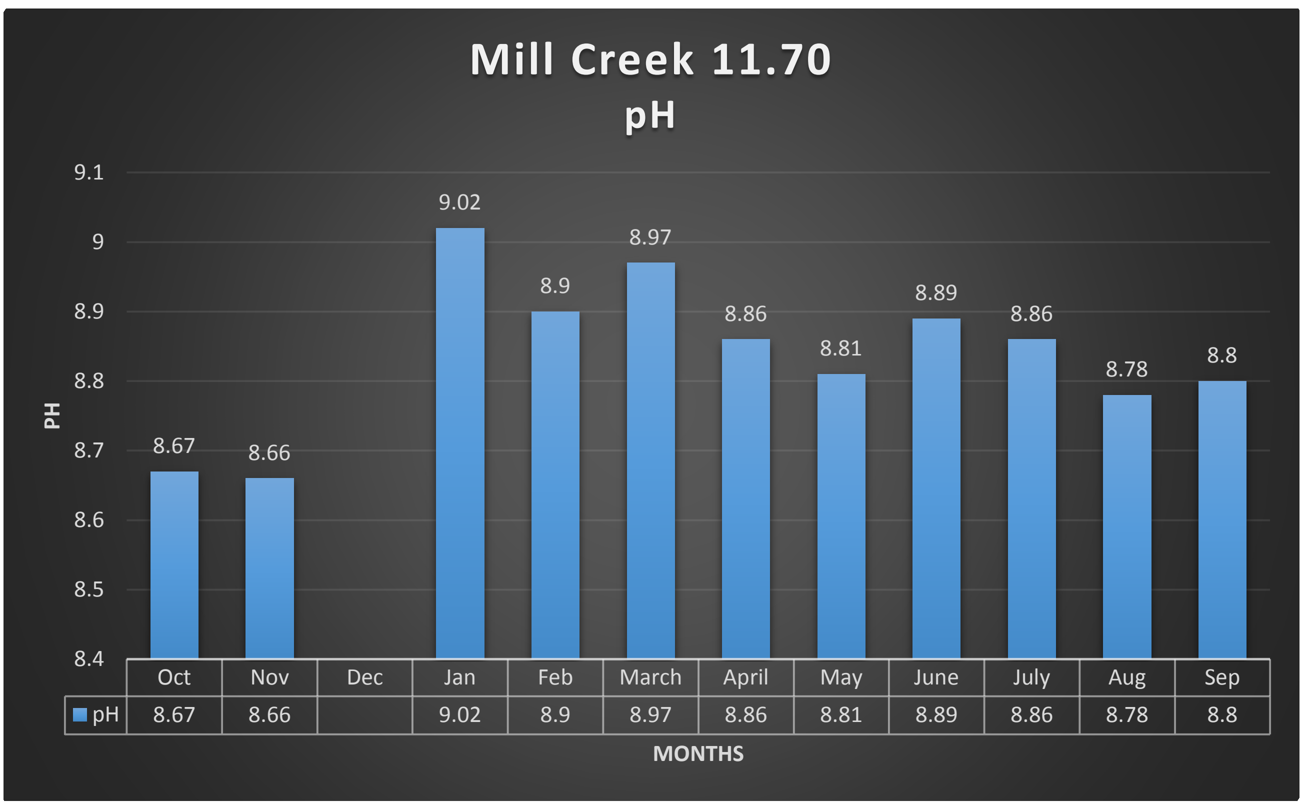
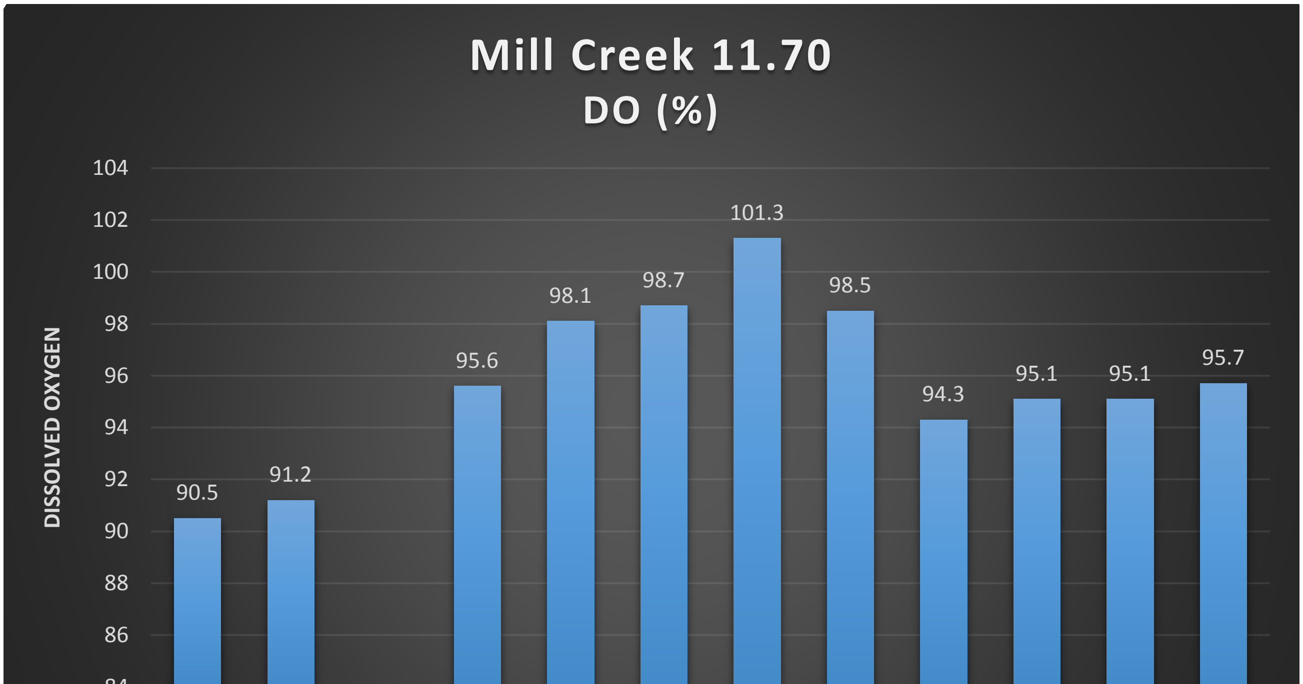
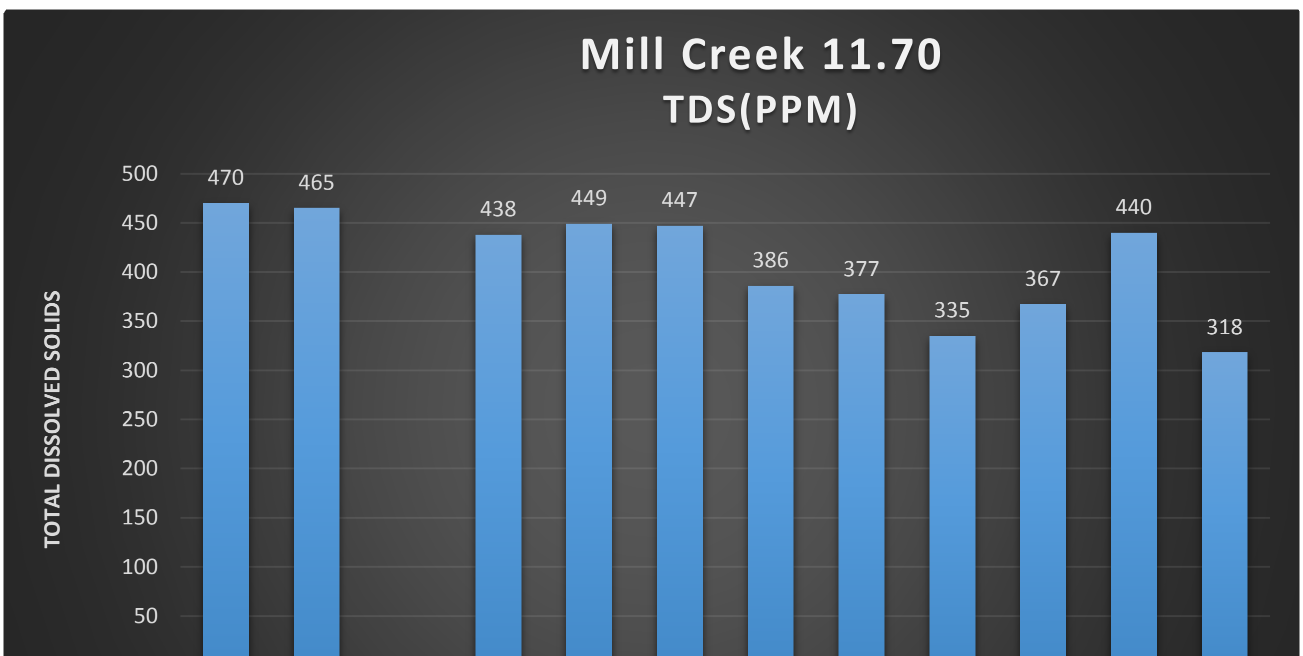


Figure 4-192 Mill Creek 11.70 Dissolved Oxygen



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
DO (%)	90.5	91.2		95.6	98.1	98.7	101.3	98.5	94.3	95.1	95.1	95.7

Figure 4-193 Mill Creek 11.70 Total Dissolved Solids



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
TDS(PPM)	470	465		438	449	447	386	377	335	367	440	318

Figure 4-194 Mill Creek 11.70 Conductivity

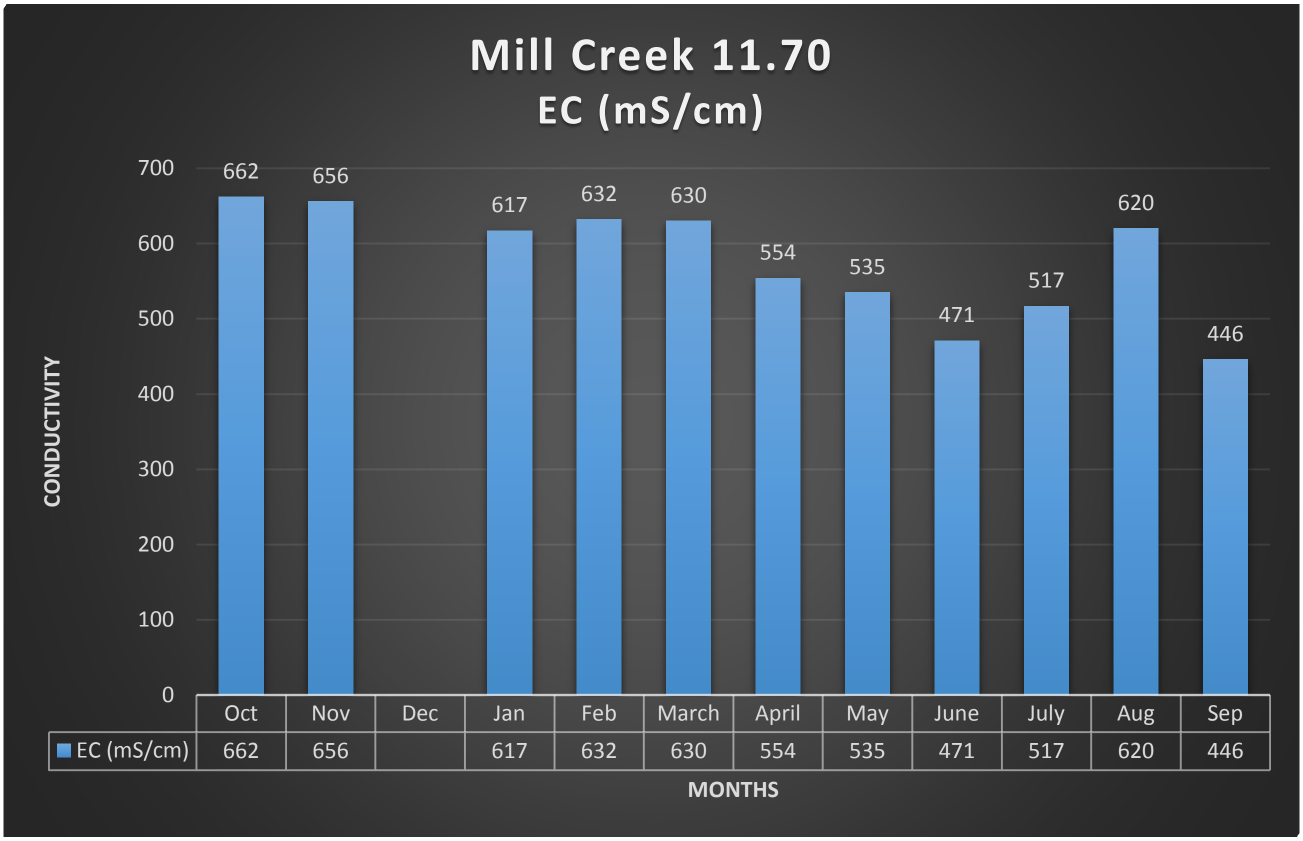


Figure 4-195 Mill Creek 11.70 Turbidity

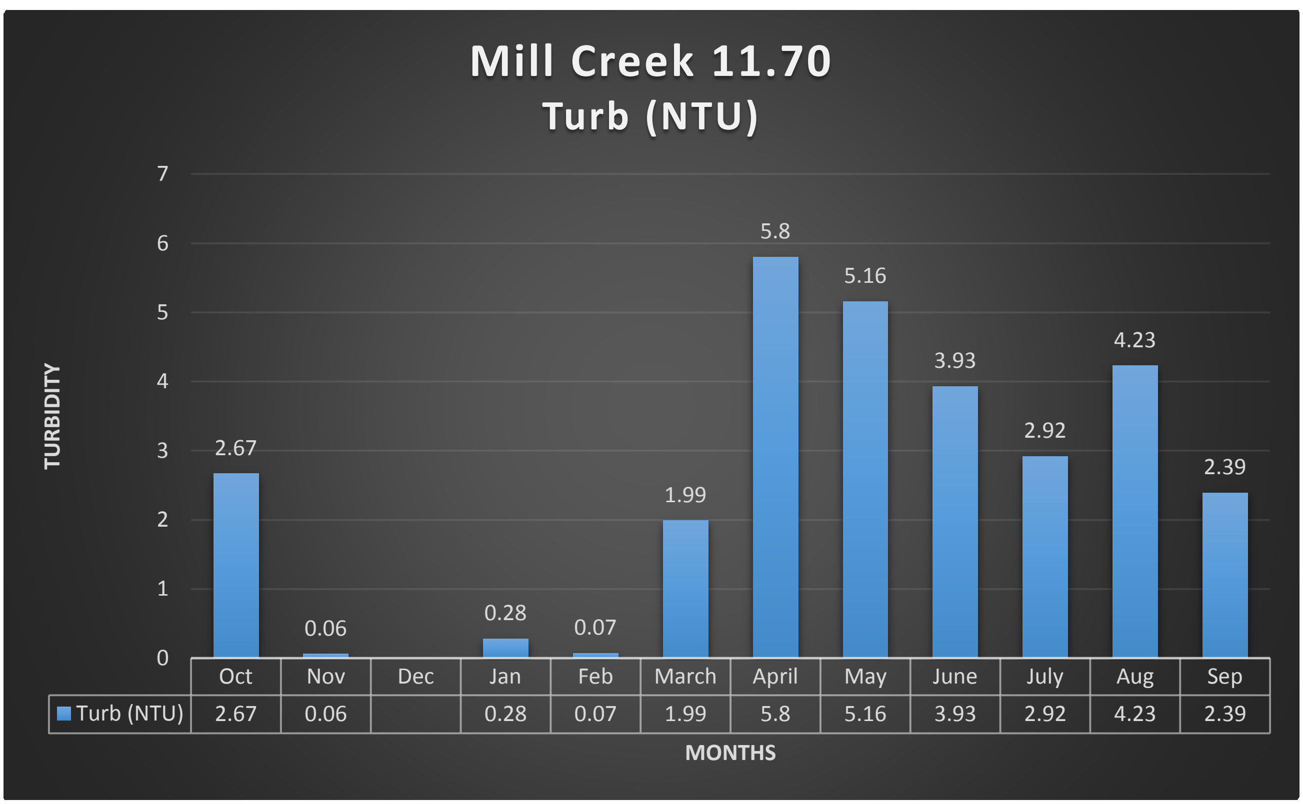
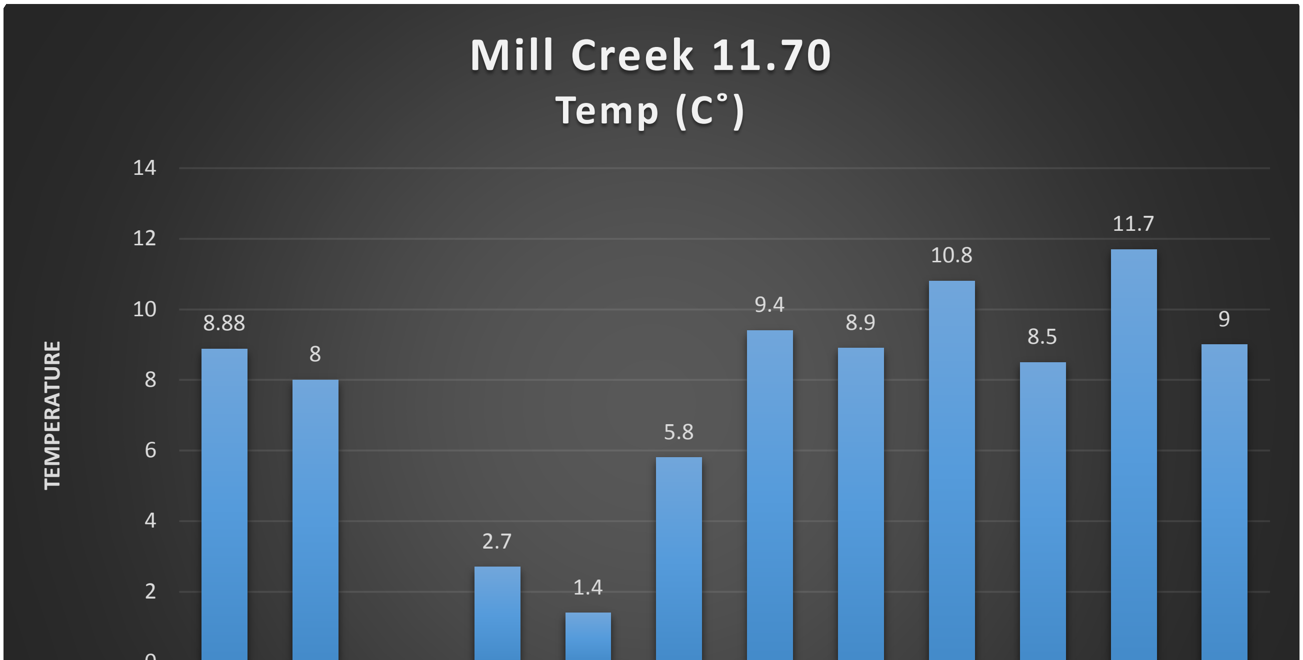
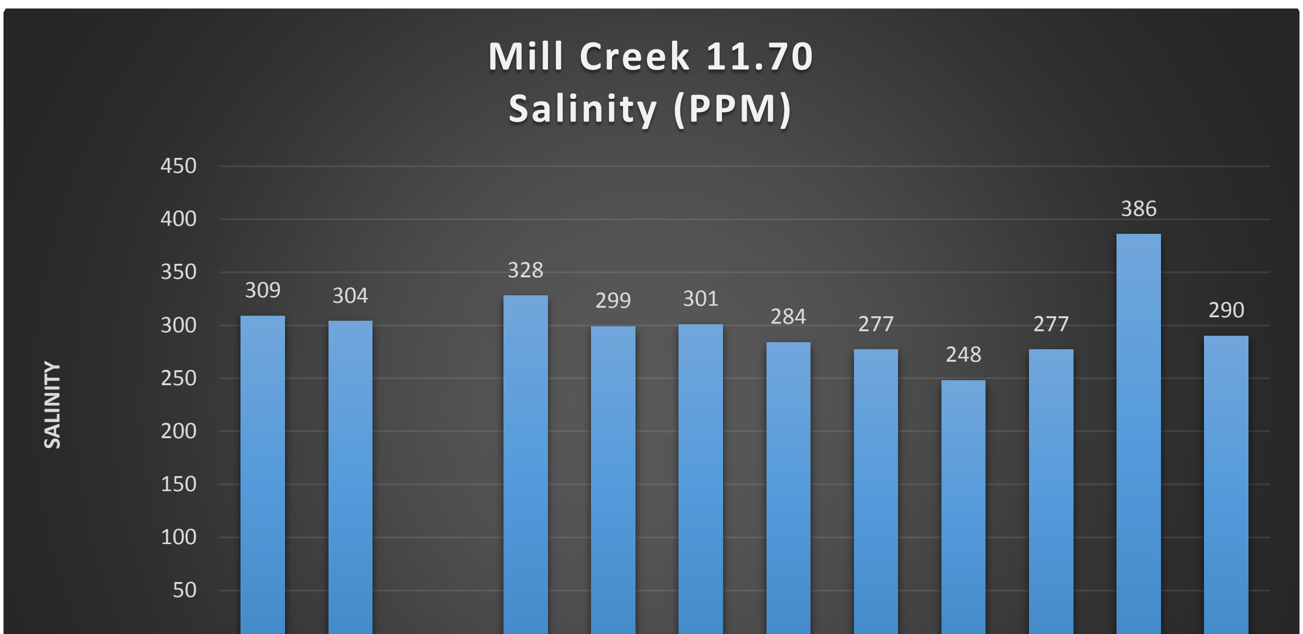


Figure 4-196 Mill Creek 11.70 Temperature



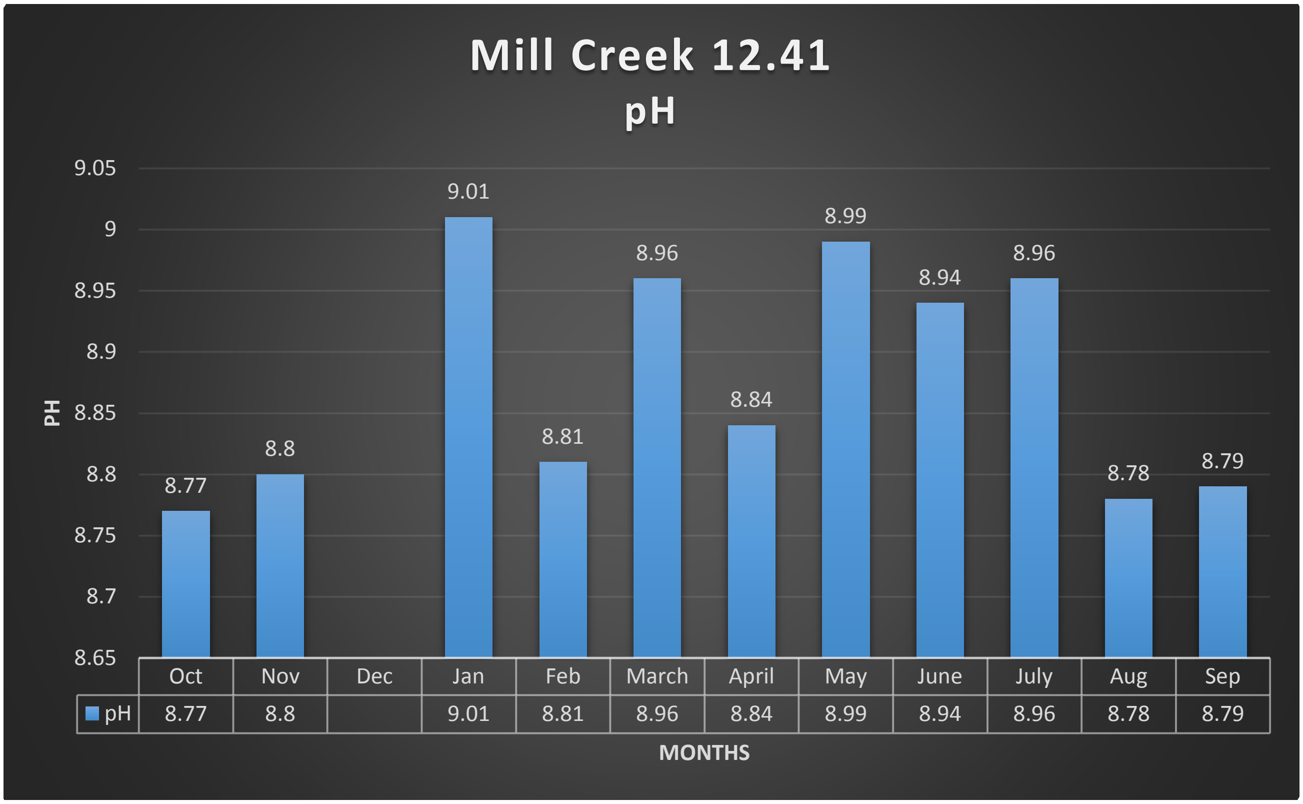
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Temp (C˚)	8.88	8		2.7	1.4	5.8	9.4	8.9	10.8	8.5	11.7	9

Figure 4-197 Mill Creek 11.70 Salinity



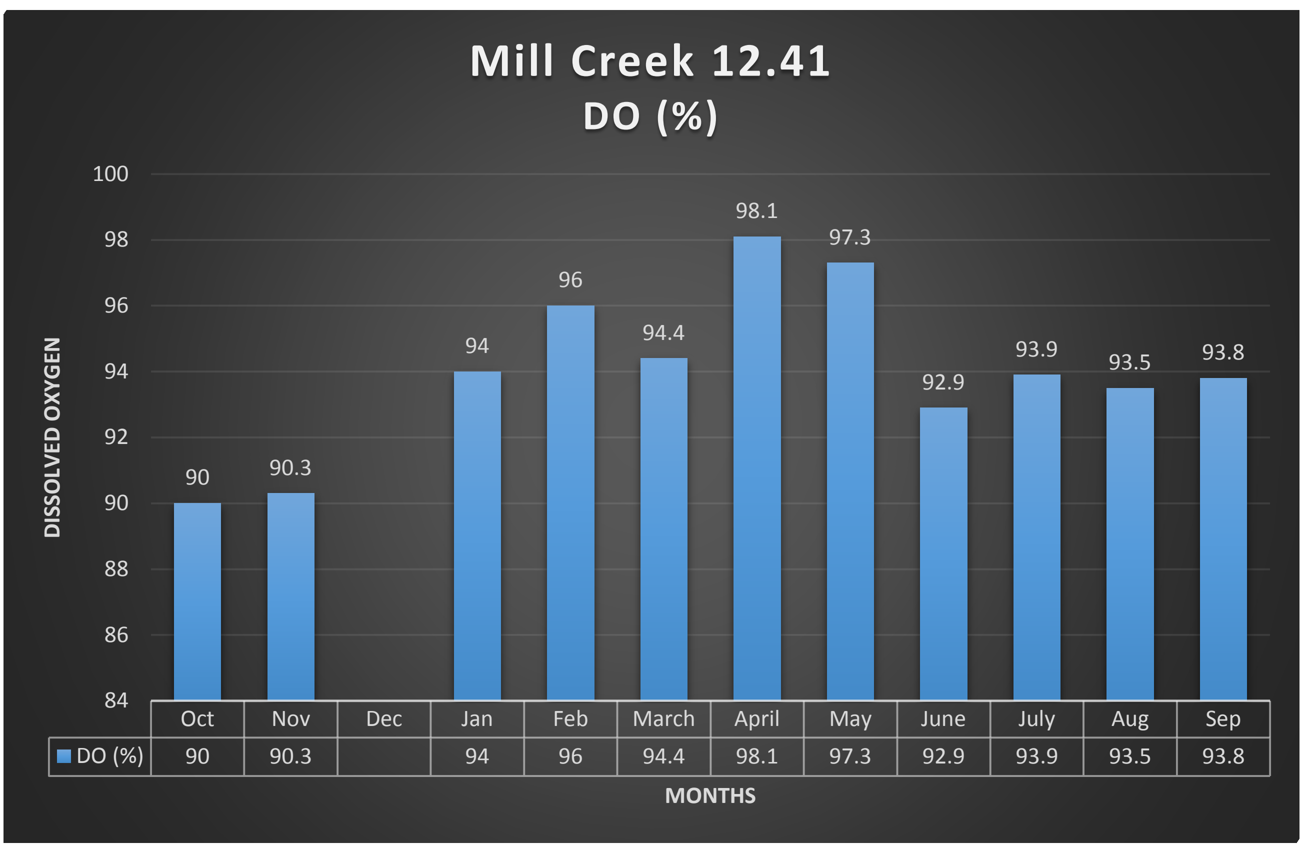
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Salinity (PPM)	309	304		328	299	301	284	277	248	277	386	290

Figure 4-198 Mill Creek 12.41 pH



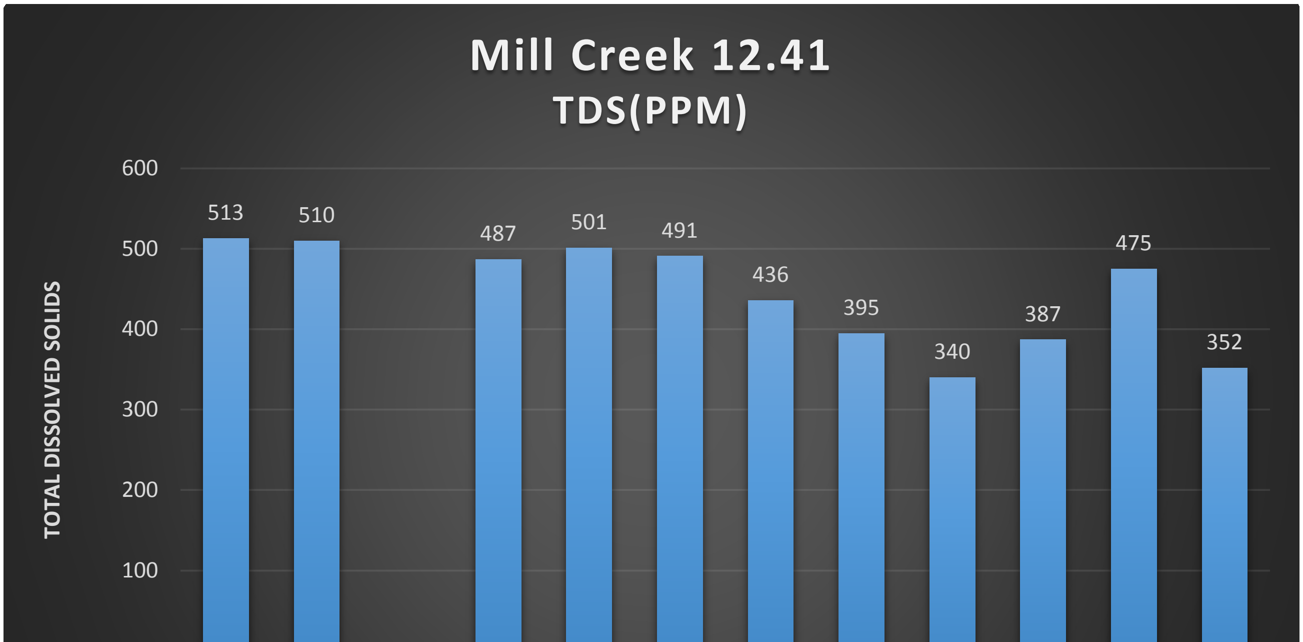
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
pH	8.77	8.8		9.01	8.81	8.96	8.84	8.99	8.94	8.96	8.78	8.79

Figure 4-199 Mill Creek 12.41 Dissolved Oxygen



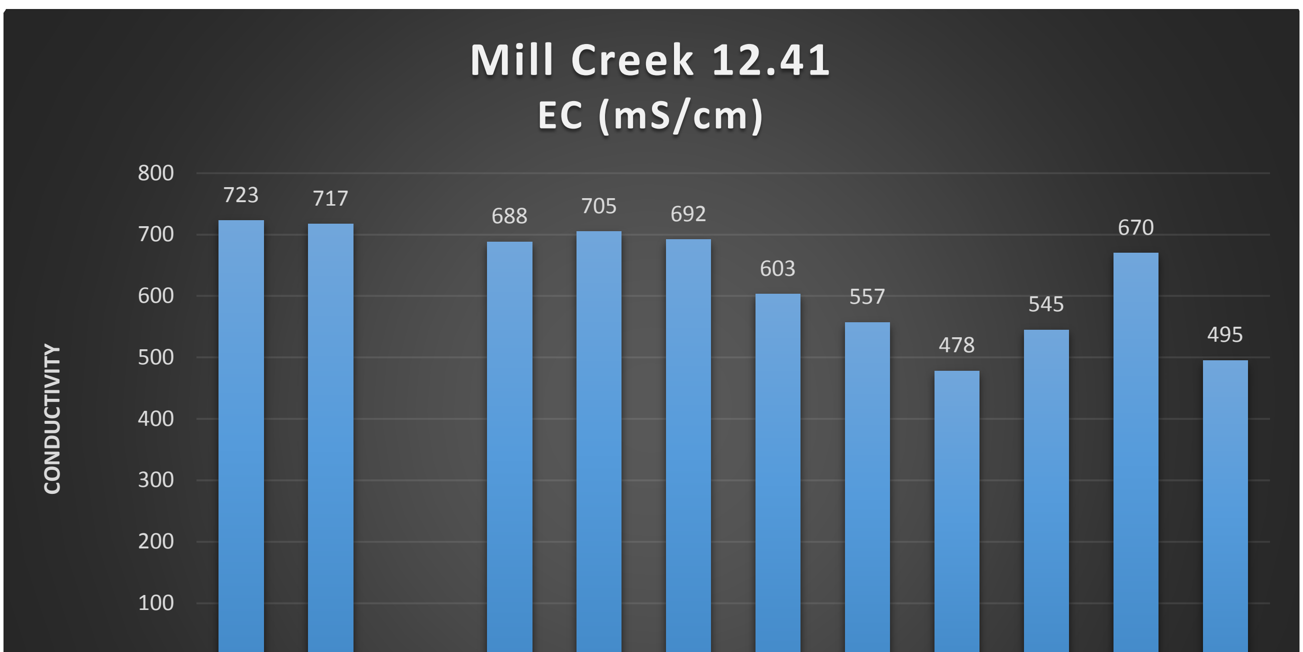
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
DO (%)	90	90.3		94	96	94.4	98.1	97.3	92.9	93.9	93.5	93.8

Figure 4-200 Mill Creek 12.41 Total Dissolved Solids



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
TDS(PPM)	513	510		487	501	491	436	395	340	387	475	352

Figure 4-201 Mill Creek 12.41 Conductivity



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
EC (mS/cm)	723	717		688	705	692	603	557	478	545	670	495

Figure 4-202 Mill Creek 12.41 Turbidity

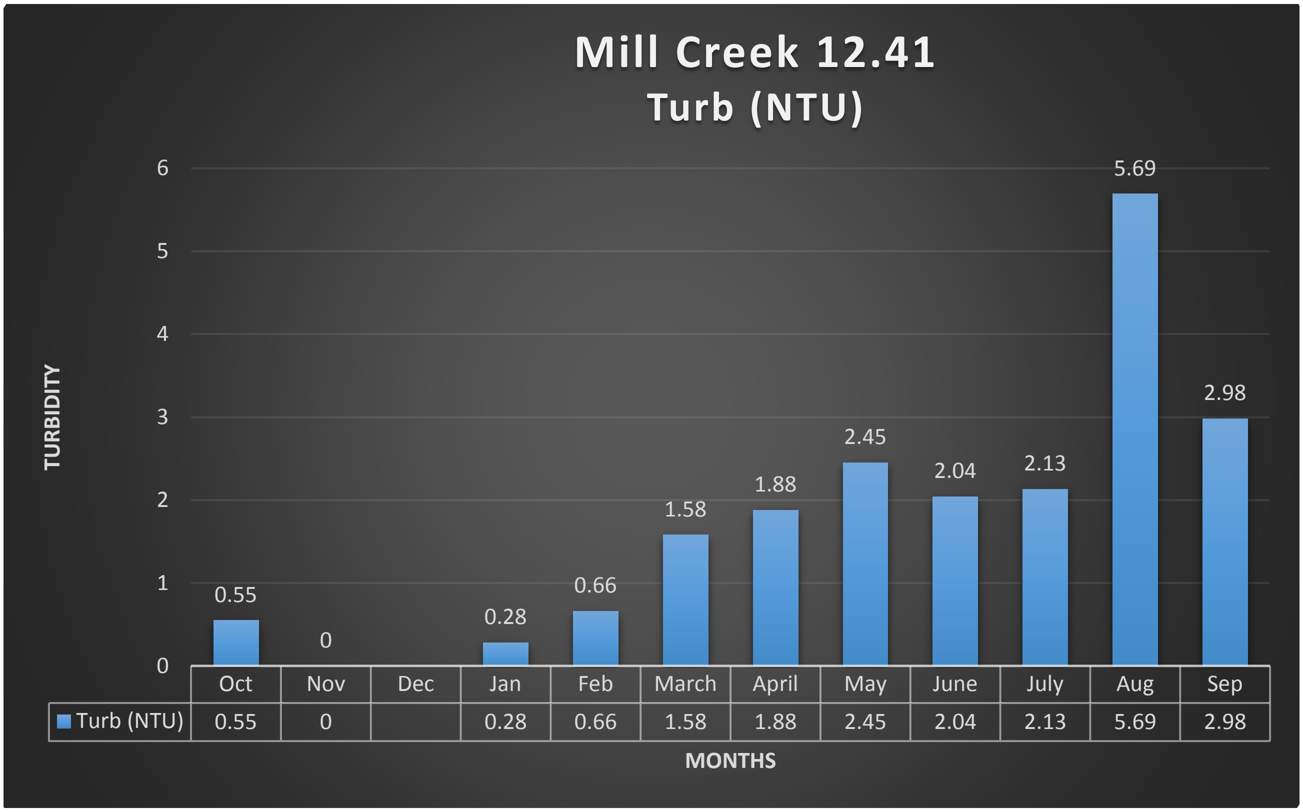


Figure 4-203 Mill Creek 12.41 Temperature

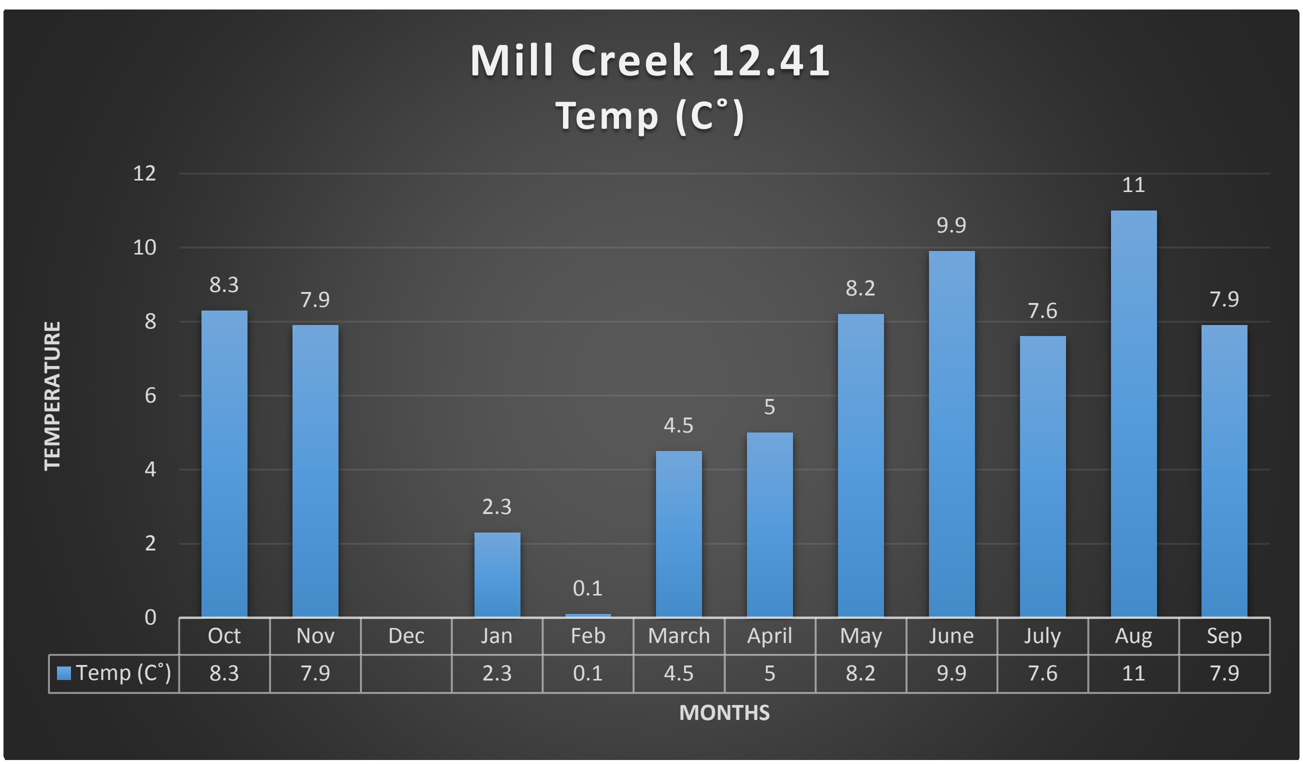
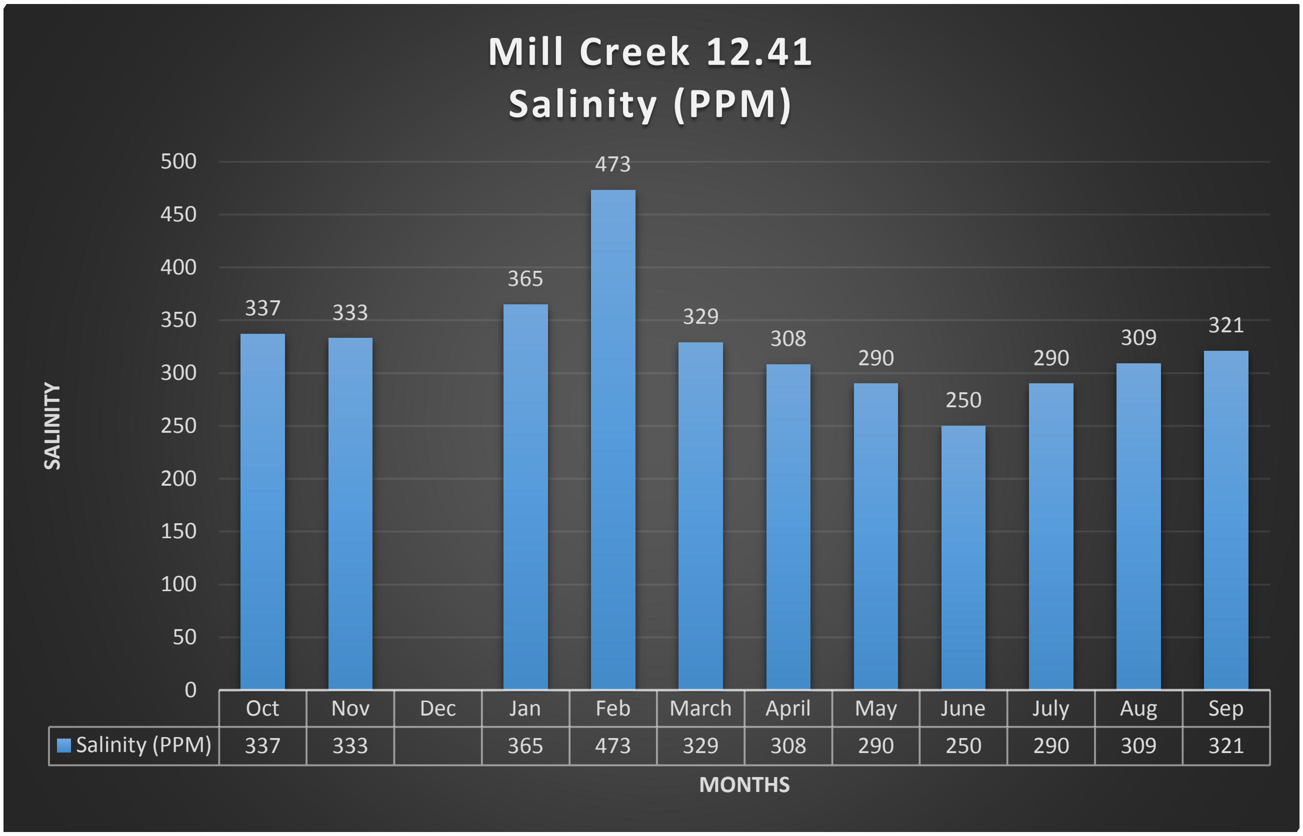
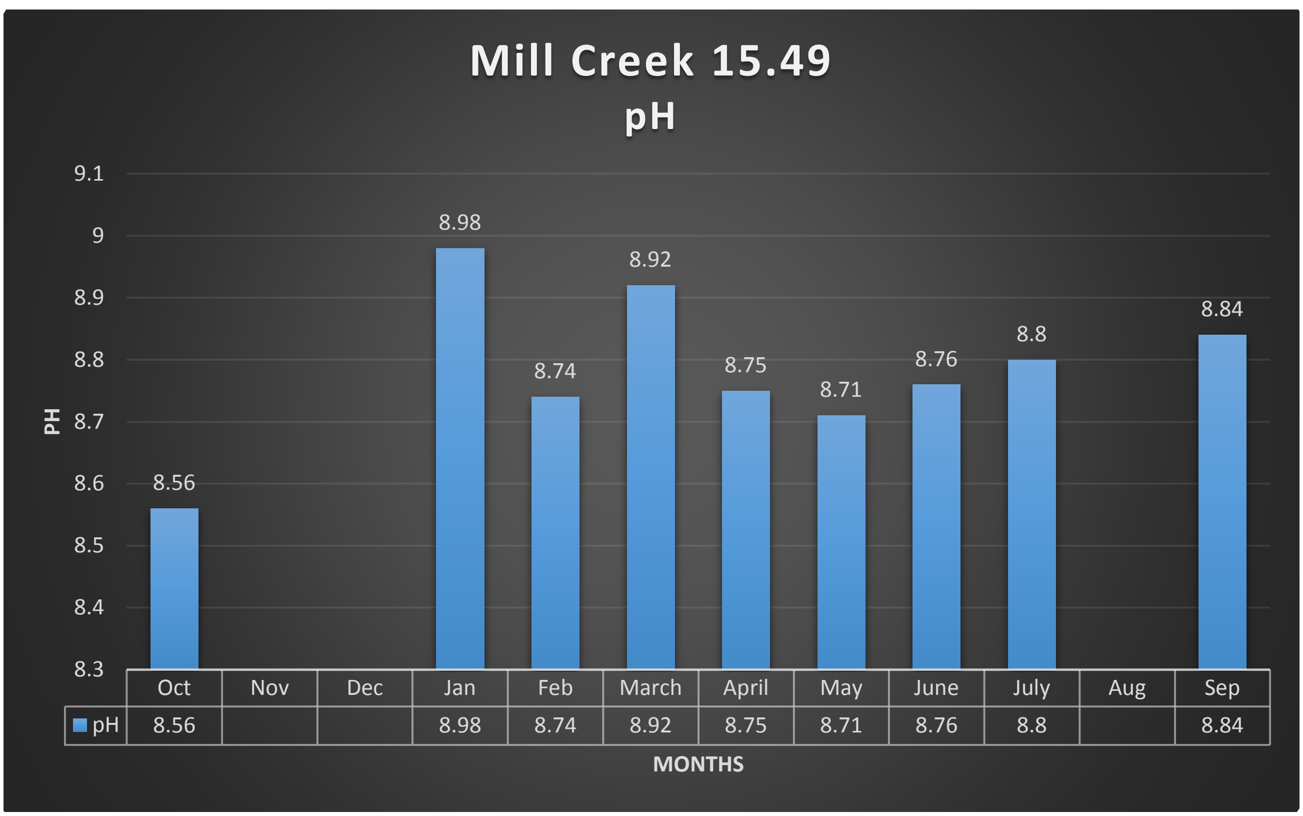


Figure 4-204 Mill Creek 12.41 Salinity



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Salinity (PPM)	337	333		365	473	329	308	290	250	290	309	321

Figure 4-205 Mill Creek 15.49 pH



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
pH	8.56			8.98	8.74	8.92	8.75	8.71	8.76	8.8		8.84

