Rationale for Proposed Revisions to Water Quality Standards for Channels Tributary to Las Vegas Wash

R115-22

Prepared by:

Nevada Division of Environmental Protection
Bureau of Water Quality Planning

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Acronyms and Abbreviations

40 CFR	Title 40, Code of Federal Regulations
95^{th}%	95^{th} percentile
AQL	Aquatic life
BMP	Best management practices
CCRFCD	Clark County Regional Flood Control District
CCWRD	Clark County Water Reclamation District
cfs	Cubic feet per second
cfu/100 mL	Colony-forming units per 100 milliliters
CPP	Continuing Planning Process
CRBSCF	Colorado River Basin Salinity Control Forum
CWA	Clean Water Act
DEQ	Department of Environmental Quality
DO	Dissolved oxygen
EPA	U.S. Environmental Protection Agency
HAU	Highest attainable use
IND	Industrial
IRR	Irrigation
MAR	Marsh
MDS	Municipal or domestic supply
µg/L	Micrograms per liter
mg/L	Milligrams per liter
NAC	Nevada Administrative Code
NDEP	Nevada Division of Environmental Protection
PWL	Propagation of wildlife
RMHQ	Requirement to maintain higher quality
RNC	Recreation not involving contact with water
RWC	Recreation involving contact with water
SNWA	Southern Nevada Water Authority
SpC	Specific conductance
TDS	Total dissolved solids
TMDL	Total maximum daily load
TSS	Total suspended solids
UAA	Use attainability analysis
USGS	U.S. Geological Survey
WLS	Watering of livestock
WRF	Water reclamation facility

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1.0 Introduction

Water quality standards regulations promulgated by the U.S. Environmental Protection Agency (EPA) at Title 40, Code of Federal Regulations (40 CFR) 131.11(a)(1) require states to adopt protective criteria that are based on established scientific rationale. Section 303 of the Clean Water Act (CWA) requires that states periodically review and, as appropriate, modify water quality standards. The Nevada Division of Environmental Protection (NDEP) is proposing herein to amend Nevada Administration Code (NAC), by creating a separate water quality standards table for channels tributary to the Las Vegas Wash that are currently covered under NAC 445A.2156 via NAC 445A.1239, the "tributary rule."

The following includes proposed revisions and rationale to designate water quality standards for certain channels tributary to the Las Vegas Wash. The regulatory petition with the proposed changes is attached as **Appendix A** to this rationale document.

2.0 Background – Las Vegas Wash and Tributary Channels

Las Vegas Wash is the main stem of the Las Vegas Valley drainage system that discharges into Las Vegas Bay of Lake Mead. The drainage area includes the cities of Las Vegas, North Las Vegas, Henderson, and the greater metropolitan area. The average flow of the Las Vegas Wash, as measured at or near Northshore Road, has increased from about 60 cubic feet per second (cfs) in 1973 to 320 cfs in 2018. This trend reflects the continuing population growth in the Las Vegas Valley. The City of Las Vegas, the City of North Las Vegas, and the Clark County Water Reclamation District (CCWRD) discharge treated wastewater into Las Vegas Wash about 11 miles upstream of Las Vegas Bay. The City of Henderson's effluent discharge enters Las Vegas Wash approximately 7 miles from the Inner Las Vegas Bay. Today's Las Vegas Wash is an effluent-dominated stream[1] in the middle and lower reaches.

2.1 Reaches

The Las Vegas Wash is currently divided into three reaches or assessment units (**Figure 1**). The upper reach (NV13-CL-45_00) begins at the origin, and ends at the confluence of Sloan Channel and Las Vegas Wash. The middle reach (NV13-CL-05_00) begins at the confluence of Sloan Channel and Las Vegas Wash and extends to a feature known as the "Historic Lateral." This segment encompasses the discharge from the City of North Las Vegas water reclamation facility (WRF), the City of Las Vegas WRF, the Clark County WRF, and the City of Henderson WRF. The lower reach (NV13-CL-06_00) begins at the Historic Lateral and extends downgradient to Lake Mead. The standards table under NAC 445A.2156 provides the beneficial uses and criteria for middle reach of Las Vegas Wash. Via the "tributary rule," these standards are carried upstream to apply to the tributary channels discussed herein. NAC 445A.2158 provides the water quality standards for the lower reach (assessment unit NV13-CL-06_00). The upper segment of the Las Vegas Wash (NV13-CL-45_00) is covered under NAC 445A.2156 via NAC 445A.1239.

[1] A stream characterized by >80% of flow due to treated effluent for more than 300 days per year.

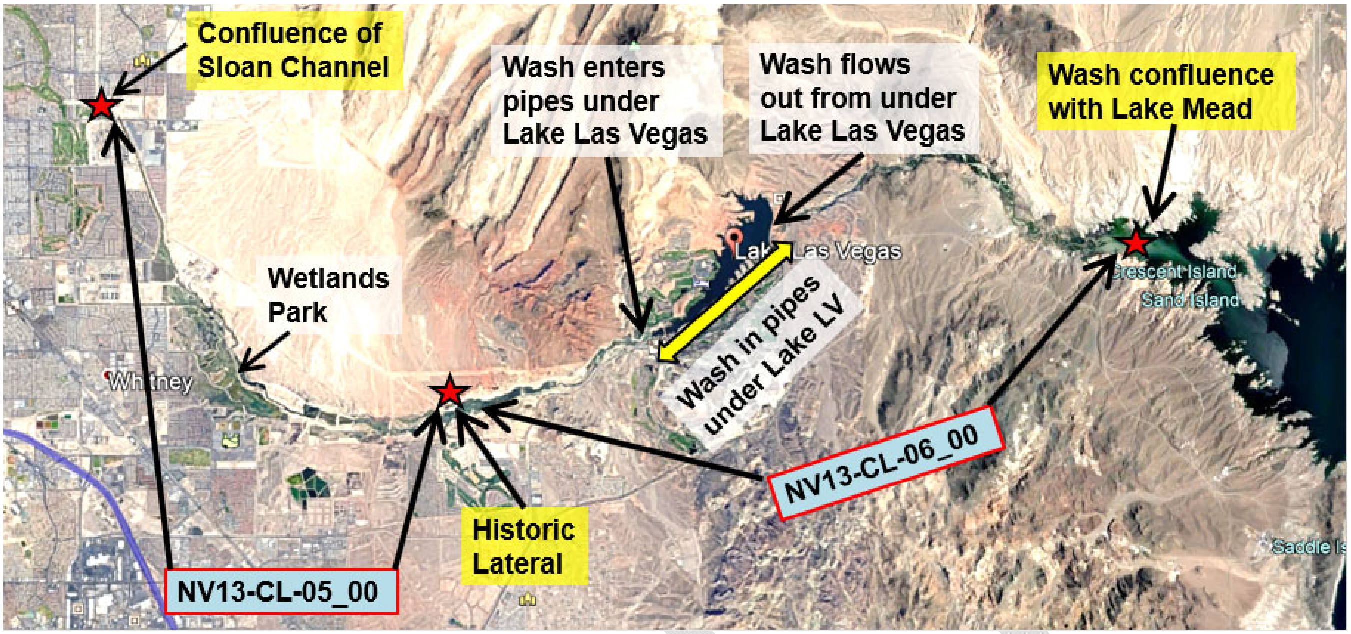

Figure 1. Segments NV13-CL-05_00 and NV13-CL-06_00 of Las Vegas Wash are downstream of WRF discharges; Upper Las Vegas Wash is upstream of the Sloan Channel confluence.

2.2 Current Water Quality Standards Applied to Tributary Channels via NAC 445A.1239

The channels tributary to Las Vegas Wash have never been adopted as designated waters by the Division, so have never had a designated water quality standards table in the NAC. Instead, the beneficial uses and criteria of the Las Vegas Wash (NAC 445A.2156) have been extended to these channels by applying NAC 445A.1239 (Control Points), which is informally known as the "tributary rule." The standards extended upstream have been used to assess water quality in the tributary channels, but the beneficial uses and associated criteria are not appropriate for these channels.

> **NAC 445A.1239 Control points: Prescription and applicability of numerical standards for water quality; designation of beneficial uses**. (NRS 445A.425, 445A.520)
>
> 1. Control points are locations where water quality criteria are specified. Criteria so specified apply to all surface waters of Nevada in the watershed upstream from the control point or to the next upstream control point or to the next water named in NAC 445A.123 to 445A.2234, inclusive.
> 2. If there are no control points downstream from a particular control point, the criteria for that control point also apply to all surface waters of Nevada in the watershed downstream of the control point or to the next water named in NAC 445A.123 to 445A.2234, inclusive.
> 3. Each standard is set to protect the beneficial use which is most sensitive with respect to that particular standard.
> 4. NAC 445A.1242 to 445A.2234, inclusive, prescribe numerical standards for water quality and designate beneficial uses at particular control points

Two reaches of the Las Vegas Wash (and by extension, all channels tributary to such) currently have the beneficial uses and criteria assigned under **NAC 445A.2156**.

> **NAC 445A.2156 Colorado Region: Las Vegas Wash at Telephone Line Road.** (NRS 445A.425, 445A.520) The limits of this table apply to the body of water known as the Las Vegas Wash from the confluence of the discharges from the City of Las Vegas and Clark County wastewater treatment plants to the Historic Lateral. This segment encompasses the discharge from the City of Henderson wastewater treatment plant. This segment of the Las Vegas Wash is located in Clark County.

The nature of the tributary and upstream flows is radically different from the flows downstream of the WRF discharges, which have created an effluent-dominated stream. This highly treated effluent has turned Las Vegas Wash into a perennial stream (~300 cfs), with habitat for fish and other aquatic organisms. In contrast, low flows and the concrete lining throughout much of the tributary system demonstrate that the beneficial uses and criteria under NAC 445A.2156 are not appropriate for the tributary channels. This rationale document and the accompanying petition set forth beneficial uses and criteria that are better suited to these channels.

Tributary channels to be covered under the proposed water quality standards table include Duck Creek from origin to the lower weir just upstream of the confluence with Las Vegas Wash, Flamingo Wash (origin to confluence with Las Vegas Wash), Las Vegas Creek (origin to confluence with Las Vegas Wash), Pittman Wash (origin to confluence with Duck Creek), Sloan Channel (origin to confluence with Las Vegas Wash), Tropicana Wash (origin to confluence with Las Vegas Wash), and upper Las Vegas Wash (origin to confluence with Sloan Channel. There are additional minor drainages and channels tributary to the Las Vegas Wash; however, these drainages are not monitored, so are not included.

2.3 Lower Duck Creek

The median dry-weather flow (8.6 cfs) in Duck Creek is the highest measured for all tributary channels. The segment of Lower Duck Creek from below the confluence with Pittman Wash at Broadbent Boulevard (site DC-1) down to its confluence with the Las Vegas Wash (site DC-0) is called out as an unlined portion of the channel. Carp and sunfish were observed in this lower segment during the May 2021 field work by CCRFCD consultants. However, one or two weirs that will act as barriers to fish migration up Duck Creek are planned to bid for construction in 2024 (**Figures 2a and 2b**).

Although there is some habitat in the unlined portion between sites DC-1 and DC-0 (**Figure 3**), the shallow low flows in any tributary channel may routinely exceed 34^{o}C in the heat of summer. The effluent-dominated flow in the Las Vegas Wash provides better habitat, as well as more consistent flow than any of the tributary channels. The construction of the weirs at the lower end of Duck Creek (near its confluence with Las Vegas Wash) should eliminate migration of fish into Duck Creek. The next flood event is likely to flush out any small fish remaining upstream in the tributary channels.

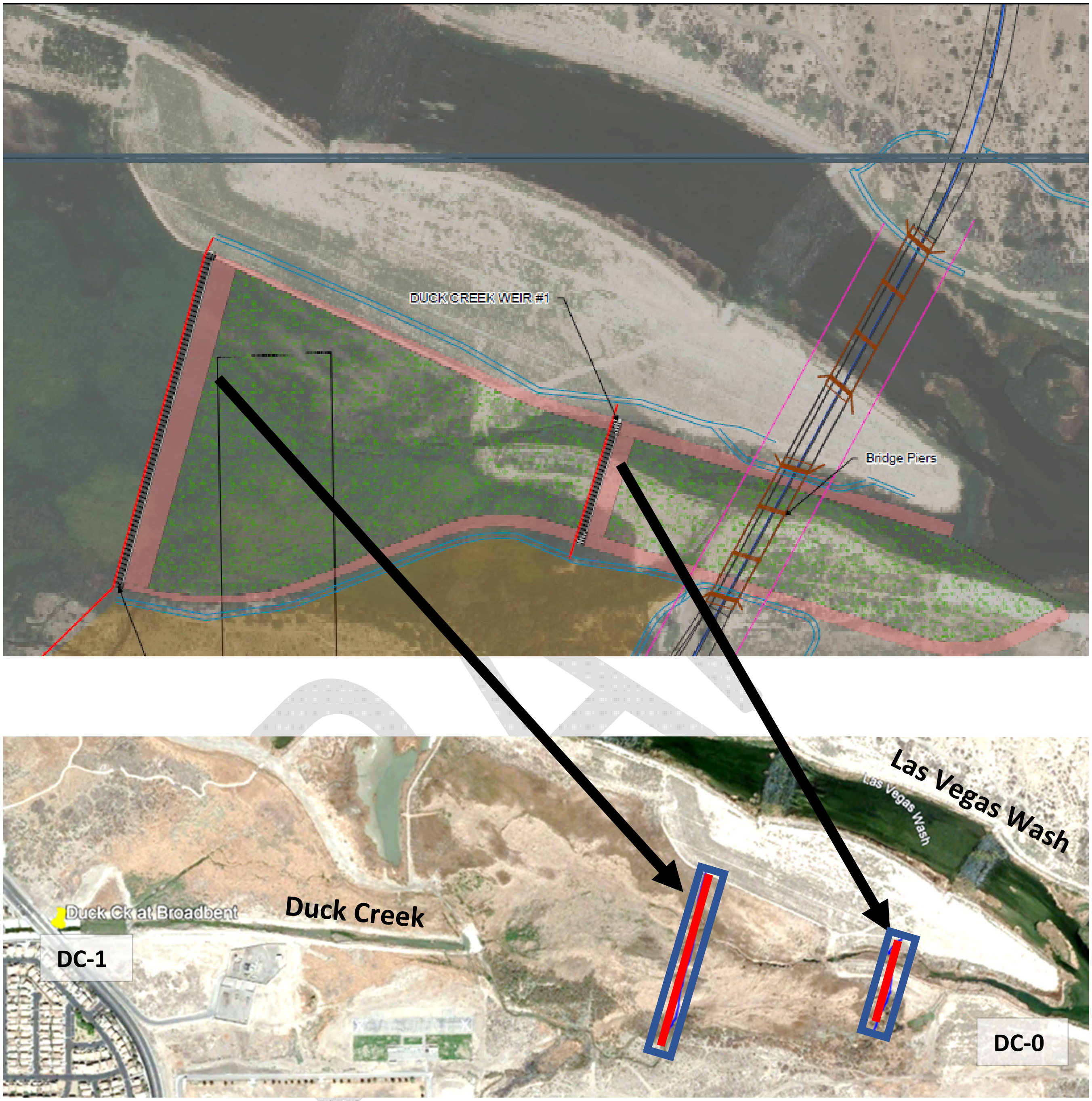

Figure 2a, 2b. Planned weirs on lower Duck Creek, showing the lower section of Duck Creek from site DC-1 (Duck Creek at Broadbent Boulevard) to DC-0 (Duck Creek confluence at Las Vegas Wash), and the two weirs planned for construction bid in 2024.

Figure 3. Lower Duck Creek, view downstream from sampling site DC-1. (Photo by CCRFCD.)

3.0 Engineering of the Tributary Channels in Las Vegas

Prior to the development of the metropolitan Las Vegas, the washes across the valley were primarily dry, ephemeral channels that routed flood waters to Las Vegas Wash and into the Colorado River system. Early in the city's history, the channels remained dry except during heavy rainstorm events. Minor rainstorms saw precipitation quickly infiltrate into the dry dirt channels, and consistent flow into Las Vegas Wash was absent. However, as the city grew and the extent of impervious surfaces increased, monsoon flooding events in the 1970s and early 1980s made clear the need to address flooding in the growing city. After a series of high profile floods, the Clark County Regional Flood Control District (CCRFCD) was established in 1985 to provide a coordinated response to flooding, and to improve drainages through the valley to protect life and property.

Historically, the unlined channels allowed flood waters to spill out across the landscape, and migrate across the alluvial fans; this became a problem after streets and homes covered the landscape. Therefore, a major portion of the work instituted by CCRFCD was to create a system of confined channels that would efficiently contain and divert flood waters into the channels. Beginning in the late 1980s, the CCRFCD began the process of modifying the ephemeral washes and converting these channels into a system of concrete-lined flood-conveyance structures. Channels were straightened to align with streets and lined with concrete to better contain and direct flood flows (**Figure 4**).

Figure 4. Engineered tributary channel in Las Vegas, showing dry-weather flow and a lack of habitat.

As the city continued to grow, dewatering increased to remove shallow groundwater from subgrade construction, and dry-weather flows to the tributary channels increased somewhat. Large detention basins were constructed to offset flood runoff from the city (**Figure 5**).

Figure 5. Angel Park detention basin. (Photo by CCRFCD.)

As of 2022, 103 detention basins have been added to the flood-control system, and another 53 basins have been proposed. Listed under “conveyance facilities” are 219 miles of concrete-lined channels completed, and another 169 miles proposed; 140 miles of natural channels completed, and another 15 miles proposed; and 310 miles of storm drains, and another 144 miles proposed. As of early 2022, the CCRFCD master plan was currently about 75 percent complete, and it is estimated that the plan will take another 30 years to complete. A map showing completed and proposed work is available on CCRFCD’s website at: https://gustfront.ccrfcd.org/vsjs/vs.html .

3.1 Current Flow Status of Selected Tributary Channels

The previously ephemeral unlined washes now contain a perennial flow of nuisance water, following placement of the concrete lining and expansion of impermeable surfaces throughout the metropolitan area. Over-irrigation of vegetation and dewatering of underground parking garages and other structures, as well as increased discharges from springs and shallow groundwater, provide a limited, but continuous, flow in the concrete-lined channels. The tributary channels within the valley currently have median dry-weather flows ranging from <1 cfs to a high of 8.6 cfs at Duck Creek.

The dry-weather flows in the engineered channels now largely reflect the chemistry of shallow groundwater. Shallow groundwater in the Las Vegas Valley typically contains high concentrations of boron, fluoride, selenium, and total dissolved solids (TDS). Shallow groundwater discharges and seepage are key contributors to the poor water quality of dry-weather flows in the tributary channels. CCRFCD (2020) reported some of the sources that lead to such impairments in the flood-conveyance channels that are tributary to Las Vegas Wash (**Table 1**).

Table 1. Sources of boron, fluoride, selenium, and TDS to the Las Vegas Wash system.

Source: Las Vegas Valley NPDES Municipal Stormwater Discharge Permit (2020), Annual Report 2019-2020.

Constituent	Constituent Sources in the Las Vegas Valley	Direct or Indirect Effects of MS4 Discharges
Boron	Flow through native subsurface soil	**Indirect:** Increased urban baseflow may recharge upper portions of shallow aquifers and force high-boron groundwater into the MS4, which carries it to the impaired segments
Fluoride	Flow through native subsurface soil	**Indirect:** Increased urban baseflow may recharge upper portions of shallow aquifers and force high-fluoride groundwater into the MS4, which carries it to the impaired segments
pH	Flow through native subsurface soil	**Indirect:** Increased urban baseflow may increase flow through high pH soils, contributing to high pH during dry weather conditions **Direct:** Potentially contaminated runoff enters the MS4 and discharges to surface waters
Selenium	Flow through native subsurface soil. Resurfacing shallow groundwater	**Indirect:** Increased urban baseflow may recharge upper portions of shallow aquifers and force high-selenium groundwater into the MS4, which carries it to the impaired segments
TDS	Flow through native subsurface soil. Resurfacing shallow groundwater	**Indirect:** Increased urban baseflow may recharge upper portions of shallow aquifers and force high-TDS groundwater into the MS4, which carries it to the impaired segments

3.2 Chemistry of Dry-Weather and Wet-Weather Flows

In contrast to the dry-weather flows described above, wet-weather monsoon flows in the tributary channels are dominated by rapid surface runoff that overwhelms the contributions from shallow groundwater. These wet-weather flows were found to rarely exceed the water quality standards for selenium in the Las Vegas Wash; however, high concentrations of bacteria are typically associated with flood flows. Monsoon rains can result in flash-flood flows throughout the system (**Figure 6**).

Figure 6. Flood Flows in Upper Las Vegas Wash at Cheyenne Street in Las Vegas. (Photo by CCRFCD.)

3.2.1 Chemistry of Dry-Weather Flows

Boron, selenium, and TDS are elevated in the shallow groundwater, which dominates dry-weather flow conditions in the tributary channels. In reviewing CCRFCD data and comparing median values for decades of data, dry-weather flows have higher average concentrations of arsenic, boron, nitrate, selenium and TDS. These five parameters were found at average concentrations from 1.3 to 4.1 times the average concentrations in wet-weather flows (**Table 2**).

