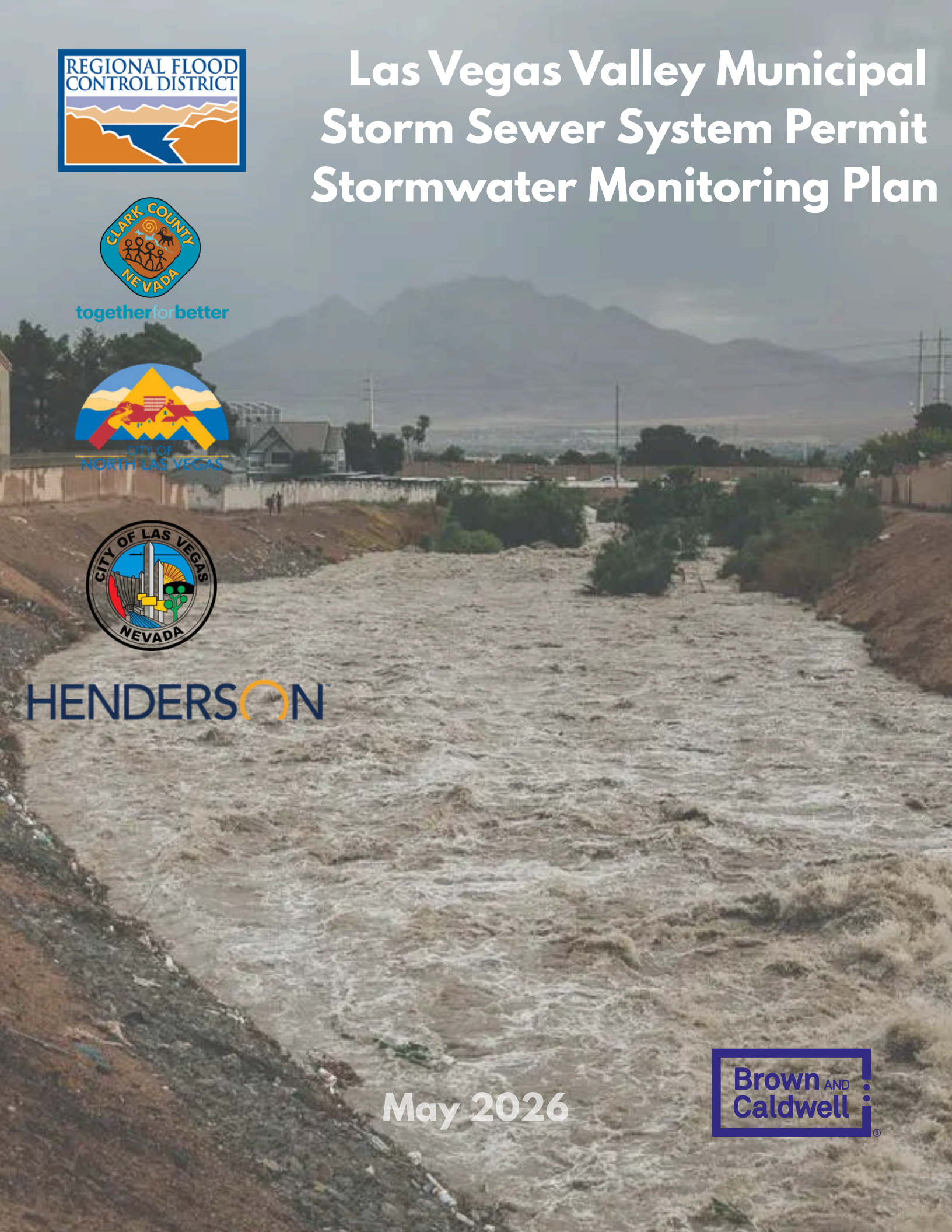

REGIONAL FLOOD CONTROL DISTRICT

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HENDERSON

Las Vegas Valley Municipal Storm Sewer System Permit Stormwater Monitoring Plan

May 2026

Brown AND Caldwell

Las Vegas Valley Municipal Storm Sewer System Permit Stormwater Monitoring Plan

Prepared for the
Stormwater Quality Management Committee
Las Vegas Valley
May 2026

FINAL

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Section 1

Introduction

The Nevada Division of Environmental Protection (NDEP) issued the National Pollutant Discharge Elimination System (NPDES) Permit authorizing discharges from the Municipal Separate Storm Sewer System (MS4) in Las Vegas Valley to the Permittees (Clark County Regional Flood Control District [CCRFCD], Clark County, City of Las Vegas [CLV], City of North Las Vegas [CNLV], and City of Henderson [COH]) on February 5, 2024.