Figure 4-206 Mill Creek 15.49 Dissolved Oxygen

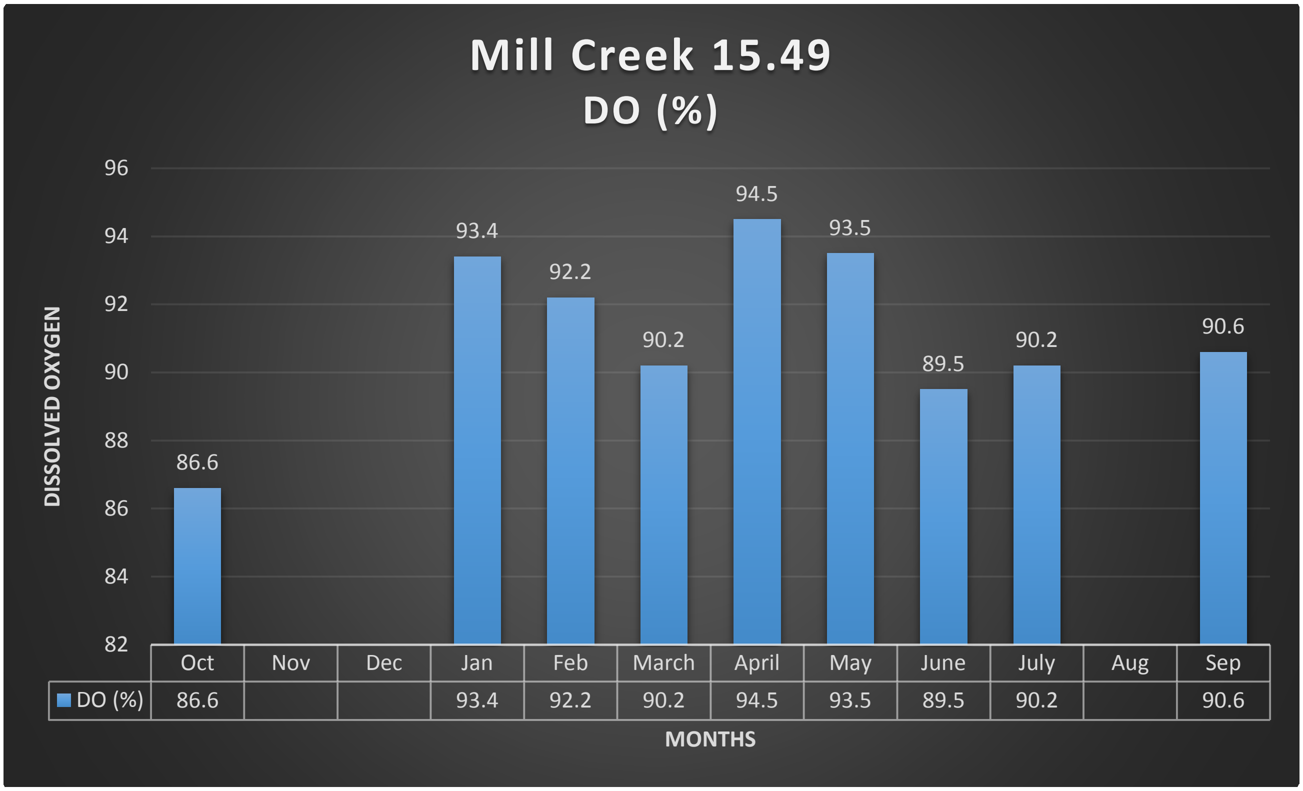


Figure 4-207 Mill Creek 15.49 Total Dissolved Solids

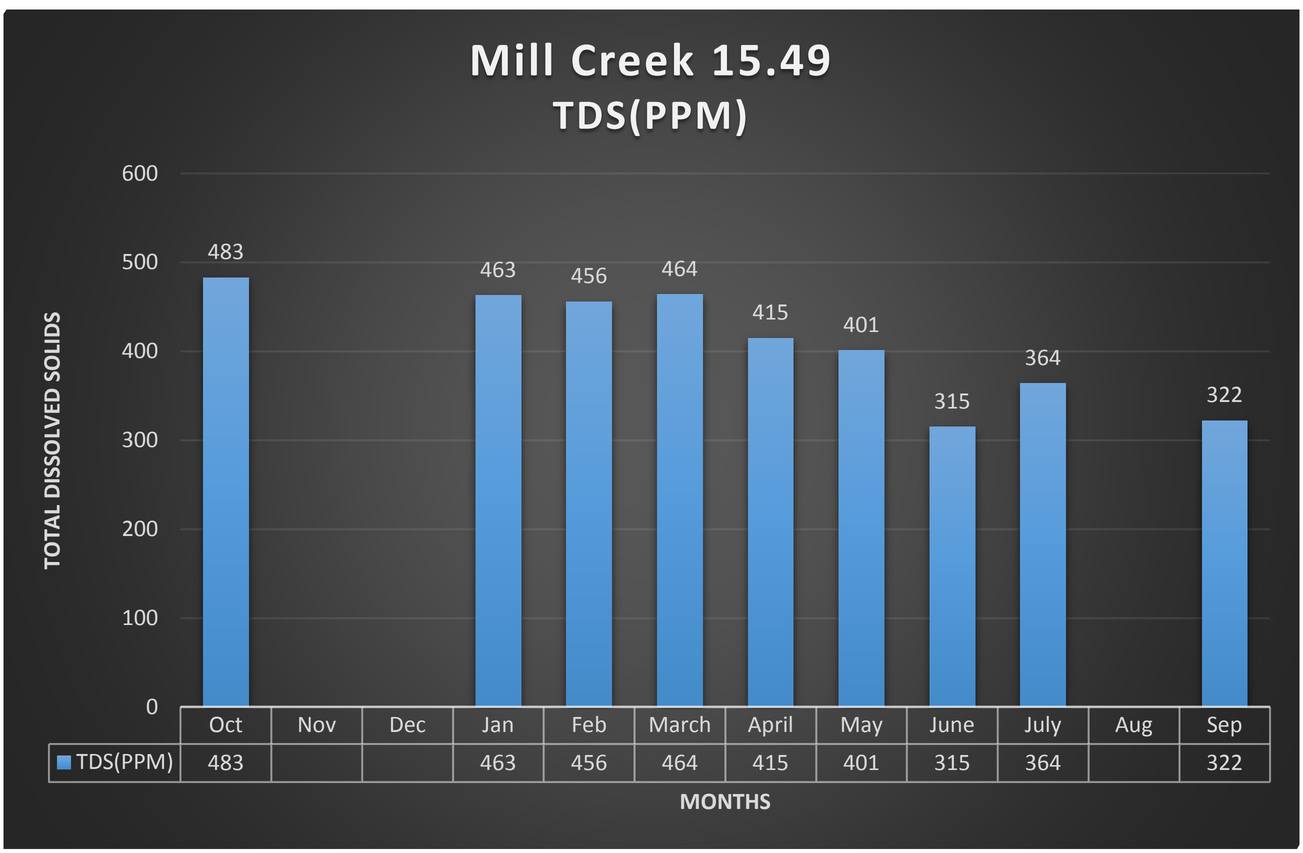


Figure 4-208 Mill Creek 15.49 Conductivity

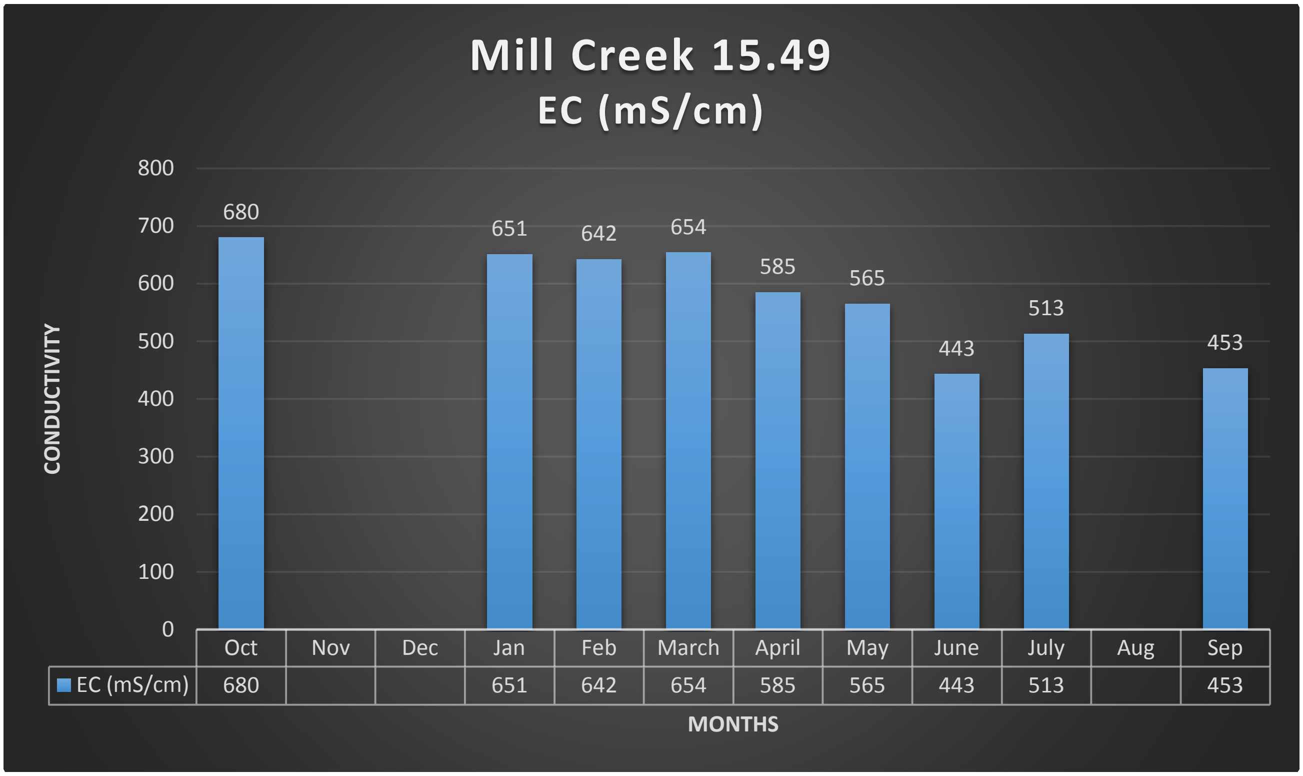


Figure 4-209 Mill Creek 15.49 Turbidity

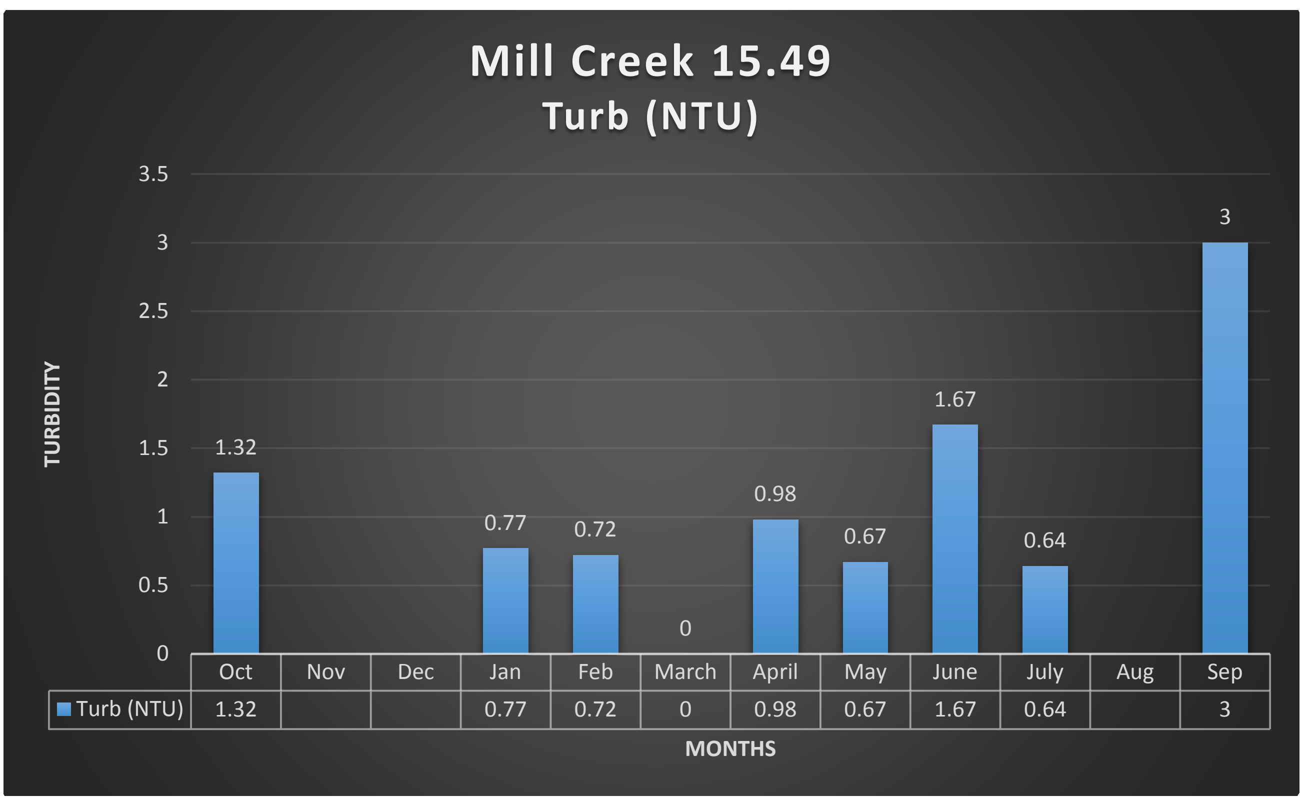


Figure 4-210 Mill Creek 15.49 Temperature

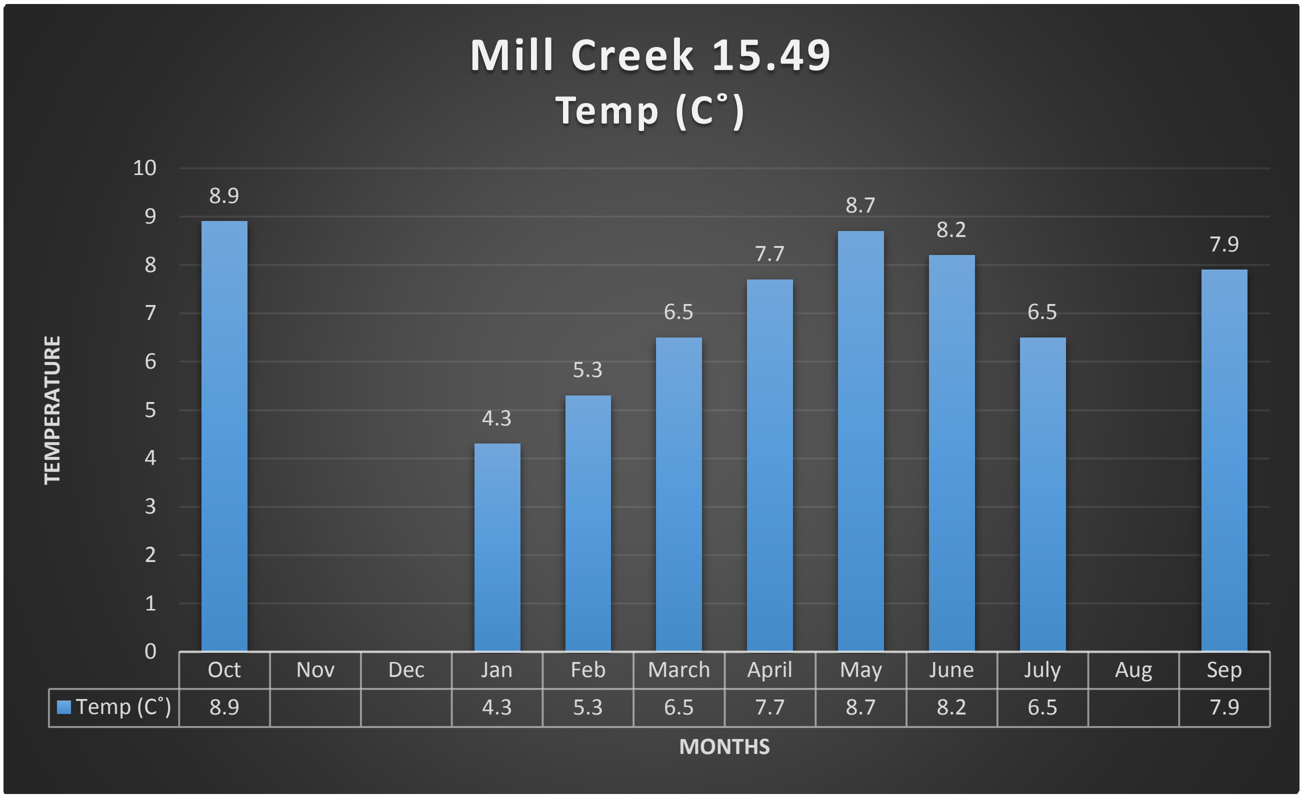


Figure 4-211 Mill Creek 15.49 Salinity

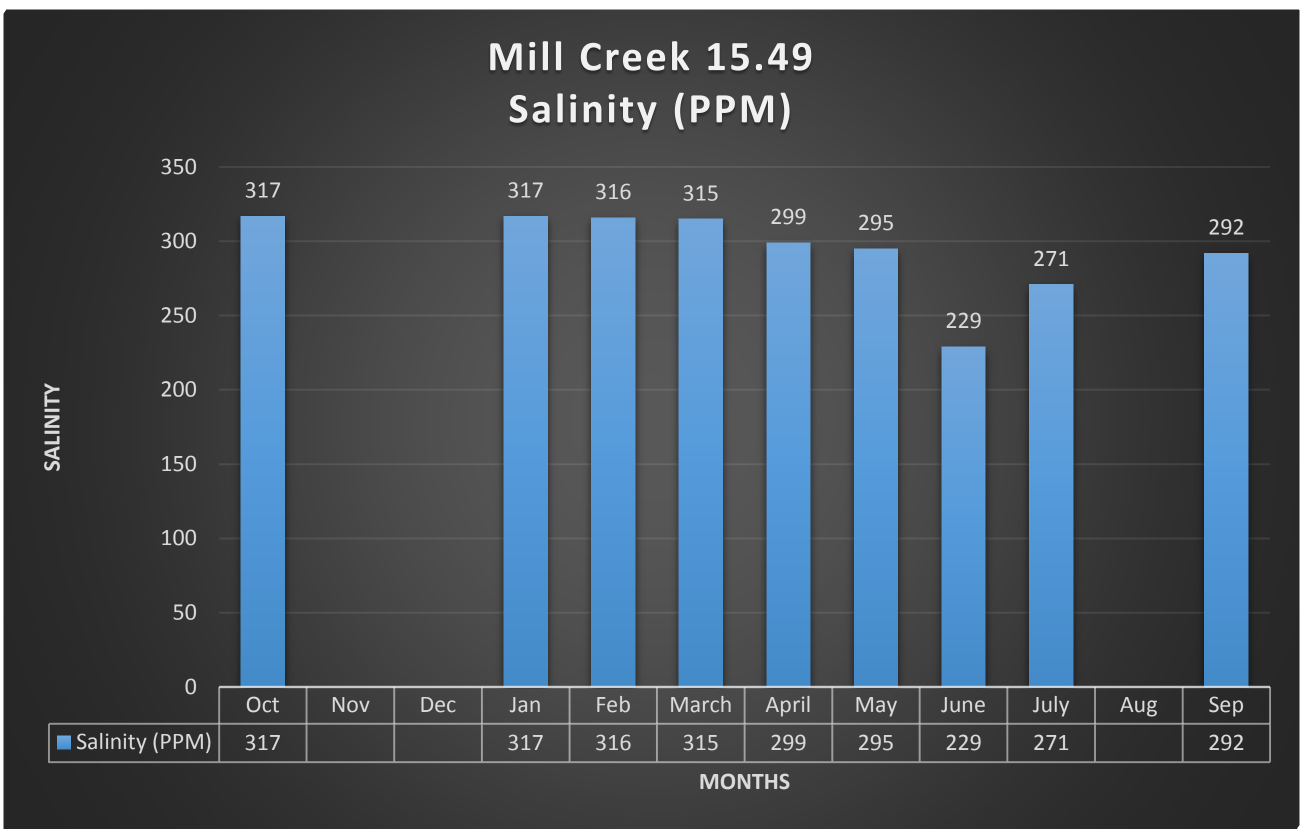


Figure 4-212 Mill Creek 16.17 pH

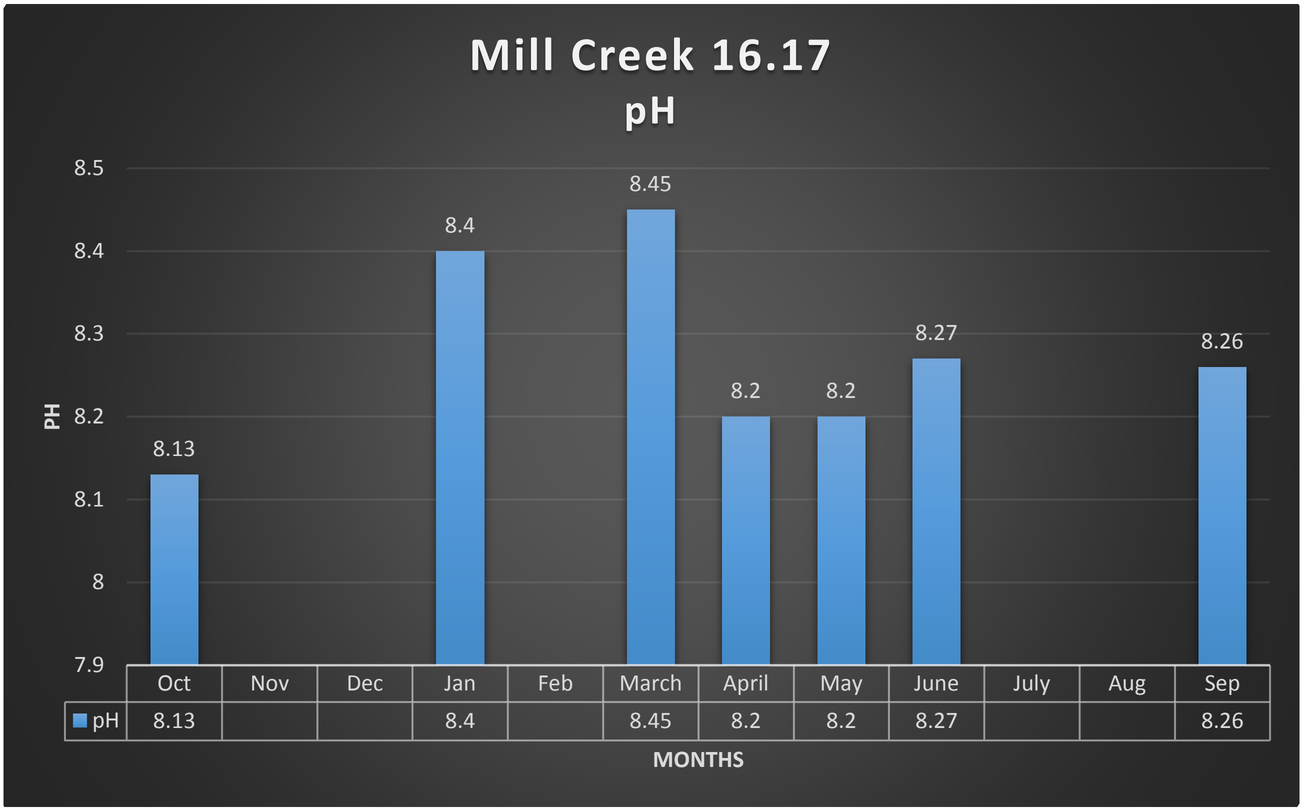


Figure 4-213 Mill Creek 16.17 Dissolved Oxygen

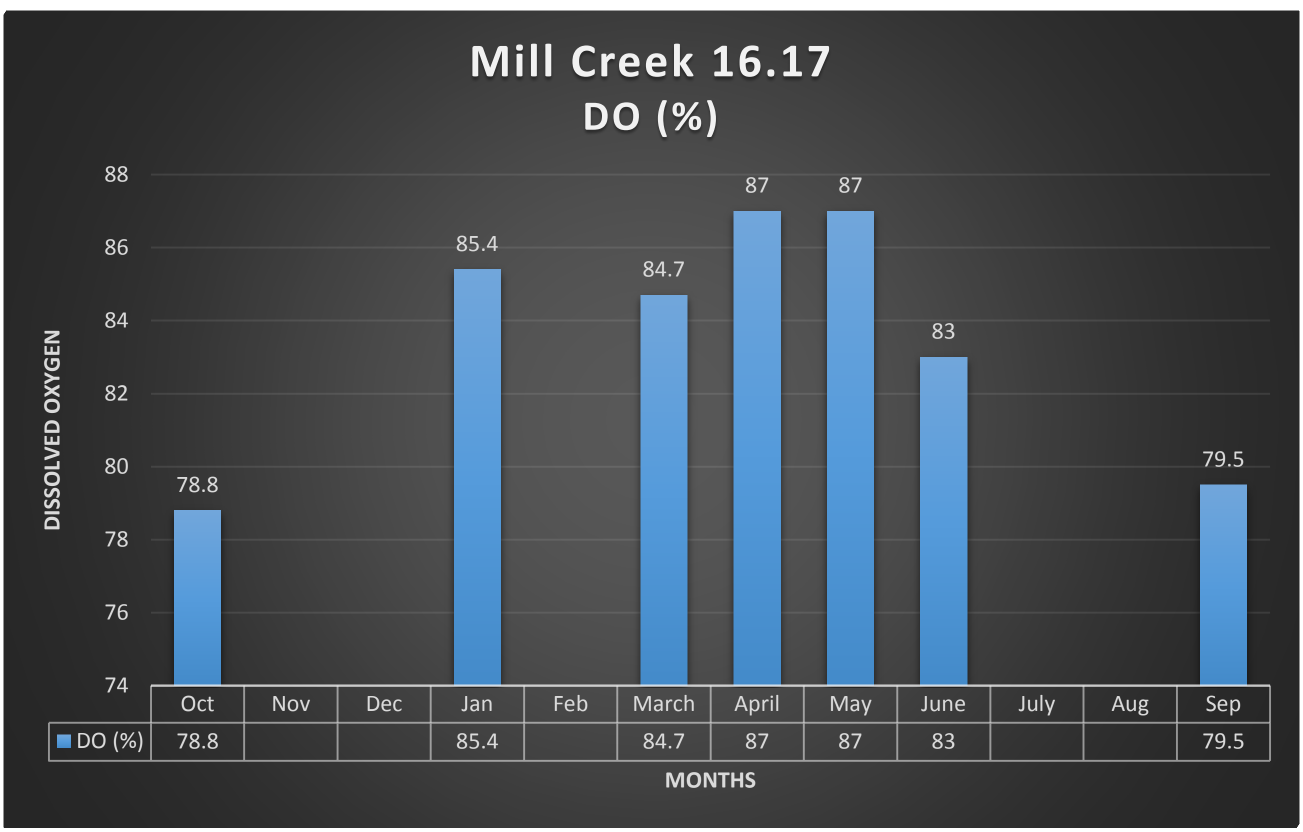


Figure 4-214 Mill Creek 16.17 Total Dissolved Solids

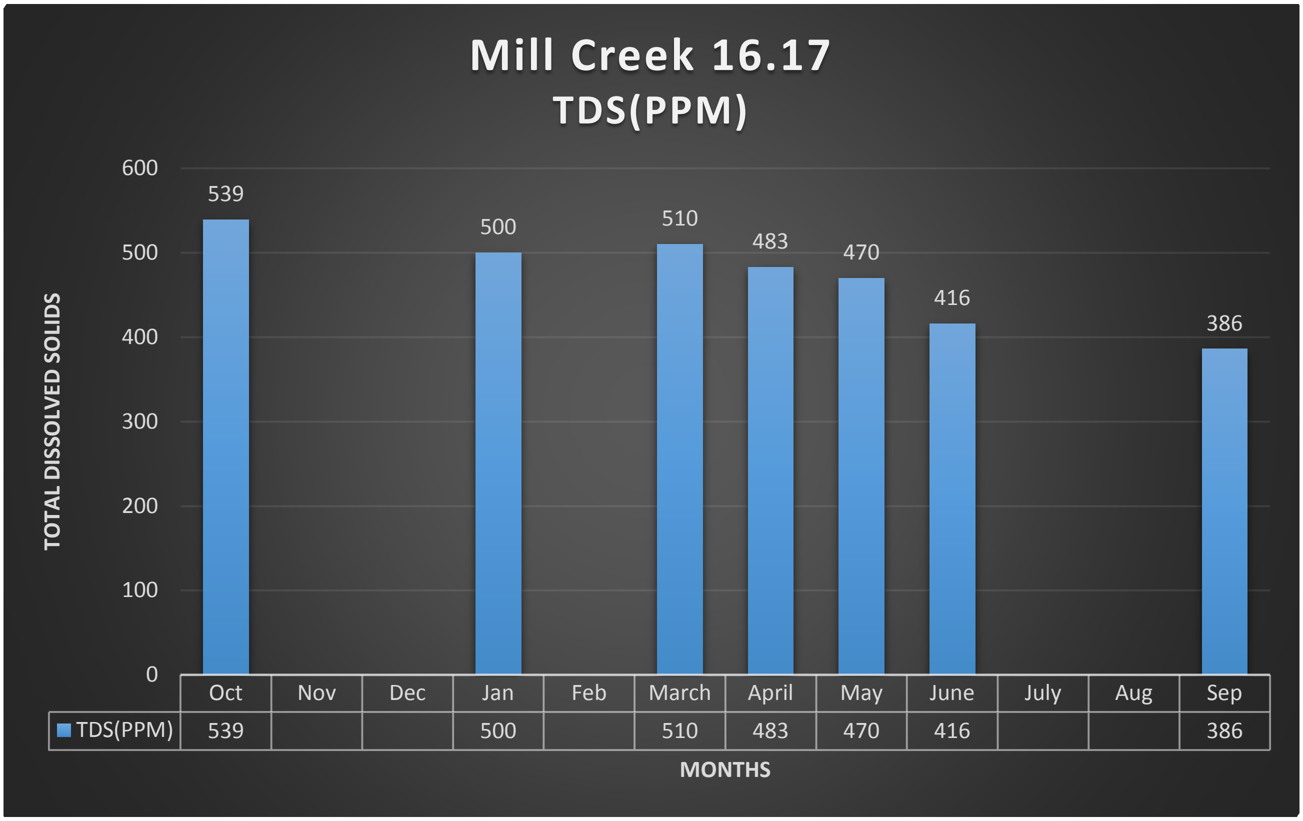


Figure 4-215 Mill Creek 16.17 Conductivity

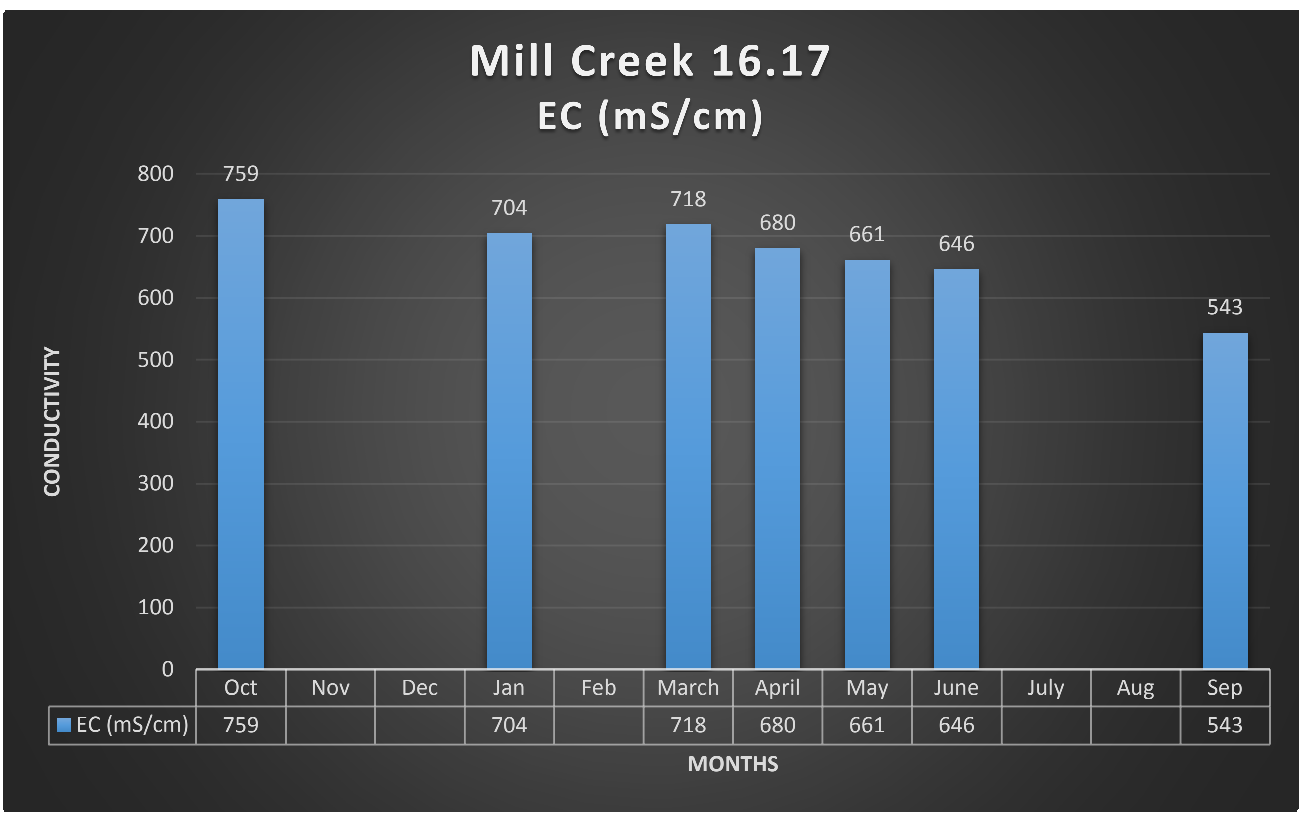


Figure 4-216 Mill Creek 16.17 Turbidity

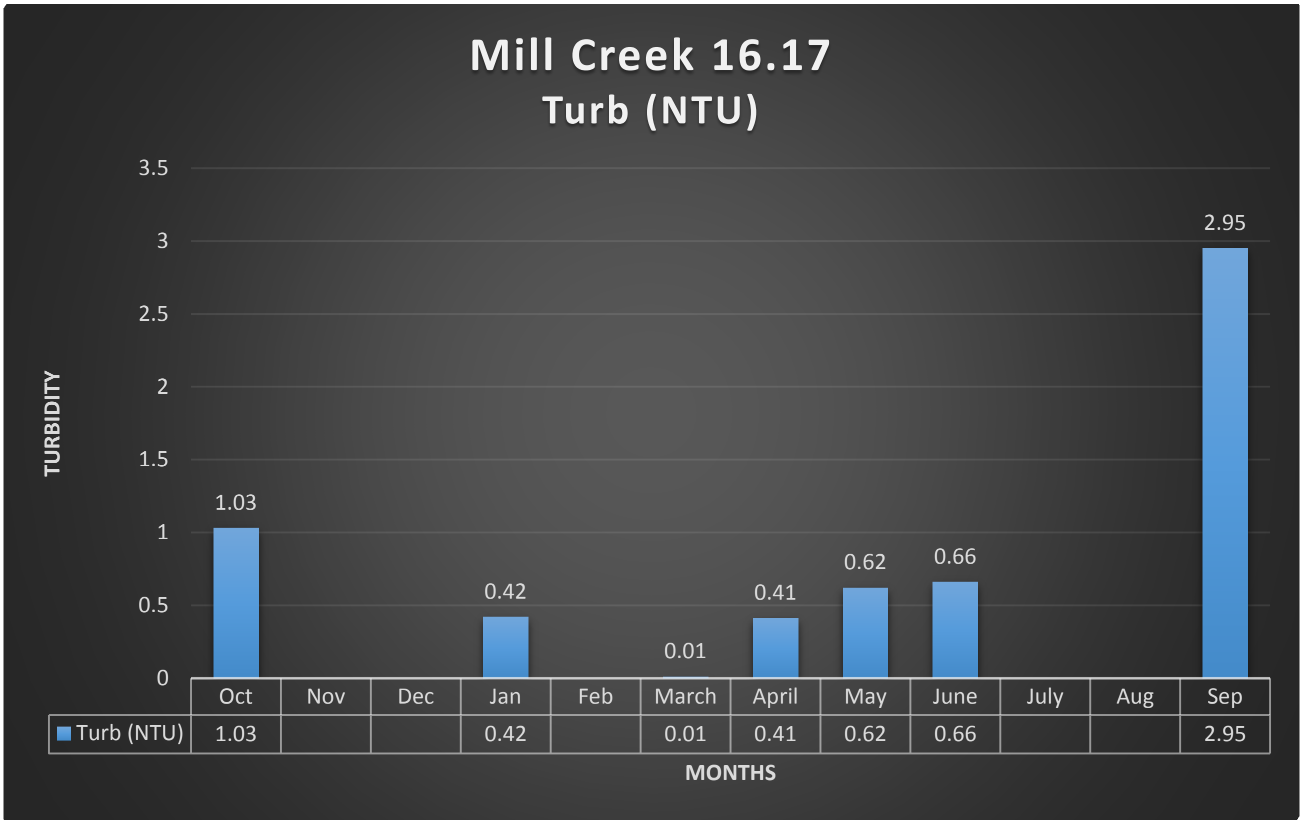


Figure 4-217 Mill Creek 16.17 Temperature

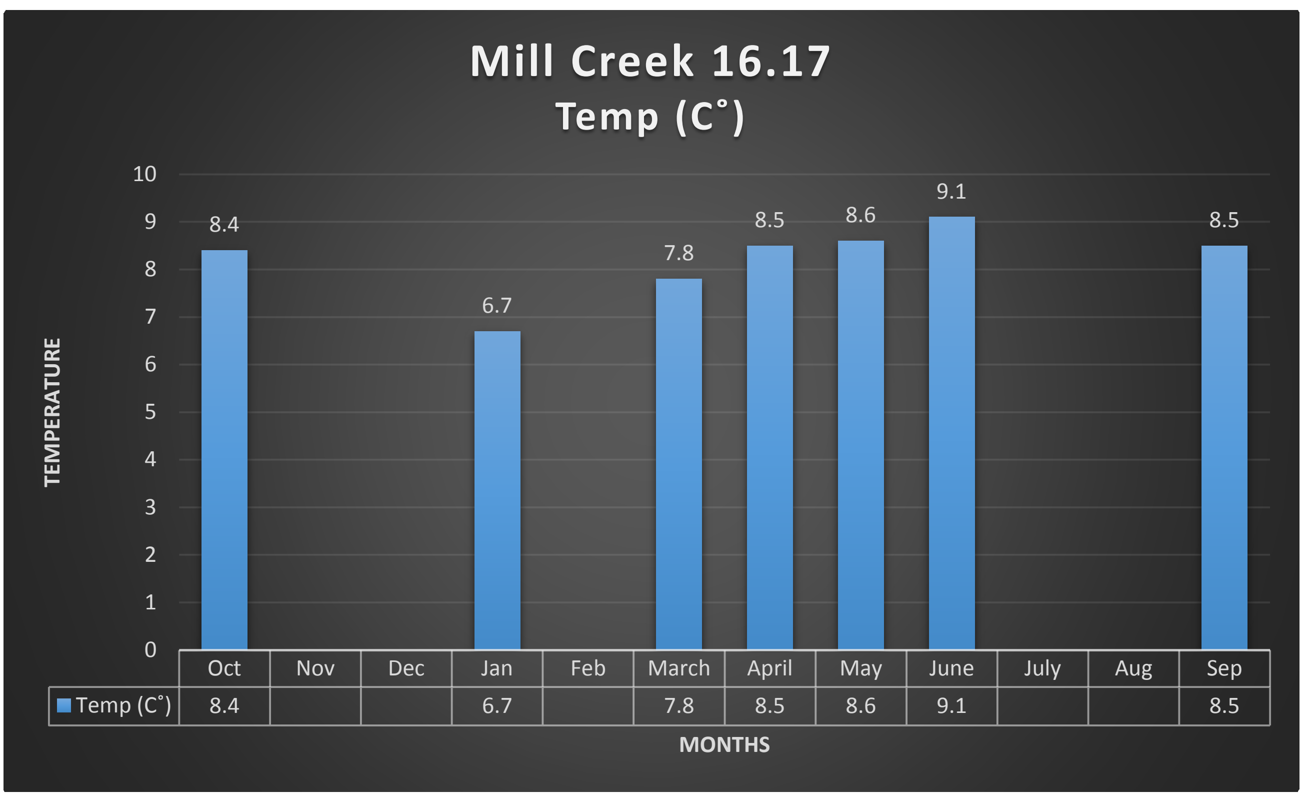
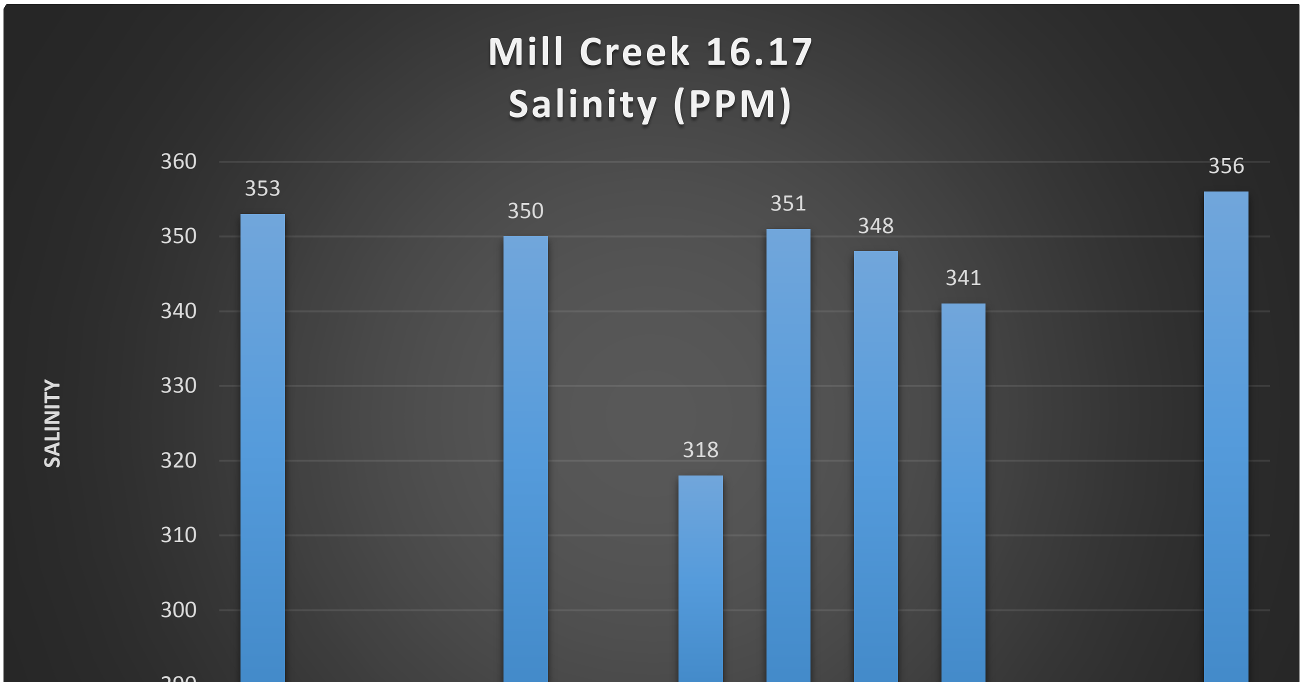
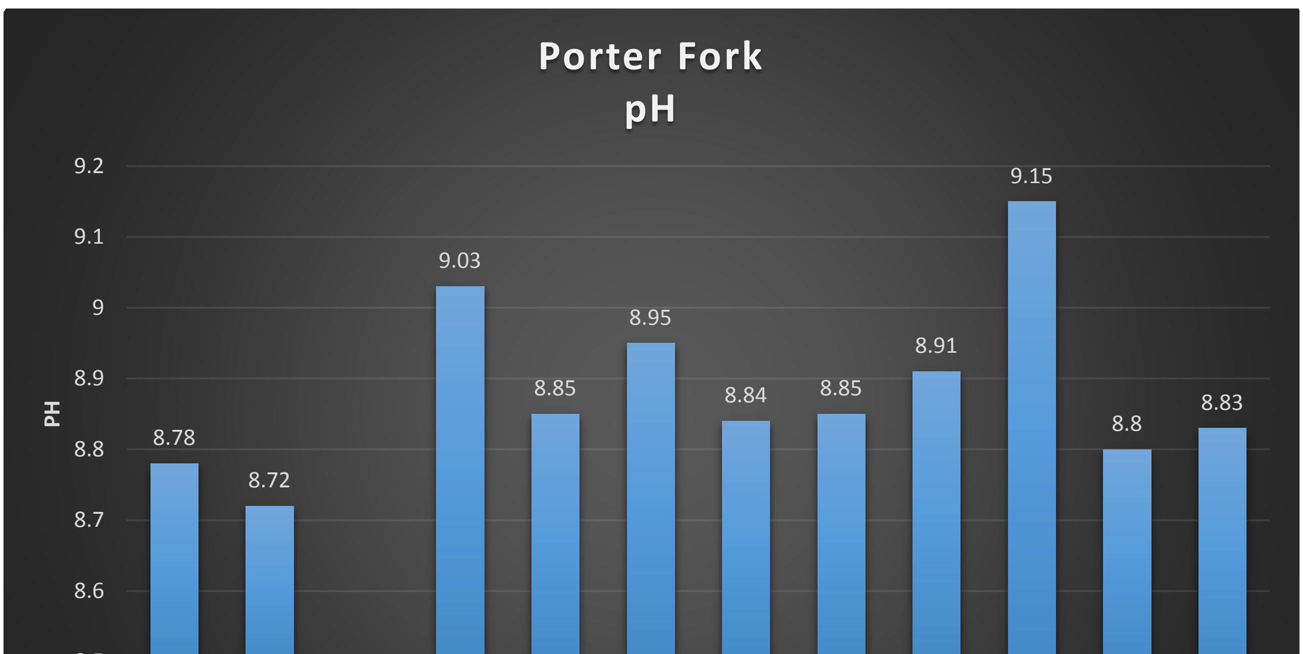


Figure 4-218 Mill Creek 16.17 Salinity



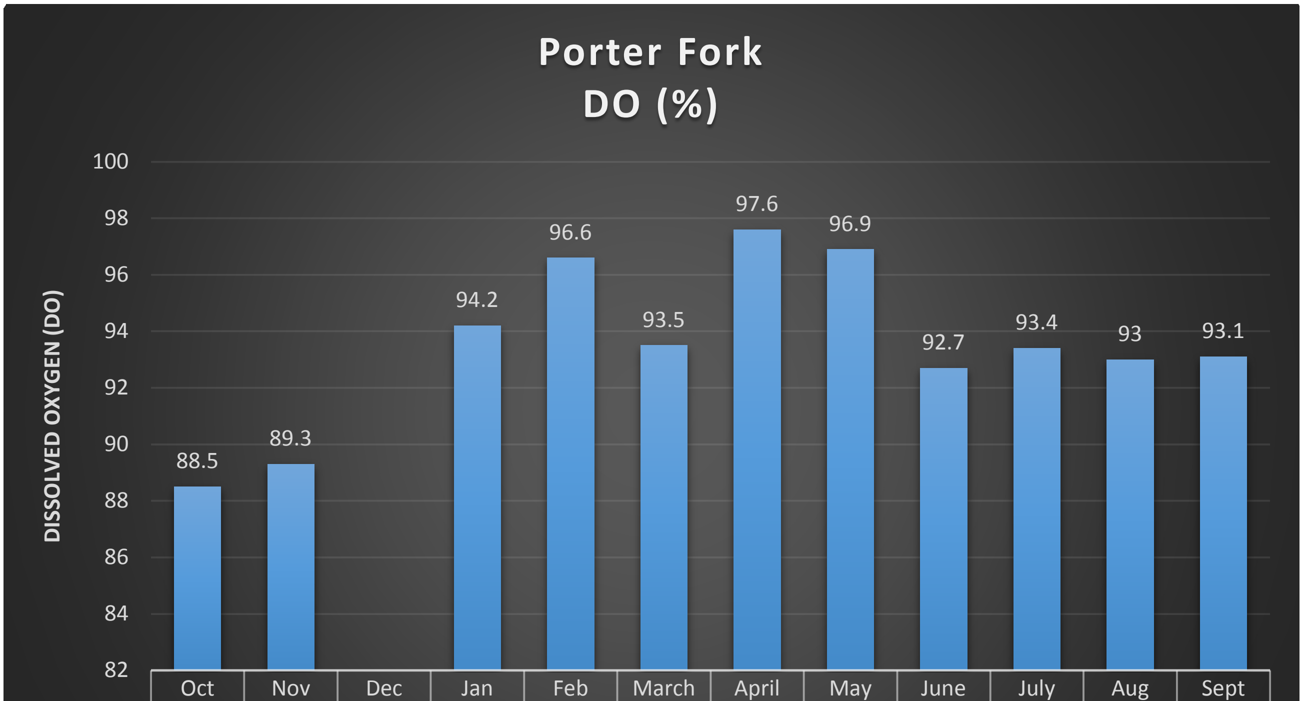
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Salinity (PPM)	353			350		318	351	348	341			356

Figure 4-219 Porter Fork pH



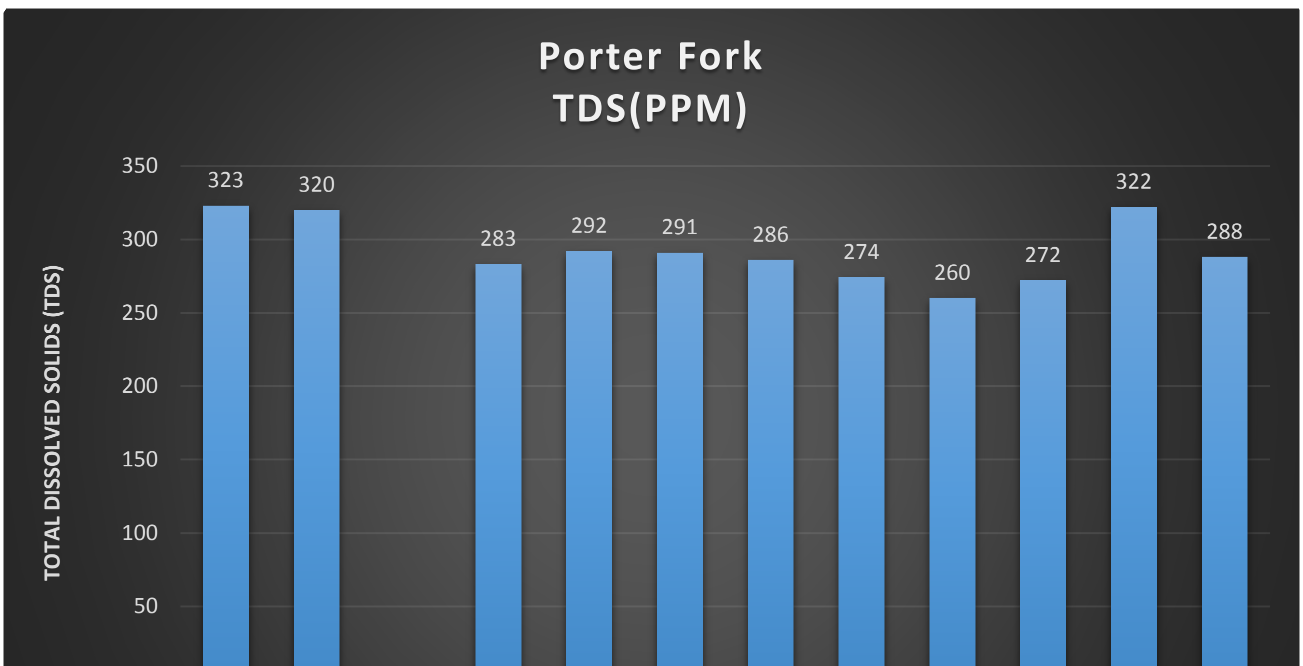
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sept
pH	8.78	8.72		9.03	8.85	8.95	8.84	8.85	8.91	9.15	8.8	8.83

Figure 4-220 Porter Fork Dissolved Oxygen



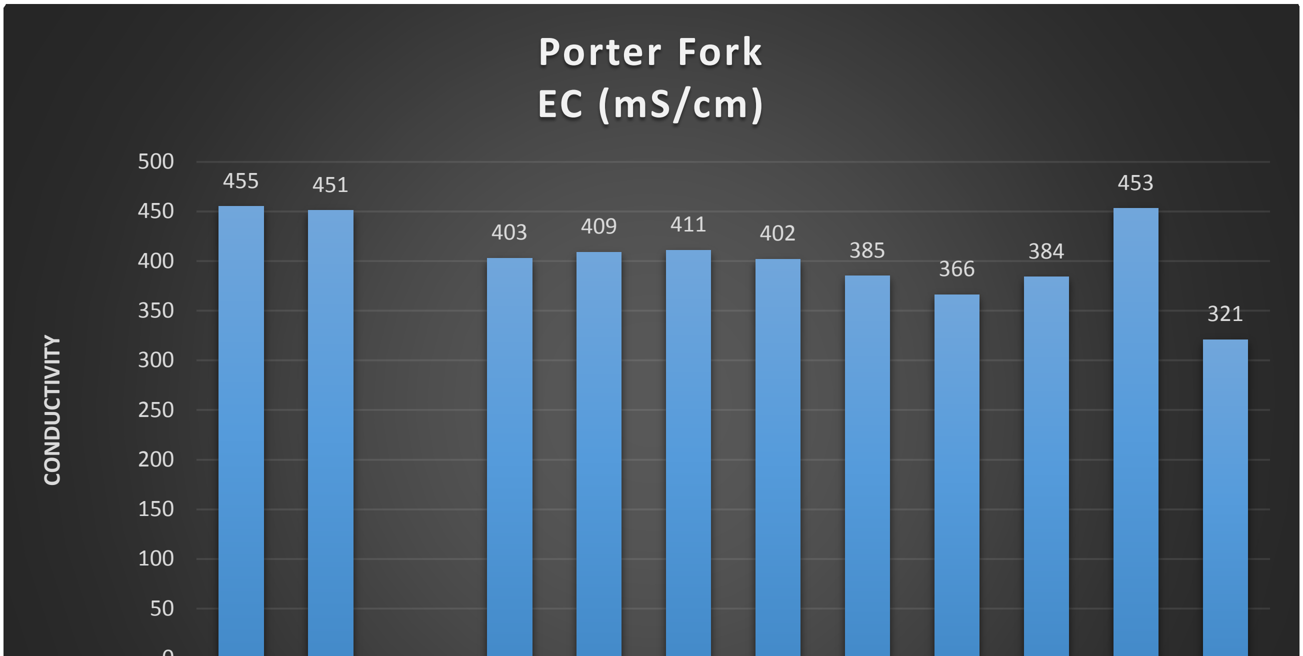
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sept
DO (%)	88.5	89.3		94.2	96.6	93.5	97.6	96.9	92.7	93.4	93	93.1

Figure 4-221 Porter Fork Total Dissolved Solids



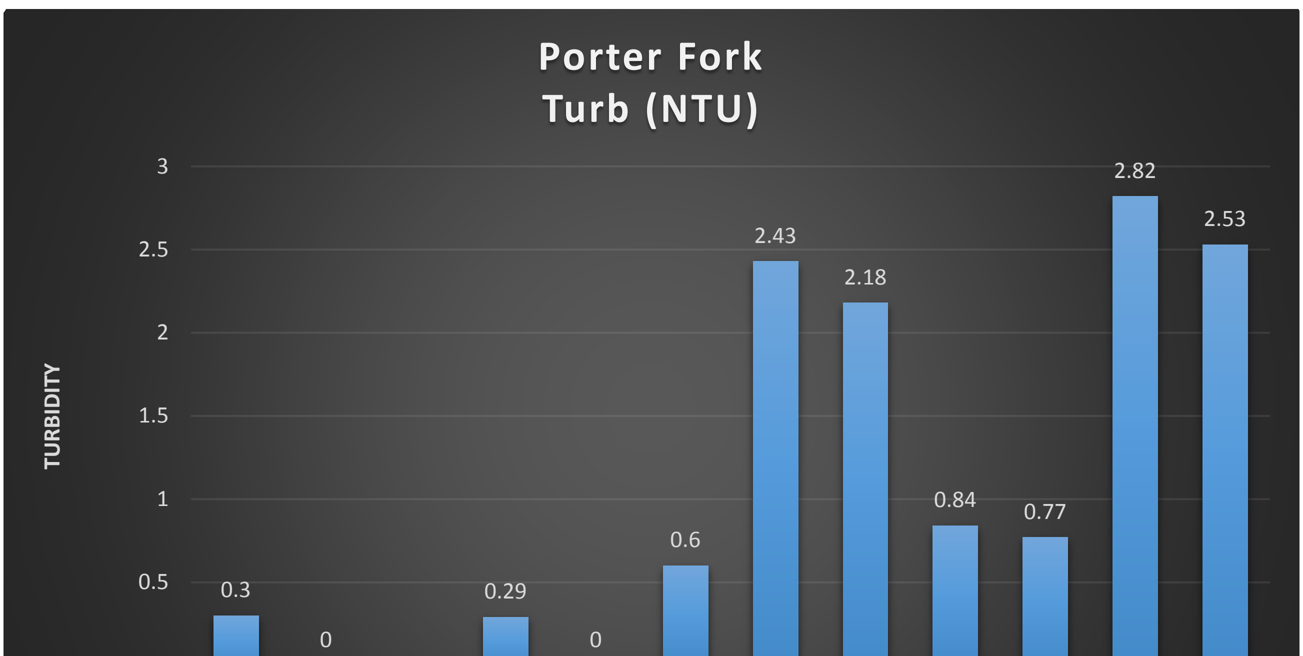
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sept
TDS(PPM)	323	320		283	292	291	286	274	260	272	322	288

Figure 4-222 Porter Fork Conductivity



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sept
EC (mS/cm)	455	451		403	409	411	402	385	366	384	453	321

Figure 4-223 Porter Fork Turbidity



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sept
Turb (NTU)	0.3	0		0.29	0	0.6	2.43	2.18	0.84	0.77	2.82	2.53

Figure 4-224 Porter Fork Temperature

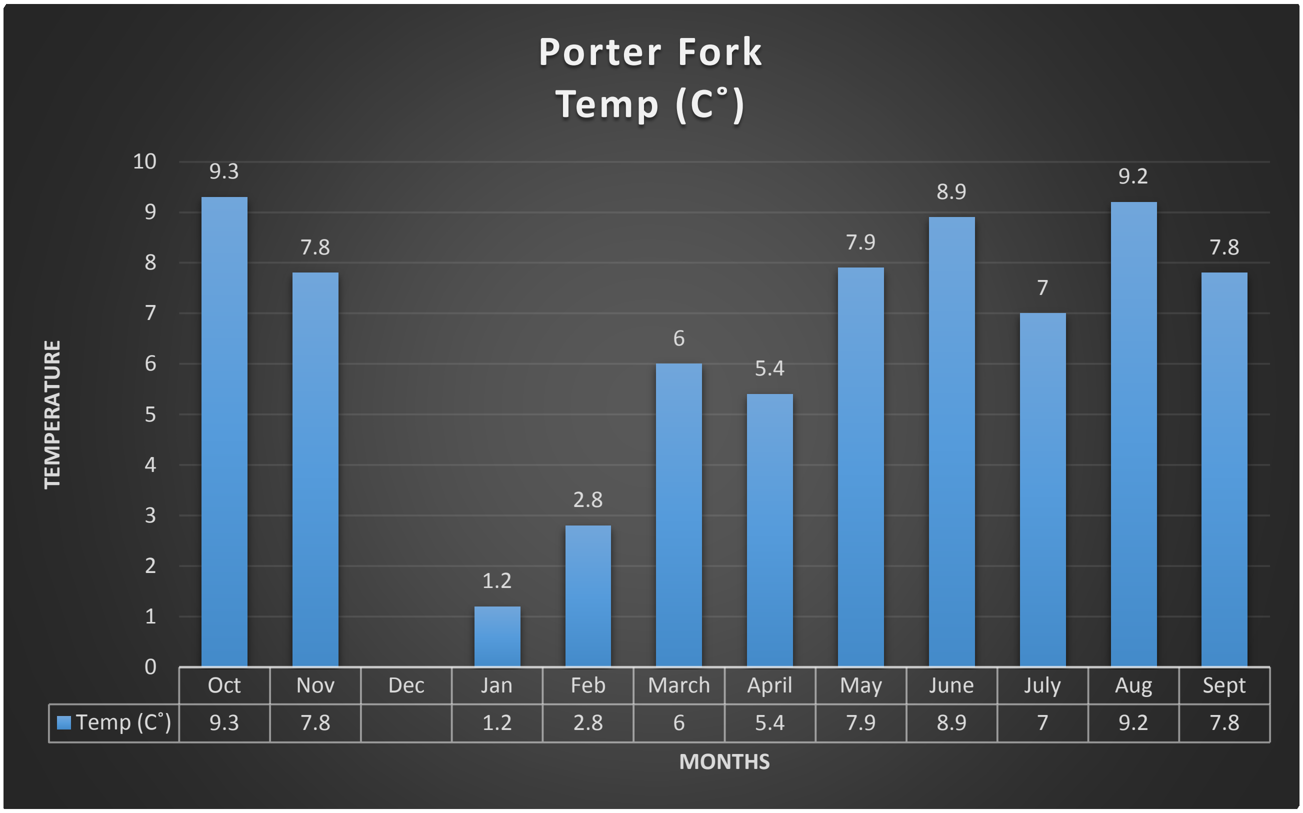


Figure 4-225 Porter Fork Salinity

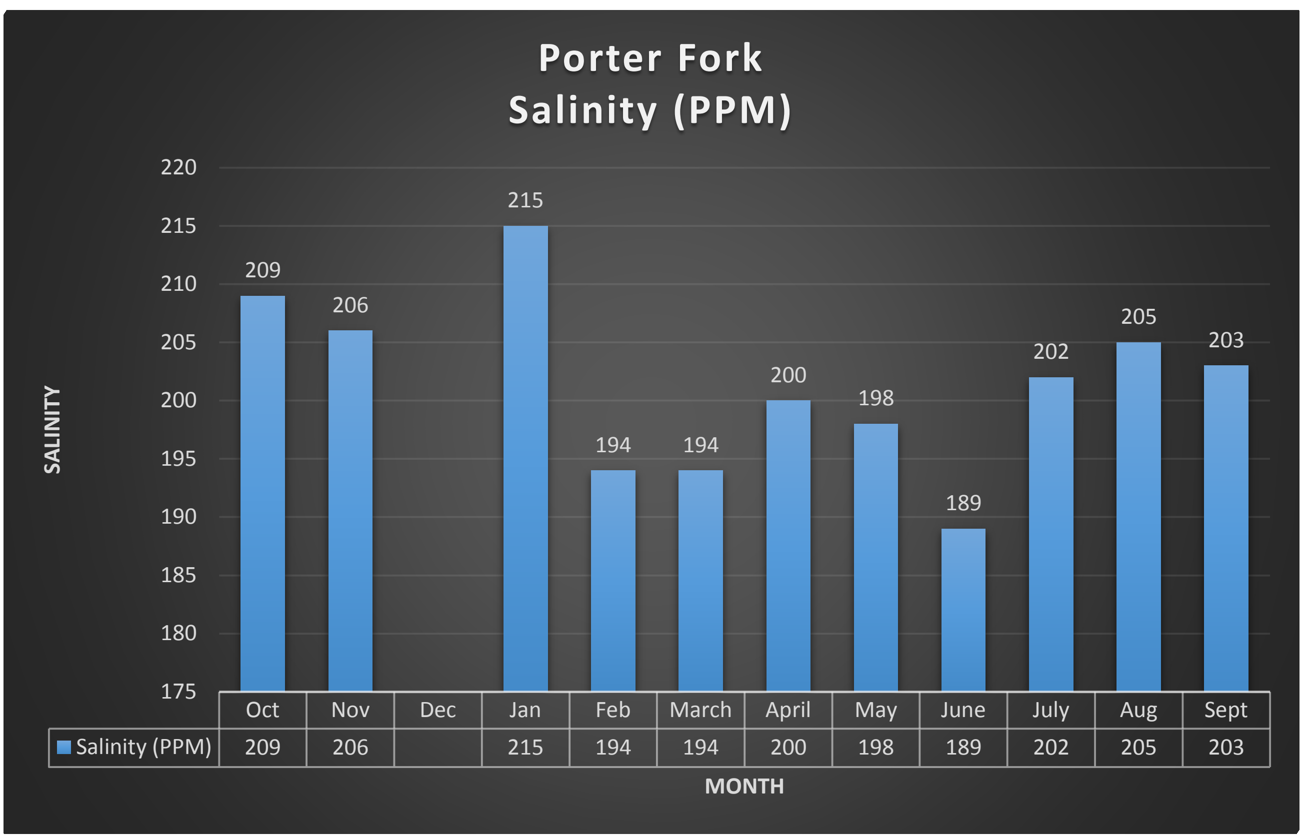
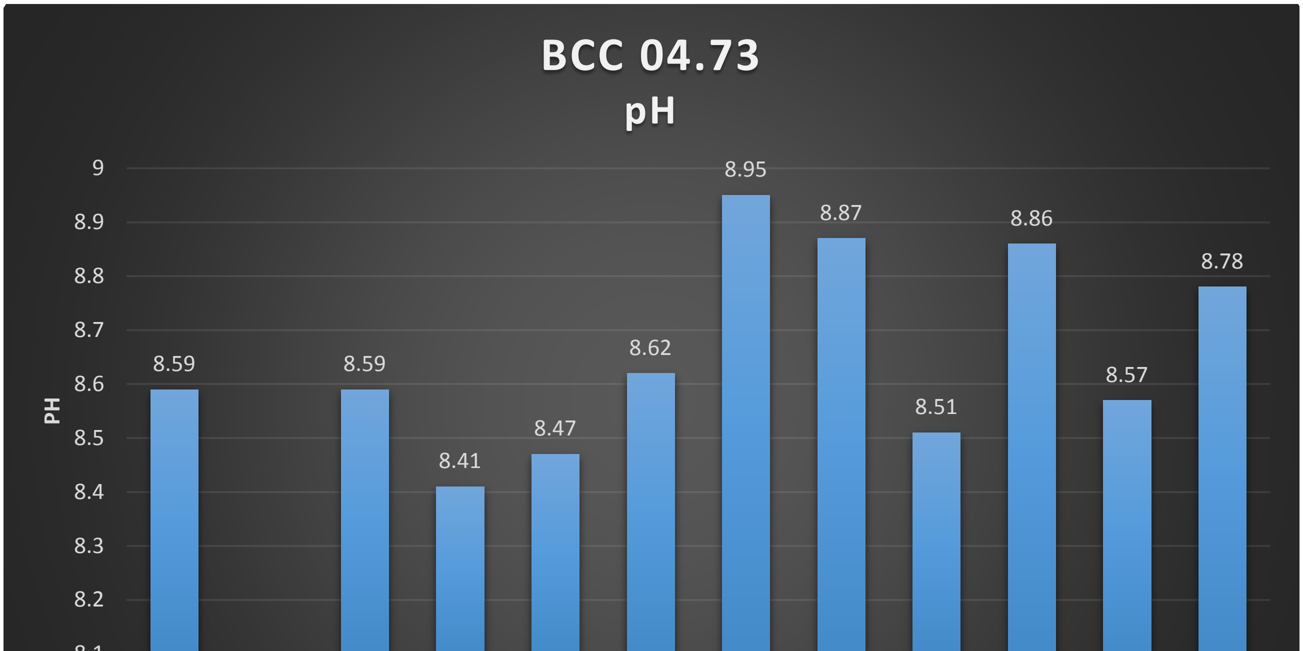
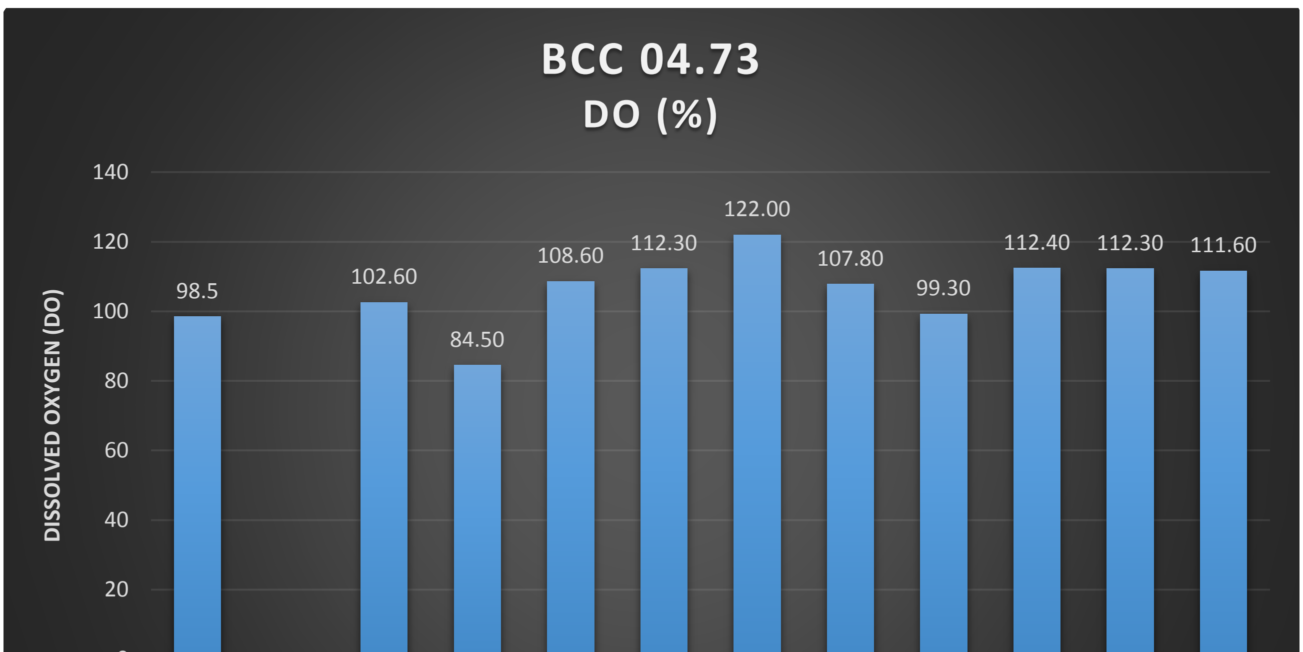


Figure 4-226 Big Cottonwood Creek 04.73 pH



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sept
pH	8.59		8.59	8.41	8.47	8.62	8.95	8.87	8.51	8.86	8.57	8.78

Figure 4-227 Big Cottonwood Creek 04.73 Dissolved Oxygen



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sept
DO (%)	98.5		102.60	84.50	108.60	112.30	122.00	107.80	99.30	112.40	112.30	111.60

Figure 4-228 Big Cottonwood Creek 04.73 Total Dissolved Solids

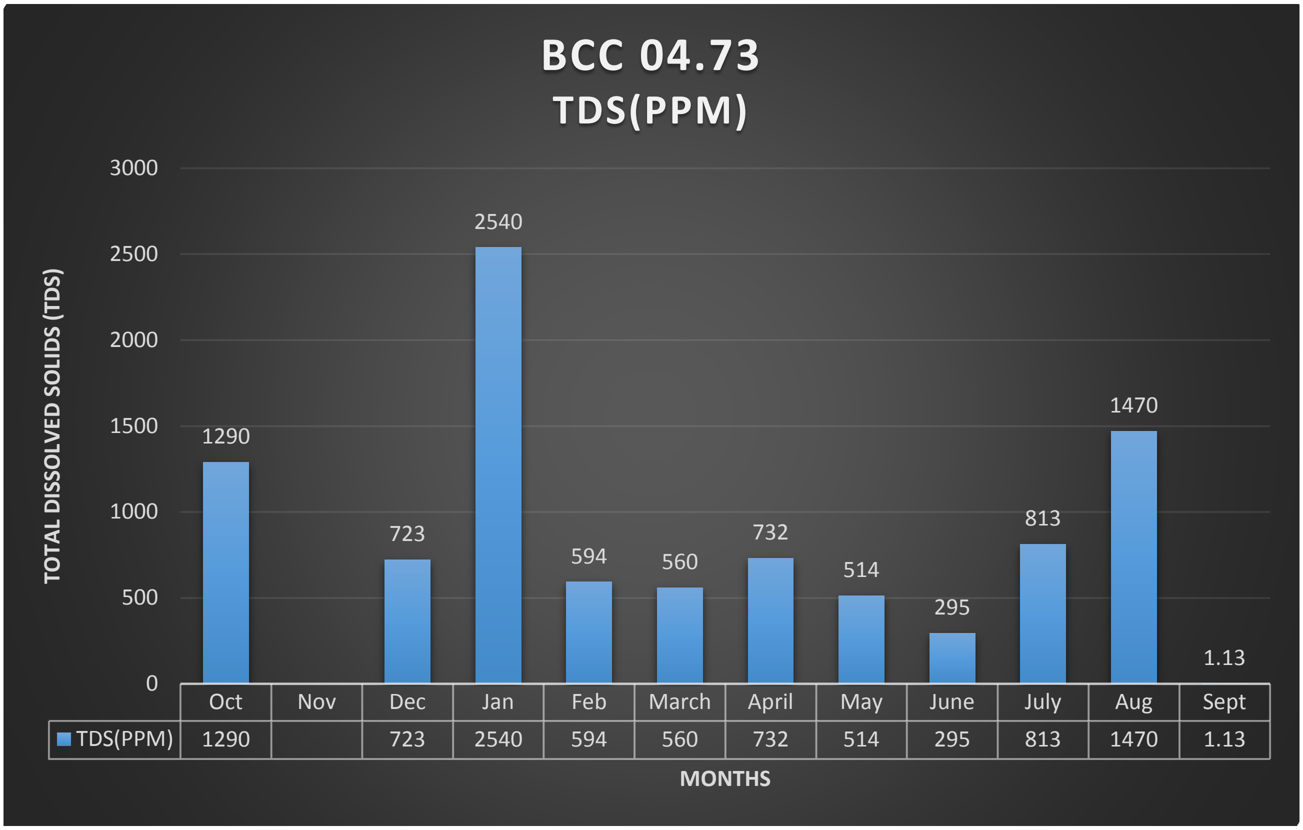


Figure 4-229 Big Cottonwood Creek 04.73 Conductivity

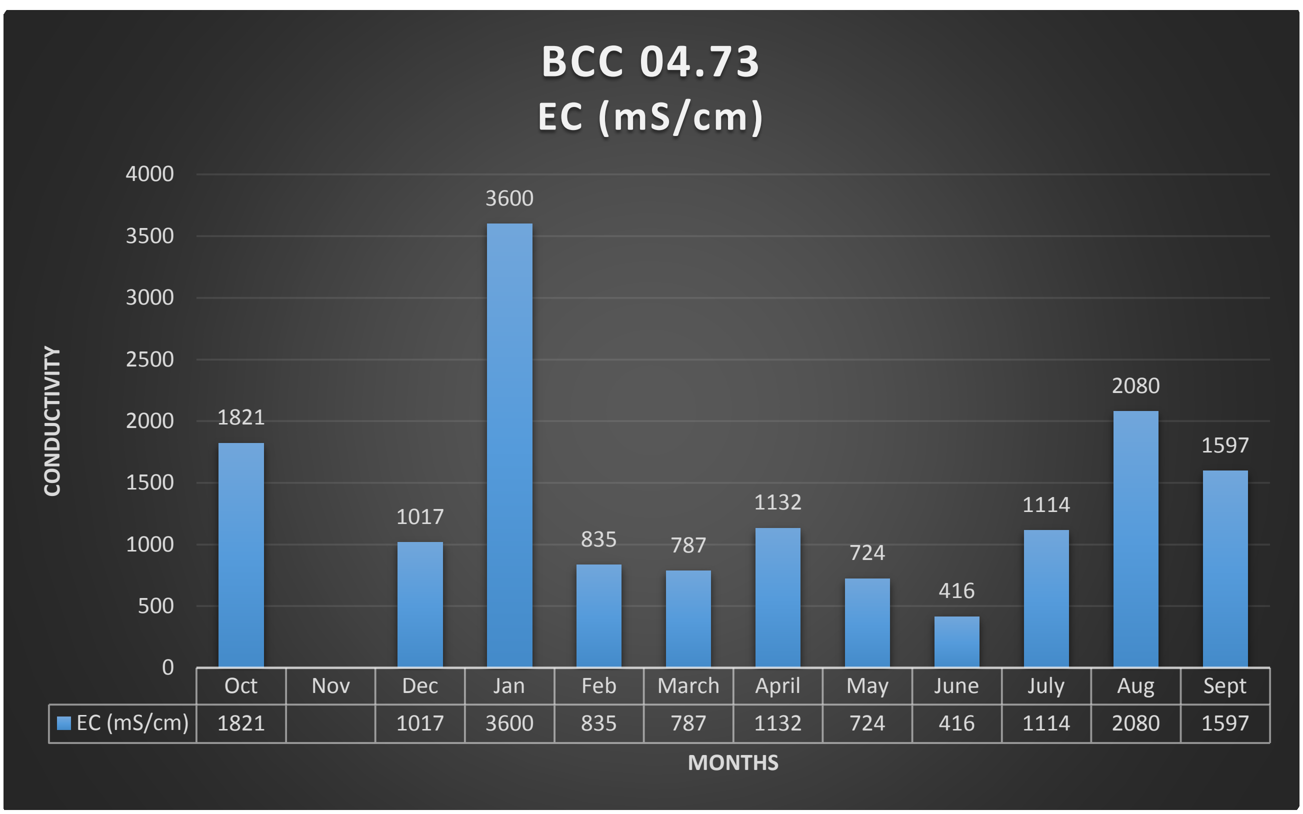
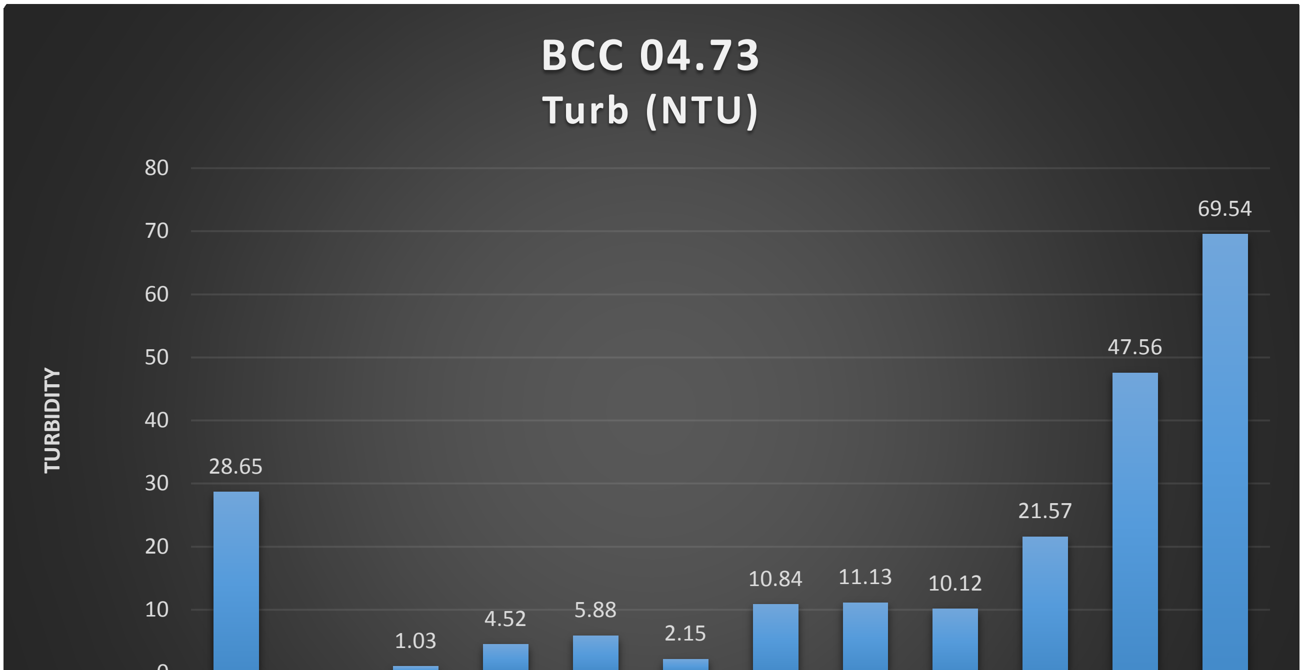
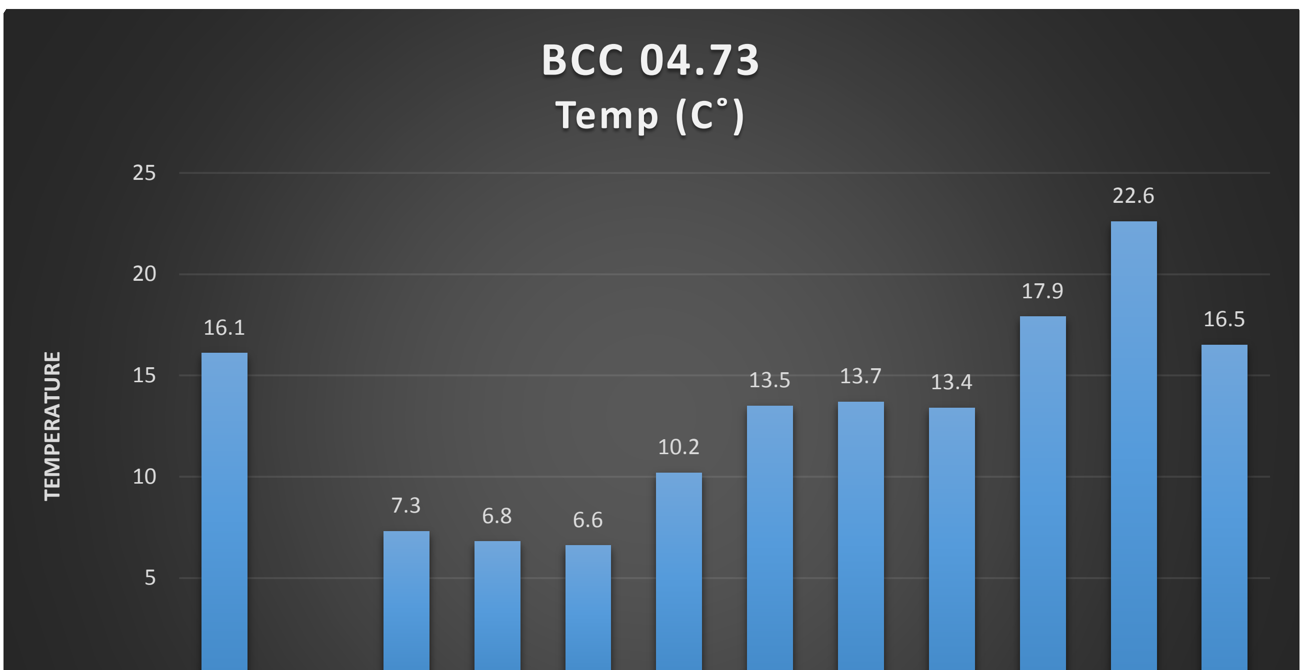


Figure 4-230 Big Cottonwood Creek 04.73 Turbidity



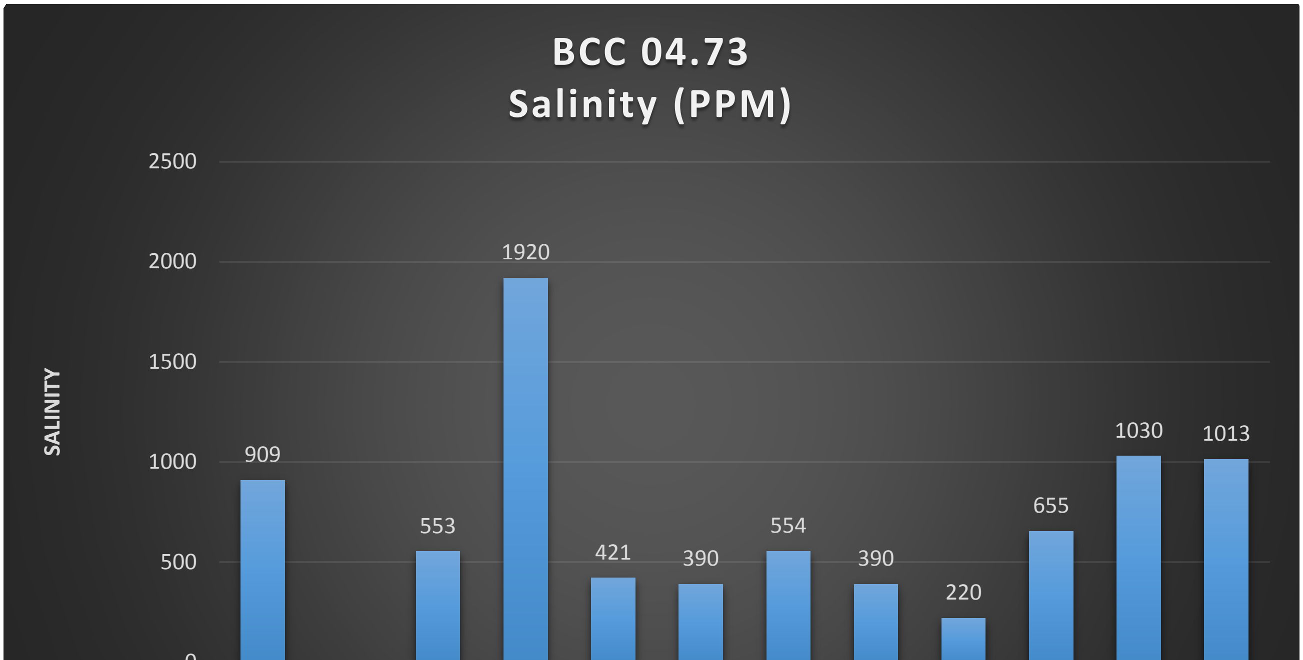
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sept
Turb (NTU)	28.65		1.03	4.52	5.88	2.15	10.84	11.13	10.12	21.57	47.56	69.54

Figure 4-231 Big Cottonwood Creek 04.73 Temperature



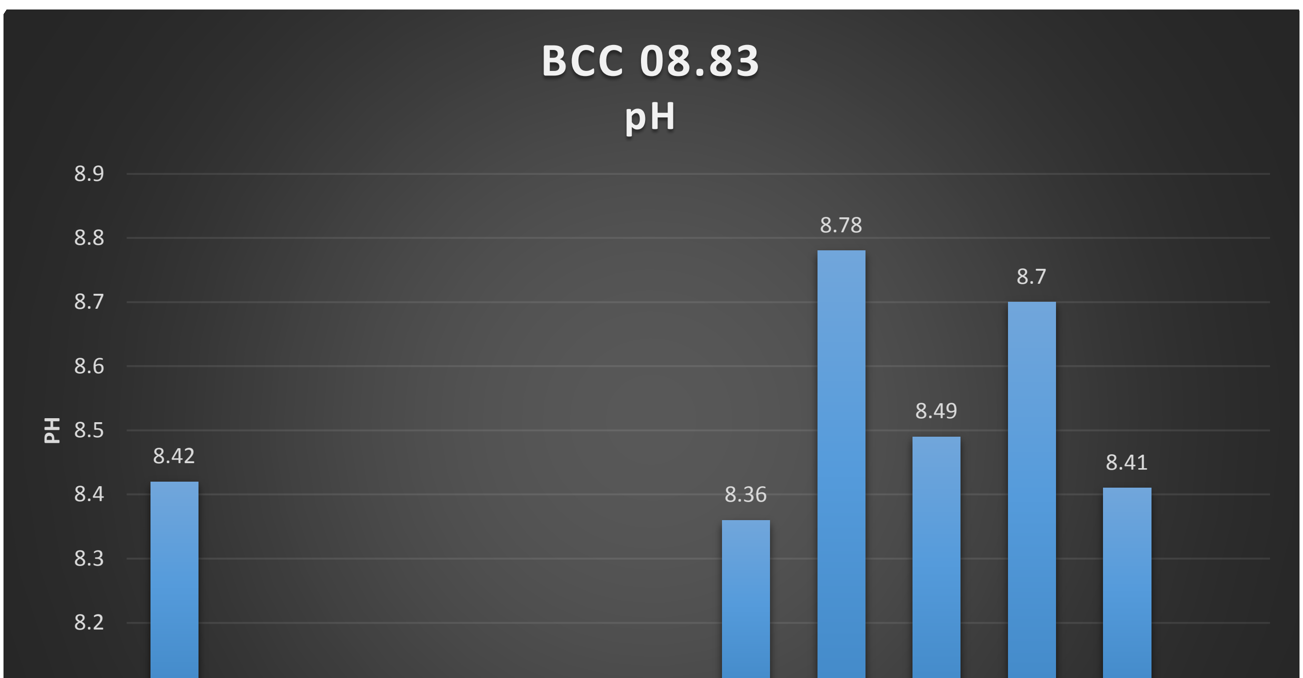
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sept
Temp (C˚)	16.1		7.3	6.8	6.6	10.2	13.5	13.7	13.4	17.9	22.6	16.5

Figure 4-232 Big Cottonwood Creek 04.73 Salinity



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sept
Salinity (PPM)	909		553	1920	421	390	554	390	220	655	1030	1013

Figure 4-233 Big Cottonwood Creek 08.83 pH



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
pH	8.42						8.36	8.78	8.49	8.7	8.41	

Figure 4-234 Big Cottonwood Creek 08.83 Dissolved Oxygen

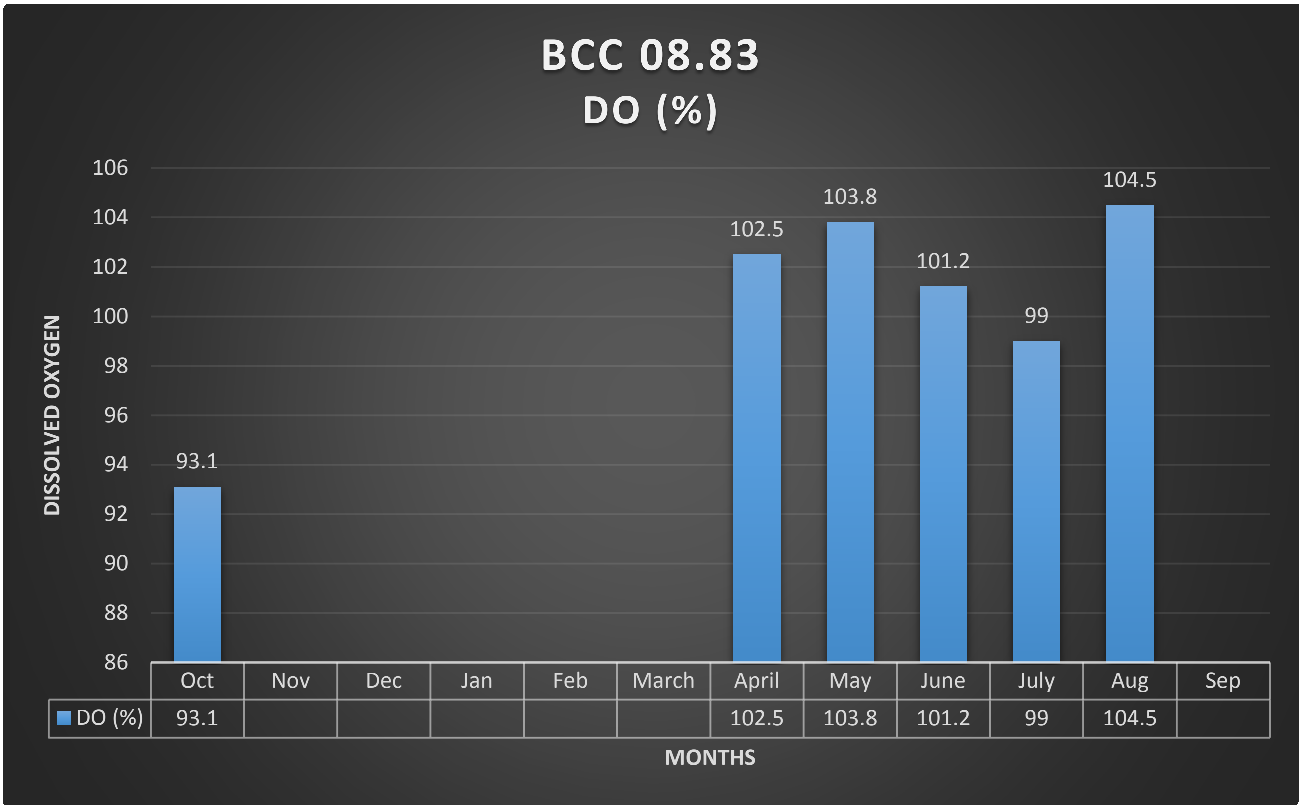


Figure 4-235 Big Cottonwood Creek 08.83 Total Dissolved Solids

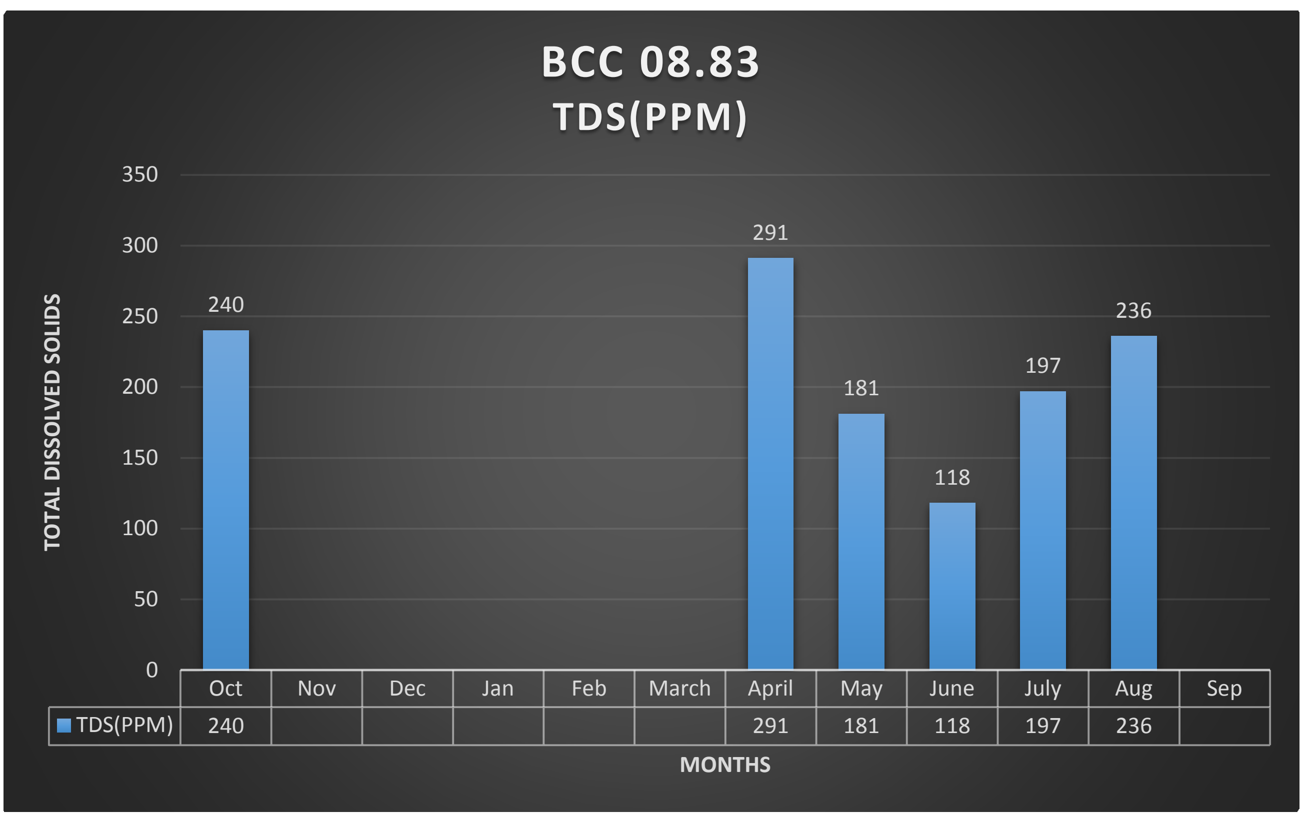
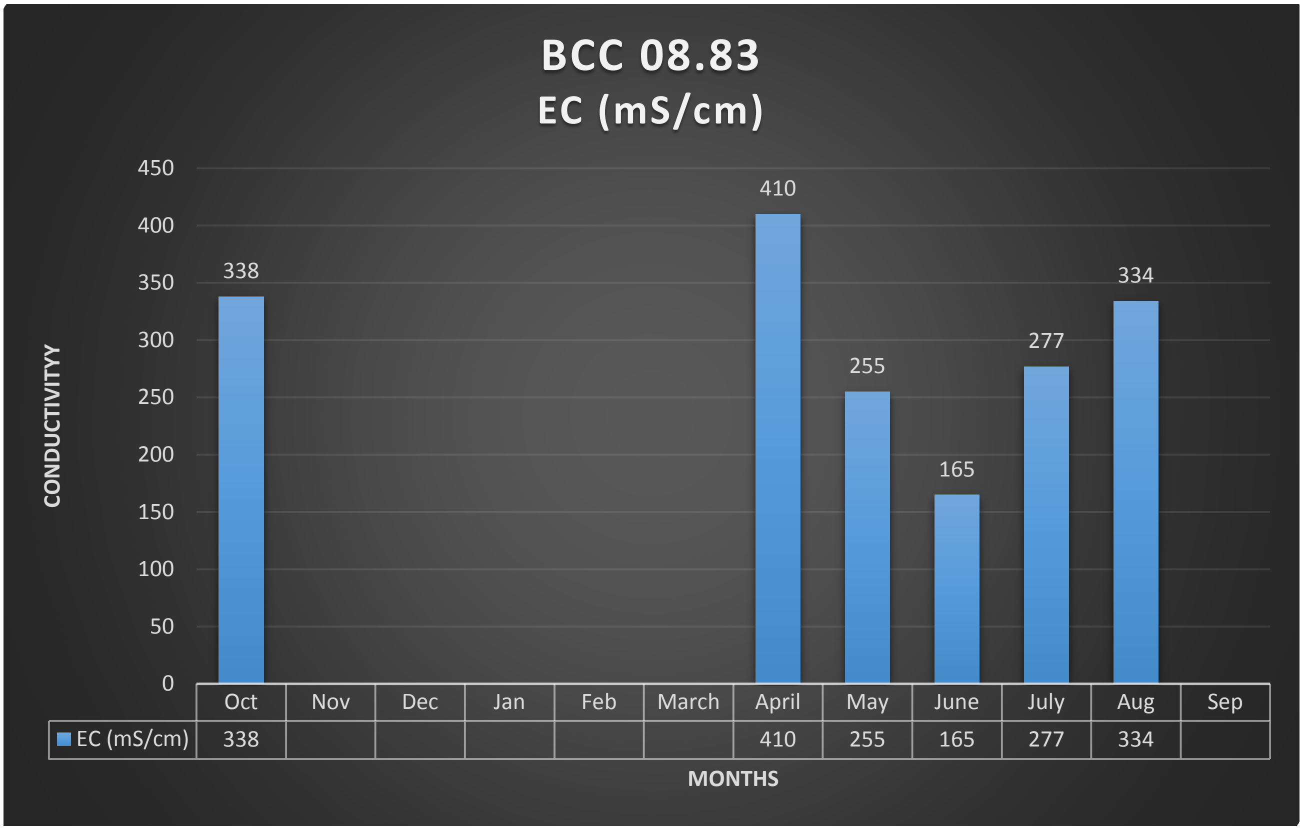
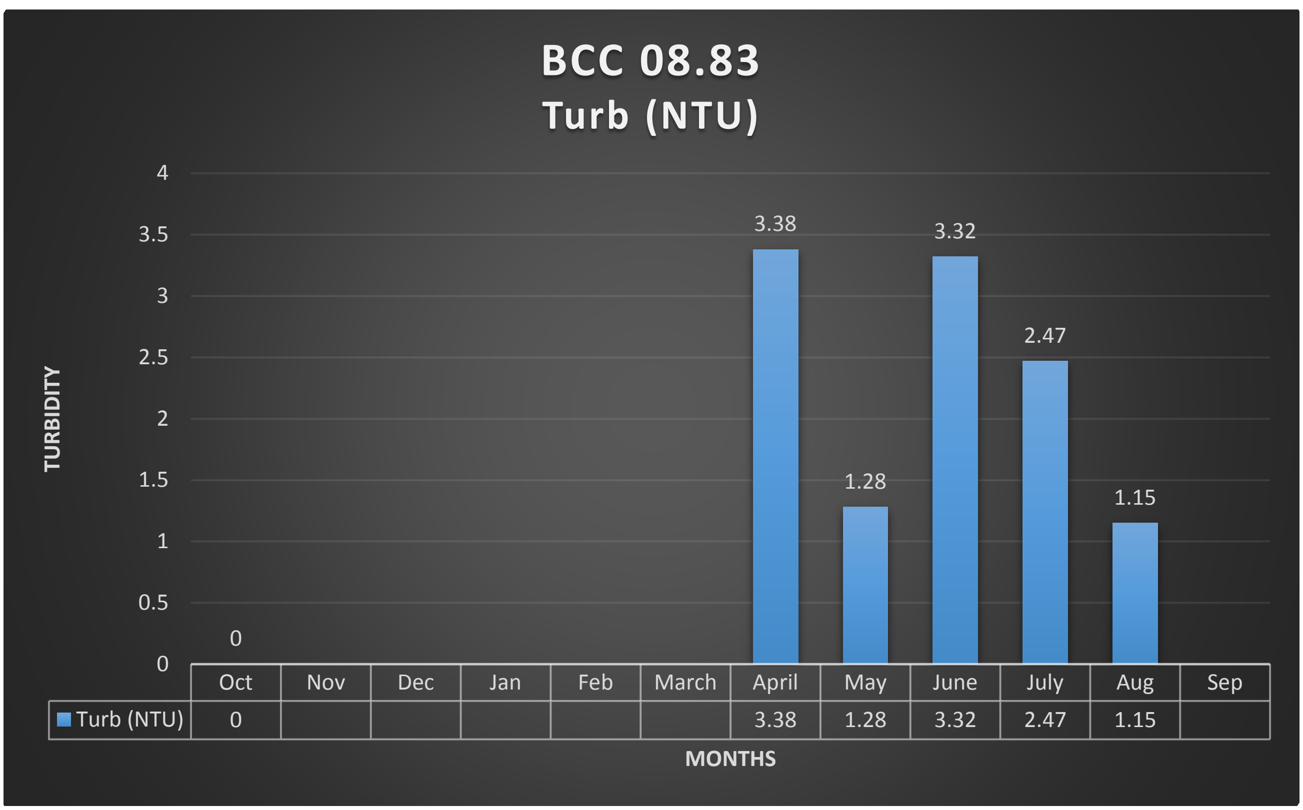


Figure 4-236 Big Cottonwood Creek 08.83 Conductivity



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
EC (mS/cm)	338						410	255	165	277	334	

Figure 4-237 Big Cottonwood Creek 08.83 Turbidity



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Turb (NTU)	0						3.38	1.28	3.32	2.47	1.15	

