WATER QUALITY MANAGEMENT PLAN FOR THE CARSON RIVER

APRIL 15, 2005

APPENDICES A-F

Prepared for:

Carson Water Subconservancy District

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APPENDIX A
SURFACE WATER HYDROLOGY DATA

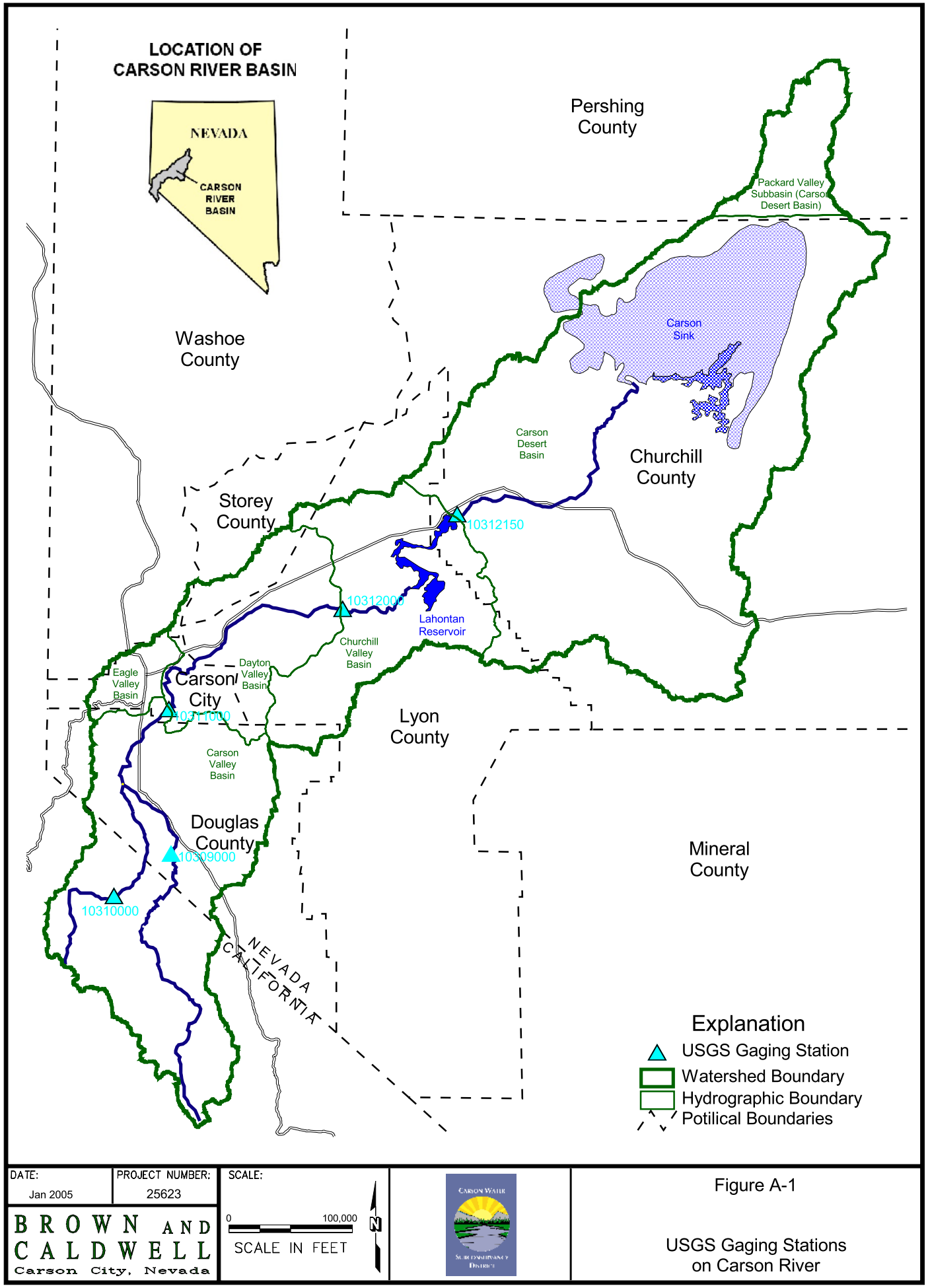

LOCATION OF
CARSON RIVER BASIN
NEVADA
CARSON
RIVER
BASIN
Pershing
County
Packard Valley
Subbasin (Carson
Desert Basin)
Carson
Sink
Washoe
County
Carson
Desert
Basin
Churchill
County
Storey
County
10312150
10312000
Lahontan
Reservoir
Churchill
Valley
Basin
Dayton
Valley
Basin
Eagle
Valley
Basin
Carson
City
10311000
Lyon
County
Carson
Valley
Basin
Douglas
County
10309000
10310000
NEVADA
CALIFORNIA
Mineral
County
Explanation
USGS Gaging Station
Watershed Boundary
Hydrographic Boundary
Potilical Boundaries
DATE:
Jan 2005
PROJECT NUMBER:
25623
SCALE:
0
100,000
SCALE IN FEET
N
BROWN AND CALDWELL
Carson City, Nevada
Figure A-1
USGS Gaging Stations
on Carson River

Figure A-2: Total Annual Flows for Gaging Station at East Fork Near Gardnerville (10309000): 1940-2003