Table 2. Dry-weather flows reflect the chemistry of shallow groundwater, 1991-2018

Parameter	Units	Median Dry	Median Wet	Dry/Wet Ratios
Arsenic	**mg/L**	**0.014**	**0.011**	**1.3**
Boron, total	**mg/L**	**1.4**	**0.34**	**4.1**
Cadmium, total	mg/L	0.00011	<0.0008	0.1
Chromium, total	mg/L	0.0012	0.0137	0.1
Copper, dissolved	mg/L	0.0014	0.01	0.1
Copper, total	mg/L	0.0021	0.0335	0.1
Fecal	cfu/100 mL	404	17,165	0.0
Fecal coliform	cfu/100 mL	688	115,165	0.0
Kjeldahl (TKN)	mg/L	0.5	2.9	0.2
Lead, dissolved	mg/L	0.00025	<0.0005	0.5
Lead, total	mg/L	0.00055	0.0162	0.0
Mercury	mg/L	<0.00002	0.0002	na
Nickel	mg/L	0.0034	0.017	0.2
Nitrate-N	**mg/L**	**4.4**	**2.8**	**1.6**
Orthophosphate-P	mg/L	0.0093	0.14	0.1
pH	SU	8.28	7.6	1.1
Selenium	**mg/L**	**0.013**	**<0.005**	**2.6**
Silver	mg/L	0.0003	<0.0005	0.6
Total Dissolved Solids	**mg/L**	**3,553**	**1,020**	**3.5**
Total Phosphorus	mg/L	0.02	0.77	0.0
Total Suspended Solids	mg/L	12	665	0.0
Turbidity	NTU	1.38	322	0.0
Zinc, dissolved	mg/L	0.007	0.02	0.4
Zinc, total	mg/L	0.011	0.14	0.1

Notes: mg/L = milligrams per liter, cfu/100 mL = colony-forming units per 100 milliliters, SU = standard units, NTU = nephelometric turbidity units, na = not applicable. Data from CCRFCD (2018).

3.2.2 Chemistry of Wet-Weather Flows

In contrast to dry-weather flows, wet-weather flows (**Table 3**) reflect the chemistry of urban runoff, because the volume of water during flooding greatly dilutes constituents found naturally in the dry-weather flows. However, flood waters also typically contain high concentrations of bacteria, with median wet-weather flows containing orders of magnitude more bacteria (fecal = 17,165 cfu/100 mL) than median dry-weather flows (fecal = 404 cfu/100 mL) (CCRFCD data, 2018). But, Nevada regulations explicitly suspend water quality standards during extreme flow events,[2] per NAC445A.121 (8), so flood-stage and no-flow data are not used in assessments of water quality.

[2] Nevada's Continuing Planning Process (CPP) defines extreme flow as the high or low 7Q10 (NDEP, 2004).

Table 3. Wet-weather flows reflect the chemistry of urban runoff, 1991-2018

Parameter	Units	Median Dry	Median Wet	Wet/Dry Ratios
Arsenic	mg/L	0.014	0.011	0.8
Boron, total	mg/L	1.4	0.34	0.2
Cadmium, total	**mg/L**	0.00011	**0.0008**	**7.3**
Chromium, total	**mg/L**	0.0012	**0.0137**	**11.4**
Copper, dissolved	**mg/L**	0.0014	**0.01**	**7.1**
Copper, total	**mg/L**	0.0021	**0.0335**	**16.0**
Fecal	**cfu/100 mL**	404	**17,165**	**42.5**
Fecal coliform	**cfu/100 mL**	688	**115,165**	**167.4**
Kjeldahl (TKN)	**mg/L**	0.5	**2.9**	**5.8**
Lead, dissolved	**mg/L**	0.00025	**0.0005**	**2.0**
Lead, total	**mg/L**	0.00055	**0.0162**	**29.5**
Mercury	mg/L	<0.00002	0.0002	na
Nickel	**mg/L**	0.0034	**0.017**	**5.0**
Nitrate-N	mg/L	4.4	2.8	0.6
Orthophosphate-P	**mg/L**	0.0093	**0.14**	**15.1**
pH	SU	8.28	7.6	0.9
Selenium	mg/L	0.013	<0.005	0.4
Silver	**mg/L**	0.0003	**0.0005**	**1.7**
Surfactants	**mg/L**	0.0605	**0.18**	**3.0**
Total Dissolved Solids	mg/L	3,553	1,020	0.3
Total Phosphorus	**mg/L**	0.02	**0.77**	**38.5**
Total Suspended Solids	**mg/L**	12	**665**	**55.4**
Turbidity	**NTU**	1.38	**322**	**233.3**
Zinc, dissolved	**mg/L**	0.007	**0.02**	**2.9**
Zinc, total	**mg/L**	0.011	**0.14**	**12.7**

Notes: mg/L = milligrams per liter, cfu/100 mL = colony-forming units per 100 milliliters, SU = standard units, NTU = nephelometric turbidity units, na = not applicable. Data from CCRFCD (2018).

3.3 Water Quality in Flood-Conveyance Channels Tributary to Las Vegas Wash

A recent assessment of surface water quality (NDEP 2022) applied the "tributary rule" to carry the water quality standards for Las Vegas Wash up into the tributary channels. The water quality in these channels was found to be impaired for the following beneficial uses and parameters (**Table 4**.).

- Aquatic Life (AQL) – Selenium, pH, iron, total suspended solids (TSS), temperature
- Irrigation (IRR) – Boron, fluoride, selenium
- Recreation not involving contact with water (RNC) – E. coli
- Watering of Livestock (WLS) –TDS

Table 4. Assessment Units under NAC 445A.2156, and Impaired Uses in 2020-2022 Assessment (NDEP 2022).

NAC	Waterbody ID	Waterbody Name	Beneficial Uses Impaired	2020-2022 Assessment
2156	**NV13-CL-05_00**	**Las Vegas Wash at the historic lateral**		**1 - All Supported**
2156	NV13-CL-39_00	Flamingo Wash	AQL, IRR	5 - TMDL Needed
2156	NV13-CL-40_00	Sloan Channel	AQL, IRR	5 - TMDL Needed
2156	NV13-CL-42_00	Duck Creek	AQL, IRR, WLS	5 - TMDL Needed
2156	NV13-CL-43_00	Tropicana Wash	nd	3 - Insufficient Data
2156	NV13-CL-44_00	Las Vegas Creek	AQL	5 - TMDL Needed
2156	NV13-CL-45_00	Las Vegas Wash above Treatment Plants	AQL, IRR, RNC, WLS	5 - TMDL Needed
2156	NV13-CL-49_00	Pittman Wash	AQL, IRR, WLS	5 - TMDL Needed

Notes: AQL = aquatic life, IRR = irrigation, RNC = noncontact recreation, WLS = watering of livestock, nd = no data.
Note that the Las Vegas Wash segment at the historic lateral (below the WRF discharge) shows no impairments.

4.0 Beneficial Uses

Beneficial use standards are established at a value to protect the most sensitive beneficial use, taking into account the likelihood of impacting other beneficial uses downstream, natural background conditions, and "existing uses"[3] since November 28, 1975.

In 1950, the population of Las Vegas was 35,000; by 1970, it was 240,000. Aerial photos from the late 1970s show alluvial fans and sprawling ephemeral channels outside of the initial core of the city. In 1990, the population was 804,000; and by 2020, the population had grown to 2,839,000. The city went from ephemeral alluvial channels in the early 1970s to destructive flash floods during monsoon storm events in the rapidly growing city, as the extent of impervious surfaces expanded.

As described in Section 3.0, the CCRFCD was created in 1985, and began creating today's concrete-lined flood-conveyance system. The ephemeral tributary channels were converted to engineered channels that now carry a small perennial flow of "nuisance water." There is limited opportunity for aquatic life to become established, as the concrete lining of these channels creates an inhospitable environment. Based on the evidence, there have been no "existing uses" of aquatic life (AQL) or and recreation involving contact with the water (RWC), which assumes immersion, since or after November 28, 1975, and current conditions prevent either use from being possible in the future.

The transition from ephemeral alluvial channels winding across the empty desert as recently as the 1960s, to engineered, concrete-lined flood-conveyance structures that carry minimal dry-weather flow, has limited the development of suitable aquatic habitat in the channels tributary to the Las Vegas Wash. AQL and RWC are not appropriate beneficial uses for these channels.

[3] "Existing uses" are defined by EPA as uses that were actually existing after November 28, 1975. See text box above.

4.1 Designating Uses Not Including AQL and RWC

The beneficial uses identified in CWA section 101(a)(2) describe a national goal that, wherever attainable, water quality provides for the protection and propagation of aquatic life (i.e., Nevada's designated use, AQL), and recreation in and on the water (i.e., Nevada's designated use, RWC). Beneficial uses are being designated for the tributary channels for the first time, and these uses do not include AQL or RWC. As noted by EPA (2021), if designating beneficial uses on a waterbody for the first time, a "use attainability analysis" (UAA) is necessary if those uses do not include AQL or RWC. (See EPA UAA website at https://www.epa.gov/wqs-tech/use-attainability-analysis-uaa for more information, 2022).

What are designated, existing, and attainable uses?

Designated uses are specifically assigned (designated) to a water body in the Nevada Administrative Code (NAC) for protection under the water quality standards.

- Designated uses may or may not be existing uses.
- After a use is designated in a state's standards, it receives specific regulatory protection.
- A UAA can be used to remove or modify designated uses, but only if they are not existing and not attainable uses.

Existing uses are those in existence on or after November 28, 1975, whether or not they have been designated in the NAC.

Attainable uses are those that can be attained by effluent limitations for point sources and cost-effective best management practices for nonpoint sources.

EPA also specifies that for a water being designated for non-101(a)(2) compliant uses (131.10(g)), the following information is needed:

- The specific waterbodies covered by the use
- A demonstration that 101(a)(2) uses are not existing uses
- A description of the existing uses of the segment under consideration
- A description of the water quality necessary to protect the existing uses (131.10(g), 31.12(a)(1))
- A UAA consistent with 40 CF 131.3(g) showing
  - why the 101(a)(2) uses are not attainable for the waterbody (131.10(j)(1))
  - why the 101(a)(2) uses cannot be attained by implementing effluent limits required by sections 301(b) and 306 of the Clean Water Act (131.10(d))
  - why the 101(a)(2) uses cannot be attained by implementing cost-effective and reasonable best management practices for nonpoint source control (131.10(d))
  - the highest attainable use (HAU)[4]
  - the water quality necessary to protect the HAU

[4] Highest attainable use (HAU) is the "modified aquatic life, wildlife, or recreation use that is both closest to the uses specified in section 101(a)(2) of the Act and attainable, based on the evaluation of the factor(s) in § 131.10(g) that preclude(s) attainment of the use and any other information or analyses that were used to evaluate attainability." (40 CFR 131.3(m))

The following sections address the information required above. Appendices B and C to this rationale contain additional information relevant to the UAA.

4.1.1 Specific Waterbodies Covered by Proposed Uses

As noted in Section 2.2, tributary channels to be covered under the proposed water quality standards table include Duck Creek, Flamingo Wash, Las Vegas Creek, Pittman Wash, upper Las Vegas Wash, Sloan Channel, and Tropicana Wash.

4.1.2 Demonstration that AQL and RWC are Not Existing Uses

The results of a recent survey documented a lack of habitat throughout the concrete-lined washes (see **Appendix B**). During dry weather, the flows are limited (see Figure 2). During monsoons, the flows scour out the concrete-lined channels (see Figure 4). Either condition is unsuitable as a viable habitat. Therefore, the condition of the channels does not provide suitable habitat for aquatic organisms in either wet or dry weather. Construction of an engineered channel is shown below (**Figure 7**).

Figure 7. CCRFCD work on flood-conveyance channels. (Photo by CCRFCD.)

During dry weather, the depth of the water in the tributary channels is generally no more than several inches throughout the lined channels. This is insufficient for swimming or any other immersion recreation. During wet weather, the channels host flash floods, making it exceedingly dangerous to enter the channels. In addition, the CCRFCD has made every effort to keep people out of the channels through public awareness campaigns and tall fencing along the tributary channels (**Figure 8**). There was no RWC in the ephemeral alluvial channels, there is no RWC use now, nor is there likely to be such use in the future. Discussion with staff who grew up in Las Vegas provides information not otherwise easily obtained. In the 1960s and 1970s, the dirt washes were dry, except after monsoon flooding. Following a flash flood, the great entertainment was riding bikes through the mud remaining after the flash floods had passed. However, then, as now, it was unsafe to enter the channels during the monsoon season. Both dry-weather and wet-weather conditions preclude RWC in the water. Although RNC may occur, it is discouraged by physical barriers (e.g., fencing) and by public messaging. The CCRFCD would prefer if nobody entered into the flood channels at *any* time, and has funded public awareness campaigns to this effect. (See: https://www.regionalflood.org/programs-services/public-information)

Figure 8. Flamingo Wash showing high fencing outside of maintenance road. Fencing and vertical concrete walls are meant to prevent people from entering into the channel.

4.1.3 Description of Beneficial Uses Under Consideration for the Tributary Channels

Despite all the measures taken to deter wildlife and humans from entering the tributary channels, it is known that incidental contact happens. Therefore, to protect for those incidental uses, RNC and propagation of wildlife (PWL) are proposed for the tributary channels.

4.1.4 Description of the Water Quality Necessary to Protect Existing Uses

The quality of water in the dry-weather flows is similar to that of shallow groundwater, which is poor. The proposed beneficial uses of RNC and PWL are intended to protect against incidental and accidental exposures that may occur. Shallow groundwater, as described in Section 5.1 below, is characterized by high concentrations of TDS, selenium, boron, sulfate, and fluoride leached from desert soils. This makes dry-weather water quality unsuitable for most any beneficial use. These natural background conditions are described below in Section 5.0 of this Rationale.

The quality of water in wet-weather (flood) flows reflects the water quality of urban runoff, including high levels of bacteria. Nonpoint sources of pollution dominate the quality of flood flows, and high levels of bacteria during flooding make the water unsuitable for any human contact.

4.1.5 UAA for Tributary Channels

All the tributary channels share similar characteristics, which is why they can be covered under the same water quality standards and the same UAA. The UAA describes the lack of applicability for both AQL and RWC uses. **Appendix C** provides a summary of factors and content for a UAA; discussion on the appropriate uses is provided in the following section. Attachment 1 to Appendix C provides regulatory language for 40 CFR 131.10, Designation of Uses, and Attachment 2 to Appendix C provides UAA checklists for RWC and AQL beneficial uses.

4.2 Overview of Beneficial Uses Appropriate for the Tributary Channels

NDEP finds that the highest beneficial uses of the tributary channels are limited to RNC and PWL. These two beneficial uses, and their associated criteria, protect for incidental exposures of people and wildlife to the channel flows. Human contact with these waters can be considered incidental, because the CCRFCD conducts public outreach aimed at promoting flash-flood awareness and keeping people out of the flood-conveyance channels as much as possible. https://www.regionalflood.org/programs-services/public-information.

CCRFCD's survey of 700 interviews indicated that nearly three-quarters of Southern Nevada residents knew about the dangers of flash floods. Additionally, nearly 20 percent of respondents gave the CCRFCD's infrastructure high marks for managing flood waters and keeping the public informed. Interestingly, more than 90 percent of those surveyed think it is **not** safe for children to play in the flood channels **at any time**, including dry weather. CCRFCD's outreach to keep people out of the channels, as well as the extremely shallow nature of dry-weather flows in the tributary channels, supports use of incidental exposure of humans as RNC, rather than RWC. Moreover, the growth and extent of the metropolitan area precludes any agricultural or livestock production using water from the tributary channels. Additionally, the high TDS and low dry-weather flows also make the channel waters unfit for industrial use (IND), RWC, and for municipal or domestic supply (MDS).

The concrete-lined channels and detention basins do not provide habitable substrate for aquatic organisms. The lack of a suitable substrate to maintain aquatic life in these channels (see Figure 2), and periodic scouring during flood events (see Figure 4), make these flood-conveyance structures unsuitable for propagation of aquatic life. A recent survey of dry-weather conditions in the channels found no life in the concrete-lined portions, and only some accidental organisms (i.e., a few small, non-native aquarium species dumped into the channels) in a few small areas of unlined channel. However, these accidental organisms are not propagating inhabitants of the tributary channels, and there is no expectation of long-term survival. Additionally, although there is no specific level of DO required for RNC and PWL, a minimum value of 2.0 mg/L is given to minimize decay odors (CENR 2000).

The additional beneficial uses of WLS, IRR, and marsh (MAR), which apply to the Las Vegas Wash itself, are not, and have not been, existing uses in the tributary channels since 1975, and are not reasonably likely to be attainable in the future. The Las Vegas Wash itself (NAC 445A.2156) does not have RWC, MDS, or IND as designated or existing uses.

5.0 Natural Background Conditions

EPA (1997) defines “natural background” as the “…*background concentration due only to non-anthropogenic sources*” and recognizes that “… *there may be naturally occurring concentrations of pollutants which may exceed the national criteria published under section 304(a) of the Clean Water Act*.” Notably, trace metals are found naturally at low concentrations in many waters. However, some of EPA’s criteria values for trace metals are less than quantitation limits (and sometimes less than detection limits) of the commonly used analytical methods (i.e., EPA Methods 200.7 and 200.8).

EPA allows use of natural background when assessing water quality, but currently requires a site-specific study and the adoption of site-specific standards (EPA 1997). Conducting such studies, followed by adopting such standards into regulation, is a time- and resource-intensive process that is well beyond the limited resources of NDEP to perform for every case of natural background. Fortunately, there are abundant water quality data and investigations available for the Las Vegas Valley that can be used to support an evaluation of ambient conditions. Natural background conditions in the Valley contribute to the unattainability of water quality standards protective of AQL and RWC.

NDEP already has a method for developing ambient concentrations for use in antidegradation evaluations. As described in NDEP’s Continuing Planning Process (CPP) document (NDEP 2004), the “requirement to maintain higher quality” (RMHQ) uses five years of quarterly data to calculate the 95th percentile value for a specific waterbody-parameter combination. By defining “background” as the 95th percentile, it is given that 5 percent of background will exceed this value. Keeping this in mind, NDEP calculated background values for selected parameters in the tributary waters using all available data. These estimates of ambient conditions reflect the sum of nonpoint source inputs from shallow groundwater and surface runoff.

5.1 Natural Background Chemistry of Shallow Groundwater

The poor quality of shallow groundwater in the Las Vegas Valley is a result of the water interacting with geologic materials and becoming mineralized by evapotranspiration. Dettinger (1987) noted that "*the poorest quality ground water in the valley is generally in the lowland parts of the valley in the first few feet beneath the water table, where dissolved-solids concentrations range from 2,000 to more than 7,000 milligrams per liter (mg/L), and probably reflects the effects of evaporite dissolution, secondary recharge, and evapotranspiration. The most common water-quality constraint on potential ground-water use is the high salinity. Huntington notes that "Discharge from the shallow aquifer is by evapotranspiration (ET)* ***and by seepage into Las Vegas Wash***..," and that shallow groundwater is "*…moderately saline, magnesium, calcium-sulfate type. Sulfate concentrations were high in these samples, with a median value of 2,000 mg/L. The sulfate is likely from the dissolution of gypsum in desert soils and the recharge of treated wastewater effluent in some areas*" and "*concentrations of dissolved solids in water samples collected from the shallow monitoring wells ranged from 351 to 5,700 mg/L, with a median of 3,240 mg/L…*"

Dettinger (1987) also described how TDS, magnesium, sulfate, chloride, and fluoride are derived from the geologic materials hosting the shallow groundwater, and that concentrations of these constituents frequently exceed drinking water standards. Bevans et al. (1998) concluded that "*Shallow ground-water seepage into Las Vegas Wash is the most likely source*" of the elevated levels of trace metals. Wild (1990) noted that "*Water quality evolves along flow path from a fresh Ca^{2+}-Mg^{2+}-$HCO3^{-}$ type water with TDS around 300 mg/l in the north to a moderately saline Ca^{2+}-Mg^{2+}- $SO_4{}^{2-}$ type water with TDS around 8000 mg/L in the southeast near Las Vegas Wash*." Wild (1990) also sampled the shallow groundwater in Las Vegas for selenium, boron and fluoride. Selenium in the shallow alluvial groundwater averaged 19 µg/L, although there was variability across the valley, ranging from <2 µg/L to 45 µg/L in the sampled wells. Boron averaged 1,980 µg/L, with a maximum concentration of 5,000 µg/L. Fluoride had an average concentration of 570 µg/L in shallow groundwater, with a maximum of greater than 6,000 µg/L (Wild, 1990).

In summary, Wild (1990) stated that "*Ground water is currently discharged from the shallow aquifer zone by evapotranspiration, ground-water inflow into Las Vegas Wash, and possibly by ground-water inflow into Tropicana and Flamingo Washes*." Even under natural conditions prior to the establishment of the City of Las Vegas, discharge from the alluvial aquifer system (i.e., the shallow groundwater system) occurred from springs and seeps fed by upward leakage of water from the deeper confined artesian zones through leaky confining layers and along fault planes, with large natural springs in the central valley. Since establishment and growth of the metropolitan area, the infiltrating water from excess landscape irrigation has produced a rising water table that has increased seepage from the shallow groundwater into Las Vegas Wash and its now largely lined, tributary channels.