Figure 4-238 Big Cottonwood Creek 08.83 Temperature

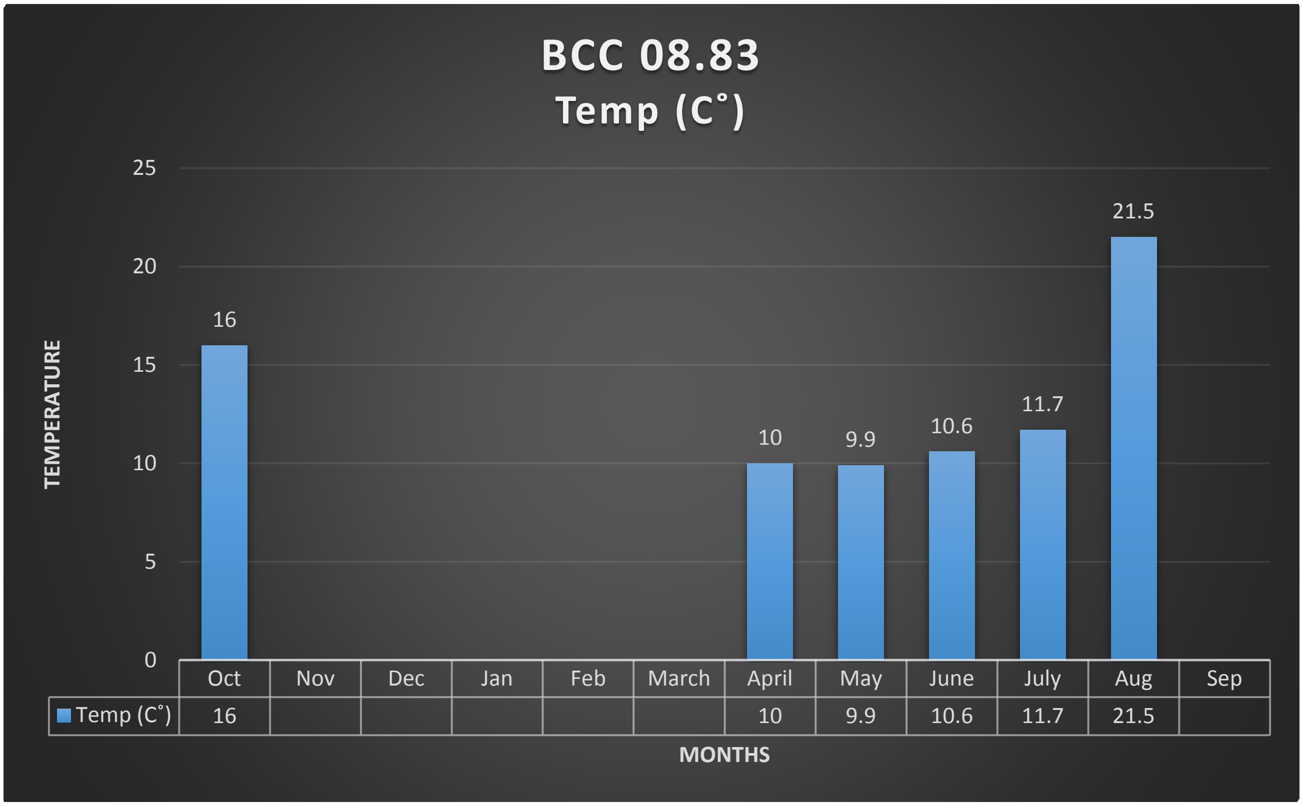


Figure 4-239 Big Cottonwood Creek 08.83 Salinity

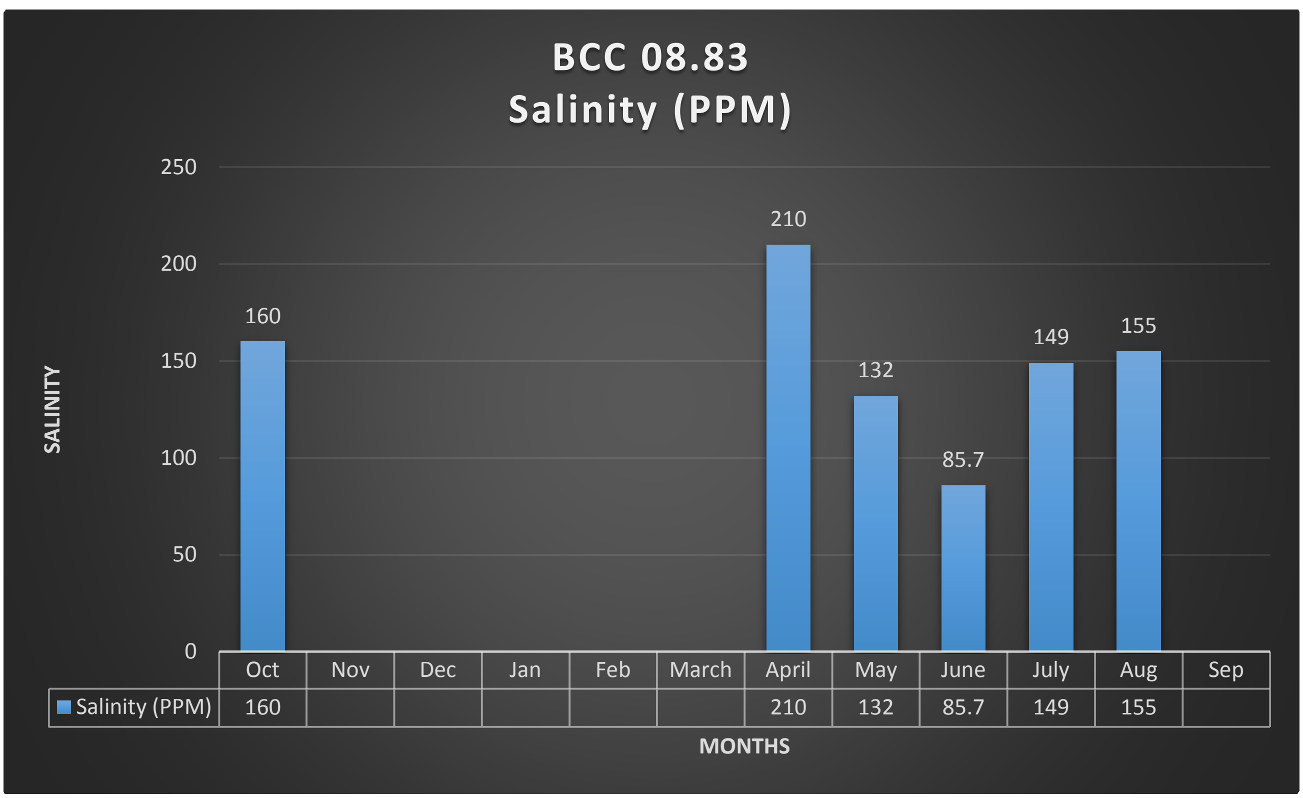


Figure 4-240 Big Cottonwood Creek 11.99 pH

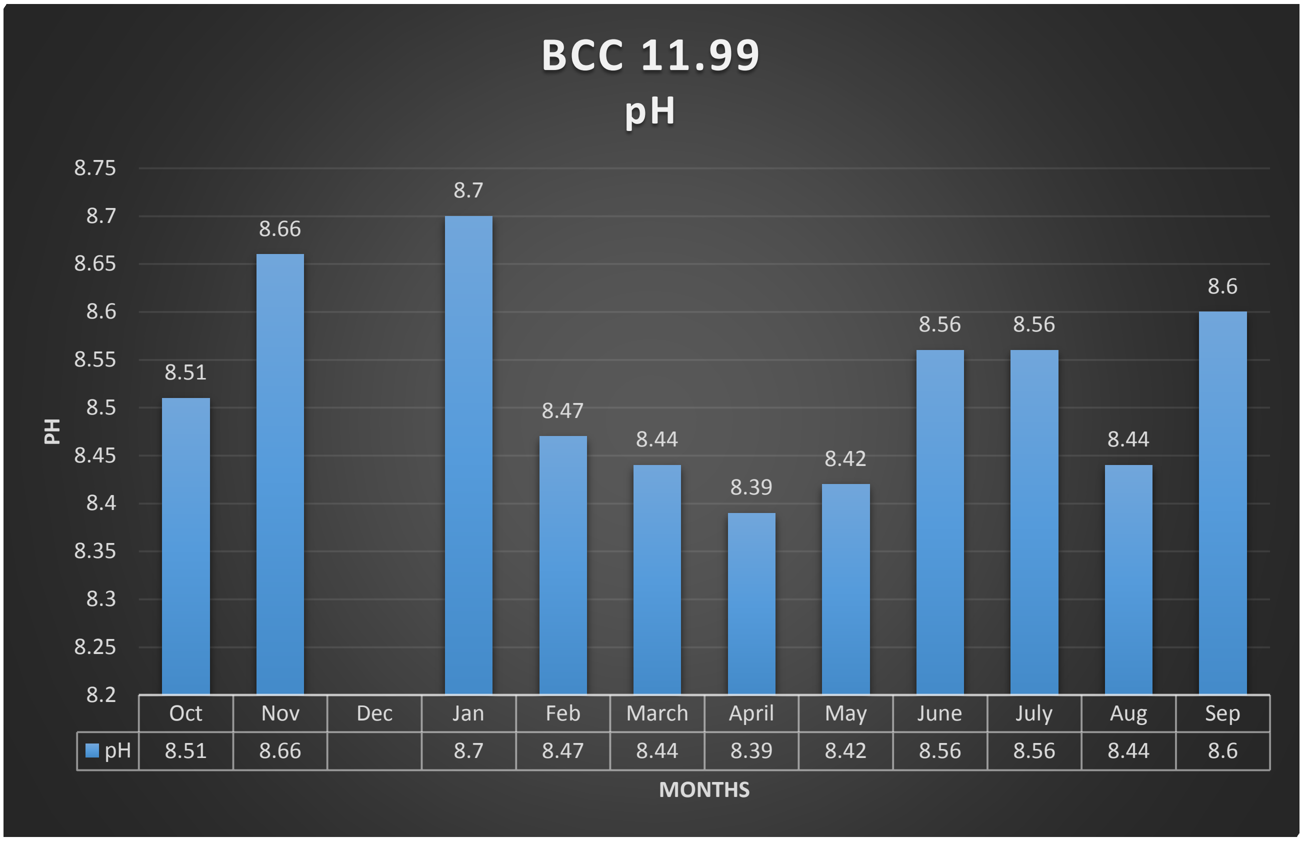


Figure 4-241 Big Cottonwood Creek 11.99 Dissolved Oxygen

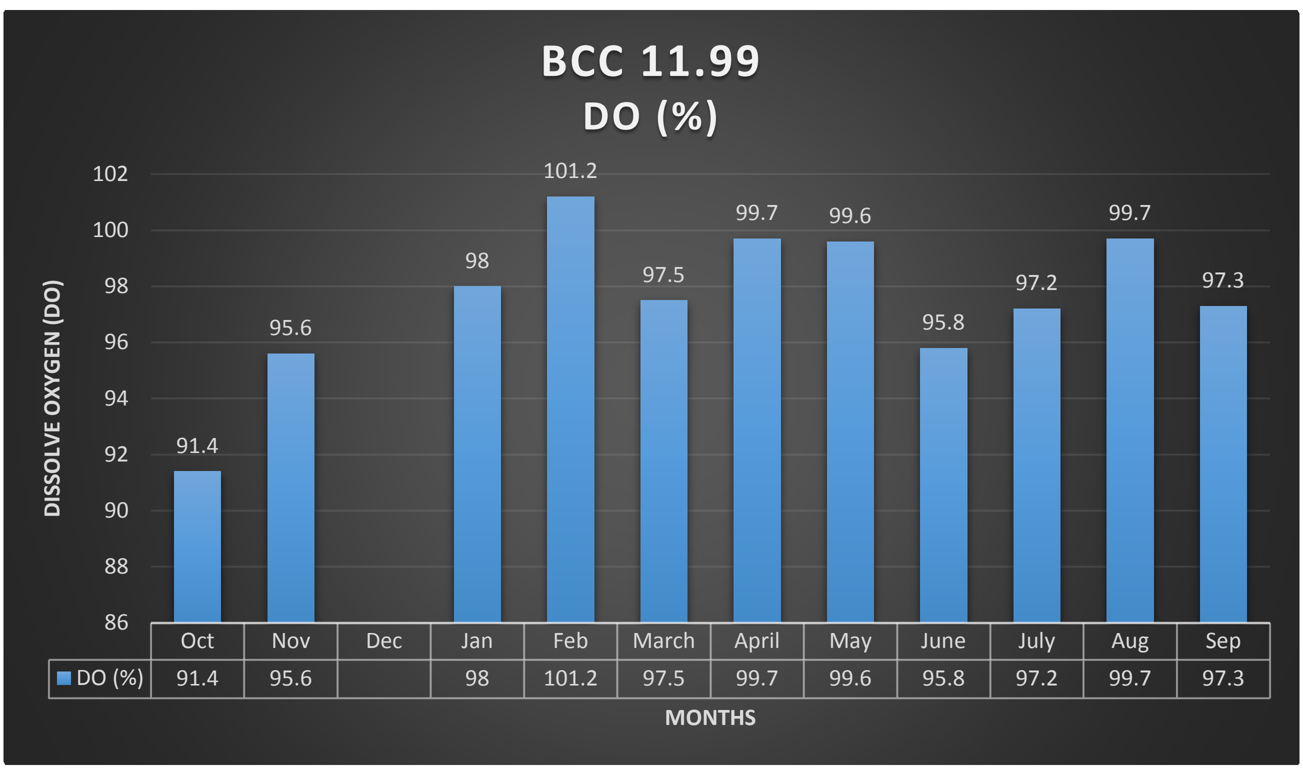
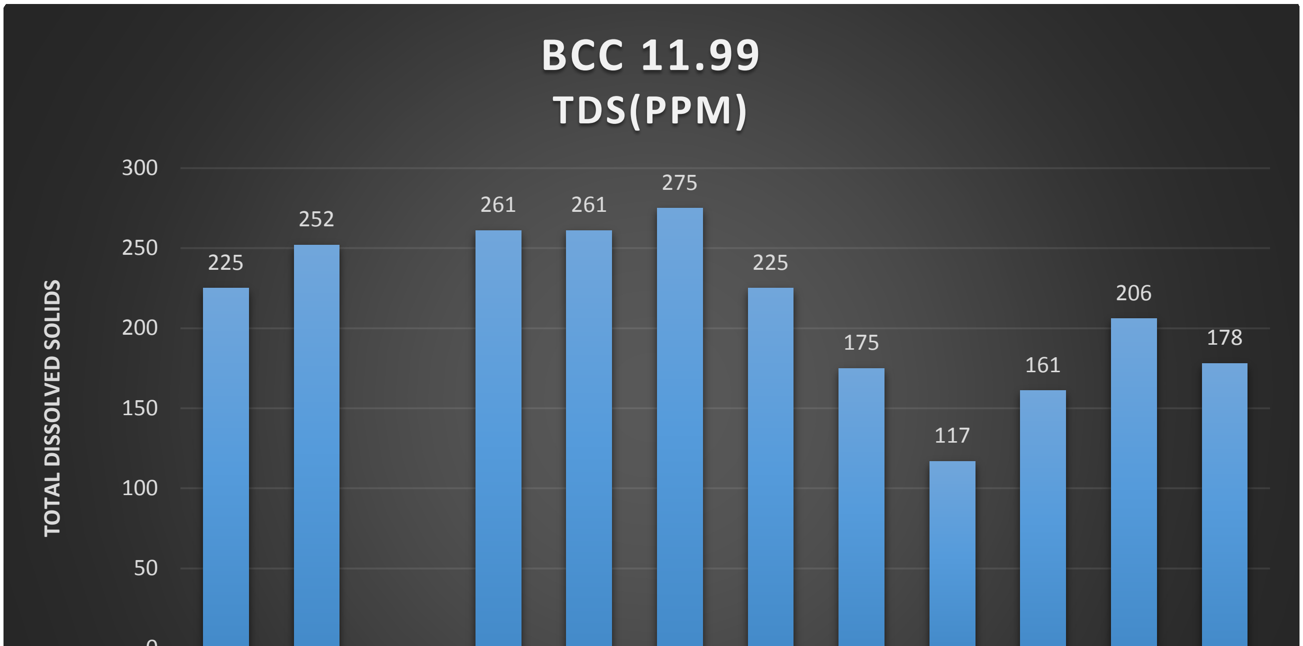
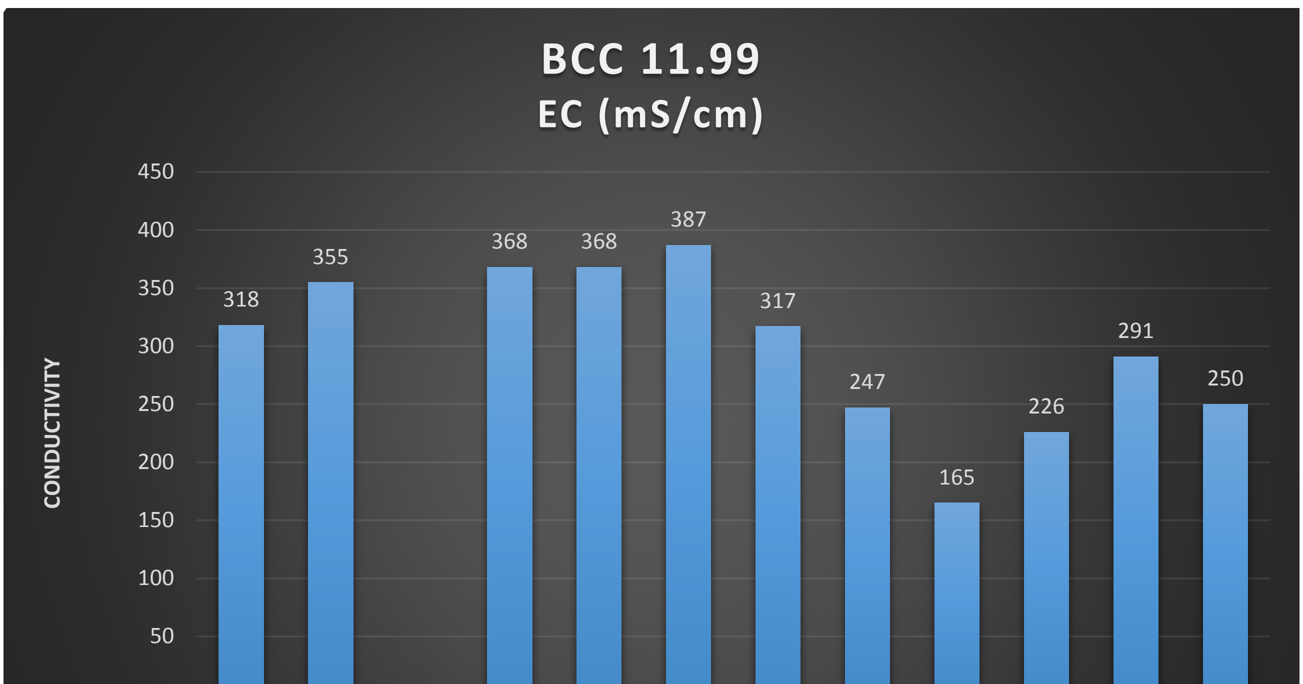


Figure 4-242 Big Cottonwood Creek 11.99 Total Dissolved Solids



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
TDS(PPM)	225	252		261	261	275	225	175	117	161	206	178

Figure 4-243 Big Cottonwood Creek 11.99 Conductivity



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
EC (mS/cm)	318	355		368	368	387	317	247	165	226	291	250

Figure 4-244 Big Cottonwood Creek 11.99 Turbidity

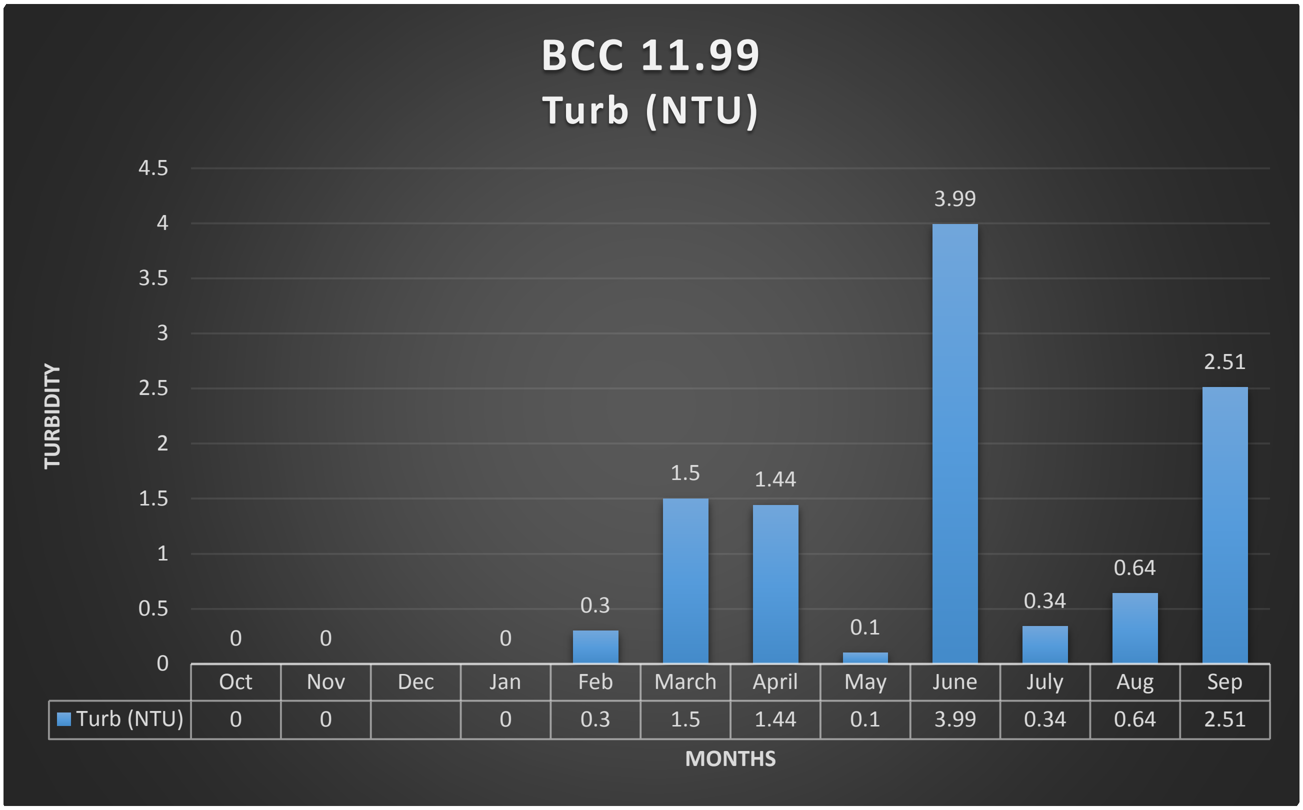


Figure 4-245 Big Cottonwood Creek 11.99 Temperature

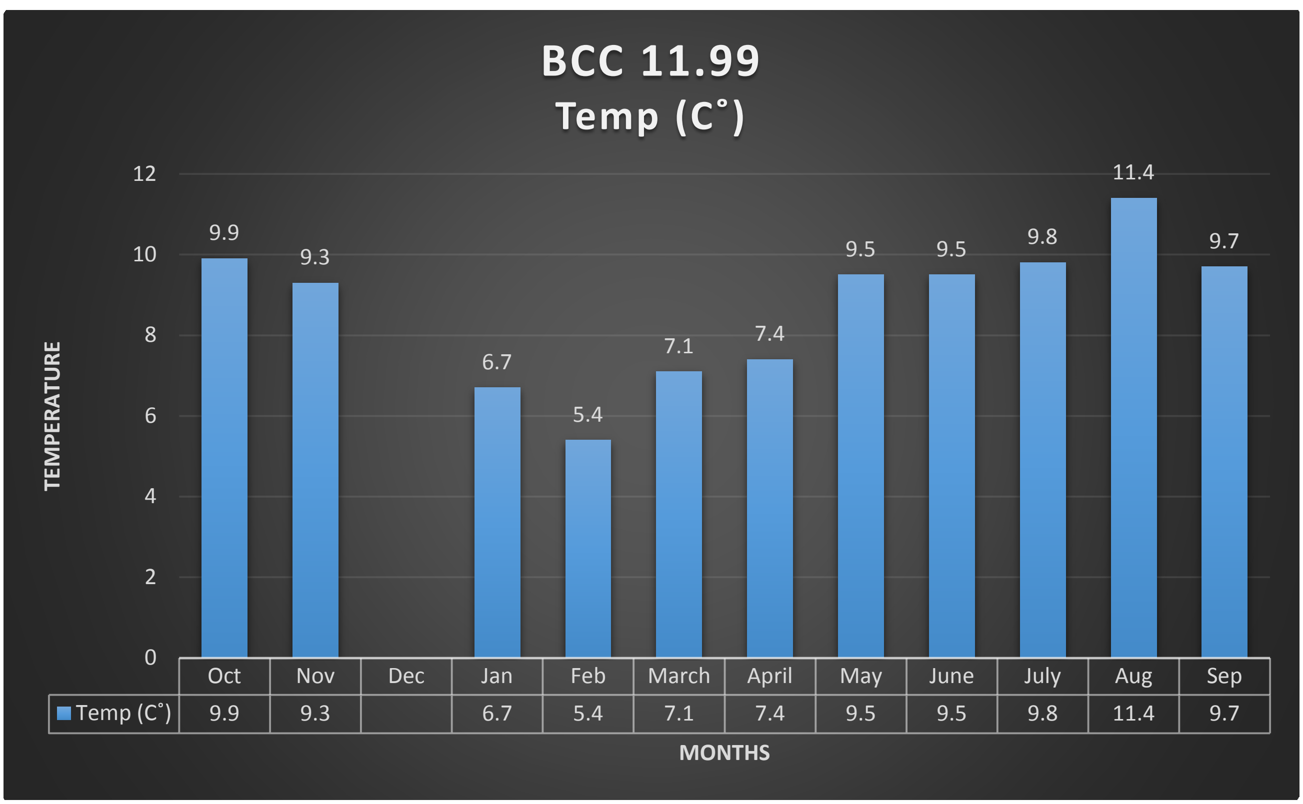
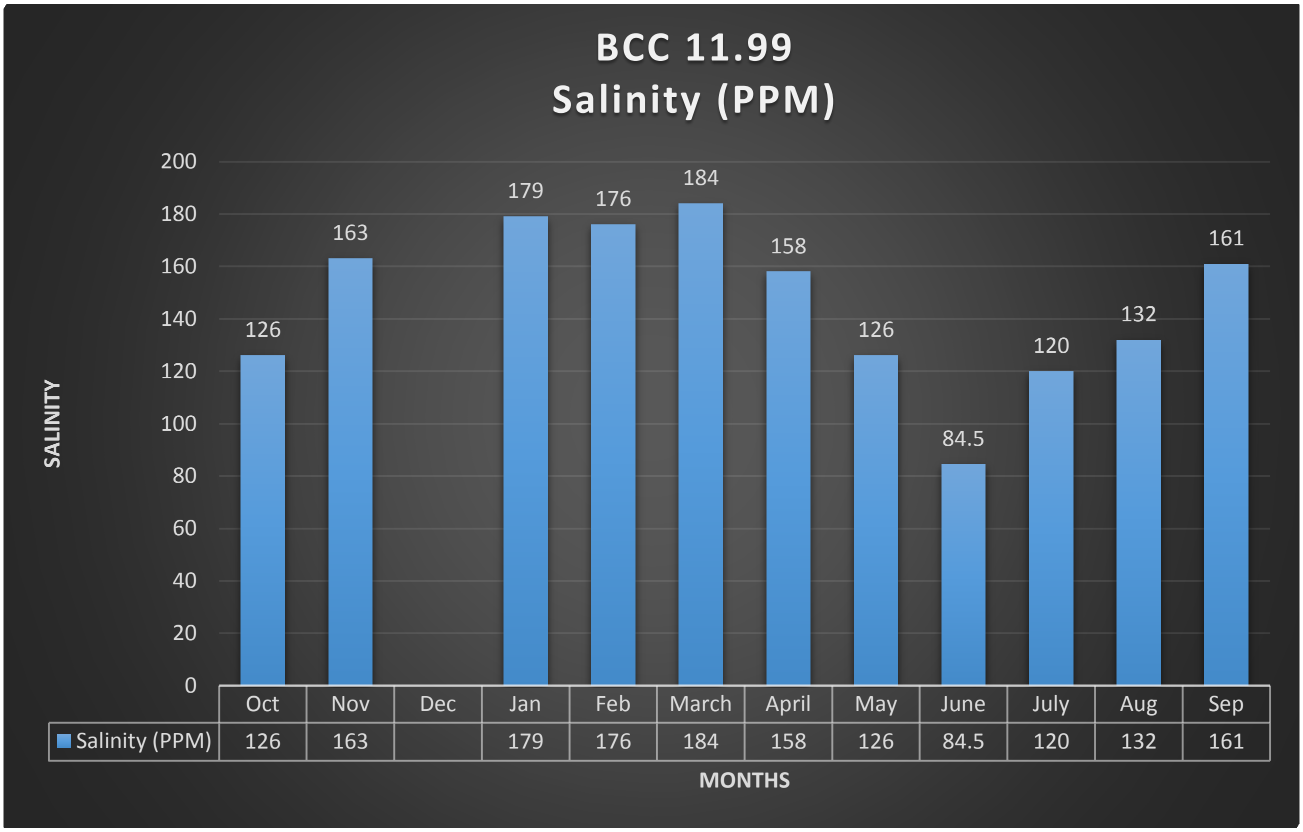
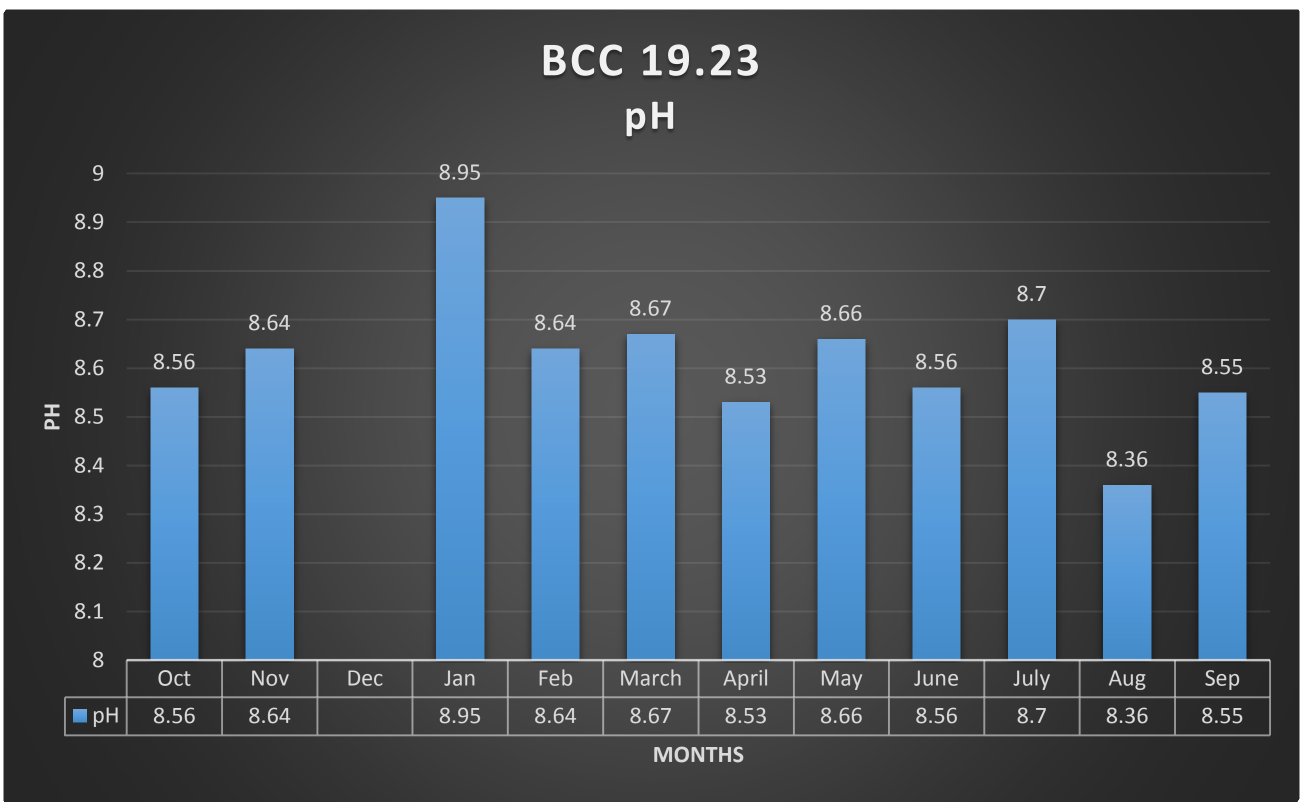


Figure 4-246 Big Cottonwood Creek 11.99 Salinity



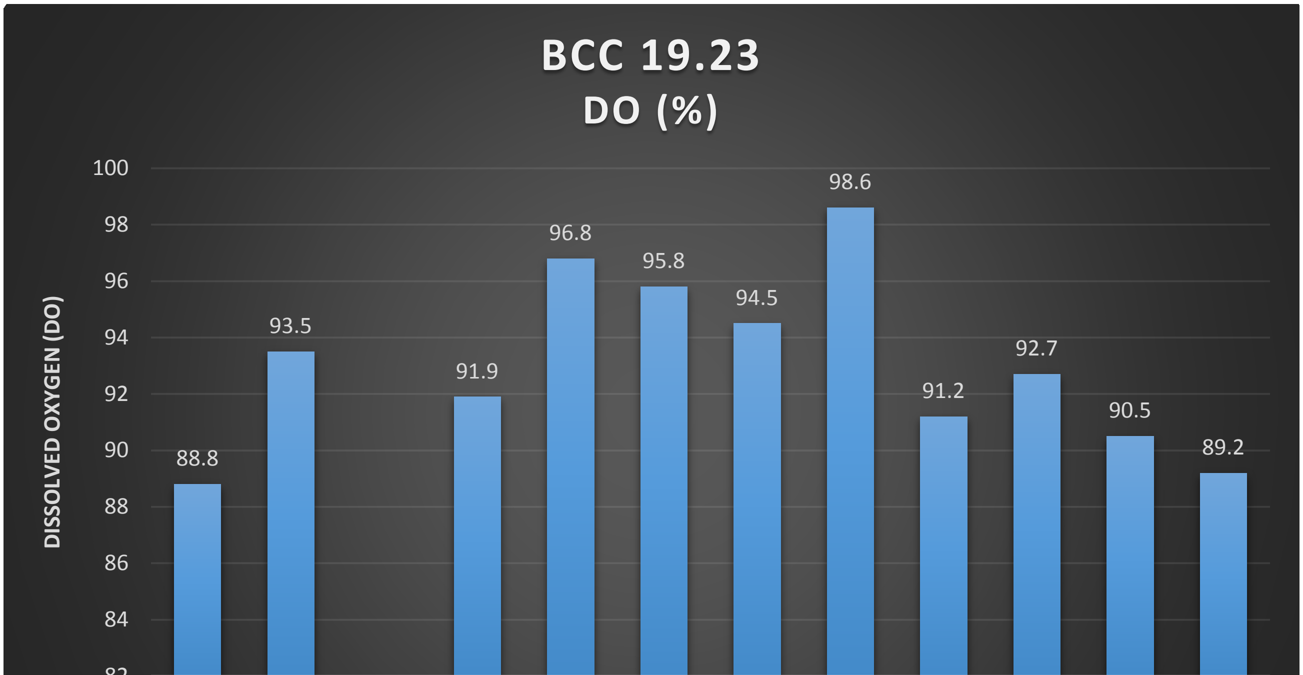
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Salinity (PPM)	126	163		179	176	184	158	126	84.5	120	132	161

Figure 4-247 Big Cottonwood Creek 19.23 pH



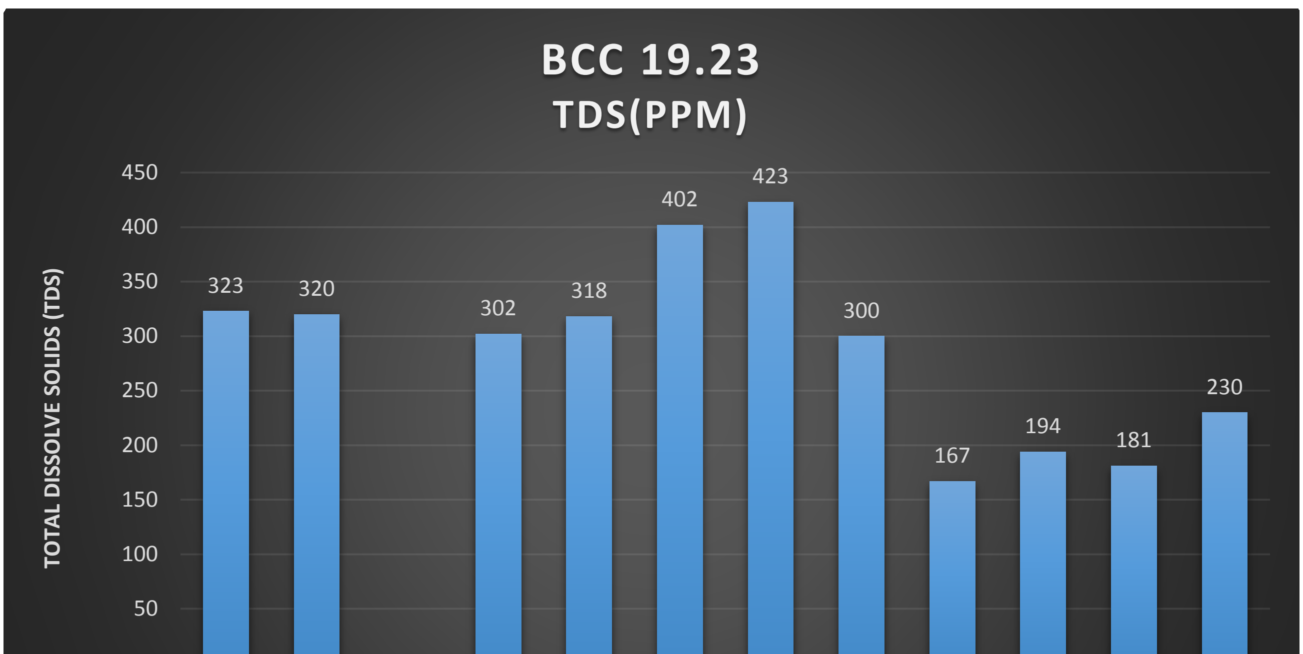
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
pH	8.56	8.64		8.95	8.64	8.67	8.53	8.66	8.56	8.7	8.36	8.55

Figure 4-248 Big Cottonwood Creek 19.23 Dissolved Oxygen



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
DO (%)	88.8	93.5		91.9	96.8	95.8	94.5	98.6	91.2	92.7	90.5	89.2

Figure 4-249 Big Cottonwood Creek 19.23 Total Dissolved Solids



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
TDS(PPM)	323	320		302	318	402	423	300	167	194	181	230

Figure 4-250 Big Cottonwood Creek 19.23 Conductivity

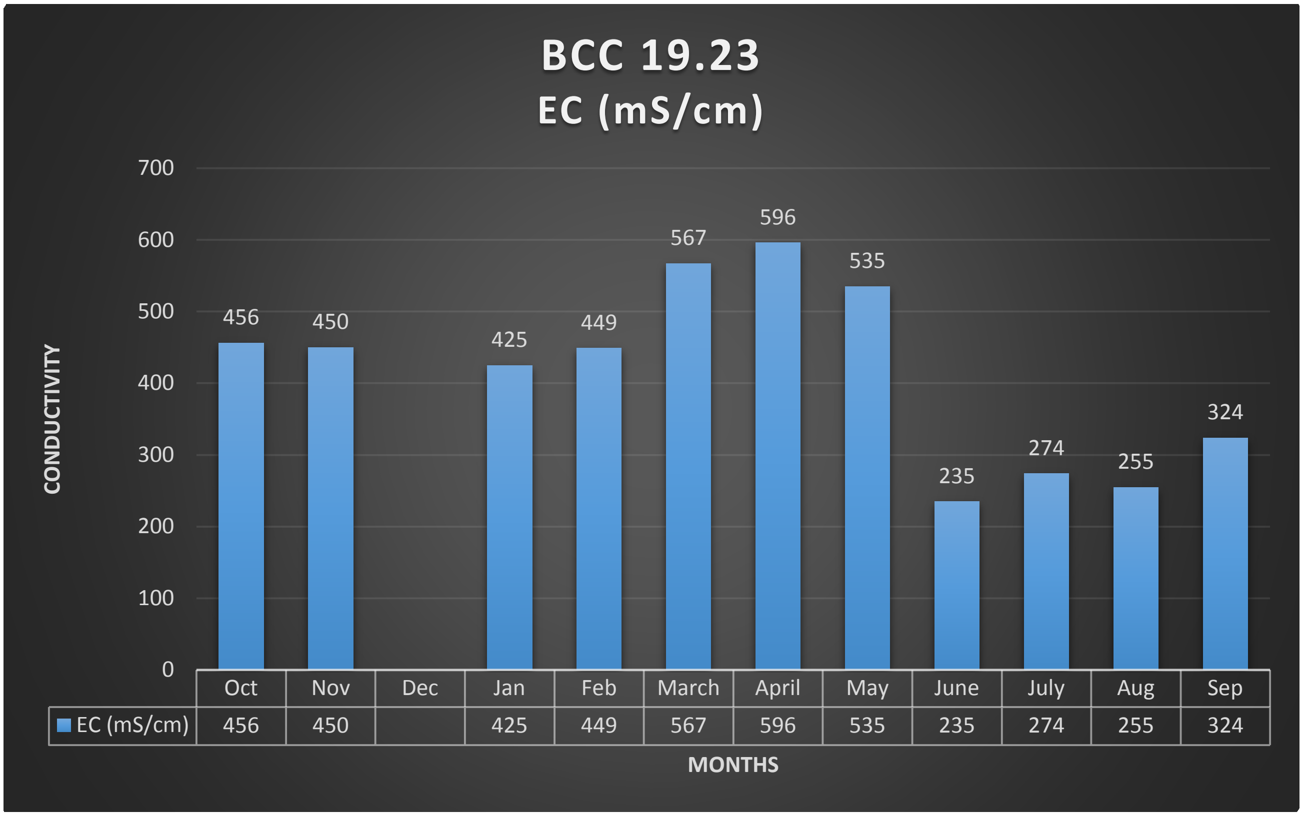


Figure 4-251 Big Cottonwood Creek 19.23 Turbidity

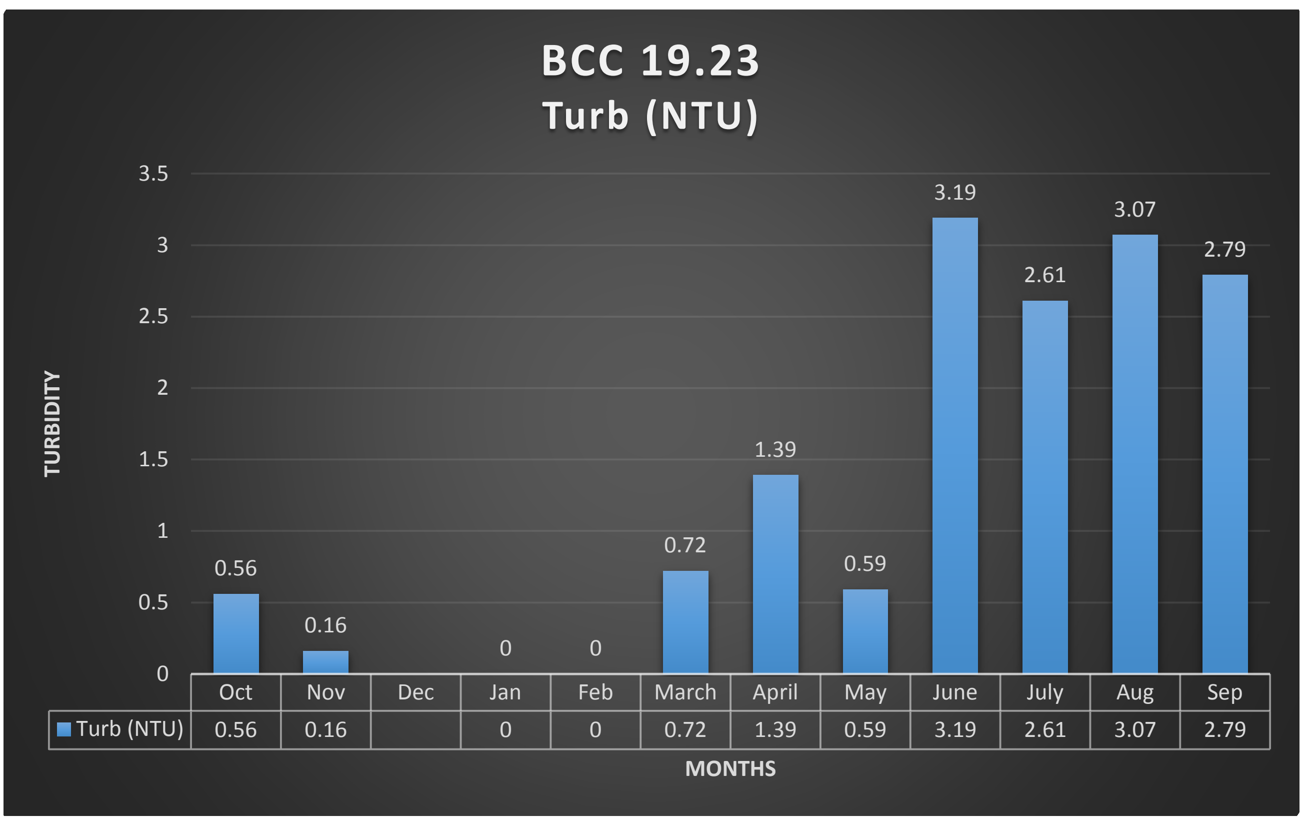
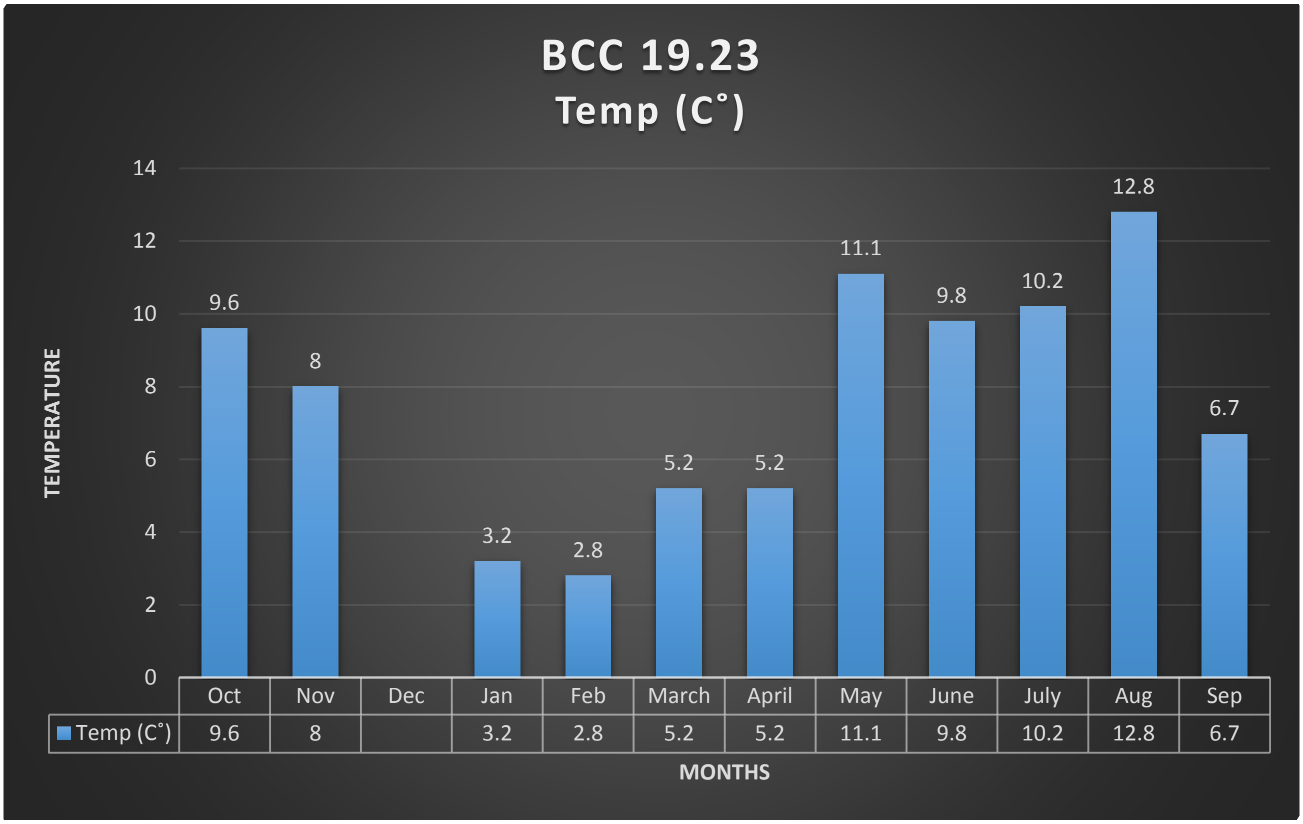
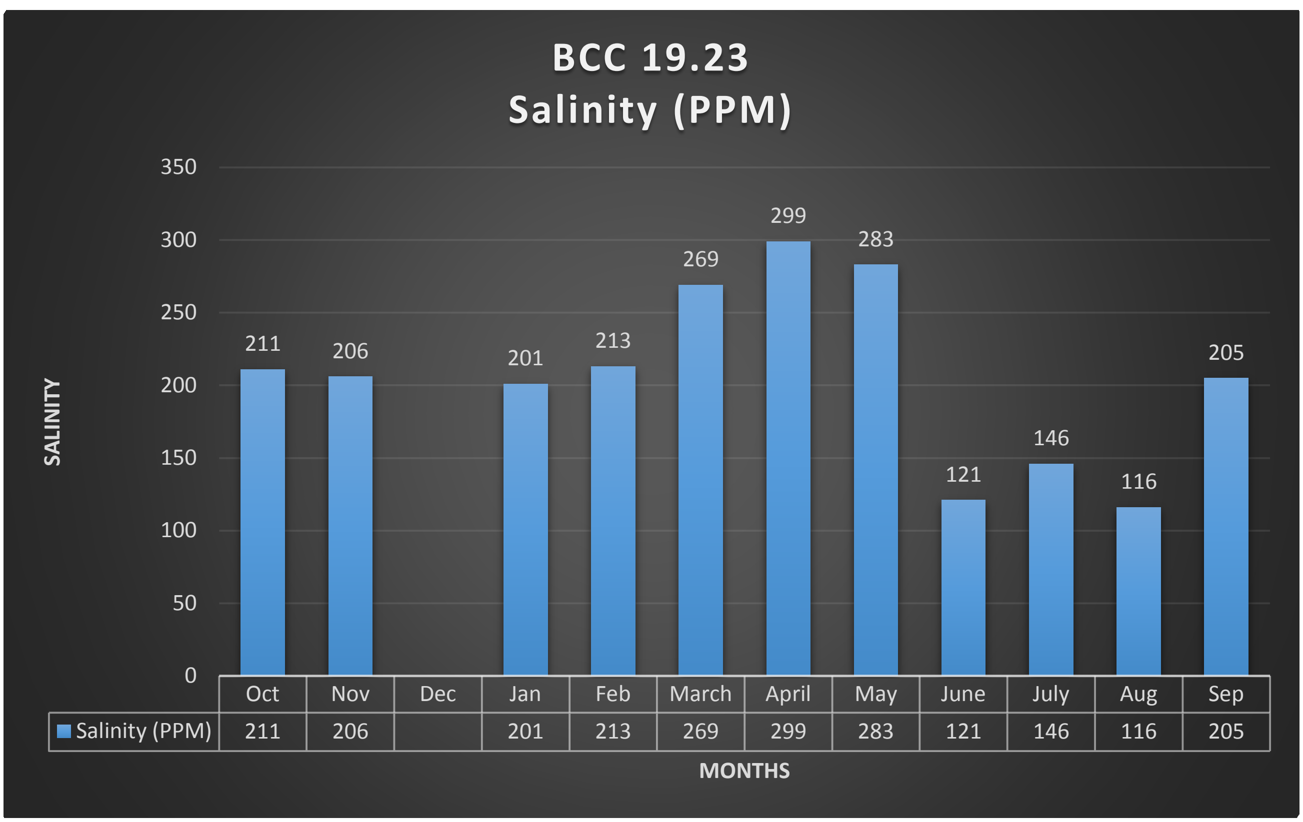


Figure 4-252 Big Cottonwood Creek 19.23 Temperature



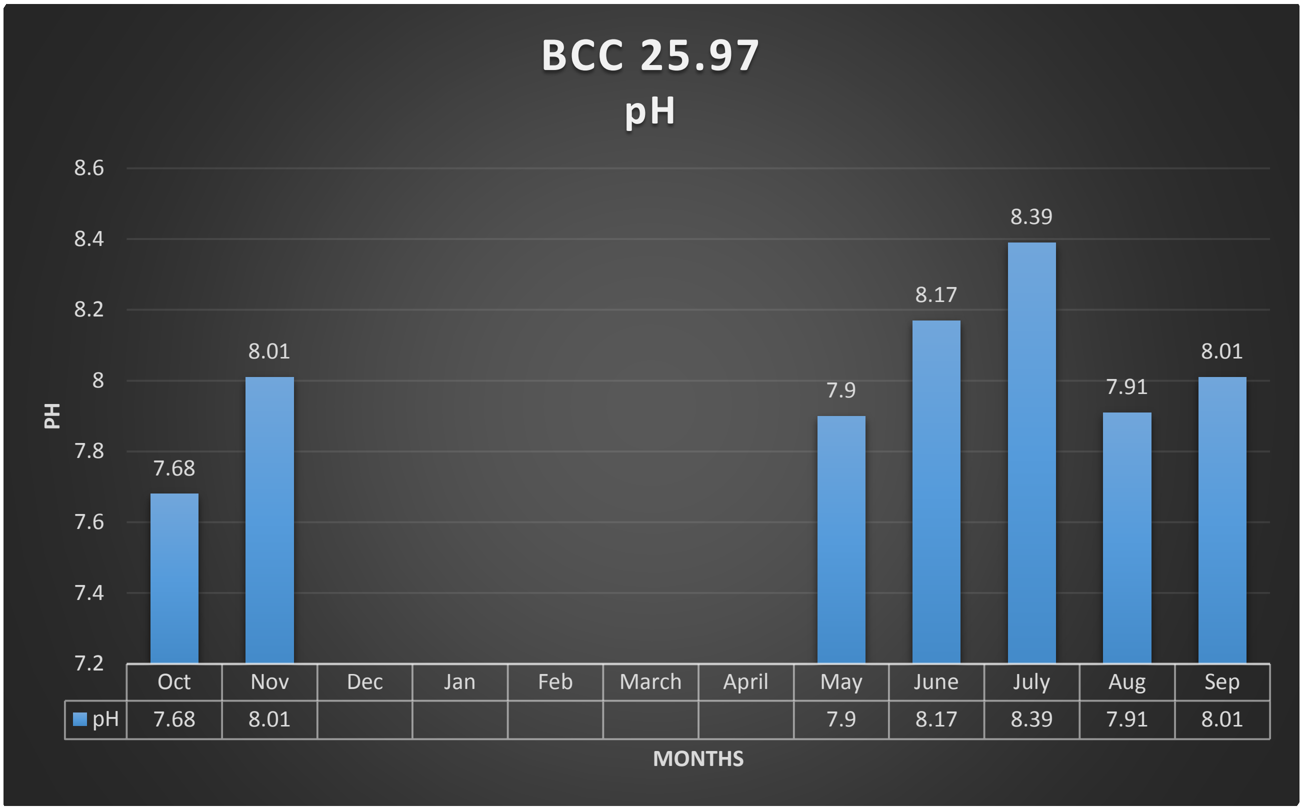
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Temp (C˚)	9.6	8		3.2	2.8	5.2	5.2	11.1	9.8	10.2	12.8	6.7

Figure 4-253 Big Cottonwood Creek 19.23 Salinity



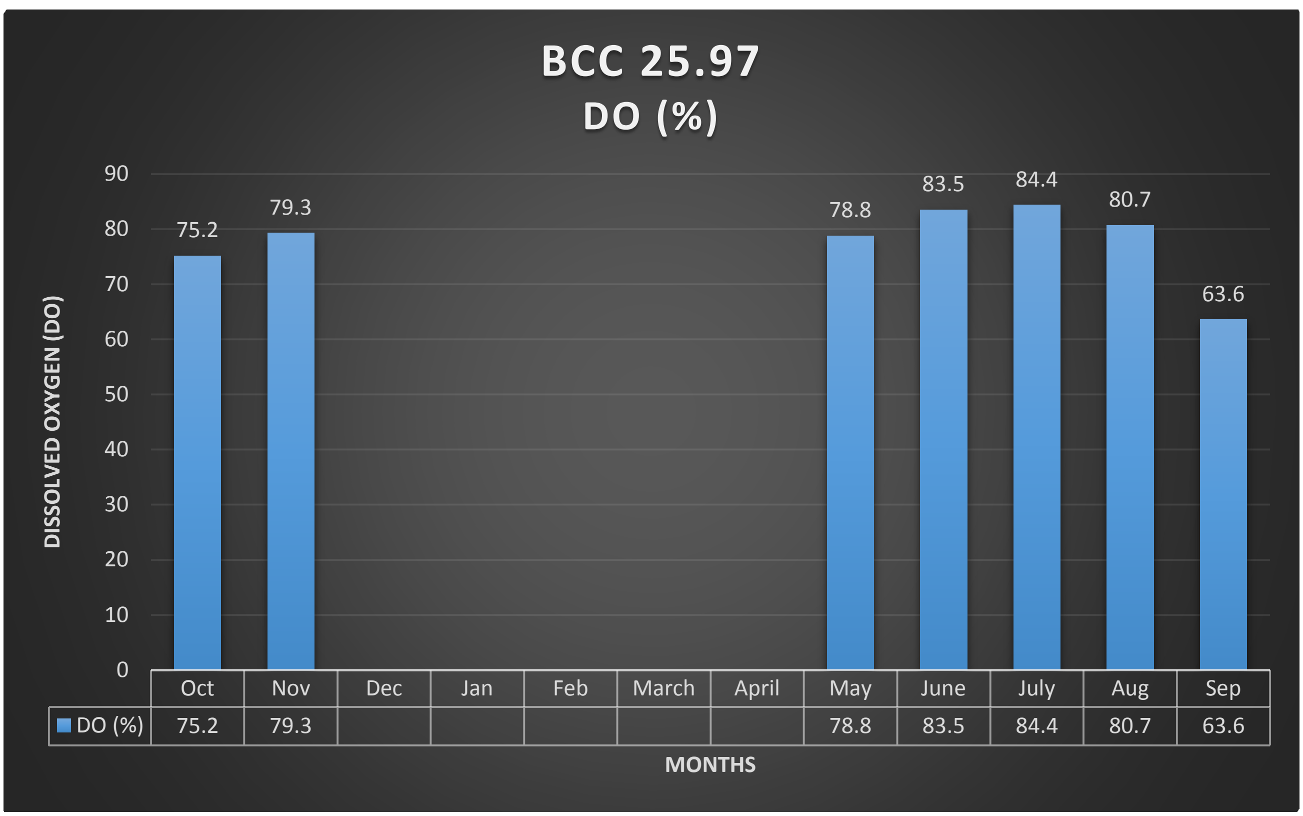
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Salinity (PPM)	211	206		201	213	269	299	283	121	146	116	205

Figure 4-254 Big Cottonwood Creek 25.97 pH



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
pH	7.68	8.01						7.9	8.17	8.39	7.91	8.01

Figure 4-255 Big Cottonwood Creek 25.97 Dissolved Oxygen



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
DO (%)	75.2	79.3						78.8	83.5	84.4	80.7	63.6

Figure 4-256 Big Cottonwood Creek 25.97 Total Dissolved Solids

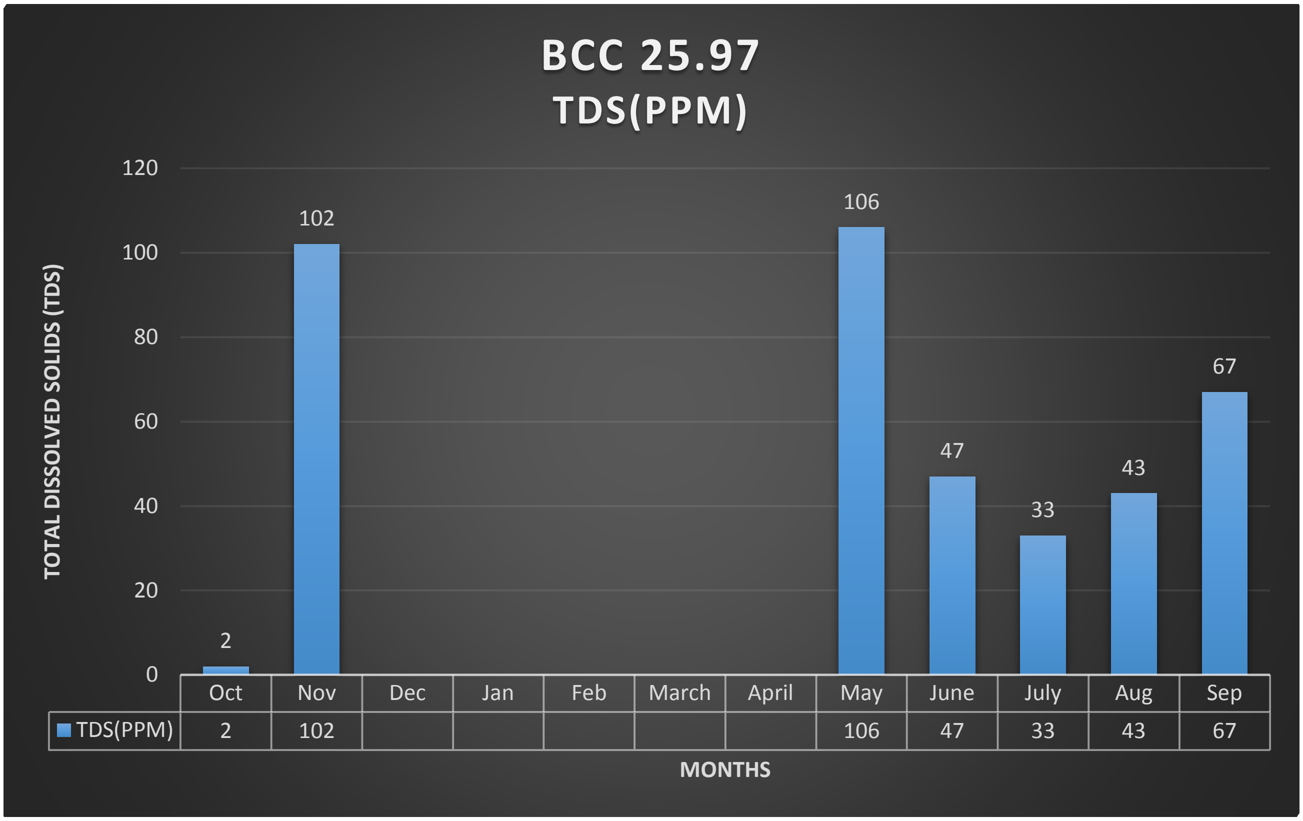


Figure 4-257 Big Cottonwood Creek 25.97 Conductivity

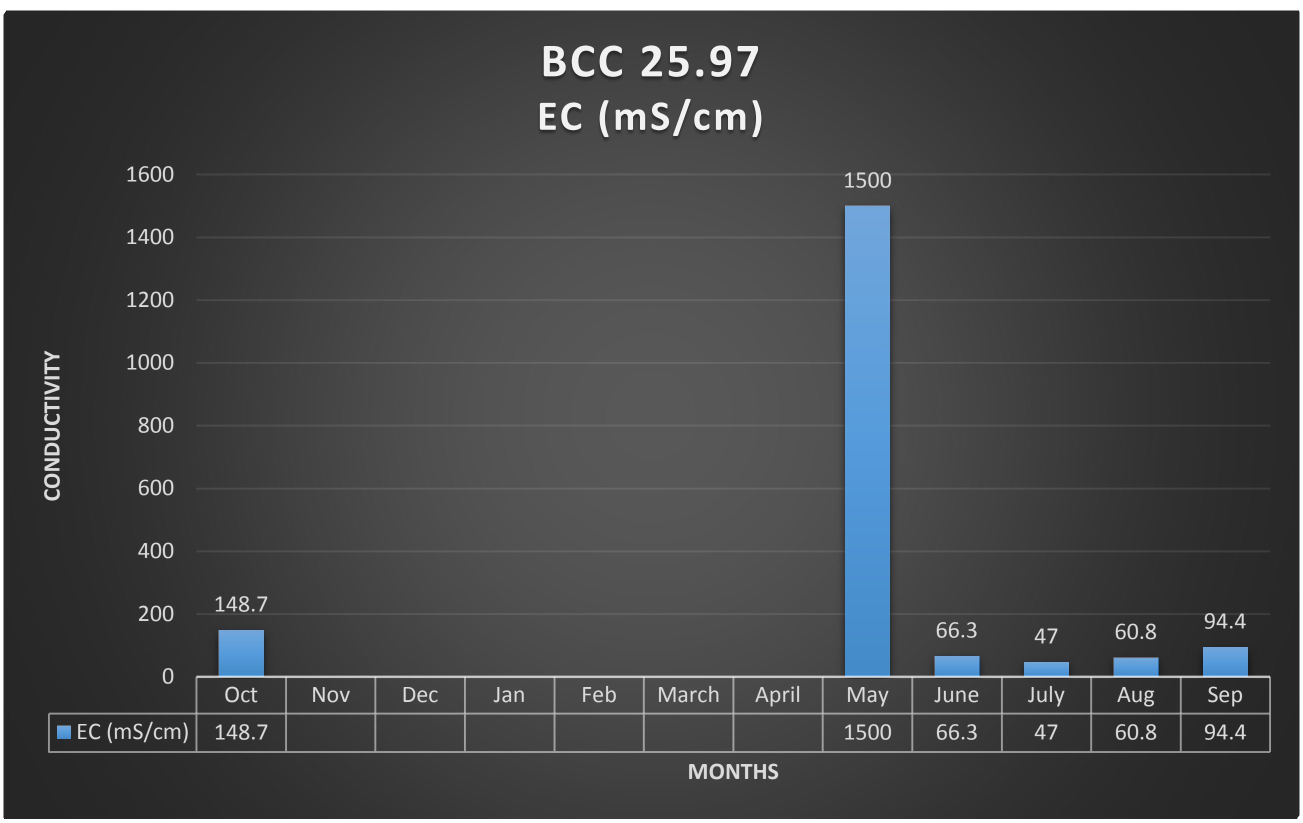


Figure 4-258 Big Cottonwood Creek 25.97 Turbidity

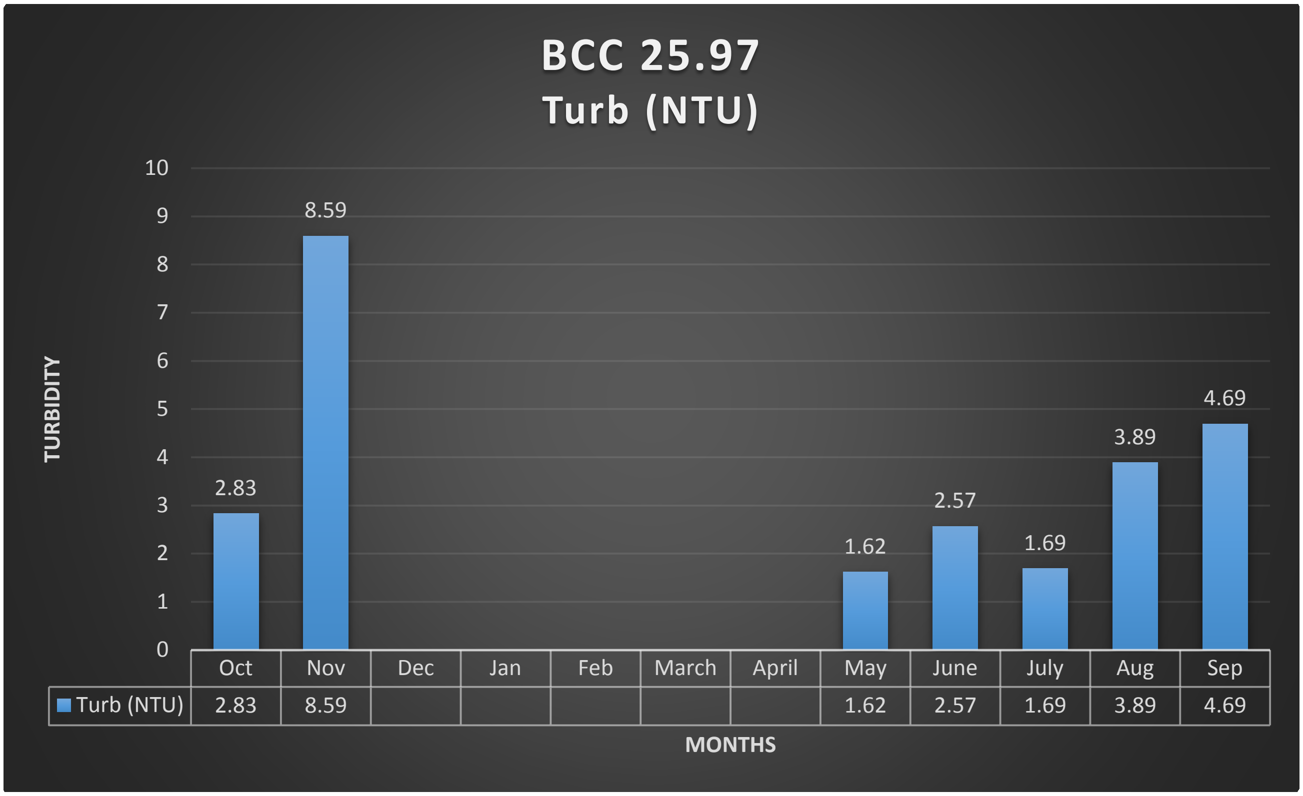


Figure 4-259 Big Cottonwood Creek 25.97 Temperature

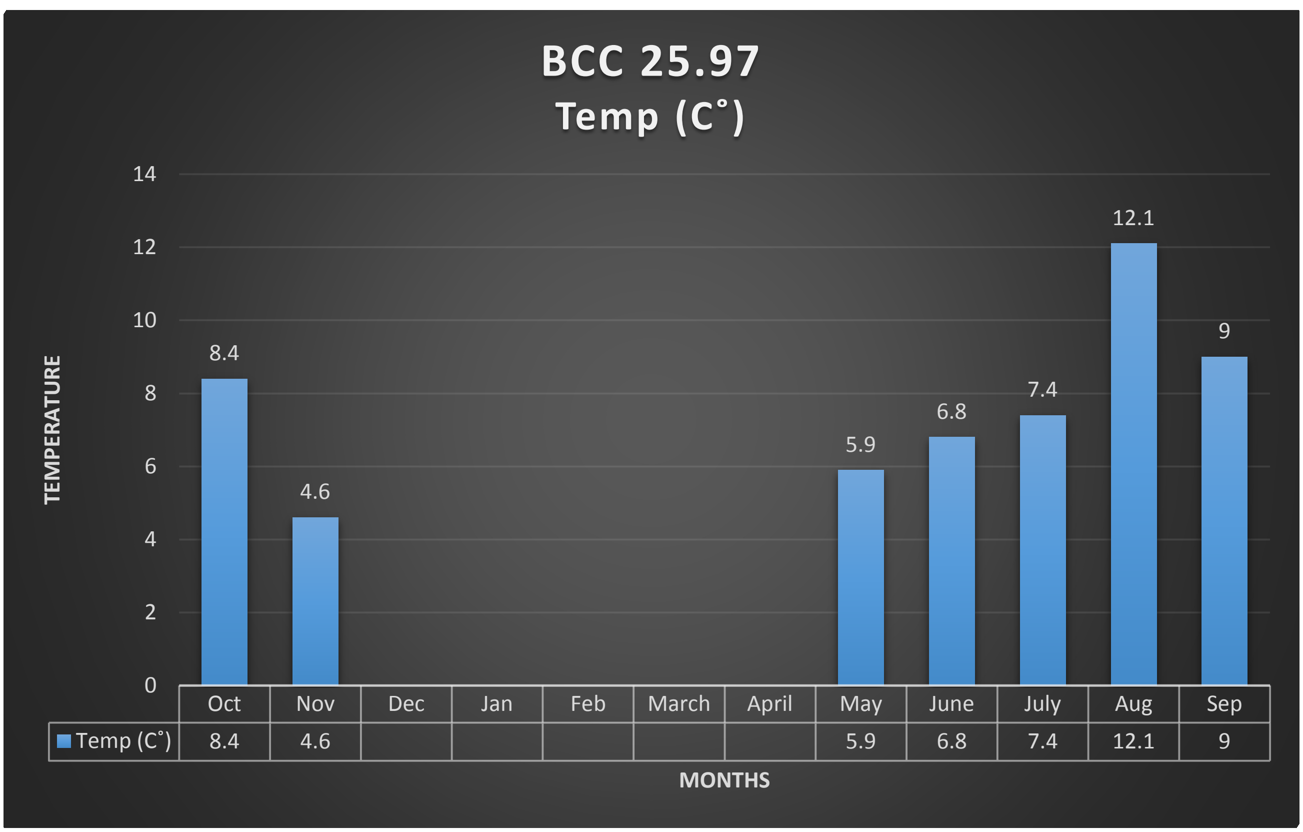


Figure 4-260 Big Cottonwood Creek 25.97 Salinity

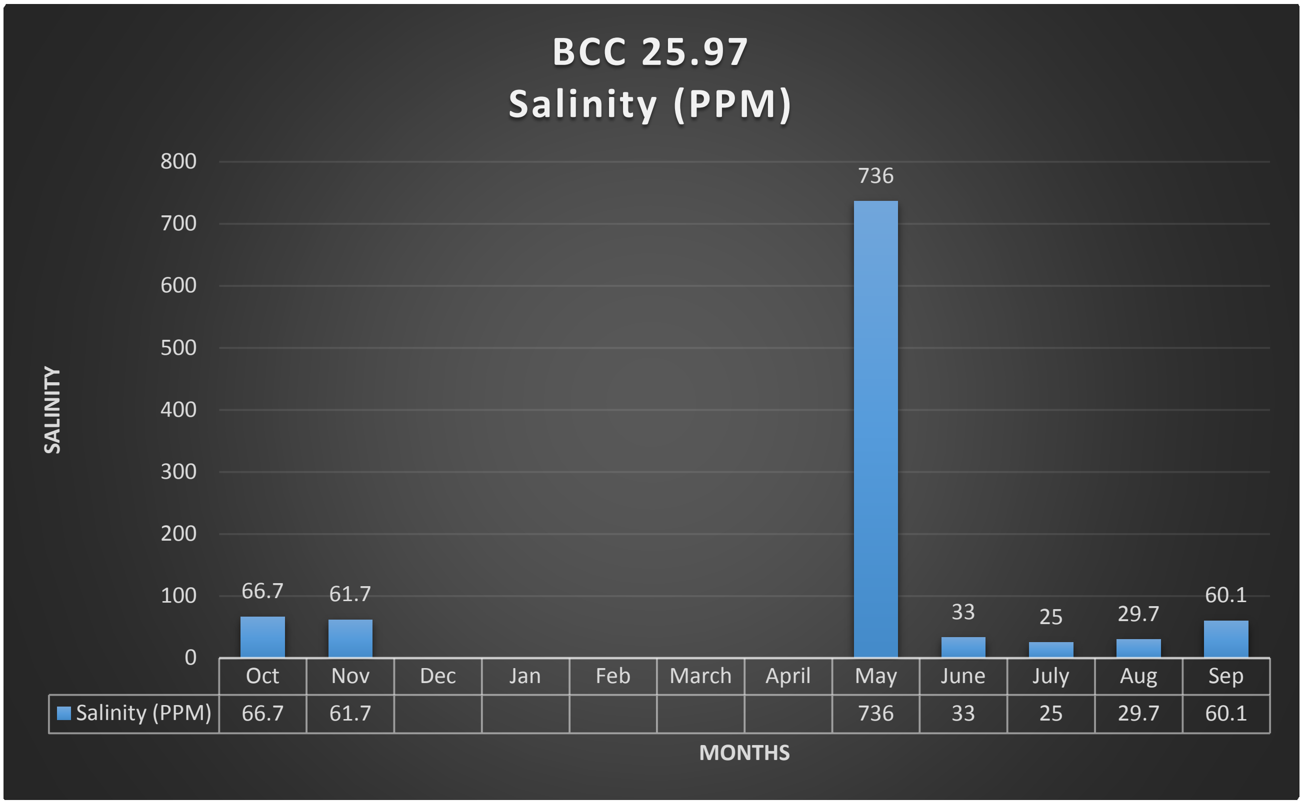


Figure 4-261 Little Cottonwood Creek 01.98 pH

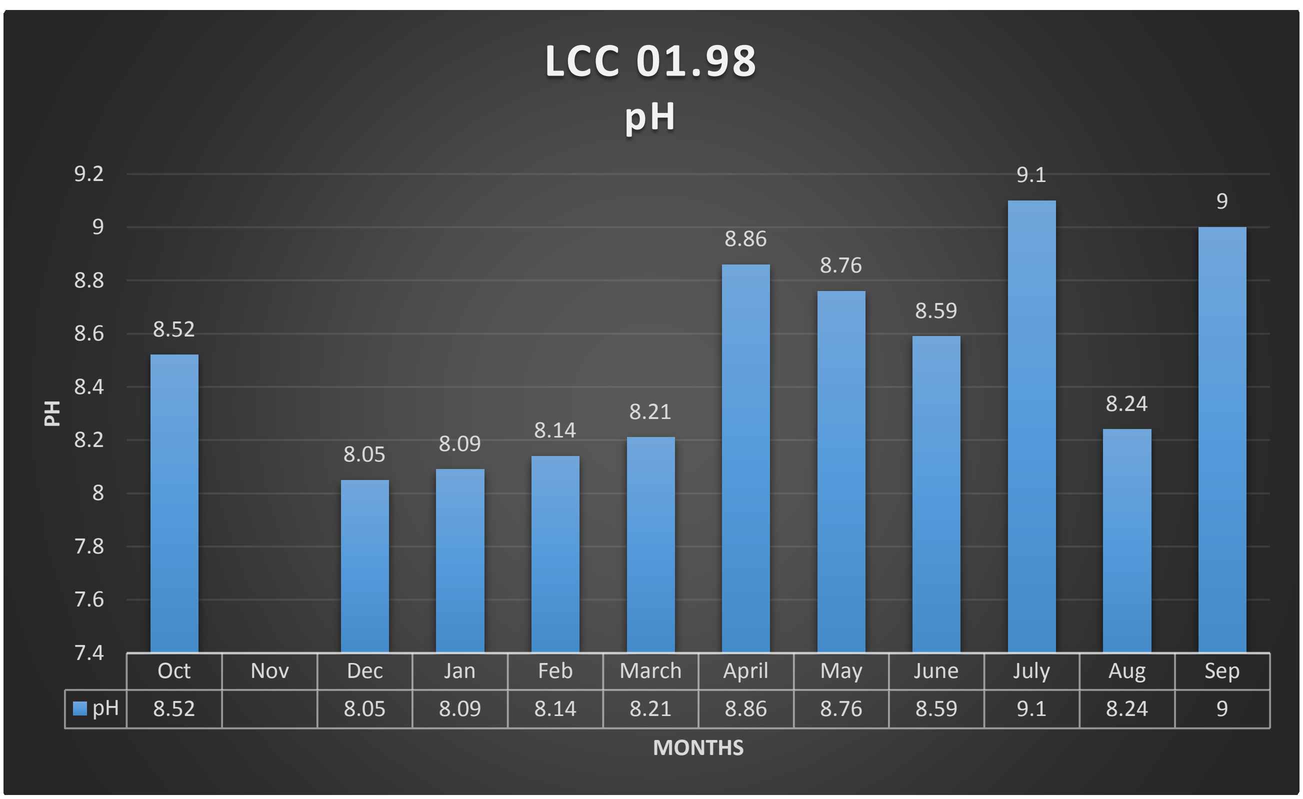


Figure 4-262 Little Cottonwood Creek 01.98 Dissolved Oxygen

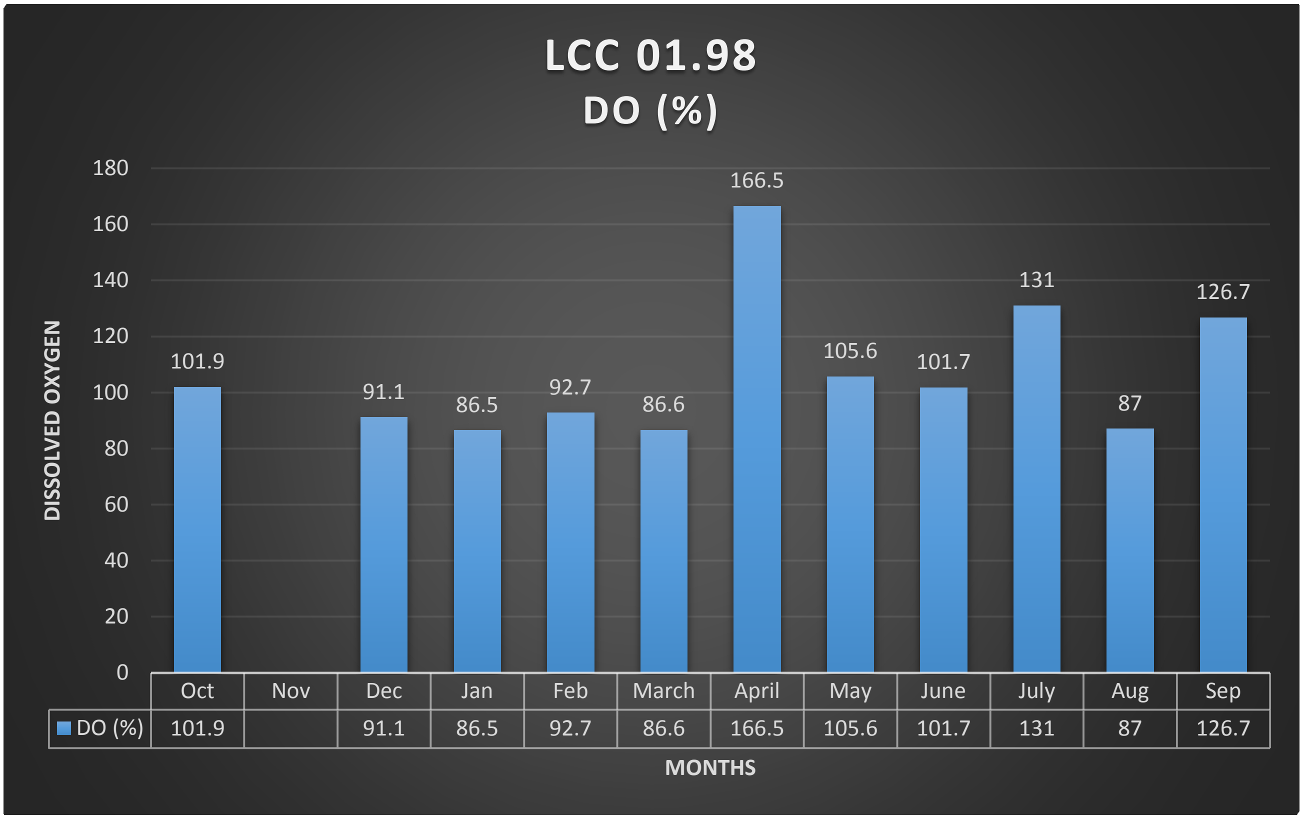
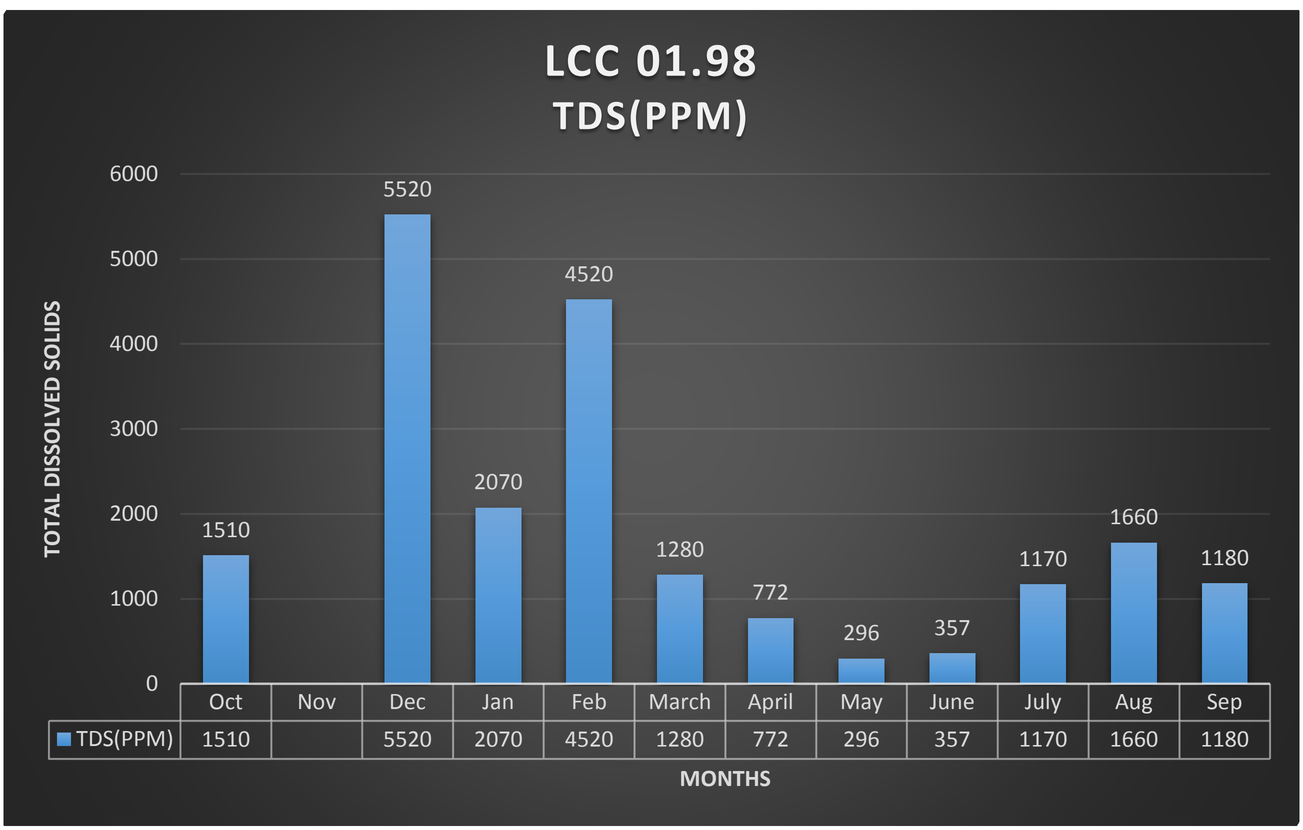
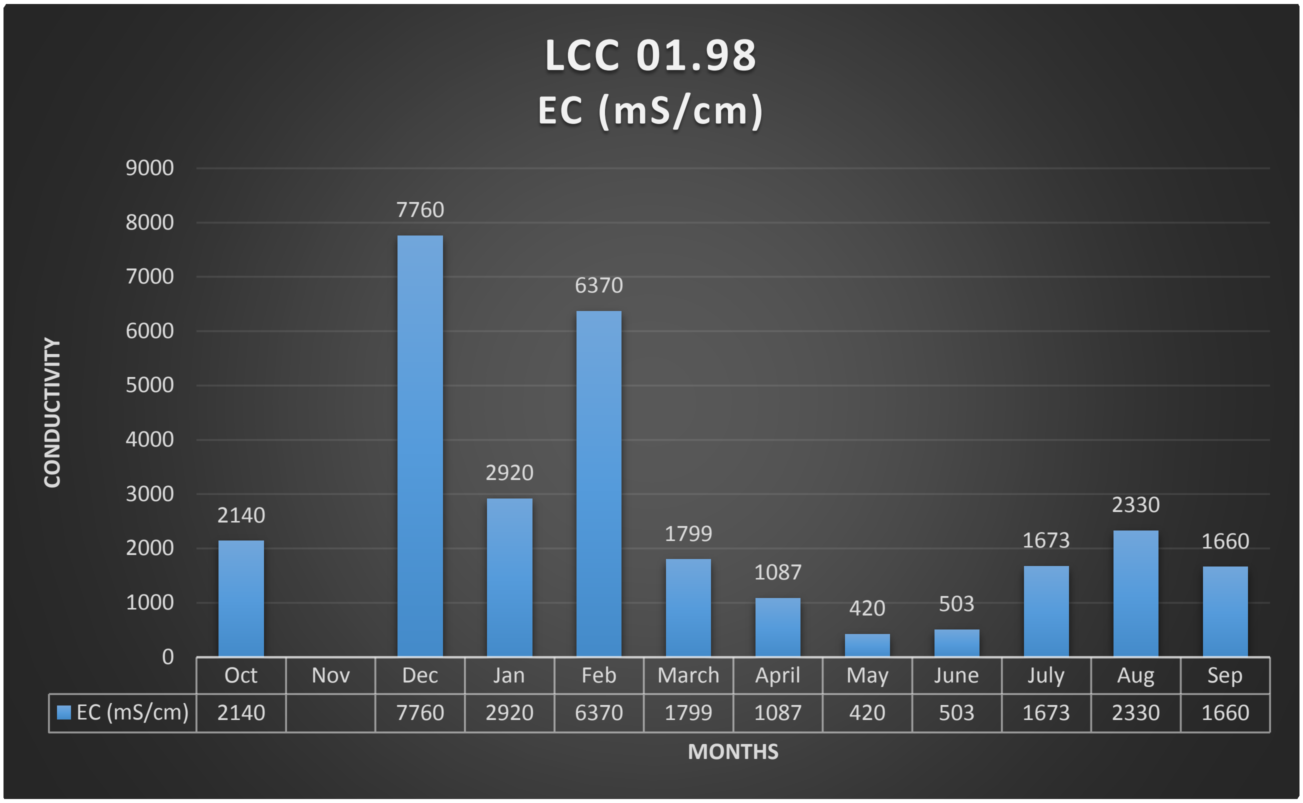