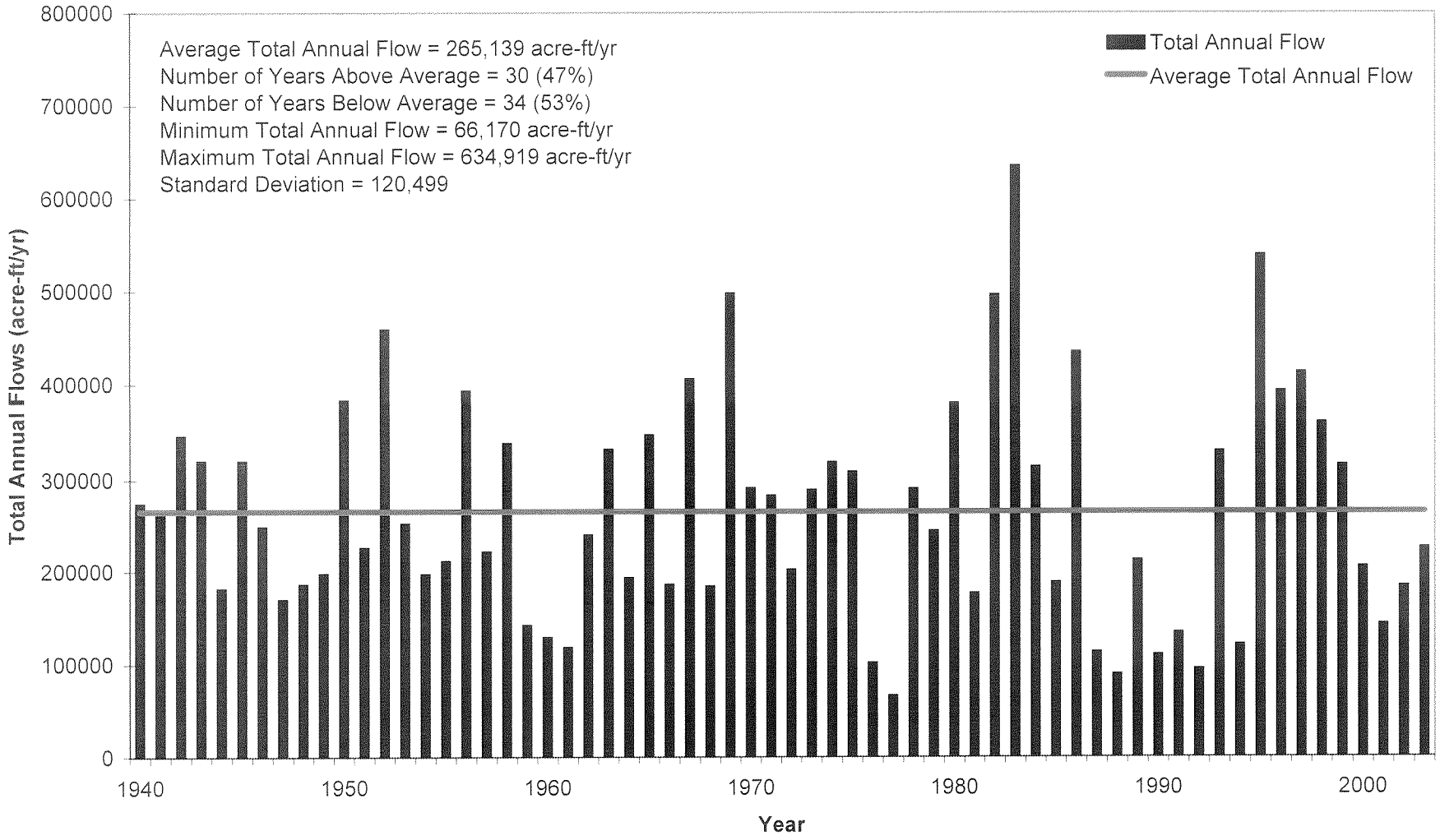


Figure A-3: Total Annual Flows for Gaging Station at West Fork Near Woodfords (10310000): 1939-2003

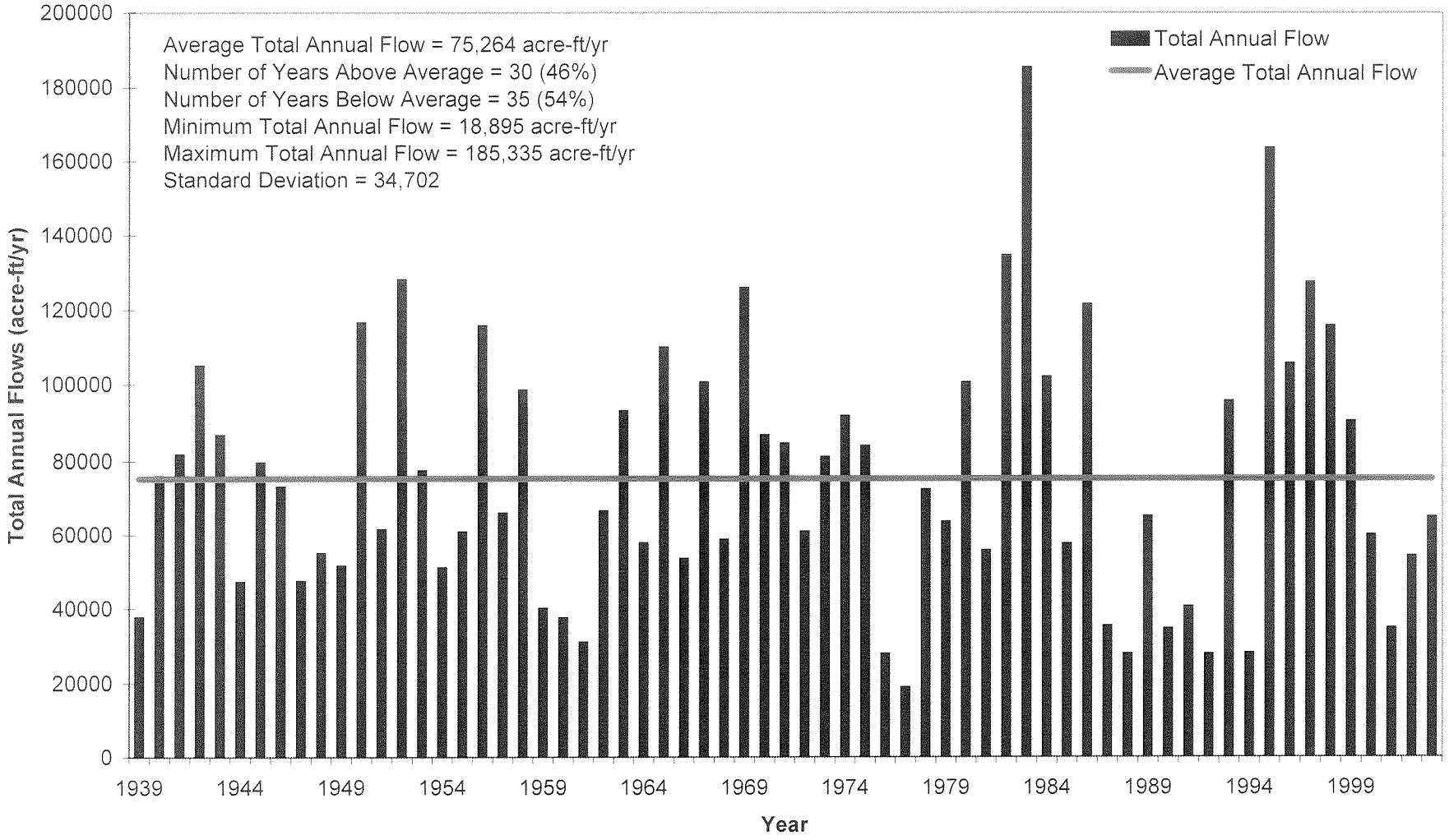


Figure A-4: Total Annual Flows at Carson City Gaging Station (10311000): 1940-2003