Section B.6.1.1 of the MS4 Permit specifies that "the Permittees shall submit a revised stormwater monitoring plan to the Division for review for this permit within eighteen (18) months of the issuance of this permit." The due date is August 5th, 2025.

Section B.6.1.1.1 and B.6.1.1.2 of the MS4 Permit specifies that "[b]efore the final revised plan is submitted to the Division for approval, the plan shall be made available for public comment for a minimum of thirty (30) days. The Permittees shall respond to significant public comments and the Permittees shall hold a public meeting in accordance with NAC 445A.67558" and "[t]he Permittees shall compile any comments received as part of the process in Section B.6.1.1.2., describe the actions taken in response to the public comments, and include this information in the revised stormwater monitoring plan."

This Draft Stormwater Monitoring Plan was submitted to NDEP on August 1, 2025. Before submittal of the final revised Stormwater Monitoring Plan, the Permittees opened a public comment period from March 30, 2026 to April 30, 2026 and held a public workshop on April 22, 2026 at the CCRFCD offices in accordance with Nevada Administrative Code (NAC) 445A.67558. No comments were received during the public comment period or during the public workshop. The Stormwater Monitoring Plan will be reviewed and updated if needed as part of the Annual Report process.

Section B.6.1.1 of the MS4 Permit also specifies that "the Permittees shall evaluate and update (as necessary) how monitoring may assist in making decisions about program compliance and the appropriateness of identified measurable goals." This evaluation is provided in Section 5 of this report.

Section B.6.1.2 of the MS4 Permit also imposes requirements on how monitoring is conducted. These requirements are identified and responded to in Section 4 of this report.

Section B.5.3.1 of the MS4 Permit specifies that "[t]he updated SWMP shall evaluate characterization data previously submitted and include additional data collected in the same manner and evaluate whether existing data collection programs should be modified to improve characterization of stormwater discharges, effects of BMPs, or ambient water quality. This information shall be submitted for approval as part of the annual monitoring plan required in Section B.6.1." This evaluation is provided in Section 5 in this report.

Section 2

Background

CCRFCD conducts a wet-weather monitoring program for compliance with the MS4 Permit. Sampling is conducted at the following two locations:

- Las Vegas Wash at The Club at Sunrise, approximately 12.1 miles upstream of the confluence at Lake Mead
- Las Vegas Wash at Rainbow Gardens, approximately 3.4 miles upstream of the confluence at Lake Mead

The Las Vegas Wash at The Club at Sunrise is the current name for the site formerly referred to as Las Vegas Wash at Desert Rose. The former title is used in long term data records. The Las Vegas Wash at The Club at Sunrise site is located on the Las Vegas Wash immediately upstream of the Sloan Channel and Las Vegas Wash confluence. This part of the Las Vegas Wash is fully concrete lined. The stormwater sampler actuator is installed about 18 inches above the channel bottom. This sampling location is upstream of all wastewater treatment plant discharges in Las Vegas Valley.

The Las Vegas Wash at Rainbow Gardens site is on the Las Vegas Wash at the upstream end of the Rainbow Gardens Weir, with the actuator installed about 6 to 12 inches above the ordinary water level. It is downstream of all wastewater treatment plants and 99 percent of the watershed area covered by the MS4 permit.

A map of these monitoring sites is shown in Figure 2-1. Photos of both sites are shown in Figure 2-2 through Figure 2-5.