Figure 4-263 Little Cottonwood Creek 01.98 Total Dissolved Solids



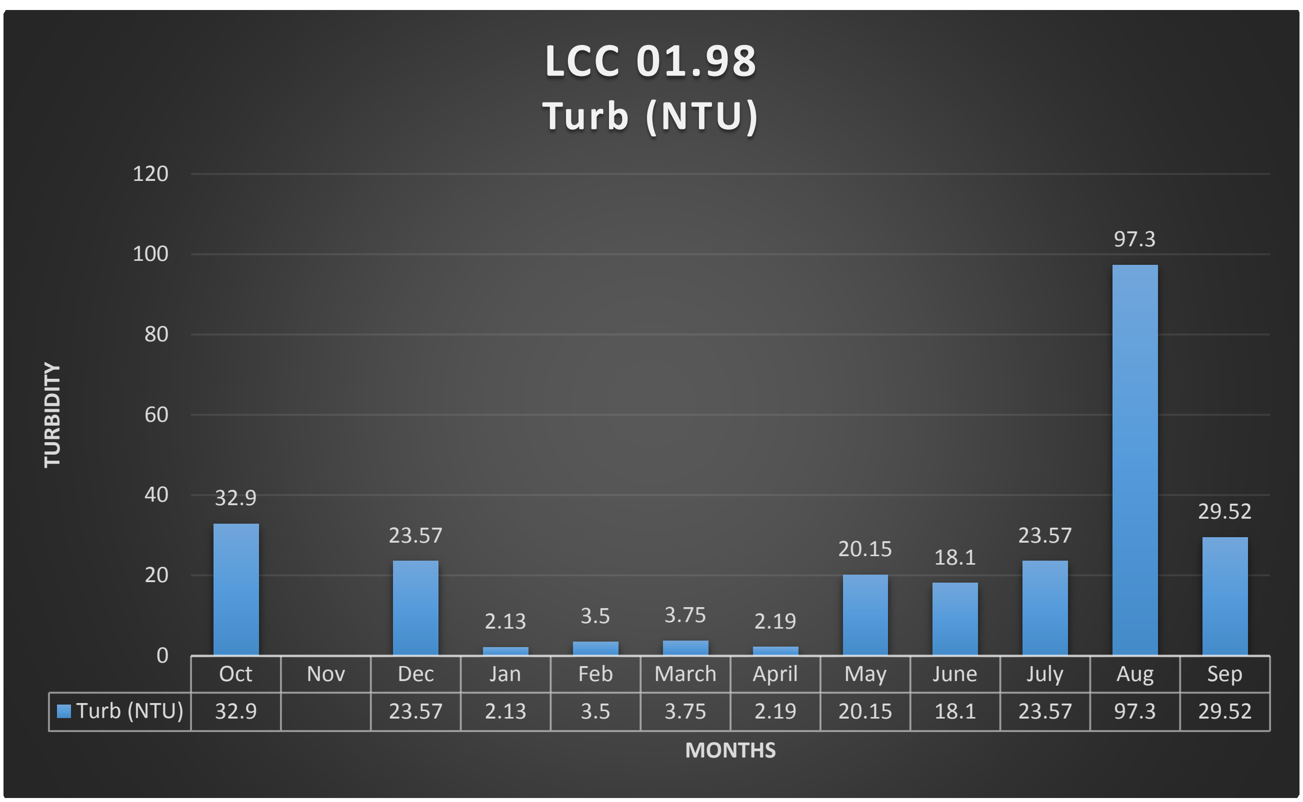
SALT LAKE COUNTY WATERSHED

Figure 4-264 Little Cottonwood Creek 01.98 Conductivity



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
EC (mS/cm)	2140		7760	2920	6370	1799	1087	420	503	1673	2330	1660

Figure 4-265 Little Cottonwood Creek 01.98 Turbidity



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Turb (NTU)	32.9		23.57	2.13	3.5	3.75	2.19	20.15	18.1	23.57	97.3	29.52

Figure 4-266 Little Cottonwood Creek 01.98 Temperature

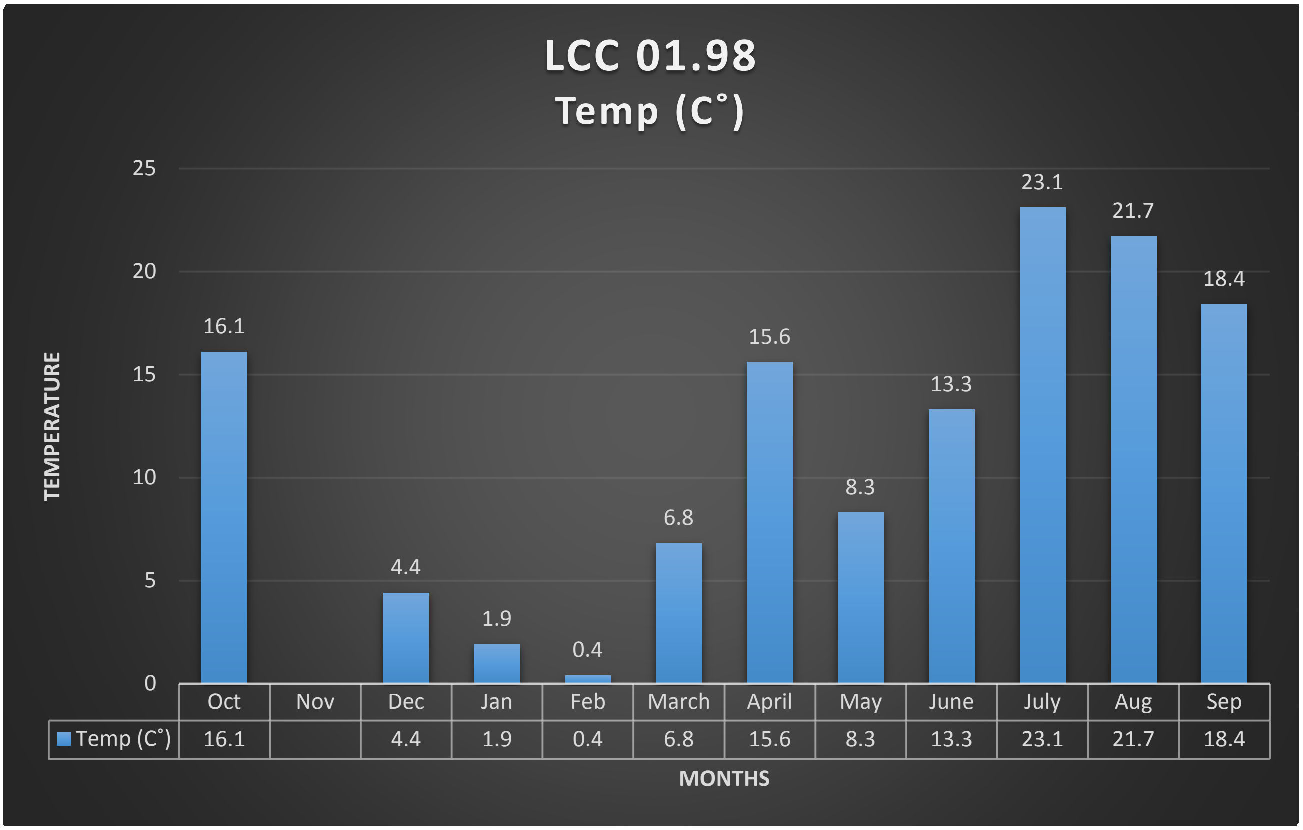


Figure 4-267 Little Cottonwood Creek 01.98 Salinity

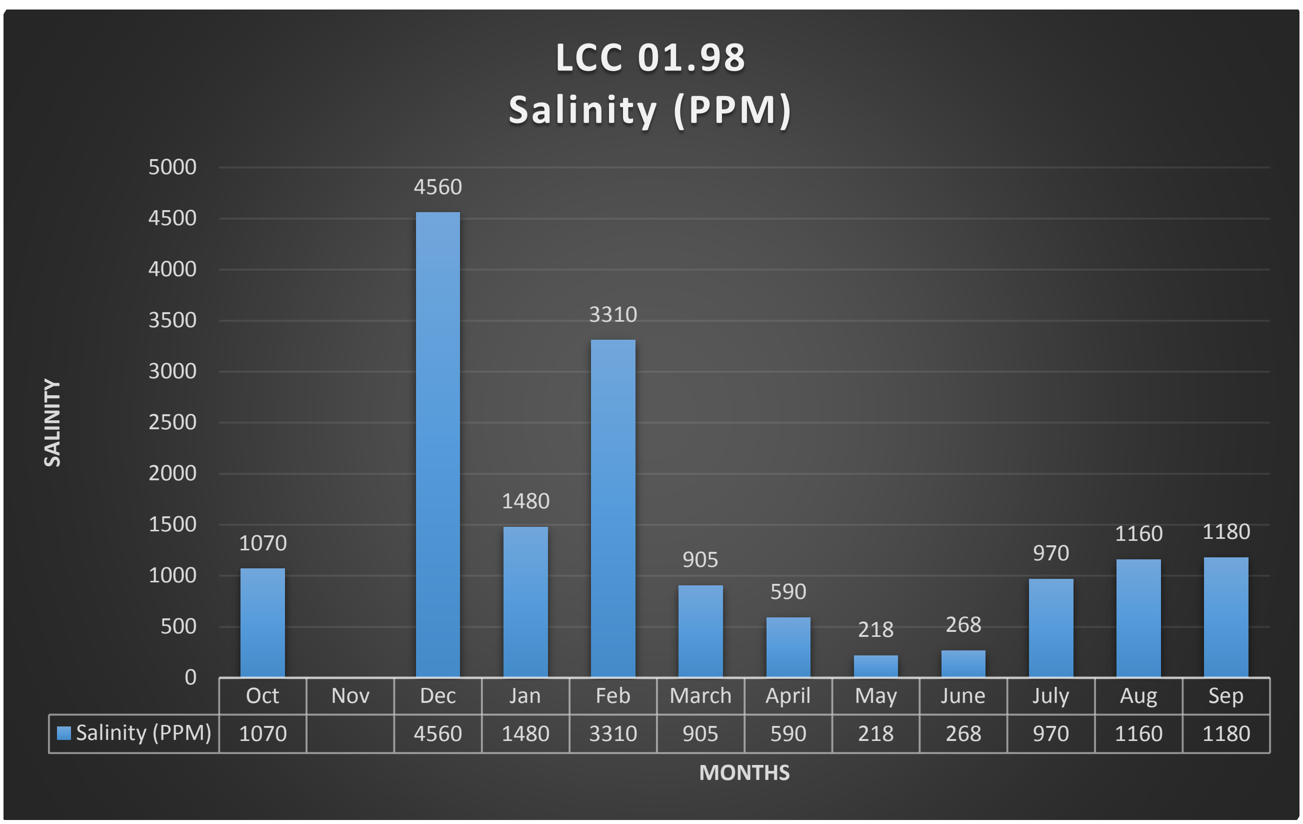
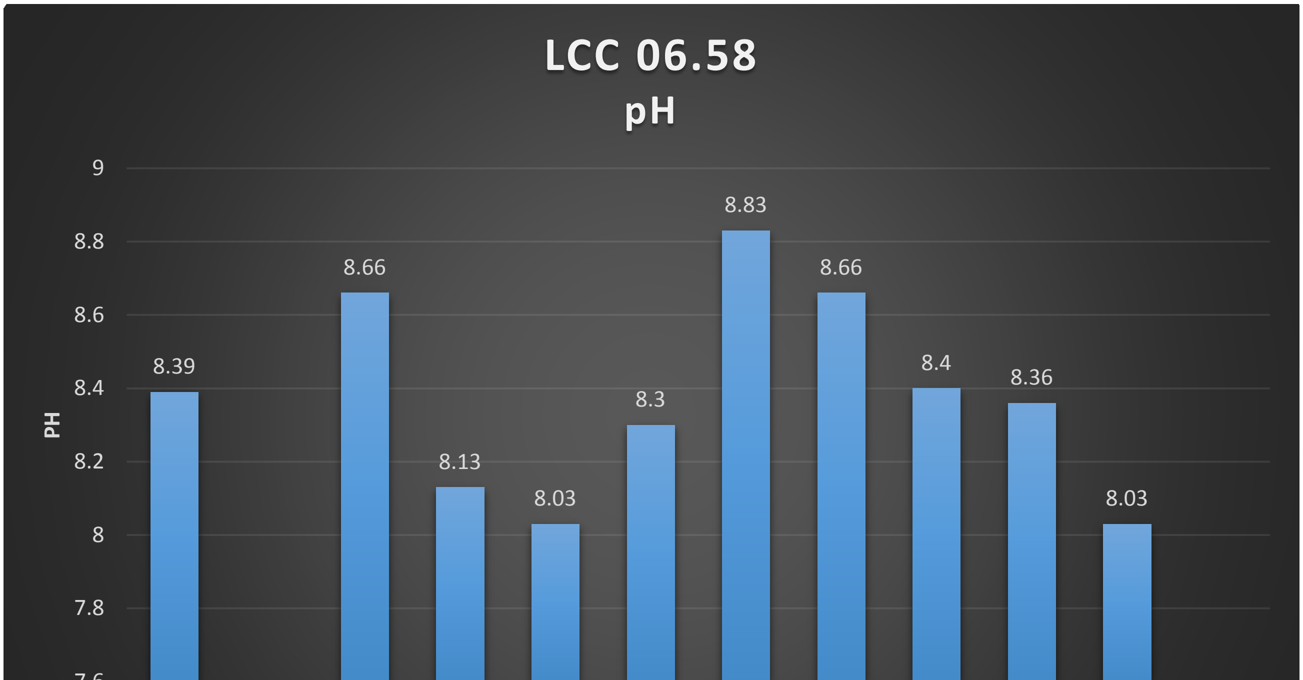
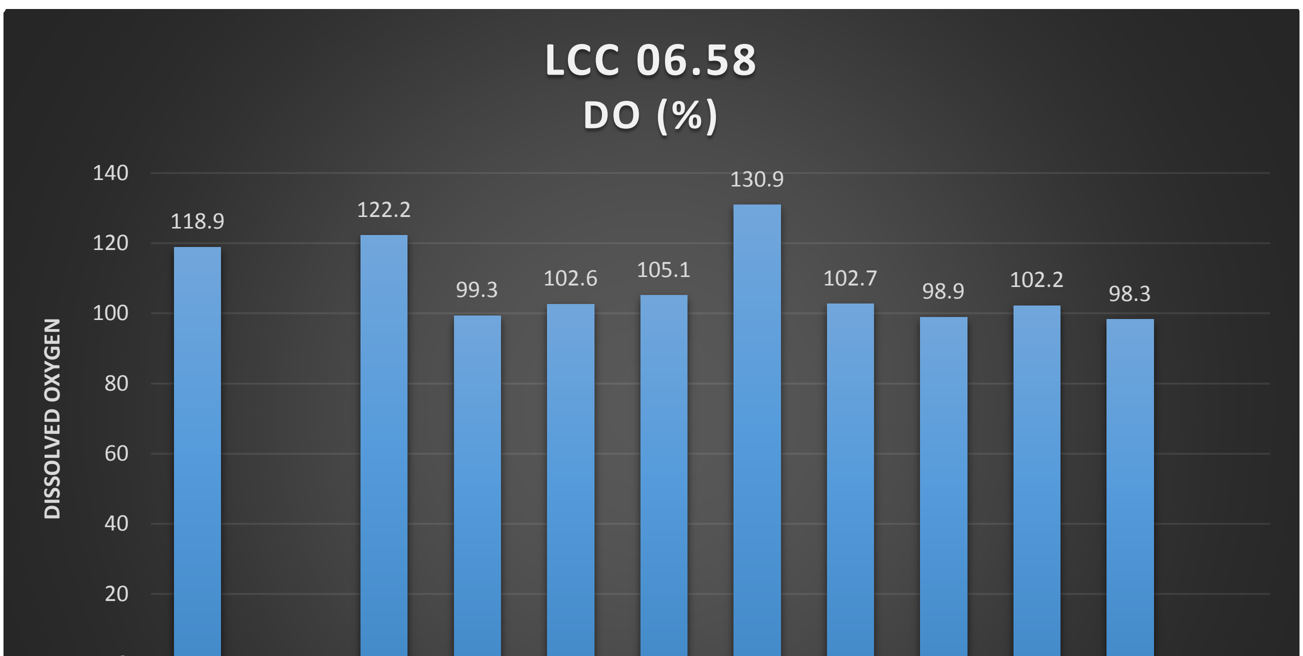


Figure 4-268 Little Cottonwood Creek 06.58 pH



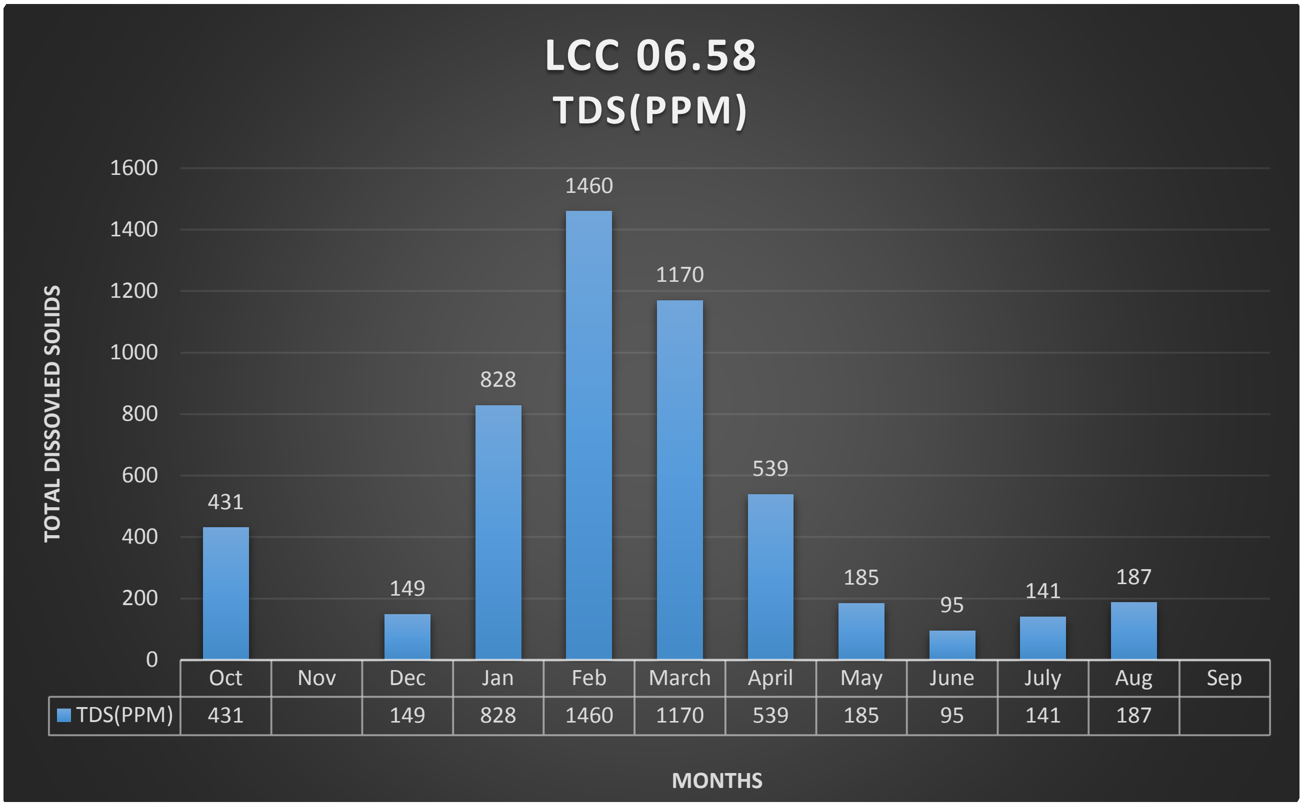
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
pH	8.39		8.66	8.13	8.03	8.3	8.83	8.66	8.4	8.36	8.03	

Figure 4-269 Little Cottonwood Creek 06.58 Dissolved Oxygen



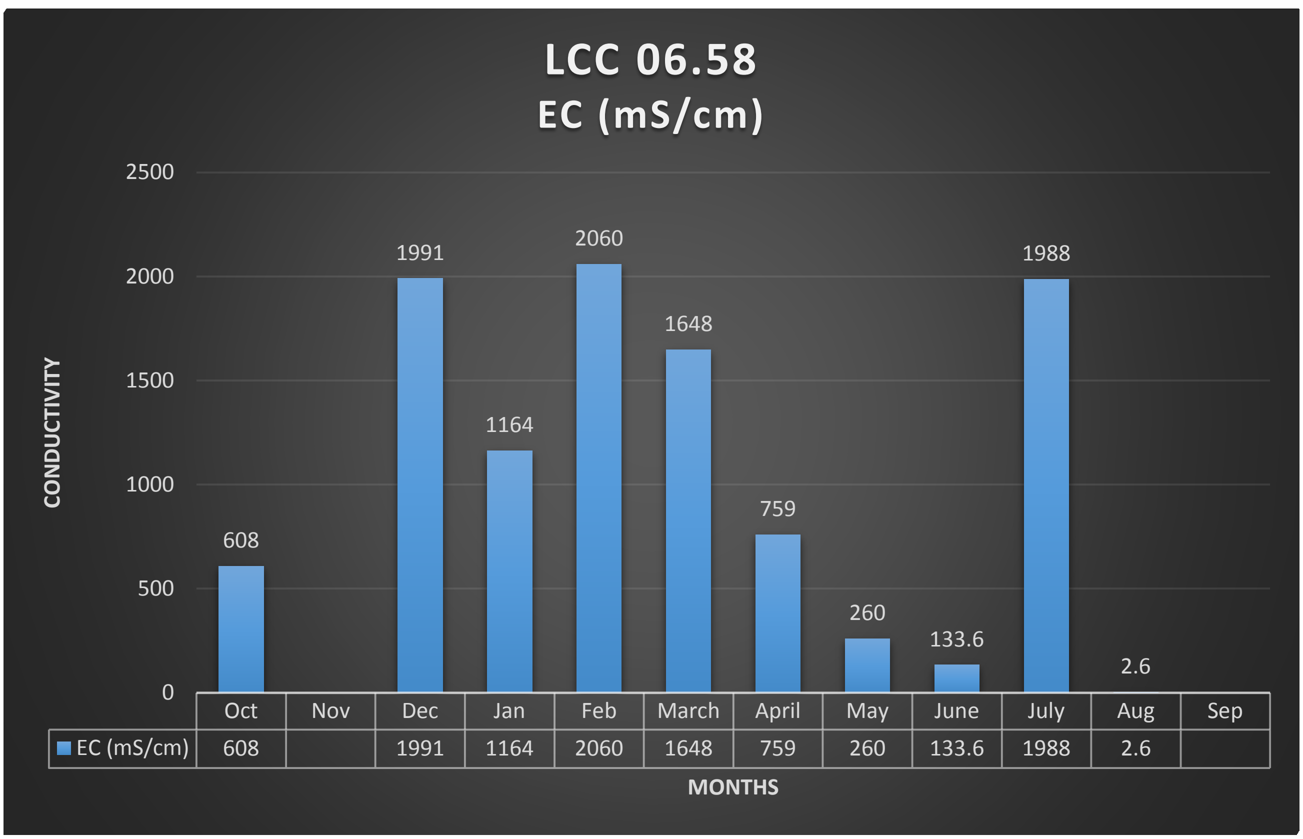
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
DO (%)	118.9		122.2	99.3	102.6	105.1	130.9	102.7	98.9	102.2	98.3	

Figure 4-270 Little Cottonwood Creek 06.58 Total Dissolved Solids



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
TDS(PPM)	431		149	828	1460	1170	539	185	95	141	187	

Figure 4-271 Little Cottonwood Creek 06.58 Conductivity



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
EC (mS/cm)	608		1991	1164	2060	1648	759	260	133.6	1988	2.6	

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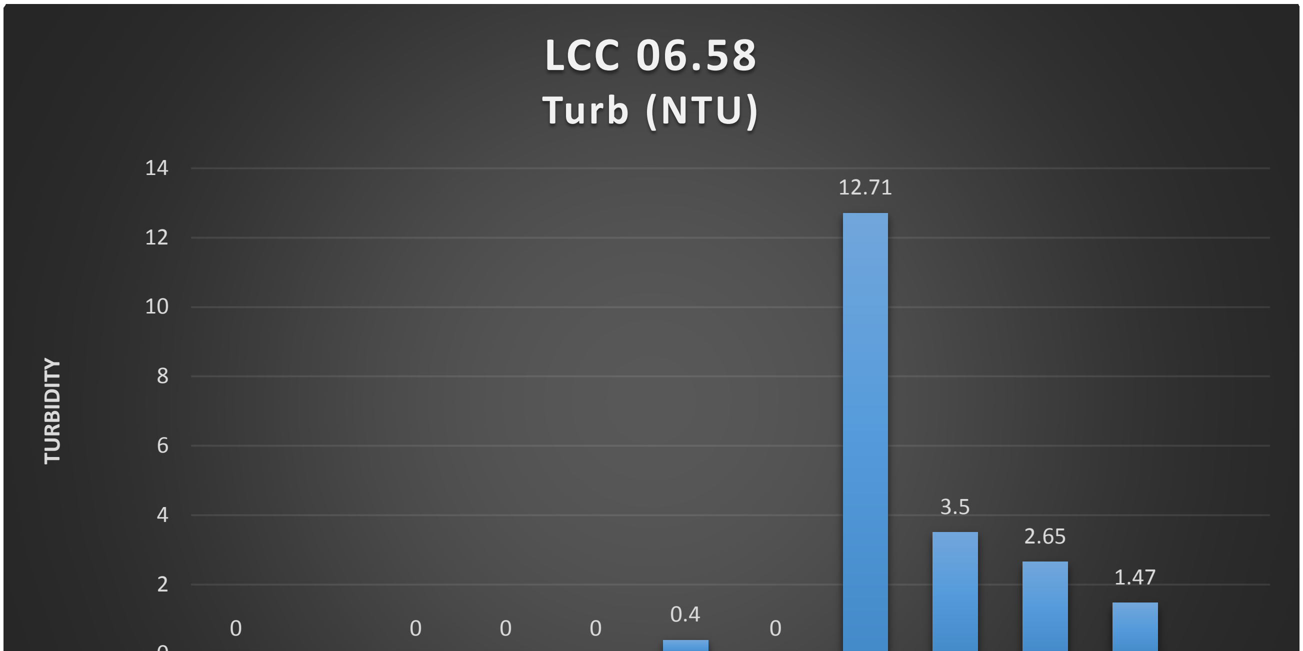
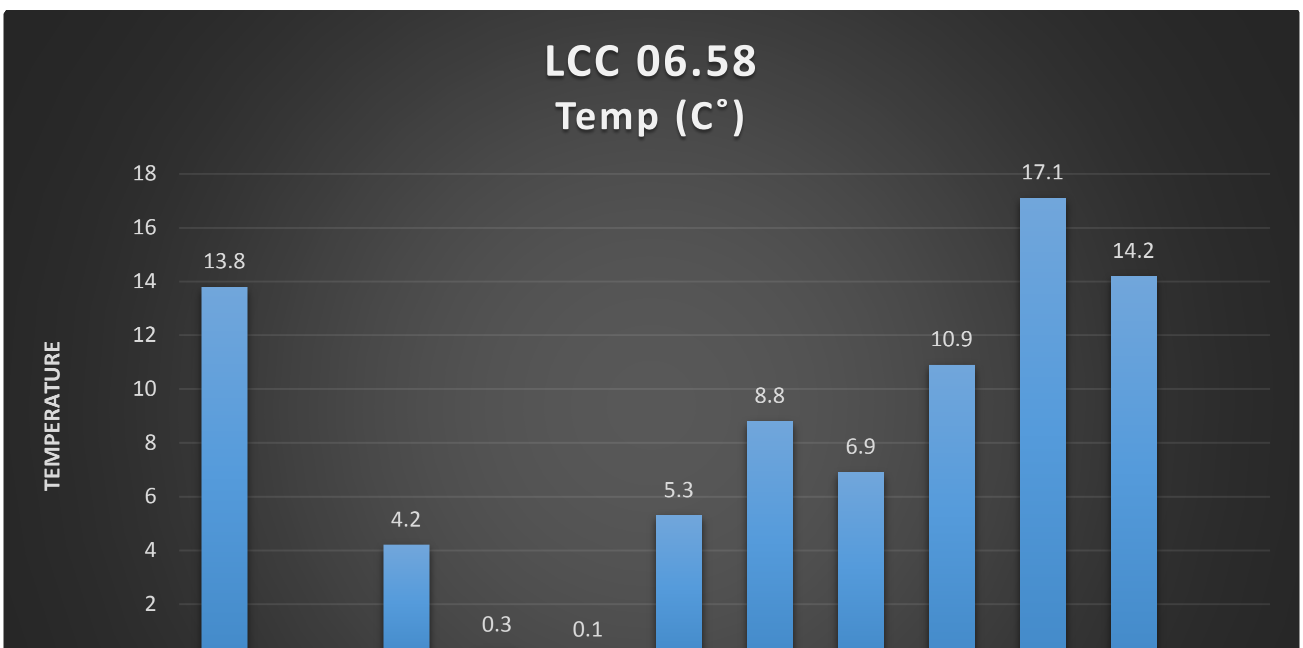
Figure 4-272 Little Cottonwood Creek 06.58 Turbidity



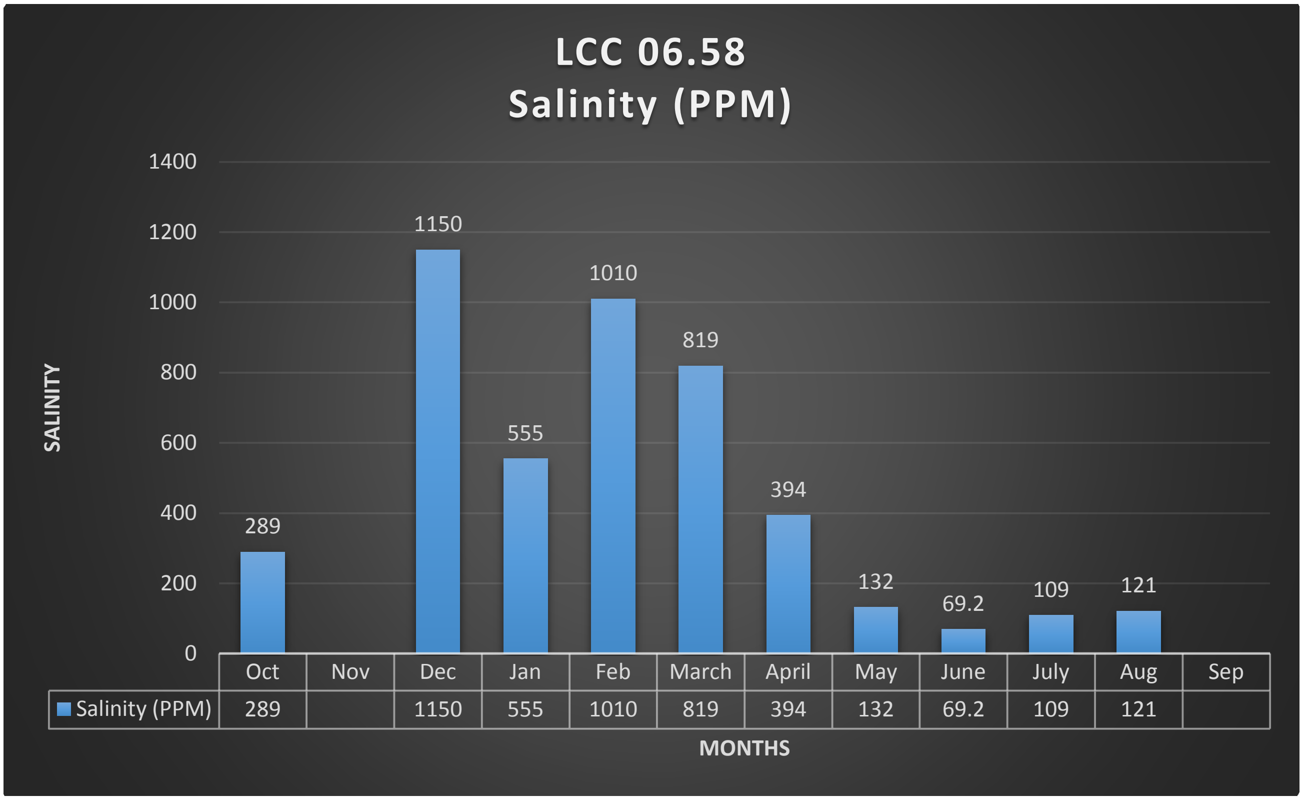
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Turb (NTU)	0		0	0	0	0.4	0	12.71	3.5	2.65	1.47	

Figure 4-273 Little Cottonwood Creek 06.58 Temperature



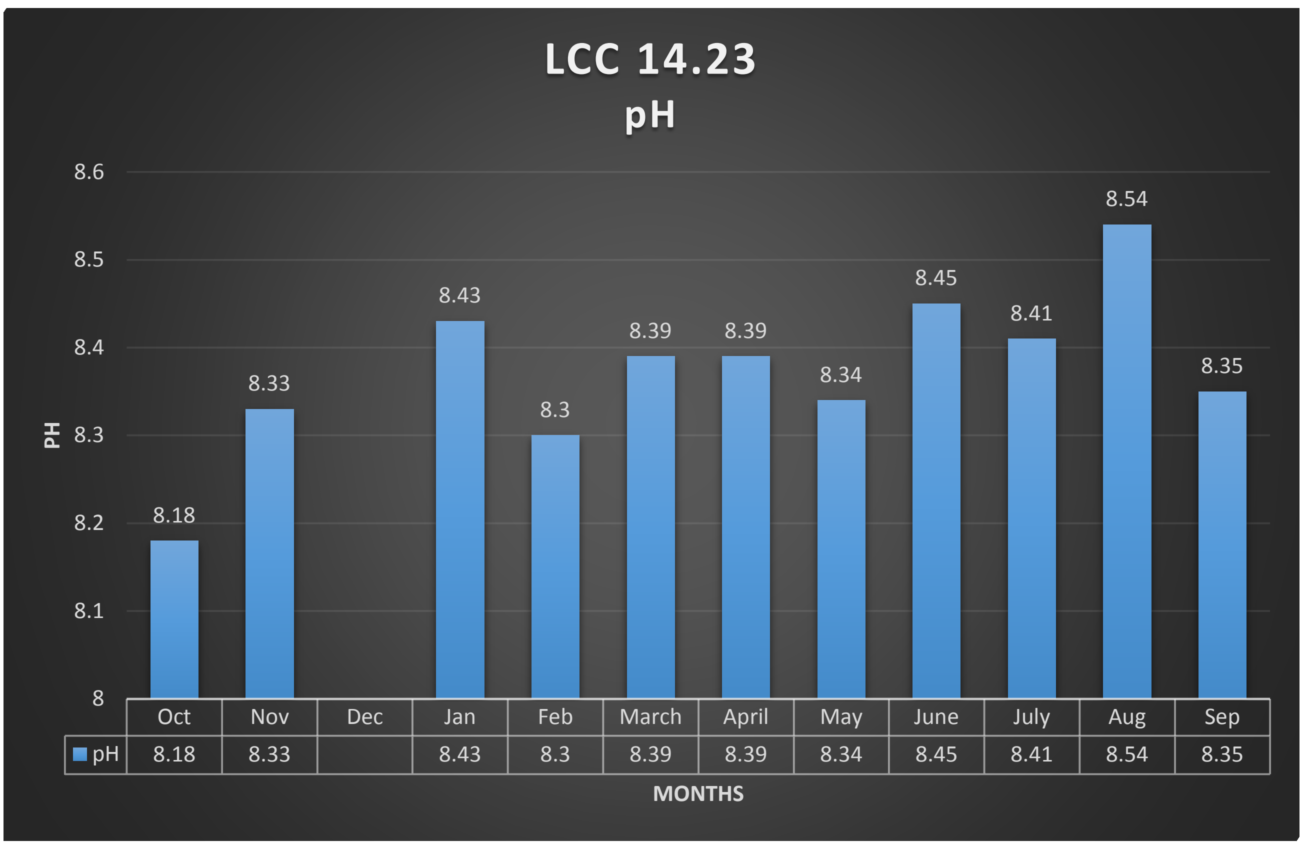
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Temp (C˚)	13.8		4.2	0.3	0.1	5.3	8.8	6.9	10.9	17.1	14.2	

Figure 4-274 Little Cottonwood Creek 06.58 Salinity



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Salinity (PPM)	289		1150	555	1010	819	394	132	69.2	109	121	

Figure 4-275 Little Cottonwood Creek 14.23 pH



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
pH	8.18	8.33		8.43	8.3	8.39	8.39	8.34	8.45	8.41	8.54	8.35

Figure 4-276 Little Cottonwood Creek 14.23 Dissolved Oxygen

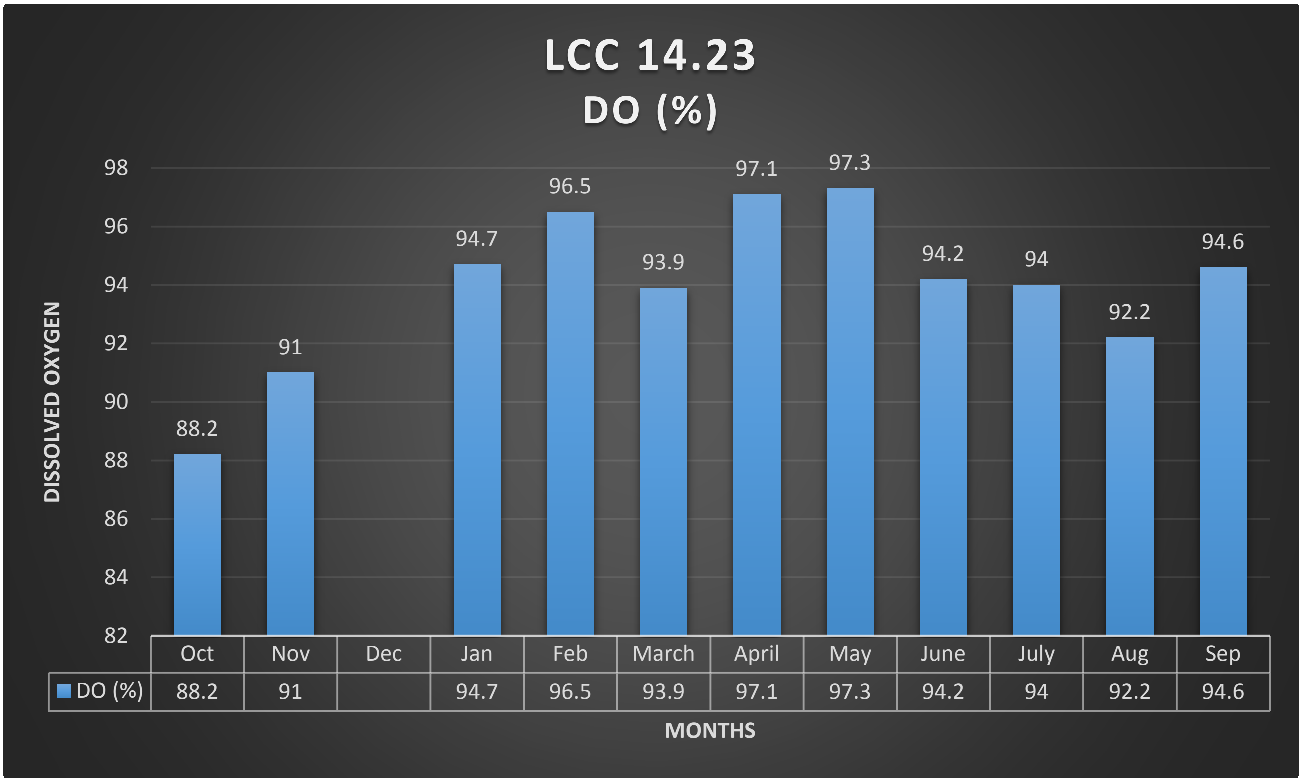


Figure 4-277 Little Cottonwood Creek 14.23 Total Dissolved Solids

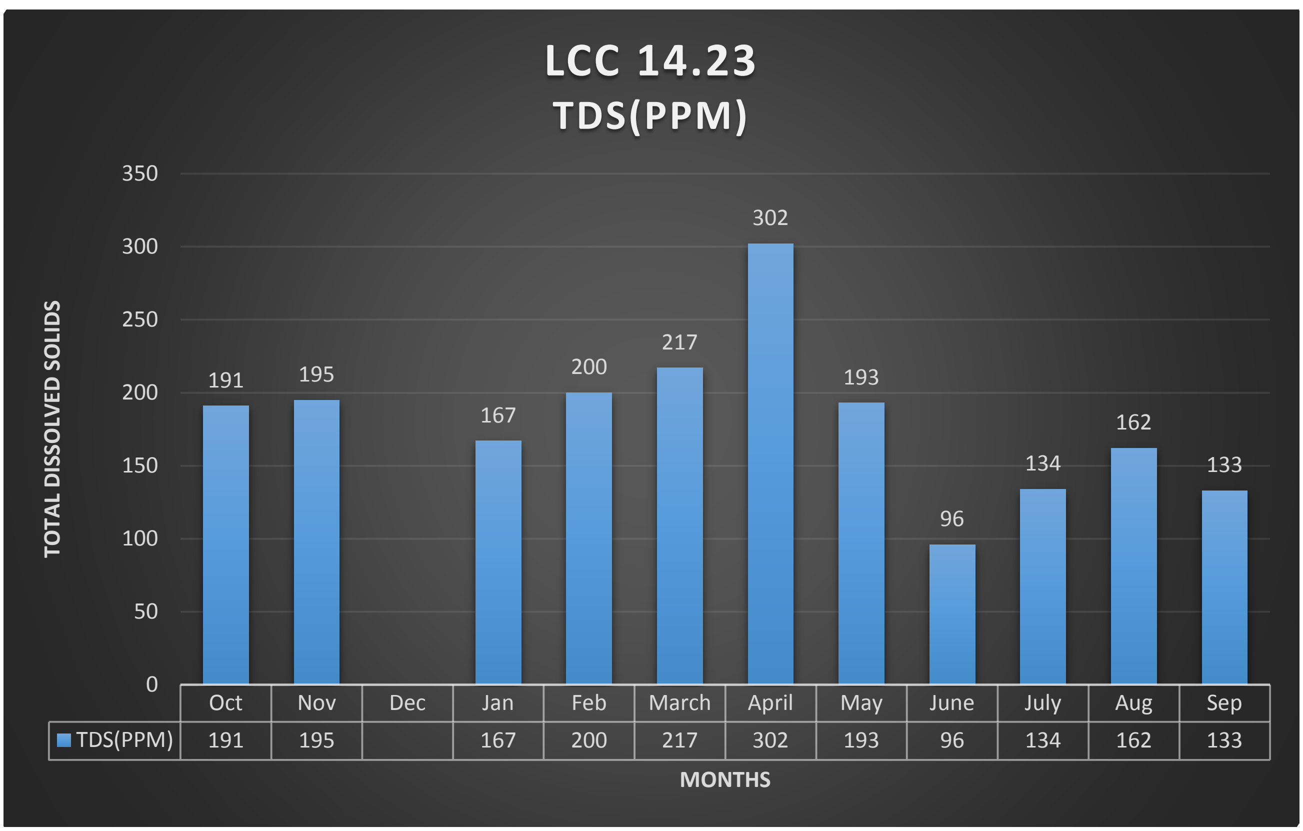
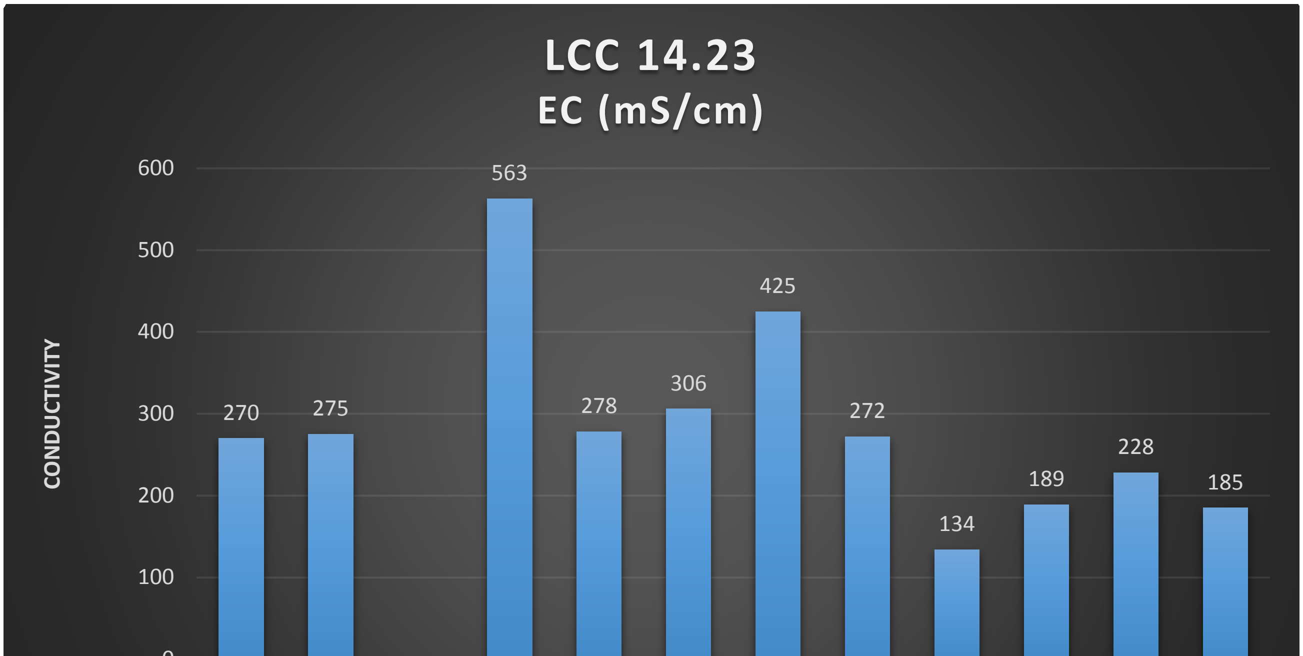
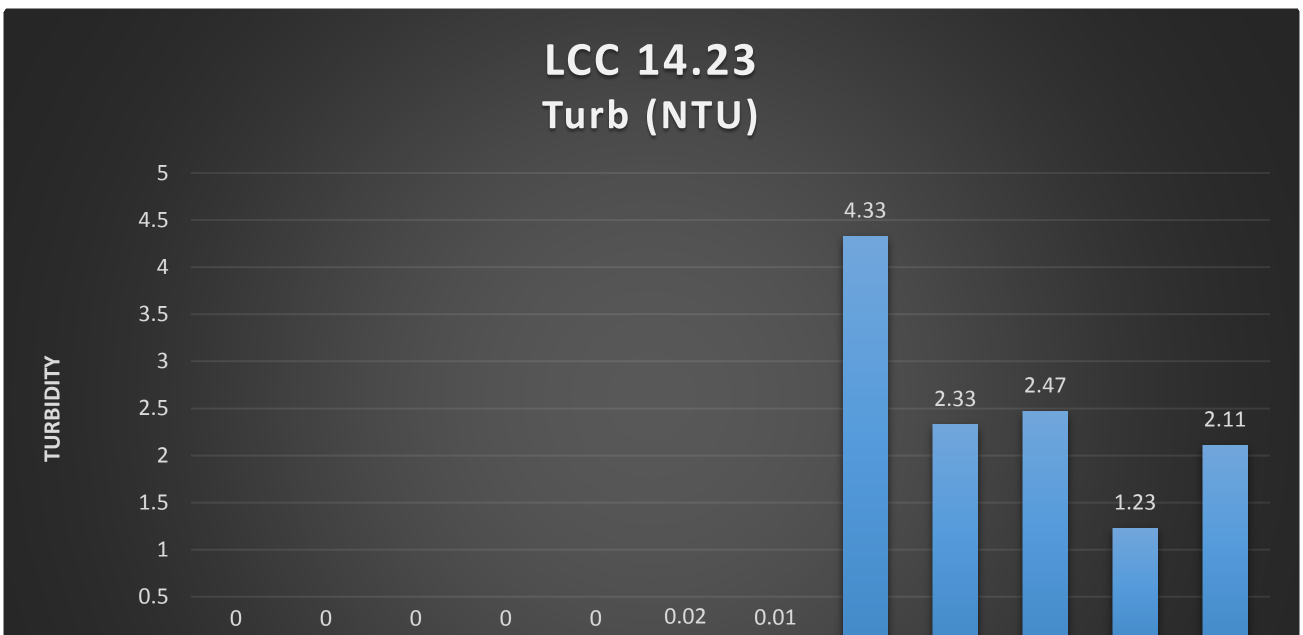


Figure 4-278 Little Cottonwood Creek 14.23 Conductivity



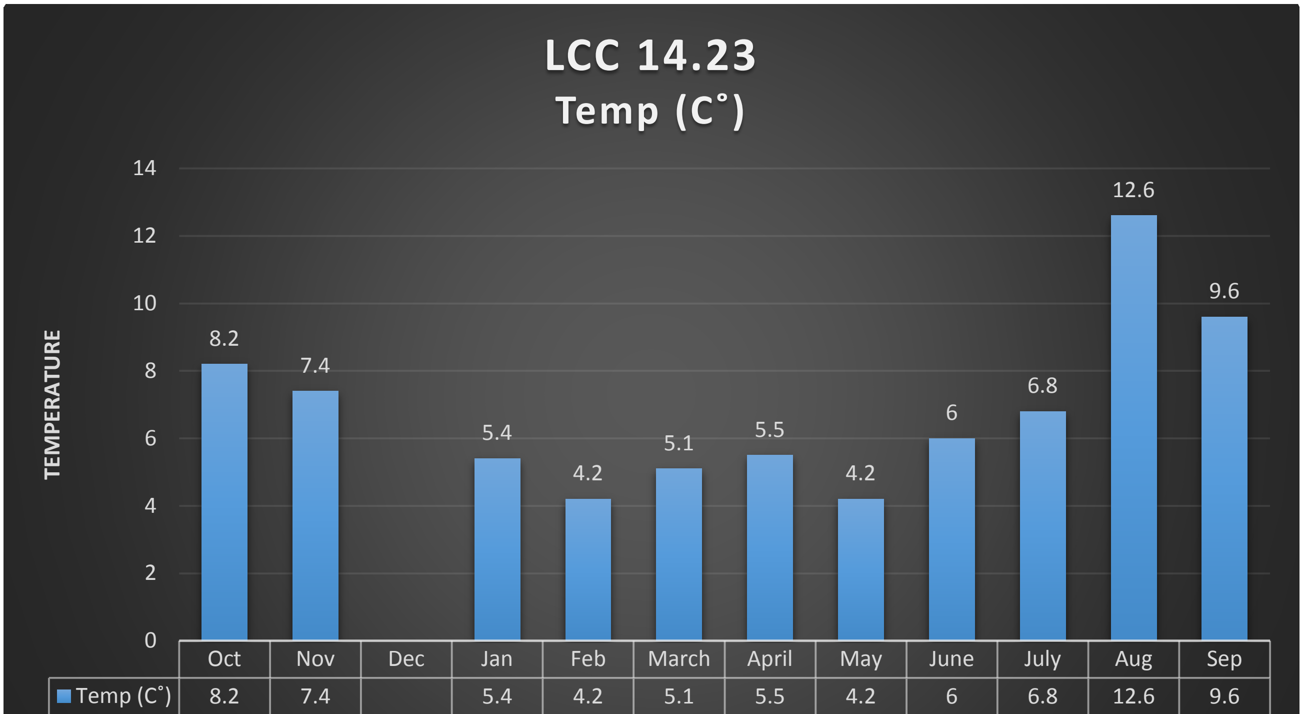
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
EC (mS/cm)	270	275		563	278	306	425	272	134	189	228	185

Figure 4-279 Little Cottonwood Creek 14.23 Turbidity



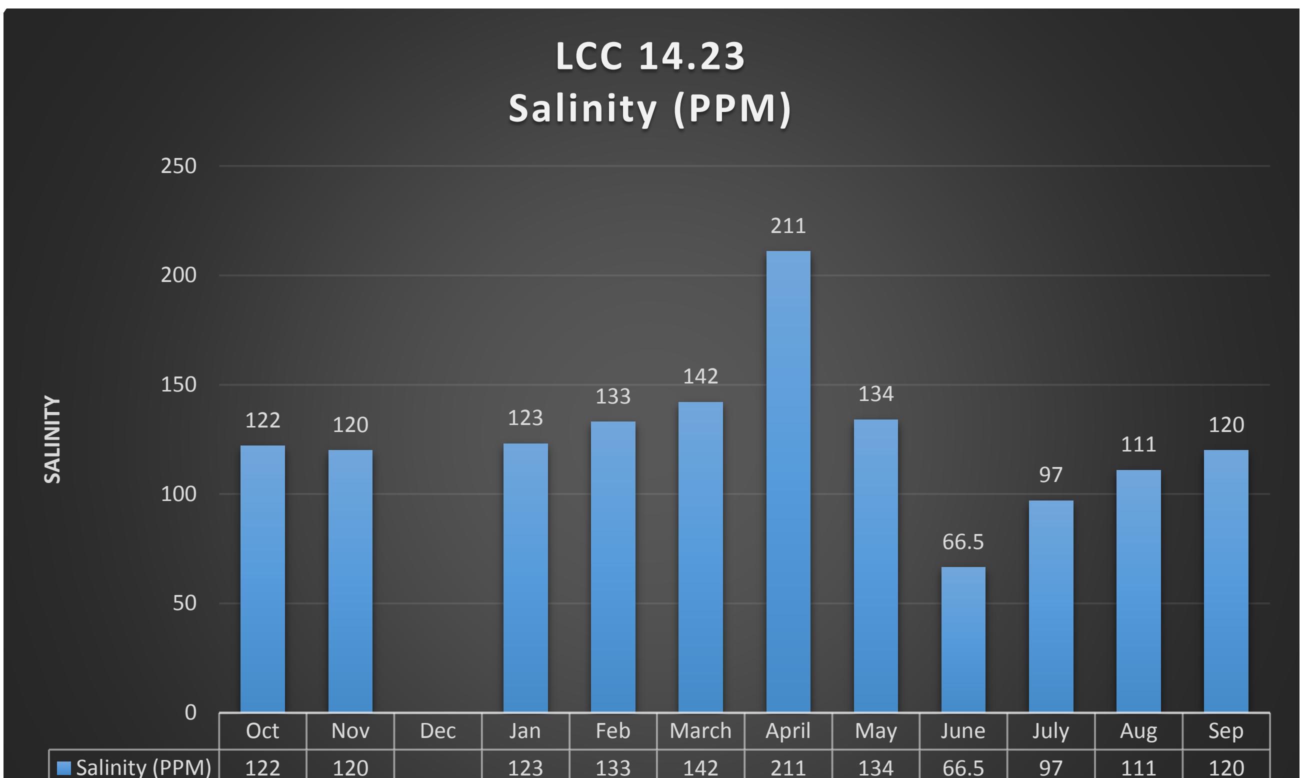
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Turb (NTU)	0	0	0	0	0	0.02	0.01	4.33	2.33	2.47	1.23	2.11

Figure 4-280 Little Cottonwood Creek 14.23 Temperature



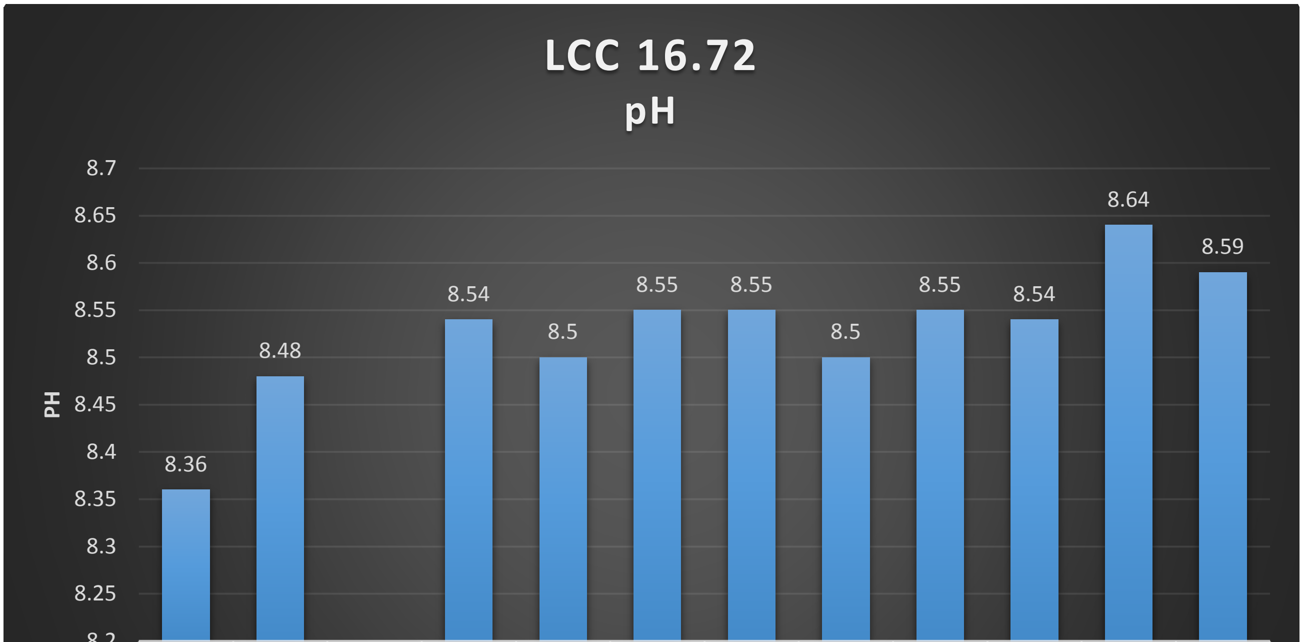
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Temp (C˚)	8.2	7.4		5.4	4.2	5.1	5.5	4.2	6	6.8	12.6	9.6

Figure 4-281 Little Cottonwood Creek 14.23 Salinity



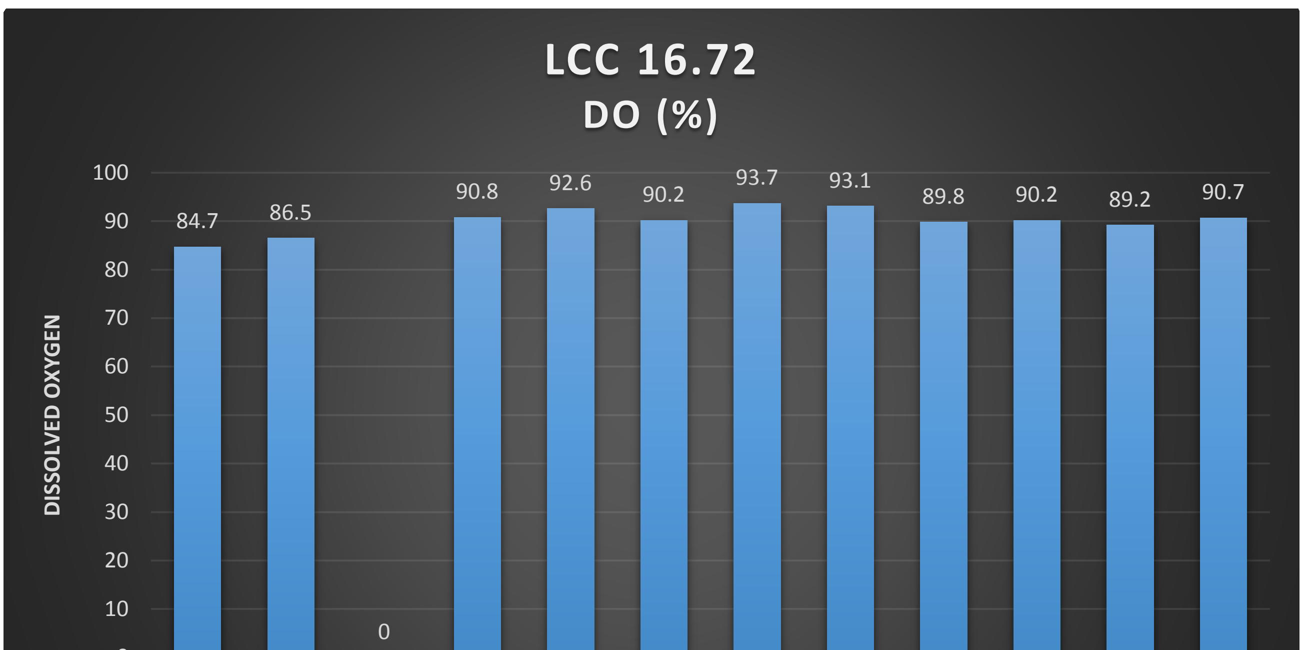
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Salinity (PPM)	122	120		123	133	142	211	134	66.5	97	111	120

Figure 4-282 Little Cottonwood Creek 16.72 pH



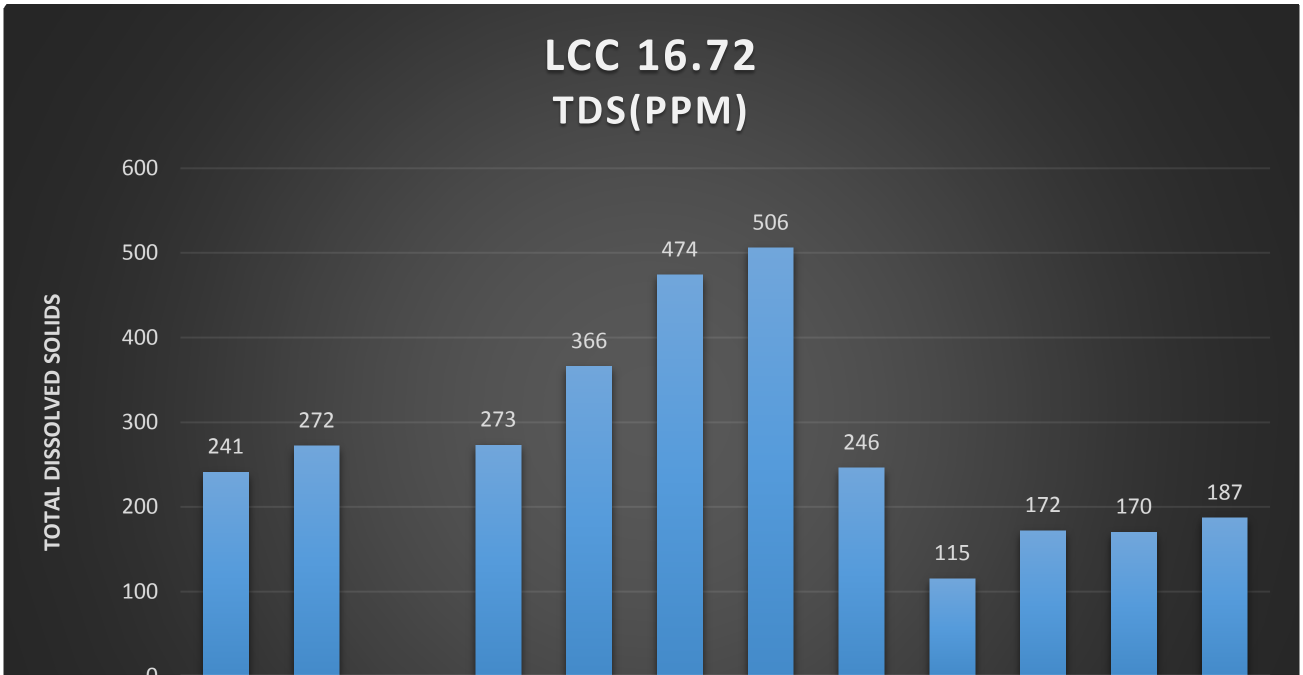
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
pH	8.36	8.48		8.54	8.5	8.55	8.55	8.5	8.55	8.54	8.64	8.59

Figure 4-283 Little Cottonwood Creek 16.72 Dissolved Oxygen



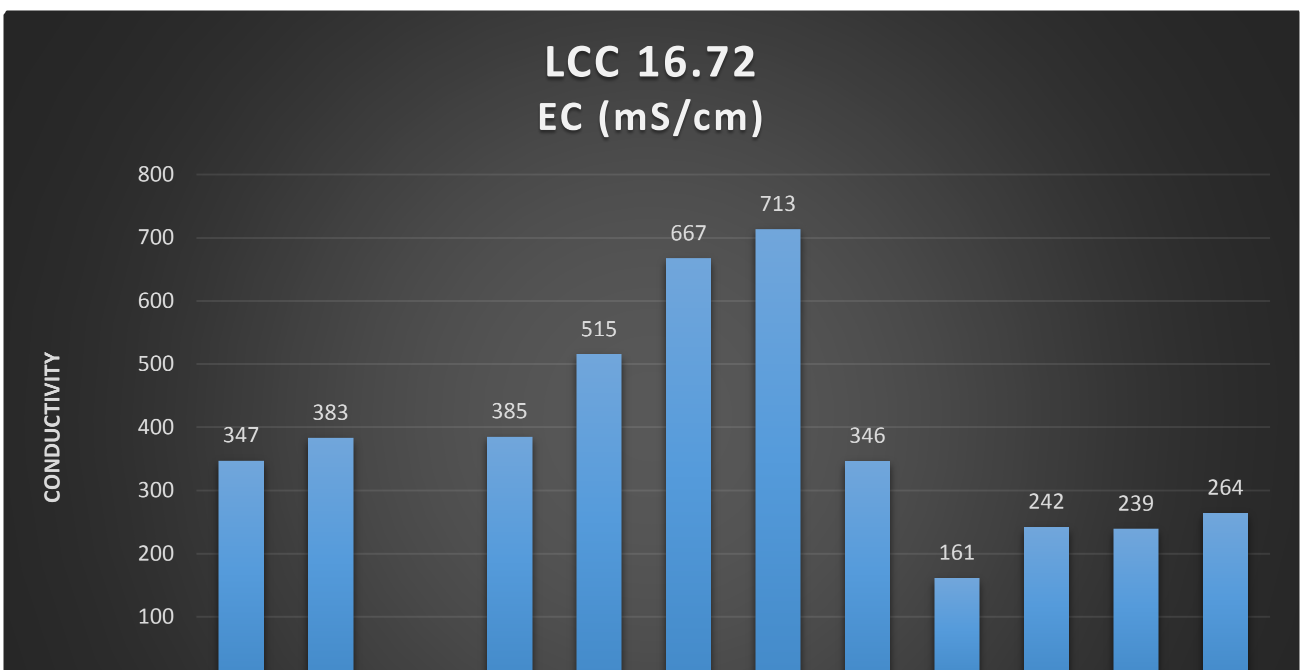
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
DO (%)	84.7	86.5	0	90.8	92.6	90.2	93.7	93.1	89.8	90.2	89.2	90.7

Figure 4-284 Little Cottonwood Creek 16.72 Total Dissolved Solids



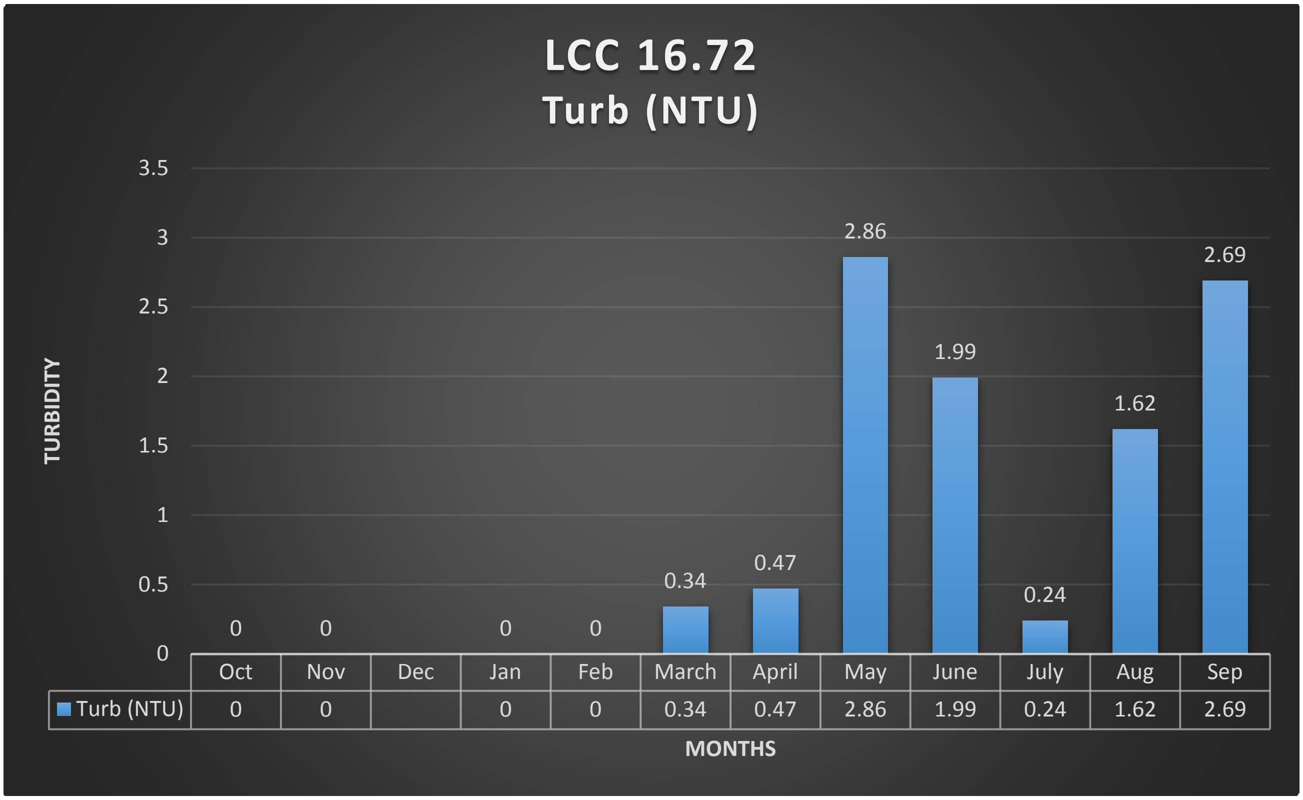
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
TDS(PPM)	241	272		273	366	474	506	246	115	172	170	187