Leising (2004) evaluated data for all hydrologic units in the Las Vegas Valley, including the shallow groundwater, which is called the "Las Vegas Aquitard" for its low hydraulic conductivity and limited water production. This aquitard consists of primarily Pleistocene and Holocene deposits, which are fine-grained in the central and eastern portion of the valley. Leising (2004) noted that "*In pre-development times, no important permanent surface flows entered or exited the Las Vegas Valley (Glancy and Whitney, 2001).*" However, he further notes that "*coincident with urban development, the Valley-wide water balance has become far more complex and the shallow system appears to have increased in geographic extent*" (Leising 2004). **Figure 9** shows the extent of the shallow groundwater, which can be described based on its chemistry.

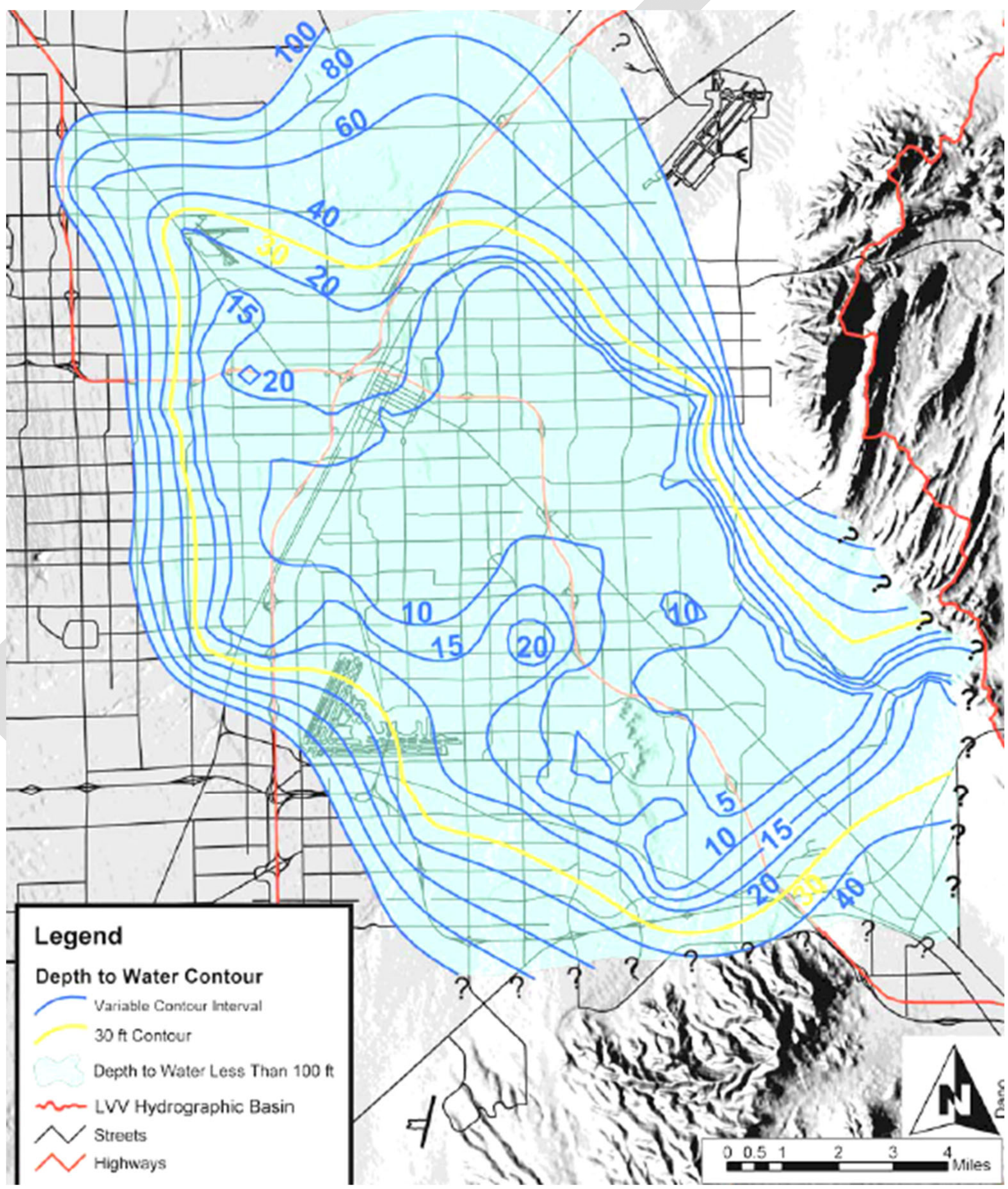

Figure 9. Extent of shallow groundwater system in the Las Vegas Valley. (Figure 53 from Leising, 2004.)

A U.S. Geological Survey (USGS) study in California (Dubrovsky et al., 1991) found that "*Detailed studies on selenium in soils and shallow ground water of the western San Joaquin Valley south of the study area showed that a primary cause of the highest selenium concentrations was evaporation of shallow ground water (Deverel and others, 1984; Deverel and Fujii, 1988; Fujii and others, 1988). This conclusion is supported by a strong positive correlation of selenium with salinity…*" This association is also seen in the data evaluated for shallow groundwater in the Las Vegas Valley (**Figure 10**). Dubrovsky et al. (1991) also noted that "…*The slope and intercept for this line are similar to lines fit to data from other areas in the western San Joaquin Valley (Deverel and Millard, 1988), which indicates a similar geochemical process*." Finally, Dubrovsky et al., concluded that "*The relation between selenium and specific conductance most likely results… from the leaching of salts from the unsaturated zone by irrigation water*."

The same analysis describe above was applied to TDS and selenium data from the channels tributary to the Las Vegas Wash. Comparing the data for specific conductance (SpC), TDS, and selenium (Figure 10), supports the link between evaporative concentration of shallow groundwater and high concentrations of selenium and TDS, as reflected in the surface waters tributary to the Las Vegas Wash. Linard (2013) examined the areas in the Lower Gunnison (Colorado River Basin) contributing salt and selenium to waters in the basin, and found a similar relationship.

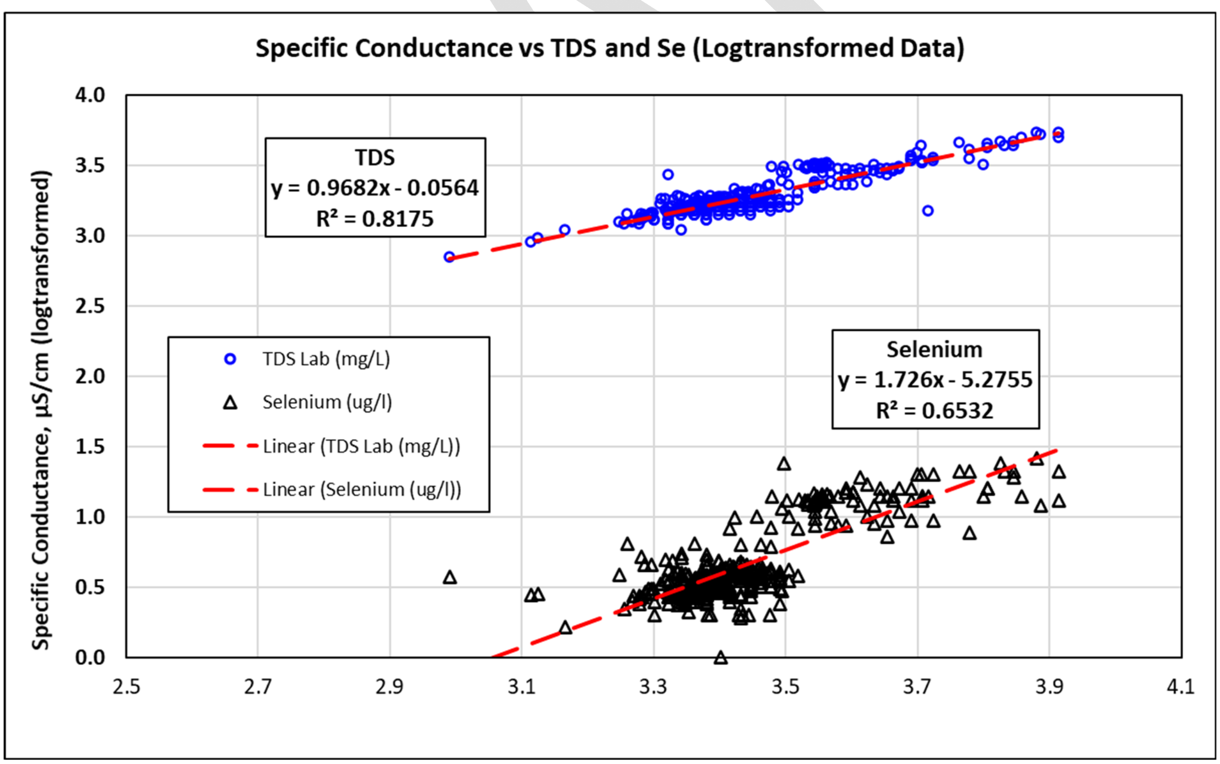

Figure 10. Correlation of SpC vs TDS, and SpC vs Selenium (logtransformed data).

5.2 Natural Background Conditions in Channels Tributary to Las Vegas Wash

In southern Nevada, the water agencies in the Las Vegas area have collected a large amount of water quality data from Las Vegas Wash and the tributary channels over the past few decades. NDEP has reviewed the information collected by these agencies, and has concluded that some of the "impairments" found in local waters reflect the natural chemistry of soils and geology in this desert basin. Bevans et al. (1998) noted that, in basin settings such as Las Vegas Valley, water tends to have higher concentrations of TDS "…*owing to the longer time the water has to react with the rock and sediment*." Bevans et al. (1998) also noted that "…*evaporite minerals, characteristically quite soluble*" are present in the Las Vegas Valley. Dissolution of these evaporite minerals adds to the solution chemistry of groundwater and surface water in the basin.

Information for trace metals is not available for pre-settlement times; however, it seems reasonable to conclude that surface waters in the Las Vegas Valley have always had a chemical composition that at least partially reflected the chemistry of shallow groundwater. Today's upward vertical gradient means there is the potential for shallow groundwater to daylight wherever the potentiometric surface intersects the ground surface. The spring at Whitney Mesa is one such instance of daylighting groundwater (**Figure 11),** and was found to contain as much as 61 micrograms per liter (µg/L) selenium (Zhou et al., 2004). Whitney Drain (**Figure 12**) enters Pittman Wash, which then enters into Duck Creek.

Figure 11. Spring daylighting from Whitney Mesa to Whitney Drainage

When the hydrogeochemical conditions of the Las Vegas Valley are considered, the natural chemistry of soil and water in this desert basin makes sense. Robertson (1991) notes that "*The oxidizing nature of the alluvial aquifers is noteworthy and geochemically significant (Winograd and Robertson, 1982) because most of the literature depicts ground water as basically reducing. Solubility and movement of many elements are dependent on the redox potential of the ground water. In the relatively narrow pH range of 7-9, a small change of the redox potential may mobilize metals. The mobilities of arsenic, chromium, molybdenum, nitrogen, sulfur, selenium, vanadium, and uranium are greatly increased by oxidizing conditions if converted to the oxyanion form in their highest oxidation state*." Weathering of geologic deposits in an alkaline, oxidizing environment has led to mobilization and accumulation of selenium and other trace elements in the Las Vegas Valley alluvium; these accumulations are readily solubilized in shallow groundwater, which then daylights into surface waters. **Figure 13** shows land conditions prior to the expansion of the metropolitan area of Las Vegas.

Figure 12. Whitney Mesa Park and Whitney Wash (Whitney Drain), showing channelized, concrete-lined wash routed through subdivision. (Snippet from Google Earth.)

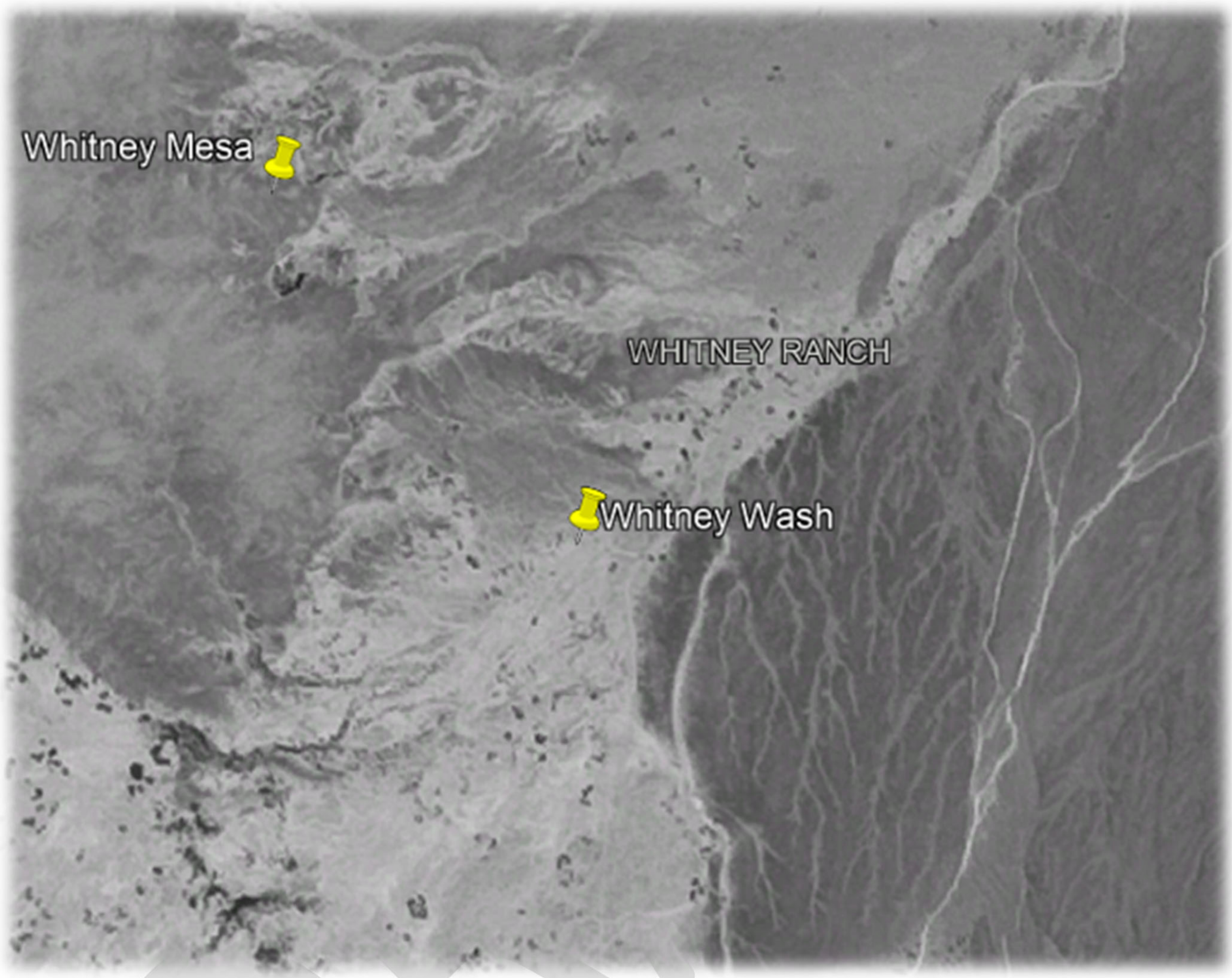

Figure 13. Dry washes from 1950s, showing Whitney Wash, demonstrating dry-weather conditions prior to development of Las Vegas. (Google Earth historical imagery.)

The unique geologic deposits and hydrogeochemistry of the Las Vegas Valley have led to naturally elevated concentrations of some major and trace elements. In particular, and as noted above, elements that form oxyanions (e.g., selenium as selenate, SeO_4^{-2}) under alkaline, oxidizing conditions, as well as those that typically occur as anions (e.g., sulfate, SO_4^{-2}, and fluoride, F^-) are easily mobilized when available in the soils. Boron typically occurs as an uncharged complex up until pH 9.24 (the pH of the first dissociation constant of boric acid, H_3BO_3); this means the uncharged ion predominates up to pH 9.24 (Hem, 1992). Boron may also form anionic complexes with fluoride. The critical note here is that anions and uncharged complexes are more mobile than positively charged ions and complexes, because soils contain far more cation exchange sites than anion exchange sites. This means that cations are more retarded in their migration than are anions. This fact also makes anions, such as sulfate, difficult to remove or contain from both groundwater and surface water, because special anion-exchange resins or other adsorbents are needed.

The flow related to daylighting groundwater has increased in the tributary channels as the water table has risen. The very existence of the Las Vegas metropolitan area has led to more flow in the channels, as water from over-irrigation and dewatering ends up in the tributary channels. However, the volume of discharges from wastewater reclamation facilities (WRFs) has also increased, and it is this effluent that dilutes the poor quality water flowing into Las Vegas Wash from the tributary channels. The Clark County Wetlands Park, which receives its water from the Las Vegas Wash downstream of the WRF discharges, benefits from this dilution. The channels tributary to Las Vegas Wash carry naturally elevated concentrations of selenium, boron, fluoride, and TDS. Combined, these channel contribute only about 8 percent of the flow in the Las Vegas Wash, whereas the highly treated effluent discharged from the WRFs provides about 90 percent of the flow (as measured at the historic lateral and other downstream locations). Other minor perennial inflows to the Las Vegas Wash come from treated groundwater from the Timet and BMI industrial remediation facilities.

5.3 Lake Mead and Contributions from the Colorado River

One additional fact to keep in mind when designating beneficial uses and setting standards, is the downstream waterbody, Lake Mead, and the downstream Colorado River. The Las Vegas Wash itself typically provides only about 2 percent of the total water inflow into Lake Mead, whereas the Colorado River provides about 97 percent of the water in Lake Mead. (The Virgin River and Muddy River each provide roughly 1 percent of the flow into Lake Mead.) Elevated levels of TDS and selenium are found throughout the Colorado River Basin. The following section evaluates selenium, one of the most common impairments to water quality in the Colorado River Basin.

5.3.1 Selenium

The Colorado River flows through agricultural lands in Colorado and is used for irrigation of agricultural lands in Colorado and Utah before arriving at Lake Mead. In a study of the Upper Colorado River Basin, Spahr et al. (2000) note that "*selenium occurs naturally in the shale bedrock of the middle and lower reaches of the basin and is present in surface and ground water.*" Spahr et al. (2000) also note that:

> *Areas of intensive agriculture are located primarily in the Colorado Plateau. Salinity, sediment, nutrients, pesticides, and selenium and other trace elements are common constituents in agricultural runoff. These constituents can have an adverse effect on the surface water, ground water, and aquatic life,* and
>
> *Extensive irrigated agriculture is present in the Grand and Uncompahgre Valleys of the Colorado Plateau in western Colorado (fig. 6). Irrigation drainage from these areas may account for as much as 75 percent of the selenium load in the Colorado River near the Colorado-Utah State line (Butler and others, 1996). It is estimated that 61 percent of the selenium load to Lake Powell in Utah originates from these agricultural areas in the UCOL (Engberg, 1999). Primary source areas of selenium in western Colorado are the western one-half of the Grand Valley and the eastern side of the Uncompahgre River Valley where the residual soils and alluvium are derived primarily from the Mancos Shale, a marine shale containing selenium.*

The Colorado River overwhelmingly controls the chemical composition of the water in Lake Mead. According to Engberg (1999) the load of selenium entering Lake Powell, upstream of Lake Mead, is nearly 30 million tons of selenium per year. In contrast, the Las Vegas Wash was estimated to provide between 1,430 pounds (Zhou et al. 2004) and 1,890 pounds (Ryan and Zhou, 2010) of selenium per year to Lake Mead. Evaluating the data for inputs to Lake Mead (Las Vegas Wash, Virgin River, Muddy River, Colorado River) helps place the selenium sources in context. The summary statistics (**Table 5**) for some available data show that the 95th percentile values for Lake Mead (3.1 µg/L), Muddy River (15.0 µg/L), Virgin River (5.0 µg/L), and Las Vegas Wash (4.6 µg/L) reflect the elevated ambient levels of selenium throughout the basin. (More general information on Lake Mead is available from the U.S. National Park Service, at https://www.nps.gov/lake/learn/nature/overview-of-lake-mead.htm)

Table 5. Summary Statistics for Selenium (µg/L) Inflow into Lake Mead and in Flood-Conveyance Channels

	Lake Mead	Muddy River	Virgin River	Las Vegas Wash	Duck Creek	Flamingo Wash	Las Vegas Creek	Sloan Channel	Pittman Wash
Count (N)	1,594	637	358	1,202	221	118	22	227	208
Mean	2.5	3.7	2.7	3.2	18.8	16.5	6.3	10.2	18.0
SD	0.6	4.9	1.6	1.4	4.3	2.7	2.1	8.0	4.9
Min	1.8	0.5	0.5	1.0	2.3	10.0	1.6	0.5	10.0
Max	12.0	39.0	10.0	28.0	31.9	25.0	10.0	37.4	34.4
Median	2.4	2.0	2.9	3.0	19.0	16.1	6.2	8.3	17.4
25th%	2.1	1.0	1.4	2.5	17.7	15.0	5.2	3.2	13.9
75th%	2.6	4.0	4.0	3.5	21.0	18.0	7.8	16.2	21.5
90th%	2.8	10.0	5.0	4.0	23.0	19.7	8.4	21.0	24.7
95th%	3.1	15.0	5.0	4.6	24.0	21.0	9.9	23.2	25.8
99th%	5.0	20.0	7.4	10.0	27.2	23.7	10.0	30.6	29.7

Notes: Nondetect data were replaced with one-half of the reporting limit. All data in micrograms per liter (µg/L). Data for Las Vegas Wash only include data for segment NV13-CL-06_00, "Las Vegas Wash at Lake Mead." (Data 1985-2020).