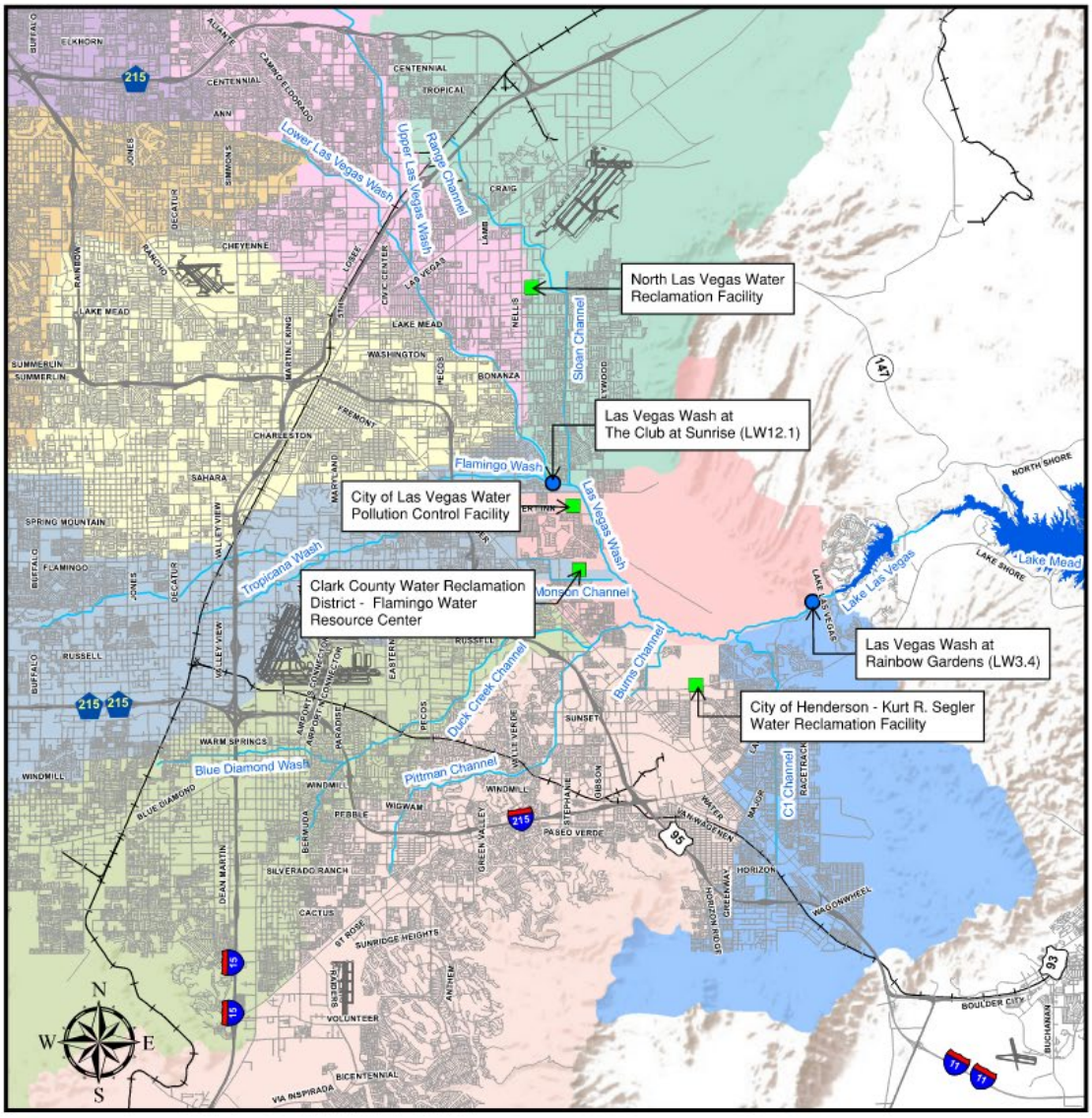

Figure 2-1. Wet weather monitoring locations

Figure 2-2. The Club at Sunrise wet weather monitoring station at the Las Vegas Wash

Figure 2-3. Rain gauge and sampler storage box at Club at Sunrise monitoring station

Figure 2-4. Conduit and strainer during dry weather at Club at Sunrise monitoring station

Figure 2-5. Rainbow Gardens wet weather monitoring station at the Las Vegas Wash

Section 3

Sampling Equipment, Storm Event Tracking, and Collection Protocol

The wet weather sampling objective is to collect samples from up to four sampleable storm events per year from each of the sample sites. A sampleable storm event is usually one having a total rainfall depth of 0.16 inches at any rain gage within the drainage area tributary to a monitoring station. It has been found over time that a storm depth of at least 0.16 inches for a few hours is required to generate sufficient runoff for sampling. Owing to drought conditions, there have been as few as zero samples in a permit year.