Figure 4-285 Little Cottonwood Creek 16.72 Conductivity



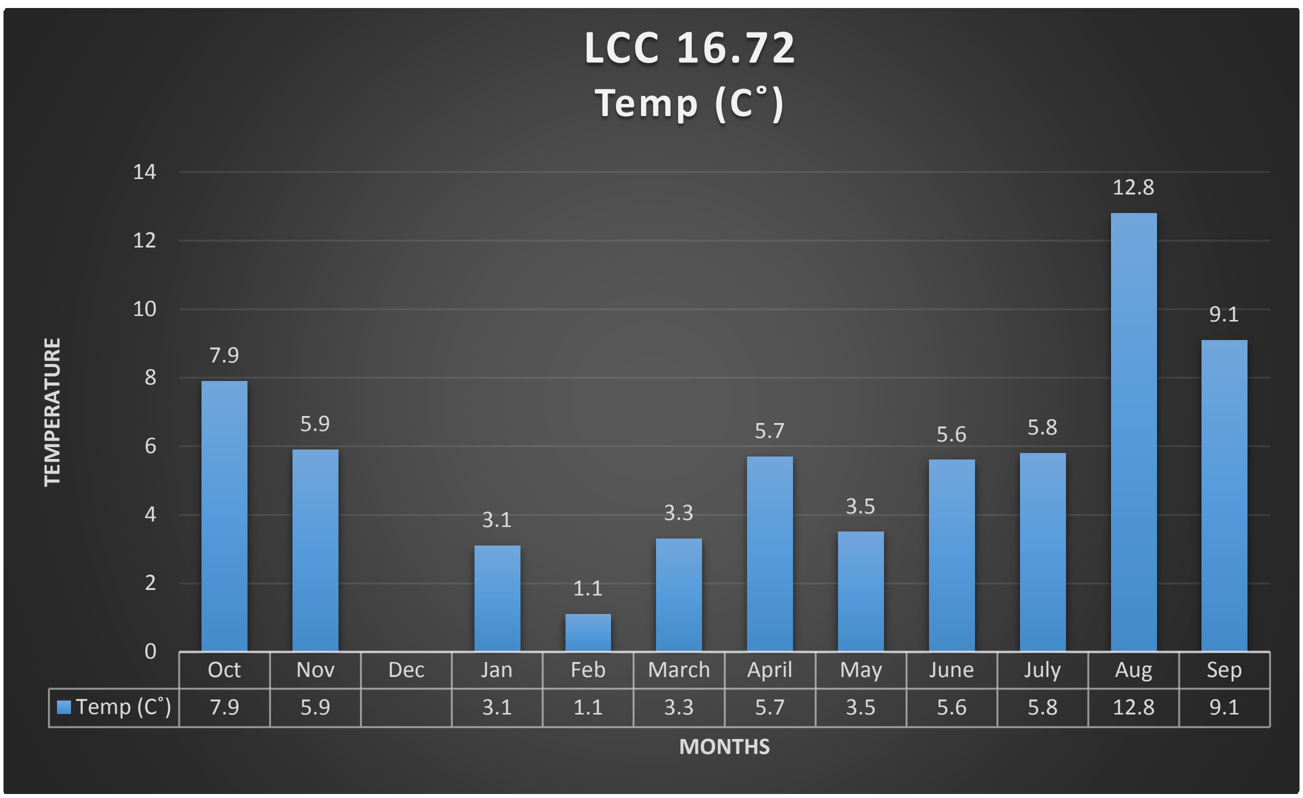
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
EC (mS/cm)	347	383		385	515	667	713	346	161	242	239	264

Figure 4-286 Little Cottonwood Creek 16.72 Turbidity



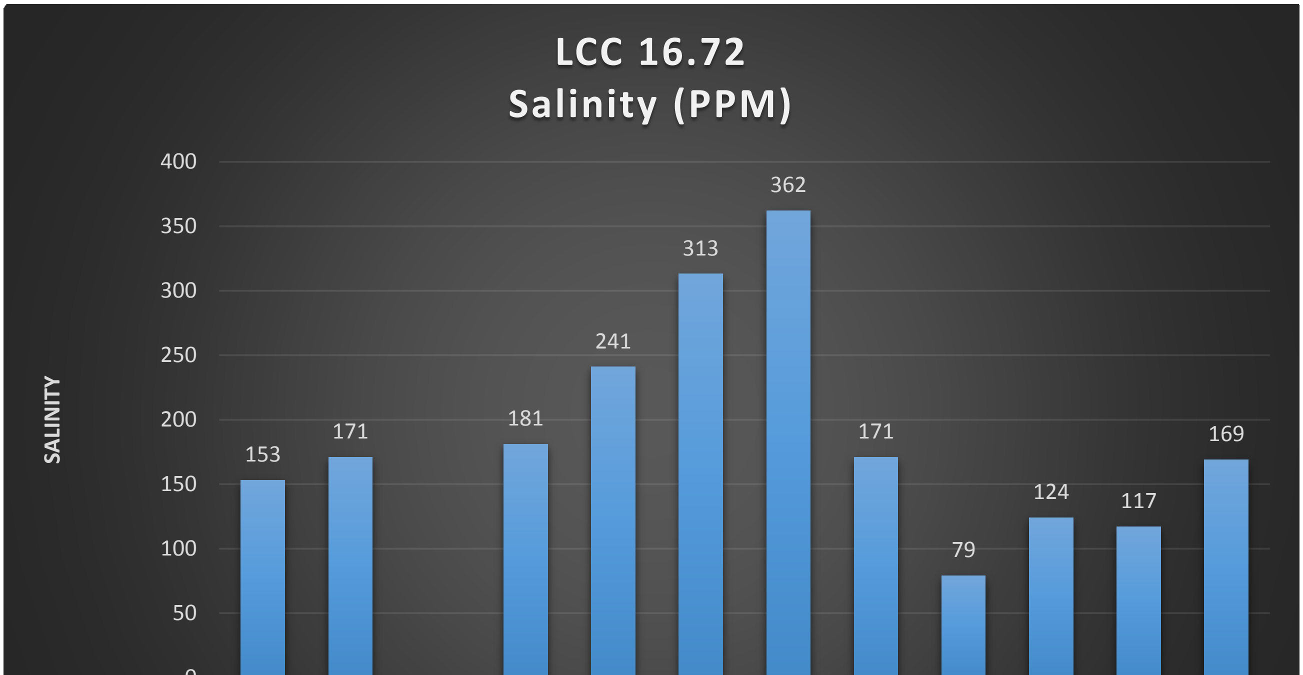
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Turb (NTU)	0	0		0	0	0.34	0.47	2.86	1.99	0.24	1.62	2.69

Figure 4-287 Little Cottonwood Creek 16.72 Temperature



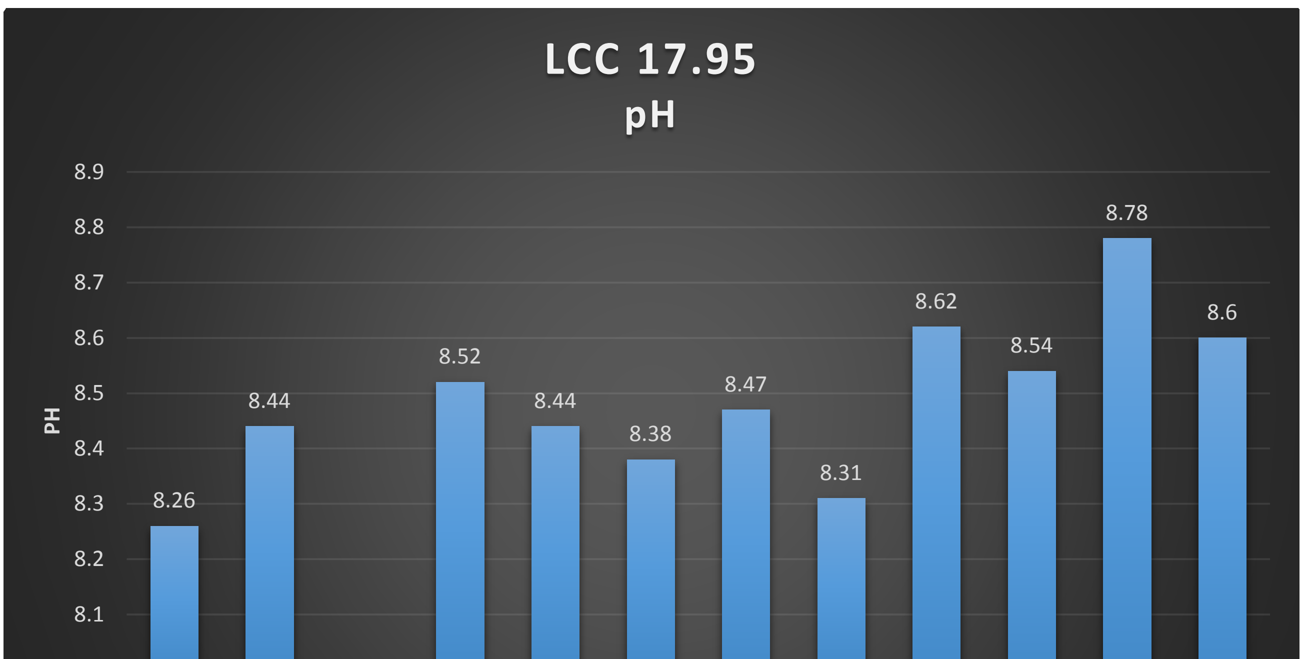
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Temp (C˚)	7.9	5.9		3.1	1.1	3.3	5.7	3.5	5.6	5.8	12.8	9.1

Figure 4-288 Little Cottonwood Creek 16.72 Salinity



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Salinity (PPM)	153	171		181	241	313	362	171	79	124	117	169

Figure 4-289 Little Cottonwood Creek 17.95 pH



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
pH	8.26	8.44		8.52	8.44	8.38	8.47	8.31	8.62	8.54	8.78	8.6

Figure 4-290 Little Cottonwood Creek 17.95 Dissolved Oxygen

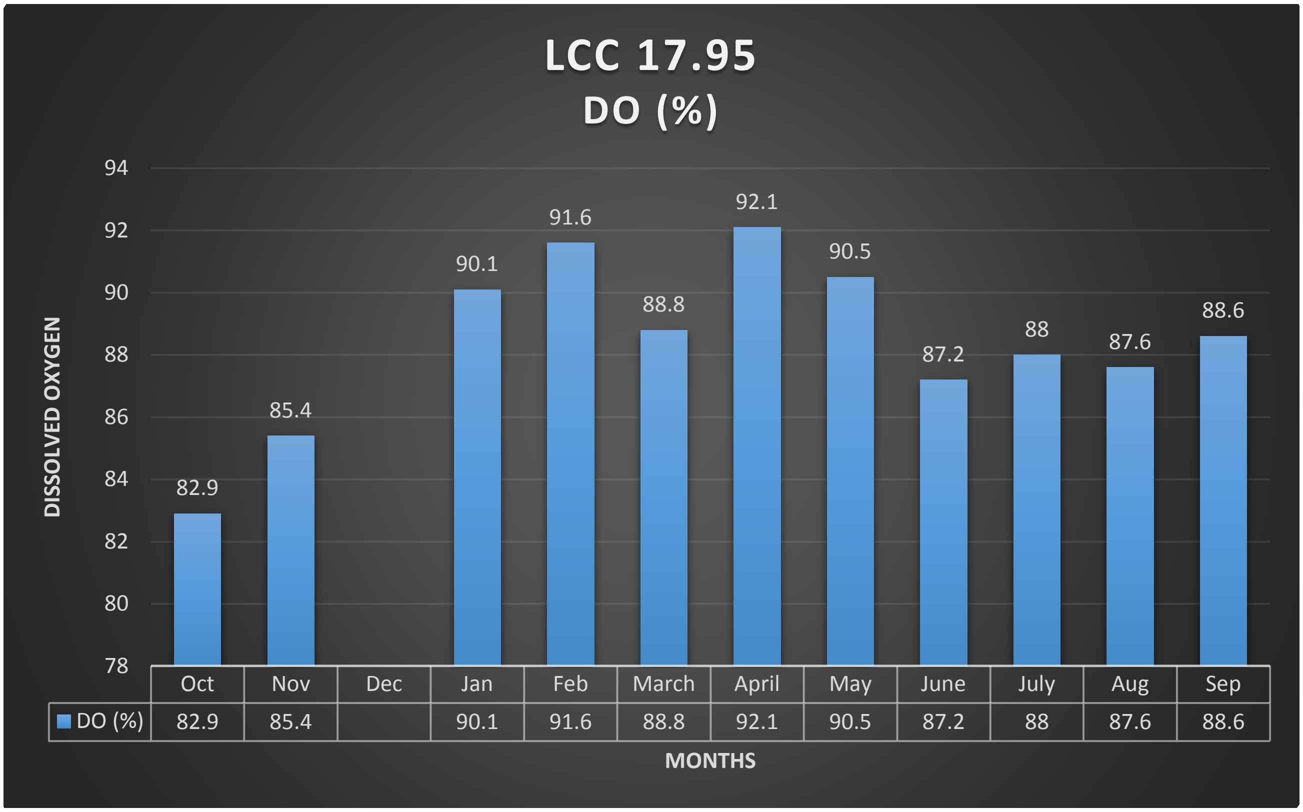


Figure 4-291 Little Cottonwood Creek 17.95 Total Dissolved Solids

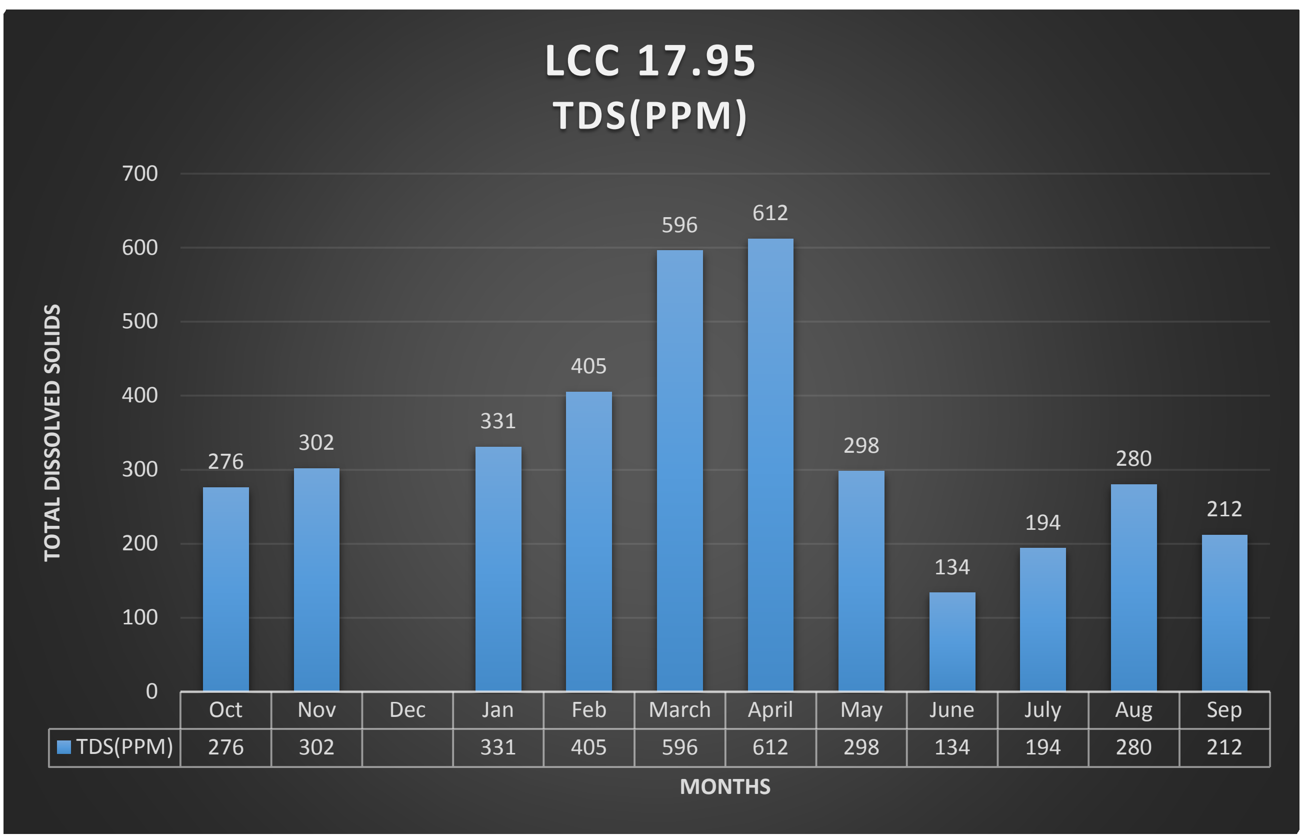


Figure 4-292 Little Cottonwood Creek 17.95 Conductivity

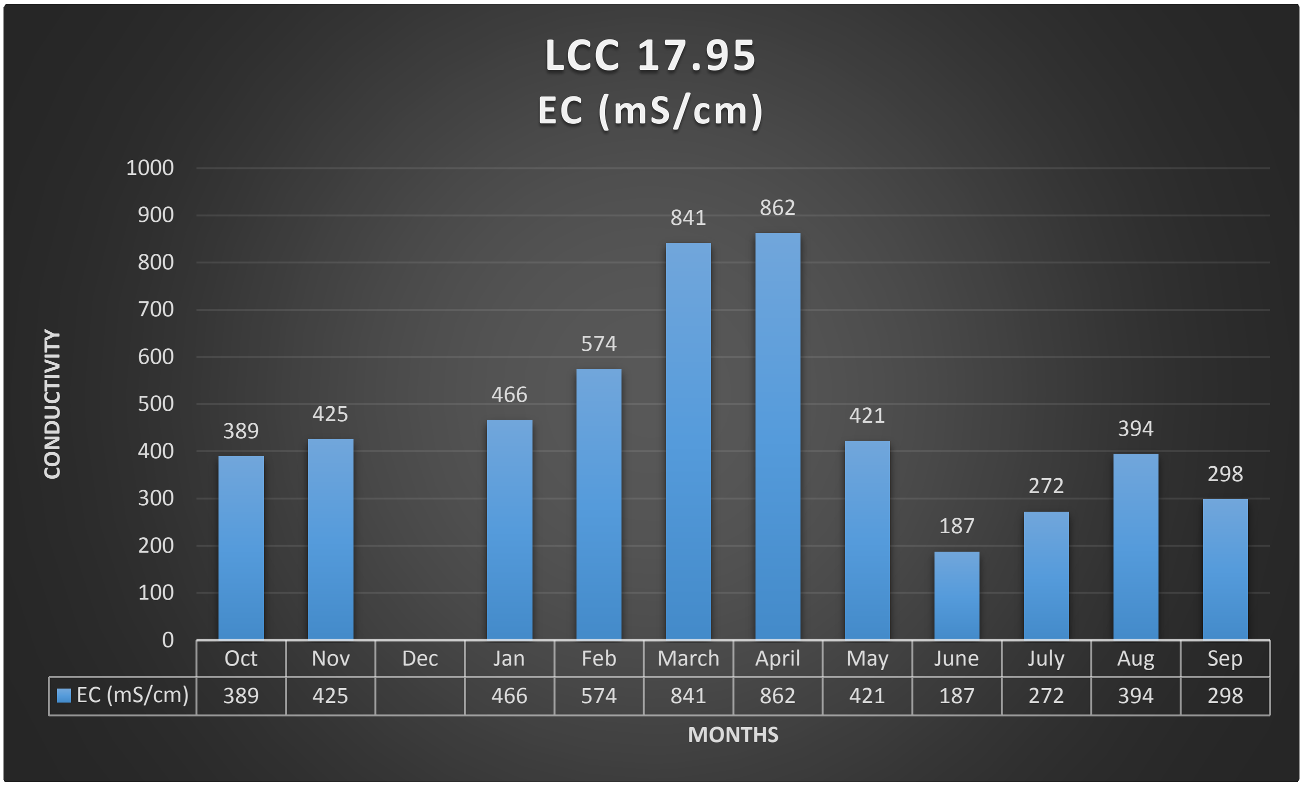


Figure 4-293 Little Cottonwood Creek 17.95 Turbidity

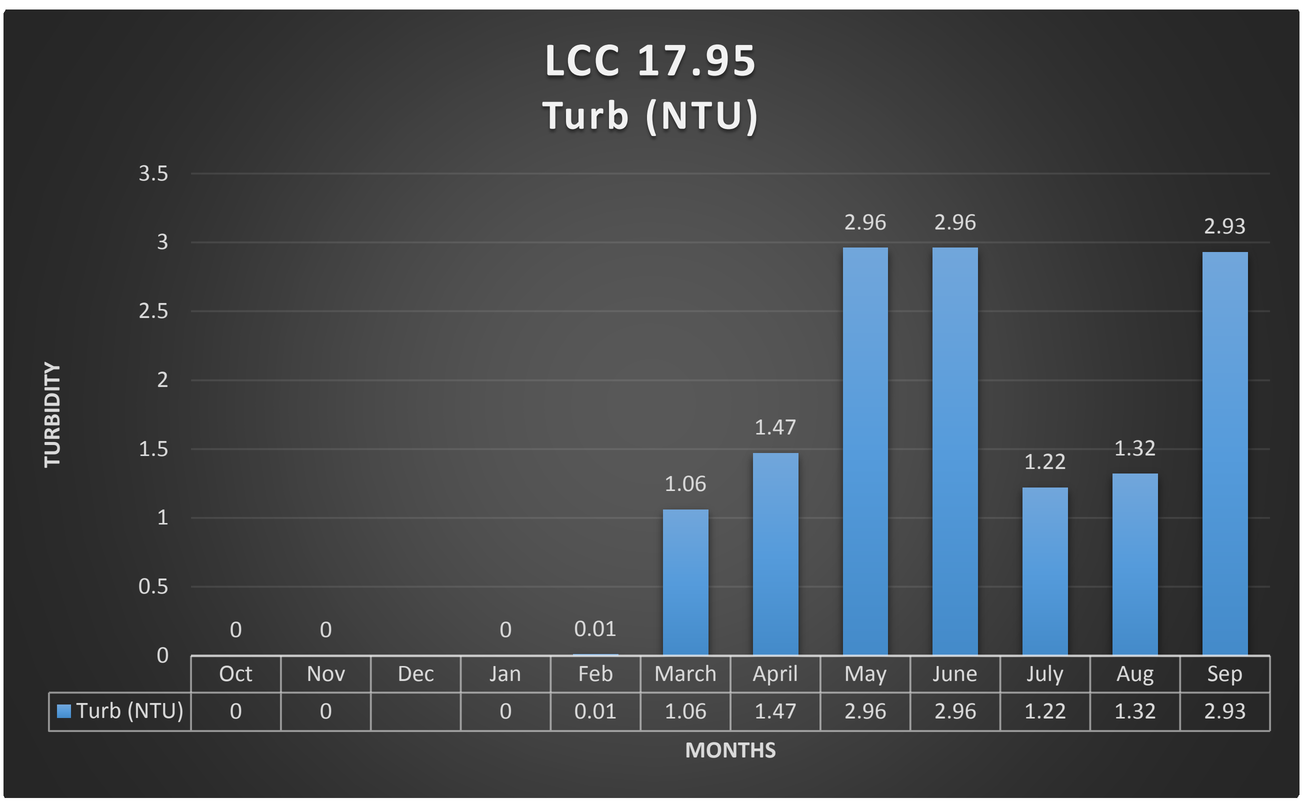
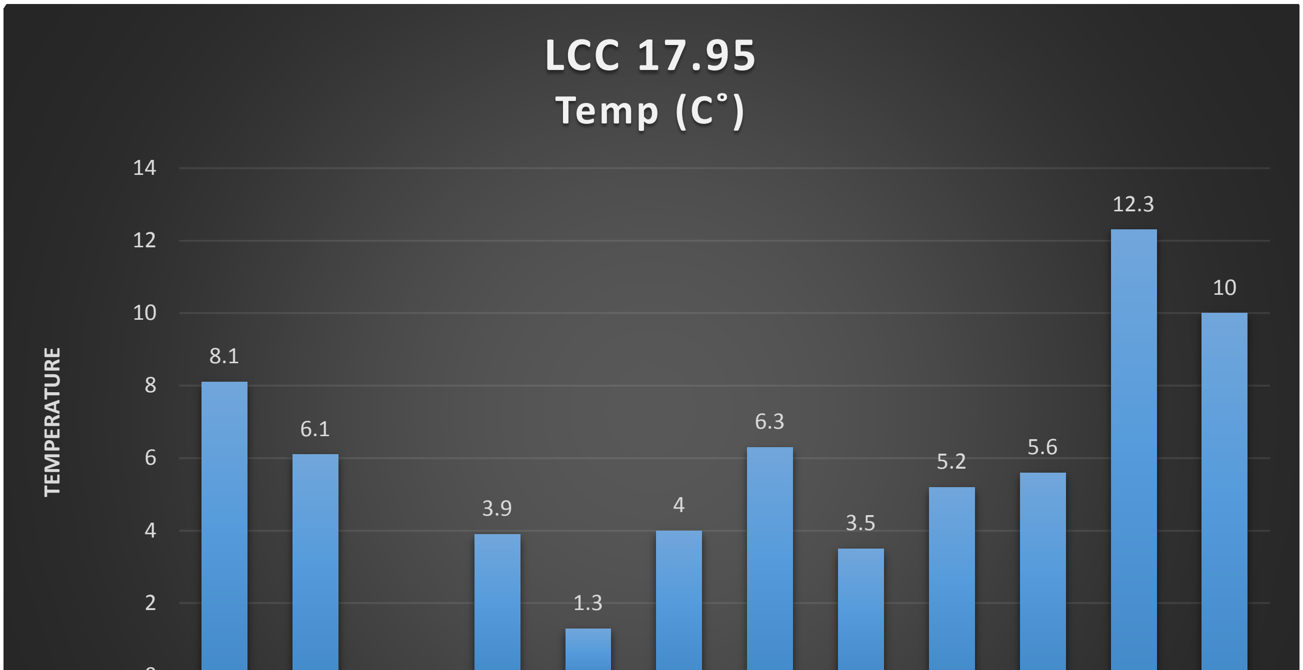
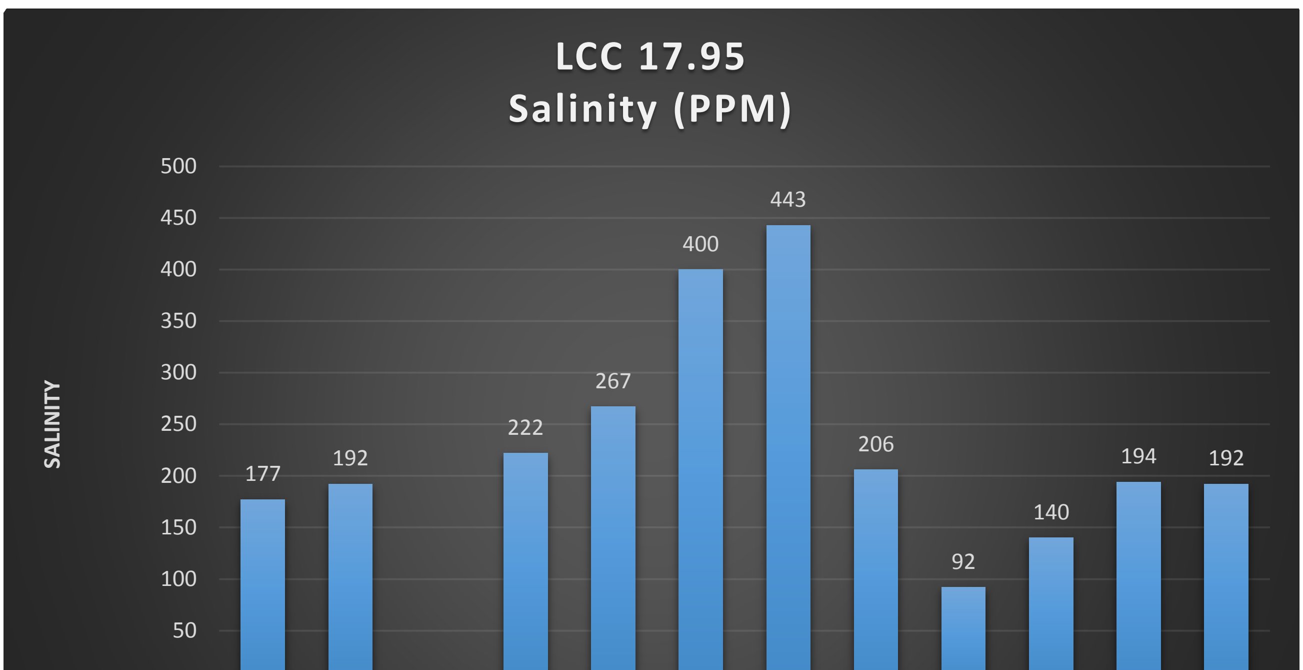


Figure 4-294 Little Cottonwood Creek 17.95 Temperature



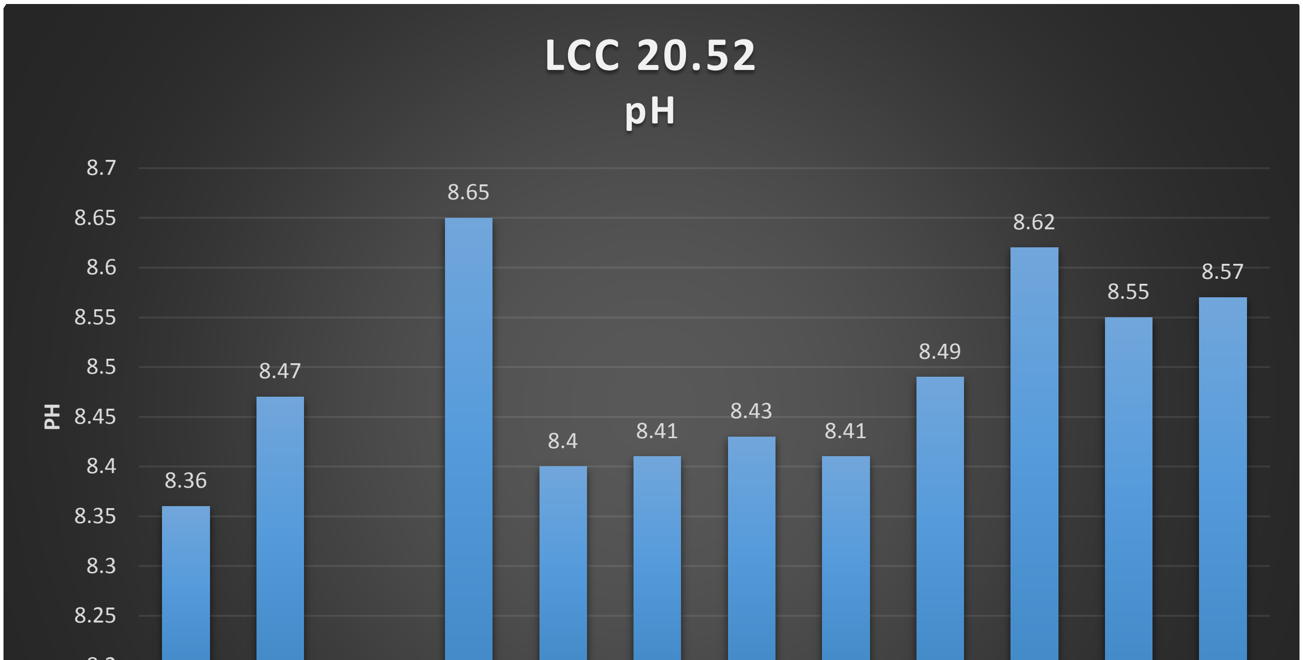
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Temp (C˚)	8.1	6.1		3.9	1.3	4	6.3	3.5	5.2	5.6	12.3	10

Figure 4-295 Little Cottonwood Creek 17.95 Salinity



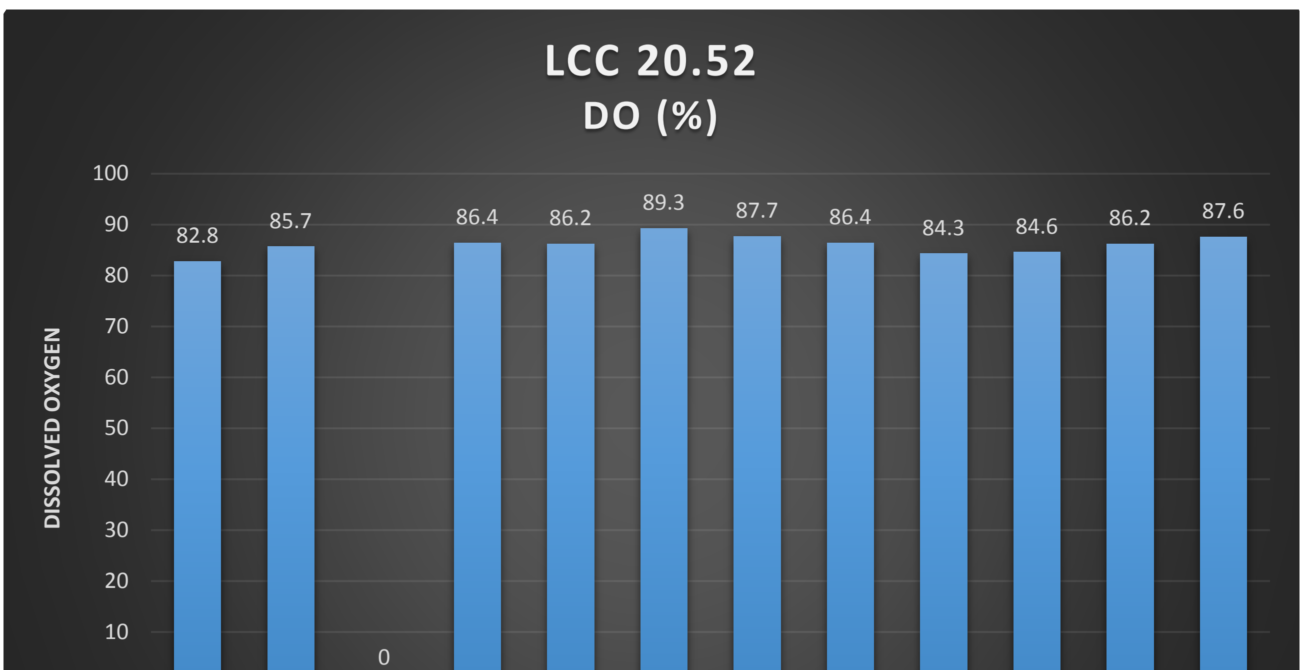
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Salinity (PPM)	177	192		222	267	400	443	206	92	140	194	192

Figure 4-296 Little Cottonwood Creek 20.52 pH



	1	2	3	4	5	6	7	8	9	10	11	12
pH	8.36	8.47		8.65	8.4	8.41	8.43	8.41	8.49	8.62	8.55	8.57

Figure 4-297 Little Cottonwood Creek 20.52 Dissolved Oxygen



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
DO (%)	82.8	85.7	0	86.4	86.2	89.3	87.7	86.4	84.3	84.6	86.2	87.6

Figure 4-298 Little Cottonwood Creek 20.52 Total Dissolved Solids

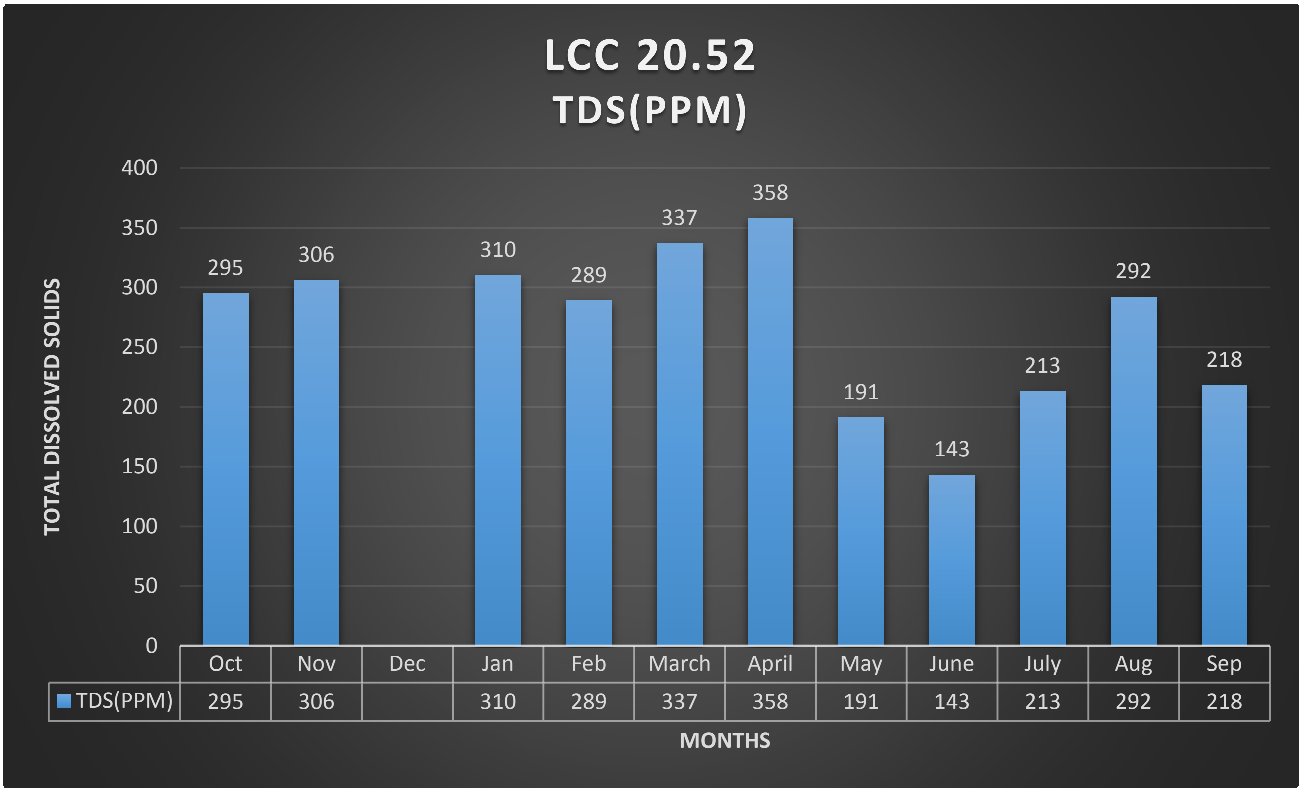


Figure 4-299 Little Cottonwood Creek 20.52 Conductivity

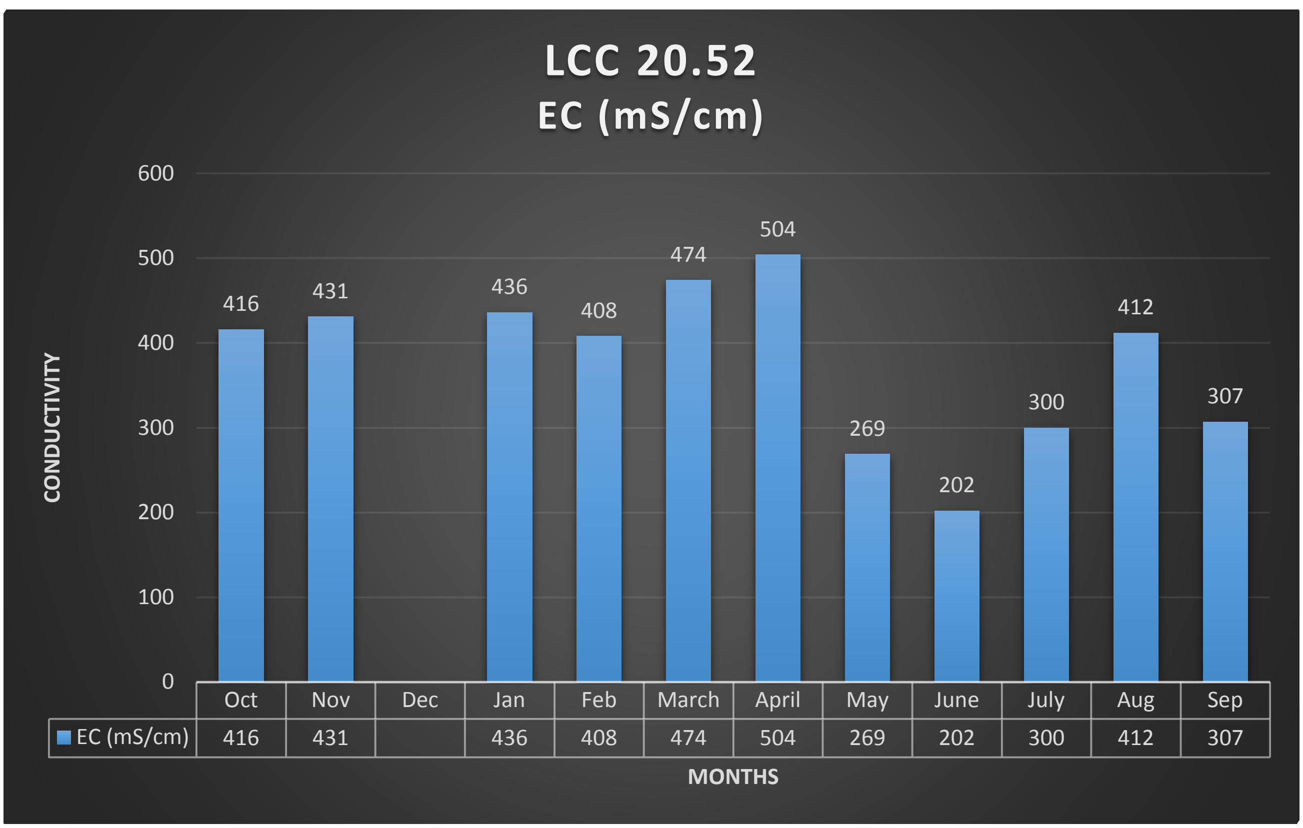


Figure 4-300 Little Cottonwood Creek 20.52 Turbidity

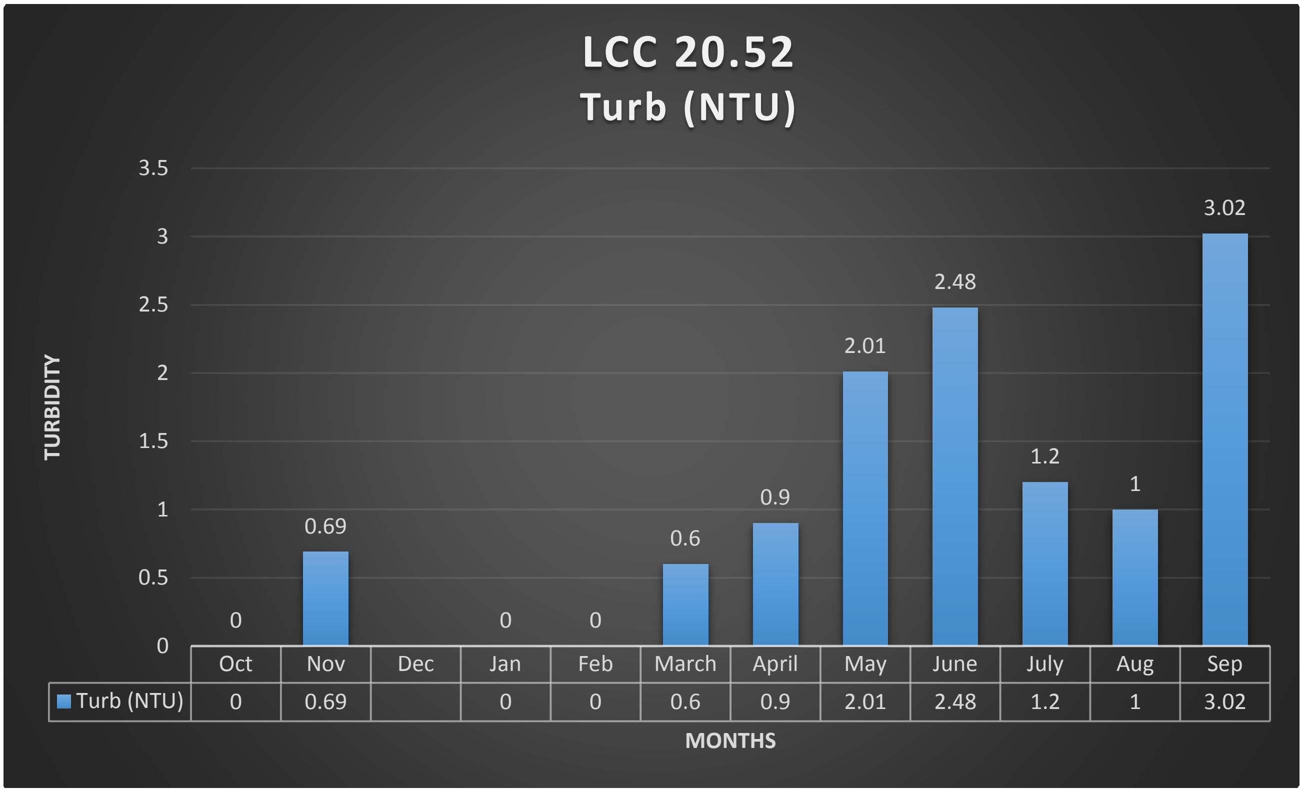


Figure 4-301 Little Cottonwood Creek 20.52 Temperature

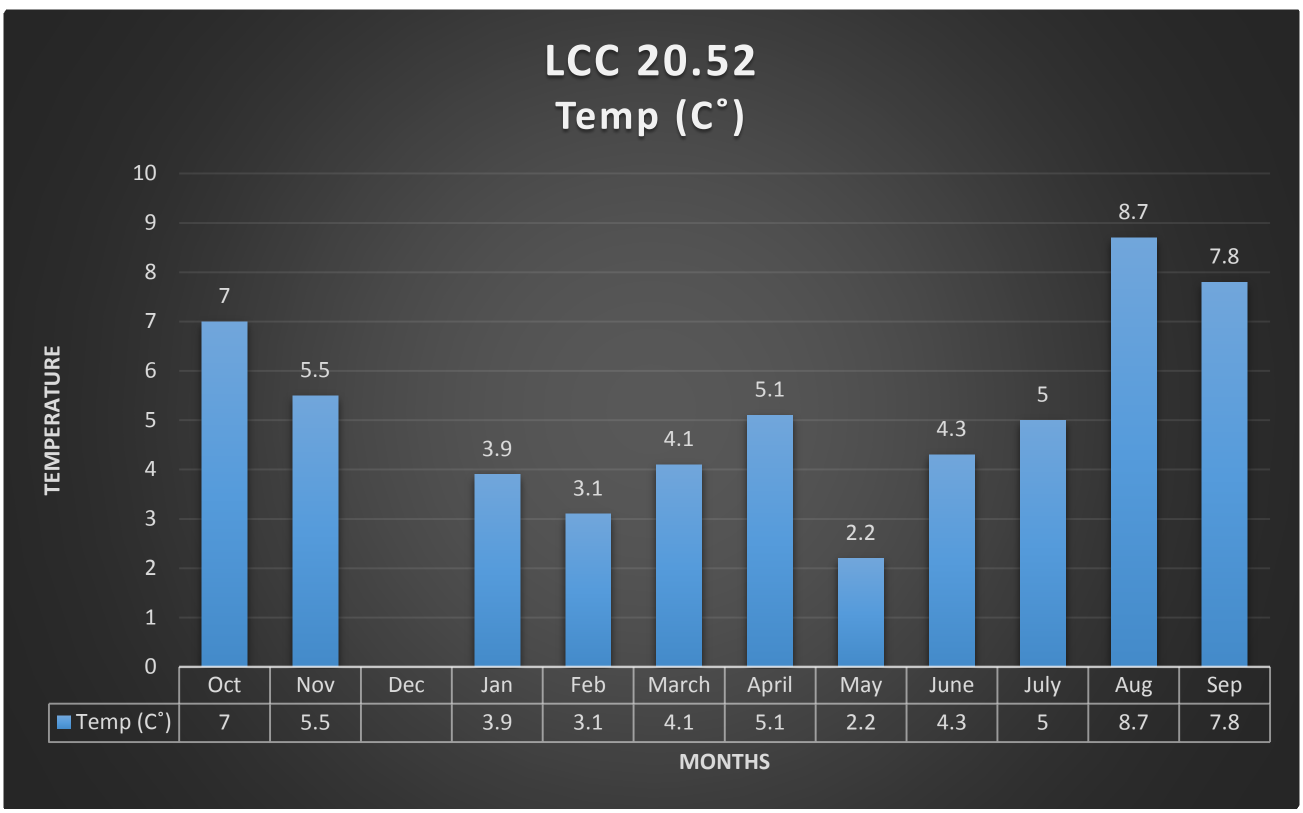


Figure 4-302 Little Cottonwood Creek 20.52 Salinity

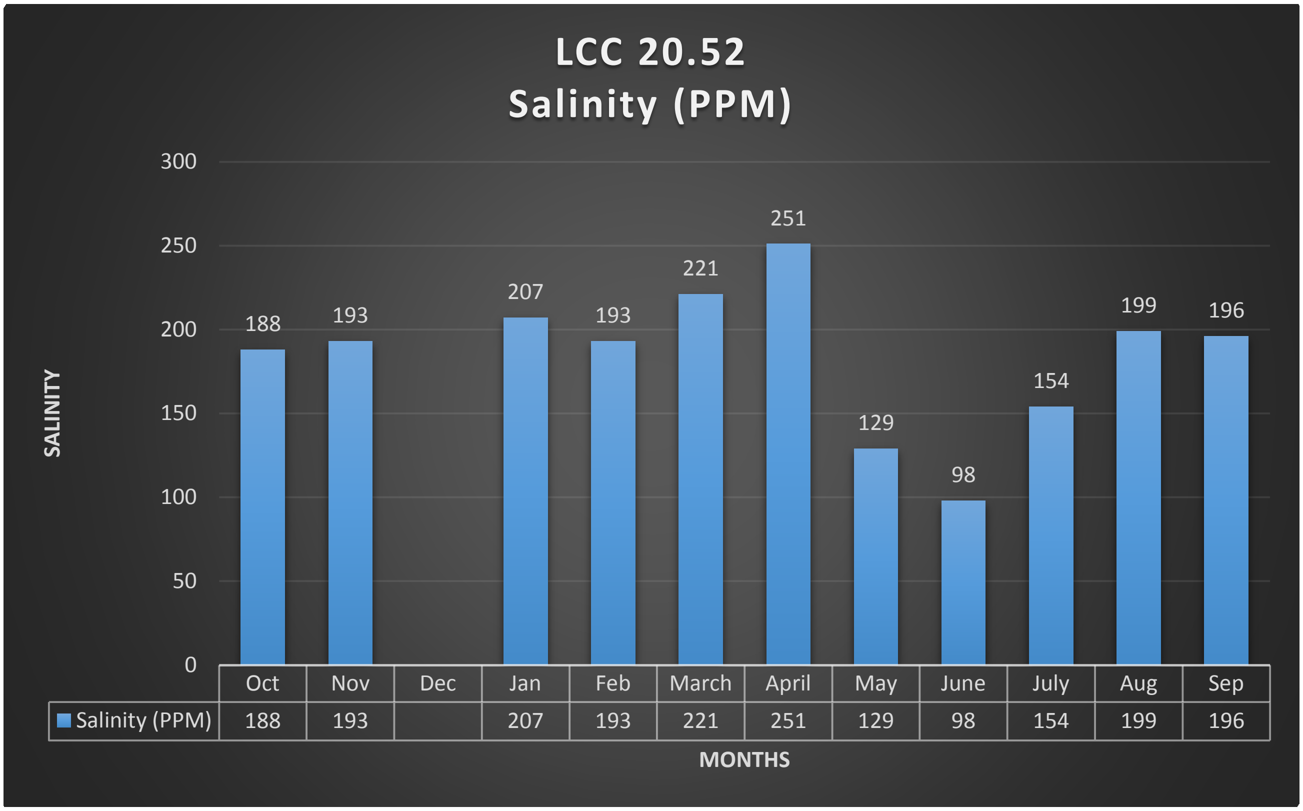


Figure 4-303 Rose Creek 00.41 pH

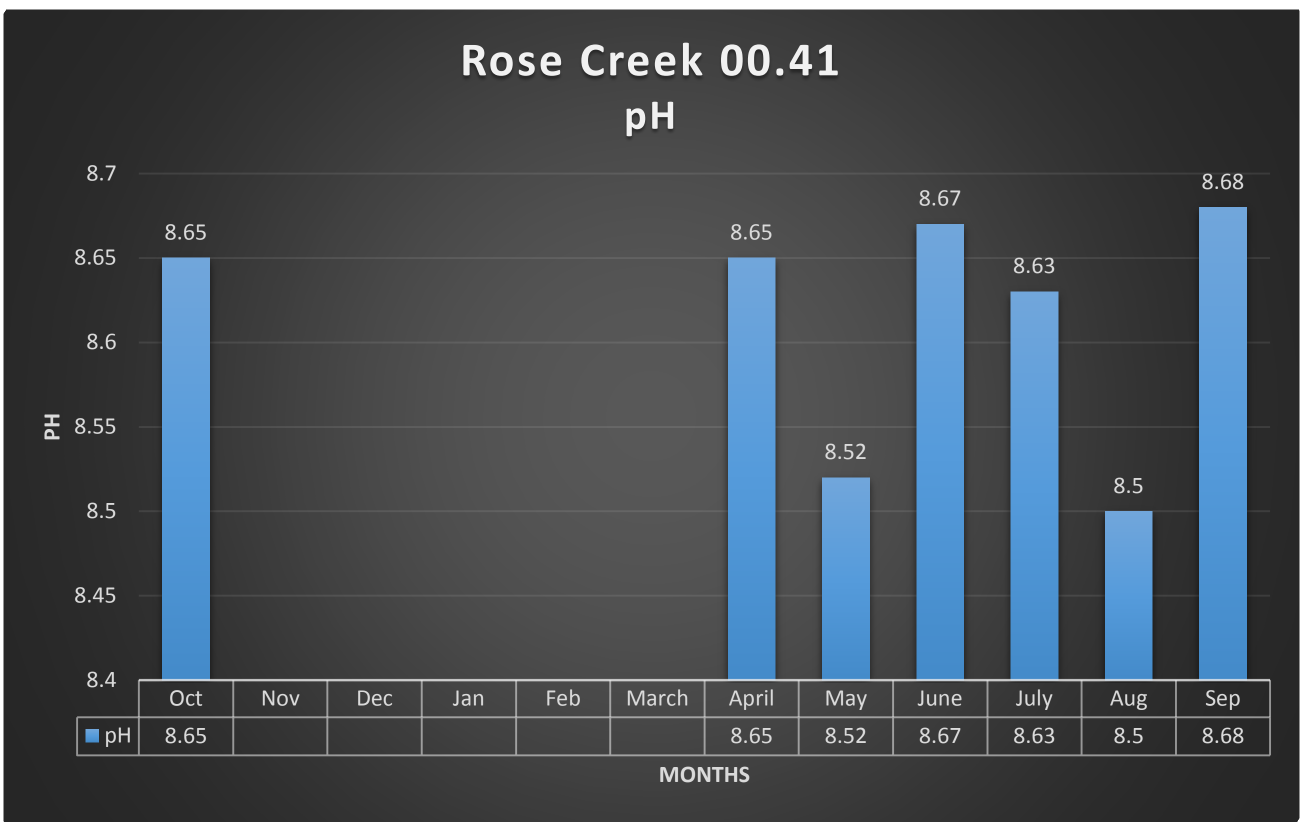
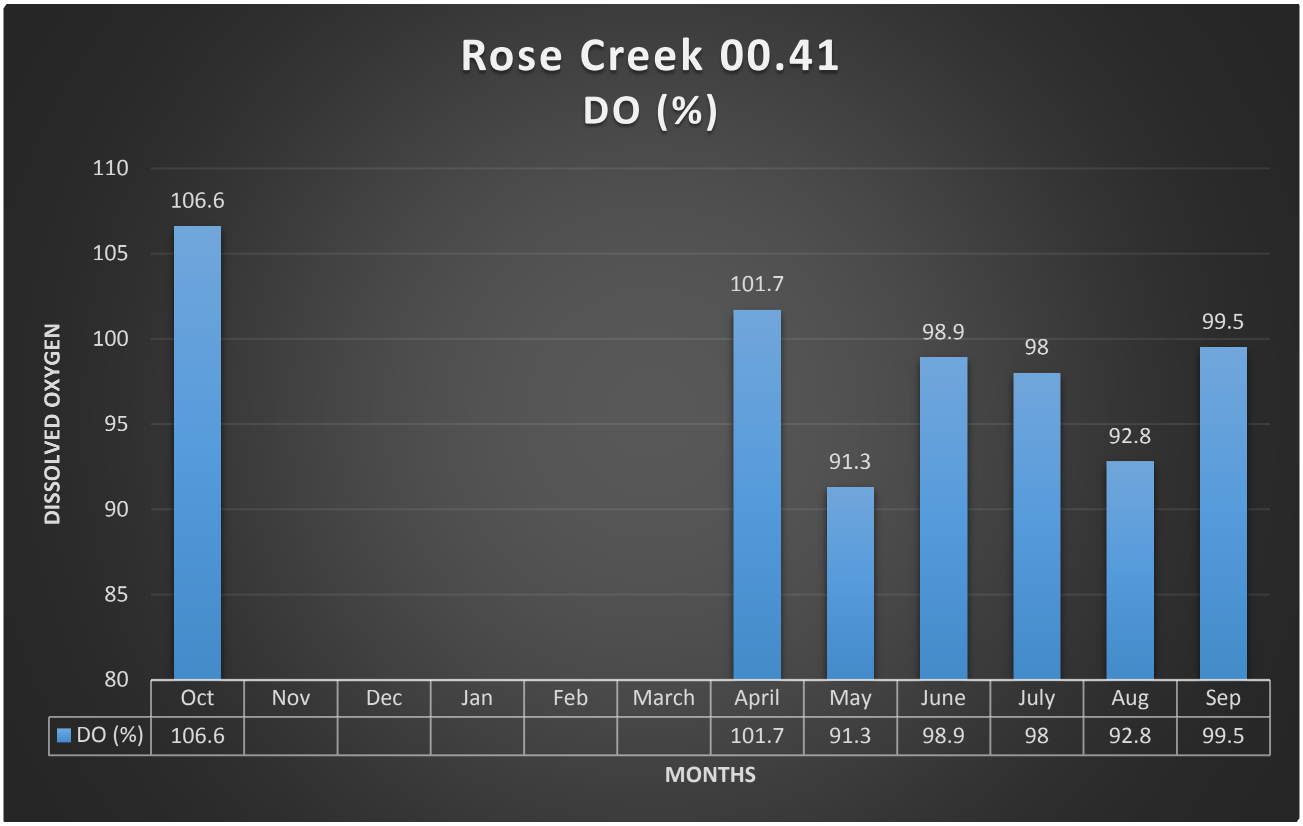
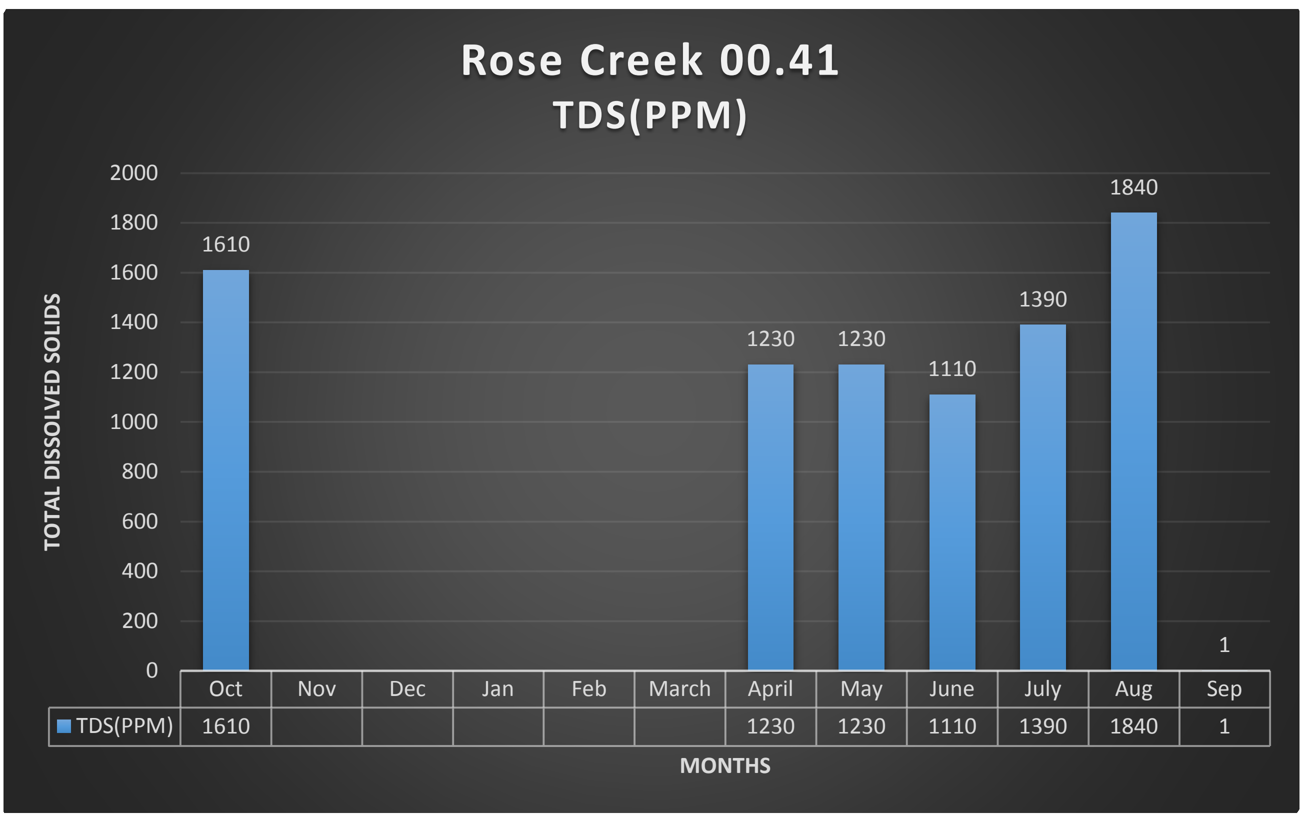


Figure 4-304 Rose Creek 00.41 Dissolved Oxygen



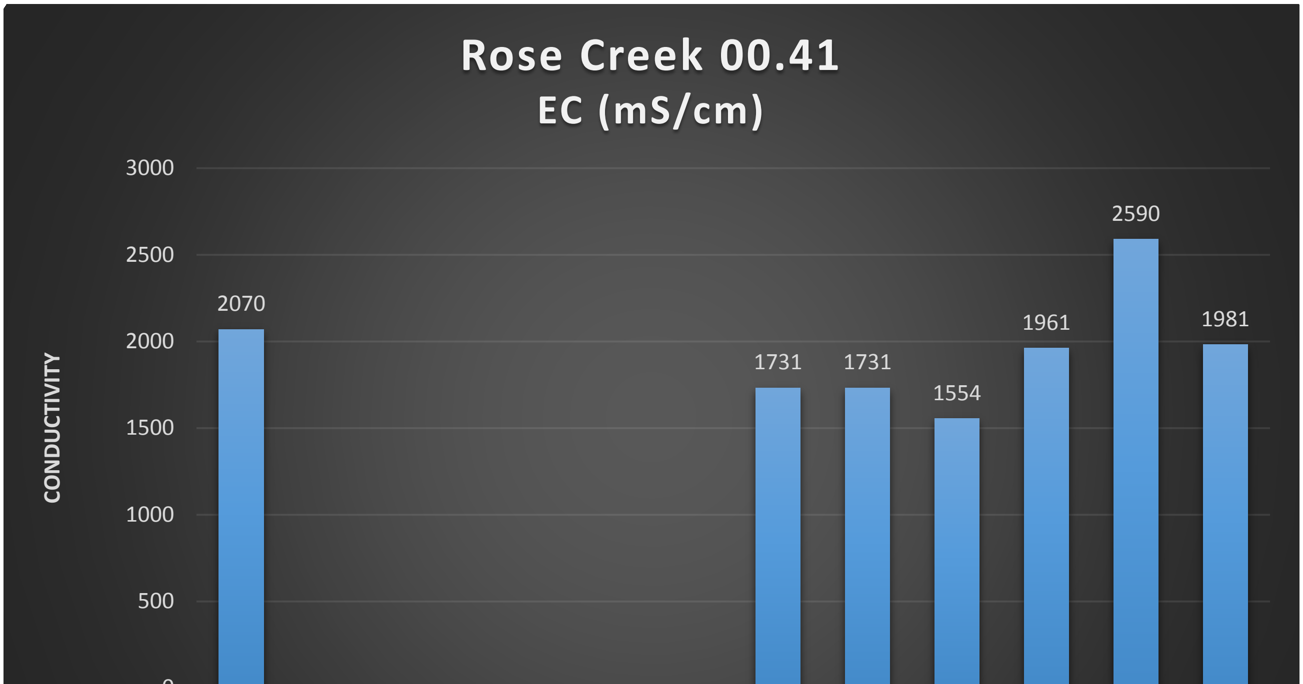
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
DO (%)	106.6						101.7	91.3	98.9	98	92.8	99.5

Figure 4-305 Rose Creek 00.41 Total Dissolved Solids



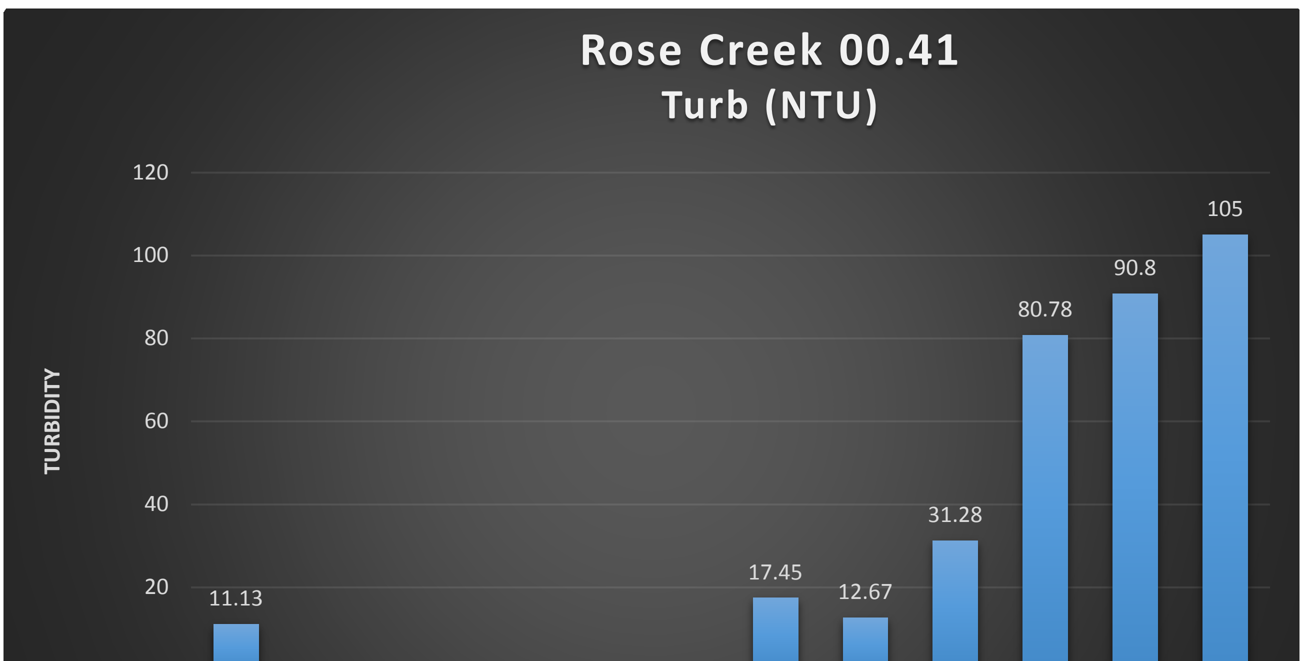
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
TDS(PPM)	1610						1230	1230	1110	1390	1840	1

Figure 4-306 Rose Creek 00.41 Conductivity



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
EC (mS/cm)	2070						1731	1731	1554	1961	2590	1981

Figure 4-307 Rose Creek 00.41 Turbidity



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Turb (NTU)	11.13						17.45	12.67	31.28	80.78	90.8	105