If the 95th percentiles (95th%) of the selenium concentrations for the channels tributary to the Las Vegas Wash (right half of **Table 5)** are also used to represent the ambient concentrations of selenium, then the background levels of selenium are as follows: Pittman Wash (25.8 µg/L), Duck Creek (24.0 µg/L), Sloan Channel (23.2 µg/L), Flamingo Wash (21.0 µg/L), Las Vegas Creek (9.9 µg/L). The Las Vegas Wash integrates the selenium load from the tributary channels prior to entering Lake Mead. Of particular note is that the WRF discharges into the Las Vegas Wash have the lowest concentration of selenium in the entire system. The average influent concentration of selenium to the WRF is 3 µg/L, while the average effluent concentration of selenium is 1.4 µg/L; so more than 50 percent of the influent selenium is removed during the treatment process (Roefer, 2009). Ryan and Zhou (2010) determined that the effluent discharge into Las Vegas Wash was necessary to dilute the concentrations selenium and TDS originating from natural background sources via the flood-conveyance channels.

Rosen et al. (2012) edited a comprehensive volume, "*A Synthesis of Aquatic Science for Management of Lakes Mead and Mohave,*" published as USGS Circular 1381. The seven chapters in this synthesis include discussions of the environmental setting of Lake Mead, along with discussions of hydrology, water quality, biological resources, and threats and stressors to the ecosystem. In this volume, Rosen discussed "*Organic and Inorganic Chemicals and Compounds in Water,*" noting that *"Selenium is a naturally occurring metalloid that is found globally in organic-rich marine sedimentary shale, including many geologic formations in the Western United States and commonly in southern Nevada.*" Ryan also noted that "*Typical concentrations of selenium in the upper Las Vegas Wash exceed the USEPA criterion for protection of wildlife of 5.0 µg/L; however, the increased water volumes provided by the wastewater reclamation plants along Las Vegas Wash dilute these concentrations.*"

The Colorado River Basin Salinity Control Forum (CRBSCF) (2020) reports that 10 stream segments in Arizona are impaired for selenium. CRBSCF (2020) also reports that, for the upper and lower Colorado River Basin, Gunnison River Basin and San Juan River Basin, "*a significant majority in the lower ends of these basins are impaired for selenium*." The concentrations of selenium and other naturally occurring constituents in the Las Vegas Valley can be put in context of the larger Colorado River Basin (**Figure 14**), in which seleniferous deposits (e.g., Mancos Shale and Dakota Sandstone) contribute soluble selenium into the surface waters from diffuse (i.e., nonpoint) sources. (See also, Thomas et al., 2008).

In Utah, upstream of the Nevada State line, the Utah Department of Environmental Quality (DEQ) has found that Kanab Creek (UT15010003-003_00) in the Lower Colorado River Basin is impaired for selenium, boron, and TDS. Segments of the Colorado River (UT14010005-001_00, UT14030001-005_00, UT14030005-004_00, UT14030005-003_00) were also found to be impaired for selenium (Utah DEQ 2022). In Arizona, the Colorado River upstream of Nevada (AZ15010002-003) was impaired for selenium, as was the Virgin River upstream of Nevada (AZ15010010-003, AZ15010010-004), along with several tributaries to the Colorado (Kanab Creek and Paria River (Arizona DEQ 2018). Evaluating data from all sources to Lake Mead makes the point that the contribution of selenium from the Las Vegas Wash is just one small component of the many sources of selenium to Lake Mead. The levels of selenium in all surface waters reflect the naturally high concentrations of selenium in soils across the Colorado River Basin.

Selenium is derived from soils in multiple states across the Colorado River Basin. The driver mobilizing the selenium (as well as other constituents) into surface waters is irrigation and seepage of shallow groundwater. In Colorado, the state has been attempting to address this issue by working with farmers and irrigation districts to minimize mobilization of selenium and reduce salinity. A local watershed initiative, the Grand Valley Selenium Task Force, was established in 2002 to address selenium in the Grand Valley. This group examines potential remediation scenarios and best management practices (BMPs) to minimize the mobilization of selenium (Leib, 2008). Such BMPs can include switching to more efficient irrigation methods that reduce runoff and deep percolation.

Figure 14. The Colorado River Basin. (Excerpted from the *2020 Review Water Quality Standards for Salinity Colorado River System,*" Colorado River Basin Salinity Control Forum [CRBSCF], 2020.)

Concentrations of selenium are somewhat elevated in Lake Mead, with the Colorado River as the main contributor of the selenium load. Soils in the Colorado River Basin are naturally enriched in selenium and other parameters, reflecting the distinctive hydrogeochemistry of the region. Enrichment of selenium in certain soils has been recognized for decades (Lakin and Byers, 1941). A comprehensive overview and synthesis of selenium occurrence and geochemistry was provided by Stillings (2017), who notes that "*Once selenium has transformed to aqueous selenate and selenite, it is readily mobile…"* and *"Selenate predominates in well-aerated surface waters, especially at alkaline pH*."

In summary, the challenge with selenium and other naturally occurring parameters, such as boron, that are mobilized from nonpoint sources of pollution, is that control of pollutant loads from nonpoint sources is achieved by voluntary implementation of BMPs. As noted in a total maximum daily load (TMDL) for selenium prepared by Utah DEQ (2014), "*The key to effectively reducing the anthropogenic loads in the Colorado River watershed while maintaining current water rights and irrigation use is to continue to improve and maintain water use efficiency projects and to minimize surface runoff, seepage, and deep percolation*." A TMDL for selenium and boron prepared by Arizona DEQ (2015) similarly acknowledged that "*the implementation plan is meant to suggest possible improvements and BMPs that can be employed to improve water quality. The time frame for the attainment of water quality standards is dependent upon the degree to which improvements are made and the timeline of those improvements in land use practices*." In other words, controlling selenium, boron, and other constituents naturally present in soils, is a voluntary action that may or may not be feasible.

6.0 Summary of Conditions

Weathering of geologic deposits in the desert environment has led to an accumulation of selenium, boron, and other constituents in the soils. In turn, mobilization of selenium and boron, along with other naturally occurring elements, has led to elevated levels of these constituents in shallow groundwater and surface waters across the Colorado River Basin. In particular, the concentrations of these constituents are elevated in the central and eastern portions of the Las Vegas Valley. Daylighting springs and seeps of the poor-quality shallow groundwater, along with dewatering and discharge of the shallow groundwater, has generated poor-quality surface water in the channels tributary to the Las Vegas Wash. The low flows and naturally elevated levels of TDS, selenium, and other constituents in these channels make the water in these channels unsuitable for most beneficial uses.

The high volume of treated effluent discharged into Las Vegas Wash accounts for about 90 percent of the flow downstream of the WRF discharges. This effluent has, to a large extent, mitigated the high concentrations of selenium, boron, fluoride, and TDS delivered by tributary channels and groundwater seeps. The highly treated wastewater has turned the Las Vegas Wash into a perennial, effluent-dominated stream that averages about 300 cfs downstream of all WRF discharges.

Until now, the "tributary rule" (NAC 445A.1239) has been used to carry the water quality standards of the Las Vegas Wash (NAC 445A.2156) upstream to the tributary channels, even though the beneficial uses ascribed to the Wash may not be appropriate for these channels. A careful review of all available data and information, including information from recent studies by NDEP and the Las Vegas dischargers (see **Appendix B**), indicates that the beneficial uses and criteria applicable to the Las Vegas Wash are **not** appropriate for the tributary channels. Additionally, the water quality standards on the Las Vegas Wash do not identify or account for natural background conditions, which dominate the water quality in dry-weather flows in the channels tributary to the Wash. For those two reasons, the NDEP is proposing for the first time, a separate water quality standards table for channels tributary to the Las Vegas Wash, with the designated beneficial uses of RNC and PWL.

The proposed water quality standards acknowledge both the extreme level of hydrologic alterations that have been made to the tributary channels, along with the unique hydrogeochemistry of the Las Vegas Valley. As noted in Section 3, the tributary channels have been redesigned to function as floodwater-conveyance structures, and offer extremely limited habitat for aquatic life. Additionally, the tributary flows themselves are extreme; ranging from a trickle in dry weather to raging flash floods in monsoon season. Flow data collected by the Southern Nevada Water Authority (SNWA) from 2012 to 2020, shows that the median dry-weather flow in the tributary channels ranges from about 1 to 8.6 cfs, spread out across wide concrete channels (see Figure 2).

6.1 Summary of Appropriate Beneficial Uses for the Tributary Channels

The default presumption for all surface waters under the CWA is that all should be "fishable and swimmable." This translates to the beneficial uses of AQL and RWC in Nevada's water quality standards. If these two uses are not proposed for a waterbody, EPA specifies that "*UAA must be conducted for any water body when a state or authorized tribe designates uses that do not include the uses specified in section 101(a)(2) of the Act….*" EPA further specifies that "*Under 40 CFR 131.10(g) states may remove a designated use which is not an existing use, as defined in § 131.3 … if the State can demonstrate that attaining the designated use is not feasible*…" because of one of six factors. These factors, along with a discussion of a UAA, are provided in **Appendix C** to this Rationale.

The only beneficial uses NDEP identified as appropriate for the tributary channels are RNC and PWL. The CCRFCD has made a concerted effort to keep people out of the channels, so there is only incidental contact. During dry-weather flows, the level of water is generally no more than several inches deep; during wet-weather flows, it is unsafe for anyone to venture into these channels. The only human contact likely occurs during dry-weather flows, wherein the depth of the water (several inches or less) is insufficient for immersion (i.e., the water is not "swimmable").

The lack of suitable substrate and habitat precludes development of a propagating fishery in the tributary channels. In fact, most of the fish found in the Las Vegas Wash are introduced species dumped from home aquariums. It is possible that small aquarium fish may be found from time to time in the channels, but the lack of suitable substrate and the poor water quality preclude propagation and long-term survival of these accidental aquatic organisms. Therefore, AQL is not an appropriate beneficial use for the tributary channels, which have been engineered as a flood-conveyance system.

6.2 Summary of Applicable Criteria for RNC and PWL Uses

Under the beneficial uses of RNC and PWL, both of which NDEP typically considers as "secondary uses," there are a limited number of criteria that apply. The pH may be from 5.5 to 9.2 (i.e., circumneutral); the amount of dissolved oxygen (DO) should be sufficient to preclude anaerobic conditions (i.e., DO > 2.0 mg/L; the concentration of nitrate and nitrite should not exceed 100 mg/L and 10 mg/L, respectively; TDS should not exceed 5,000 mg/L, and levels of E. coli should be less than 630 colony-forming units per 100 milliliters (cfu/100 mL) as a geometric mean.

7.0 Proposed Changes to Water Quality Standards

The proposed table of water quality standards for the channels tributary to Las Vegas Wash is provided in the regulatory petition, which is also attached here as **Appendix A** to this rationale document. The changes proposed in this rationale and the accompanying petition seek to realistically address the conditions found in the channels tributary to Las Vegas Wash. Until now, the water quality standards of the Las Vegas Wash (NAC 445A.2156) have been applied upstream to these channels via the tributary rule (NAC 445A.1239), without considering differences related to flow conditions, concrete lining of channels, suitability of habitat, and natural background chemistry.

The proposed table of water quality standards for the channels tributary to the Las Vegas Wash includes only two designated beneficial uses: RNC and PWL. There are a limited number of criteria that apply to these two uses. The "Toxics Table" (NAC 445A.1236) does not apply to RNC and PWL beneficial uses, nor does the ammonia standard (NAC 445A.118) apply. The bacteria standard for RNC (630 cfu/100 mL) is unlikely to be met during flood conditions; however, water quality standards do not apply during extreme events; defined as 7Q10[5] flows.

Waterbodies downstream of the tributary channels are protected by the high volume of highly treated effluent discharged into the Las Vegas Wash by the municipal WRFs. As for selenium and TDS, the dilution afforded by the effluent results in median concentration of 3.0 µg/L selenium and about 1,550 mg/L TDS at the lower end of Las Vegas Wash (**Table 6**).

Table 6. Summary of median concentrations for key parameters in Las Vegas Wash system.

Waterbody ID	**Waterbody Name**	**Key Parameters**			
Tributary Channel		**Sulfate**	**TDS**	**Se, total**	**Se, diss**
NV13-CL-42_00	Duck Creek – origin to Las Vegas Wash	2,100	4,490	19.0	17.2
NV13-CL-49_00	Pittman Wash to Duck Creek		3,735	17.4	14.9
NV13-CL-39_00	Flamingo Wash – origin to Las Vegas Wash	1,500	2,800	16.1	15.8
NV13-CL-45_00	Upper LV Wash – origin to Sloan Channel	1,534	2,988	14.8	13.0
NV13-CL-40_00	Sloan Channel – origin to Las Vegas Wash	1,000	1,895	8.3	7.6
NV13-CL-44_00	Las Vegas Creek – origin to Las Vegas Wash	695	1,625	6.2	6.2
Median for all Tributary Channels =		**1,515**	**3,000**	**15.4**	**13**
Las Vegas Wash Downstream of WRFs		**Sulfate**	**TDS**	**Se, total**	**Se, diss**
NV13-CL-05_00	Las Vegas Wash at Historic Lateral	529	1,420	2.9	2.6
NV13-CL-06_00	Las Vegas Wash at Las Vegas Bay	562	1,546	3.0	2.8
Median of LV Wash below WRFs =		**546**	**1,500**	**3.0**	**2.7**

Notes: TDS = total dissolved solids, Se = selenium, diss = dissolved (field-filtered), WRF = wastewater reclamation facility. Statistics based on data collected from 10-01-2001 to 9-30-2021.

[5] 7Q10 is defined as the mean high (or low) flow that occurs over 7 consecutive days at a 10-year recurrence interval.

If data solely for the site Las Vegas Wash at Las Vegas Bay (2002 to 2016) are evaluated for total selenium, the 95th percentile is 3.9 µg/L as the Wash enters the Bay, with a median value of 2.8 µg/L.

8.0 References

Arcadis US, Inc. and Benchmark Environmental, LLC. 2022. Draft Evaluation of Existing and Attainable Uses for the Tributaries to Lower Las Vegas Wash. March. 108 pages.

Arizona Department of Environmental Quality (DEQ). 2015. TMDLs for Total Boron and Total Selenium (Chronic). November. 110 pages. https://www.azdeq.gov/sites/default/files/middlegila_centennial_tmdl_final.pdf

Arizona DEQ. 2018. Arizona's 2018 303(d) List of Impaired Waters. https://static.azdeq.gov/pn/pn_303d_2018draft.pdf

Bevans, Hugh E., Michael S. Lico, and Stephen J. Lawrence USGS. 1998. Water Quality in the Las Vegas Valley Area and the Carson and Truckee River Basins, Nevada and California, 1992–96. USGS Circular 1170. https://pubs.usgs.gov/circ/circ1170/nvbr.book.pdf

Committee on Environment and Natural Resources (CENR). 2000. An Integrated Assessment of Hypoxia in the Northern Gulf f Mexico. May. https://www.epa.gov/sites/default/files/2016-06/documents/hypoxia_integrated_assessment_final.pdf

Clark County Regional Flood Control District (CCRFCD). 2020. 2019-2020 Annual Report, Las Vegas Valley National Pollutant Discharge Elimination System Municipal Separate Storm Sewer System Permit https://www.regionalflood.org/home/showpublisheddocument/586/637429345988670000

Colorado River Basin Salinity Control Forum. 2020. 2020 Review, Water Quality Standards for Salinity, Colorado River System. https://coloradoriversalinity.org/docs/2020%20REVIEW%20-%20Final%20w%20appendices.pdf

Dettinger, M.D. 1987, Ground-water quality and geochemistry of Las Vegas Valley, Clark County, Nevada, 1981-1983: implementation of a monitoring network: U.S. Geological Survey, Water Resources Investigations Report 87-4007, 69 p.

Dubrovsky, Neil M.; Neil, John M.; Welker, Mary C. and Kristin D. Evenson. 1991.Geochemical relations and distribution of selected trace elements in ground water of the northern part of the western San Joaquin Valley, California. USGS Water Supply Paper 2380. 51 pages. https://pubs.er.usgs.gov/publication/wsp2380

Engberg, R.A. 1999. Selenium budgets for Lake Powell and the Upper Colorado River Basin: Journal of the American Water Resources Association, v. 35, no. 4, p. 771786. https://www.sciencebase.gov/catalog/item/4f4e48c4e4b07f02db53f018

Hem, John D. 1992. Study and Interpretation of the Chemical Characteristics of Natural Water. USGS Water-Supply Paper 2254. 263 pages.

Lakin H.W. and H.G. Byers. 1941 Selenium Occurrence in Certain Soils in the United States, with a Discussion of Related Topics: Sixth Report. USDA Technical Bulletin No. 783. October. 26 pages.

Leib, Kenneth J., 2008, Concentrations and loads of selenium in selected tributaries to the Colorado River in the Grand Valley, western Colorado, 2004–2006: U.S. Geological Survey Scientific Investigations Report 2008–5036, 36. https://pubs.usgs.gov/sir/2008/5036/pdf/SIR08-5036_508.pdf

Leising, Joseph F. 2004. Chemical Conditions in the Primary Producing Aquifers and Portions of the Shallow Groundwater System of the Las Vegas Valley in 2000. Southern Nevada Water Authority. March. 128 pages.

Linard, J.I., 2013, Ranking contributing areas of salt and selenium in the Lower Gunnison River Basin, Colorado, using multiple linear regression models: U.S. Geological Survey Scientific Investigations Report 2013–5075, 35 p., http://pubs.usgs.gov/sir/2013/5075/ .

Nevada Division of Environmental Protection (NDEP). Nevada's Continuing Planning Process. December. 52 pages.

NDEP. 2004. 2022. Nevada 2020-2022 Water Quality Integrated Report. February. 210 pages.

Robertson, Frederick N. 1991. Geochemistry of Ground Water in Alluvial Basins of Arizona and Adjacent Parts of Nevada, New Mexico, and California. USGS Professional Paper 1406-C. 90 pages.

Roefer, Peggy. 2009. Presentation of the results of the selenium treatment study. Lake Mead Water Quality Forum.

Roslyn Ryan & Xiaoping Zhou (2010). TDS and selenium projections for the Las Vegas Wash, post completion of the Systems Conveyance and Operations Program (SCOP), Lake and Reservoir Management, 26:4, 249-257, DOI: 10.1080/07438141.2010.541374. https://www.tandfonline.com/doi/full/10.1080/07438141.2010.541374

Rosen, M.R., Turner, K., Goodbred, S.L., and Miller, J.M., eds. 2012. *A synthesis of aquatic science for management of Lakes Mead and Mohave.* U.S. Geological Survey Circular 1381, 162 p. https://pubs.usgs.gov/circ/1381/

Rosen, M.R. 2012. Organic and Inorganic Chemicals and Compounds in Water. In: Rosen et al., "*A synthesis of aquatic science for management of Lakes Mead and Mohave*." U.S. Geological Survey Circular 1381. Pages 58-68.

Southern Nevada Water Authority (SNWA) 2021. Las Vegas Wash Surface Water Quality Monitoring and Assessment Plan. 471 pages. October. Prepared for Las Vegas Wash Coordination Committee. https://www.lvwash.org/assets/pdf/resources-surfacewq-2021.pdf

Spahr, N.E., Apodaca, L.E., Deacon, J.R., Bails, J.B., Bauch, N.J., Smith, C.M., and Driver, N.E., 2000, *Water Quality in the Upper Colorado River Basin, Colorado, 1996–98.* U.S. Geological Survey Circular 1214, 33 p., on-line at https://pubs.water.usgs.gov/circ1214/

Stillings, L.L., 2017, Selenium, chap. Q of Schulz, K.J., DeYoung, J.H., Jr., Seal, R.R., II, and Bradley, D.C., eds., Critical mineral resources of the United States—Economic and environmental geology and prospects for future supply: U.S. Geological Survey Professional Paper 1802, p. Q1–Q55, https://doi.org/10.3133/pp1802Q .

Thomas, J.C., Leib, K.J., Mayo, J.W. 2008. *Analysis of dissolved selenium loading for selected sites in the Lower Gunnison River Basin, Colorado, 1978–2005*. Reston, VA, U.S. Geological Survey Scientific Investigations Report 2007–5287, 25 p. https://pubs.usgs.gov/sir/2007/5287/

U.S. Environmental Protection Agency (EPA). 1997. Establishing Site Specific Aquatic Life Criteria Equal to Natural Background. Memo. November 5.