Figure 3-1 shows the ISCO 6712 automated samplers used at both monitoring sites for sample collection. Each monitoring station has permanently installed a suction hose, liquid level actuator, and sampler housing. A sampler is sometimes left permanently on-site at Rainbow Gardens. A 12-volt car battery and sampler, when not permanently installed, are transported to the site for each sampling event. Equipment is housed within a locked metal enclosure with a conduit that extends to a strainer box mounted approximately 6 to 18 inches above the base flow depth or channel bottom. The liquid level actuator and suction hose are installed from the sampling unit through the conduit and mounted in the strainer box.

Figure 3-1. Automated sampler at Rainbow Gardens monitoring station

Sampling crews are mobilized to track and gather samples during potentially sampleable storm events. Due to the variability in localized rainfall, both sites are not always sampled during each storm. Each storm is tracked by the amount of rainfall occurring in the watershed tributary to each site. The CCRFCD website (www.ccrfcd.org) is used to view real-time rainfall maps of the Las Vegas Valley. Each map displays the amount of rainfall that has occurred at various sites during different time increments. Additionally, the CCRFCD website and United States Geological Survey (USGS) website (www.waterdata.usgs.gov) are used to view stream flow stage data for numerous gauges in the valley.

The Las Vegas Wash at The Club at Sunrise and the Las Vegas Wash at Rainbow Gardens sites are set up for automated sampling; however, due to equipment malfunctions, samples may be collected as grab samples to be composited following the same method programmed in the automated samplers as described below. Oil and grease and bacteria samples are always collected via grab samples. Sampling crews always follow stringent safety measures and in cases of extreme weather conditions where they may be exposed to significant risk, refrain from attempting to collect a grab sample or check the automated collectors until the conditions are deemed safe.

During a storm event, the automated samplers are activated when the water level in the channel reaches the wire actuator. The samplers are programmed to collect enough water to fill 24 bottles sized at 1,000 milliliters (also called aliquots). Currently, the Las Vegas Wash at The Club at Sunrise site is programmed to collect a sample at 3-minute intervals and the Las Vegas Wash at Rainbow Gardens site is programmed to collect at 5-minute intervals. The 24 aliquots are then combined in a carboy into a composite sample, regardless of whether they were collected as grab or automated samples.

Section 4

Handling and Analysis Protocol

Section B.6.1.2 of the MS4 Permit imposes the following requirements on stormwater monitoring:

- B.6.1.2. Permittees. When the Permittees conduct monitoring at the Permittees' MS4, the Permittees are required to comply with the following:
- B.6.1.2.1. Samples and measurements taken as required herein shall be representative of the volume and nature of the monitored discharge. This requirement does not prevent Permittees from analyzing or reporting samples that are representative of a limited situation (e.g., concentration at peak flow);
- B.6.1.2.2. Test procedures for the analysis of pollutants shall conform to regulations (40 CFR, Part 136) published pursuant to Section 304(h) of the CWA, unless other procedures are approved by the Division.
- B.6.1.2.3. Records of monitoring information shall include:
- B.6.1.2.3.1. The date, exact place, and time of sampling or measurements;
- B.6.1.2.3.2. The names(s) of the individual(s) who performed the sampling or measurements;
- B.6.1.2.3.3. The date(s) analyses were performed;
- B.6.1.2.3.4. The name(s) of the individual(s) who performed the analyses;
- B.6.1.2.3.5. The analytical techniques or methods used; and
- B.6.1.2.3.6. The results of such analyses.
- B.6.1.2.4. Analyses shall be performed by a State of Nevada-certified laboratory. Laboratory reports shall be provided if requested by the Division.
- B.6.1.2.5. If the Permittees perform stormwater monitoring more frequently than required by the stormwater monitoring plan the results of such monitoring shall be reported in the Annual Report.
- B.6.2. Recordkeeping
- B.6.2.1. The Permittees must retain records of all monitoring information, including: all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by this permit, a copy of the NPDES permit, and records of all data used to complete the application for this permit, for a period of at least three (3) years from the termination date of this permit. This period may be extended at the direction of the Division at any time.
- B.6.2.2. The Permittees must submit the records to the Division only when specifically asked to do so. The Permittees must retain a copy of the SWMP required by this permit (including a copy of the permit language) at a location accessible to the Division. The Permittees must make the records, including a copy of the SWMP, available to the public if requested to do so in writing.
- B.6.2.3. For public requests of records, the Permittees may impose a reasonable fee for personnel time and copying expenses.