Figure 4-308 Rose Creek 00.41 Temperature

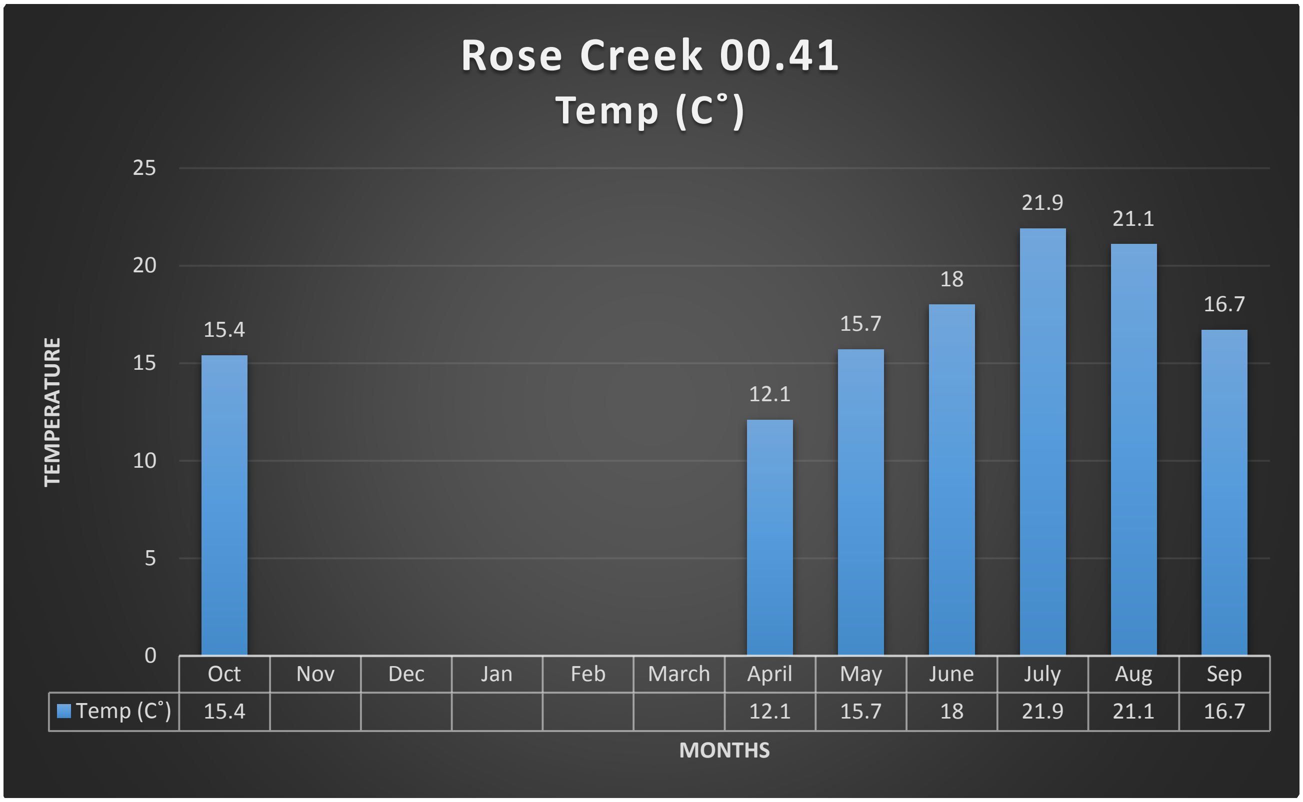


Figure 4-309 Rose Creek 00.41 Salinity

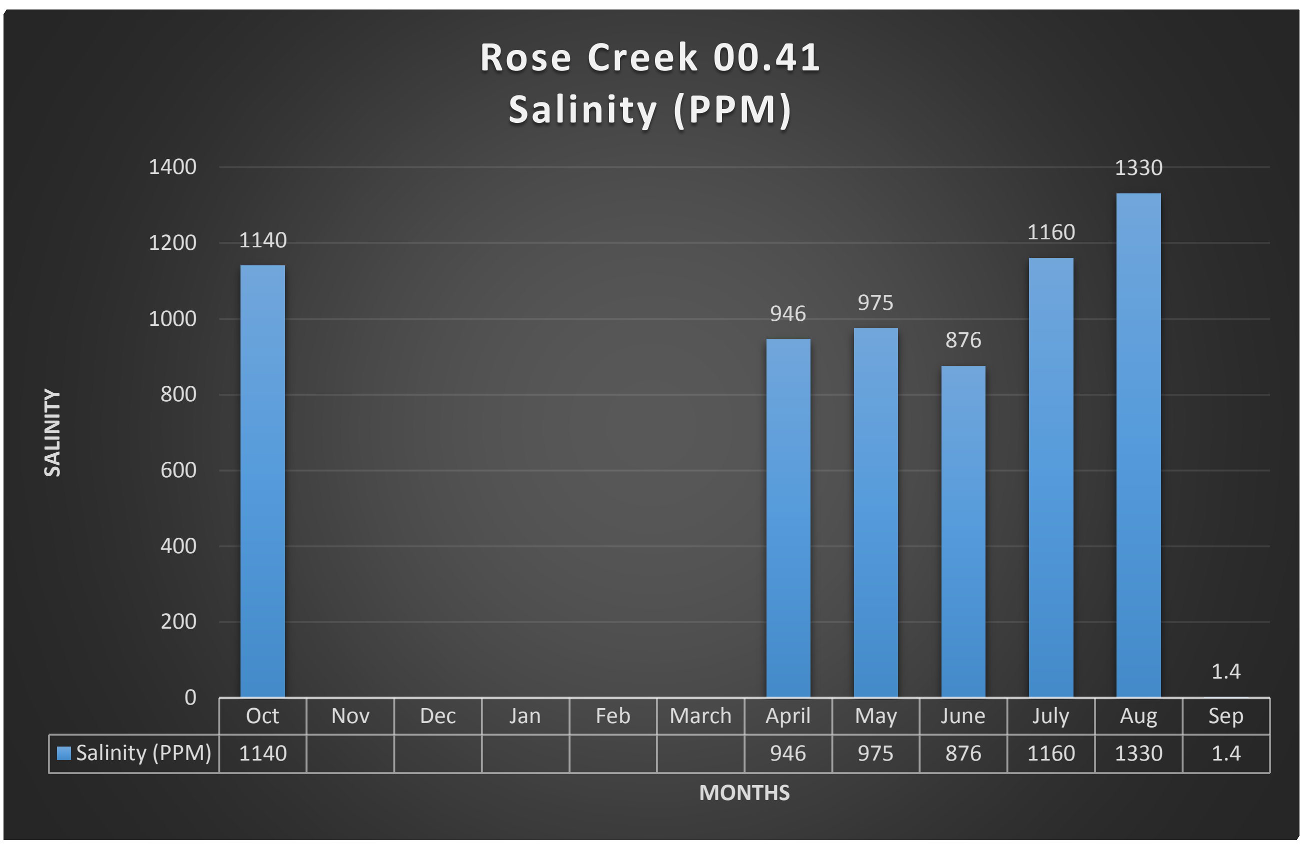


Figure 4-310 Rose Creek 10.58 pH

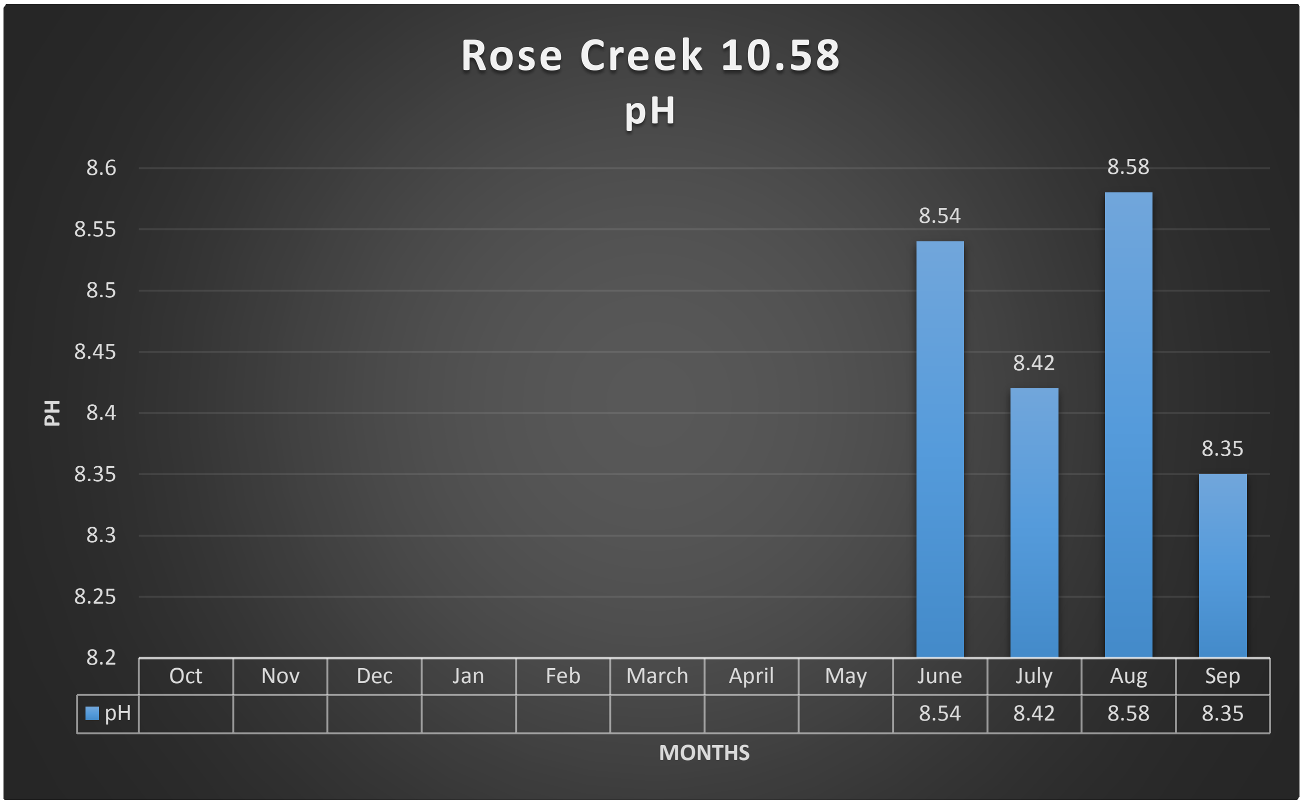


Figure 4-311 Rose Creek 10.58 Dissolved Oxygen

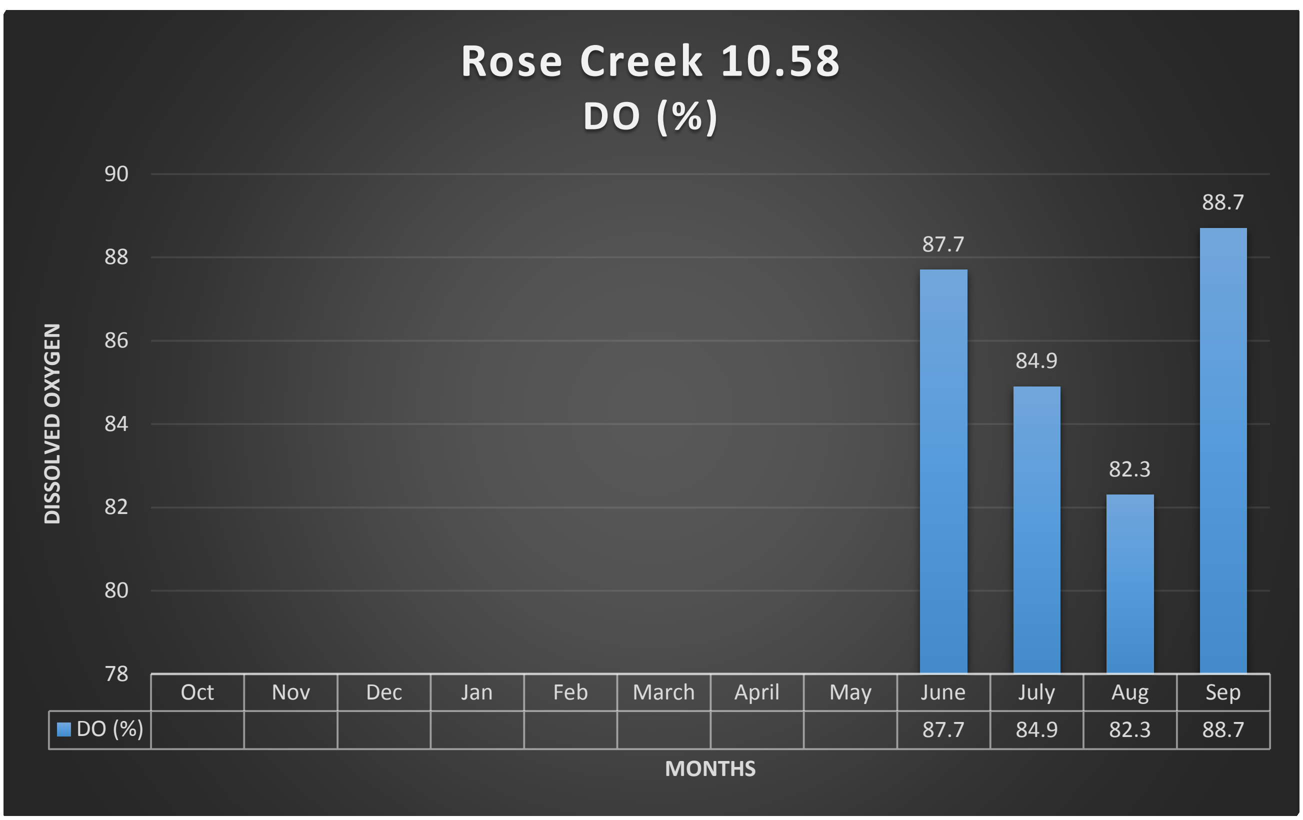
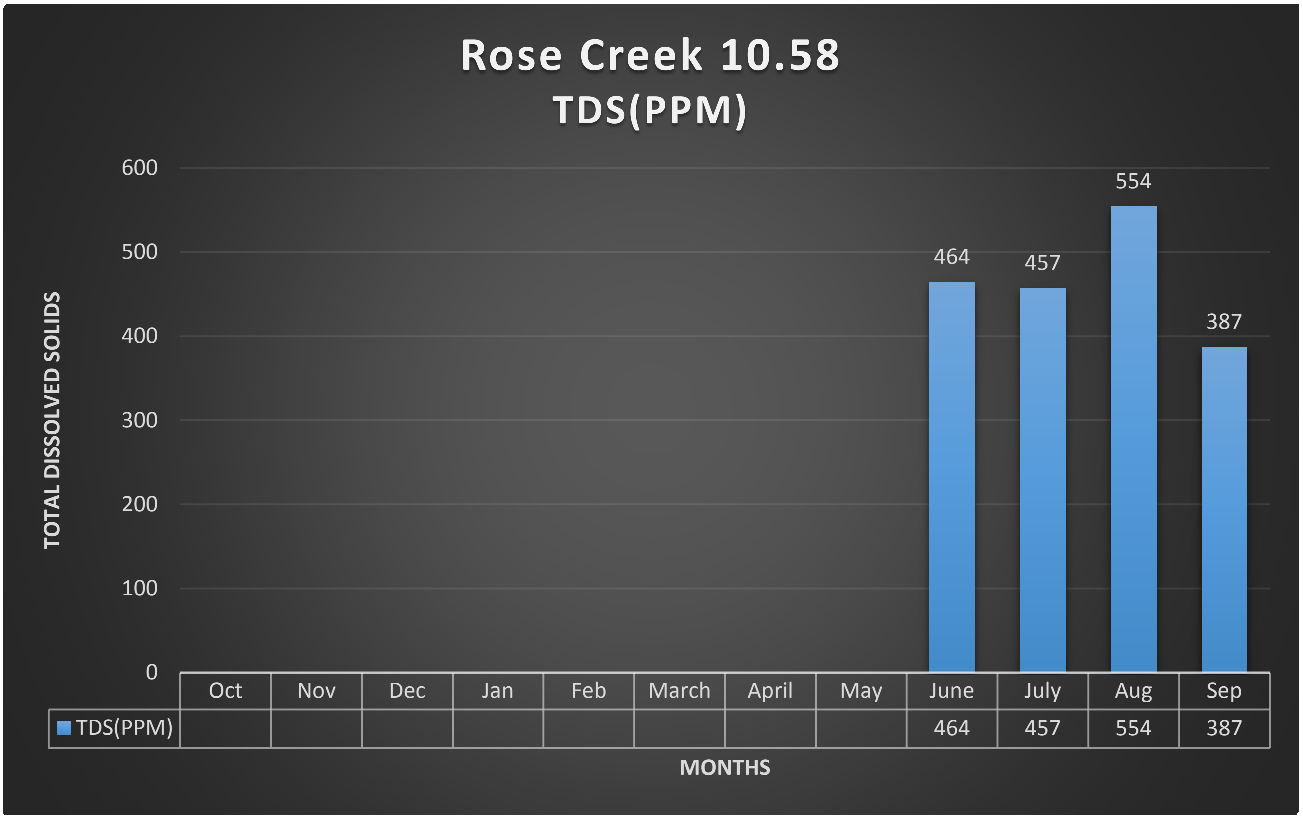
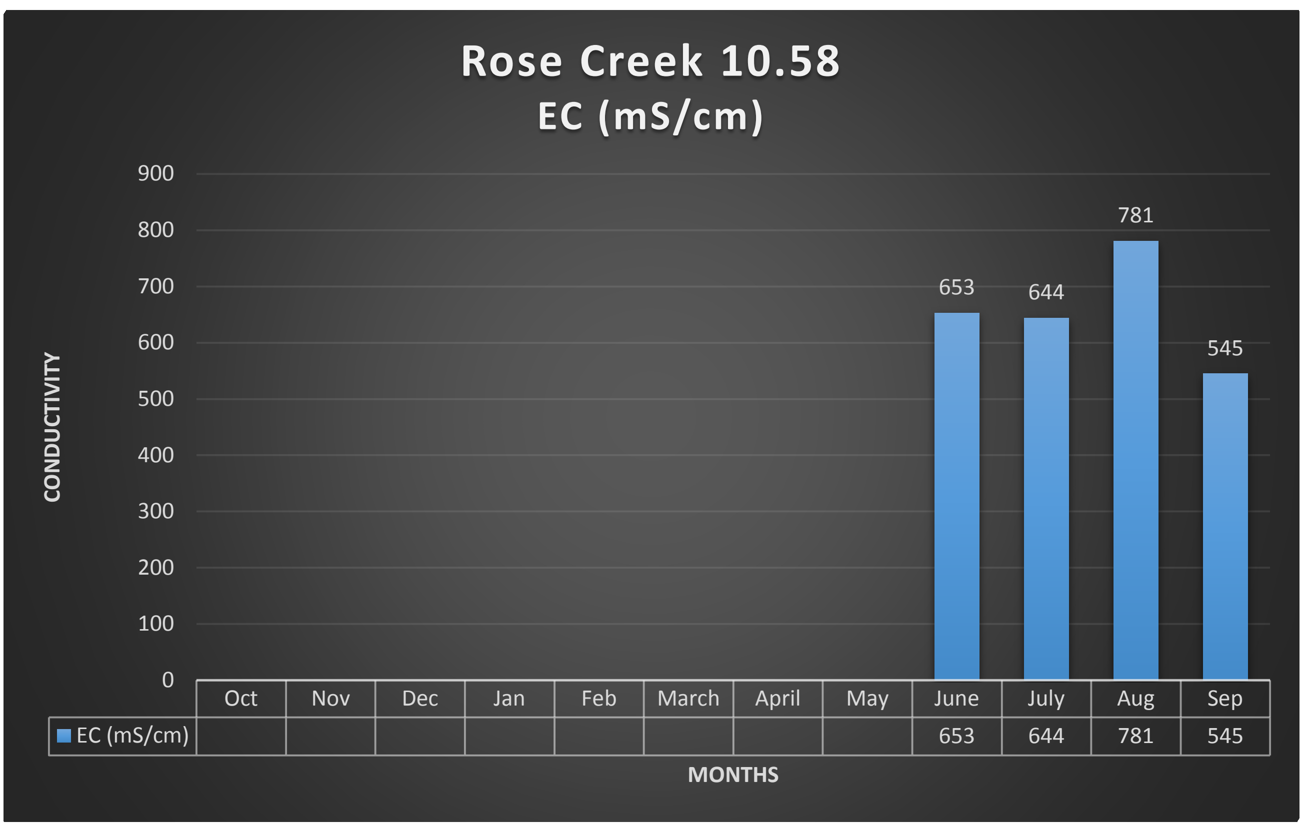


Figure 4-312 Rose Creek 10.58 Total Dissolved Solids



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
TDS(PPM)									464	457	554	387

Figure 4-313 Rose Creek 10.58 Conductivity



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
EC (mS/cm)									653	644	781	545

Figure 4-314 Rose Creek 10.58 Turbidity

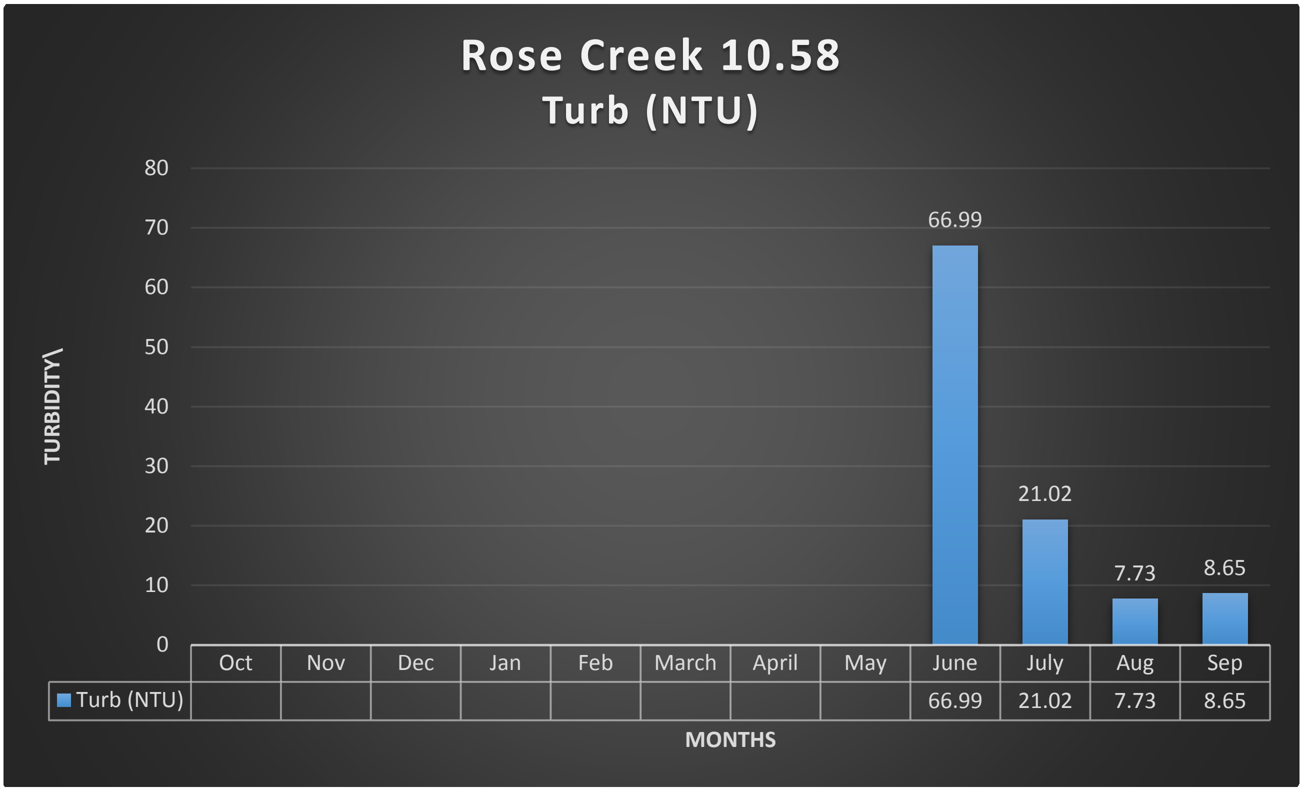


Figure 4-315 Rose Creek 10.58 Temperature

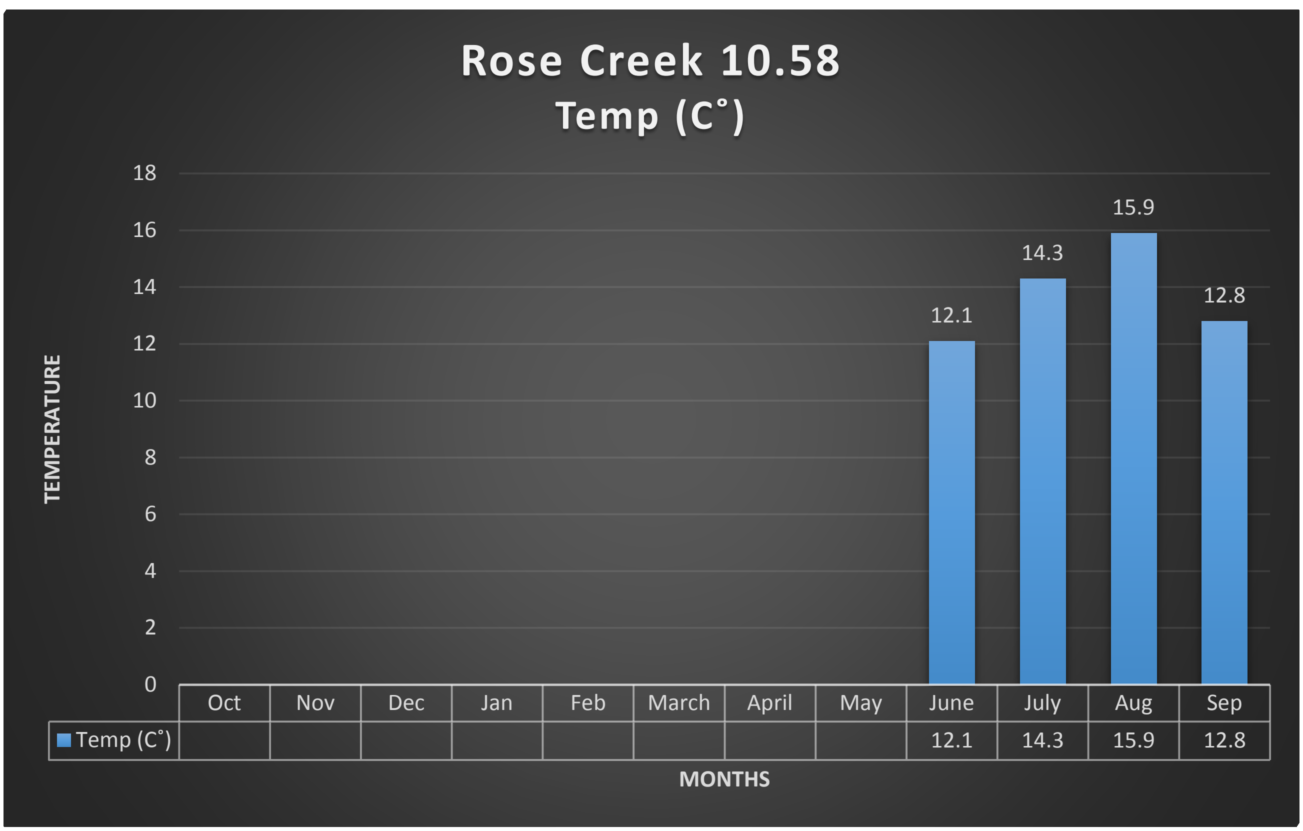


Figure 4-316 Rose Creek 10.58 Salinity

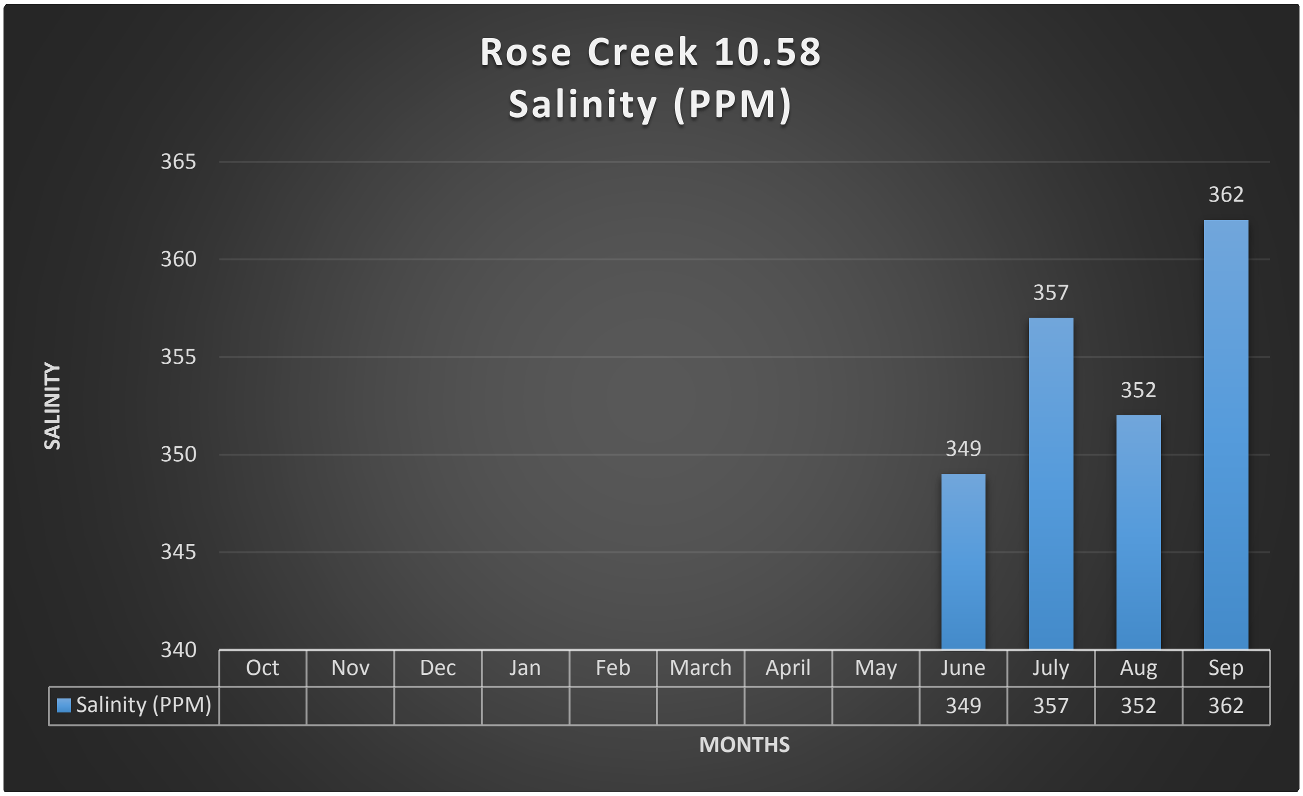


Figure 4-317 Rose Creek 11.32 pH

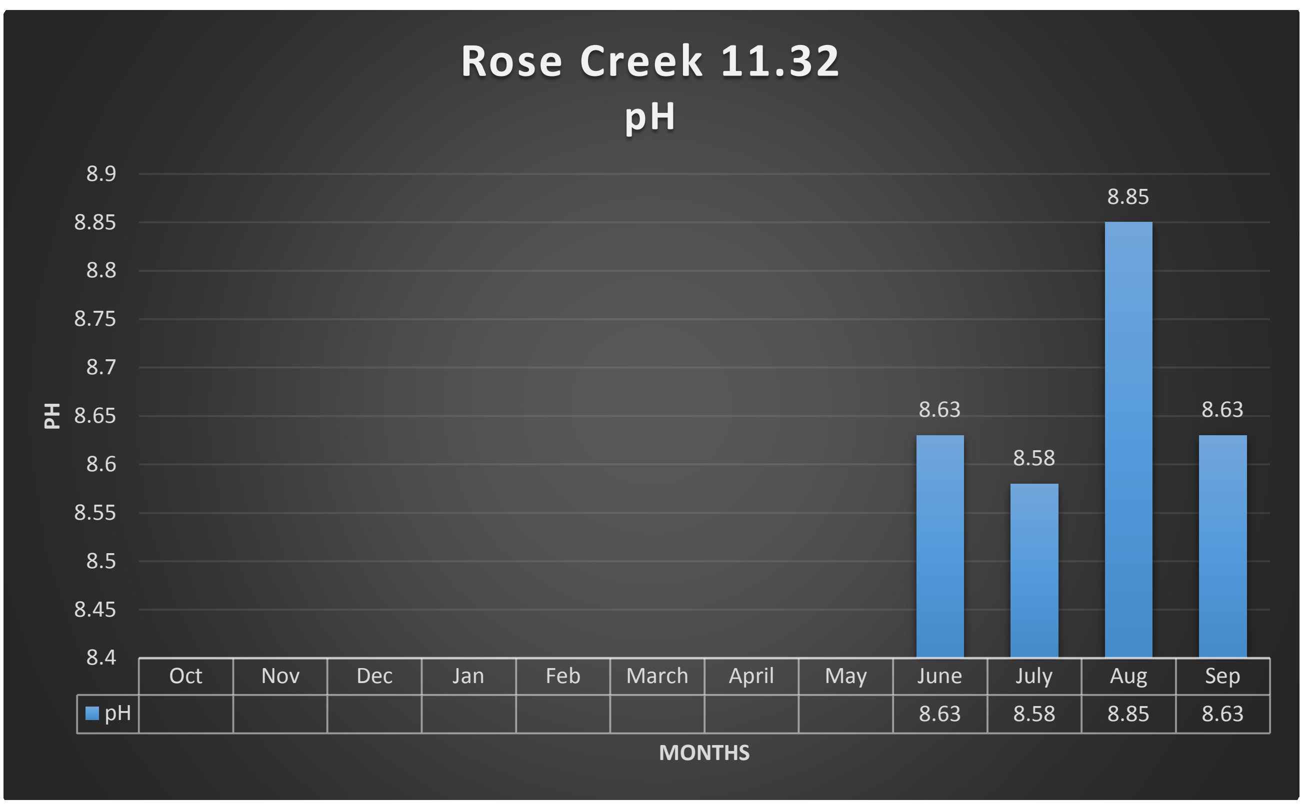
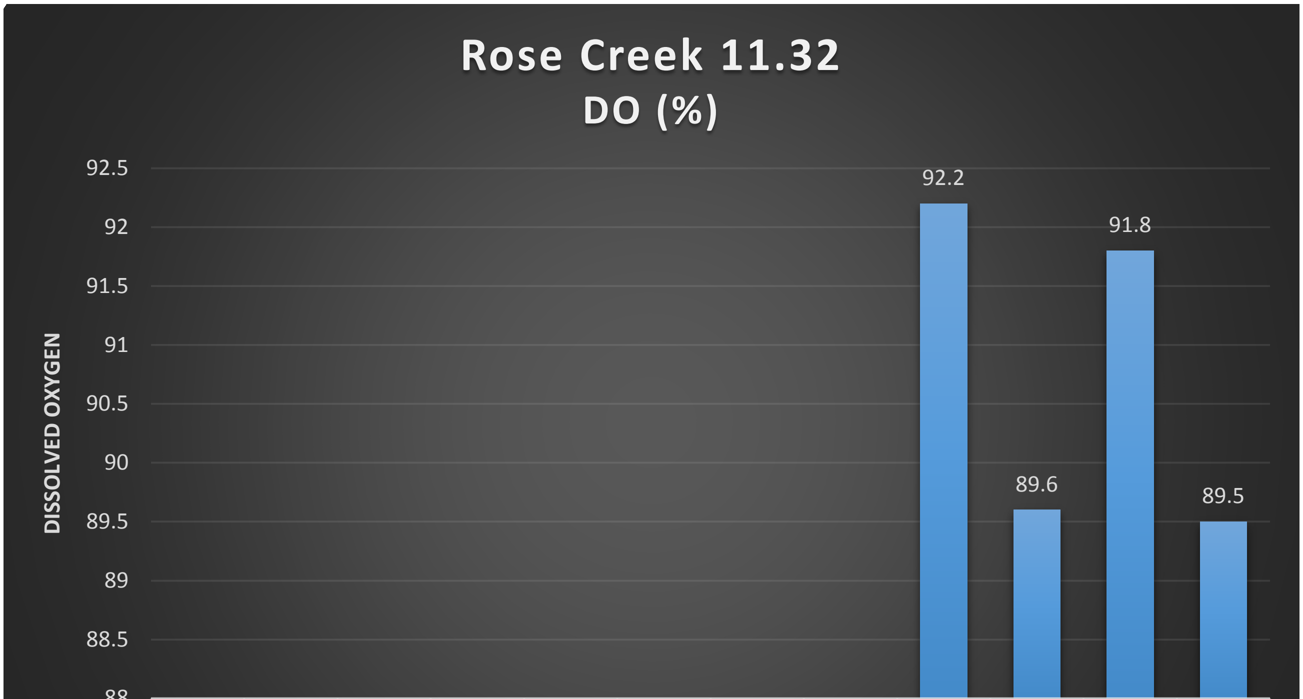
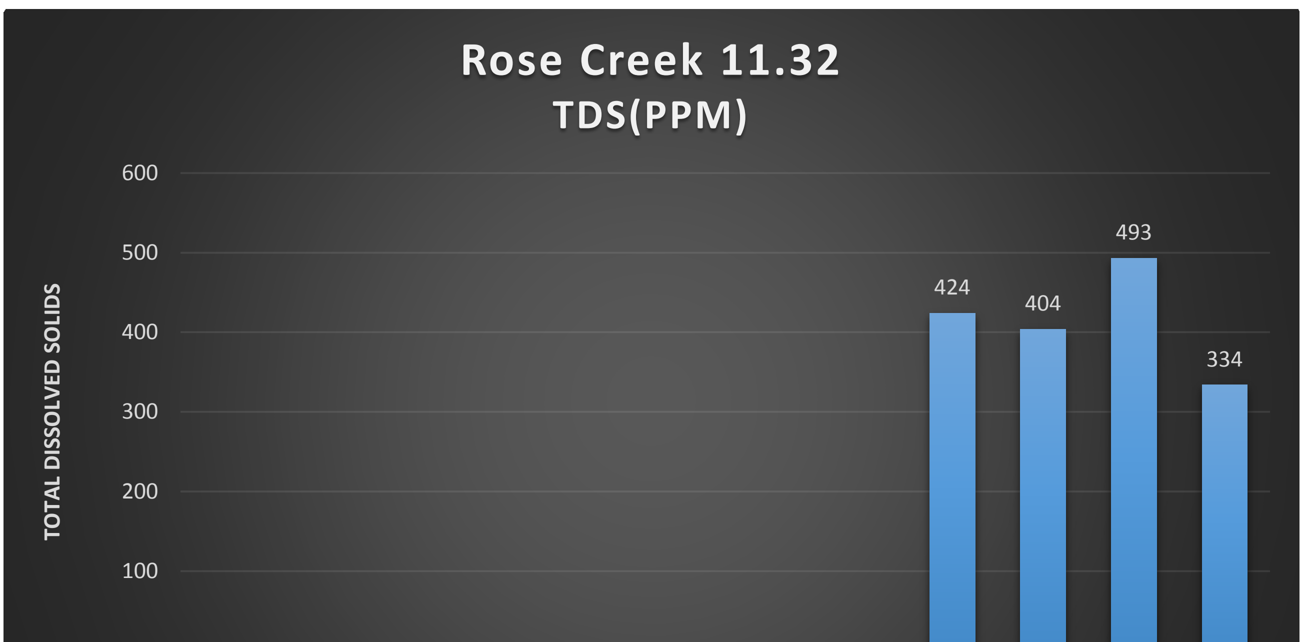


Figure 4-318 Rose Creek 11.32 Dissolved Oxygen



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
DO (%)									92.2	89.6	91.8	89.5

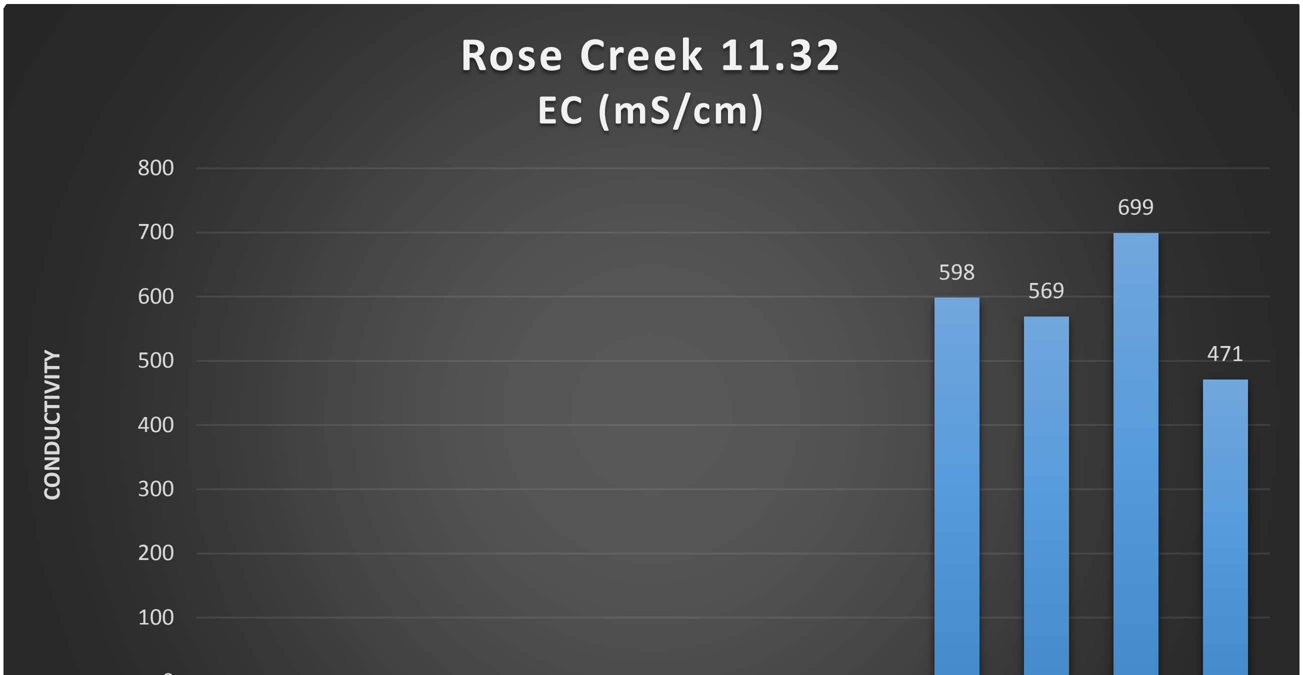
Figure 4-319 Rose Creek 11.32 Total Dissolved Solids



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
TDS(PPM)									424	404	493	334

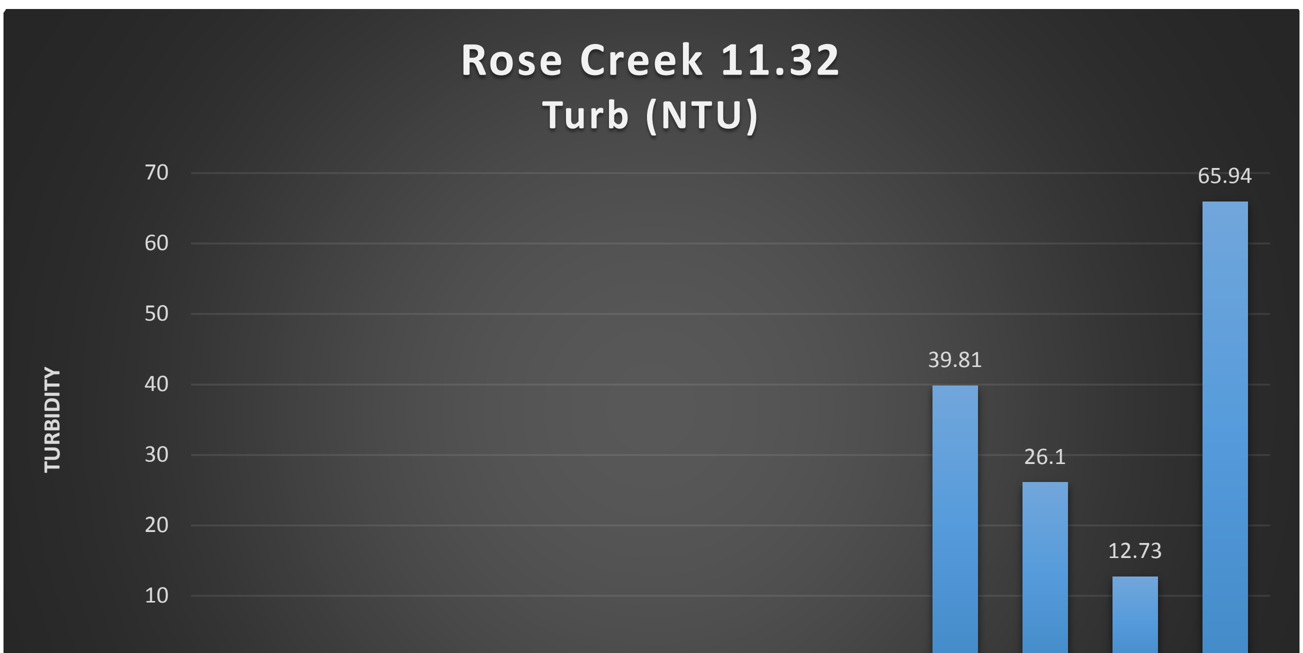
SALT LAKE COUNTY WATERSHED

Figure 4-320 Rose Creek 11.32 Conductivity



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
EC (mS/cm)									598	569	699	471

Figure 4-321 Rose Creek 11.32 Turbidity



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Turb (NTU)									39.81	26.1	12.73	65.94

Figure 4-322 Rose Creek 11.32 Temperature

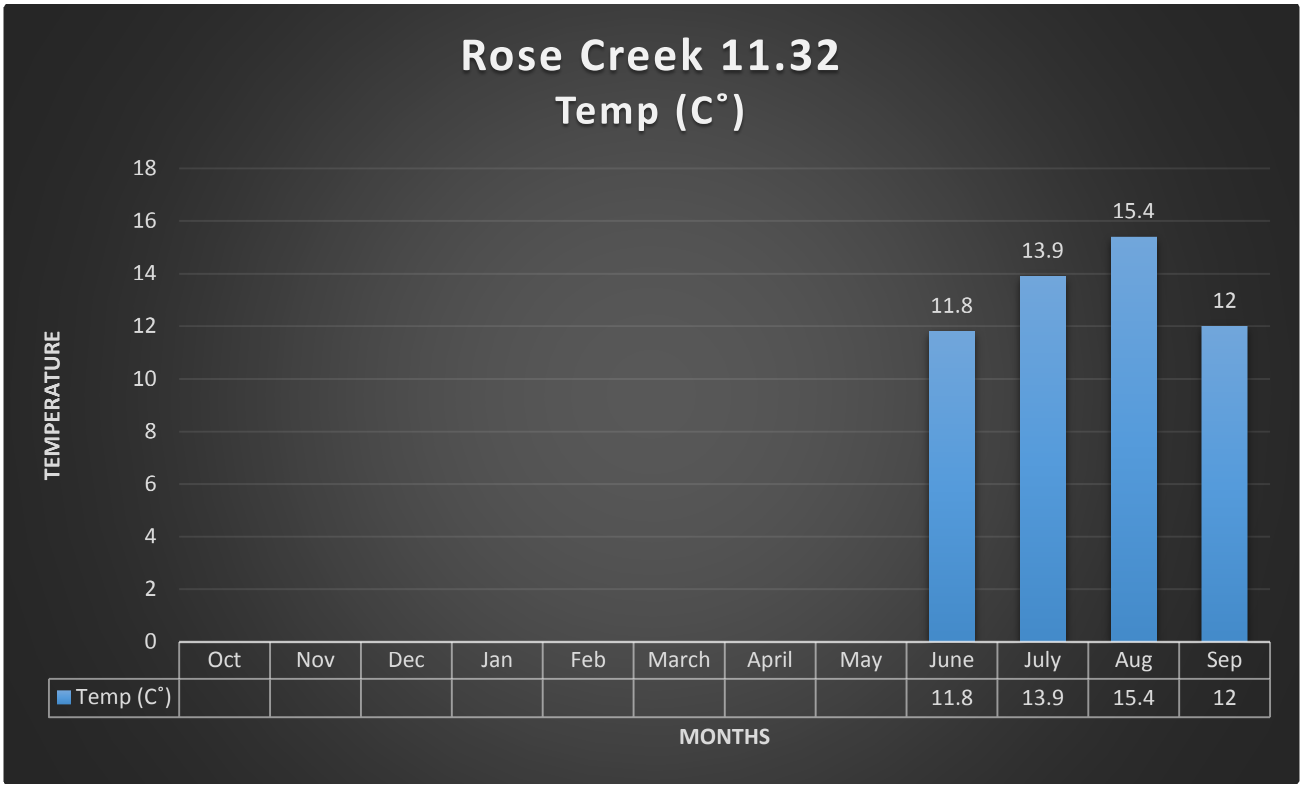


Figure 4-323 Rose Creek 11.32 Salinity

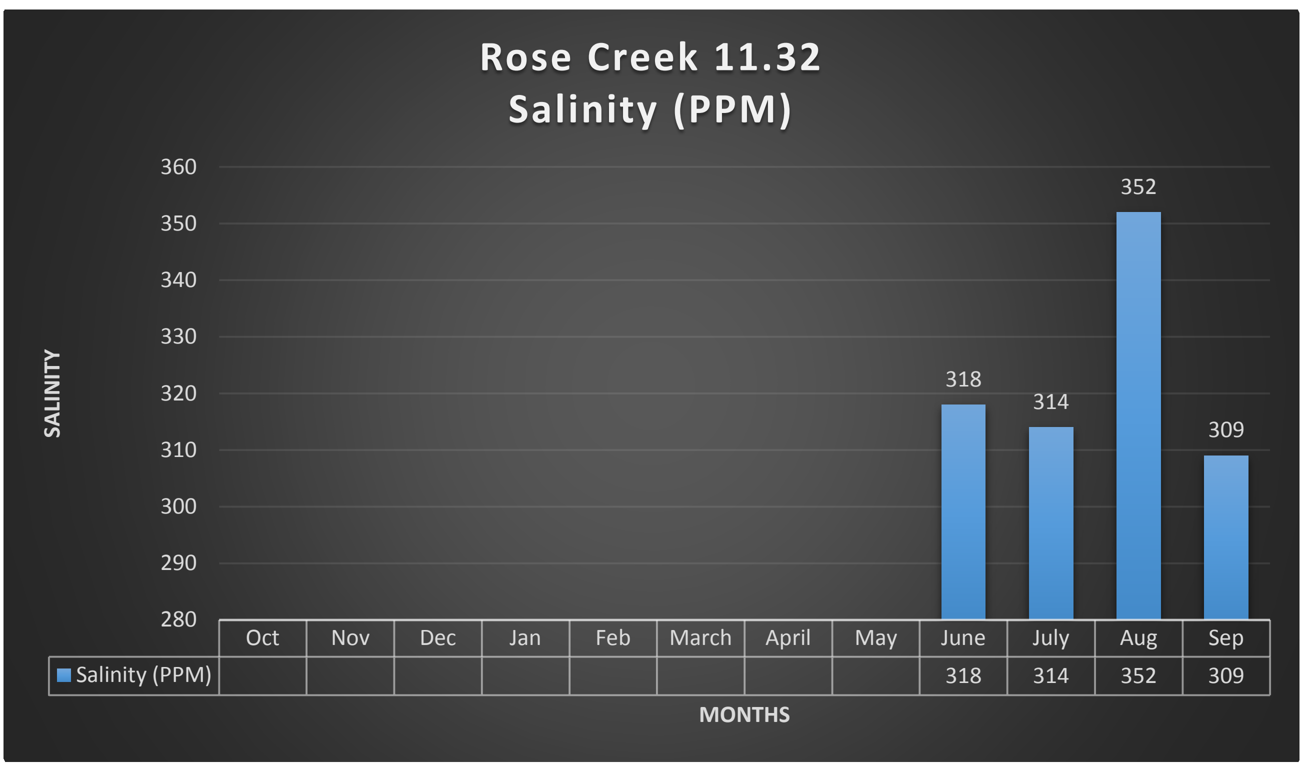


Figure 4-324 Midas Creek pH

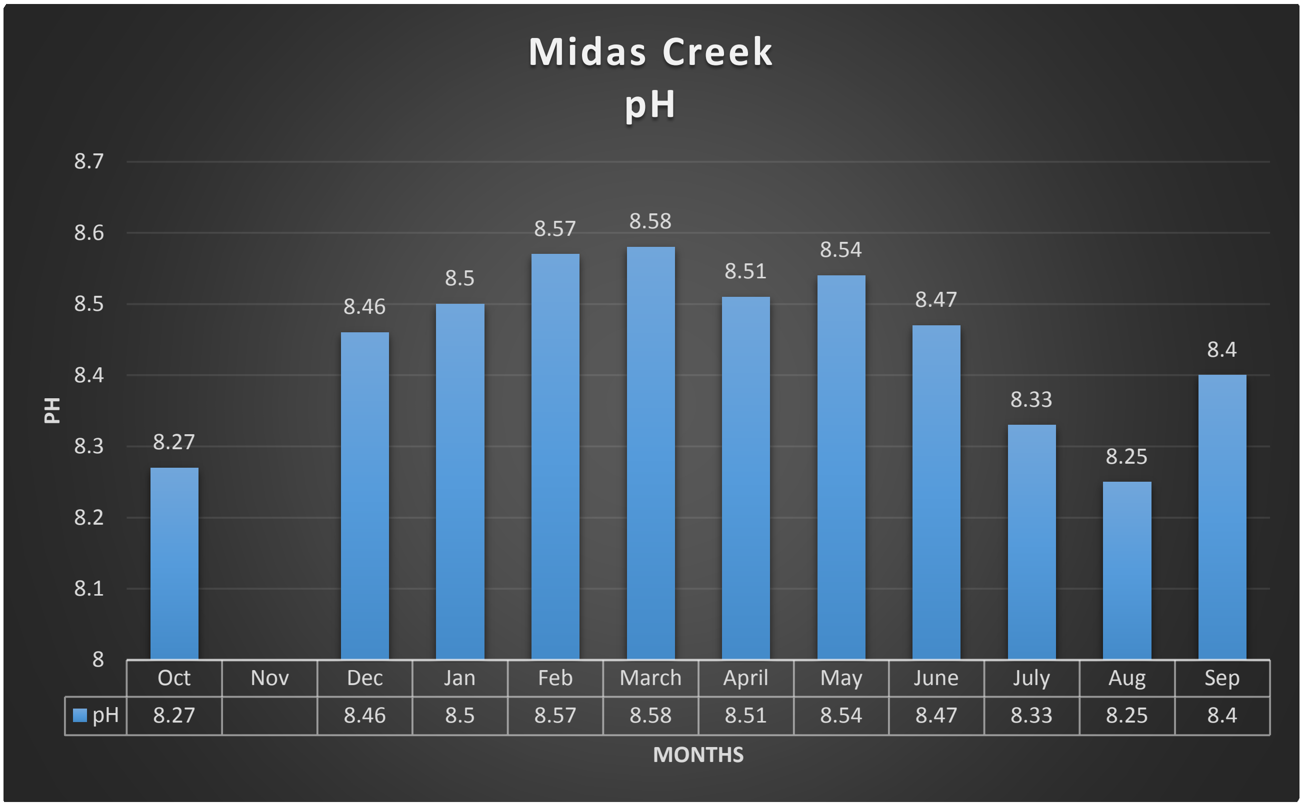


Figure 4-325 Midas Creek Dissolved Oxygen

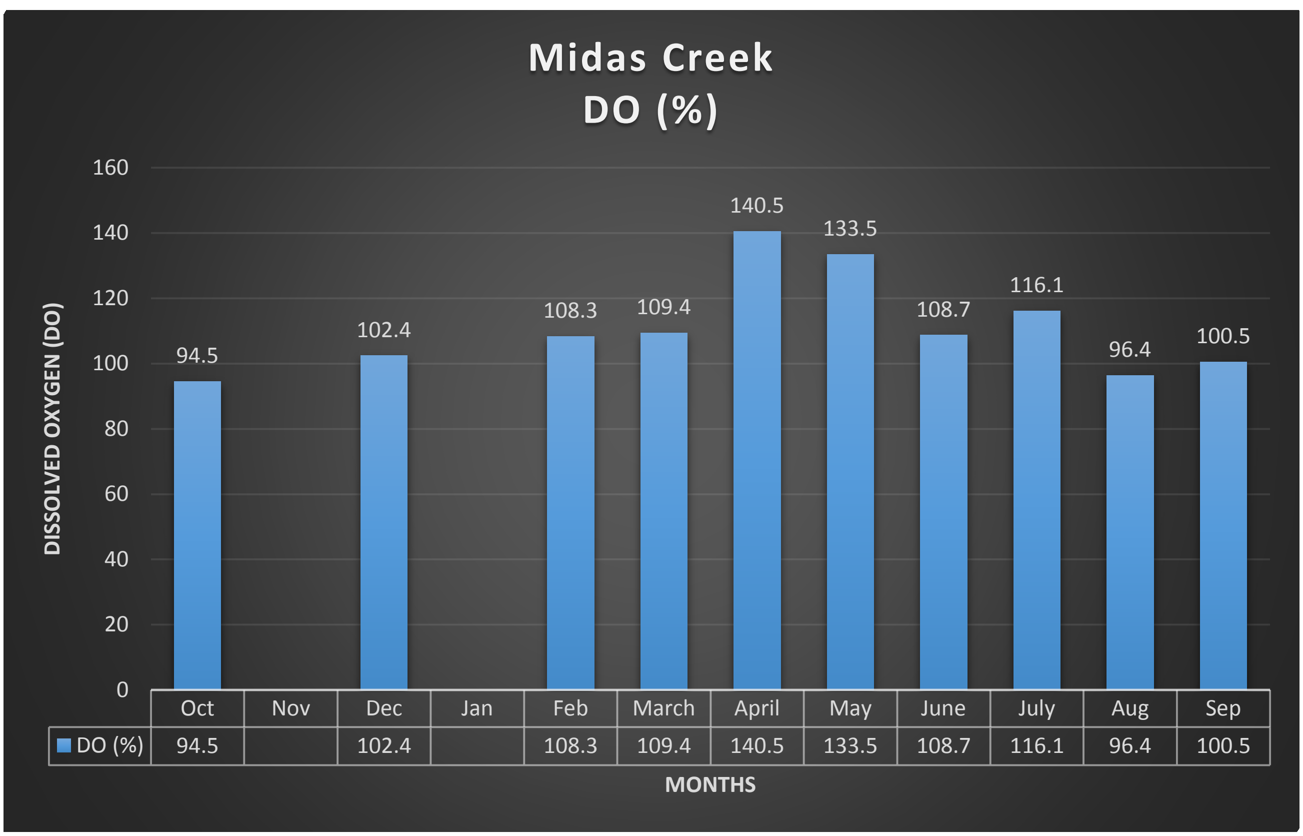


Figure 4-326 Midas Creek Total Dissolved Solids

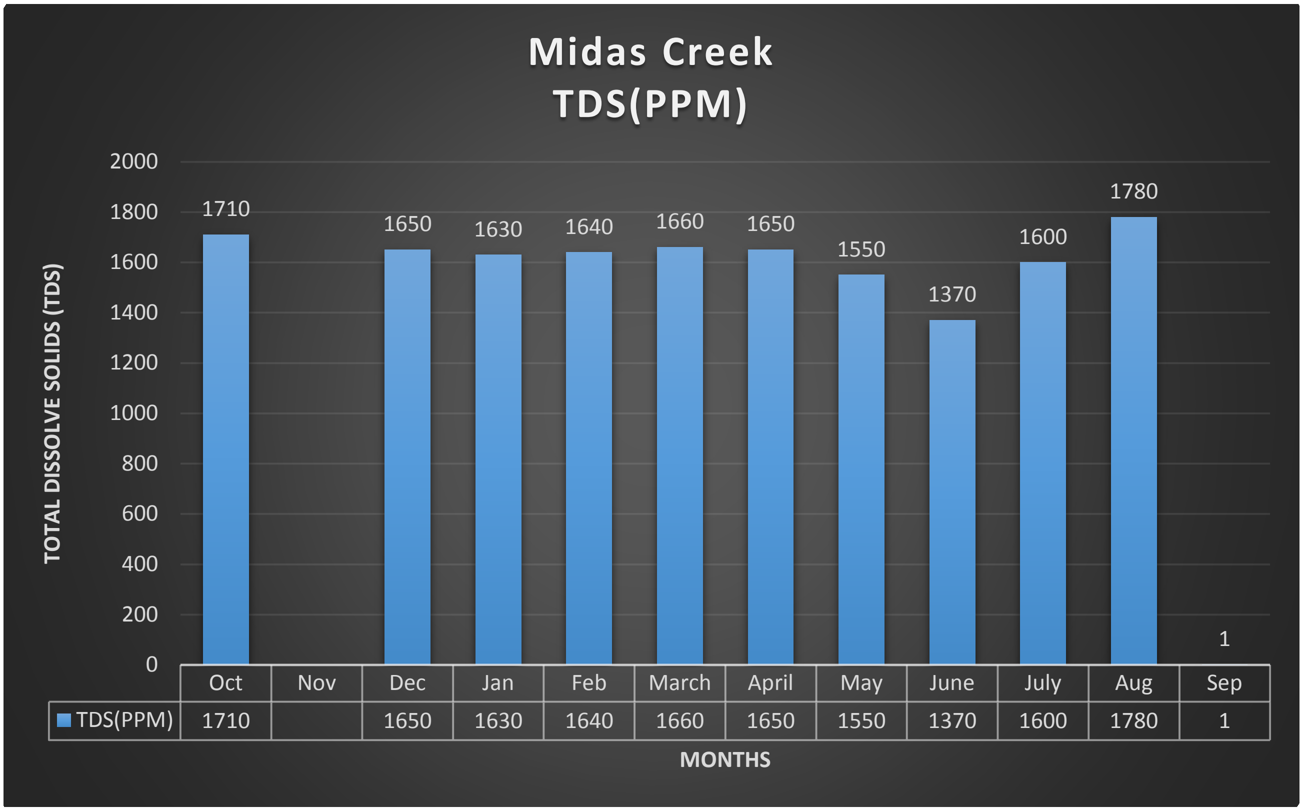


Figure 4-327 Midas Creek Conductivity

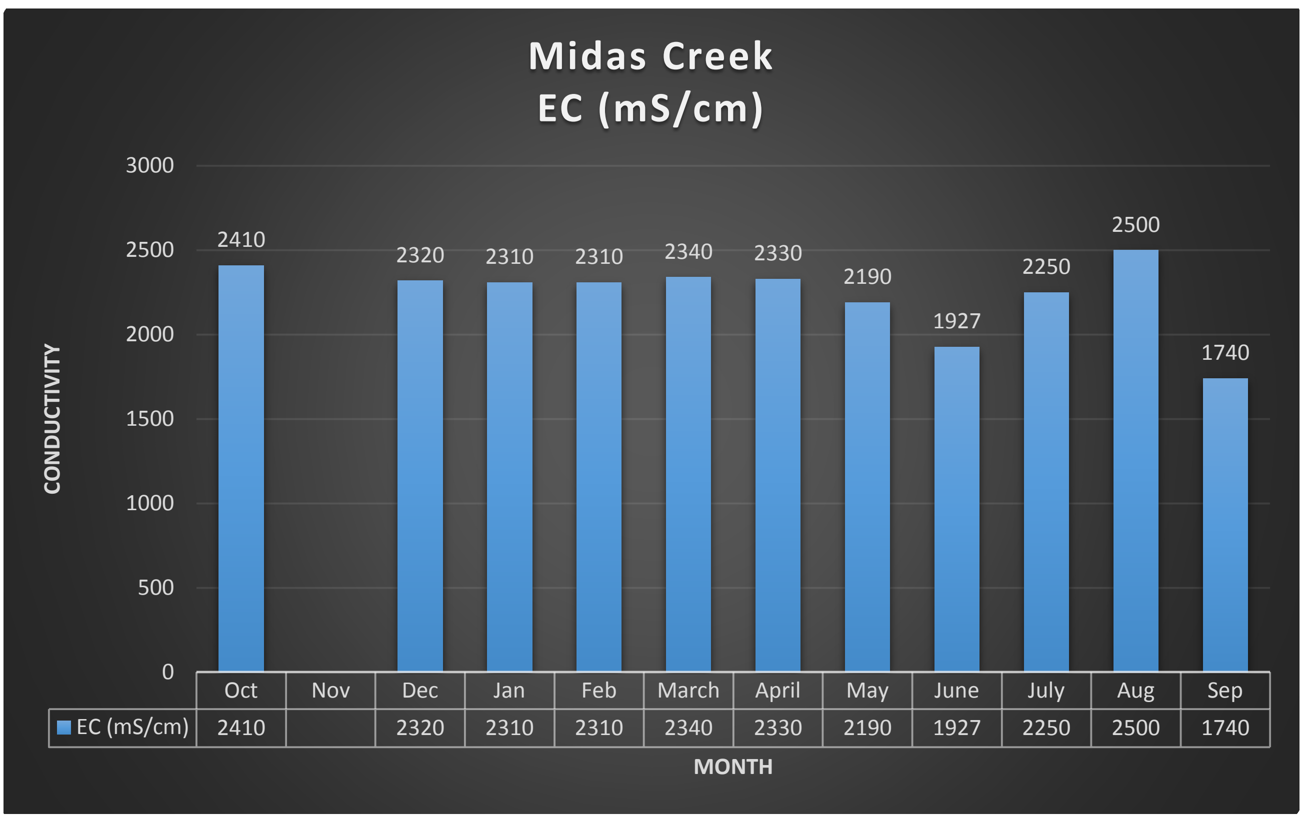
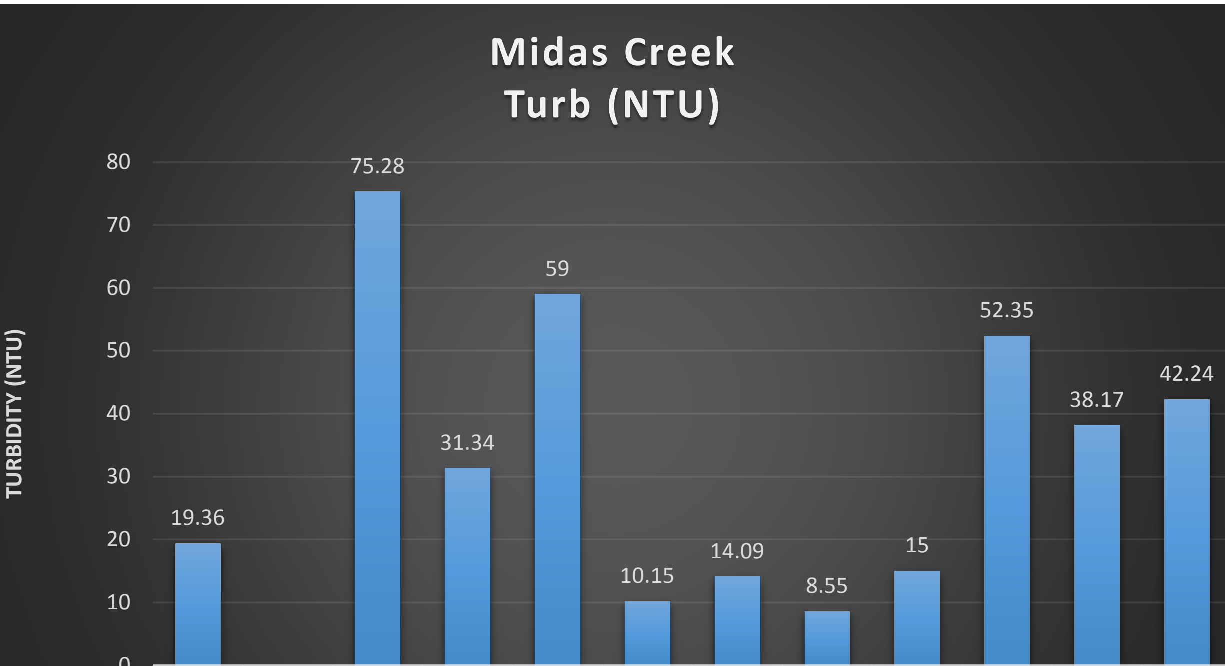
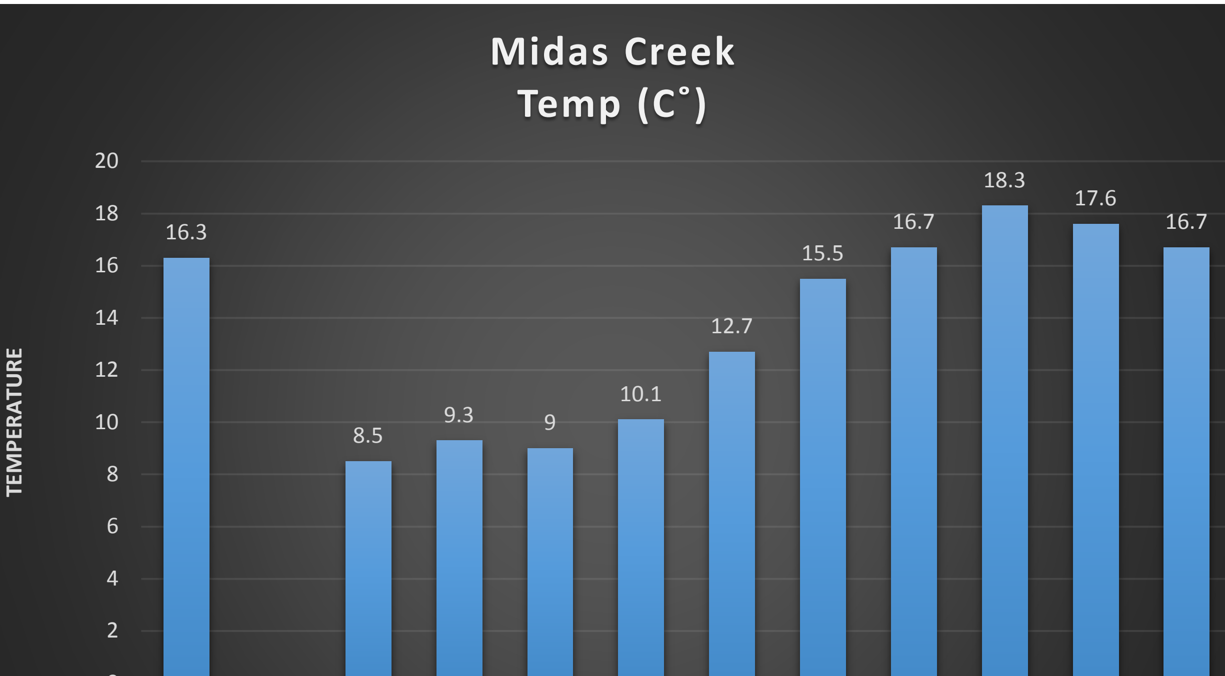


Figure 4-328 Midas Creek Turbidity



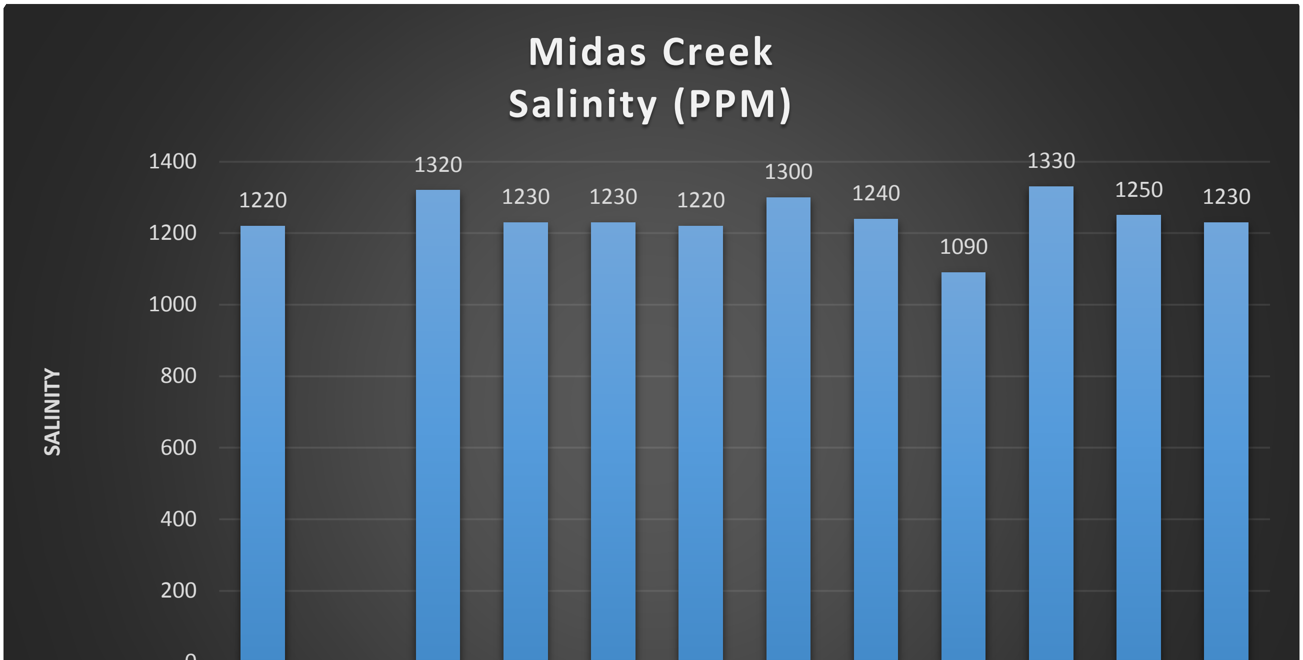
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Turb (NTU)	19.36		75.28	31.34	59	10.15	14.09	8.55	15	52.35	38.17	42.24

Figure 4-329 Midas Creek Temperature



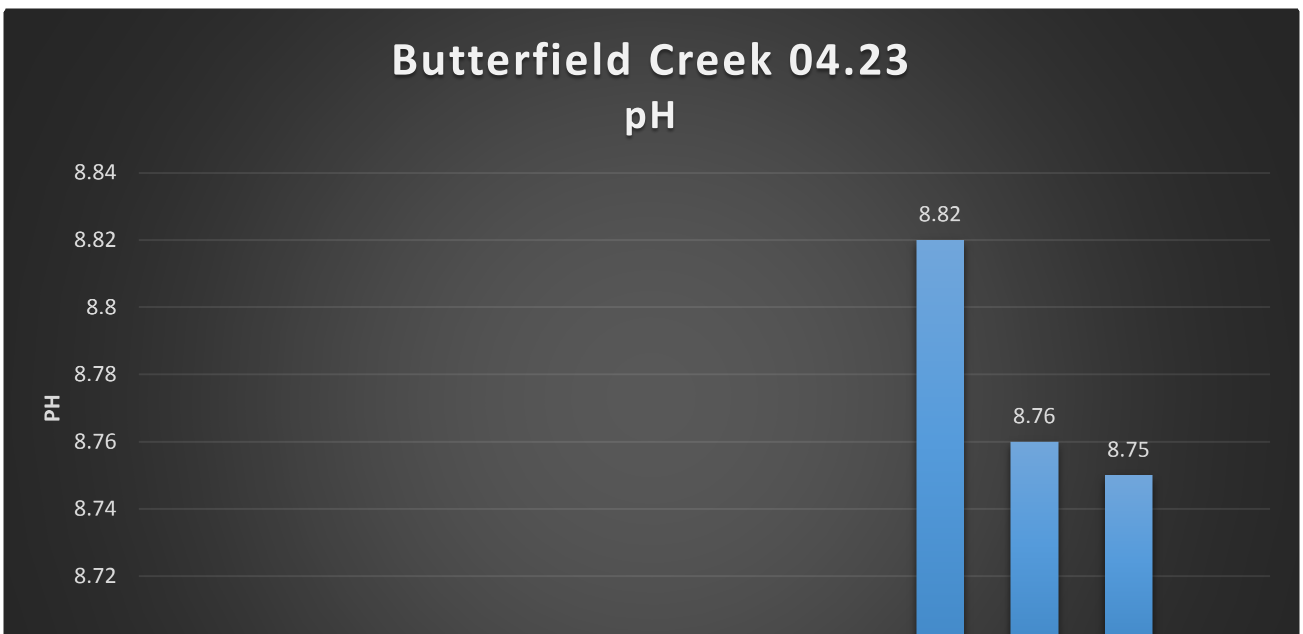
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Temp (C˚)	16.3		8.5	9.3	9	10.1	12.7	15.5	16.7	18.3	17.6	16.7

Figure 4-330 Midas Creek Salinity



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Salinity (PPM)	1220		1320	1230	1230	1220	1300	1240	1090	1330	1250	1230

Figure 4-331 Butterfield Creek 04.23 pH



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
pH									8.82	8.76	8.75	

Figure 4-332 Butterfield Creek 04.23 Dissolved Oxygen

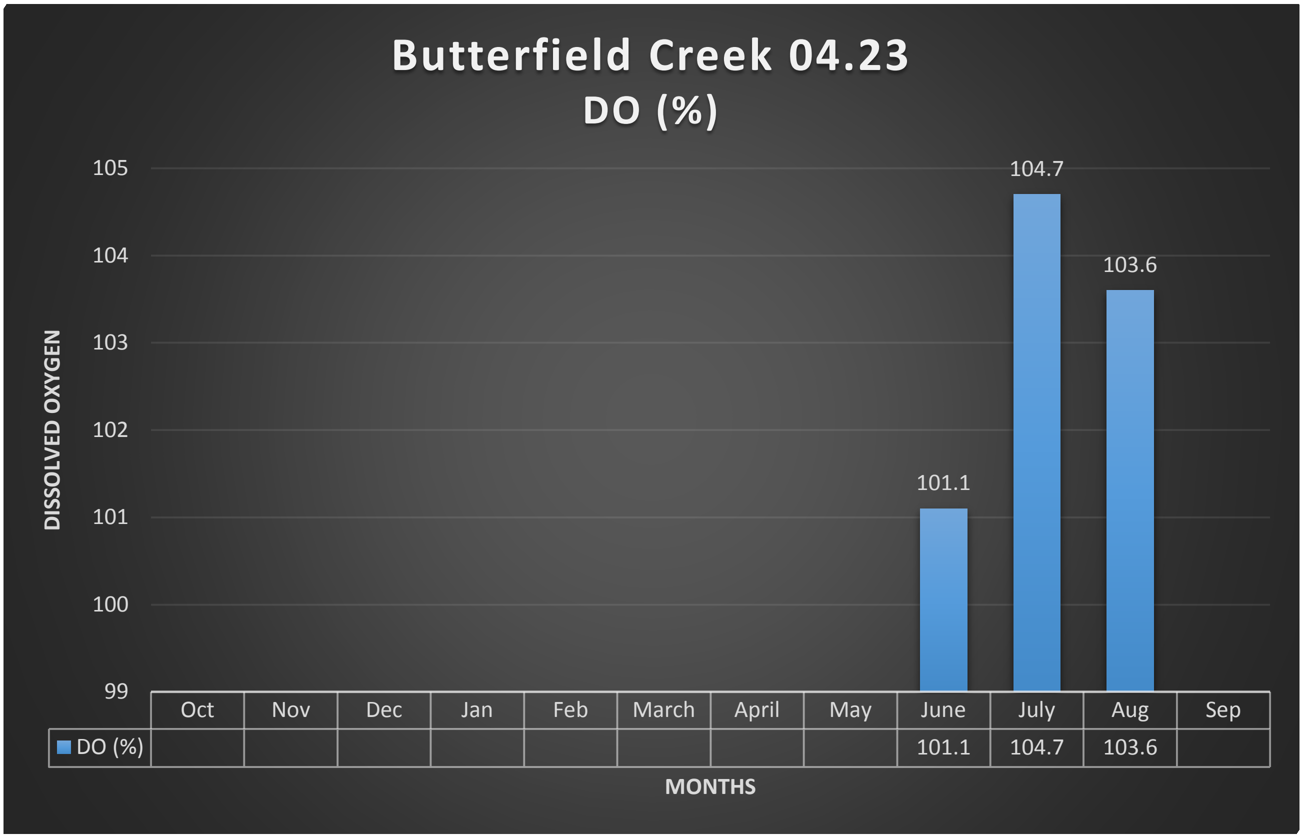


Figure 4-333 Butterfield Creek 04.23 Total Dissolved Solids

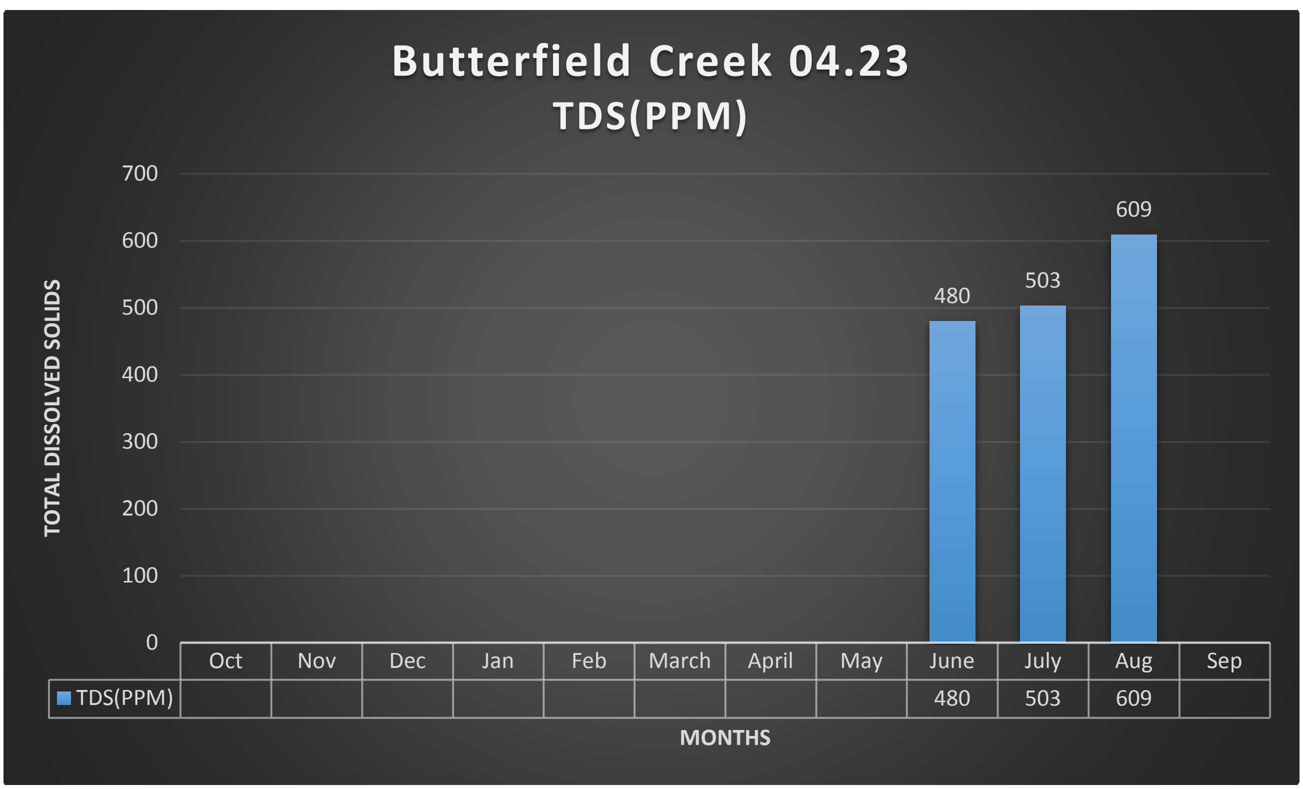


Figure 4-334 Butterfield Creek 04.23 Conductivity

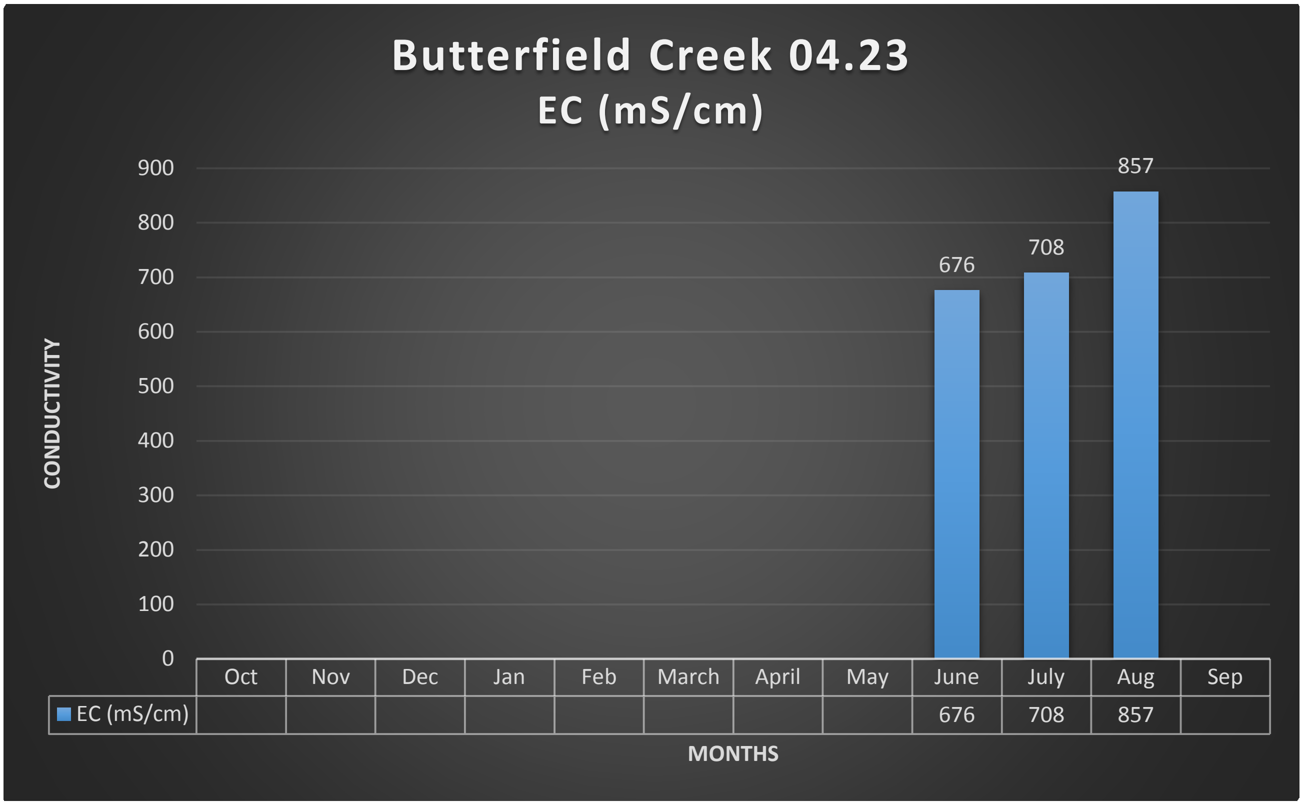
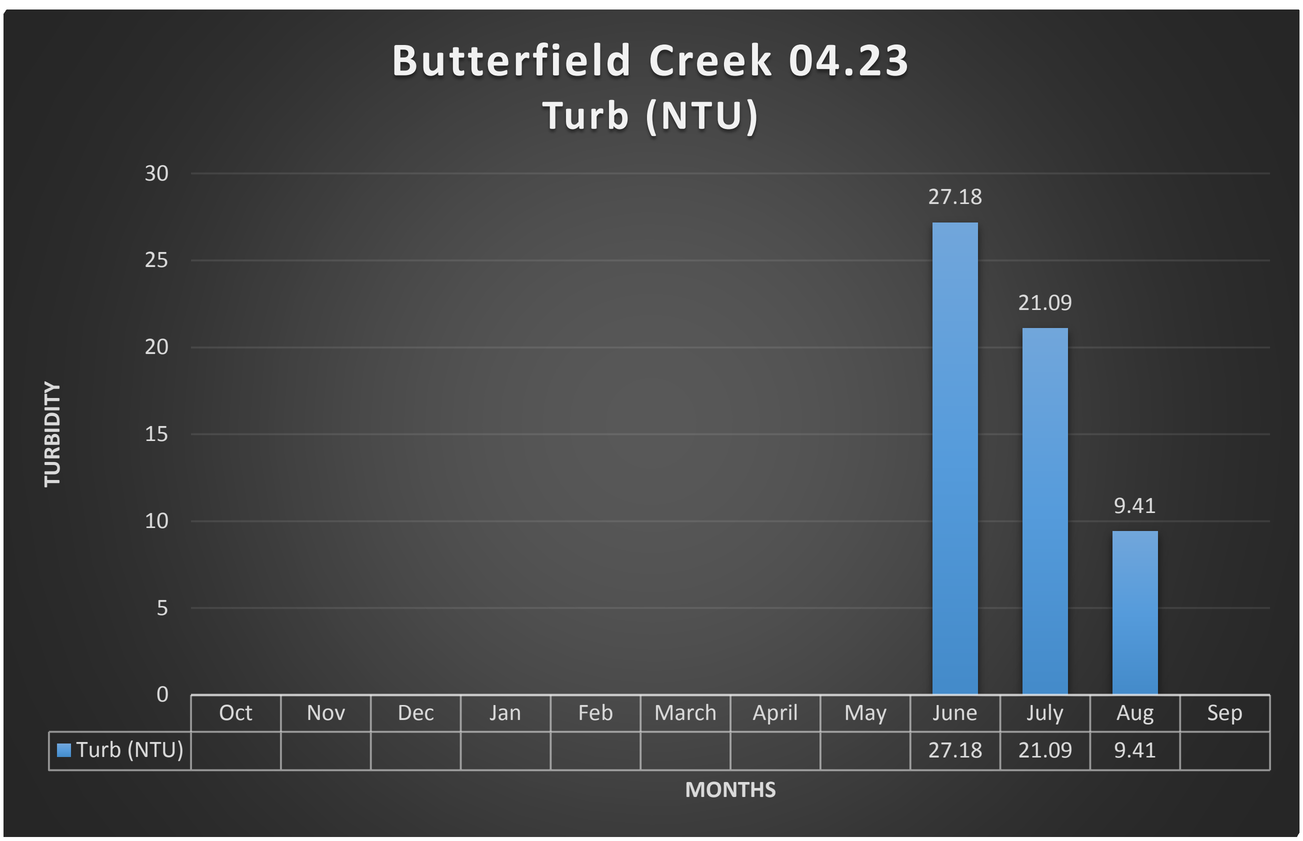