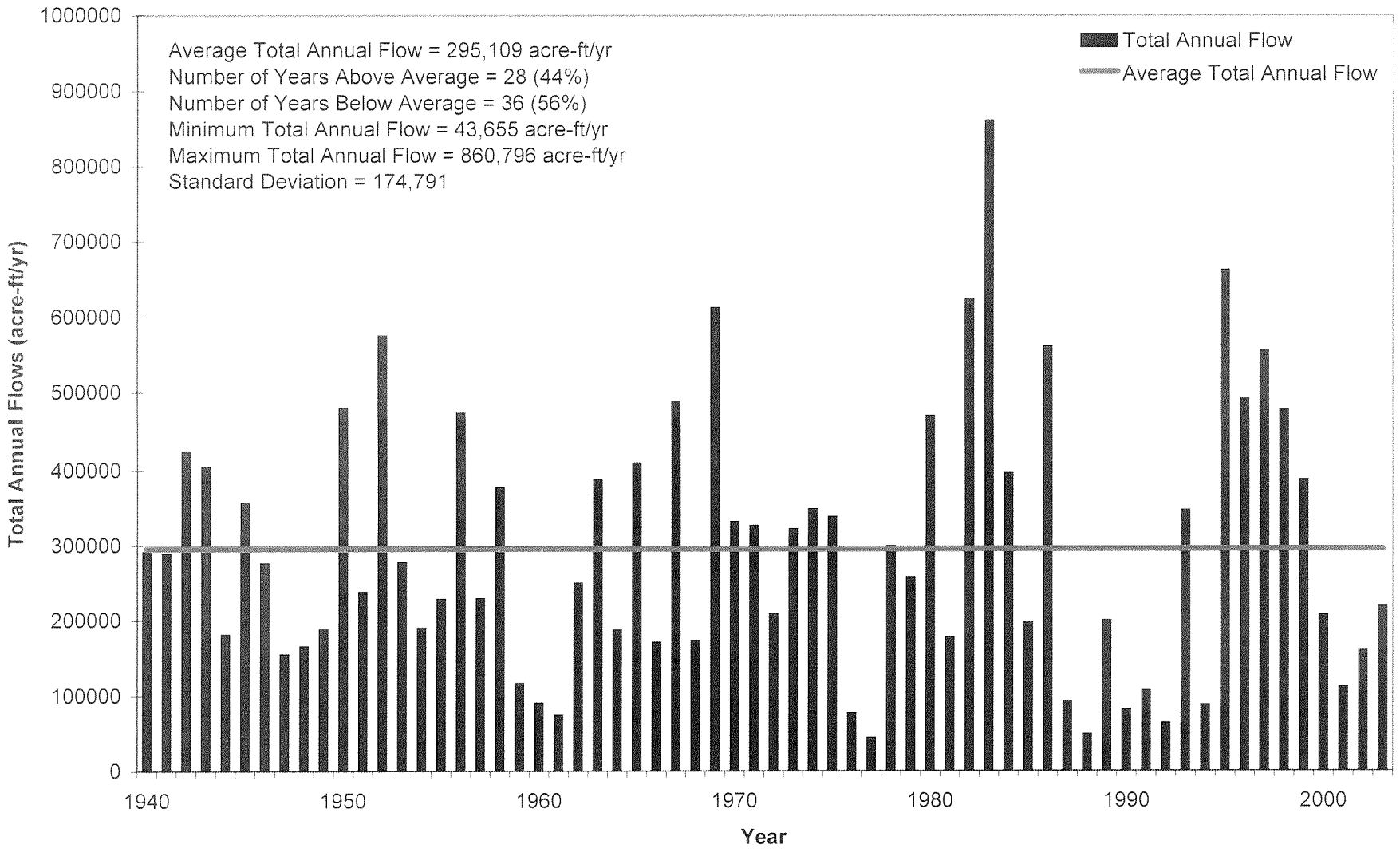


Figure A-5: Total Annual Flows at Fort Churchill Gaging Station (10312000): 1912-2003