EPA. 2021. Introduction to Water Quality Standards (WQS). Presentation. https://www.epa.gov/sites/default/files/2021-04/documents/intro_to_wqs.pdf

EPA. 2022. EPA webpage for Use Attainability Analysis (UAA). https://www.epa.gov/wqs-tech/use-attainability-analysis-uaa

U.S. National Park Service. Lake Mead. 2022. Overview of Lake Mead. https://www.nps.gov/lake/learn/nature/overview-of-lake-mead.htm

Utah Department of Environmental Quality (DEQ). 2014. TMDL for Selenium in the Colorado River Watershed. https://documents.deq.utah.gov/water-quality/watershed-protection/total-maximum-daily-loads/DWQ-2015-006573.pdf

Utah DEQ. Draft 2022 Integrated Report on Water Quality. https://documents.deq.utah.gov/water-quality/monitoring-reporting/integrated-report/DWQ-2021-024844.pdf

Wild, Harry Stephen Jr. 1990. Hydrogeology and Hydrogeochemistry of the Shallow Alluvial Aquifer Zone, Las Vegas Valley, Nevada. UNLV Theses, Dissertations, Professional Papers, and Capstones. 1114. http://dx.doi.org/10.34917/2493756

Zhou, Xiaoping; Roefer, Peggy; Zikmund, Kimberly S.; and James F. LaBounty. 2004. Selenium Concentrations in the Las Vegas Wash and Its Tributaries. Southern Nevada Water Authority (SNWA). In *American Water Works Association – Water Sources Conference*.

National Park Service (NPS). Overview of Lake Mead. https://www.nps.gov/lake/learn/nature/overview-of-lake-mead.htm

Additional Notes:

Notes: A selenium budget for Lake Powell, Utah-Arizona was determined based on selenium loads at the principal stream input sites to and the output site from the lake. Based on data collected during 1985-1994, 83 percent of the selenium entering Lake Powell is accounted for at the output site. The rest of the selenium may be incorporated by lake sediment or used by the biota. Considerably more selenium per unit area is produced from the Colorado River Basin above the Colorado River-Green River confluence than from the Green River Basin and the San Juan River Basin combined. The Gunnison River Basin and the Grand Valley in Colorado produce an estimated 31 and 30 percent of the selenium that reaches Lake Powell, respectively. Irrigation-related activities are thought to be responsible for mobilizing 71 percent of the selenium that reaches Lake Powell. Selenium concentrations in water at Imperial Dam on the Colorado River upstream of the United States-Mexico international border are similar to those at the output site of Lake Powell. Therefore, most selenium observed in downstream areas of the Colorado River therefore probably is derived mostly from the Colorado River Basin above Lake Powell. Published in **Journal of the American Water Resources Association**, volume 35, issue 4, on pages 771 - 786, in 1999. https://onlinelibrary.wiley.com/doi/10.1111/j.1752-1688.1999.tb04173.x

Appendix A

Proposed Regulation R115-22
Water Quality Standards for Channels Tributary to Las Vegas Wash

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PROPOSED REGULATION OF THE

STATE ENVIRONMENTAL COMMISSION

LCB File No. R115-22

July 25, 2022

EXPLANATION – Matter in ***italics*** is new; matter in brackets **[**~~omitted material~~**]** is material to be omitted.

AUTHORITY: §§ 1 and 2, NRS 445A.425 and 445A.520.

A REGULATION relating to water quality; establishing water quality standards for channels tributary to the Las Vegas Wash; designating the beneficial uses for such channels; and providing other matters properly relating thereto.

Legislative Counsel's Digest:

Existing law requires the State Environmental Commission to adopt regulations establishing the standards of water quality and amounts of waste which may be discharged into the waters of this State. (NRS 445A.425) Each standard adopted by the Commission must ensure a continuation of the designated beneficial use or uses applicable to the body of water to which the standard applies. (NRS 445A.520)

Section 1 of this regulation establishes the water quality standards for channels tributary to the Las Vegas Wash. **Section 1** provides which bodies of water make up these channels and further provides that these channels are located in Clark County. **Section 2** of this regulation makes a conforming change by providing that the designated beneficial uses for such channels are noncontact use and wildlife use.

Section 1. Chapter 445A of NAC is hereby amended by adding thereto a new section to read as follows:

The limits of this table apply to the channels tributary to the Las Vegas Wash, including the bodies of water known as:

1. Flamingo Wash from its origin to the confluence with the Las Vegas Wash;

2. Sloan Channel from North Las Vegas Boulevard to the confluence with the Las Vegas Wash;

3. Duck Creek from its origin to the confluence with the Las Vegas Wash;

4. Las Vegas Creek from its origin to the confluence with the Las Vegas Wash;

5. Pittman Wash from its origin to the confluence with Duck Creek;

6. Tropicana Wash from its origin to the confluence with the Flamingo Wash; and

7. Upper Las Vegas Wash from its origin to the confluence with Sloan Channel.

➥ *These channels tributary to the Las Vegas Wash are located in Clark County.*

STANDARDS OF WATER QUALITY

Channels tributary to the Las Vegas Wash

PARAMETER	REQUIREMENTS TO MAINTAIN EXISTING HIGHER QUALITY	WATER QUALITY CRITERIA TO PROTECT BENEFICIAL USES	Beneficial Uses[a]										
			Livestock	Irrigation	Aquatic	Contact	Noncontact	Municipal	Industrial	Wildlife	Aesthetic	Enhance	Marsh
Beneficial Uses							X			X			
Aquatic Life Species of Concern			None										
pH - SU		S.V. 5.5 - 9.2					*			*			
Dissolved Oxygen - mg/L		S.V.≥ 2.0					*			*			
Nitrate (as N) - mg/L		S.V.≤ 100[b]								*			
Nitrite (as N) - mg/L		S.V.≤ 10[c]								*			
Total Dissolved Solids - mg/L		S.V.≤ 5,000[c]								*			
E. coli - cfu/100 mL		A.G.M.≤ 630					*						
Toxic Materials		[d]											

** = The most restrictive beneficial use.*
X = Beneficial use.
[a] Refer to NAC 445A.122 and 445A.2142 for beneficial use terminology.
[b] Value from Miranda A. Meehan, Gerald Stokka and Michelle Mostrom, Livestock Water Quality, North Dakota State University (Feb. 2021), https://www.ag.ndsu.edu/publications/livestock/livestock-water-quality.
[c] Value from National Academy of Sciences and National Academy of Engineering, Water Quality Criteria - A Report of the Committee on Water Quality Criteria (1972); National Research Council, Nutrients and Toxic Substances in Water for Livestock and Poultry (1974); Adam Sigler, Marley Manoukian and Megan Van Emon, "Water Quality for Livestock," Montana State University (May 2022), https://store.msuextension.org/publications/AgandNaturalResources/MT202209AG.pdf.
[d] Toxic Materials standards specified in NAC 445A.1236 apply only to the beneficial uses of aquatic life, municipal or domestic supply, irrigation, and watering of livestock. None of those beneficial uses are applicable for these channels, which consist predominantly of concrete-lined channels constructed for stormwater flow. Accidental organisms, such as dumped aquarium organisms may occur sporadically, but these are not considered to be established, propagating organisms. Monsoon floods periodically scour and flush out the largely concrete-lined channels and detention basins.

Sec. 2. NAC 445A.2142 is hereby amended to read as follows:

445A.2142 The designated beneficial uses for select bodies of water within the Colorado Region are prescribed in this section:

Water Body Name	Segment Description	Beneficial Uses											Aquatic Life Species of Concern	Water Quality Standard NAC Reference
		Livestock	Irrigation	Aquatic	Contact	Noncontact	Municipal	Industrial	Wildlife	Aesthetic	Enhance	Marsh		
Colorado River below Davis Dam	Colorado River, from Davis Dam to the California-Nevada state line, except for the length of the river within the exterior borders of the Fort Mojave Indian Reservation.	X	X	X	X	X	X	X	X				Adult cold-water fishery	NAC 445A.2146
Lake Mohave	The entire lake.	X	X	X	X	X	X	X	X				Adult cold-water fishery	NAC 445A.2147
Colorado River below Hoover Dam	From Hoover Dam to Willow Beach.	X	X	X	X	X	X	X	X				Adult cold-water fishery	NAC 445A.2148
Lake Mead	Lake Mead, excluding the area covered by NAC 445A.2154, Inner Las Vegas Bay.	X	X	X	X	X	X	X	X				Warm-water fishery	NAC 445A.2152
Inner Las Vegas Bay	Lake Mead from the confluence of the Las Vegas Wash with Lake Mead to 1.2 miles into Las Vegas Bay.	X	X	X		X		X	X				Warm-water fishery	NAC 445A.2154
Las Vegas Wash at the Historic Lateral	From the confluence of Sloan Channel and Las Vegas Wash to the Historic Lateral. This segment encompasses the discharge from Clark County wastewater treatment plant, the City of Las Vegas wastewater treatment plant and the City of Henderson wastewater treatment plant.	X	X	X		X			X			X	Warm-water fish.	NAC 445A.2156
Las Vegas Wash at Lake Mead	From the Historic Lateral to its confluence with Lake Mead.	X	X	X		X			X			X	Warm-water fish.	NAC 445A.2158
Channels tributary to the Las Vegas Wash	***Flamingo Wash, Sloan Channel, Duck Creek and Las Vegas Creek from the applicable origin to the confluence with the Las Vegas Wash. Pittman Wash from its origin to the confluence with Duck Creek. Tropicana Wash from its origin to the confluence with Flamingo Wash. Upper Las Vegas Wash from its origin to the confluence with Sloan Channel.***					***X***			***X***					***Section 1 of this regulation***
Lake Las Vegas	The entire lake.		X	X	X	X			X				Warm-water fishery.	NAC 445A.2161
Virgin River at the state line	At the Arizona-Nevada state line, near Littlefield, Arizona.	X	X	X		X		X	X					NAC 445A.2162
Virgin River at Mesquite	From the Arizona-Nevada state line to Mesquite.	X	X	X		X		X	X					NAC 445A.2164
Virgin River at Lake Mead	From Mesquite to the river mouth at Lake Mead.	X	X	X		X		X	X					NAC 445A.2166

Water Body Name	Segment Description	Beneficial Uses											Aquatic Life Species of Concern	Water Quality Standard NAC Reference
		Livestock	Irrigation	Aquatic	Contact	Noncontact	Municipal	Industrial	Wildlife	Aesthetic	Enhance	Marsh		
Muddy River at the Glendale Bridge	From the river source to the Glendale Bridge, except for the length of the river within the exterior borders of the Moapa Indian Reservation.	X	X	X	X	X	X	X	X					NAC 445A.2168
Muddy River at the Wells Siding Diversion	From the Glendale Bridge to the Wells Siding Diversion.	X	X	X	X	X		X	X					NAC 445A.2172
Muddy River at Lake Mead	From the Wells Siding Diversion to the river mouth at Lake Mead.	X	X	X	X	X		X	X					NAC 445A.2174
Meadow Valley Wash	From the bridge above Rox to its confluence with the Muddy River.	X	X	X		X		X	X					NAC 445A.2176
Beaver Dam Wash	Above Schroeder Reservoir.	X	X	X	X	X	X	X	X					NAC 445A.2178
Schroeder Reservoir	The entire reservoir.	X	X	X	X	X	X	X	X				Trout	NAC 445A.2182
White River at the national forest boundary	From its origin to the national forest boundary.	X	X	X	X	X	X		X					NAC 445A.2184
White River at Ellison Creek	From the national forest boundary to its confluence with Ellison Creek.	X	X	X	X	X	X	X	X				Trout	NAC 445A.2186
Dacey Reservoir	The entire reservoir.	X	X	X	X	X	X	X	X					NAC 445A.2188
Sunnyside Creek	From its origin to Adams McGill Reservoir.	X	X	X	X	X	X	X	X					NAC 445A.2192
Adams McGill Reservoir	The entire reservoir.	X	X	X	X	X	X	X	X					NAC 445A.2194
Hay Meadow Reservoir	The entire reservoir.	X	X	X	X	X	X	X	X				Trout	NAC 445A.2196
Nesbitt Lake	The entire lake.	X	X	X	X	X	X	X	X					NAC 445A.2198
Pahranagat Reservoir	The entire reservoir.	X	X	X	X	X	X	X	X					NAC 445A.2202
Bowman Reservoir	The entire reservoir.	X	X	X	X	X	X	X	X					NAC 445A.2204
Eagle Valley Creek	From its headwaters to Eagle Valley Reservoir.	X	X	X	X	X	X	X	X				Trout	NAC 445A.2206
Eagle Valley Reservoir	The entire reservoir.	X	X	X	X	X	X	X	X				Trout	NAC 445A.2208
Echo Canyon Reservoir	The entire reservoir.	X	X	X	X	X	X	X	X				Trout	NAC 445A.2212
Clover Creek	From its origin to the point where it crosses the east range line of T. 4 S., R. 67 E., M.D.B. & M.	X	X	X	X	X	X	X	X				Trout	NAC 445A.2214

Irrigation	Irrigation
Livestock	Watering of livestock
Contact	Recreation involving contact with the water
Noncontact	Recreation not involving contact with the water
Industrial	Industrial supply
Municipal	Municipal or domestic supply, or both
Wildlife	Propagation of wildlife
Aquatic	Propagation of aquatic life
Aesthetic	Waters of extraordinary ecological or aesthetic value
Enhance	Enhancement of water quality

Water Body Name	Segment Description	Beneficial Uses											Aquatic Life Species of Concern	Water Quality Standard NAC Reference
		Livestock	Irrigation	Aquatic	Contact	Noncontact	Municipal	Industrial	Wildlife	Aesthetic	Enhance	Marsh		
Marsh	Maintenance of a freshwater marsh													

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Appendix B

Excerpts from study of channels tributary to Las Vegas Wash (Arcadis and Benchmark 2022), with additional discussion by NDEP

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B.1.0 Excerpts from "Draft - Evaluation of Existing and Attainable Uses for the Channels Tributary to Lower Las Vegas Wash,"[6] and additional discussion by NDEP

The City of Las Vegas and surrounding area constitute the most populous metropolitan area in Nevada, which is the most arid state in the U.S. Not unexpectedly, the Nevada Division of Environmental Protection (NDEP) engages with the southern Nevada stakeholders on multiple topics and projects related to water. The Clark County Regional Flood Control District (CCRFCD) works with other water agencies and dischargers in the Las Vegas Valley, and has taken the lead in working with NDEP on certain water quality issues. As part of that work, CCRFCD contracted Arcadis U.S., Inc. (Arcadis) and Benchmark Environmental LLC (Benchmark) to evaluate conditions in the channels and prepare a report to assess existing and attainable uses for the channels tributary of Las Vegas Wash. This appendix provides excerpts of that work, and adds some discussion.

The CCRFCD is responsible for developing and implementing a comprehensive flood control Master Plan Update (MPU) to alleviate flooding and improve the protection of life and property within the Las Vegas Valley. The Las Vegas Valley MPU is updated every five years and is used as a planning tool for implementation of the flood control system. The MPU makes certain assumptions about growth and development in the Las Vegas Valley and represents the full build out condition for the valley. The flood-conveyance system is being built with that condition in mind. The following description is excerpted from CCRFCD (2022), which begins with an overview of the hydrologic conditions.

> *Las Vegas Wash and its tributaries are located in Las Vegas Valley within the Mojave Desert in southern Nevada. The arid, northwest-trending valley includes about 600 square miles of an alluvial valley floor surrounded virtually on all sides by steep mountain ranges. The valley is bounded on the west by the Spring Mountains, on the north by the Sheep and Las Vegas Ranges, on the east by Frenchman and Sunrise Mountains, and on the south by the River Mountains and McCullough Range (United States Geologic Survey [USGS] 1984). The valley floor ranges in elevation from approximately 3,000 feet at the western mountain front to 1,500 feet in the east at the outflow of the valley.*
>
> *The Las Vegas Valley metropolitan area includes the cities of North Las Vegas, Las Vegas, Henderson and unincorporated Clark County. It is the driest metropolitan area in the United States, receiving 4.18 inches of annual precipitation (National Weather Service, 2021) and has also been one of the fastest growing metropolitan areas, with a current population of approximately 2.4 million that is projected to reach 3 million by 2035 (Center for Business and Economic Research 2021).* ***Figure B-1*** *depicts the urbanization and land use changes that have occurred in Las Vegas Valley from 1950 to 2010.*

[6] The Clark County Regional Flood Control District (CCRFCD) contracted with Arcadis and Benchmark Environmental to work on several studies on the Las Vegas Wash, including this assessment of the channels tributary to the Las Vegas Wash.

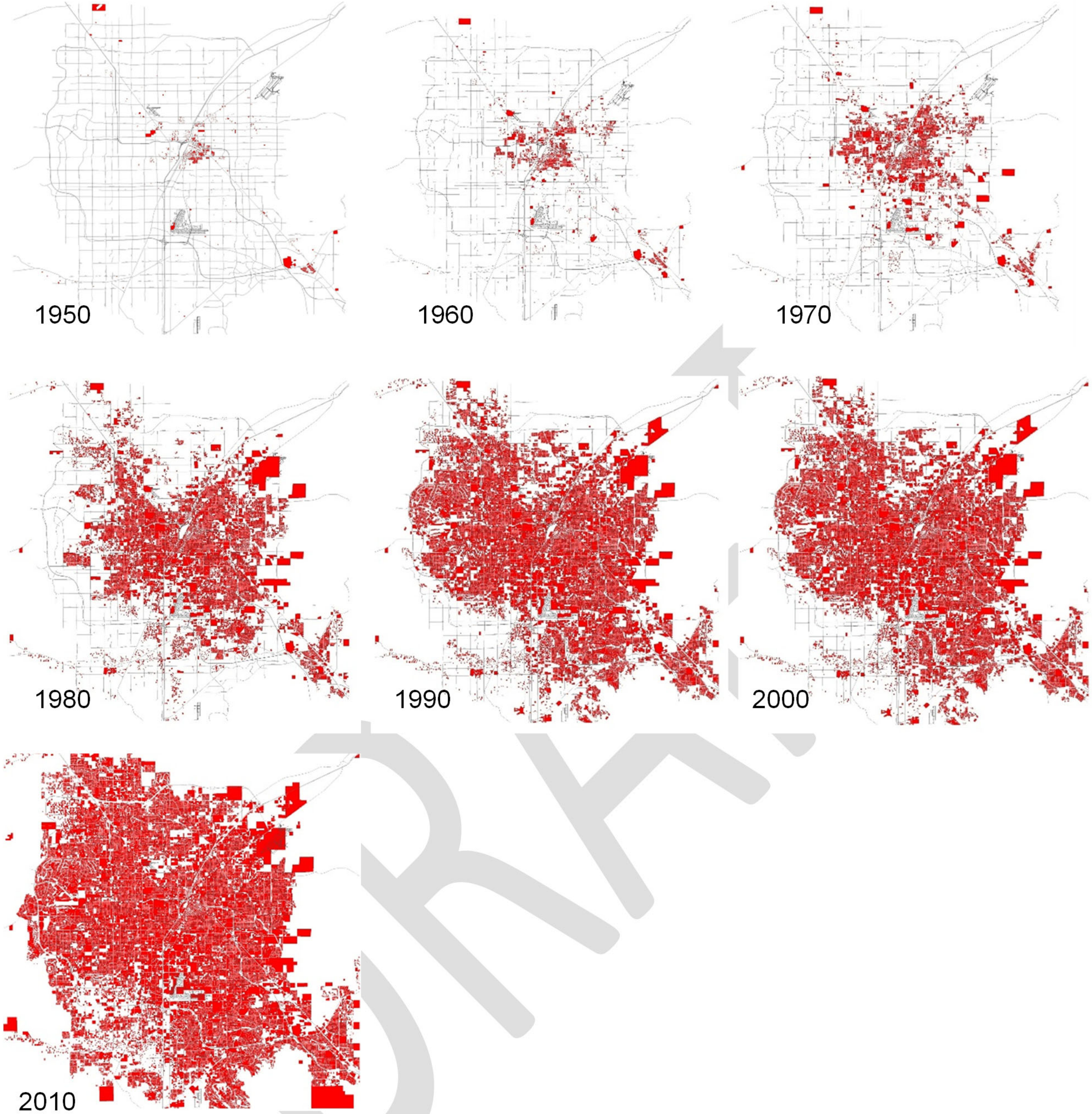

Figure B-1. The growth of greater Las Vegas and the changes in urban land use between 1950 and 2010. (Figure excerpted from CCRFCD, 2022).

The draft report for CCRFCD also notes that the "*groundwater flow system in Las Vegas Valley has been greatly altered since the early 1900s when water development began (USGS 2010; Leising 2004). Prior to urban development, recharge to the basin-fill deposits occurred from precipitation on the Spring Mountains and the Sheep Range and recharge to the shallow aquifer of the valley was mostly by upward flow from the deeper confined aquifer (Bell 1981 and USGS 2010). Discharge of the shallow aquifer historically occurred through evapotranspiration or spring flow*."