Figure 4-335 Butterfield Creek 04.23 Turbidity



SALT LAKE COUNTY WATERSHED

Figure 4-336 Butterfield Creek 04.23 Temperature

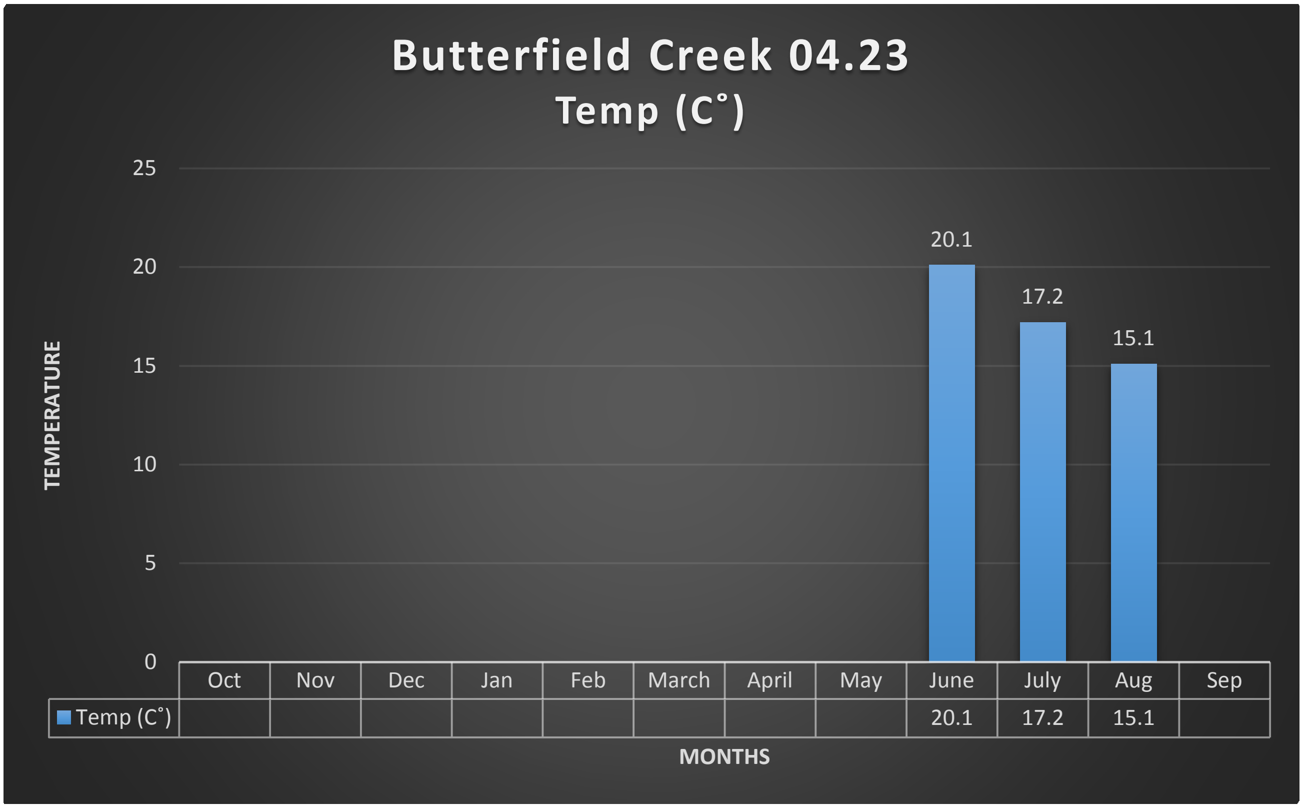


Figure 4-337 Butterfield Creek 04.23 Salinity

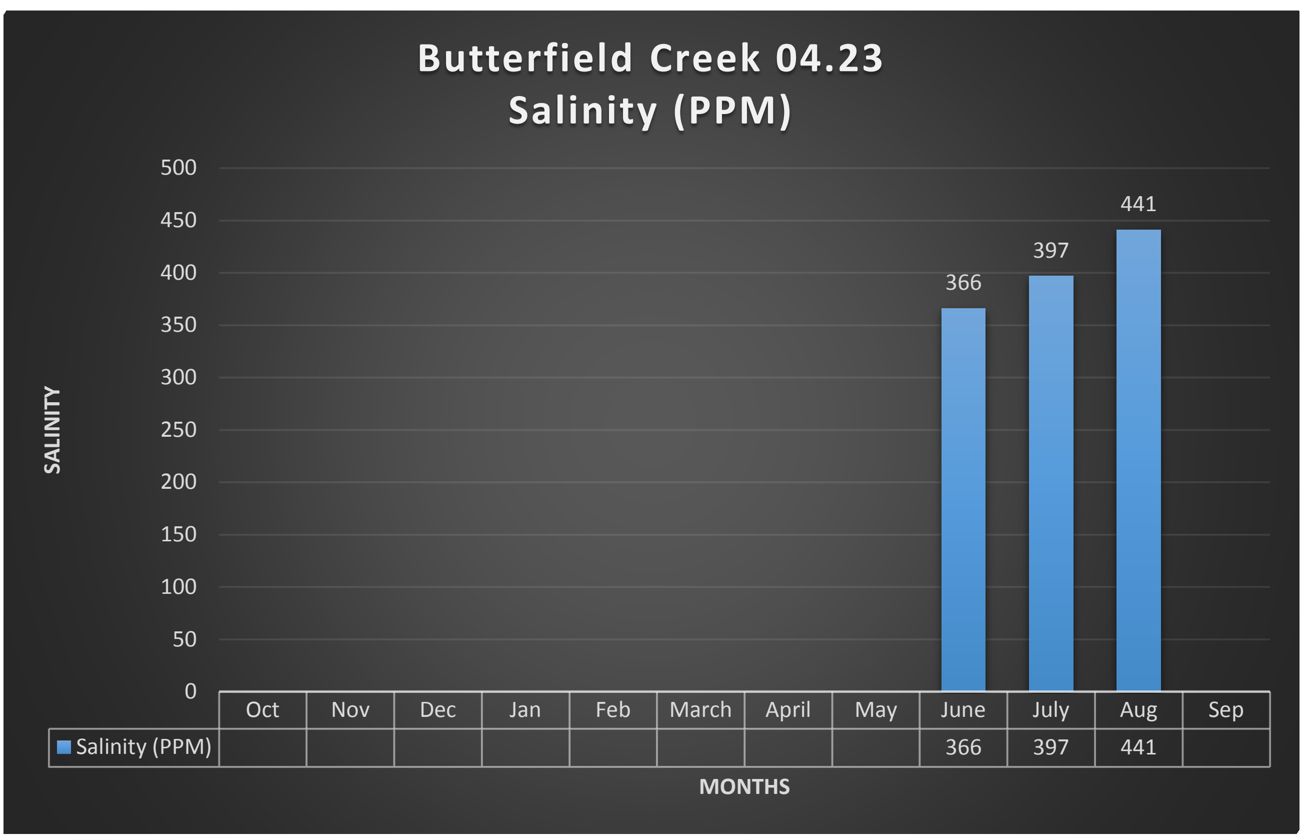


Figure 4-338 Butterfield Creek 05.29 pH

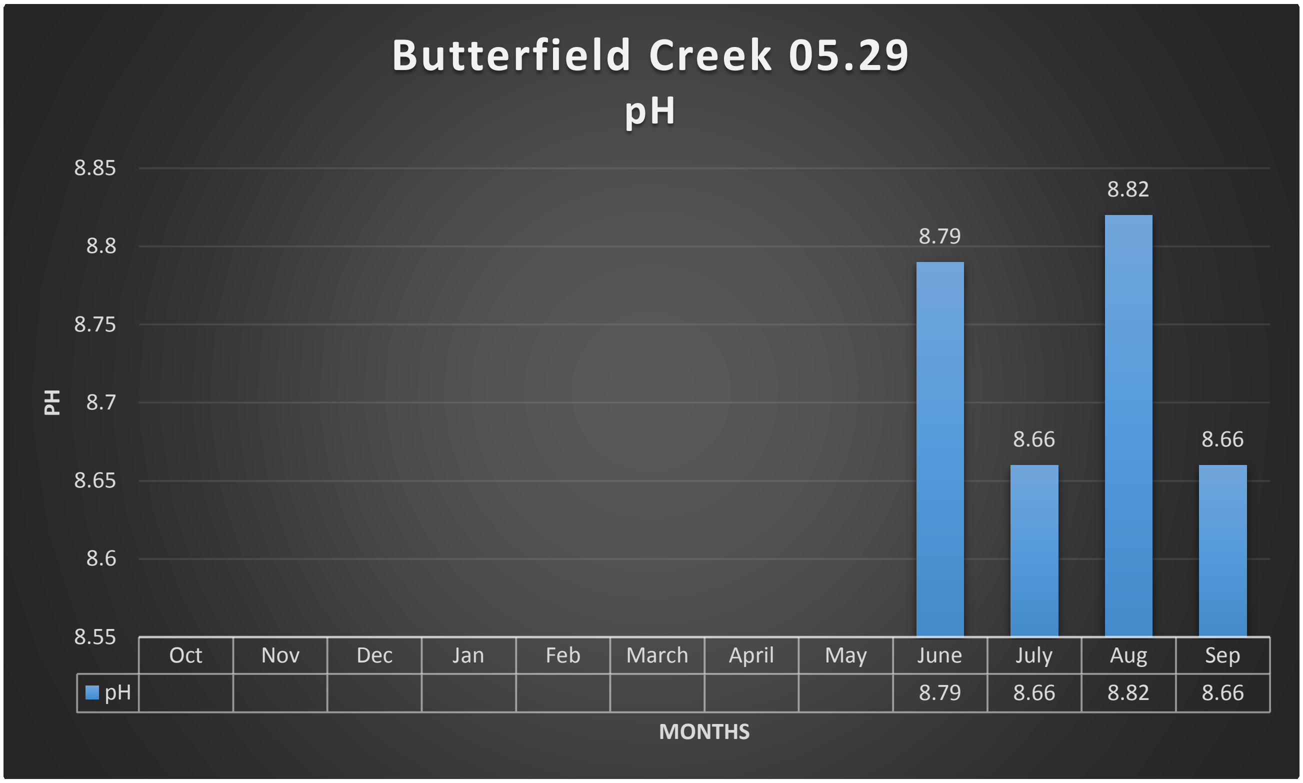


Figure 4-339 Butterfield Creek 05.29 Dissolved Oxygen

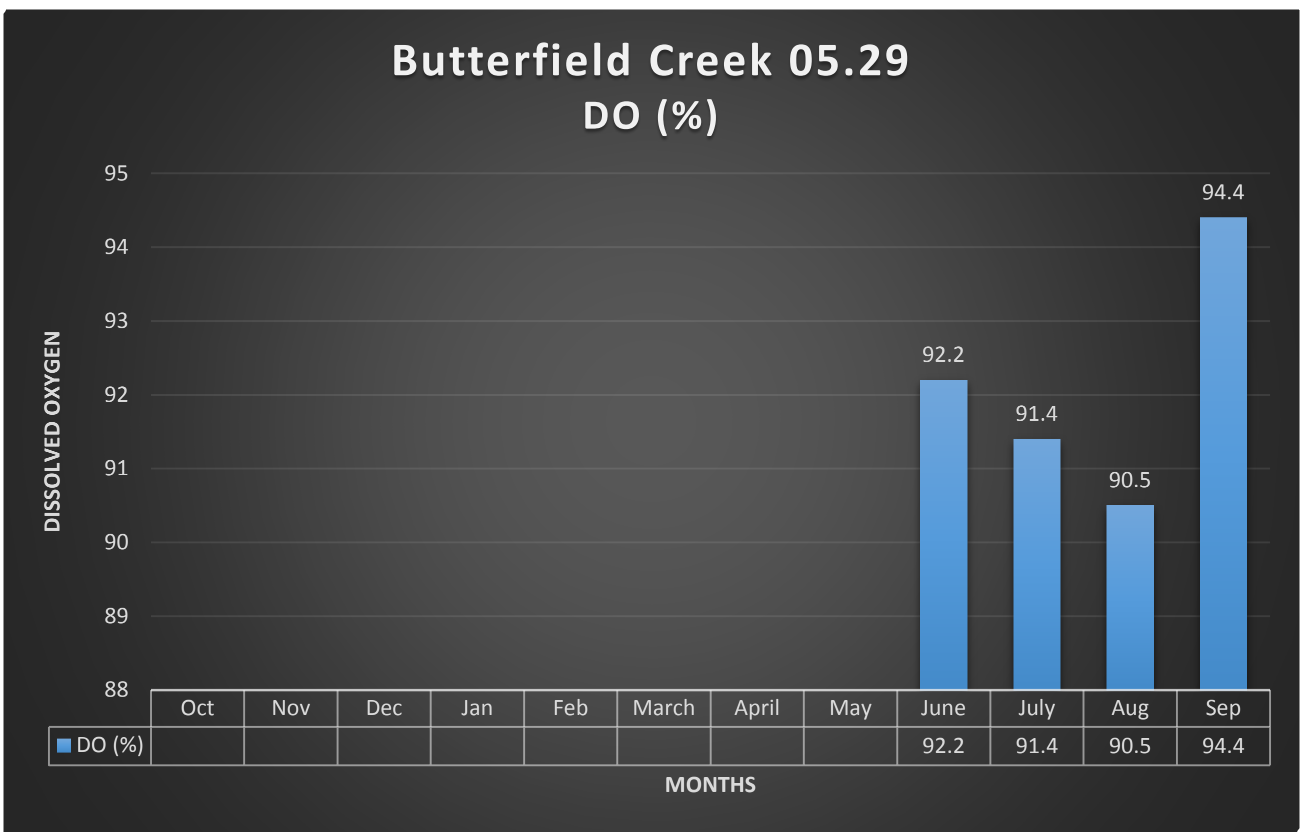


Figure 4-340 Butterfield Creek 05.29 Total Dissolved Solids

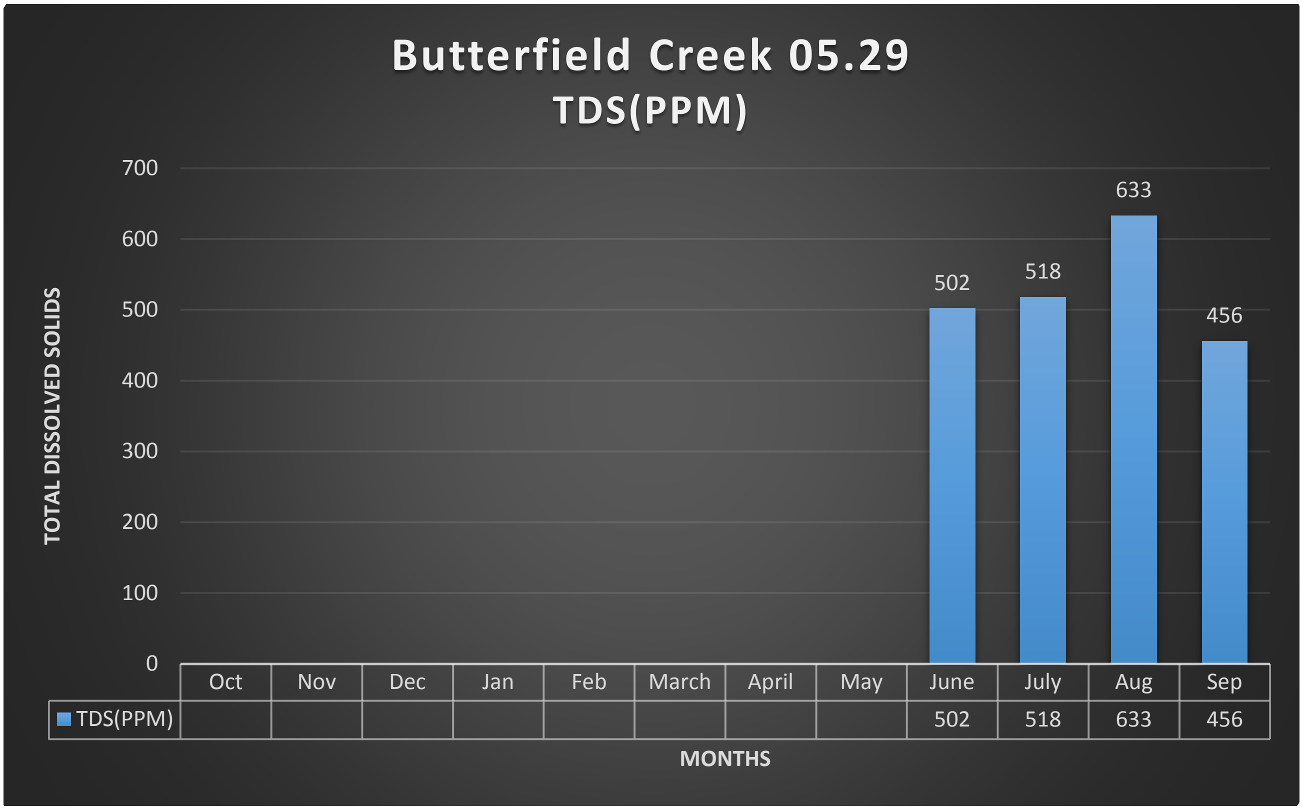


Figure 4-341 Butterfield Creek 05.29 Conductivity

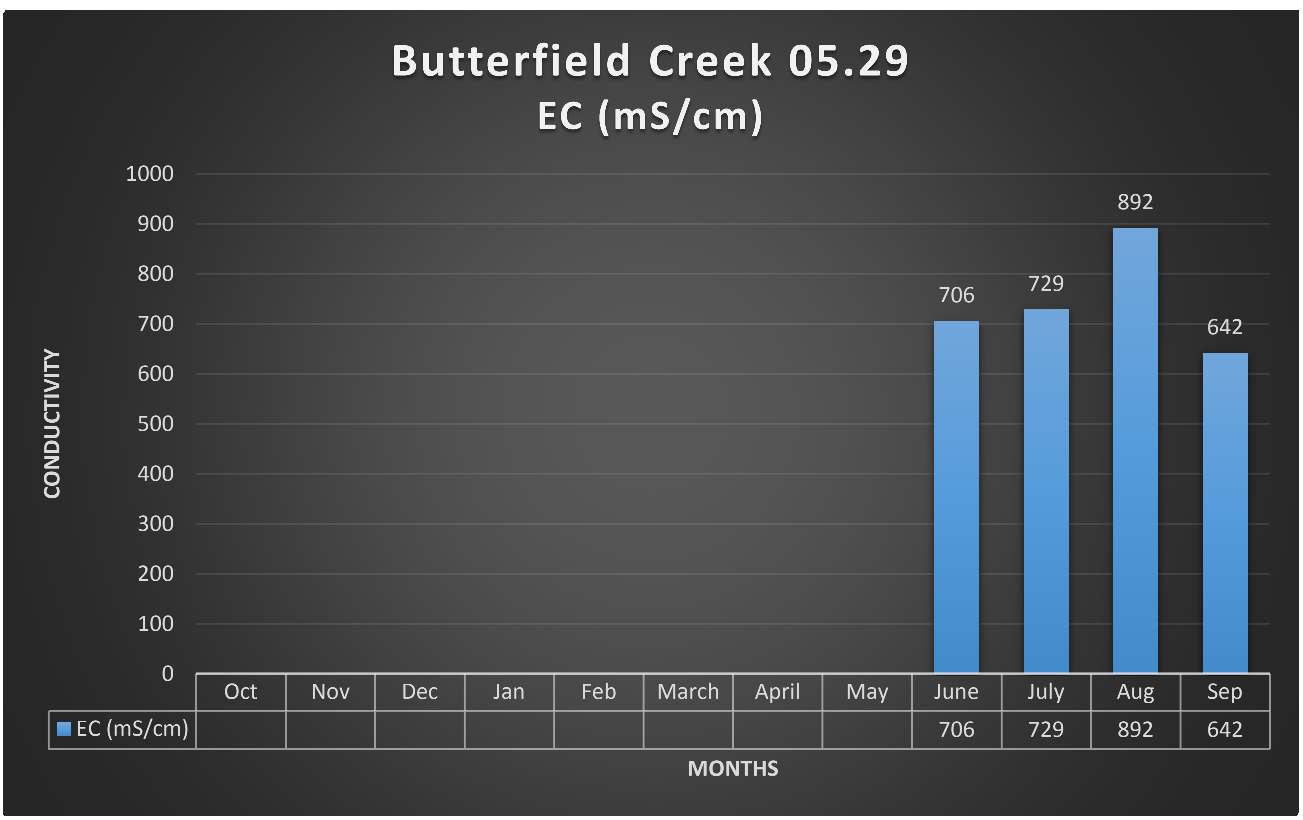


Figure 4-342 Butterfield Creek 05.29 Turbidity

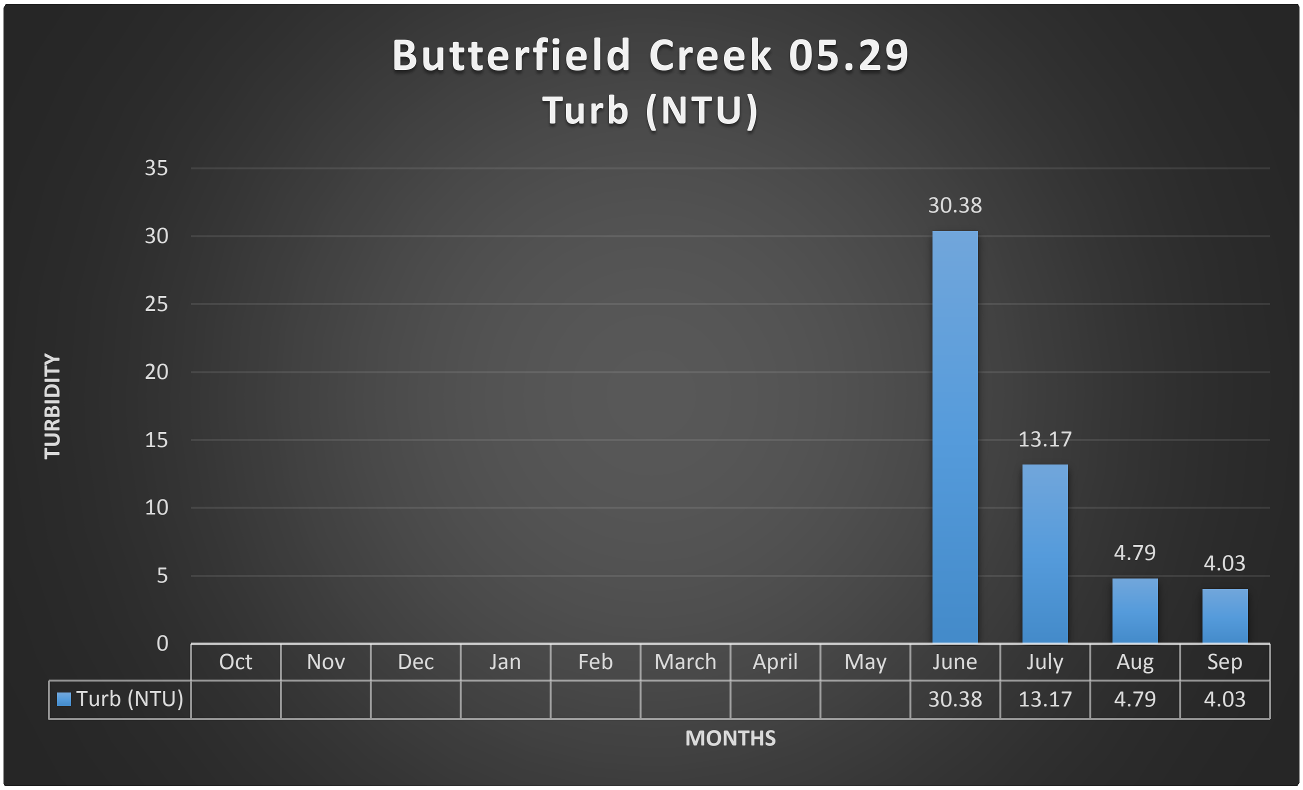


Figure 4-343 Butterfield Creek 05.29 Temperature

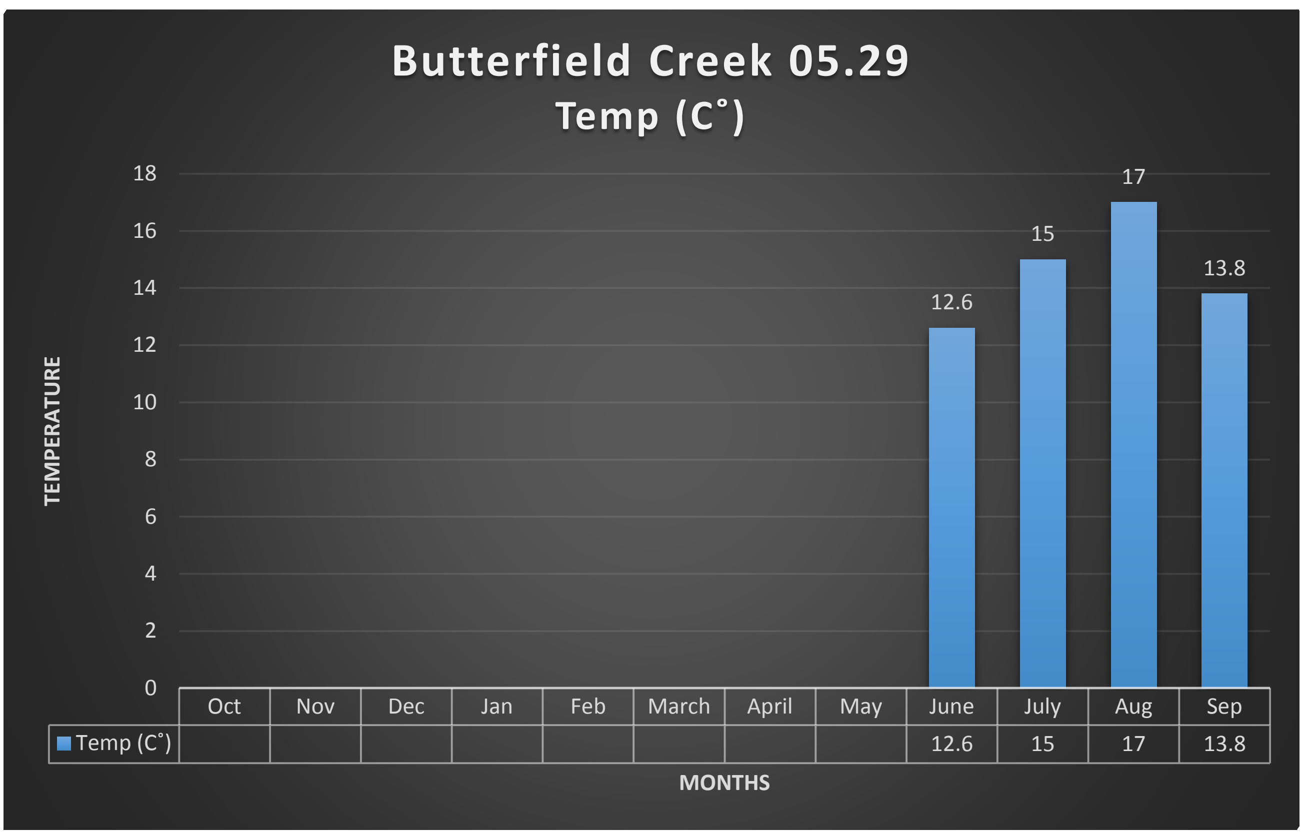
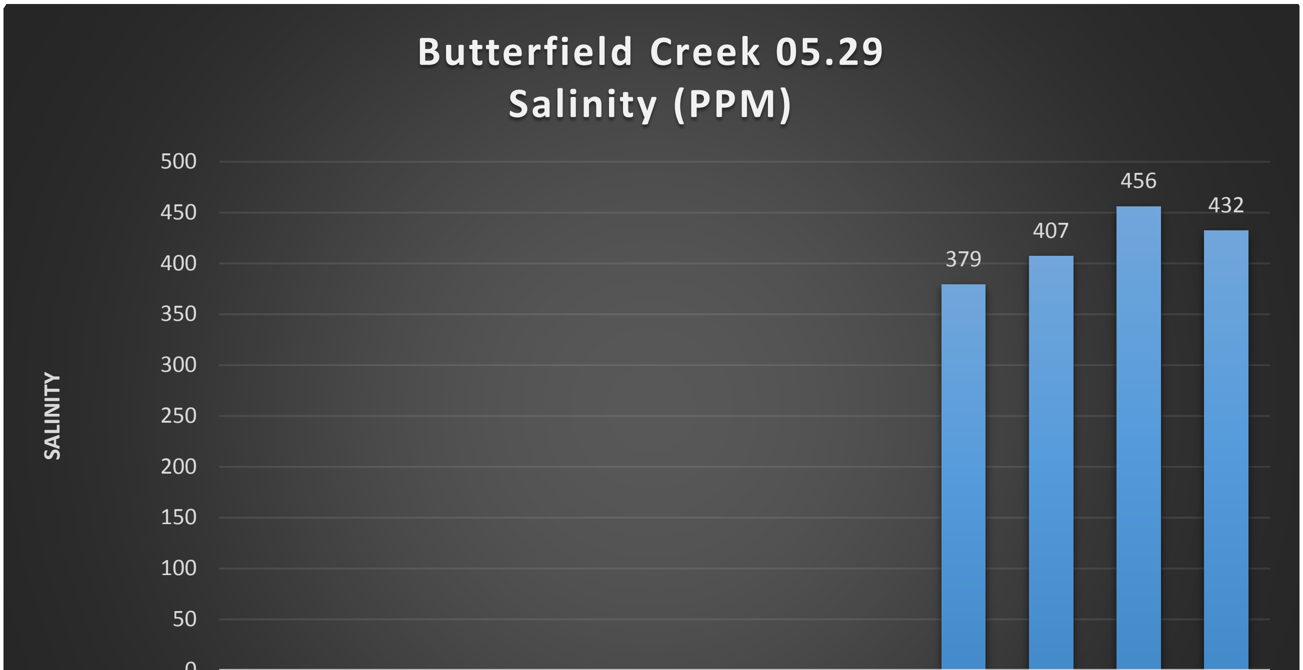
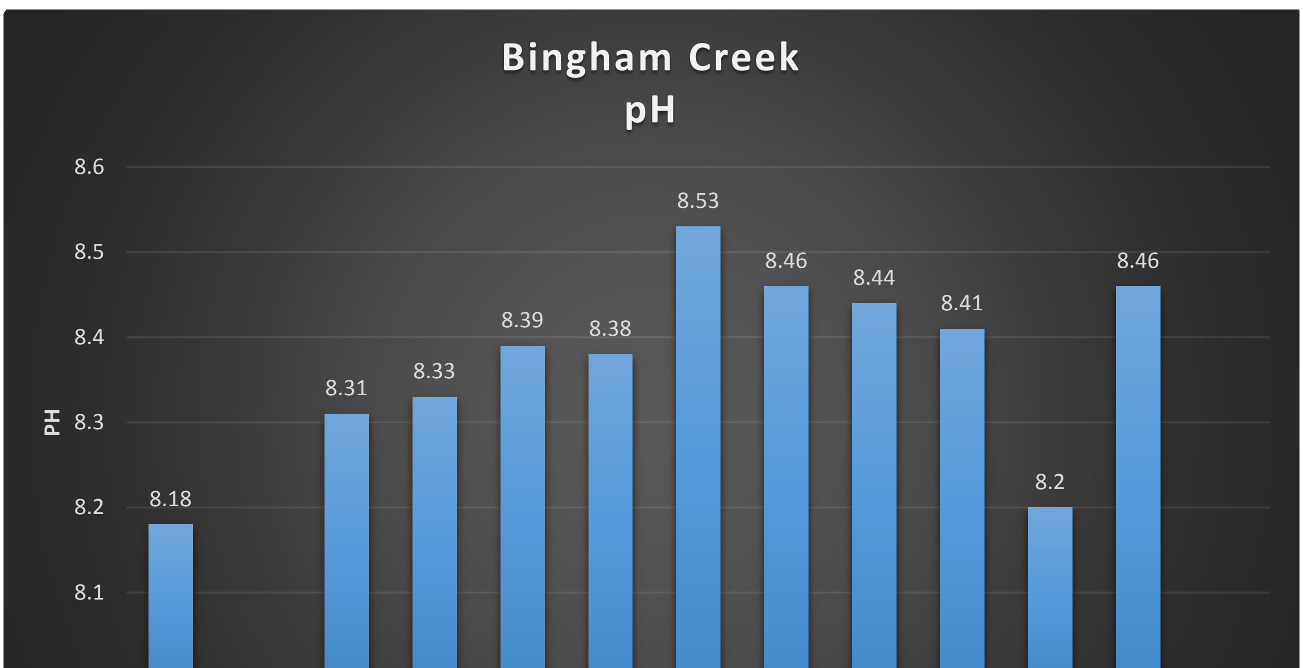


Figure 4-344 Butterfield 05.29 Creek Salinity



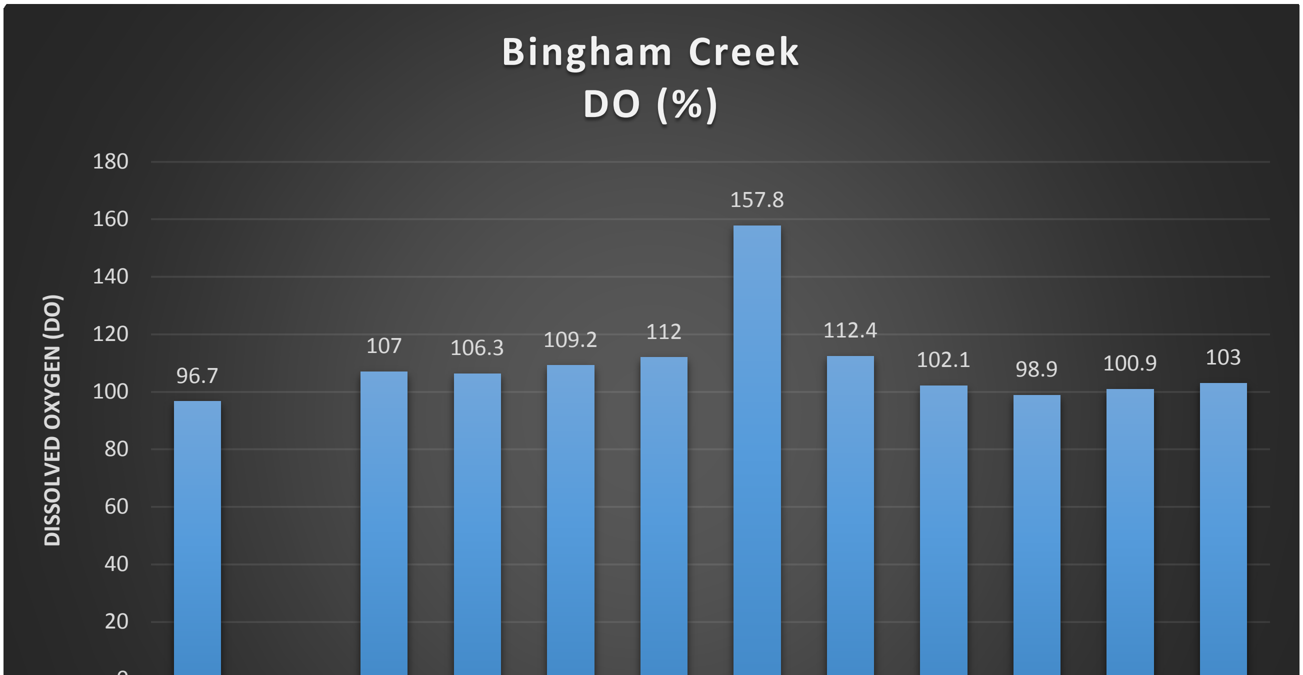
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Salinity (PPM)									379	407	456	432

Figure 4-345 Bingham Creek pH



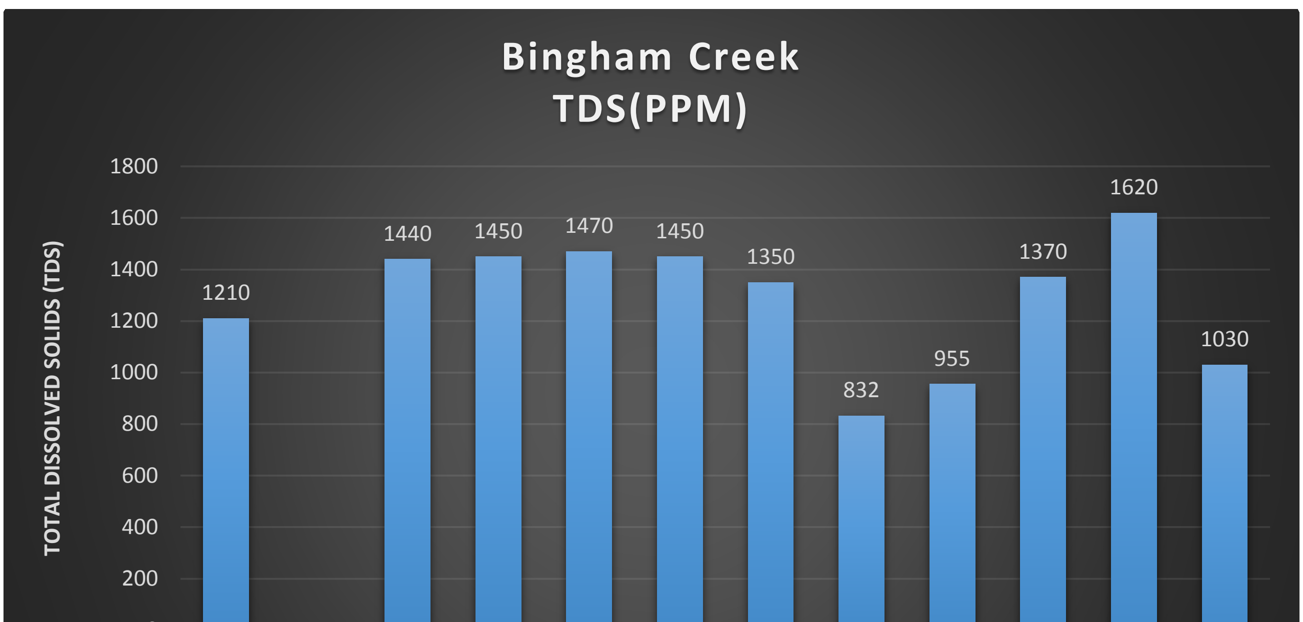
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep	
pH	8.18		8.31	8.33	8.39	8.38	8.53	8.46	8.44	8.41	8.2	8.46	

Figure 4-346 Bingham Creek Dissolved Oxygen



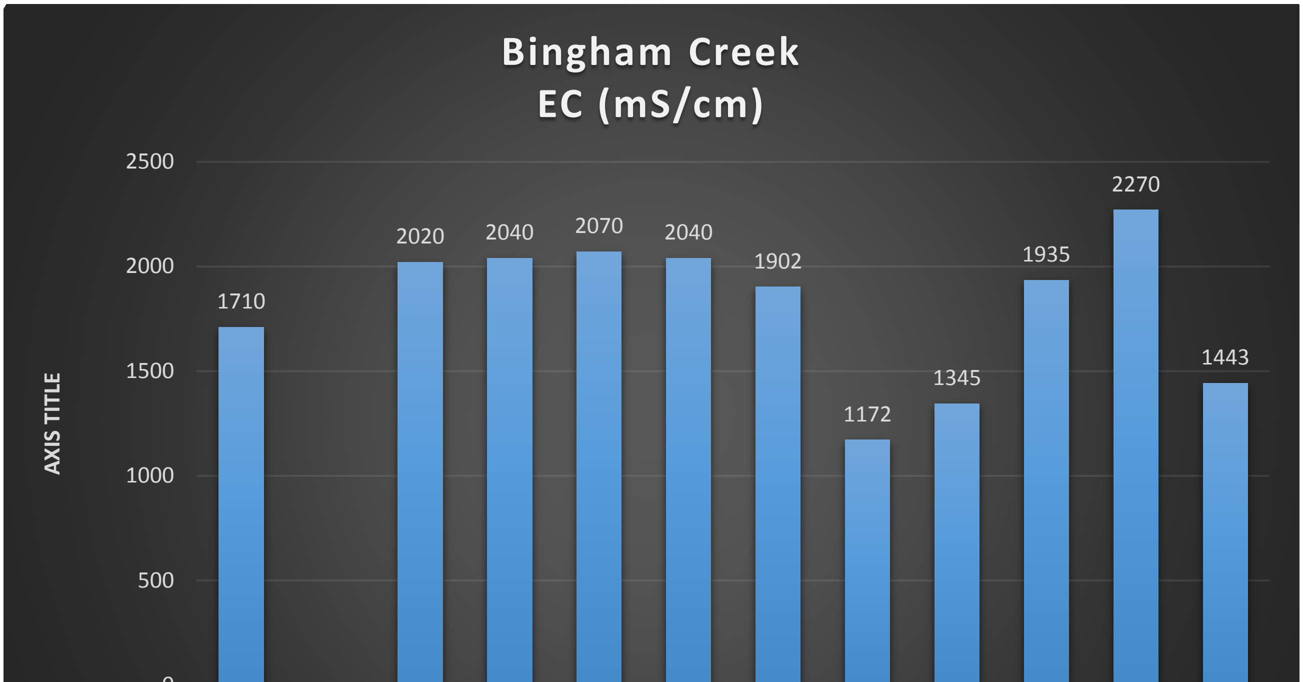
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
DO (%)	96.7		107	106.3	109.2	112	157.8	112.4	102.1	98.9	100.9	103

Figure 4-347 Bingham Creek Total Dissolved Solids



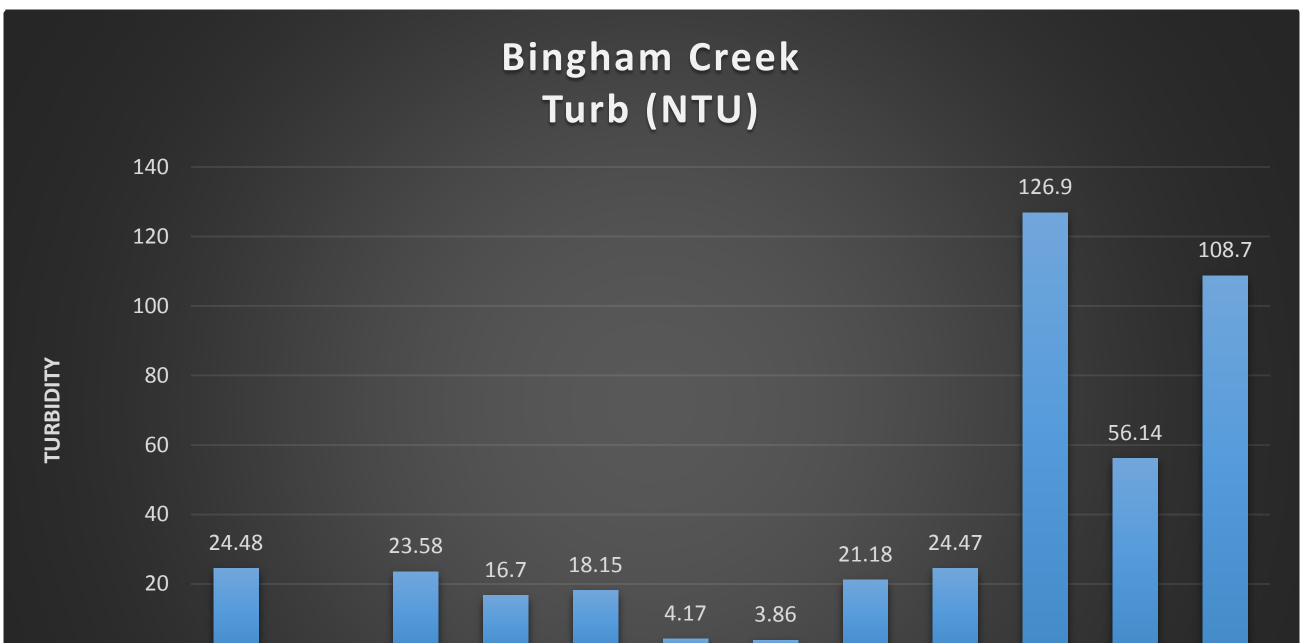
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
TDS(PPM)	1210		1440	1450	1470	1450	1350	832	955	1370	1620	1030

Figure 4-348 Bingham Creek Conductivity



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
EC (mS/cm)	1710		2020	2040	2070	2040	1902	1172	1345	1935	2270	1443

Figure 4-349 Bingham Creek Turbidity



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Turb (NTU)	24.48		23.58	16.7	18.15	4.17	3.86	21.18	24.47	126.9	56.14	108.7

Figure 4-350 Bingham Creek Temperature

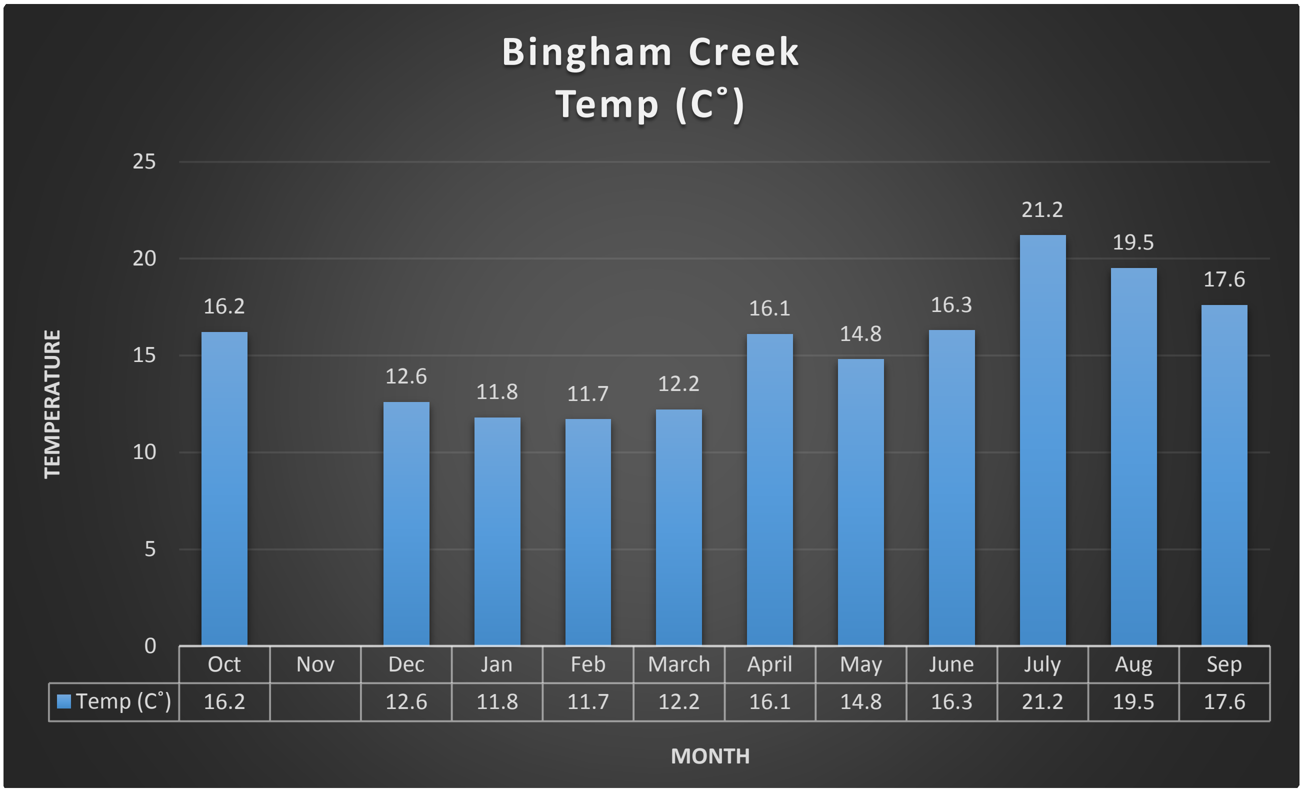


Figure 4-351 Bingham Creek Salinity

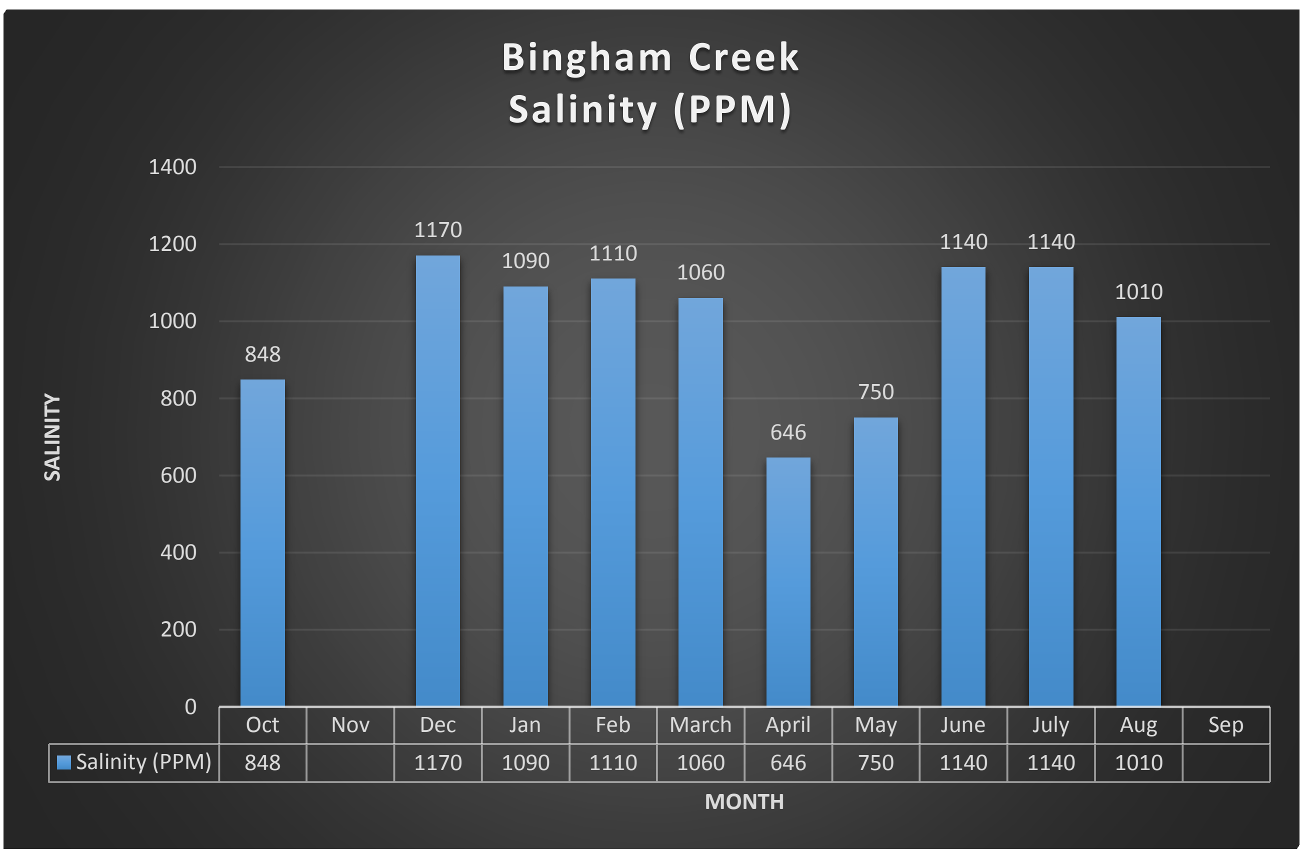
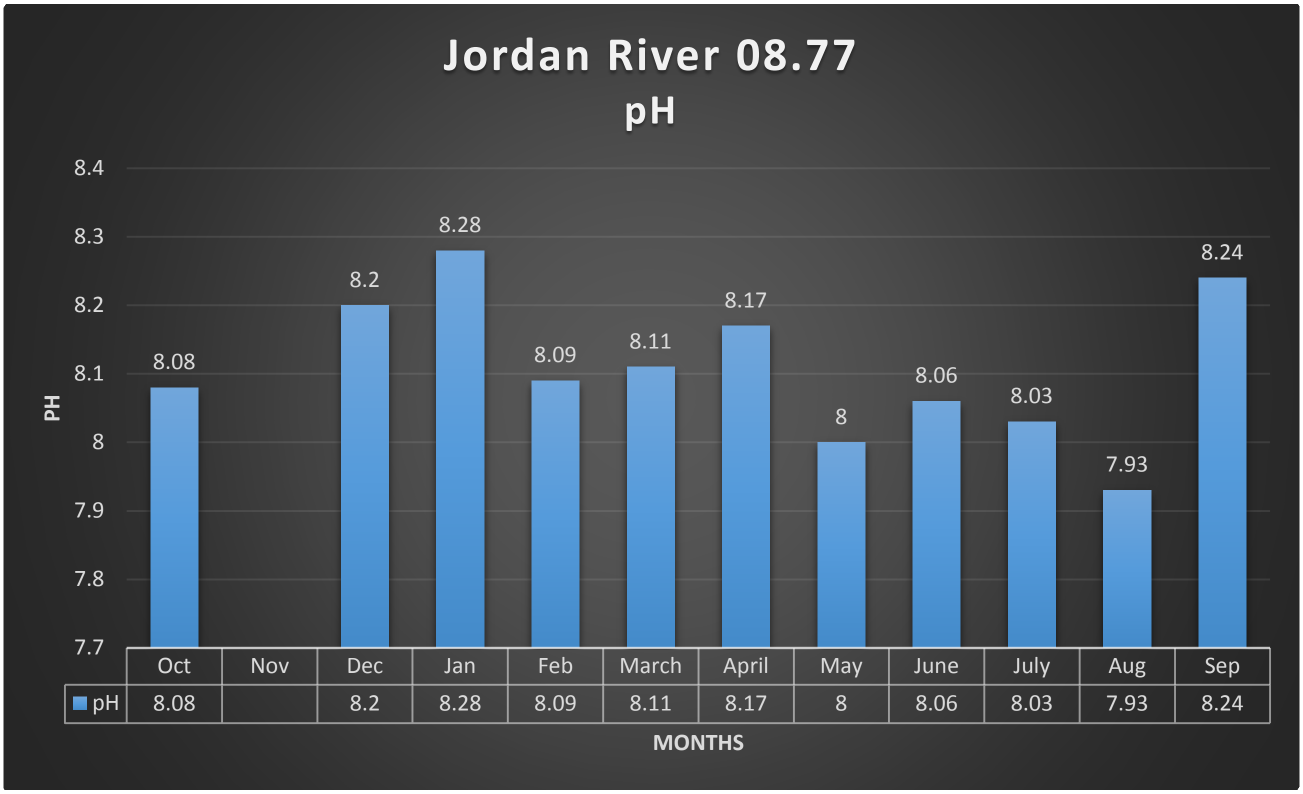
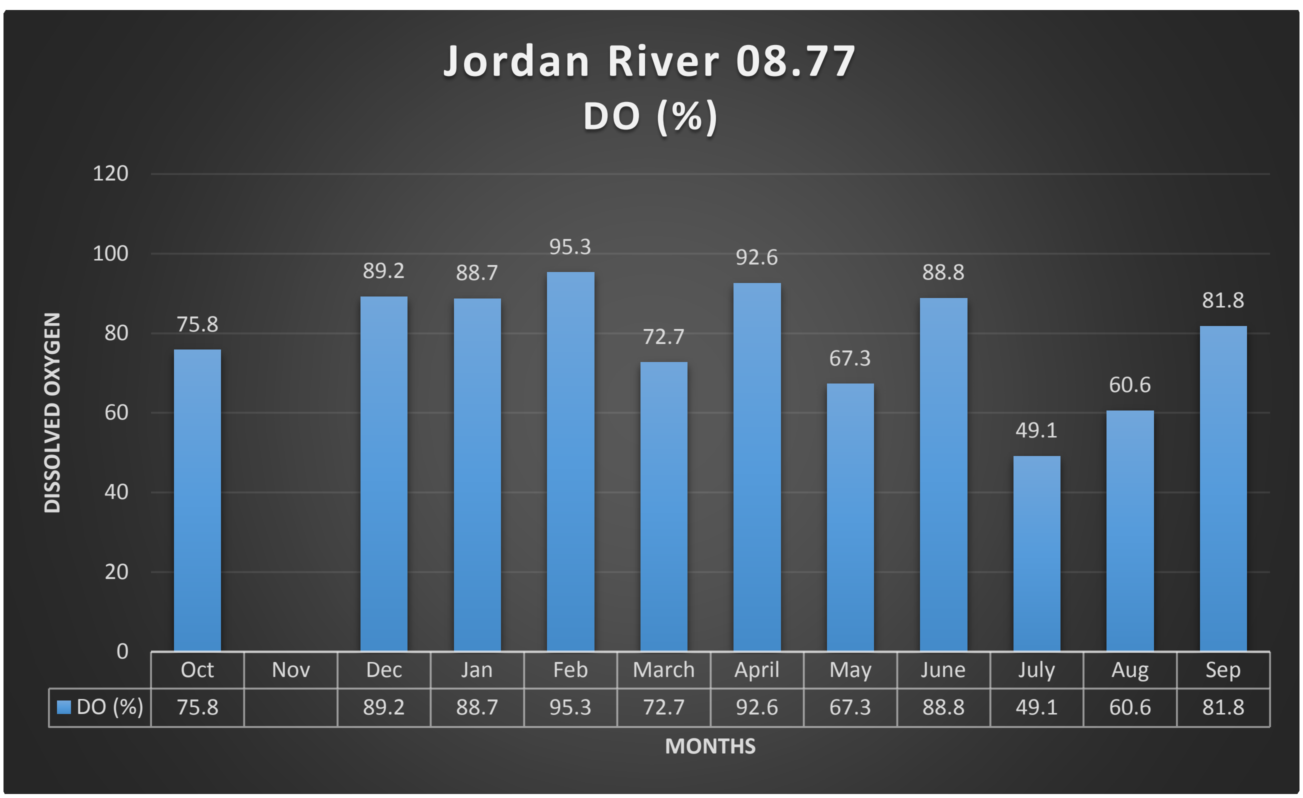


Figure 4-352 Jordan River 08.77 pH



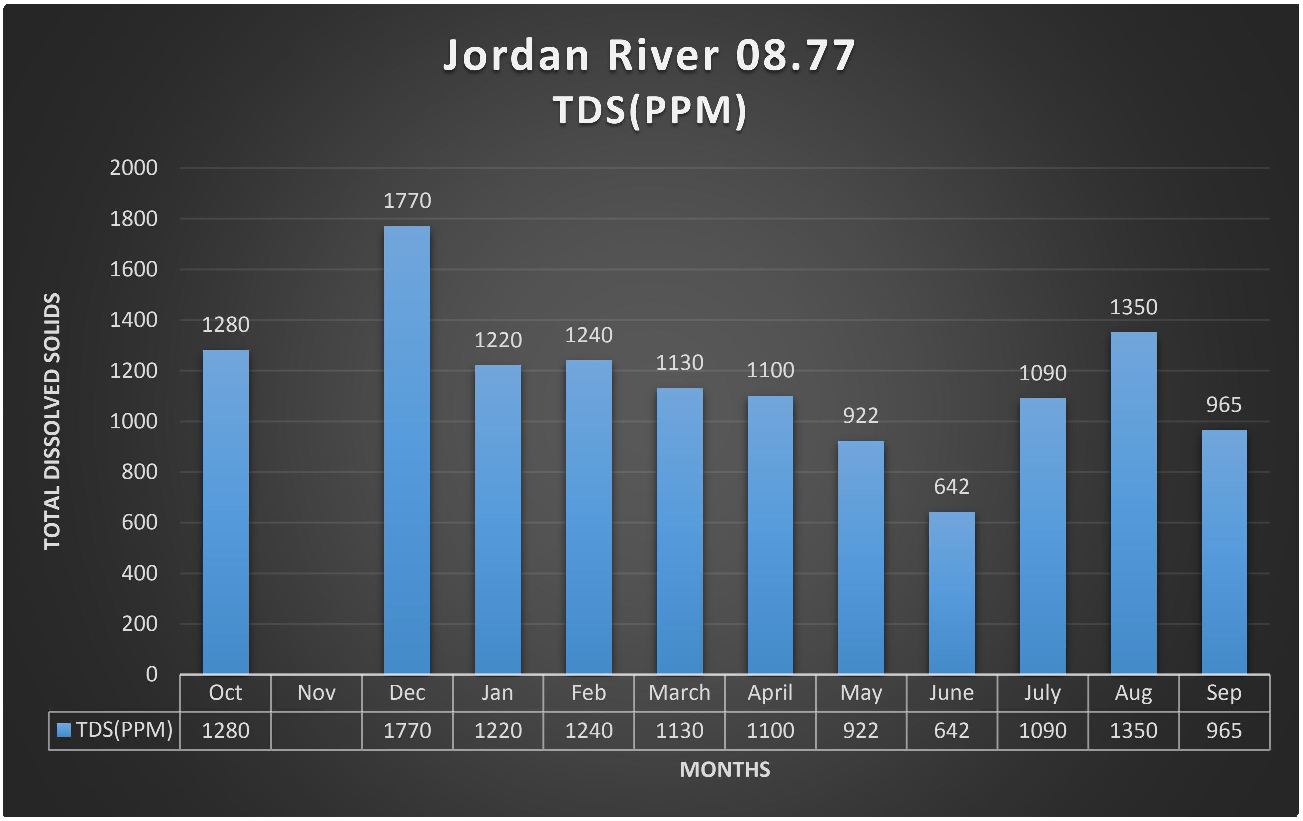
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
pH	8.08		8.2	8.28	8.09	8.11	8.17	8	8.06	8.03	7.93	8.24

Figure 4-353 Jordan River 08.77 Dissolved Oxygen



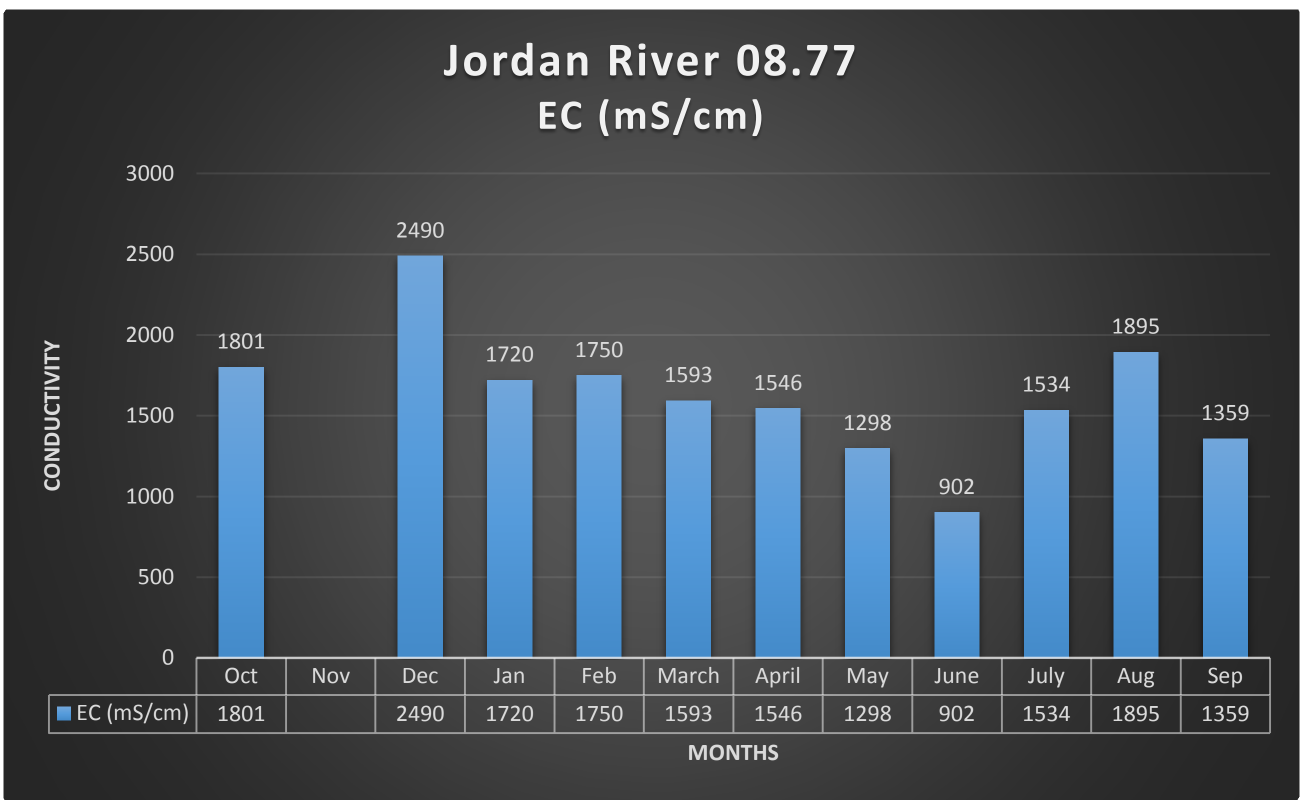
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
DO (%)	75.8		89.2	88.7	95.3	72.7	92.6	67.3	88.8	49.1	60.6	81.8

Figure 4-354 Jordan River 08.77 Total Dissolved Solids



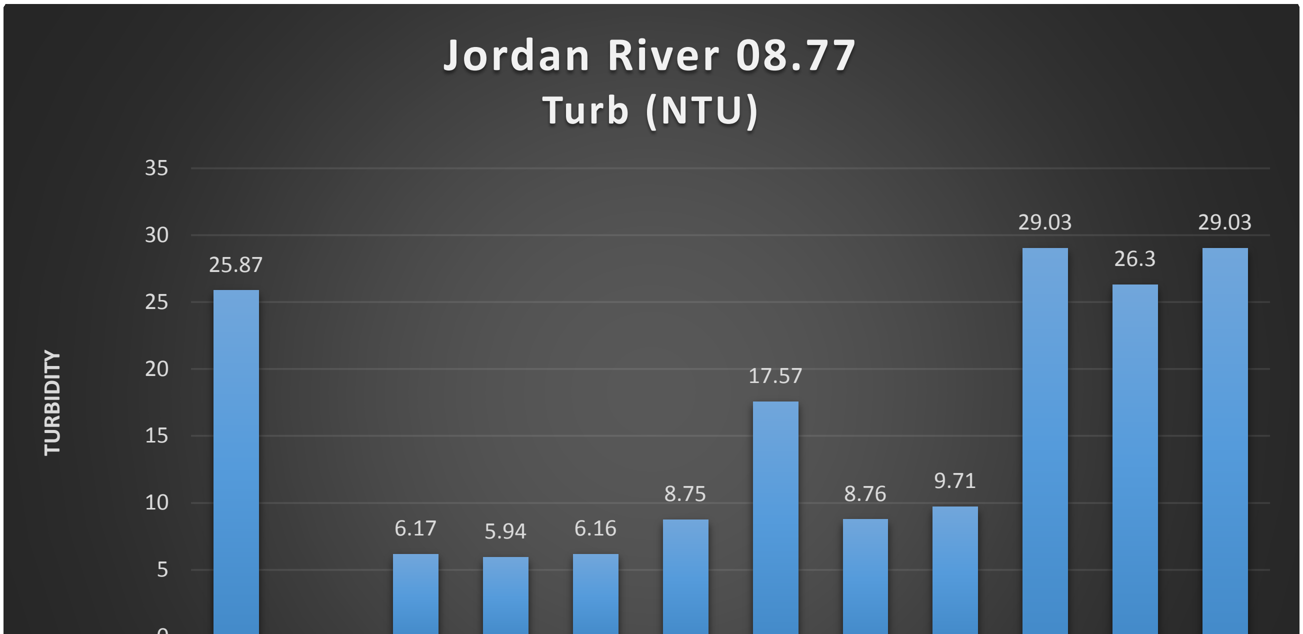
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
TDS(PPM)	1280		1770	1220	1240	1130	1100	922	642	1090	1350	965

Figure 4-355 Jordan River 08.77 Conductivity



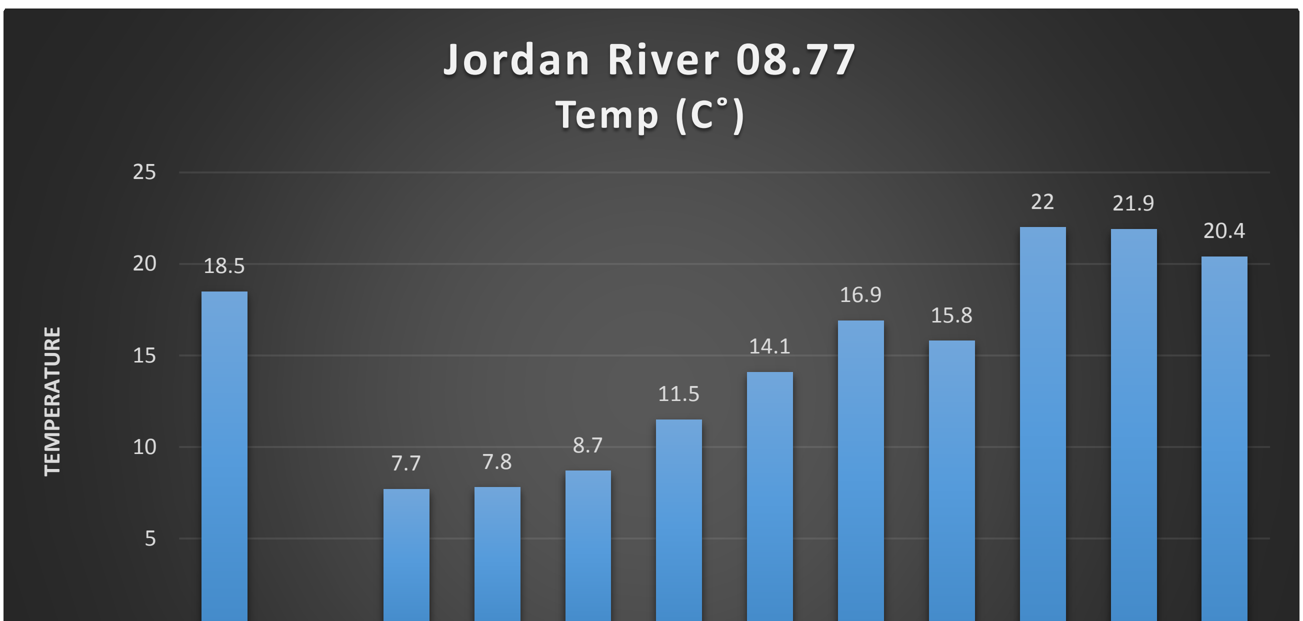
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
EC (mS/cm)	1801		2490	1720	1750	1593	1546	1298	902	1534	1895	1359

Figure 4-356 Jordan River 08.77 Turbidity



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Turb (NTU)	25.87		6.17	5.94	6.16	8.75	17.57	8.76	9.71	29.03	26.3	29.03

Figure 4-357 Jordan River 08.77 Temperature



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Temp (C˚)	18.5		7.7	7.8	8.7	11.5	14.1	16.9	15.8	22	21.9	20.4