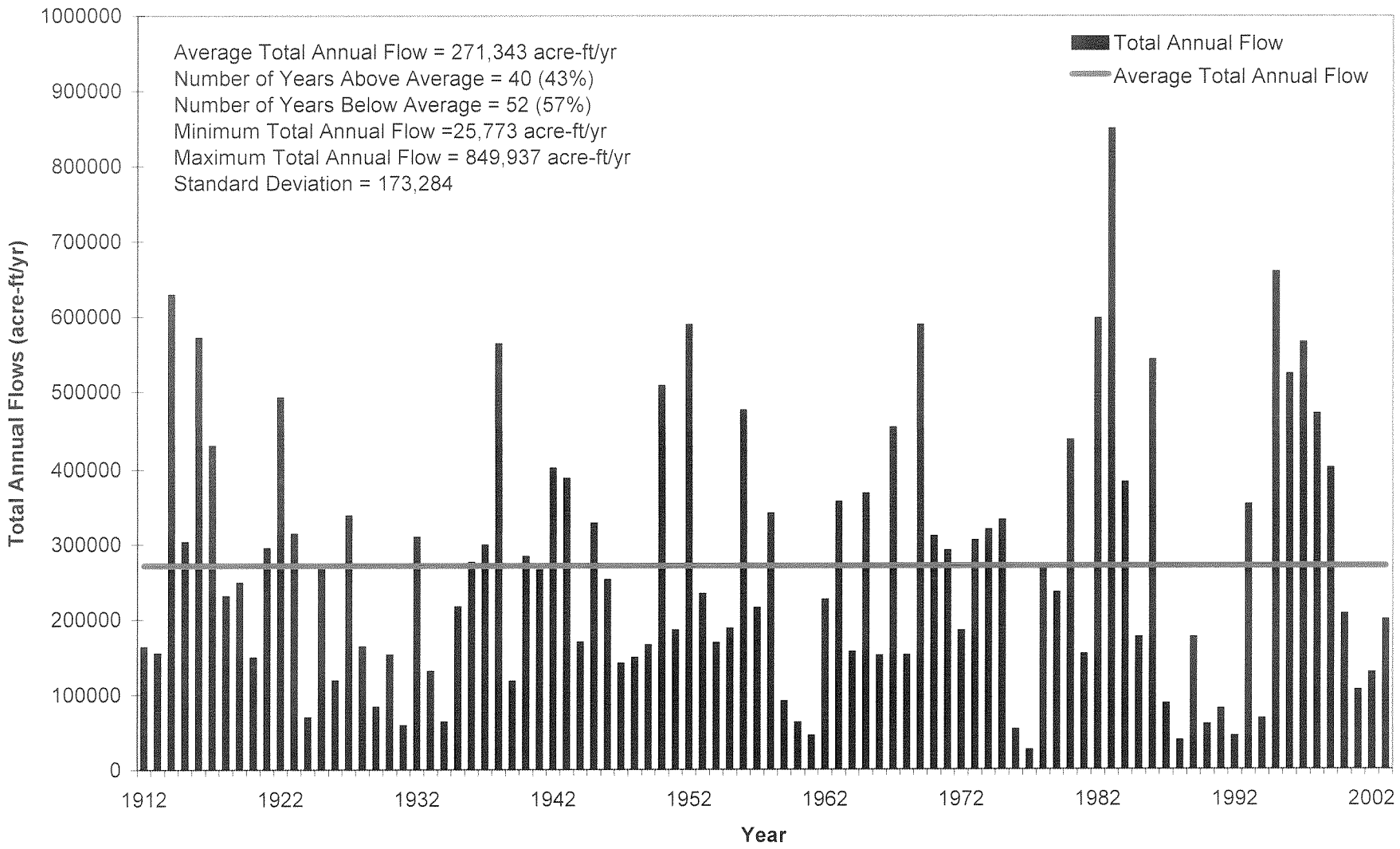
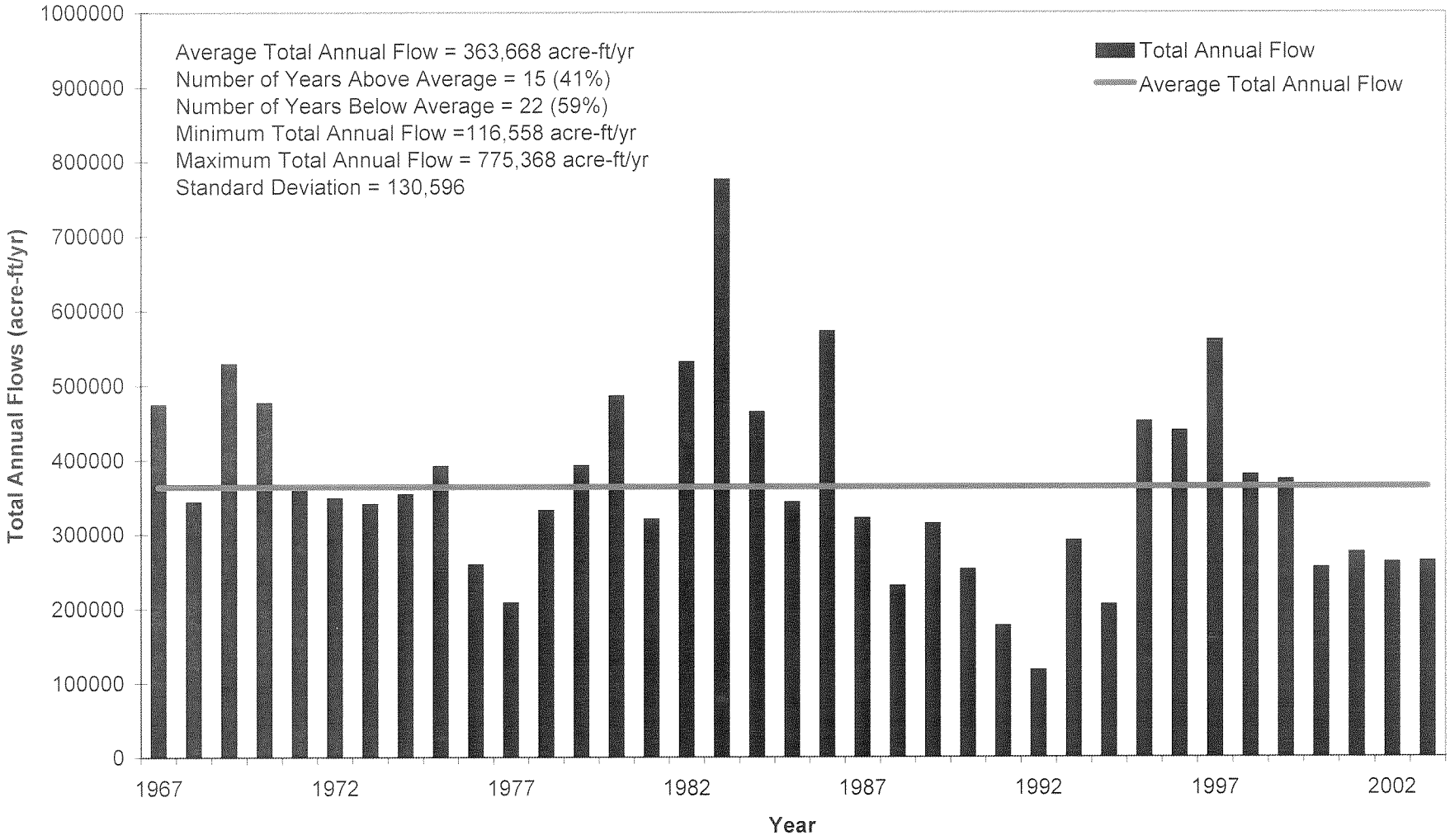
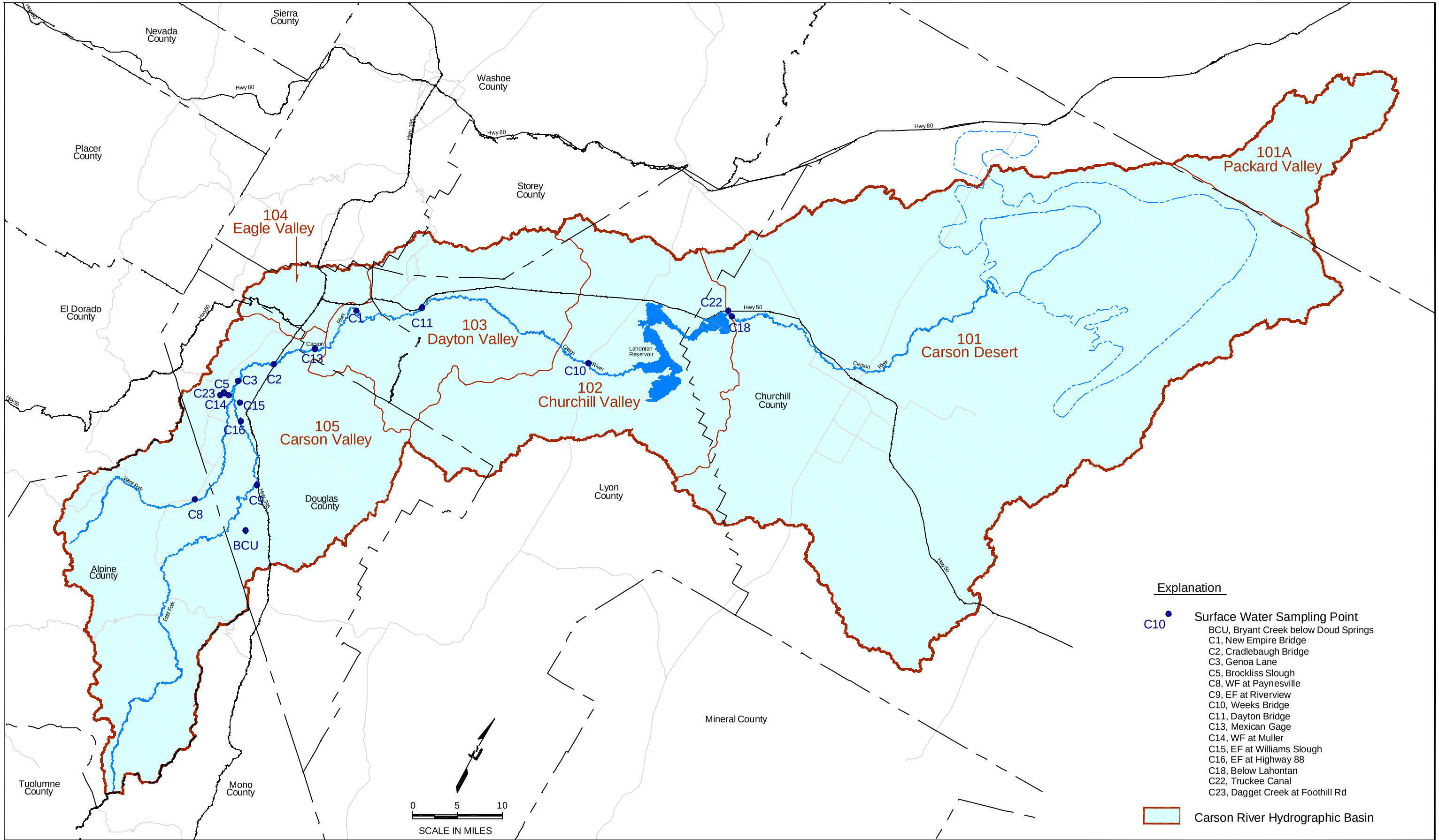


Figure A-6: Total Annual Flows at Gaging Station Below Lahontan Reservoir Near Fallon (10312150): 1967-2003



APPENDIX B
CARSON RIVER WATER QUALITY STANDARDS



BROWN AND CALDWELL
Carson City, Nevada

DATE: Jan 2005
PROJECT NUMBER:

Water Quality Management (208) Plan for the Carson River Basin

Figure B-1

NDEP's Ambient Monitoring Network - Carson Basin

Table B-1. Carson River WQS -- West Fork at the Stateline (NAC 445A.147)			
Parameter	**Requirements to Maintain Existing Higher Quality**	**Water Quality Standards For Beneficial Uses**	**Beneficial Uses**
Temperature °C- Maximum ΔT^a	 $\Delta T = 0°C$	Nov.-May : ≤13°C June : ≤17°C July : ≤21°C Aug.-Oct. : ≤22°C $\Delta T \leq 2°C$	Aquatic life[b] and recreation involving contact with the water.
pH Units	7.4 - 8.4 —	S.V. : 6.5 - 9.0 ΔpH : ±0.5 Max.	Recreation involving contact with the water,[b] propagation of wildlife,[b] aquatic life, irrigation, watering of livestock, municipal or domestic supply and industrial supply.
Total Phosphates (as P) - mg/l	A-Avg. : ≤.016 S.V. : ≤.033	A-Avg. : ≤0.10	Aquatic life,[b] recreation involving contact with water,[b] municipal or domestic supply and recreation not involving contact with the water.
Nitrogen Species (N) - mg/l	A-Avg. : ≤0.4 S.V. : ≤0.5	Nitrate S.V. : ≤10 Nitrite S.V. : ≤.06	Aquatic life,[b] municipal or domestic supply,[b] recreation involving contact with the water, watering of livestock, propagation of wildlife and recreation not involving contact with the water.
Total Ammonia (as N) - mg/l	—	e	Aquatic life.[b]
Dissolved Oxygen - mg/l	 — —	S.V. : Nov.-May : ≥5.0 Jun.-Oct. : ≥6.0	Aquatic life,[b] recreation involving contact with the water, propagation of wildlife, watering of livestock, municipal or domestic supply and recreation not involving contact with the water.
Suspended Solids - mg/l	A-Avg. : ≤15 —	S.V. : ≤25	Aquatic life.[b]
Turbidity - NTU	A-Avg. : ≤3 S.V. : ≤5	S.V. : ≤10	Aquatic life[b] and municipal or domestic supply.
Color - PCU	d	S.V. : ≤75	Municipal or domestic supply.[b]
Total Dissolved Solids - mg/l	A-Avg. : ≤70 S.V. : ≤95	A-Avg. : ≤500	Municipal or domestic supply,[b] irrigation and watering of livestock.
Chlorides - mg/l	A-Avg. : ≤3 S.V. : ≤5	S.V. : ≤250	Municipal or domestic supply,[b] propagation of wildlife, irrigation and watering of livestock.
Sulfate - mg/l	— S.V. : ≤4	S.V. : ≤250	Municipal or domestic supply.[b]
Sodium - SAR	A-Avg. : ≤1	A-Avg. : ≤8	Irrigation[b] and municipal or domestic supply.
Alkalinity (as $CaCO_3$) - mg/l	— —	less than 25% change from natural conditions	Aquatic life[b] and propagation of wildlife.
Fecal Coliform- No./100 ml	A.G.M. : ≤105 —	≤200/400c	Recreation involving contact with the water,[b] recreation not involving contact with the water, municipal or domestic supply, irrigation, propagation of wildlife and watering of livestock.
E coli - No./100 ml Annual Geometric Mean Single Value	 — —	 ≤126 ≤410	Recreation involving contact with the water[b] and recreation not involving contact with the water.

Control Point at the West Fork at the Stateline. The limits of this table apply only to the West Fork at the Stateline.

Table B-2. Carson River WQS -- Bryant Creek near the Stateline (NAC 445A.148)			
Parameter	**Requirements to Maintain Existing Higher Quality**	**Water Quality Standards For Beneficial Uses**	**Beneficial Uses**
Temperature °C- Maximum ΔT^a	 $\Delta T = 0°C$	Nov.-May : ≤13°C June : ≤17°C July : ≤21°C Aug.-Oct. : ≤22°C $\Delta T \leq 2°C$	Aquatic life[b] and recreation involving contact with the water.
pH Units	— —	 S.V. : 6.5 - 9.0 ΔpH : ±0.5 Max.	Recreation involving contact with the water,[b] propagation of wildlife,[b] aquatic life, irrigation, watering of livestock, municipal or domestic supply and industrial supply.
Total Phosphates (as P) - mg/l	A-Avg. : ≤.036 S.V. : ≤.05	A-Avg. : ≤0.10	Aquatic life,[b] recreation involving contact with the water,[b] municipal or domestic supply and recreation not involving contact with the water.
Nitrogen Species (N) - mg/l	A-Avg. : ≤0.6 S.V. : ≤1.0	Nitrate S.V. : ≤10 Nitrite S.V. : ≤.06	Aquatic life,[b] municipal or domestic supply,[b] recreation involving contact with the water, watering of livestock, propagation of wildlife and recreation not involving contact with the water.
Total Ammonia (as N) - mg/l	—	e	Aquatic life.[b]
Dissolved Oxygen - mg/l	 — —	S.V. : Nov.-May : ≥6.0 Jun.-Oct. : ≥5.0	Aquatic life,[b] recreation involving contact with the water, propagation of wildlife, watering of livestock, municipal or domestic supply and recreation not involving contact with the water.
Suspended Solids - mg/l	— —	S.V. : ≤25	Aquatic life.[b]
Turbidity - NTU	— —	S.V. : ≤10	Aquatic life[b] and municipal or domestic supply
Color - PCU	d	S.V. : ≤75	Municipal or domestic supply.[b]
Total Dissolved Solids - mg/l	A-Avg. : ≤375 S.V. : ≤420	A-Avg. : ≤500	Municipal or domestic supply,[b] irrigation and watering of livestock.
Chlorides - mg/l	A-Avg. : ≤6 S.V. : ≤7	S.V. : ≤250	Municipal or domestic supply,[b] propagation of wildlife, irrigation and watering of livestock.
Sulfate - mg/l	— —	S.V. : ≤250	Municipal or domestic supply.[b]
Sodium - SAR	A-Avg. : ≤1	A-Avg. : ≤8	Irrigation[b] and municipal or domestic supply.
Alkalinity (as $CaCO_3$) - mg/l	— —	less than 25% change from natural conditions	Aquatic life[b] and propagation of wildlife.
Fecal Coliform- No./100 ml	A.G.M. : ≤50 S.V. : ≤90	≤200/400[c]	Recreation involving contact with the water,[b] recreation not involving contact with the water, municipal or domestic supply, irrigation, propagation of wildlife and watering of livestock.
E coli - No./100 ml Annual Geometric Mean Single Value	 — —	 ≤126 ≤410	Recreation involving contact with the water[b] and recreation not involving contact with the water.

Control Point at Bryant Creek near the Stateline. The limits of this table apply only to Bryant Creek near the Stateline.