The samples collected are reasonably representative of the volume and nature of the stormwater discharge. Representativeness is improved by the compositing procedure used to collect samples and by the duration of sample collection, which extends over an hour. A one-to-two-hour collection period is reasonable for storm events in the Las Vegas Valley because those events are of relatively short duration. Samples are composited equally by time rather than adjusted for flow, which is necessary for practical purposes. This compositing practice may also produce some unrepresentativeness.

Stormwater sampling in Las Vegas Valley tends to be near the peak flows. Evaluation of the data has shown that suspended solids and turbidity concentrations are somewhat higher at peak flows at the Club at Sunrise, but not at Rainbow Gardens. There are no samples taken at or near the extreme ends of the storms, when concentrations may be lower. As a result, stormwater samples in Las Vegas Valley may not be perfectly representative of the entire storm. If they are unrepresentative, they are likely to be higher than the true values for the storm, thereby providing some conservatism to the data.

Test procedures conform to regulations. The collected composite sample is poured into bottles provided by the certified laboratory, chilled using ice packs, and promptly delivered to the laboratory for analysis of a variety of constituents that may be present in the stormwater. Table 4-1 provides a breakdown of analyzed constituents and the respective testing method used.

Table 4-1. Constituents to be Analyzed in Wet Weather Samples in 2024-2029 Permit Cycle

Analytical Method	Constituent Analyzed
8260B	2-chloroethyl vinyl ether
SM 2320B	Alkalinity, bicarbonate, carbonate
SM 4500NH3D	Ammonia
SM 5210B	Biological Oxygen Demand
531.2/632	Carbamate pesticides
SM 5220D	Chemical Oxygen Demand (COD)
SM 4500CNE	Cyanide
SM 2510B	Electrical conductivity
SM 9223B	*E. Coli*
Colilert-18	Fecal coliform
Enterolert	Fecal *Streptococcus*
SM 2340B	Hardness
8151A	Herbicides
200.7	Magnesium, sodium, iron, aluminum
SM 5540C	Methylene Blue Active Substances (Surfactants)
245.2	Mercury
300	Nitrate-N, nitrite-N, bromide, sulfate, fluoride
1664A	Oil and grease
525.2, 531.2, 551.1, 556, 625, 8081A, 8082, 8270D	Organics
556	Pesticides, volatile organic compounds

Table 4-1. Constituents to be Analyzed in Wet Weather Samples in 2024-2029 Permit Cycle

Analytical Method	Constituent Analyzed
SM 4500-HB	pH
200.8	Selenium, selenium (dissolved), antimony, barium, beryllium, boron, cadmium, chromium, copper, copper (dissolved), lead, lead (dissolved), arsenic, manganese, nickel, silver, thallium, zinc, zinc (dissolved)
SM 5540C, 425.1	Surfactants
In Situ	Temperature
SM 2540C	Total Dissolved Solids
SM 5310C, 415.3	Total Organic Carbon
Calculation	Total Organic Nitrogen
SM 4500NorgC	Total Kjeldahl Nitrogen
SM 4500PE	Total phosphorus-P, orthophosphate-P
SM 2540D	TSS
SM 2130B, In Situ	Turbidity

As required in Section B.6.1.2.3 of the MS4 Permit, records of monitoring information include: the date, exact place, and time of sampling or measurements; the names(s) of the individual(s) who performed the sampling or measurements; date(s) analyses were performed; name(s) of the individual(s) who performed the analyses; the analytical techniques or methods used; and the results of such analyses.

All constituents are analyzed using Nevada-certified laboratories, except for Method 632 for carbamates. Because there are no Nevada-certified laboratories using Method 632, they are sent to a laboratory certified by a state other than Nevada.

The Permittees keep records of all monitoring information, as required by the MS4 Permit.

Section 5

Evaluation of Characterization Data

An evaluation of characterization data was included in Section 15 of the 2023-2024 Annual Report. Evaluations were conducted on the key constituents: suspended solids and turbidity, nutrients, and dissolved metal data. The evaluation in this report considers more recent data and reaches the following conclusions.

5.1 Suspended Solids and Turbidity

A large part of the Permittees' stormwater management program is directed at the control of sediment, especially the retention of soil onsite. The wet weather monitoring program includes two parameters, TSS and turbidity, which measure sediment suspended in water. EPA and NDEP have repeatedly focused on the transport of sediments and constituents attached to sediments when evaluating stormwater management programs.