B1.1 Engineering the Channels

Water from over-irrigation and urban runoff has contributed to the expansion of poor-quality shallow groundwater (i.e., the Las Vegas Aquitard) (Leising 2004). The saline nature of this groundwater can be corrosive of concrete structures, so dewatering of manmade structures is common throughout the city. This shallow groundwater is typically then discharged directly into channels that lead to the Las Vegas Wash. The increased flow, along with the lining of many channels with concrete (Figures B-1 through B-6), has created perennial, but limited, dry-weather flows in these tributary channels. Plans are to continue engineering the tributary channels to better convey floodwaters through the valley and into the Las Vegas Wash.

The following figures excerpted from CCRFCD (2022) show the current extent to which the major channels tributary to the Las Vegas Wash have been engineered to function as flood-conveyance structures. Most of the tributary channels are now hardened with concrete or rip rap. Figures B-1 through B-6 depict the length of the concrete lining (blue) and the unlined (green) portions of seven channels tributary to the Las Vegas Wash. Figure B-7 shows the overall flood control system, including detention basins, across the Las Vegas Valley.

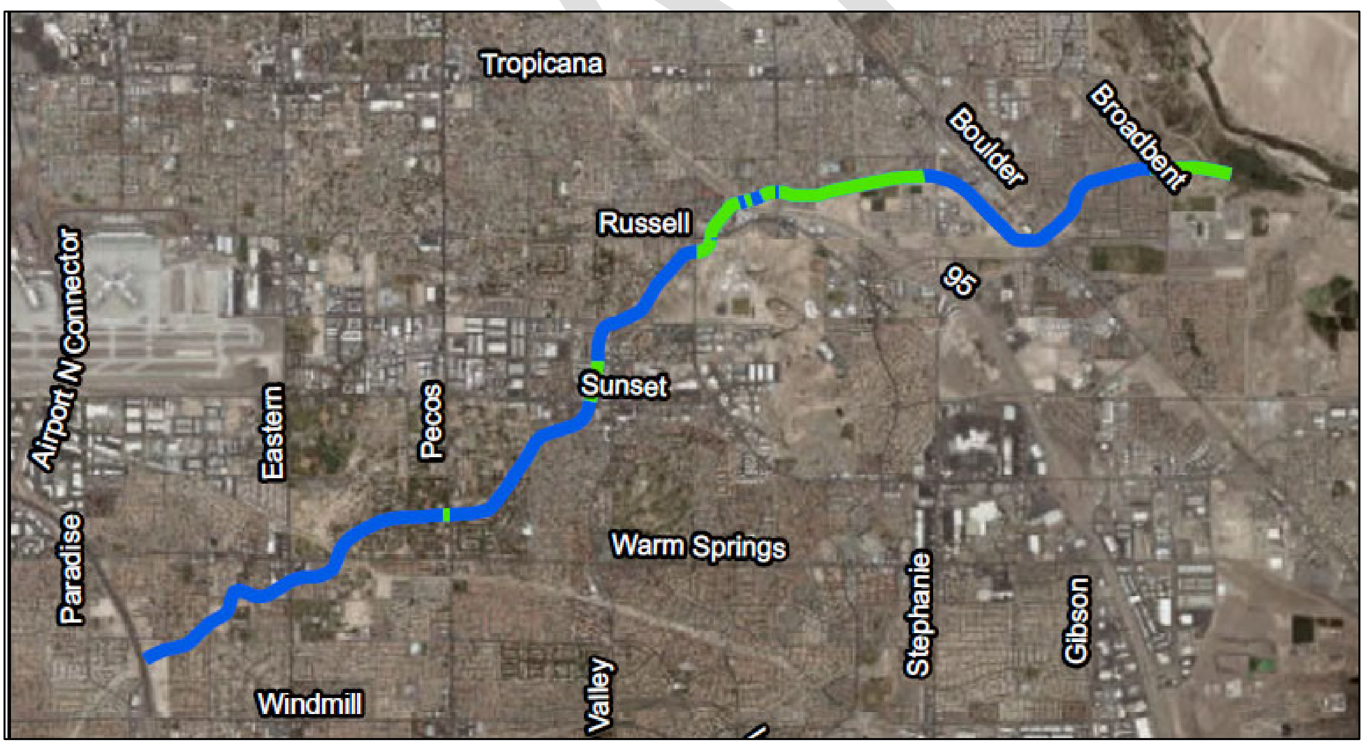

Figure B-1. Duck Creek (8.6 miles), showing concrete-lined portions (blue, 6.4 miles) and non-concrete portions (green, 2.2 miles). (Figure excerpted from Appendix D, CCRFCD, 2022).

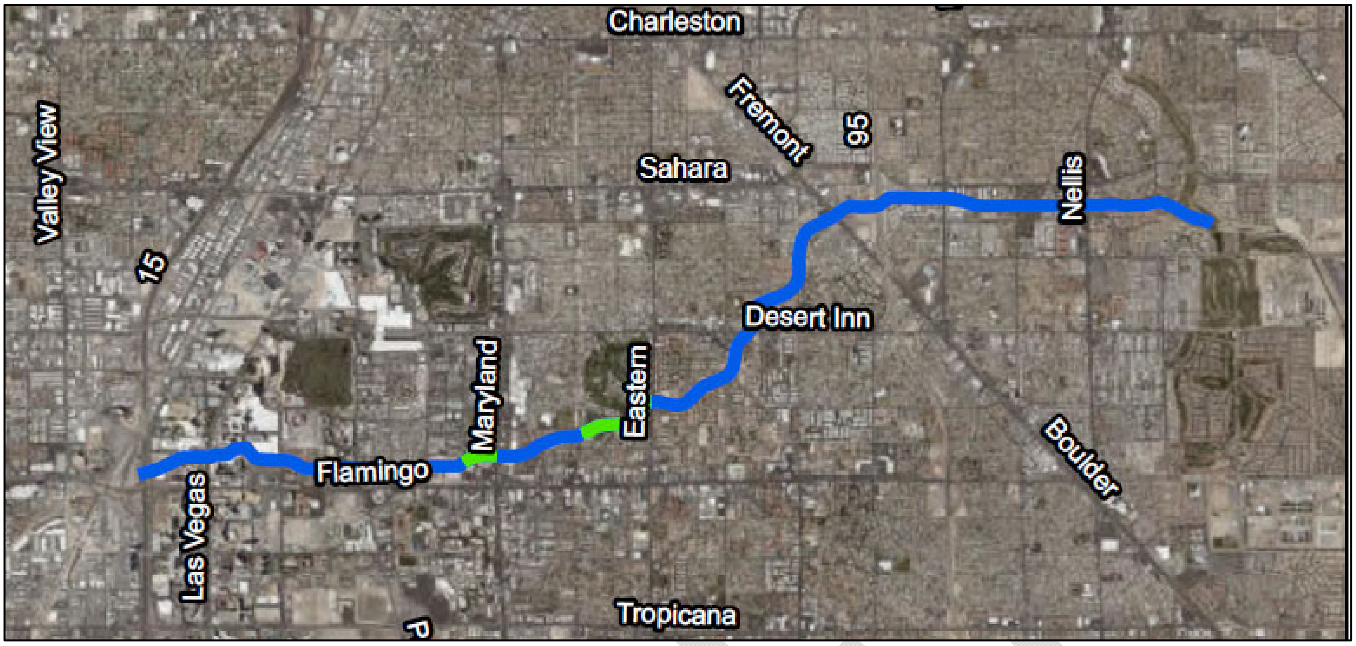

Figure B-2. Flamingo Wash (8.4 miles), showing concrete-lined portions (blue, 7.4 miles) and non-concrete portions (green, 1 mile). (Figure excerpted from Appendix D, CCRFCD, 2022).

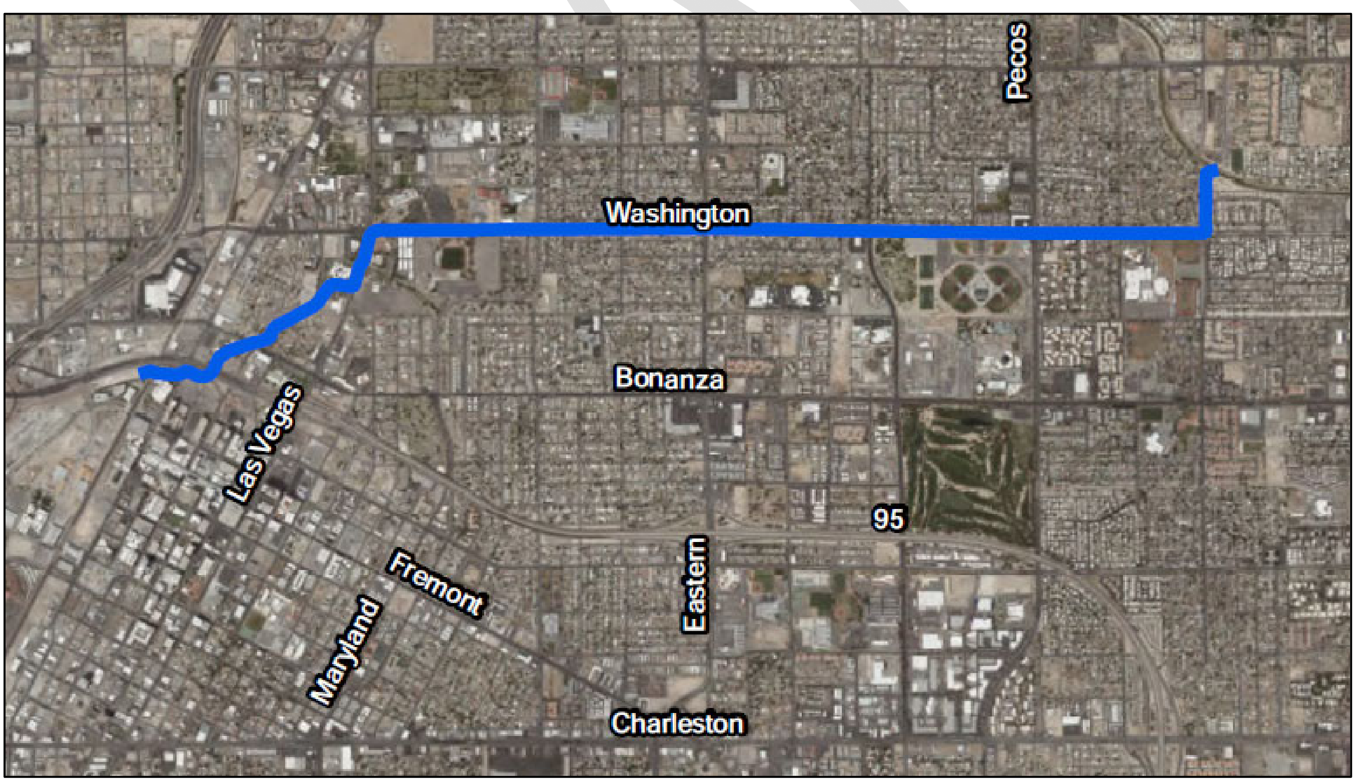

Figure B-3. Las Vegas Creek (3.7 miles), showing concrete-lined portions (blue, 3.7 miles). (Figure excerpted from Appendix D, CCRFCD, 2022).

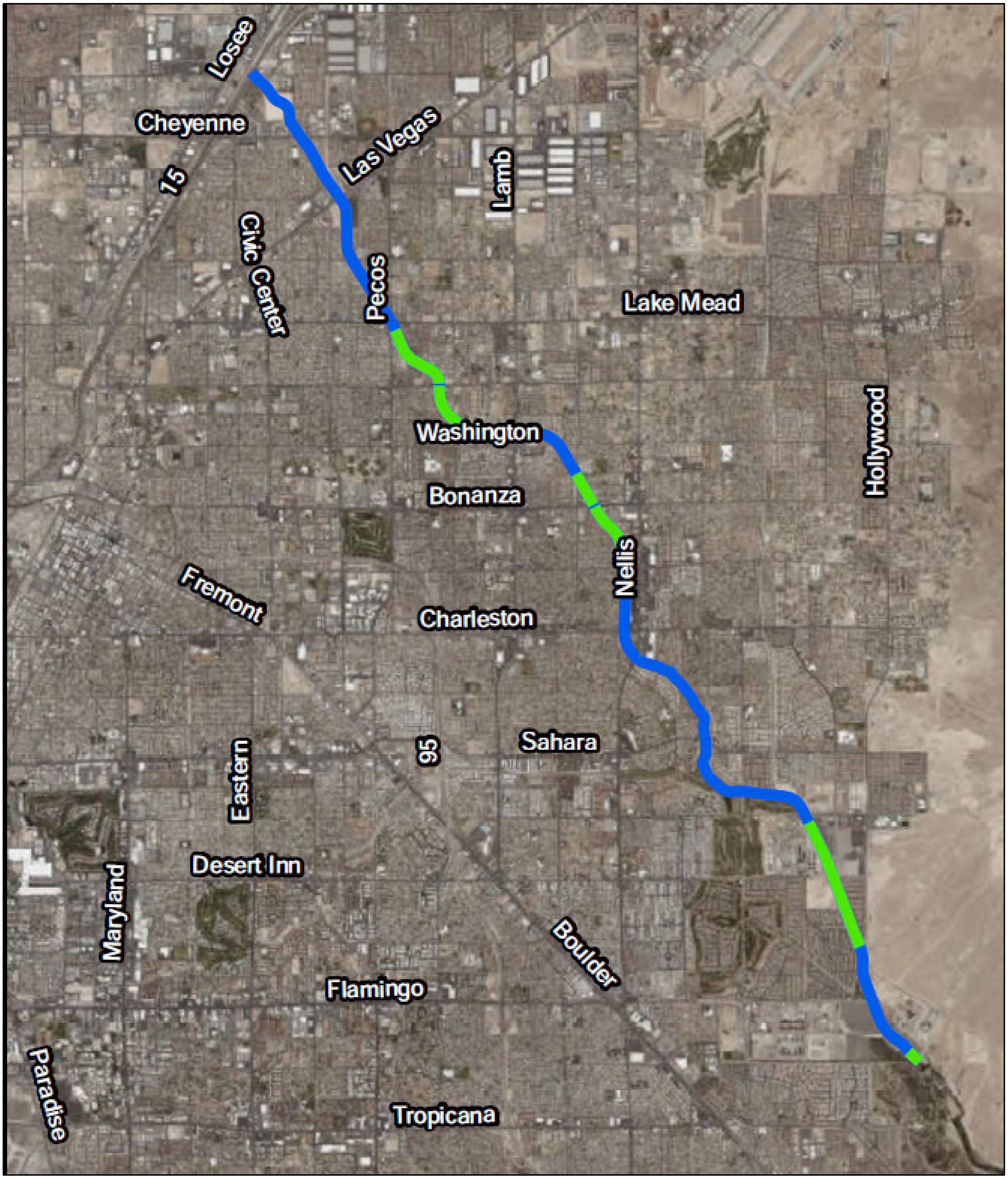

Figure B-4. Upper Las Vegas Wash (upstream of WRF discharges), 10.7 miles total length, with 7.2 miles of concrete-lined channel (blue) and 3.5 miles of unlined channel (green). (Figure excerpted from Appendix D, CCRFCD, 2022).

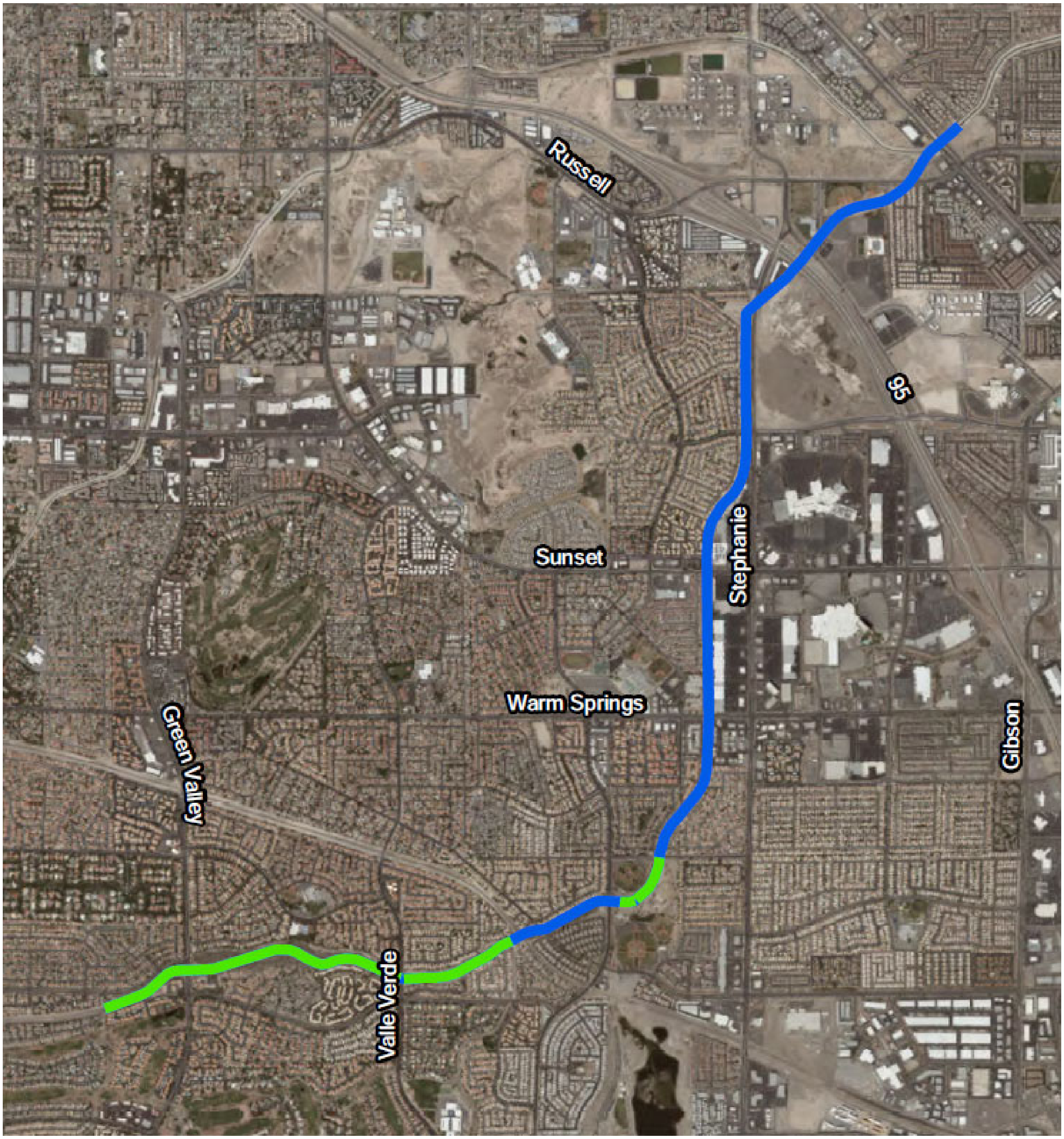

Figure B-5. Pittman Wash, 5.3 miles total length, with 3.5 miles of concrete-lined channel (blue) and 1.8 miles of unlined channel (green). (Figure excerpted from Appendix D, CCRFCD, 2022).

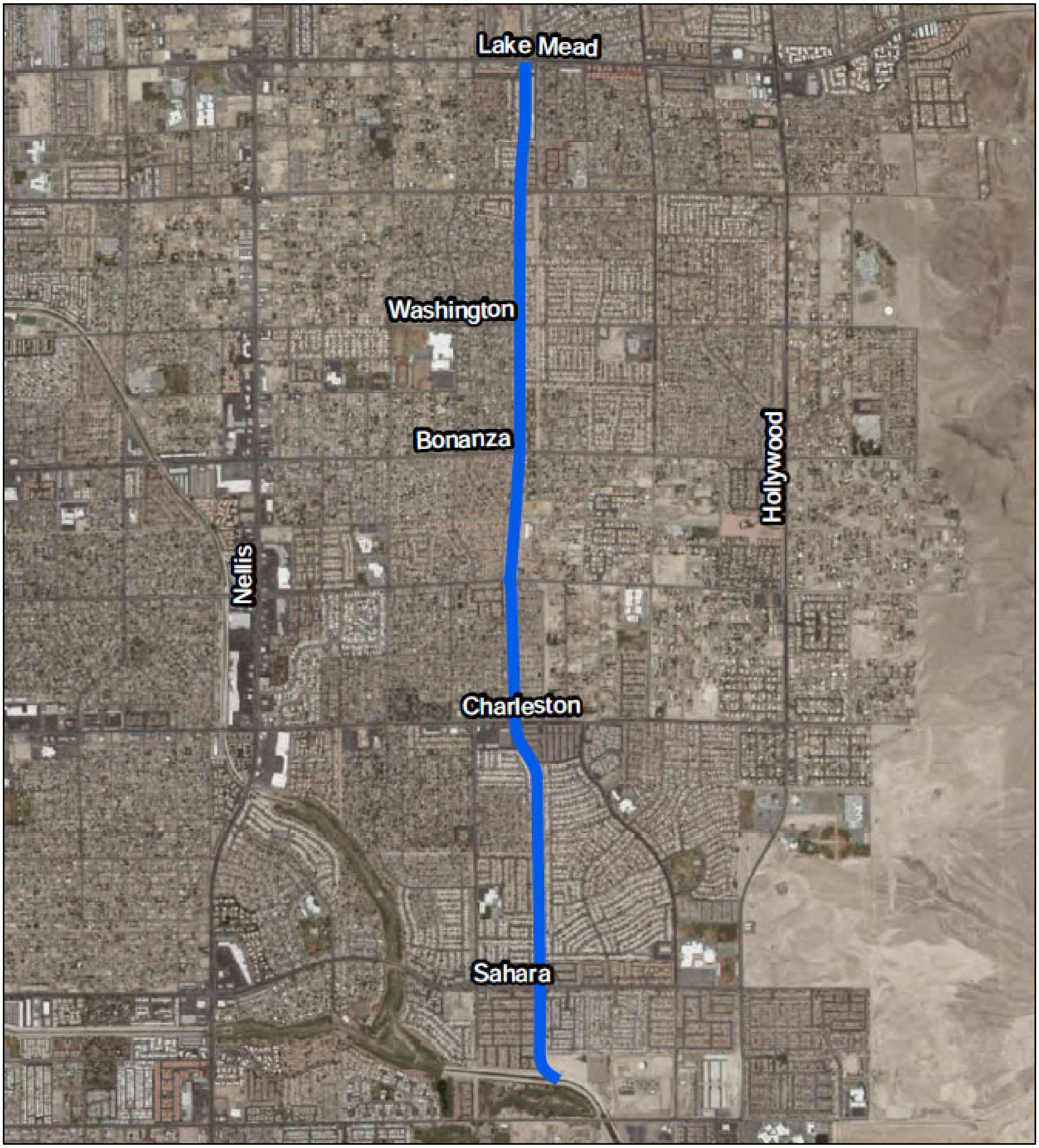

Figure B-6. Sloan Channel, 4.0 miles total length, with 4.0 miles of concrete-lined channel (blue). (Figure excerpted from Appendix D, CCRFCD, 2022).