Table B-3. Carson River WQS -- East Fork at the Stateline (NAC 445A.149)			
Parameter	**Requirements to Maintain Existing Higher Quality**	**Water Quality Standards For Beneficial Uses**	**Beneficial Uses**
Temperature °C- Maximum ΔT^a	 $\Delta T = 0°C$	Nov.-May : ≤13°C June : ≤17°C July : ≤21°C Aug.-Oct. : ≤22°C $\Delta T \leq 2°C$	Aquatic life[b] and recreation involving contact with the water.
pH Units	— —	S.V. : 6.5 - 9.0 ΔpH : ±0.5 Max.	Recreation involving contact with the water,[b] propagation of wildlife,[b] aquatic life, irrigation, watering of livestock, municipal or domestic supply and industrial supply.
Total Phosphates (as P) - mg/l	A-Avg. : ≤.03 S.V. : ≤.065	A-Avg. : ≤0.10	Aquatic life,[b] recreation involving contact with the water,[b] municipal or domestic supply and recreation not involving contact with the water.
Nitrogen Species (N) - mg/l	Total Nitrogen A-Avg. : ≤0.5 S.V. : ≤1.1	Nitrate S.V. : ≤10 Nitrite S.V. : ≤.06	Aquatic life,[b] municipal or domestic supply,[b] recreation involving contact with the water, watering of livestock, propagation of wildlife and recreation not involving contact with the water.
Total Ammonia (as N) - mg/l	—	e	Aquatic life.[b]
Dissolved Oxygen - mg/l	— —	S.V. : Nov.-May : ≥6.0 Jun.-Oct. : ≥5.0	Aquatic life,[b] recreation involving contact with the water, propagation of wildlife, watering of livestock, municipal or domestic supply and recreation not involving contact with the water.
Suspended Solids - mg/l	— —	S.V. : ≤25	Aquatic life.[b]
Turbidity - NTU	A-Avg. : ≤5 S.V. : ≤8	S.V. : ≤10	Aquatic life[b] and municipal or domestic supply.
Color - PCU	d	S.V. : ≤75	Municipal or domestic supply.[b]
Total Dissolved Solids - mg/l	A-Avg. : ≤145 S.V. : ≤185	A-Avg. : ≤500	Municipal or domestic supply,[b] irrigation and watering of livestock.
Chlorides - mg/l	A-Avg. : ≤3 S.V. : ≤5	S.V. : ≤250	Municipal or domestic supply,[b] propagation of wildlife, irrigation and watering of livestock.
Sulfate - mg/l	— S.V. : ≤3	S.V. : ≤250	Municipal or domestic supply.[b]
Sodium - SAR	A-Avg. : ≤2	A-Avg. : ≤8	Irrigation[b] and municipal or domestic supply.
Alkalinity (as $CaCO_3$) - mg/l	— —	less than 25% change from natural conditions	Aquatic life[b] and propagation of wildlife.
Fecal Coliform- No./100 ml	A.G.M. : ≤40 S.V. : ≤60	≤200/400[c]	Recreation involving contact with the water,[b] recreation not involving contact with the water, municipal or domestic supply, irrigation, propagation of wildlife and watering of livestock.
E coli - No./100 ml Annual Geometric Mean Single Value	 — —	 ≤126 ≤410	Recreation involving contact with the water[b] and recreation not involving contact with the water.

Control Point at the East Fork at the Stateline. The limits of this table apply only to the East Fork at the Stateline.

Table B-4. Carson River WQS -- East Fork at Highway 395, South of Gardnerville (NAC 445A.150)			
Parameter	**Requirements to Maintain Existing Higher Quality**	**Water Quality Standards For Beneficial Uses**	**Beneficial Uses**
Temperature °C- Maximum ΔT^a	 $\Delta T = 0°C$	Nov.-May : ≤13°C June : ≤17°C July : ≤21°C Aug.-Oct. : ≤22°C $\Delta T \leq 2°C$	Aquatic life[b] and recreation involving contact with the water.
pH Units	7.5 - 8.6 —	S.V. : 6.5 - 9.0 ΔpH : ±0.5 Max.	Recreation involving contact with the water,[b] propagation of wildlife,[b] aquatic life, irrigation, watering of livestock, municipal or domestic supply and industrial supply.
Total Phosphates (as P) - mg/l	— —	A-Avg. : ≤0.10	Aquatic life,[b] recreation involving contact with the water,[b] municipal or domestic supply and recreation not involving contact with the water.
Nitrogen Species (N) - mg/l	Total Nitrogen A-Avg. : ≤0.4 S.V. : ≤0.5	Nitrate S.V. : ≤10 Nitrite S.V. : ≤.06	Aquatic life,[b] municipal or domestic supply,[b] recreation involving contact with the water, watering of livestock, propagation of wildlife and recreation not involving contact with the water.
Total Ammonia (as N) - mg/l	—	e	Aquatic life.[b]
Dissolved Oxygen - mg/l	— —	: S.V. Nov.- : ≥6.0 May : ≥5.0 Jun.-Oct.	Aquatic life,[b] recreation involving contact with the water, propagation of wildlife, watering of livestock, municipal or domestic supply and recreation not involving contact with the water.
Suspended Solids - mg/l	— —	S.V. : ≤80	Aquatic life.[b]
Turbidity - NTU	— —	S.V. : ≤10	Aquatic life[b] and municipal or domestic supply.
Color - PCU	d	S.V. : ≤75	Municipal or domestic supply.[b]
Total Dissolved Solids - mg/l	A-Avg. : ≤120 S.V. : ≤175	A-Avg. : ≤500	Municipal or domestic supply,[b] irrigation and watering of livestock.
Chlorides - mg/l	A-Avg. : ≤6 S.V. : ≤10	S.V. : ≤250	Municipal or domestic supply,[b] propagation of wildlife, irrigation and watering of livestock.
Sulfate - mg/l	— —	S.V. : ≤250	Municipal or domestic supply.[b]
Sodium - SAR	A-Avg. : ≤2	A-Avg. : ≤8	Irrigation[b] and municipal or domestic supply.
Alkalinity (as $CaCO_3$) - mg/l	— —	less than 25% change from natural conditions	Aquatic life[b] and propagation of wildlife.
Fecal Coliform-No./100 ml	A.G.M. : ≤20 S.V. : ≤85	≤200/400[c]	Recreation involving contact with the water,[b] recreation not involving contact with the water, municipal or domestic supply, irrigation, propagation of wildlife and watering of livestock.
E coli - No./100 ml Annual Geometric Mean Single Value	 — —	 ≤126 ≤410	Recreation involving contact with the water[b] and recreation not involving contact with the water.

Control Point for East Fork at Highway 395, south of Gardnerville (Riverview). The limits of this table apply from Riverview Mobile Home Park to the Stateline.

Table B-5. Carson River WQS -- East Fork at Muller Lane (NAC 445A.151)			
Parameter	**Requirements to Maintain Existing Higher Quality**	**Water Quality Standards For Beneficial Uses**	**Beneficial Uses**
Temperature °C- Maximum ΔT^a	 $\Delta T = 0°C$	Nov.-May : ≤13°C June : ≤17°C July : ≤21°C Aug.-Oct. : ≤22°C $\Delta T \leq 2°C$	Aquatic life[b] and recreation involving contact with the water.
pH Units	7.4 - 8.7 —	S.V. : 6.5 - 9.0 ΔpH : ±0.5 Max.	Recreation involving contact with the water,[b] propagation of wildlife,[b] aquatic life, irrigation, watering of livestock, municipal or domestic supply and industrial supply.
Total Phosphates (as P) - mg/l	— —	A-Avg. : ≤0.10	Aquatic life,[b] recreation involving contact with the water,[b] municipal or domestic supply and recreation not involving contact with the water.
Nitrogen Species (N) - mg/l	Total Nitrogen A-Avg. : ≤0.5 S.V. : ≤0.8	Nitrate S.V. : ≤10 Nitrite S.V. : ≤.06	Aquatic life,[b] municipal or domestic supply,[b] recreation involving contact with the water, watering of livestock, propagation of wildlife and recreation not involving contact with the water.
Total Ammonia (as N) - mg/l	—	e	Aquatic life.[b]
Dissolved Oxygen - mg/l	— —	S.V. : Nov.-May : ≥6.0 Jun.-Oct. : ≥5.0	Aquatic life,[b] recreation involving contact with the water, propagation of wildlife, watering of livestock, municipal or domestic supply and recreation not involving contact with the water.
Suspended Solids - mg/l	— —	S.V. : ≤80	Aquatic life.[b]
Turbidity - NTU	— —	S.V. : ≤10	Aquatic life[b] and municipal or domestic supply.
Color - PCU	d	S.V. : ≤75	Municipal or domestic supply.[b]
Total Dissolved Solids - mg/l	A-Avg. : ≤180 S.V. : ≤205	A-Avg. : ≤500	Municipal or domestic supply,[b] irrigation and watering of livestock.
Chlorides - mg/l	A-Avg. : ≤8 S.V. : ≤10	S.V. : ≤250	Municipal or domestic supply,[b] propagation of wildlife, irrigation and watering of livestock.
Sulfate - mg/l	— —	S.V. : ≤250	Municipal or domestic supply.[b]
Sodium - SAR	A-Avg. : ≤2	A-Avg. : ≤8	Irrigation[b] and municipal or domestic supply.
Alkalinity (as $CaCO_3$) - mg/l	— —	less than 25% change from natural conditions	Aquatic life[b] and propagation of wildlife.
Fecal Coliform- No./100 ml	A.G.M. : ≤50 —	≤200/400[c]	Recreation involving contact with the water,[b] recreation not involving contact with the water, municipal or domestic supply, irrigation, propagation of wildlife and watering of livestock.
E coli - No./100 ml Annual Geometric Mean Single Value	 — —	 ≤126 ≤410	Recreation involving contact with the water[b] and recreation not involving contact with the water.