Because of concerns about the consistency of TSS and turbidity data, additional data were collected starting in the 2024-2025 permit year. Samples from the carboy were sent to two laboratories for turbidity and TSS analysis. Although samples from the same carboy are assumed to be identical, the particulate nature of suspended solids may make individual samples not identical. Table 5-1 presents the results from the two laboratories.

Table 5-1. Turbidity and TSS Data from Laboratories

Site	Laboratory	February 2025 Data	
		Turbidity (NTU)	TSS (mg/L)
The Club at Sunrise	ASSET Laboratories	680	720
	SGS	1,280	1,130
Rainbow Gardens	ASSET Laboratories	330	610
	SGS	527	370

The results were not consistent. For samples collected at the Club at Sunrise, SGS (formerly named Silver State Analytical Laboratories) produced a turbidity measurement that was almost twice as high as ASSET Laboratories' measurement, and the TSS measurement that was about 50 percent higher. For samples collected at Rainbow Gardens, SGS produced a turbidity measurement that was almost 50 percent higher than ASSET Laboratories' measurement, and the TSS measurement was about 40 percent lower. What these results show is that when standard sampling and analysis procedures are applied, the laboratory results can be dramatically different.

In addition, field crews collected onsite turbidity measurements from the actual water body as aliquots were being collected. Figure 5-1 provides the results for the Club at Sunrise, with the laboratory data superimposed.

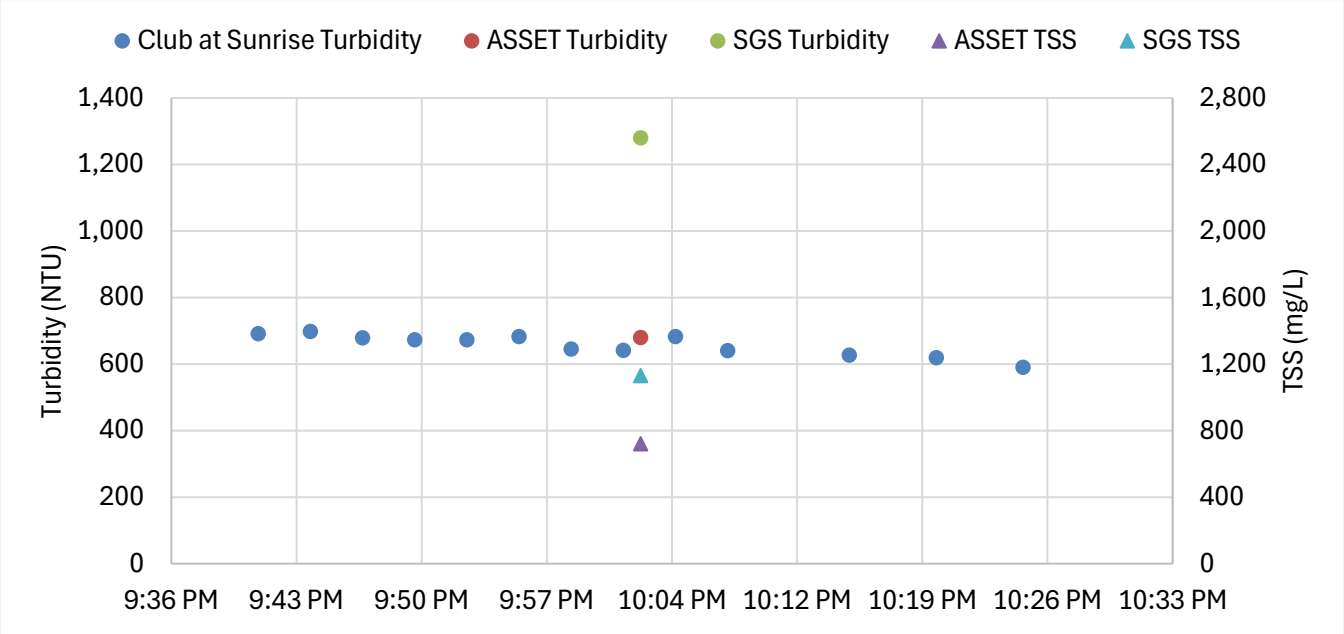

Figure 5-1. Club at Sunrise: Turbidity and TSS data for the February 2025 storm event

The TSS scale was set at twice the turbidity scale consistent with previous analyses showing that TSS is generally twice as high as turbidity in the Las Vegas Valley. The onsite turbidity data varied little from beginning to end. These data add support to the conclusion that sampling data are representative because they tend to show that turbidity levels are consistent over time during a Las Vegas Valley stormwater runoff event. The onsite turbidity data were also consistent with the ASSET Laboratories' turbidity result and the SGS TSS result. However, the ASSET Laboratories' TSS result and the SGS turbidity result were noticeably lower and higher, respectively.