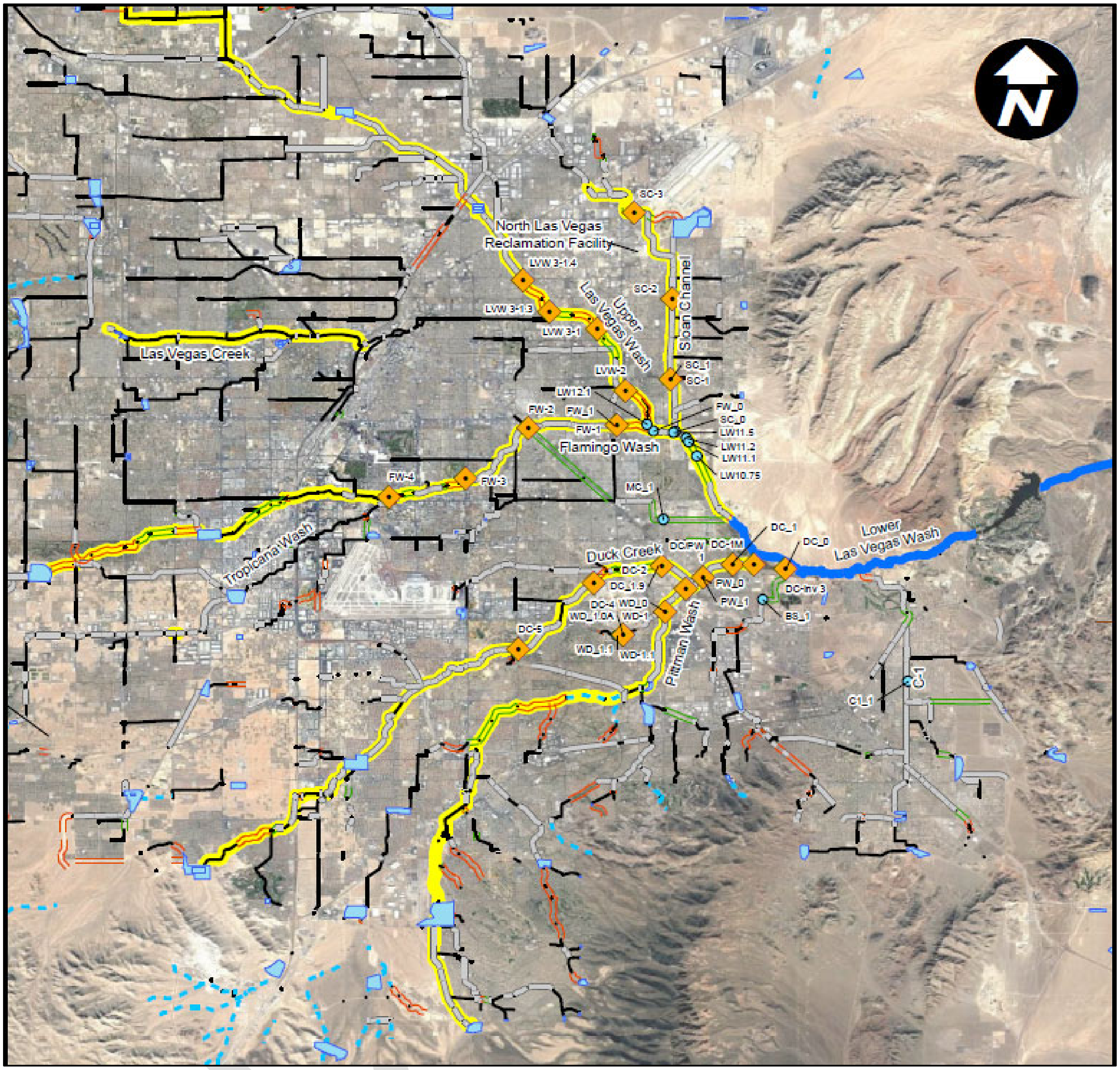

Figure B-7. The main channels (yellow) and detention basins (light blue) that serve as part of the flood-conveyance system to the Las Vegas Wash, along with portions of the storm drain system (black lines) in the greater Las Vegas metropolitan area. (Figure excerpted from Appendix E, CCRFCD, 2022).

B1.2 Existing and Attainable Uses

As described in the body of this rationale document, the channels tributary to the Las Vegas Wash have not had their own table of water quality standards. Instead, the “tributary rule” (NAC 445A.1239) has been used to carry the standards of the Las Vegas Wash (NAC 445A.2156) upstream into the tributary channels. The CCRFCD report (2022) describes why standards for the Las Vegas Wash are not appropriate for these channels.

The Clean Water Act (CWA) requires all waters of the U.S. to have as a goal, the beneficial uses of propagation of aquatic life and contact recreation and (i.e., “fishable/swimmable”). Otherwise, a demonstration is needed to show why these uses are not appropriate and not attainable. This demonstration is called a “use attainability analysis” (UAA). The draft report (CCRFCD 2022) discusses all six factors of a UAA, but focuses on factors 2 and 4 as the principal limiting factors for attainment of aquatic life use (AQL). Additionally, factors 1, 3, and 5 were found to play a role in limiting beneficial uses of the tributary channels. Factor 6 was also found to play a role in limiting use attainability on the channels tributary to Las Vegas Wash (**Table B-3**).

Table B-3. The six factors of a UAA

1. *Naturally occurring pollutant concentrations prevent the attainment of the use (40 CFR 131.10(g)(1)); or*
2. *Natural, ephemeral, intermittent or low flow conditions or water levels prevent the attainment of the use, unless these conditions may be compensated for by the discharge of sufficient volume of effluent discharges without violating State water conservation requirements to enable uses to be met(40 CFR 131.10(g)(2)); or*
3. *Human caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct than to leave in place (40 CFR 131.10(g)(3)); or*
4. *Dams, diversions or other types of hydrologic modifications preclude the attainment of the use, and it is not feasible to restore the water body to its original condition or to operate such modification in a way that would result in the attainment of the use (40 CFR 131.10(g)(4)); or*
5. *Physical conditions related to the natural features of the water body, such as the lack of a proper substrate, cover, flow, depth, pools, riffles, and the like, unrelated to water quality, preclude attainment of aquatic life protection uses (40 CFR 131.10(g)(5)); or*
6. *Controls more stringent than those required by sections 301(b) and 306 of the Act would result in substantial and widespread economic and social impact.*

B1.2.1 Aquatic Life Beneficial Use

The CCRFCD report stated that “*The limited aquatic habitat that currently exists in the tributaries is a consequence primarily of (1) intensive urban development of a desert environment and (2) flood control measures that have been implemented throughout the Las Vegas Valley in accordance with the CCRFCD MPU in order to safeguard human life and property. Accordingly, two of the principal limiting UAA factors for aquatic life uses in the tributaries…”* were identified as Factors 2 and 4 (CCRFCD 2022).

The fifth factor of a UAA was implicated because, “*As a result of the hydrologic modifications, the tributaries are now mostly broad concrete-lined flood-control channels with very shallow flow in the reaches that hold water. As such, the physical conditions, such as lack of proper substrate, cover, flow, depth, pools and the like, unrelated to water quality further limit the aquatic use*.“

The CCRFCD report (2022) continued, stating that "*In addition, the elevated selenium levels in the tributaries exist not because of any industry or point-source discharge, but because of selenium that is naturally present in the soils and has mobilized in response to lawn irrigation and entered the tributaries due to resurfacing shallow groundwater. This implicates two other factors…*" referring to Factors 1 and 3.

B1.2.2 Recreation Involving Contact with Water

The Las Vegas Wash is an effluent-dominated system that currently does not have contact recreation (RWC) as a beneficial use. Accordingly, the tributary channels have never had, or been assessed, for contact recreation. Considering the quantity and quality of both low-flow and high-flow (i.e., flood) waters, as described previously, contact recreation is not an existing or attainable use.

B1.2.3 Other Beneficial Uses

Although a UAA is not needed to remove or exclude other beneficial uses, such as irrigation and watering of livestock, the rationale for excluding such uses should be provided (i.e., a "uses and value" demonstration). The CCRFCD report (2022) stated that "*The irrigation and livestock watering beneficial uses have been applied to all surface waters in Nevada including tributaries of Las Vegas Wash; however, there is no indication that surface water is currently extracted from the Las Vegas Wash tributaries for any agricultural or irrigation uses. There is also no indication that these uses have been actually attained in tributaries since 1975, and therefore not considered an existing use per 40 CFR131.3(e). Given the desert environment and urbanization of the Las Vegas Valley it is also reasonable to expect that these uses would not be attained in the future*."

CCRFCD (2022) reviewed records from the Nevada Division of Water Resources (NDWR) to "*assess if any surface water diversions for agricultural or irrigation uses are occurring on any tributaries of the Las Vegas Wash*." Both active and historical water rights were reviewed to identify any potential surface water diversions for agricultural uses. The records search found a total of six water rights (dating from the early 1900s) for extracting surface water from channels tributary to the Las Vegas Wash. No surface water rights were granted after the 1940s. CCRFCD (2022) listed the following:

- Duck Creek – Impaired for Livestock Watering and Irrigation
  - Ed W. Clark, Certificate Record 401, Appropriation date December 26, 1911
  - Doris P. Stadleman, Certificate Record 2450, Appropriation date February 20, 1919
- Las Vegas Creek – Not impaired for either Livestock Watering or Irrigation beneficial uses
  - Frank Seibert, Certificate Record 3413, Appropriation date March 8, 1946
  - Bridge Stream – Not assessed as part of the Water Quality Integrated Report
  - Edward M. Taylor Estate, Certificate Record 1689, Appropriation date April 24, 1926
- Prospect Creek – Not assessed as part of the Water Quality Integrated Report and located greater than 15 miles northwest of the tributary network
  - F.S. Dickerson, Certificate Record 1092, Appropriation date July 13, 1921

- Deer Creek – Not assessed as part of the Water Quality Integrated Report and located greater than 15 miles northwest of the tributary network
  - G. W. Hail, Certificate Number 401, Appropriation date December 26, 1911

Researching the above water rights, CCRFCD (2022) stated that

> *These water rights proposed a dam across Duck Creek to create a reservoir with an approximate 30-acre feet capacity. From the reservoir ditches were included for the irrigation of approximately 65 acres of crops associated with the Stadleman right and 40 acres associated with the Clark right. It is unclear if either project was completed, but available areal imagery dating back to the early 1950's does not indicate a reservoir or cropland in the vicinity of where the project had been proposed.*
>
> *There are no parcels of land currently identified as having an agricultural or livestock use within a 1-mile radius of the Stadleman and Clark water right. Additionally, field reconnaissance of the area was completed to confirm that there are no agricultural or livestock land uses associated with these properties, and there are no indications of surface water diversions or other infrastructure associated with the water rights. Currently this area is commercially and residentially developed and includes the Edward W. Clark Generating Station, constructed in 1954, located on the original property just to the south of Duck Creek (Figure 9). Based on the review work completed and the reconnaissance of the area it is evident that these water rights are not active and could be formally abandoned in accordance with Nevada Revised Statutes (NRS) 533.060.*

CCRFCD (2022) continued, stating that:

> *The Seibert water right from 1946 is listed in State of Nevada Division of Water Resources records as being located on Las Vegas Creek, which is assessed but not 303(d) listed for either the irrigation or livestock watering uses. Based on the available records, the water right was located along what is currently identified as a constructed storm drain that is in the general vicinity of the historic location of Las Vegas Creek prior to development of the City of Las Vegas. The water right is approximately 1.5 miles upstream of the storm drain connection to Las Vegas Wash (Map 3).*
>
> *The water right proposed a small dam and point of diversion from Las Vegas Creek for purposes of stock watering and irrigation. The total area irrigated associated with the water right was 40 acres. It is unclear if the project was completed and there are limited historical images or other references to confirm the existence or duration of the water right usage.*
>
> *There are no parcels of land currently identified as having an agricultural or livestock use within a 1-mile radius of the Seibert water right. Additionally, field reconnaissance of the area was completed to confirm that there are no agricultural or livestock land uses in the area, and there*

are no indications of surface water diversions or other infrastructure associated with the water right. Currently this area is commercially and residentially developed. Based on the review work completed and the reconnaissance of the area it is evident that the water right is not active and could be formally abandoned in accordance with NRS 533.060.

Based on the review of the surface water rights for the Las Vegas Valley Hydrographic Basin, it is apparent that surface water from the 303(d) listed tributaries of the Las Vegas Wash is not being used to support Irrigation and Livestock Watering uses. Additionally, there was only very limited agricultural use even in the early 1900's, which appears to have ceased by the middle of the 20th century.

B2.0 Summary and Conclusion

The tributary study found that the aquatic life use is inappropriate for the tributary channels due to a lack of suitable flow, habitat, and natural chemical conditions (CCRFCD 2022). Additionally, the beneficial uses of irrigation and watering of livestock, which are designated uses on the Las Vegas Wash, have not existed since before 1975, nor after. Neither is either use likely to be attained in the future.

The CCRFCD report (2022) provided the following conclusions and recommendations based on the current evaluation. "*The information and data reviewed support the following principal conclusions:*

1. *Tributaries to the Lower Wash were historically ephemeral washes that naturally supported limited if any aquatic life.*
2. *Hydrological modifications made for flood control purposes have greatly impacted physical habitats for aquatic life uses. These modifications are needed to protect human life and property.*
3. *While limited low flows are present in the tributary channels, they are a result of urban development and are not sufficient to support full aquatic life uses.*
4. *Elevated background selenium occurs throughout the Las Vegas Valley due to local geology. Urban development may exacerbate ambient selenium concentrations in the tributaries, but the background nature of selenium and urbanized flow pathways make it technically and economically impracticable to control.*
5. *Downstream fish populations in the Lower Wash are not adversely impacted by selenium.*
6. *Livestock watering and irrigation uses are not existing or attainable uses for the tributaries.*

Water quality standards for the Las Vegas Wash (NAC 445A.2156), which has previously provided beneficial uses and criteria to the channels via the "tributary rule," has the following beneficial uses: aquatic life (AQL), recreation not involving contact with water (RNC), irrigation (IRR), watering livestock (WLS), propagation of wildlife (PWL), and marsh (MAR). NDEP's analysis and CCRFCD's study conclude that AQL, RWC, IRR, and WLS are not appropriate uses for the channels tributary to Las Vegas Wash.

NDEP concludes, and CCRFCD study supports, that the only appropriate beneficial uses for the tributary channels are noncontact recreation and propagation of wildlife. These two beneficial uses (RNC and PWL) are designated to protect for any incidental contact by people or wildlife with the water found in the tributary channels.

B3.0 References

Arcadis U.S., Inc and Benchmark Environmental, LLC. 2022. Draft Evaluation of Existing and Attainable Uses for the Tributaries to Lower Las Vegas Wash. March. 108 pages.

CCRFCD. 2018. Las Vegas Valley NPDES Municipal Stormwater Discharge Permit Annual Report, 2017-2018. September. 292 pages. https://gustfront.ccrfcd.org/pdf_arch1/npdes/Las%20Vegas%20Valley%20NPDES%20Municipal%20Stormwater%20Discharge%20Permit%20-%20Annual%20Report%20-%202017-2018.pdf

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Appendix C

Use Attainability Analysis

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Appendix C

Use Attainability Analysis

C1.0 The Use Attainability Analysis

As noted in Section 6.1 of this Rationale, the default presumption for all surface waters under the Clean Water Act is that they should be "fishable and swimmable" (**Attachment 1**). This translates to the beneficial uses of contact recreation (RWC) and propagation of aquatic life (AQL) in Nevada's water quality standards. If these two uses are not proposed for a waterbody, EPA specifies that "*UAA must be conducted for any water body when a state or authorized tribe designates uses that do not include the uses specified in section 101(a)(2) of the Act….*" EPA further specifies that "*Under 40 CFR 131.10(g) states may remove a designated use which is not an existing use, as defined in § 131.3 … if the State can demonstrate that attaining the designated use is not feasible*…" because of one of six factors.

C1.1 The Six Factors

Under **40 CFR 131.10(g)** states may remove a designated use which is not an existing use, as defined in § 131.3, or establish sub-categories of a use if the State can demonstrate that attaining the designated use is not feasible because:

1. Naturally occurring pollutant concentrations prevent the attainment of the use; or
2. Natural, ephemeral, intermittent or low flow conditions or water levels prevent the attainment of the use, unless these conditions may be compensated for by the discharge of sufficient volume of effluent discharges without violating State water conservation requirements to enable uses to be met; or
3. Human caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct than to leave in place; or
4. Dams, diversions or other types of hydrologic modifications preclude the attainment of the use, and it is not feasible to restore the water body to its original condition or to operate such modification in a way that would result in the attainment of the use; or
5. Physical conditions related to the natural features of the water body, such as the lack of a proper substrate, cover, flow, depth, pools, riffles, and the like, unrelated to water quality, preclude attainment of aquatic life protection uses; or
6. Controls more stringent than those required by sections 301(b) and 306 of the Act would result in substantial and widespread economic and social impact.

Designated uses are those that have been established via the formal process of rulemaking (i.e., uses and criteria adopted into the NAC). Existing uses are those actually attained for a given waterbody, on or after November 28, 1975. Attainable uses are those uses that could reasonably be achieved with cost-effective mitigation measures. A UAA asks three questions.

1) ***Is the use an existing use?***
   No, the original channels were ephemeral under natural conditions (**see Figure 11**), and the dry-weather flows seen today typically form a thin flow in the middle of large concrete channels **(see Figure 2)** that were designed as a flood-conveyance system.

2) ***Is the use specified in CWA section 101(a)(2) (i.e., is it a fishable/swimmable use)?***
   Yes, so a UAA is required to establish water quality standards that do not include AQL and RWC as designated beneficial uses.

3) ***Is the use attainable?***
   No, it is highly unrealistic to think that the tributary conditions could support a fishery, or support swimming and boating as recreational activities. The CCRFCD would prefer if nobody ever entered the tributary channels, due to the potential for sunny-day flash floods that may catch people unaware.

C1.2 The Highest Attainable Use

EPA (2006a) stresses that *"UAAs are meant to assess what is attainable, it is not simply about documenting the current water quality condition and use (although documenting current conditions is often part of the analysis)*." A UAA is a change to a water quality standard, and requires public comment and response, SEC approval, and legislative approval. Changes in water quality standards are subject to EPA review and approval before becoming effective for Clean Water Act purposes (e.g., discharge permits, total maximum daily loads, §303(d) listing decisions). The goal of a UAA is to ensure that the new use or subcategory of use more accurately reflects the use that is attainable, given one or more of the six conditions listed in 40 CFR 131.10(g). A UAA reevaluates designated beneficial uses or subcategories of uses, if data show the standards for a waterbody are inappropriate due to local conditions. The flow chart (Figure 5) shows the basic logic path of a UAA.