Control Point at the East Fork at Muller Lane. The limits of this table apply only from East Fork at Muller Lane to Highway 395, south of Gardnerville (Riverview Mobile Home Park).

Table B-6. Carson River WQS at Genoa Lane (NAC 445A.152)			
Parameter	**Requirements to Maintain Existing Higher Quality**	**Water Quality Standards For Beneficial Uses**	**Beneficial Uses**
Temperature °C- Maximum ΔT[a]	 $\Delta T = 0°C$	Nov.-Apr. : ≤13°C May-June : ≤17°C Jul.-Oct. : ≤23°C $\Delta T \leq 2°C$	Aquatic life[b] and recreation involving contact with the water.
pH Units	7.4 - 8.5 —	 S.V. : 6.5 - 9.0 ΔpH : ±0.5 Max.	Recreation involving contact with the water,[b] propagation of wildlife,[b] aquatic life, irrigation, watering of livestock, municipal or domestic supply and industrial supply.
Total Phosphates (as P) - mg/l	— —	A-Avg. : ≤0.10	Aquatic life,[b] recreation involving contact with the water,[b] municipal or domestic supply and recreation not involving contact with the water.
Nitrogen Species (N) - mg/l	Total Nitrogen A-Avg. : ≤0.8 S.V. : ≤1.3	 Nitrate S.V. : ≤10 Nitrite S.V. : ≤.06	Aquatic life,[b] municipal or domestic supply,[b] recreation involving contact with the water, watering of livestock, propagation of wildlife and recreation not involving contact with the water.
Total Ammonia as (N) - mg/l	—	e	Aquatic life.[b]
Dissolved Oxygen - mg/l	— —	S.V. : Nov.-Apr. : ≥6.0 May-Oct. : ≥5.0	Aquatic life,[b] recreation involving contact with the water, propagation of wildlife, watering of livestock, municipal or domestic supply and recreation not involving contact with the water.
Suspended Solids - mg/l	— —	 S.V. : ≤80	Aquatic life.[b]
Turbidity - NTU	— —	 S.V. : ≤10	Aquatic life[b] and municipal or domestic supply.
Color - PCU	d	S.V. : ≤75	Municipal or domestic supply.[b]
Total Dissolved Solids - mg/l	A-Avg. : ≤165 S.V. : ≤220	A-Avg. : ≤500	Municipal or domestic supply,[b] irrigation and watering of livestock.
Chlorides - mg/l	A-Avg. : ≤8 S.V. : ≤12	 S.V. : ≤250	Municipal or domestic supply,[b] propagation of wildlife, irrigation and watering of livestock.
Sulfate - mg/l	— —	 S.V. : ≤250	Municipal or domestic supply.[b]
Sodium - SAR	A-Avg. : ≤2	A-Avg. : ≤8	Irrigation[b] and municipal or domestic supply.
Alkalinity (as $CaCO_3$) - mg/l	— —	less than 25% change from natural conditions	Aquatic life[b] and propagation of wildlife.
Fecal Coliform- No./100 ml	A.G.M. : ≤180 —	 ≤200/400[c]	Recreation involving contact with the water,[b] recreation not involving contact with the water, municipal or domestic supply, irrigation, propagation of wildlife and watering of livestock.
E Coli - No./100 ml Annual Geometric Mean Single Value	 — —	 ≤126 ≤410	Recreation involving contact with the water[b] and recreation not involving contact with the water.

Control Point at Genoa Lane. The limits of this table apply from Genoa Lane to the East Fork at Muller Lane and to the West Fork at the Stateline.

Table B-7. Carson River WQS at Cradlebaugh Bridge (NAC 445A.153)			
Parameter	**Requirements to Maintain Existing Higher Quality**	**Water Quality Standards For Beneficial Uses**	**Beneficial Uses**
Temperature °C- Maximum ΔT^a	 $\Delta T = 0°C$	Nov.-Apr. : ≤13°C May-June : ≤17°C Jul.-Oct. : ≤23°C $\Delta T \leq 2°C$	Aquatic life[b] and recreation involving contact with the water.
pH Units	7.5 - 8.4 —	 S.V. : 6.5 - 9.0 ΔpH : ±0.5 Max.	Recreation involving contact with the water,[b] propagation of wildlife,[b] aquatic life, irrigation, watering of livestock, municipal or domestic supply and industrial supply.
Total Phosphates (as P) - mg/l	— —	A-Avg. : ≤0.10	Aquatic life,[b] recreation involving contact with the water,[b] municipal or domestic supply and recreation not involving contact with the water.
Nitrogen Species (N) - mg/l	Total Nitrogen A-Avg. : ≤.85 S.V. : ≤1.2	Nitrate S.V. : ≤10 Nitrite S.V. : ≤.06	Aquatic life,[b] municipal or domestic supply,[b] recreation involving contact with the water, watering of livestock, propagation of wildlife and recreation not involving contact with the water.
Total Ammonia (as N) - mg/l	—	e	Aquatic life.[b]
Dissolved Oxygen - mg/l	— —	S.V. : Nov.-Apr. : ≥6.0 May-Oct. : ≥5.0	Aquatic life,[b] recreation involving contact with the water, propagation of wildlife, watering of livestock, municipal or domestic supply and recreation not involving contact with the water.
Suspended Solids - mg/l	— —	 S.V. : ≤80	Aquatic life.[b]
Turbidity - NTU	— —	 S.V. : ≤10	Aquatic life[b] and municipal or domestic supply.
Color - PCU	d	S.V. : ≤75	Municipal or domestic supply.[b]
Total Dissolved Solids - mg/l	A-Avg. : ≤180 S.V. : ≤230	A-Avg. : ≤500	Municipal or domestic supply,[b] irrigation and watering of livestock.
Chlorides - mg/l	A-Avg. : ≤8 S.V. : ≤15	 S.V. : ≤250	Municipal or domestic supply,[b] propagation of wildlife, irrigation and watering of livestock.
Sulfate - mg/l	— —	 S.V. : ≤250	Municipal or domestic supply.[b]
Sodium - SAR	A-: ≤2 Avg.	A-Avg. : ≤8	Irrigation[b] and municipal or domestic supply.
Alkalinity (as $CaCO_3$) - mg/l	— —	less than 25% change from natural conditions	Aquatic life[b] and propagation of wildlife.
Fecal Coliform- No./100 ml	— —	≤200/400[c]	Recreation involving contact with the water,[b] recreation not involving contact with the water, municipal or domestic supply, irrigation, propagation of wildlife and watering of livestock.
E coli - No./100 ml Annual Geometric Mean Single Value	 — —	 ≤126 ≤410	Recreation involving contact with the water[b] and recreation not involving contact with the water.