Figure 5-2 provides the results for Rainbow Gardens, with the laboratory data superimposed.

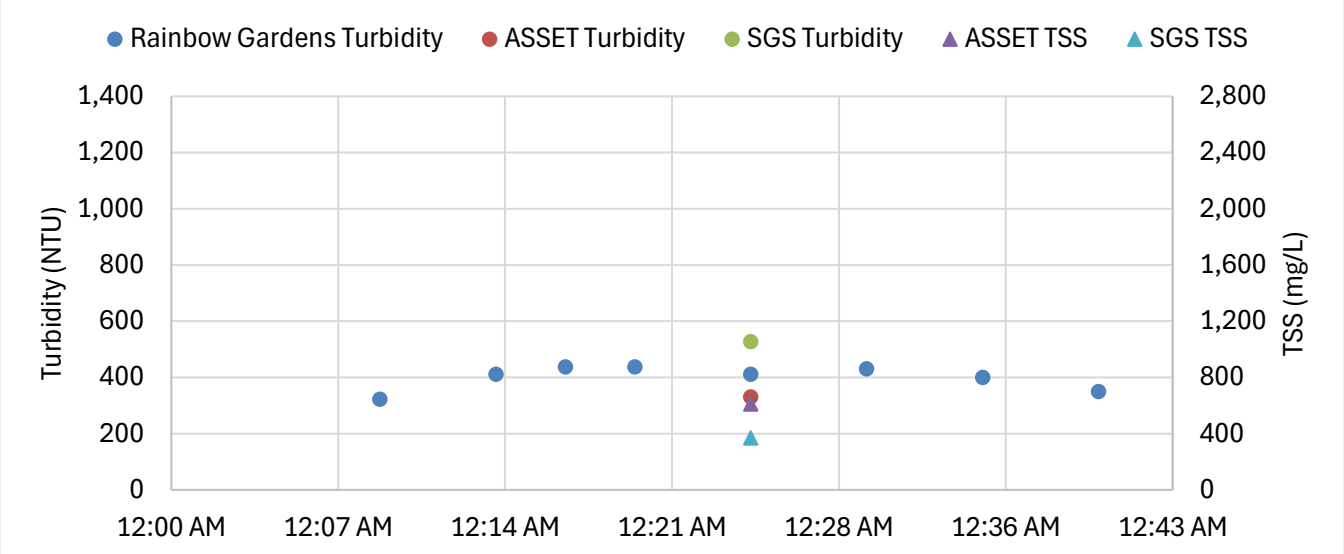

Figure 5-2. Rainbow Gardens: Turbidity and TSS data for the February 2025 storm event

Once again, the onsite turbidity data varied little from beginning to end. The SGS turbidity and ASSET turbidity were reasonably close to the onsite data. The TSS data from both laboratories, however, was somewhat less than the onsite turbidity data. Consistent with the historical data, turbidity at Rainbow Gardens was much lower than turbidity at the Club at Sunrise. These data support previous conclusions that the erosion control structures and bank stabilization protect lower Las Vegas Wash.

These additional data from 2025 show that there continue to be differences between laboratory measured TSS and turbidity data. On the other hand, these data provide some reassurance that repeated measurements of turbidity during the sampling interval can provide consistent results. Additional data will be collected during the 2025-2026 permit year to ascertain whether additional data are helpful.