Figure 4-358 Jordan River 08.77 Salinity

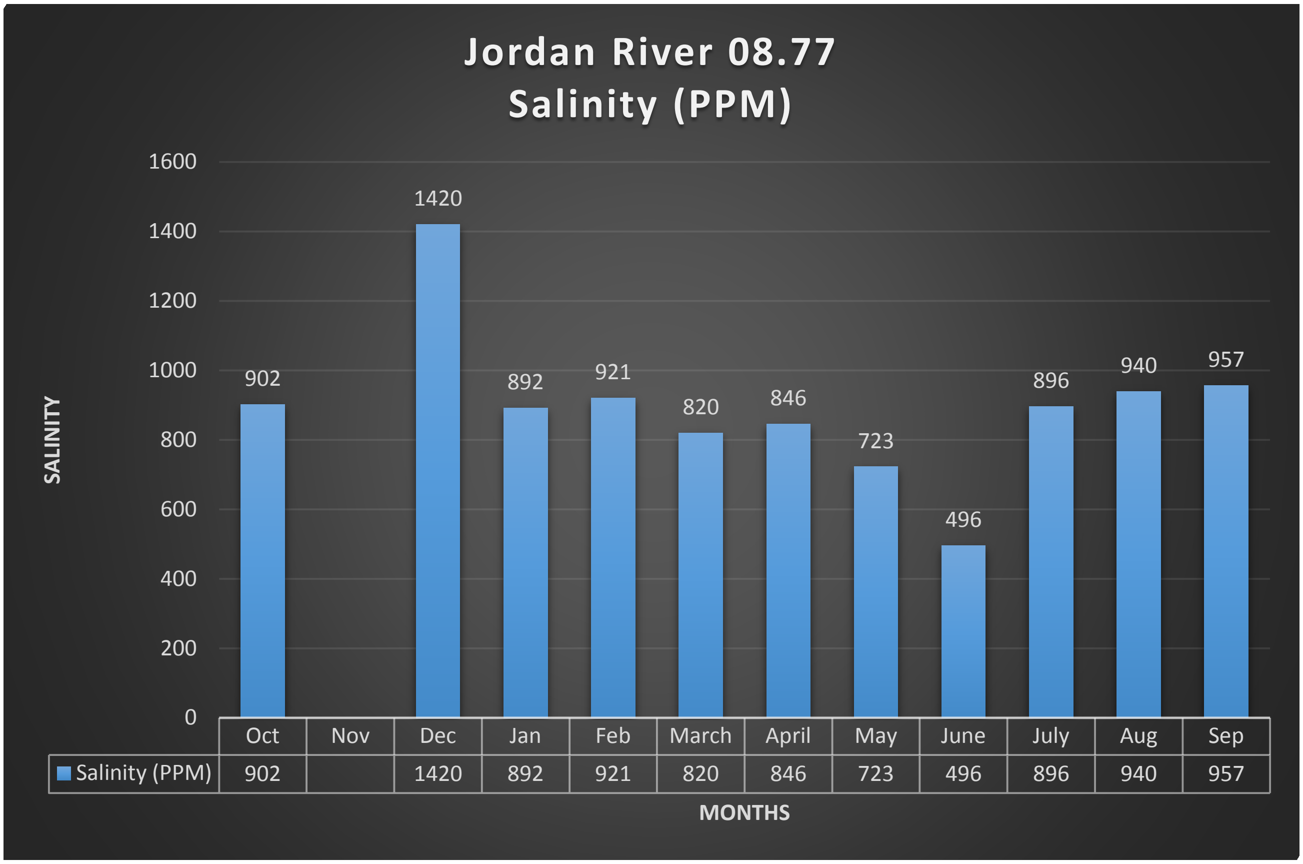


Figure 4-359 Jordan River 23.20 pH

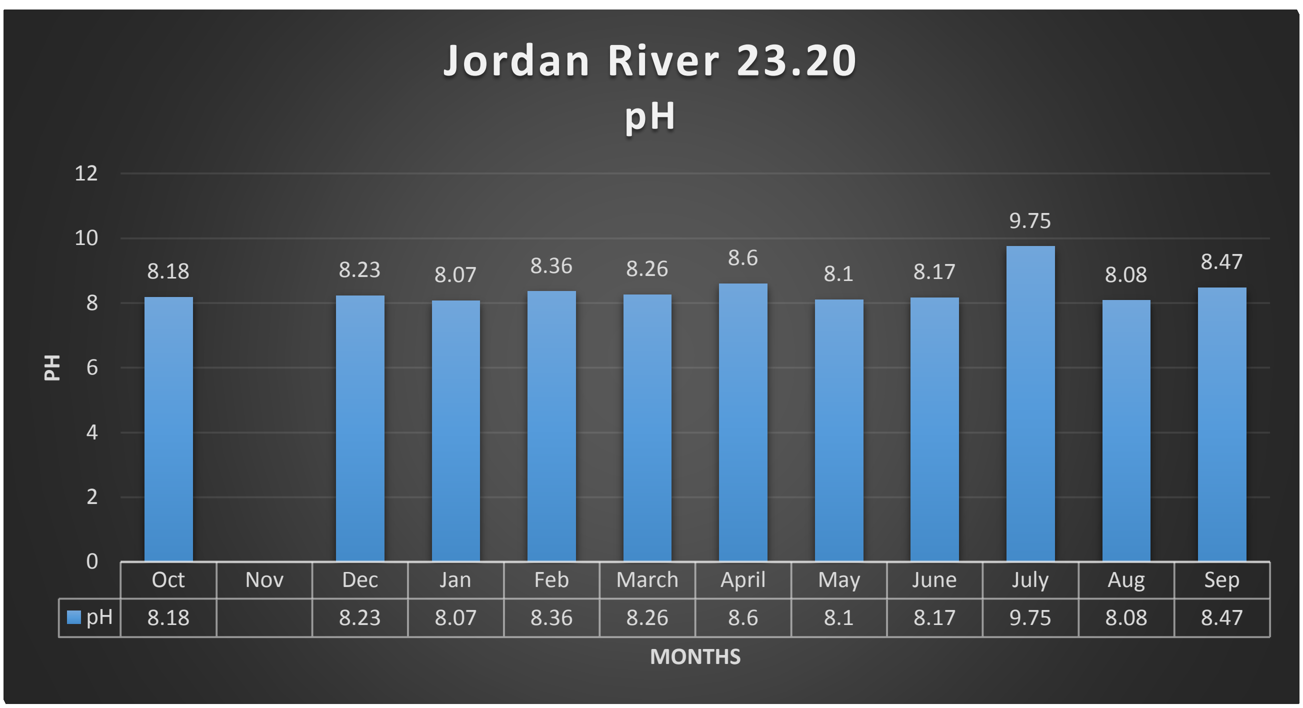


Figure 4-360 Jordan River 23.20 Dissolved Oxygen

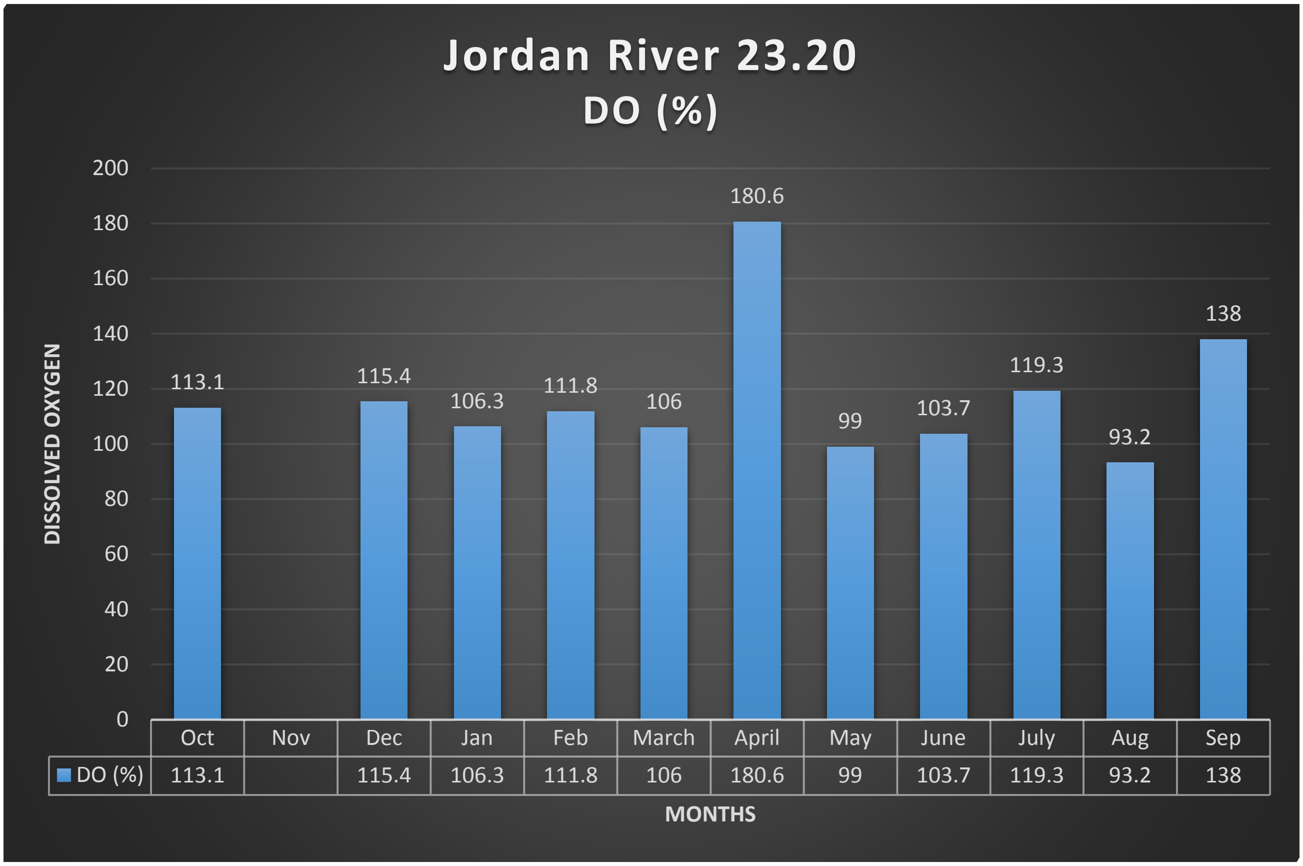


Figure 4-361 Jordan River 23.20 Total Dissolved Solids

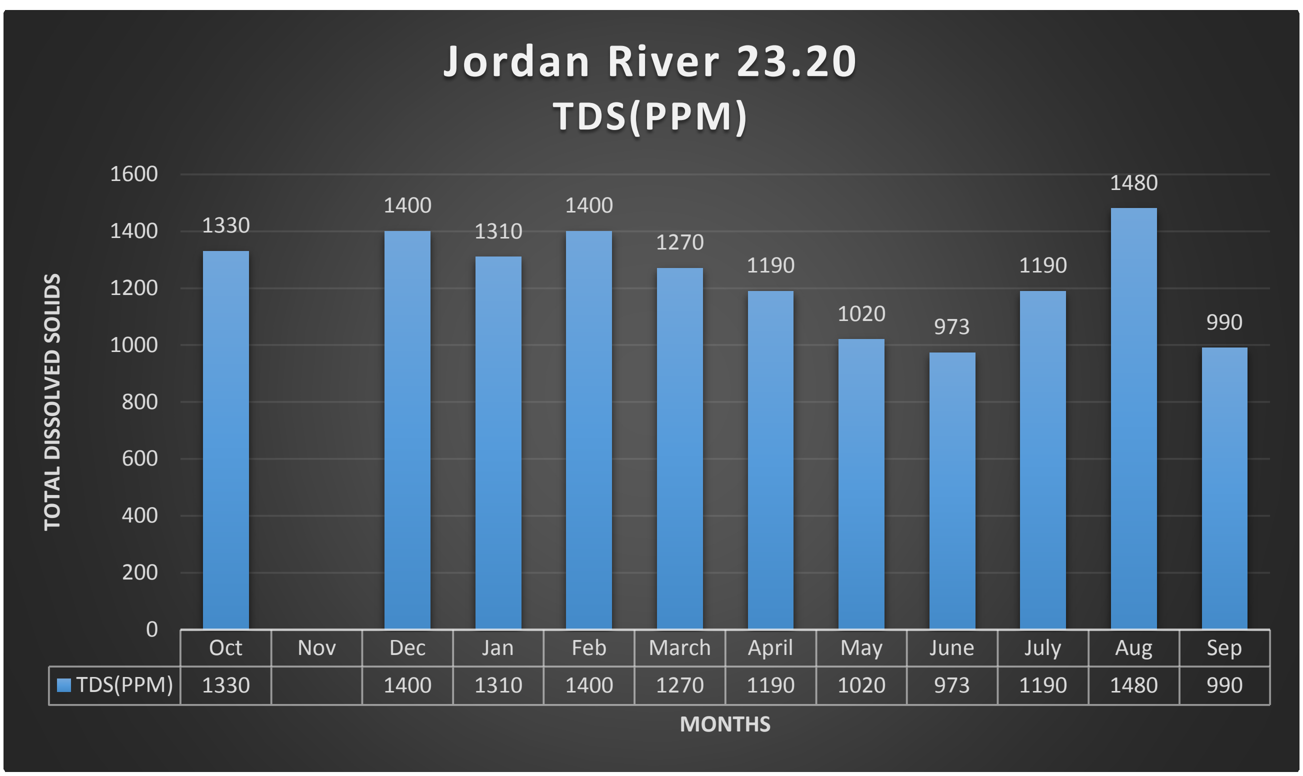


Figure 4-362 Jordan River 23.20 Conductivity

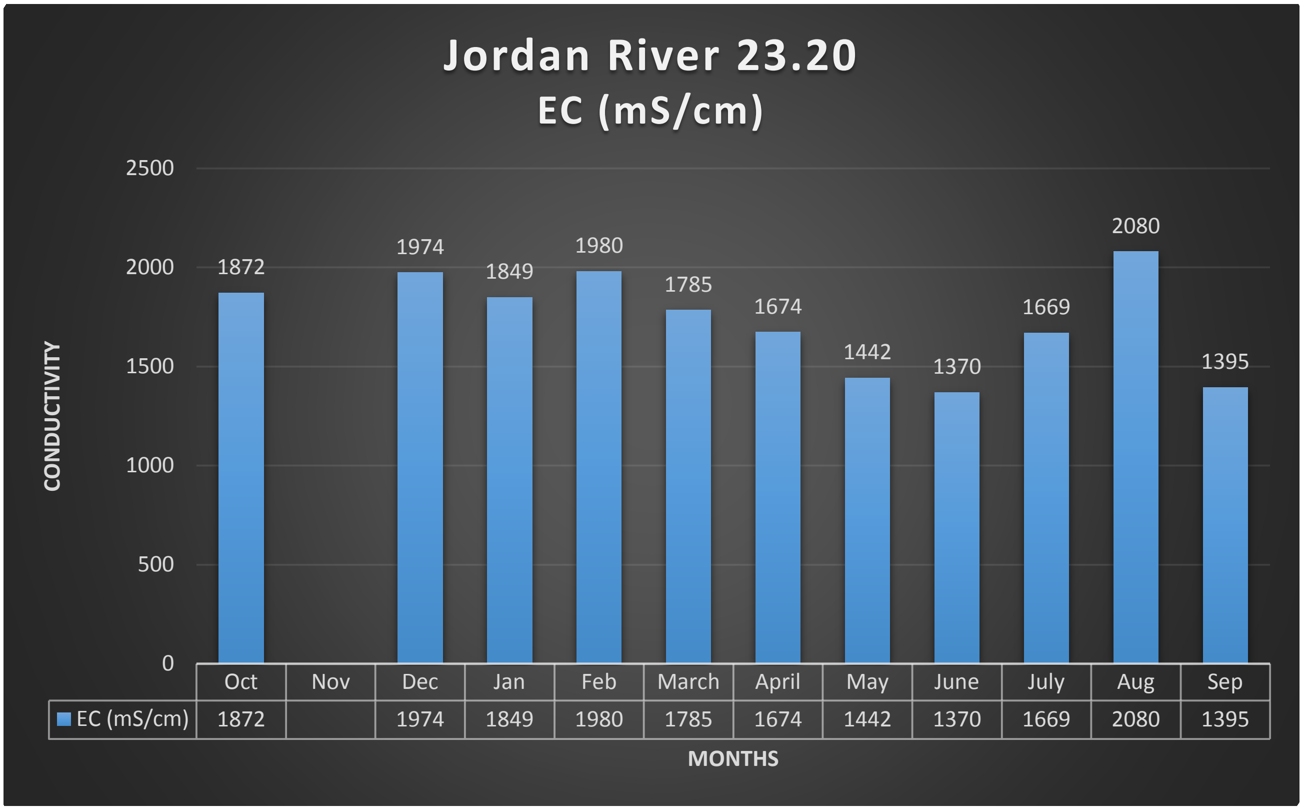


Figure 4-363 Jordan River 23.20 Turbidity

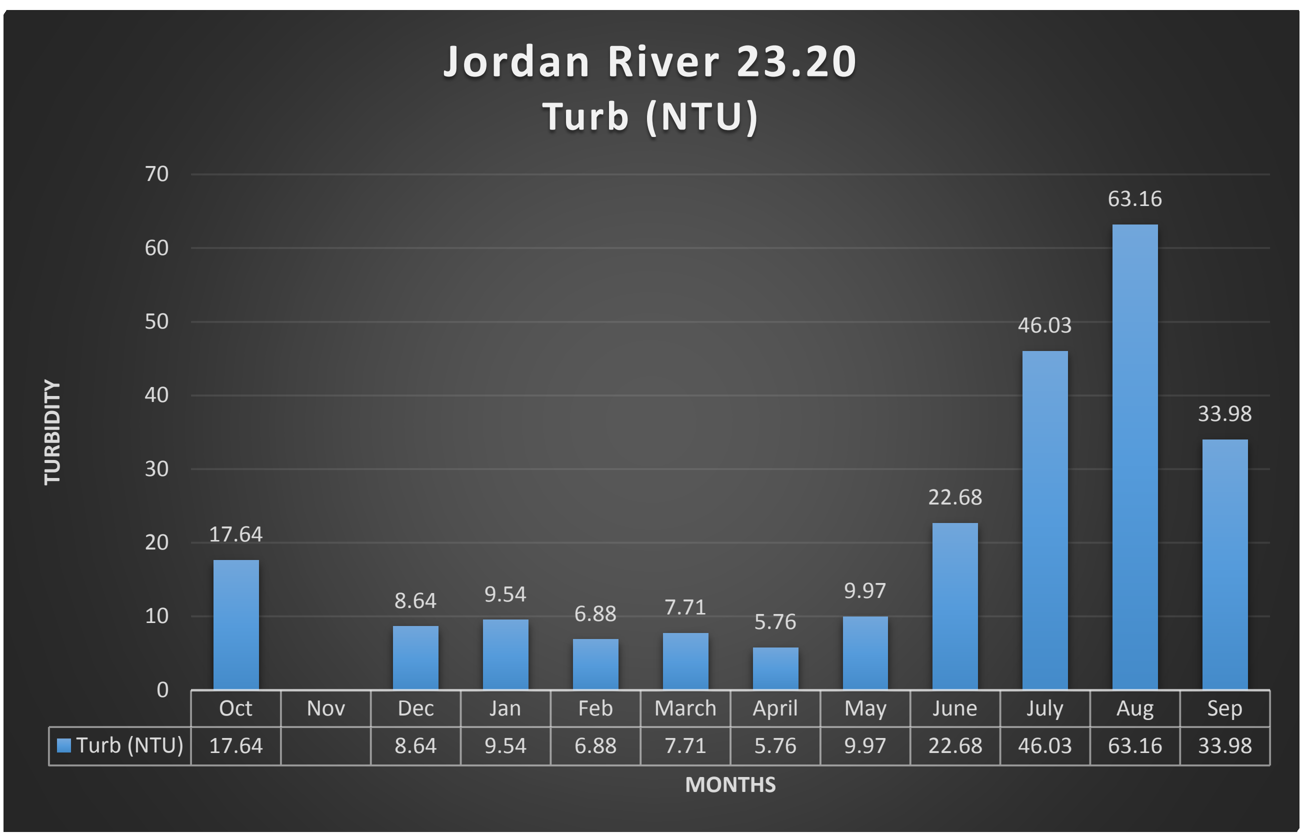


Figure 4-364 Jordan River 23.20 Temperature

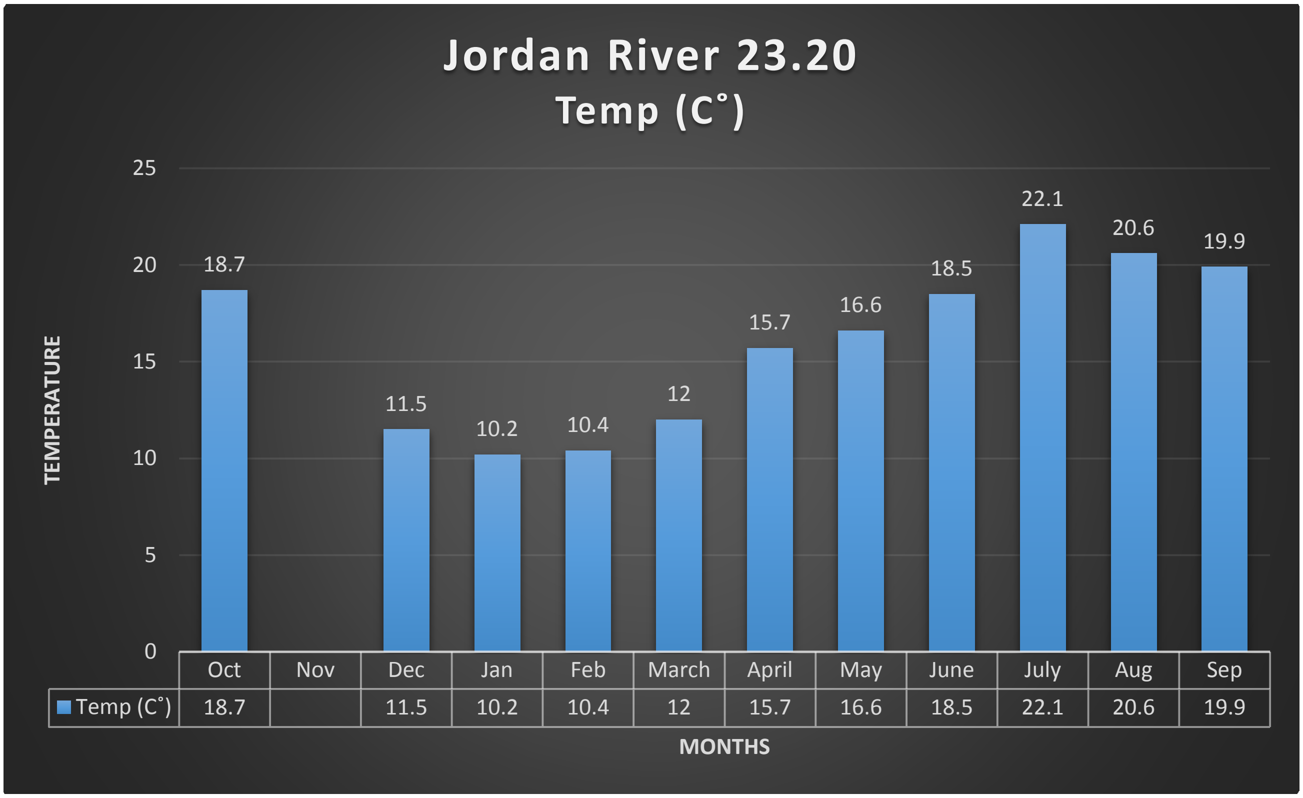


Figure 4-365 Jordan River 23.20 Salinity

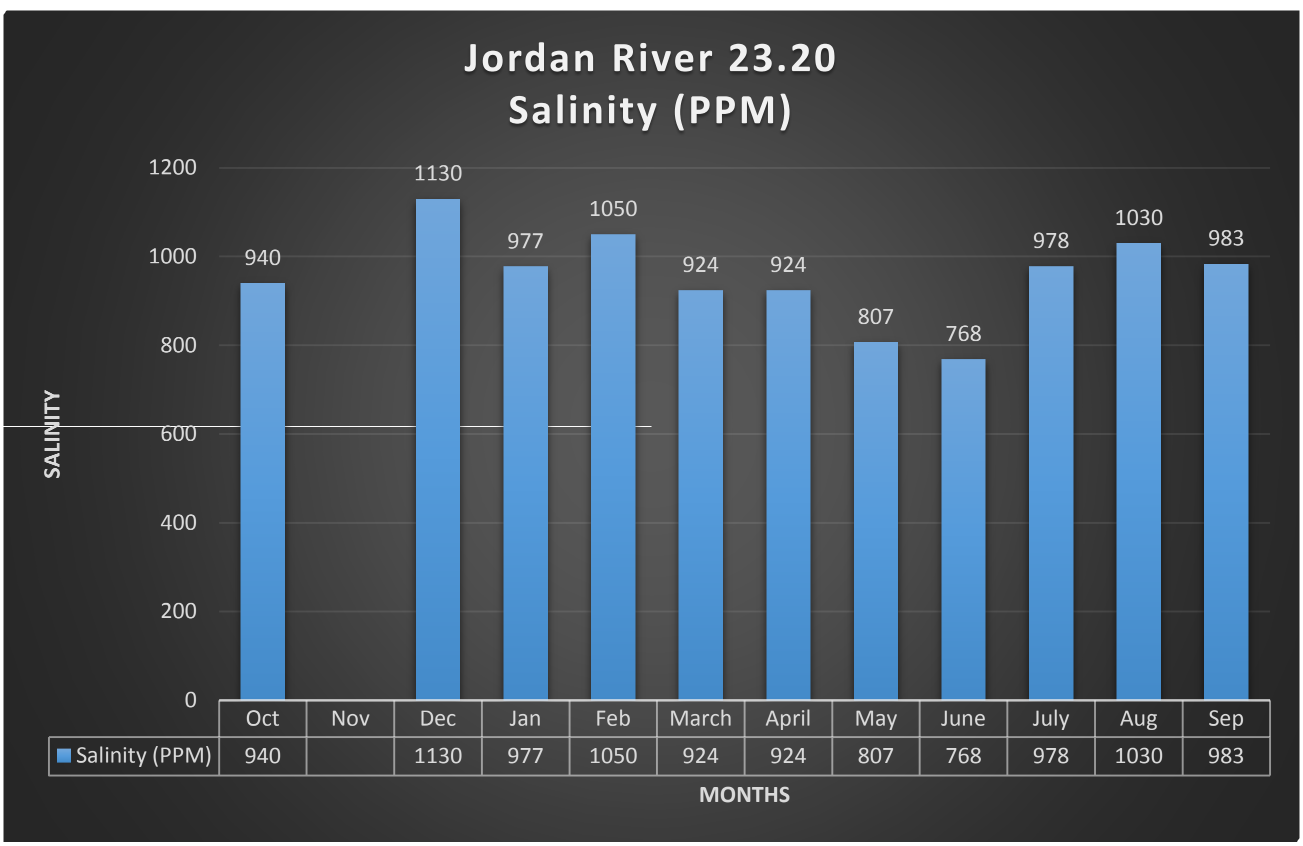
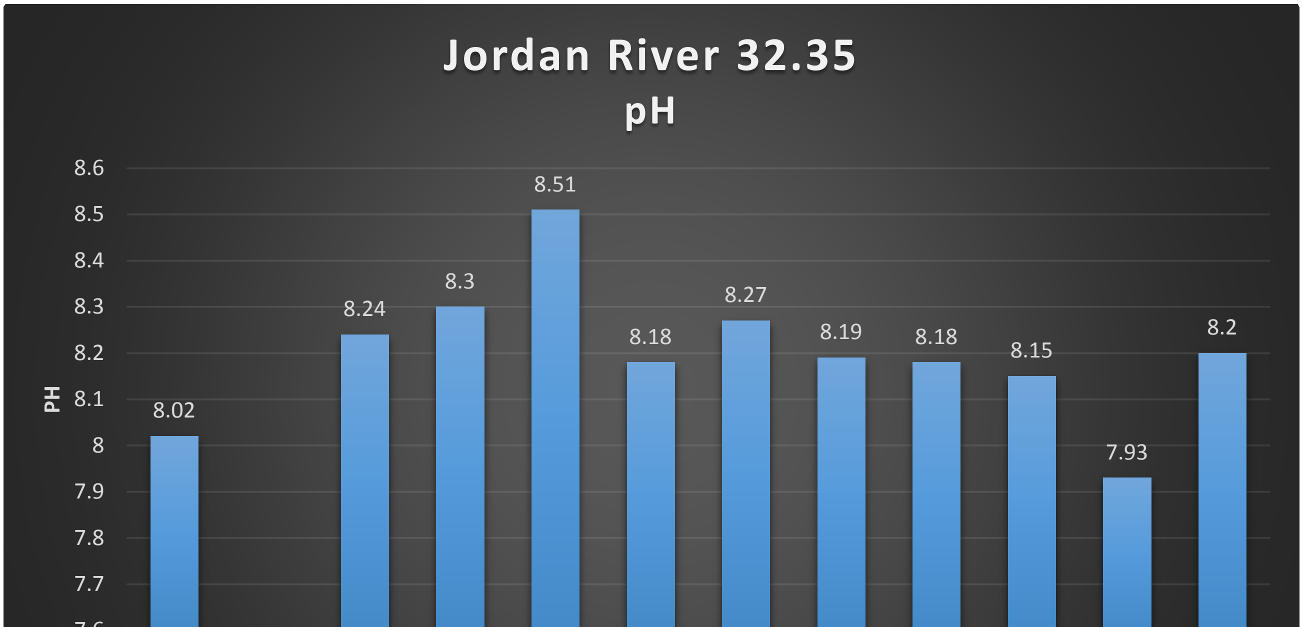
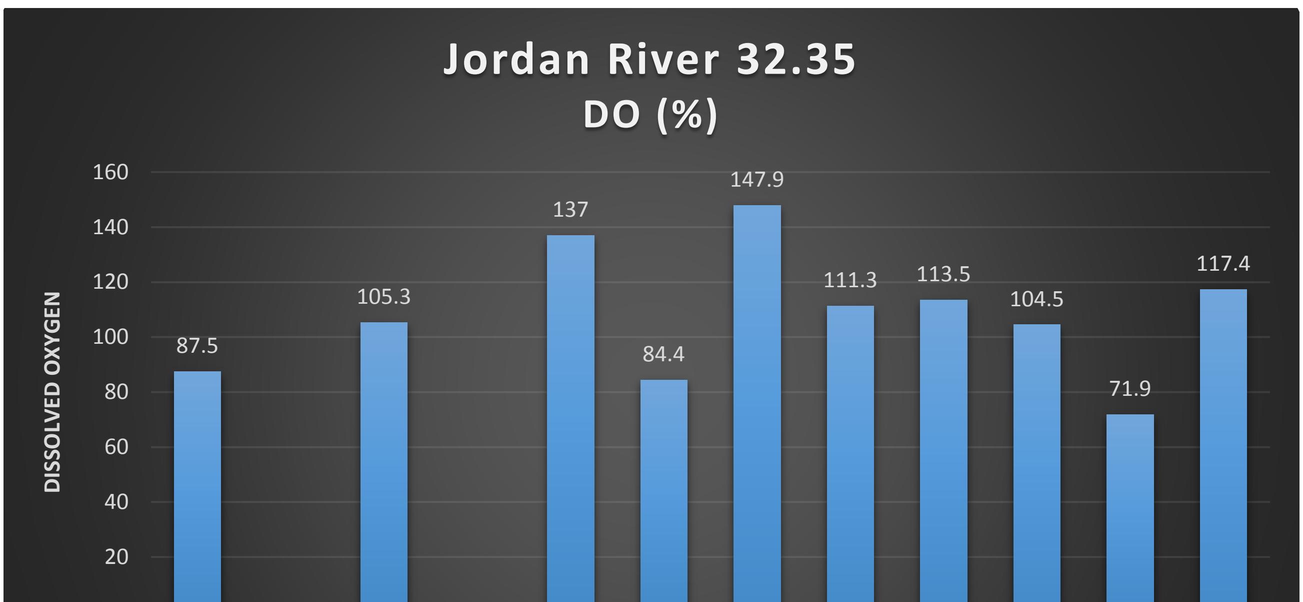


Figure 4-366 Jordan River 32.35 pH



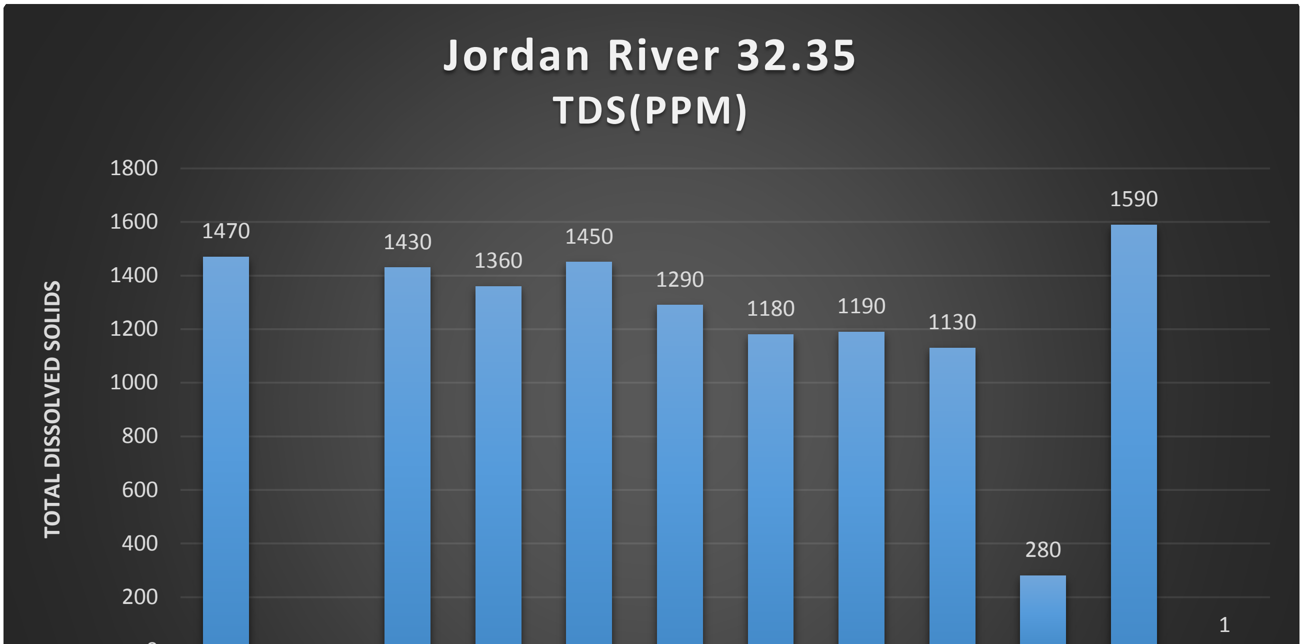
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
pH	8.02		8.24	8.3	8.51	8.18	8.27	8.19	8.18	8.15	7.93	8.2

Figure 4-367 Jordan River 32.35 Dissolved Oxygen



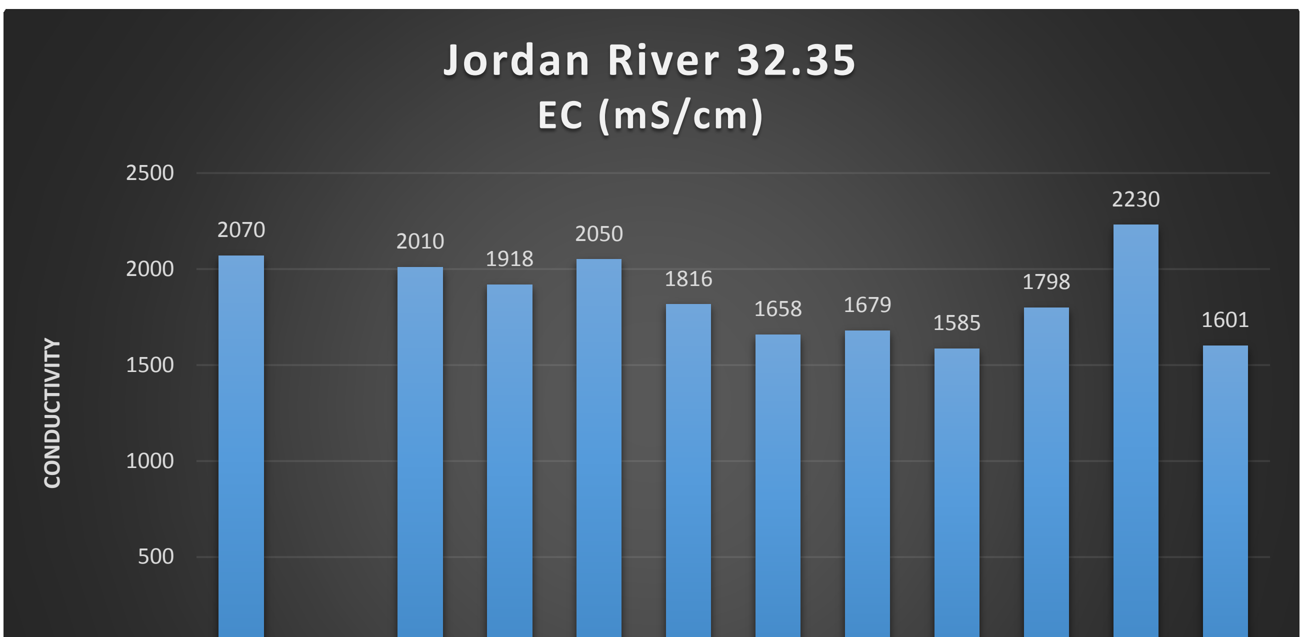
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
DO (%)	87.5		105.3		137	84.4	147.9	111.3	113.5	104.5	71.9	117.4

Figure 4-368 Jordan River 32.35 Total Dissolved Solids



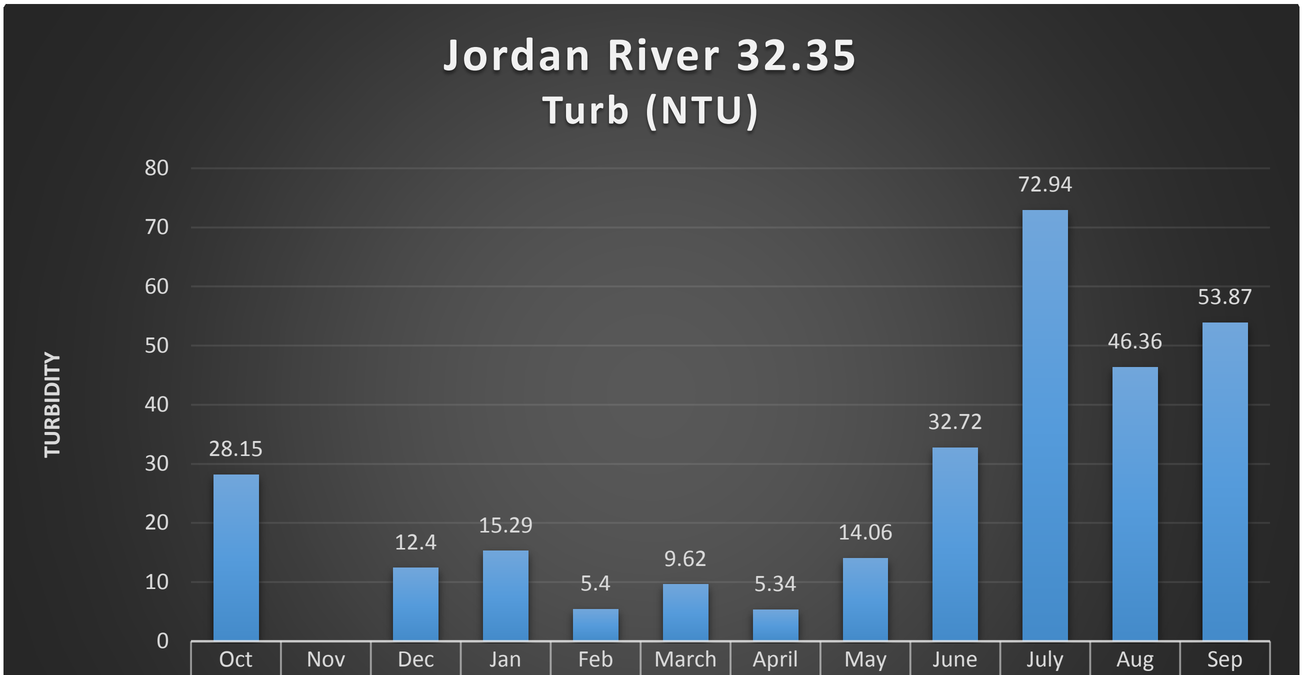
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
TDS(PPM)	1470		1430	1360	1450	1290	1180	1190	1130	280	1590	1

Figure 4-369 Jordan 32.35 River Conductivity



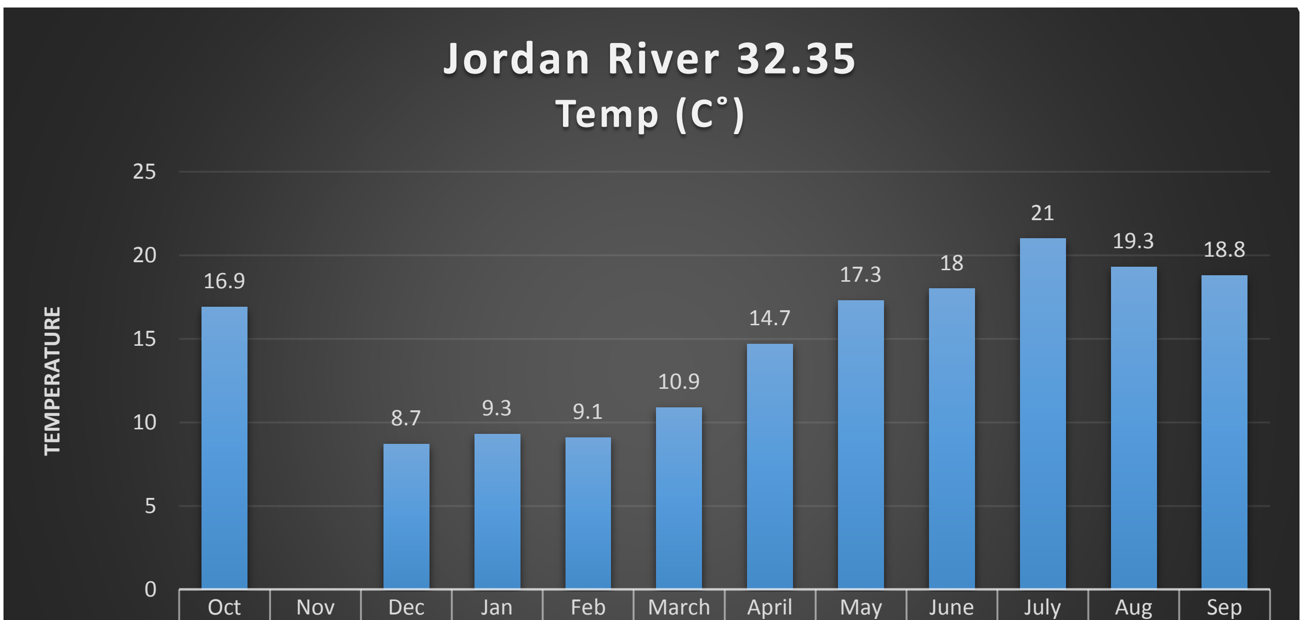
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
EC (mS/cm)	2070		2010	1918	2050	1816	1658	1679	1585	1798	2230	1601

Figure 4-370 Jordan 32.35 River Turbidity



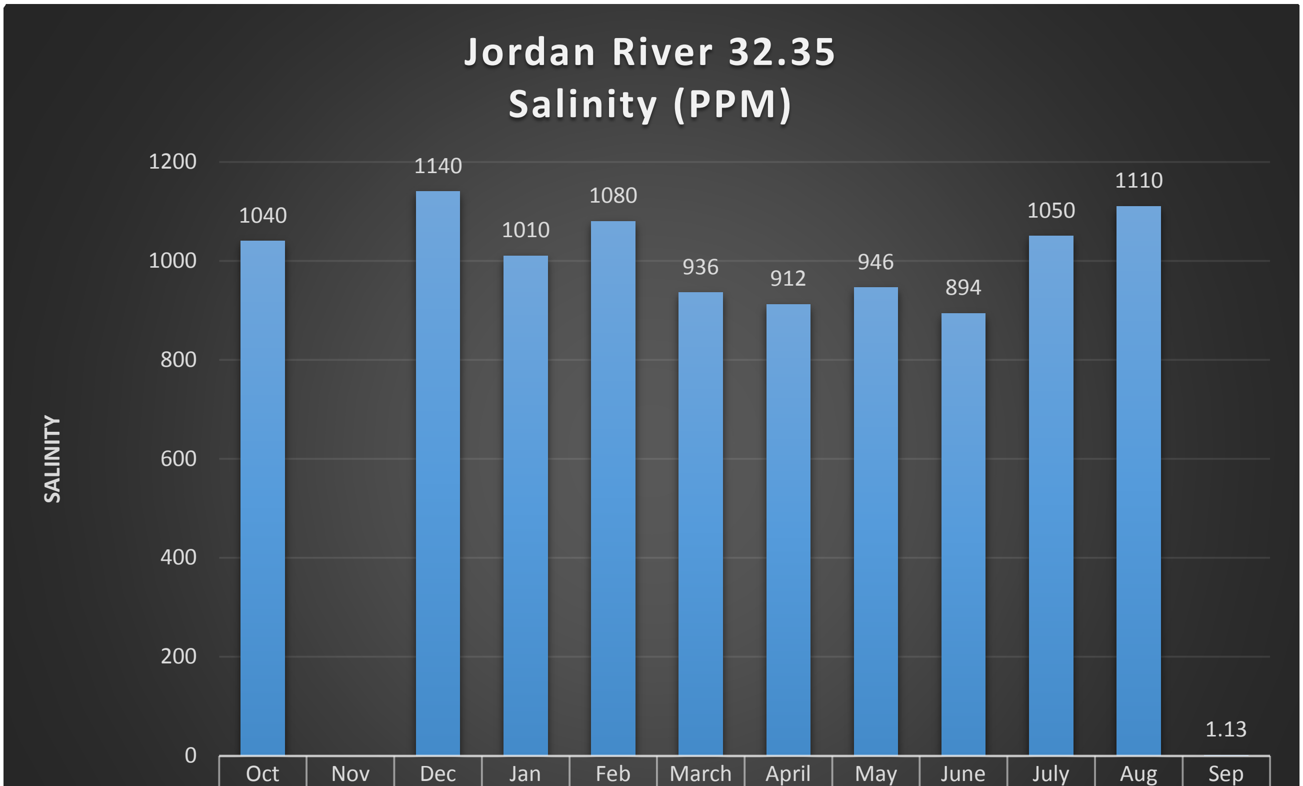
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Turb (NTU)	28.15		12.4	15.29	5.4	9.62	5.34	14.06	32.72	72.94	46.36	53.87

Figure 4-371 Jordan River 32.35 Temperature



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Temp (C˚)	16.9		8.7	9.3	9.1	10.9	14.7	17.3	18	21	19.3	18.8

Figure 4-372 Jordan River 32.35 Salinity



	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep
Salinity (PPM)	1040		1140	1010	1080	936	912	946	894	1050	1110	1.13

8.0 SAMPLING AND ANALYSIS APPENDIX

Sampling and Analysis Plan (SAP)
For
Salt Lake County, Utah

Prepared by:

Salt Lake County
Watershed Planning & Restoration Program
2001 S. State St. Suite N3100
PO Box 144575
Salt Lake City, UT 84112-4575
Watershed.slco.org

Prepared May 2013
Updated May 2016

1.0 Introduction & Background

In 2009 Salt Lake County finalized the Salt Lake Countywide Water Quality Stewardship Plan (WaQSP), which identified the need for a greater body of water quality data in order to more completely and accurately assesses the condition of County waterways.

As a result, an expanded water quality data collection program was undertaken in 2009, and includes the following:

- Macroinvertebrate & Physical Habitat sampling program was initiated using the Utah Division of Water Quality and U.S. Environmental Protection Agency protocols
- *E.coli* sampling study was initiated in cooperation with the Utah Division of Water Quality
- Water chemistry data collected at all sampling sites (pH, DO %, DO mg/L, E, TDS, Salinity, Temperature and Turbidity)

This data provides valuable information for ongoing and future watershed planning, such as updates to the Water Quality Stewardship Plan (WaQSP), and is used by regulatory agencies at the federal, state and local levels.
The update of the WaQSP is due out in 2015 but is not published at this time. The document does, however, call for maintained sampling efforts in the same magnitude as conducted for the 2009 plan.

1.1 Study Area

The Jordan River Watershed in Salt Lake County is part of the larger Jordan River Watershed, which is a closed basin in North Central Utah that drains a total area of 805 square miles (515,200 acres). The Watershed in Salt Lake County is bounded on the east by the Wasatch Mountains, on the west by the Oquirrh Mountains, and on the south by the Traverse Range (Figure 1). Although the majority of water flowing to the Jordan River in Salt Lake County comes from the eastern tributaries, there are sixteen (16) identified sub-basins throughout the County. The majority (72.3%; 372,800 acres) of lands in the Watershed are privately owned. The U.S. Federal Government (21.1%; 108,800 acres) and the State Government (6.5%; 33,600 acres) manage the remaining sections. With the exceptions of limited areas of Emigration, Big Cottonwood and Little Cottonwood canyons, the mountainous areas of the Jordan River Watershed are almost entirely uninhabited.

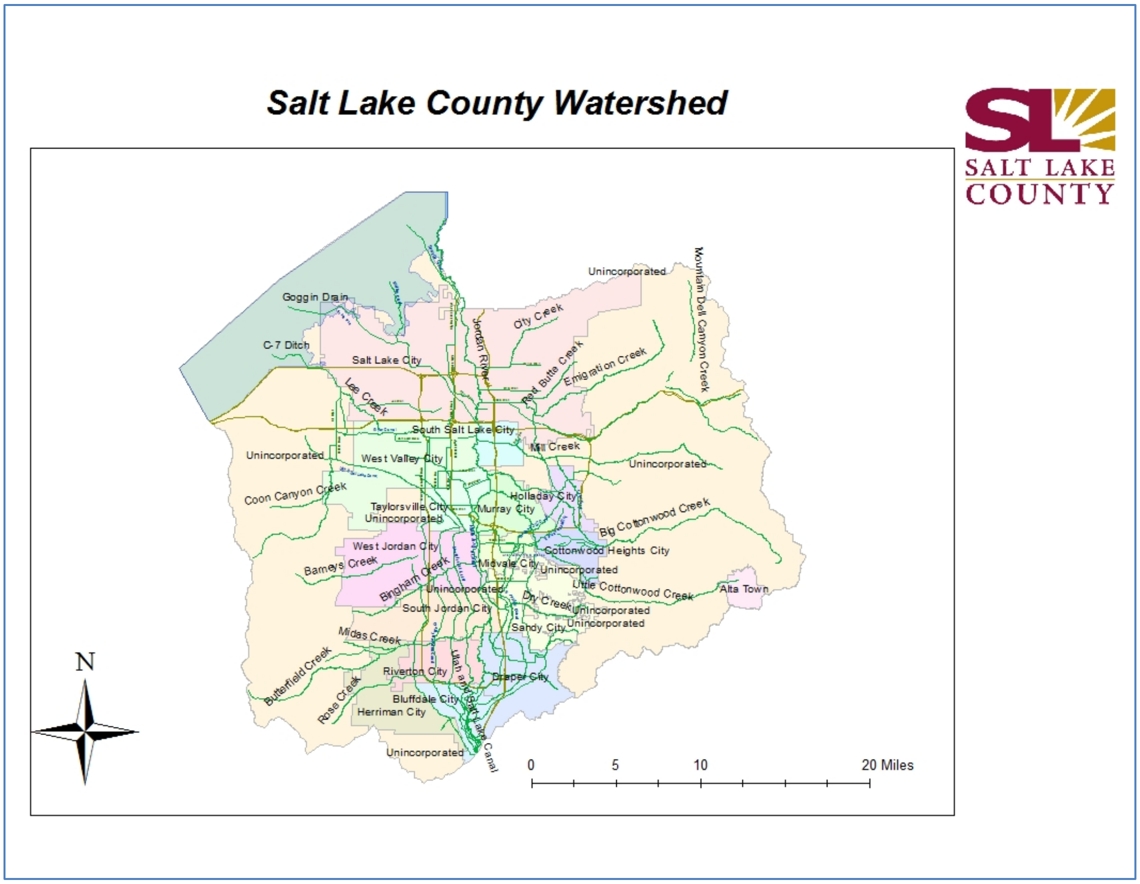


Figure 1. Salt Lake County Watershed

Over 898,387 people (40% of Utah's population) live in the Jordan River Watershed (US Census website). In this confined watershed, population is continuing to rise with densities increasing from 900 people per square mile in 1990 to 1,218 people per square mile in 2000 (SLCO, 2005). Notably, the population density of valley bottoms is much higher—2,000 people per square mile. Projected population for the year 2020 is 1.3 million, or an average of 1,614 people/square mile. The Jordan River Watershed is not only the population center for the State, but is also an economic center for the Intermountain West. As with many western states, Salt Lake County has been undergoing an economic shift away from agriculture to manufacturing and retail sales. With increasing development/land conversions, substantial stream alteration/channelization, and sections of the Jordan River and Emigration Creek on the State's 303(d) list, the Jordan River Watershed is a complex area in great need of stakeholder involvement that will result in innovative solutions to watershed concerns. The issues in this watershed range from abandoned mine concerns in the Wasatch Canyons to stormwater shock loads and land development in the urban areas. With nearly 900,000 people who live, work, and play in this county, it is a challenging and essential task to facilitate communication and restoration efforts between various constituents.

1.2 Regulatory

Area-Wide Water Quality Planning

Section 208 of the Clean Water Act requires states to designate areas which, ‘as a result of urban-industrial concentrations and other factors, have substantial water quality control problems,” and to designate a regional planning organization for such areas to develop area-wide management plans for the control of pollution. With respect to the point sources such as wastewater treatment plants, these plans are required to identify waste treatment facilities, specify construction priorities and develop a regulatory program.

On February 6, 1978, with the completion of the Area-Wide Water Quality Management Plan, Salt Lake County Government was designated the regional water quality planning authority by then Governor Scott M. Matheson. The primary goals outlined in the 1978 Plan were to provide a “continuous planning process directed toward achieving the policy of restoring and maintaining the chemical, physical and biological integrity of the waters of Salt Lake County.”

At this time, the Council of Governments (COG), in conjunction with the Salt Lake County Planning Commission, hired staff to conduct water quality planning and subsequently created the Water Quality and Water Pollution Department. The Water Quality and Water Pollution Department functioned as the primary water quality planning authority until 1985.

In 1985, the Salt Lake County Health Department took over this responsibility. Liability was again shifted in 1992 when water quality planning was placed directly under the Salt Lake County Commission. This situation continued until 1997 when the Public Works Department of Salt Lake County again took on the charge of area-wide water quality planning.

303(d) List

The Utah 303(d) list of impaired waters is used to characterize water quality from a regulatory perspective. The initial assessment of water quality monitoring is compiled into a report (more commonly called the 303(d) list), that is updated every 2 years and submitted to the Environmental Protection Agency (EPA) for review and approval. Once a water body is included on the 303(d) list, action must be taken to identify pollutant sources that contribute to water quality impairment. Load recommendations are then made for each source that will result in achievement of water quality standards. This process results in a Total Maximum Daily Load (TMDL) for a water body. When a TMDL has been approved by the EPA, the water body is recommended for delisting and removal from the 303(d) list.

Waters of Utah are organized by the Utah Division of Water Quality (DWQ). Streams and rivers are typically divided into individual Assessment Units (AU) that may have different beneficial uses and water quality standards. Individual AUs for a stream can be included on the 303(d) list. The target for the 303(d) List is 100 percent of all AUs, including those found on mountain and valley tributaries as well as the Jordan River, not included on the Utah 303(d) list.

2.0 Objectives

In 2009 Salt Lake County finalized the Salt Lake Countywide Water Quality Stewardship Plan (WaQSP), which identified the need for a greater body of water quality data in order to more completely and accurately assesses the condition of County waterways.

As a result, an expanded water quality data collection program was undertaken in 2009, and includes the following:

- Benthic Macroinvertebrate & Physical Habitat sampling program was initiated using the Utah Division of Water Quality and U.S. Environmental Protection Agency protocols
- *E.coli* sampling study was initiated in cooperation with the Utah Division of Water Quality
- Water chemistry data (real time) collected at all sampling sites (pH, DO %, DO mg/L, E, TDS, Salinity, Temperature and Turbidity)

This data provides valuable information for ongoing and future watershed planning, such as updates to the Water Quality Stewardship Plan, and is used by regulatory agencies at the federal, state and local levels.

2.1 Sampling Site Locations

Sampling locations and frequencies for *E. Coli* and Macroinvertebrates on detailed below and in the attached maps. These are proposed sampling locations and frequencies may change due to externalities such as, but not limited to, changes in Salt Lake County funding and staffing, weather, and stream flows.

Salt Lake County WPRP staff has coordinated with DWQ staff on the site locations to ensure benefit of the sites as well to avoid duplication of sampling efforts.

2.1.1 *E. Coli*

E. Coli sampling is performed monthly unless there are outlying issues that prevent as such. Also, *E. Coli* sampling is dry weather sampling and performed a minimum of 24 hours outside of a precipitation event. Legacy sites are detailed in Figure 2.

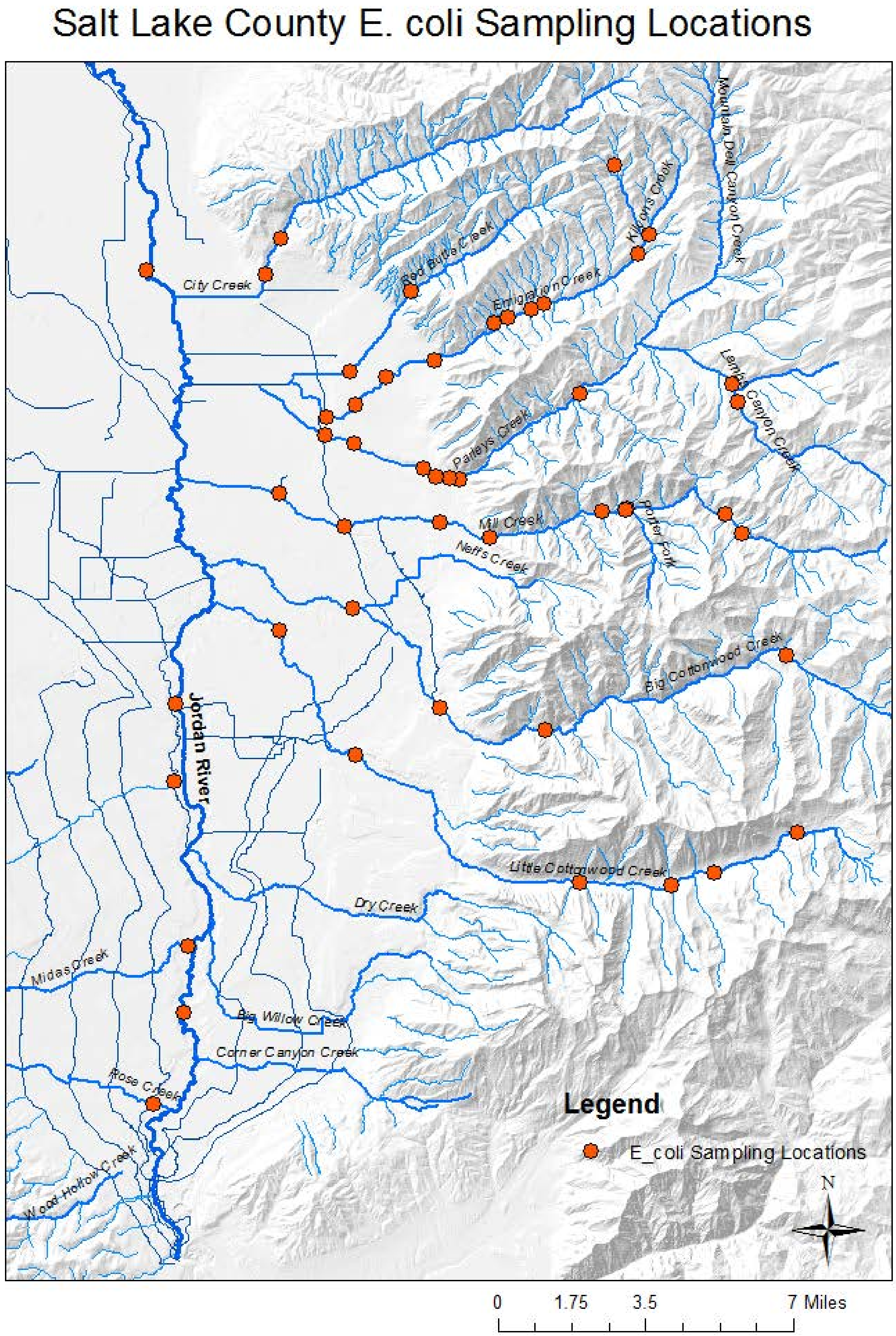


Figure 2. ***E. Coli*** **Sampling Locations**

2.1.2 Benthic Macroinvertebrates

Benthic macroinvertebrate sampling is performed annually beginning 2018 and ending in 2019 unless there are outlying issues that prevent as such. Also, Macroinvetebrate sampling is performed during seasonal low flows; approximately July through November. Legacy sites are detailed in Figure 3.

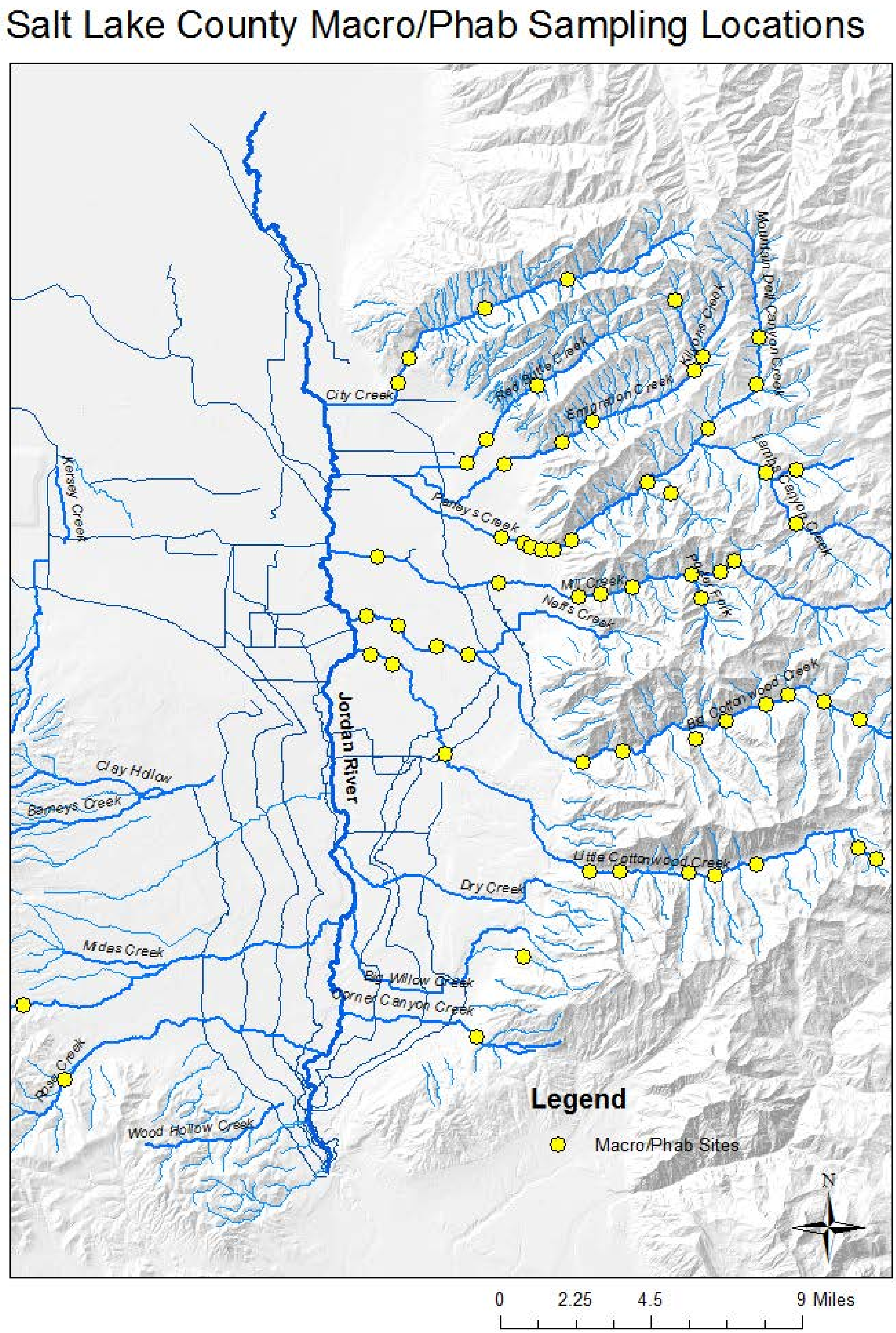


Figure 3: Sampling Macroinvetebrate Locations

2.1.3 Chemistry

Chemistry sampling is performed monthly in tandem with E. coli samples unless there are outlying issues that prevent sampling runs. Also, Chemistry sampling is dry weather sampling and performed a minimum of 24 hours after a precipitation event. Legacy sites are detailed in Figure 4.

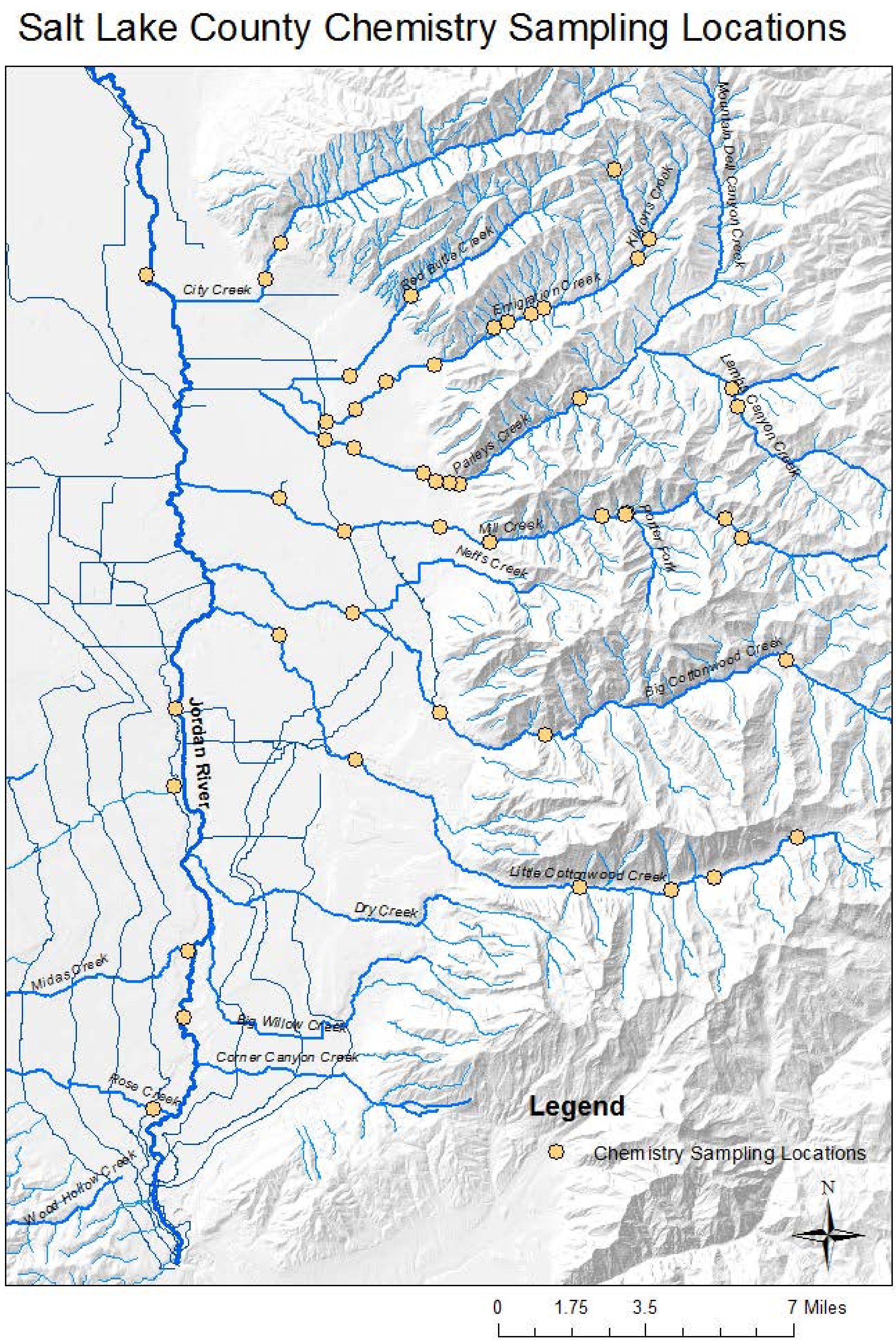


Figure 4: Sampling Chemistry Locations

3.0 Field Health & Safety Plan

The health and safety of field personnel and staff is an essential part of sampling and day to day work activities. Therefore all sampling sites are selected with health and safety as a priority.

3.1 General Safety Procedures

Appropriate safety gear such as waders, gloves, life jackets, etc. must be available and used when necessary. First aid kits and fire extinguishers must be readily available in the field. It is recommended to bring a cellular telephone in case of an emergency. Supplies such as anti-bacterial soap and an adequate supply of clean water will be available for cleaning exposed body parts that may have been contaminated by pollutants in the water. TecNu must be provided in areas with poison oak, poison ivy, etc. Personnel should be aware of and take caution when walking on uneven, rocky surfaces.

The following guidelines briefly outline important health and safety precautions for all field personnel. In order to minimize potential safety hazards, personnel are to exercise extra precautions when working around outfalls and avoid proceeding into areas which will compromise safety.

Emergency - **Personnel Injury -** If affected personnel can be moved safely, take him/her to nearest health care facility (see attached map). If there is a possibility of a head, neck, or back injury **do not** move the injured party; contact paramedics **(911)**. Notify supervisor as soon as possible.

Communication - Use mobile phone to stay in contact with team members.

Vehicle safety - Use caution at all times when driving as roads will be wet and may be slick. Park vehicles off the traveled way when possible. Always use safety cones and vehicle safety flashers to alert oncoming traffic of the parked vehicle.

Confined spaces - Under no circumstances are field personnel authorized to enter manholes, storm drains, culverts or any other confined spaces.

Steep embankments - A tie-off rope shall be used by all personnel required to descend embankments, and the rope shall be manned at the top of the embankment.

Water safety - Use basic water safety precautions around flowing streams and channels. Be aware of wet and slippery surfaces in and around the sampling locations.

Flooding and lightning - Be alert to high water or flash flooding conditions that may occur during a storm.

Do not stay out in the open or stand under trees if lightning is occurring in the vicinity. Enclosed automobiles and buildings are the safest places to be during lightning storms.

Visibility - Limited visibility will exist when sampling during nighttime and/or during a storm event. Wear reflective safety vest during all sampling events. Activate vehicle flashing hazard lights or beacons at all times vehicle is parked at a sampling site.

Proper lifting - To avoid back strain or injury, use team lifting techniques when possible. Lift with leg muscles, not with the back muscles by bending at the knees, not at the waist.

Cold exposure - Because sampling will occur during a various seasons, exposure to cold may be a potential hazard. To guard against cold injury, wear appropriate clothing; have warm shelter available; and carefully monitor field personnel and weather conditions. Some of the symptoms of cold stress include pain in an exposed extremity, and/or shivering.

If any symptoms of cold stress occur, the affected personnel should be removed from the cold environment. If the symptoms are not relieved, professional medical attention should be sought.

Heat stress - Heat stress is one of the most common (and potentially serious) illnesses which may affect field personnel. The potential for heat stress is dependent on a number of factors, including environmental conditions, clothing, workload, physical conditioning, and age. The effects of heat stress can range from mild symptoms, such as fatigue, irritability, and decreased mobility, to death. Some symptoms of heat stress include the following:

- **Heat rash:** A resultant of continuous exposure to heat and humidity, heat rash decreases the body's ability to tolerate heat.
- **Heat cramps:** A result of profuse perspiration with inadequate fluid intake and chemical replacement, heat cramps are signaled by muscle spasms and pain in the abdomen and the extremities.
- **Heat exhaustion:** A result of increased stress on various organs. The signs of heat exhaustion include elevated body temperature; shallow breathing; pale, cool, moist skin; profuse sweating; dizziness and weakness.
- **Heat stroke:** The most severe form of heat stress, heat stroke must be relieved immediately to prevent severe injury or death. The signs of heat stroke are red, hot, dry skin; elevated body temperature; no perspiration; nausea; dizziness and confusion; strong, rapid pulse; and coma. The body must be cooled and professional medical attention sought immediately.

Preventive measures to preclude heat stress include regular work breaks during field activity, and regular water and food replenishment. Should one or more symptoms be detected, the affected worker should drink plenty of fluids, and seek professional medical attention, if required.

Material Safety Data Sheets (MSDS) for preservatives used in grab sample and composite sample bottles, Colilert, as well as TecNu are attached in Appendix A.

4.0 Field Sampling Methods

All sampling methodologies are EPA and Utah Division of Water Quality (DWQ) approved methodology. Salt Lake County personnel have received training from DWQ staff on Standard Operating Procedures (SOP).

4.1 *E. Coli* Sampling

Sampling of *E. Coli* and Fecal Coliform involves using the Idexx Colilert Quanti-Tray method of analysis **(Appendix B).** The minimum detection limit is > 1.0 MPN/100 mL and the maximum detection limit is 2419.6 MPN/100 mL. MPN stands for Most Probable Number and is analogous with Colony Forming Units (CFUs).

4.2 Benthic Macroinvertebrate Sampling
Benthic macroinvertebrates are collected from an undisturbed area using a D-net along a 150-500-m transect. Procedures are described in the SOP (**Appendix C**). Briefly, 11 equally spaced transects are surveyed through a longitudinal length 40 times the wetted width of the stream. Eight composited kick net samples are taken at riffles in marked transects. The samples are taken by placing the D-net firmly on the stream substrate, kicking the substrate in a 0.4 x 0.4 m square in front of the net for 30 seconds. The net is thoroughly rinsed with creek water into the composite bucket. Samples are placed into jars with 95% denatured ethanol as preservative and sent to the Buglab at Utah State University for final processing.

4.3 Chemistry
Sampling of water chemistry parameters involves two separate activities. *Field parameters* are measured using a multi-parameter probe as described in Table 1. This is typically one of the first activities performed during a site visit. Temperature, specific conductance, pH, DO and turbidity probes are used at all sites unless deemed unwise by field personnel. Multi-parameter probe (Table 1) data will be recorded on electronic field sheets once the results have been verified as acceptable by the field crew, and stored on the instrument; electronic field sheets will also include any notes about site conditions observed during the measurement or discarded measurements (Table 3).

4.4-Field Instrumentation

Table 1: Field Instruments

Instrument	Procedure	Special Considerations
Oakton Multiparameter 35	Hold in water for 30 seconds	Calibrate monthly
Orbeco B200 Turbidometer	Triple rinse sampling cuvette, index to lowest reading	Calibrate bi-monthly
YSI ProDO DO Meter	Hold in water for 30 seconds	Calibrate Monthly

Table 2: Sampling Equipment

Equipment	Procedure	Special Considerations
Trimble Yuma Tablet	MS Access database	Charge weekly
Trimble Geo XH GPS	Terra Sync GIS	Charge Daily

5.0 Record Keeping

Incidents
Due to the nature of field work, problems may arise in the field that will require corrective action. A person's best professional judgment should be used to correct issues that are not listed in this

document. If a particular issue may interfere with the integrity of data, action must be validated and approved by a Salt Lake County Watershed Scientist/Planner.

Field Sheets

Several different types of field sheets, including electronic, are used in Salt Lake County's data collection. Care must be given to make sure these field sheets are properly handled and filed correctly, either electronically or hard copies. All data is entered in the field at the time of capture and 10% of all entries are randomly checked against field forms at the end of each sampling run for validity.

Table 3: Field Sheets

Field sheet	Handling
MS Access Data sheets	NA
E. *coli* sample sheet	New sheet each sample day, 1 set/month

6.0 Quality Assurance/Control Methods & Requirements

Field personnel are responsible for performing quality control checks on field equipment to ensure proper functionality. Along with routine calibration, duplicate QC samples are taken to double check accuracy. Re-calibration may have to be performed again if the field equipment is reading out of QC range. The following is a list of approved parameter ranges:

Table 4: Quality Control Corrective Actions

Parameter	Range	Corrective Action
Dissolved oxygen	≤ 100 % saturation	Recalibrate, Check Temp coefficient
pH	6.5 – 9.0	Recalibrate
Conductivity	2.00-20.00 ms	Recalibrate, Check Temp coefficient
Temperature	0-50 Celcius	Check temp coefficient, Recalibrate
TDS	0-99.9 ppm	Check TDS Factor, Recalibrate
Salinity	0-99.99 ppm	Recalibrate
Turbidity	.01-1100 NTU	Recalibrate

Following along with the DWQ's Quality Assurance Program Plan, the Salt Lake County utilizes the preceding chart (Table 5) to deal with bias, precision, and accuracy.

Table 5: Quality Control/Quality Assurance

Data Quality Indicator	QC Check/QC Sample	DWQ Goal
Precision	● Field duplicates/replicates ● Laboratory duplicates ● Detection limits	● Water samples: ±20% ● Adopt percent RPD for laboratory duplicates established by the analyzing laboratory. ● Adopt percent RPD for MS/MSD established by the analyzing laboratory

Bias & Accuracy	● Calibration of field water quality instruments ● Utilize pertinent SOPs ● Field/equipment & Trip blanks ● Nutrient split samples	● 100% calibration compliance ● All data collected following SOPs. ● Blank results < detection limit. ● Splits: Sample & QC results should be similar.

RPD: Relative Percent Difference

Data quality assurance reviews (Table 6) will be performed during the sampling time frame. The following outline explains how each review will be executed.

Table 6: Quality Assurance Reviews

Data quality review	QC check	Evaluation criteria	DWQ Goal
Representativeness	● SOPs ● SAP requirements ●Field sheets ● Sample holding times ● Field duplicates ● Blanks	● Field audits ● Adherence to SAP ● Review of sheets ● Holding times ● Meet RPD ● Detection limits	●All data following SOP. ● 100 % SAP compliance ● 100% compliance ● Meet holding times ● Water samples: ±20% for duplicates ● Blank results < detection limit.
Comparability	● SOPs ●Holding times ● Analytical methods ● Frequency & types of QC samples	● Determine adherence to SOPs ● Holding times ●EPA or DWQ approved methods ● Verify	● All data following SOP ● Meet holding times ● 100% use of approved methods ● Evaluate for comparability
Completeness	● Complete sampling	● Percent of valid data	●95% completeness with respect to planned data set

RPD: Relative Percent Difference

7.0 Data Analysis and Reporting

All data collected will be housed within the Salt Lake County's Water Quality Database. In addition, per the request of Utah Division of Water Quality (DWQ) Salt Lake County will share the data, which will be hosted on the DWQ Water Quality database for internal and external use. The data serves as indication for watershed planning purposes. Data that was unable to be collected will not be included within the entire dataset. Depending on the interest of data users, sites may be re-visited to attempt to collect missing data.

The Salt Lake County database is constantly being updated and QA/QC measures are built in to the design of the database. Salt Lake County Uses an MS Access Database set up as a one to many database with the master table being Location ID; this only allows users to enter valid pre-existing site information. All relationships are pre-determined with allowable tolerances built in to the tables thus entries outside those parameters will not be accepted. The new data is downloaded from pre-determined paths so only new data is imported. The database is also backed-up monthly so any systemic errors can only reach back one month.