One of the issues encountered when establishing water quality standards is the question of whether or not the proposed standards are reasonably achievable. In fact, section 445A.521(2)) of the Nevada Revised Statutes (NRS) requires that water quality standards be reasonably attainable:

> *The commission shall base its water quality standards on water quality criteria which numerically or descriptively define the conditions necessary to maintain the designated beneficial use or uses of the water. The water quality standards must reflect water quality criteria which define the conditions necessary to support, protect and allow the propagation of fish, shellfish and other wildlife and to provide for recreation in and on the water if these objectives are reasonably attainable.*

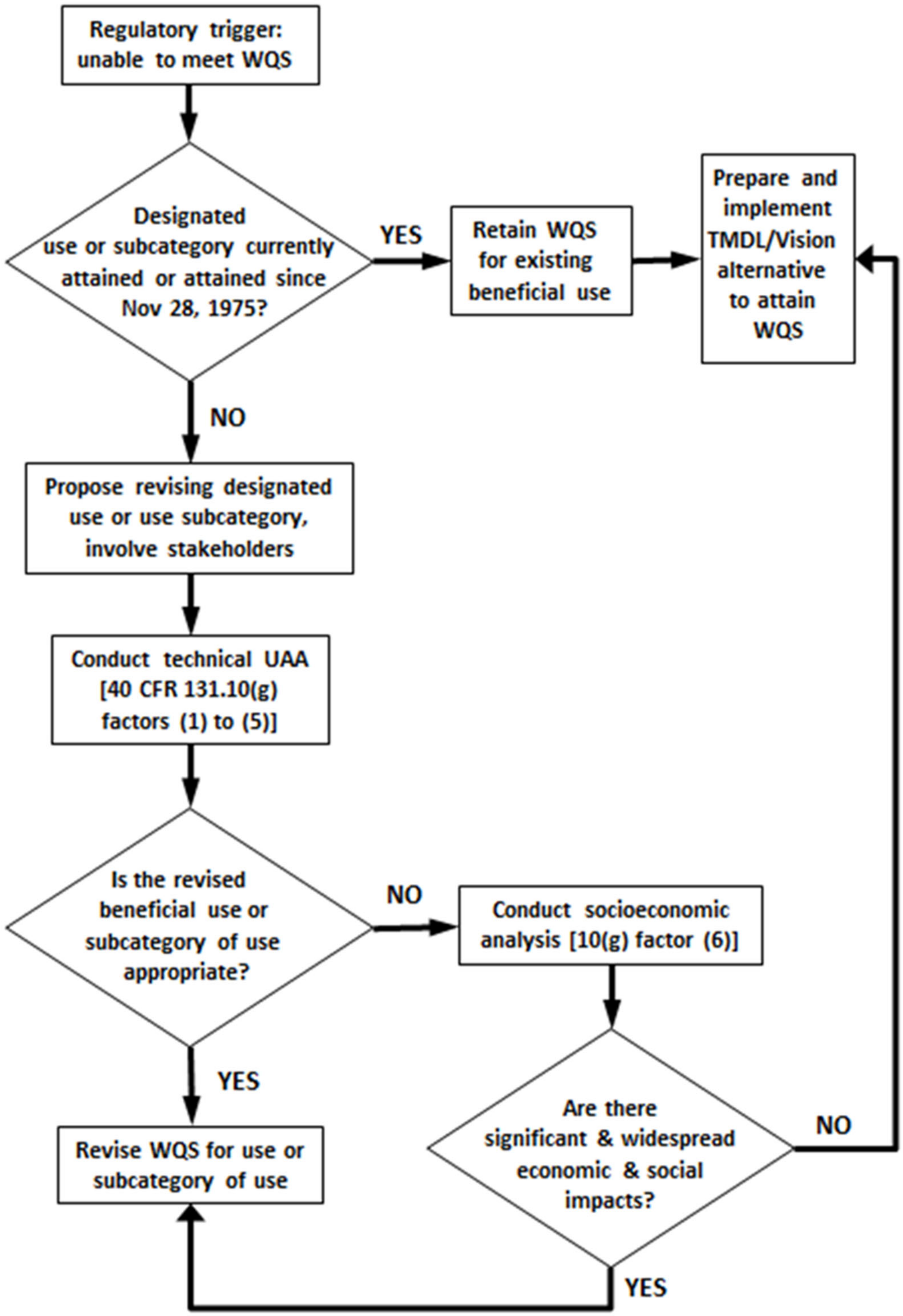

Figure 5. Basic Logic Path of a Use Attainability Analysis.

C2.0 Evaluating the Six Factors

Aspects of all six of the six factors apply to the tributary channels. (1) **Natural background conditions** that result from the unique hydrogeochemical conditions in the Las Vegas Valley reflect high levels of selenium, boron, fluoride, and TDS in dry-weather flows. (2) **Low-flow conditions** during dry weather prevent attainment of a viable fishery or immersion recreation. (3) **Human-caused conditions** that are required to provide effective flow-conveyance and flood control structures preclude other priorities and uses. (4) **Extreme hydrologic modifications**, including straightening channels and lining them with concrete, preclude use of the channels for aquatic life or immersion recreation. (5) **Physical conditions** in the modified channels do not provide a suitable substrate for aquatic life. (6) Controls to ameliorate natural conditions would result in substantial and widespread economic and social impact. The tributary water reflects the poor water quality of shallow groundwater in the Las Vegas Valley, and restoring the area to conditions that existed prior to establishment of Las Vegas are impossible.

Three of the six factors stand out, however. These factors are discussed below.

- For **factor 1**, the natural background quality of shallow groundwater in the Las Vegas Valley is well documented. Where the potentiometric surface of this groundwater intersects the ground surface, seeps and springs occur. The addition of pumped groundwater, which is necessitated by subgrade infrastructure throughout Las Vegas, contributes more of this poor quality water to the tributary channels. Treatment of this water for naturally occurring constituents (TDS, boron, fluoride, selenium) is infeasible.
- For **factor 4**, the mandate of the CCRFCD is clear; construct a system of engineered channels and detention basins across the Las Vegas Valley, in order to protect life and property during flood events. There is no reasonable way to prevent monsoon storms from creating flash flood events in the valley; therefore, the modification of tributary channels as flood-conveyance structures must continue.
- For **factor 5**, the physical conditions and low dry-weather flows in the modified channels do not provide a suitable substrate for aquatic life, nor do they provide recreational potential. Monsoon season renders the channels unsafe for both humans and wildlife.

C2.1 Natural Background Conditions (Factor 1)

The Las Vegas Valley is a structural basin formed by bedrock that ranges in age from Precambrian through Miocene (Plume, 1989). Plume (1989) noted that bedrock comprises Precambrian metamorphic rocks; Precambrian and Paleozoic carbonate rocks; Permian, Triassic, and Jurassic clastic rocks; and Miocene igneous rocks.

As discussed in **Section 5.0** of this Rationale, the unique hydrogeochemical conditions of desert basins, such as the Las Vegas Valley, can lead to naturally poor-quality waters. The mobilization and subsequent accumulation of trace elements derived from surrounding geologic sources can create high concentrations of constituents in valley soils. The exact composition depends on the composition of the source rocks. In the case of Las Vegas, the source materials have provided selenium, boron, fluoride, and other constituents to the soils and groundwater. Evaporation concentrates these constituents, and the addition of water dissolves and remobilizes them.

High levels of naturally occurring selenium and other trace elements are found throughout the Colorado River Basin. The upstream reaches of the Colorado River system in Colorado, Utah, and Arizona show impairments due to selenium. This is upstream of where the river enters Nevada and Lake Mead.

C2.2 Hydrologic Modifications (Factor 4)

Prior to development of the metropolitan area of Las Vegas, the valley floor was crossed by alluvial channels, which were typically present as dry washes (**see Figure 11**). As the city grew, evermore acreage was transformed into impermeable surfaces, leading to greater runoff and serious flooding during monsoon downpours. In response to catastrophic flooding, the State of Nevada created the Clark County Regional Flood Control District (CCRFCD) in 1986.

The goal of the CCRFCD is to create a floodwater-conveyance system that efficiently and effectively captures and channels floodwaters, and prevents loss of life and property due to flash floods. If it were cost-effective to bury all channels in giant box culverts throughout the city, that would be ideal; however, it is unrealistic to do so. Instead, CCRFCD has engineered the formerly dry washes to act as concrete conduits for directing floodwaters to the Las Vegas Wash.

Appendix B to this rationale document provides the results of field study that examined the nature and condition of the channels tributary to Las Vegas Wash. The hydrologic modifications to the original alluvial channels, along with the expansion of metropolitan Las Vegas, has permanently and profoundly altered the natural channels. There is no expectation that any accidental aquatic organisms found in the channels will survive.

C2.3 Physical Conditions (Factor 5)

The formerly ephemeral washes now carry a small perennial flow; however, the thin flows across the wide concrete channels do not provide habitat for propagating aquatic life. Moreover, the intermittent flash flood scour out the channels and, with nowhere to hide, any organisms would be swept away by the floodwaters. Review of USGS gage data for the Las Vegas Wash shows the flashy nature of the surface water system in the Las Vegas Valley (**Figure C-1**). Baseflow downstream of the WRFs is currently about 300 cfs (green line on figure).

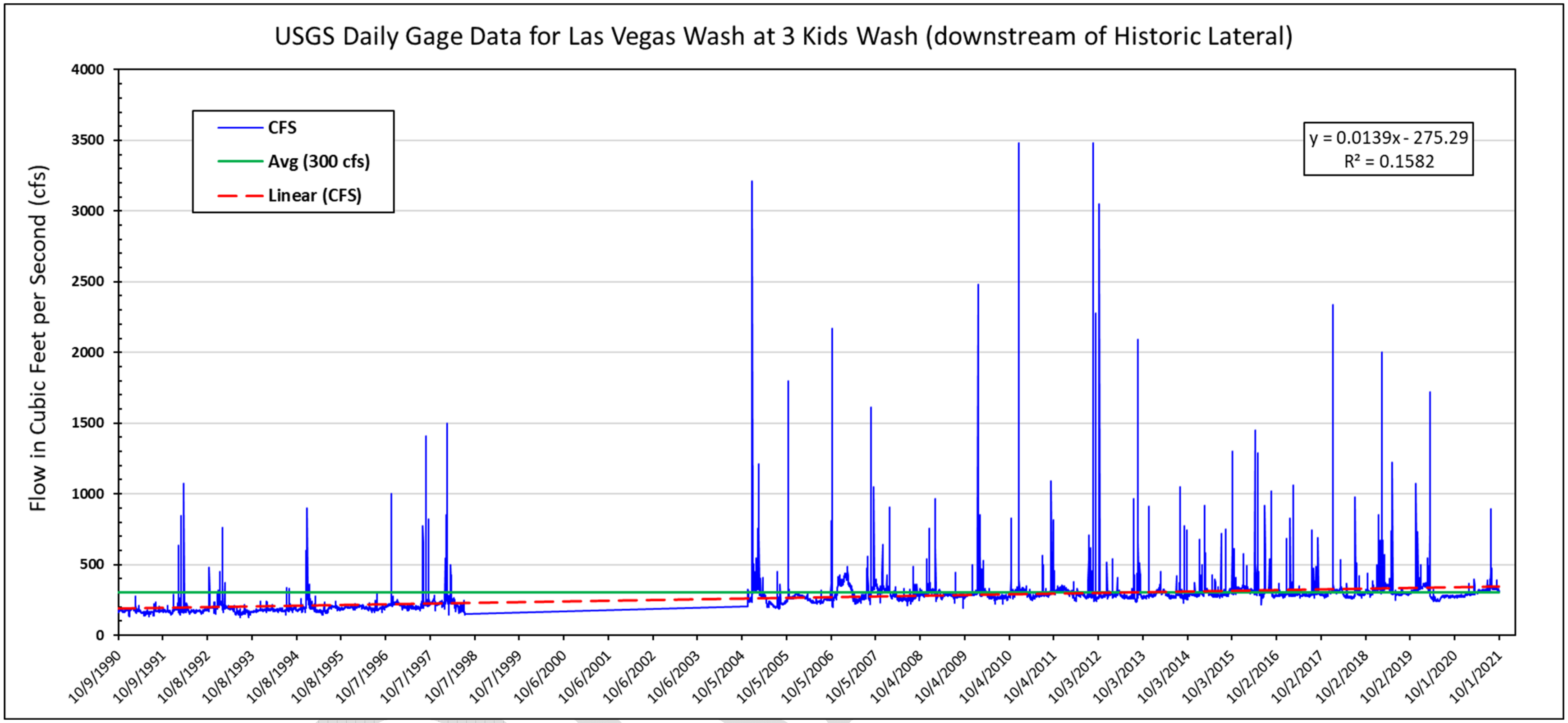

Figure C-1. Average daily flow on the Las Vegas Wash from 1990 to 2021. Gage 9419753 located downstream of Historic Lateral.

Out of 9,004 days of averaged flow data, there were 147 days where the average flow was greater than 500 cfs; 34 days when average flow was greater than 1,000 cfs; 9 days when average flow was greater than 2,000 cfs; and 4 days when average flow was greater than 3,000 cfs. There is a missing time period from August 1998 until November 2004. A large flood event on July 8, 1999 was deemed a 100-year event that caused more than $20 million in damages, destroyed 369 homes, and claimed two lives. This flood also knocked out USGS streamflow gages on the Las Vegas Wash. A peak flow of 18,000 cfs was measured at Las Vegas Wash flows above Three Kids wash during the July 8, 1999 flood event (USGS, 2000. Fact sheet 080-00)

Attachment 1 to Appendix C

Code of Federal Regulations, Title 40 § 131.10 – Designation of Uses

§ 131.10 Designation of uses.
[48 FR 51405, Nov. 8, 1983, as amended at 80 FR 51047, Aug. 21, 2015]

(a) Each State must specify appropriate water uses to be achieved and protected. The classification of the waters of the State must take into consideration the use and value of water for public water supplies, protection and propagation of fish, shellfish and wildlife, recreation in and on the water, agricultural, industrial, and other purposes including navigation. If adopting new or revised designated uses other than the uses specified in section 101(a)(2) of the Act, or removing designated uses, States must submit documentation justifying how their consideration of the use and value of water for those uses listed in this paragraph appropriately supports the State's action. A use attainability analysis may be used to satisfy this requirement. In no case shall a State adopt waste transport or waste assimilation as a designated use for any waters of the United States.

(b) In designating uses of a water body and the appropriate criteria for those uses, the State shall take into consideration the water quality standards of downstream waters and shall ensure that its water quality standards provide for the attainment and maintenance of the water quality standards of downstream waters.

(c) States may adopt sub-categories of a use and set the appropriate criteria to reflect varying needs of such sub-categories of uses, for instance, to differentiate between cold water and warm water fisheries.

(d) At a minimum, uses are deemed attainable if they can be achieved by the imposition of effluent limits required under sections 301(b) and 306 of the Act and cost-effective and reasonable best management practices for nonpoint source control.

(e) [Reserved]

(f) States may adopt seasonal uses as an alternative to reclassifying a water body or segment thereof to uses requiring less stringent water quality criteria. If seasonal uses are adopted, water quality criteria should be adjusted to reflect the seasonal uses, however, such criteria shall not preclude the attainment and maintenance of a more protective use in another season.

(g) States may designate a use, or remove a use that is not an existing use, if the State conducts a use attainability analysis as specified in paragraph (j) of this section that demonstrates attaining the use is not feasible because of one of the six factors in this paragraph. If a State adopts a new or revised water quality standard based on a required use attainability analysis, the State shall also adopt the highest attainable use, as defined in § 131.3(m).

(1) Naturally occurring pollutant concentrations prevent the attainment of the use; or

(2) Natural, ephemeral, intermittent or low flow conditions or water levels prevent the attainment of the use, unless these conditions may be compensated for by the discharge of sufficient volume of effluent discharges without violating State water conservation requirements to enable uses to be met; or

(3) Human caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct than to leave in place; or

(4) Dams, diversions or other types of hydrologic modifications preclude the attainment of the use, and it is not feasible to restore the water body to its original condition or to operate such modification in a way that would result in the attainment of the use; or

(5) Physical conditions related to the natural features of the water body, such as the lack of a proper substrate, cover, flow, depth, pools, riffles, and the like, unrelated to water quality, preclude attainment of aquatic life protection uses; or

(6) Controls more stringent than those required by sections 301(b) and 306 of the Act would result in substantial and widespread economic and social impact.

(h) States may not remove designated uses if:

(1) They are existing uses, as defined in § 131.3, unless a use requiring more stringent criteria is added; or

(2) Such uses will be attained by implementing effluent limits required under sections 301(b) and 306 of the Act and by implementing cost-effective and reasonable best management practices for nonpoint source control.

(i) Where existing water quality standards specify designated uses less than those which are presently being attained, the State shall revise its standards to reflect the uses actually being attained.

(j) A State must conduct a use attainability analysis as described in § 131.3(g), and paragraph (g) of this section, whenever:

(1) The State designates for the first time, or has previously designated for a water body, uses that do not include the uses specified in section 101(a)(2) of the Act; or

(2) The State wishes to remove a designated use that is specified in section 101(a)(2) of the Act, to remove a sub-category of such a use, or to designate a sub-category of such a use that requires criteria less stringent than previously applicable.

(k) A State is not required to conduct a use attainability analysis whenever:

(1) The State designates for the first time, or has previously designated for a water body, uses that include the uses specified in section 101(a)(2) of the Act; or

(2) The State designates a sub-category of a use specified in section 101(a)(2) of the Act that requires criteria at least as stringent as previously applicable; or

(3) The State wishes to remove or revise a designated use that is a non-101(a)(2) use. In this instance, as required by paragraph (a) of this section, the State must submit documentation justifying how its consideration of the use and value of water for those uses listed in paragraph (a) appropriately supports the State's action, which may be satisfied through a use attainability analysis.

See: https://www.law.cornell.edu/cfr/text/40/131.10

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Attachment 2 to Appendix C

Use Attainability Checklists

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USE ATTAINABILITY ANALYSIS FOR SURFACE WATERS – AQL Limitations

The following waterbody or stream segment has been evaluated using all available data and information, and has been found to not meet criteria for propagation of certain aquatic life. Specific reasons and limitations are provided below:

Region: ____

Waterbody Name: ____

Reach Description: ____

Waterbody ID: ____

Reason for Nonattainment (check one or more)

(1) Naturally occurring pollutant concentrations prevent the attainment of the use.

(2) Natural, ephemeral, intermittent or low flow conditions or water levels prevent the attainment of the use, unless these conditions may be compensated for by the discharge of sufficient volume of effluent discharges without violating State water conservation requirements to enable uses to be met.

(3) Human caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct than to leave in place.

(4) Dams, diversions or other types of hydrologic modifications preclude the attainment of the use, and it is not feasible to restore the water body to its original condition or to operate such modification in a way that would result in the attainment of the use.

(5) Physical conditions related to the natural features of the water body, such as the lack of a proper substrate, cover, flow, depth, pools, riffles, and the like, unrelated to water quality, preclude attainment of aquatic life protection uses.

(6) Controls more stringent than those required by sections 301(b) and 306 of the Act would result in substantial and widespread economic and social impact.

☐ Temperature exceeds criteria: ______
____

☐ Chronic toxicity from: ______________
____

☒ Natural Background Conditions:
High TDS, B, F, Se from groundwater

☒ Stream flow too low or intermittent: Median dry-weather flows from 1 to 8.6 cfs in tributary channels.

☒ Human-caused conditions prevent attainment and cannot be rectified: Channels straightened and lined to act as flood-conveyance structures.

☒ Hydrologic Modifications: fish propagation prevented by: Concrete lining (no suitable substrate/habitat) to promote conveyance of flood waters into the Las Vegas Wash.

☐ Diversions: fish propagation prevented by:
____

☒ Physical conditions related to lack of substrate preclude some or all aquatic life: Concrete-lined channels contain shallow flows and no refuge from high temperatures.

☐ Controls would result in substantial and widespread economic and social impact. __
____

☐ Other ____________________________
____
____

Seepage into Sloan Channel

USE ATTAINABILITY ANALYSIS FOR SURFACE WATERS – RWC Limitations

The following waterbody or stream segment has been evaluated using all available data and information, and has been found to not meet criteria for contact recreation. Specific reasons and limitations are provided below:

Region: ____

Waterbody Name: ____

Reach Description: ____

Waterbody ID: ____

Reason for Nonattainment (check one or more)

(1) Naturally occurring pollutant concentrations prevent the attainment of the use.

(2) Natural, ephemeral, intermittent or low flow conditions or water levels prevent the attainment of the use, unless these conditions may be compensated for by the discharge of sufficient volume of effluent discharges without violating State water conservation requirements to enable uses to be met.

(3) Human caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct than to leave in place.

(4) Dams, diversions or other types of hydrologic modifications preclude the attainment of the use, and it is not feasible to restore the water body to its original condition or to operate such modification in a way that would result in the attainment of the use.

(5) Physical conditions related to the natural features of the water body, such as flow, depth, and the like, unrelated to water quality, preclude attainment of contact recreation.

(6) Controls more stringent than those required by sections 301(b) and 306 of the Act would result in substantial and widespread economic and social impact.

☐ Toxicity from: ______________________
____
____

☐ Other:____________________________
____
____

☒ Stream flow too low or intermittent: Dry-weather flows typically from 1 to 4 inches in depth. Flood flows too dangerous.

☒ Human-caused conditions prevent attainment and cannot be rectified: Channels developed as flood-conveyance structures are critical to protect life and property from flash floods

☒ Diversions; contact recreation prevented by: Concrete channels are fenced to exclude humans. Some concrete channels have vertical walls that limit access.

☒ Physical conditions preclude contact recreation: Concrete channels are fenced to exclude humans and terrestrial wildlife. Some concrete channels have vertical walls.

☐ Controls would result in substantial and widespread economic and social impact. __
____

☐ Other ____________________________
____
____