The main conclusions for the evaluation of suspended solids and turbidity data include:

- There is a tight relationship between TSS concentrations and turbidity levels in the majority of samples.
- TSS concentrations and turbidity levels do not increase with increased flows, apparently because of the extensive channel lining, regional detention basins, and erosion control structures in the Las Vegas Valley.
- No additional monitoring stations are needed for the Las Vegas Valley. The Club at Sunrise location effectively monitors stormwater conditions upstream of the wastewater treatment plants, and the Rainbow Gardens location effectively monitors stormwater conditions for the whole of the Las Vegas Valley.
- TSS concentrations and turbidity levels are not consistently higher on the rising arm of the hydrograph as compared with peak flow and the falling arm.
- TSS concentrations and turbidity levels do not substantially increase when there are long dry periods. The absence of an upwards trend may be explained either by the effectiveness of the Permittees' street sweeping program and debris cleanout, and/or because material buildup is not a significant source of solids in stormwater.
- The stormwater management program for the Las Vegas Valley is highly effective. Median TSS concentrations at Rainbow Gardens are 1/20th of the background concentrations for the Mojave Basin and Range.
- TSS concentrations and turbidity levels from the Las Vegas Valley are not having a significant effect on lower Las Vegas Wash or Lake Mead.

5.2 Nutrients

Phosphorus and nitrogen are the nutrients that are the focus of most nutrient monitoring programs since they are most likely to affect algal growth. The dissolved fraction of nutrients (orthophosphate and dissolved nitrogen) is of special interest because dissolved nutrients are more likely to be available to algae and can be a concern if they produce nuisance algal blooms. Most of Lake Mead is oligotrophic, which means that there are few nutrients available to grow algae, fish, or other aquatic life. Lake Mead is also considered phosphorus-limited; therefore, the focus of wet weather nutrient monitoring is orthophosphate.

The main conclusions for the evaluation of nutrients data include:

- Lake Mead and Las Vegas Wash are not sensitive to nutrients in stormwater.
- Orthophosphate concentrations do not substantially increase when there are long dry periods. The absence of an upwards trend may be explained either by the effectiveness of the Permittees' street sweeping program and debris cleanout, and/or because there is not an overuse of phosphate fertilizer.

5.3 Dissolved Metals

EPA reports that all metals can be toxic to fish at high concentrations. The three metals typically focused on for fish toxicity are dissolved copper, dissolved lead, and dissolved zinc, which have an inverse relationship with hardness. EPA has established recommended water quality criteria for dissolved metals, generally based on four-day and 30-day bioassays. In Las Vegas Wash, there are no fish at the Club at Sunrise sampling location, and that location is not classified for fish. Bioassays used to generate the data on which EPA water quality criteria are based are generally four days for acute toxicity and 30 days for chronic toxicity. In the lower Las Vegas Wash, however, fish are not exposed to stormwater for 30 days or even four days, because stormwater flows out of the Las Vegas Valley very quickly. In Nevada, water quality standards often set a one-hour time limit for acute toxicity, even though the criteria are based on four-day bioassays. In Lake Mead, however, fish are not likely to be exposed to stormwater from Las Vegas Valley for even one hour, because the stormwater is highly diluted and occupies only a small part of Lake Mead. There have been no fish kills at any time in the lower Las Vegas Wash or Lake Mead that were attributed to stormwater.

The main conclusions for the evaluation of dissolved metals data include:

- Dissolved metals do not substantially increase when there are long dry periods. The absence of an upwards trend may be explained either by the effectiveness of the Permittees' street sweeping program and debris cleanout, and/or because material buildup is not a significant source of dissolved metals in stormwater.
- Dissolved metals in stormwater come from widely distributed sources, rather than a few localized sources.

5.4 How Monitoring May Assist in Decision-Making

The Permittees' evaluations of the wet weather monitoring data have provided answers to questions about whether increased intervals between storms results in long-term buildup, whether high flows produce concentrations different from low flows, whether there is a first flush effect, whether concentrations in the Las Vegas Valley exceed background levels, whether existing measurable goals are appropriate, and generally whether additional actions are needed. These data have shown that the Permittees' stormwater management program is highly effective and that no additional measurable goals are needed. The continuation of the existing monitoring program will continue to provide these answers in the future.

5.5 Overall Conclusions

The main conclusions for the evaluation of wet weather characterization data include:

- There are an appropriate number of monitoring stations and they are appropriately located.
- Although the amount of data is limited by the number of sampleable storms, the amount of data collected is sufficient to inform the issues considered in this evaluation.
- Samples collected are sufficiently representative of conditions in Las Vegas Valley.

- The stormwater management program for the Las Vegas Valley is highly effective. Turbidity and suspended solids are far lower than background levels, nutrients in stormwater are not causing algal problems, and dissolved metals are not harming fish.