Control Point at Cradlebaugh Bridge. The limits of this table apply from Cradlebaugh Bridge to Genoa Lane.

Table B-8. Carson River at Mexican Ditch Gage (NAC 445A.154)			
Parameter	**Requirements To Maintain Existing Higher Quality**	**Water Quality Standards For Beneficial Uses**	**Beneficial Uses**
Temperature °C- Maximum ΔT[a]	 $\Delta T = 0°C$	Nov.-Apr. : ≤13°C May-June : ≤17°C Jul.-Oct. : ≤23°C $\Delta T \leq 2°C$	Aquatic life[b] and recreation involving contact with the water.
pH Units	7.4 - 8.5 —	S.V. : 6.5 - 9.0 ΔpH : ±0.5 Max.	Recreation involving contact with the water,[b] propagation of wildlife,[b] aquatic life, irrigation, watering of livestock, municipal or domestic supply and industrial supply.
Total Phosphates (as P) - mg/l	— —	A-Avg. : ≤0.10	Aquatic life,[b] recreation involving contact with the water,[b] municipal or domestic supply and recreation not involving contact with the water.
Nitrogen Species (N) - mg/l	Total Nitrogen A-Avg. : ≤0.8 S.V. : ≤1.3	Nitrate S.V. : ≤10 Nitrite S.V. : ≤.06	Aquatic life,[b] municipal or domestic supply,[b] recreation involving contact with the water, watering of livestock, propagation of wildlife and recreation not involving contact with the water.
Total Ammonia (as N) - mg/l	—	e	Aquatic life.[b]
Dissolved Oxygen - mg/l	— —	S.V. : Nov.-Apr. : ≥6.0 May-Oct. : ≥5.0	Aquatic life,[b] recreation involving contact with the water, propagation of wildlife, watering of livestock, municipal or domestic supply and recreation not involving contact with the water.
Suspended Solids - mg/l	— —	S.V. : ≤80	Aquatic life.[b]
Turbidity - NTU	— —	S.V. : ≤10	Aquatic life[b] and municipal or domestic supply.
Color - PCU	d	S.V. : ≤75	Municipal or domestic supply.[b]
Total Dissolved Solids - mg/l	A-Avg. : ≤285 S.V. : ≤360	A-Avg. : ≤500	Municipal or domestic supply,[b] irrigation and watering of livestock.
Chlorides - mg/l	A-Avg. : ≤17 S.V. : ≤23	S.V. : ≤250	Municipal or domestic supply,[b] propagation of wildlife, irrigation and watering of livestock.
Sulfate - mg/l	A-Avg. : ≤24 S.V. : ≤100	S.V. : ≤250	Municipal or domestic supply.[b]
Sodium - SAR	A-Avg. : ≤2	A-Avg. : ≤8	Irrigation[b] and municipal or domestic supply.
Alkalinity (as $CaCO_3$) - mg/l	— —	less than 25% change from natural conditions	Aquatic life[b] and propagation of wildlife.
Fecal Coliform- No./100 ml	A.G.M. : ≤110 S.V. : ≤295	≤200/400[c]	Recreation involving contact with the water,[b] recreation not involving contact with the water, municipal or domestic supply, irrigation, propagation of wildlife and watering of livestock.
E coli - No./100 ml Annual Geometric Mean Single Value	 — —	 ≤126 ≤410	Recreation involving contact with the water[b] and recreation not involving contact with the water.

Control Point at Mexican Ditch Gage. The limits of this table apply from Mexican Ditch Gage to Highway 395, at Cradlebaugh Bridge.

Table B-9. Carson River near New Empire (NAC 445A.155)			
Parameter	**Requirements to Maintain Existing Higher Quality**	**Water Quality Standards For Beneficial Uses**	**Beneficial Uses**
Temperature °C- Maximum ΔT[a]	 $\Delta T = 0°C$	Nov.-May : ≤18°C Jun.Oct. : ≤23°C $\Delta T \leq 2°C$	Aquatic life[b] and recreation involving contact with the water.
pH Units	7.4 - 8.4 —	 S.V. : 6.5 - 9.0 ΔpH : ±0.5 Max.	Recreation involving contact with the water,[b] propagation of wildlife,[b] aquatic life, irrigation, watering of livestock, municipal or domestic supply and industrial supply.
Total Phosphates (as P) - mg/l	— —	A-Avg. : ≤0.10	Aquatic life,[b] recreation involving contact with the water,[b] municipal or domestic supply and recreation not involving contact with the water.
Nitrogen Species (N) - mg/l	Total Nitrogen A-Avg. : ≤1.3 S.V. : ≤1.7	Nitrate S.V. : ≤10 Nitrite S.V. : ≤.06	Aquatic life,[b] municipal or domestic supply,[b] recreation involving contact with the water, watering of livestock, propagation of wildlife and recreation not involving contact with the water.
Total Ammonia (as N) - mg/l	—	e	Aquatic life.[b]
Dissolved Oxygen - mg/l	— —	 S.V. : ≥5.0	Aquatic life,[b] recreation involving contact with the water, propagation of wildlife, watering of livestock, municipal or domestic supply and recreation not involving contact with the water.
Suspended Solids - mg/l	— —	 S.V. : ≤80	Aquatic life.[b]
Turbidity - NTU	— —	 S.V. : ≤10	Aquatic life[b] and municipal or domestic supply.
Color - PCU	d	S.V. : ≤75	Municipal or domestic supply.[b]
Total Dissolved Solids - mg/l	A-Avg. : ≤260 S.V. : ≤375	A-Avg. : ≤500	Municipal or domestic supply,[b] irrigation and watering of livestock.
Chlorides - mg/l	A-Avg. : ≤13 S.V. : ≤24	 S.V. : ≤250	Municipal or domestic supply,[b] propagation of wildlife, irrigation and watering of livestock.
Sulfate - mg/l	— —	 S.V. : ≤250	Municipal or domestic supply.[b]
Sodium - SAR	A-Avg. : ≤2	A-Avg. : ≤8	Irrigation[b] and municipal or domestic supply.
Alkalinity (as $CaCO_3$) - mg/l	— —	less than 25% change from natural conditions	Aquatic life[b] and propagation of wildlife.
Fecal Coliform- No./100 ml	— —	≤200/400[c]	Recreation involving contact with the water,[b] recreation not involving contact with the water, municipal or domestic supply, irrigation, propagation of wildlife and watering of livestock.
E coli - No./100 ml Annual Geometric Mean Single Value	 — —	 ≤126 ≤410	Recreation involving contact with the water[b] and recreation not involving contact with the water.

Control Point near New Empire. The limits of this table apply from New Empire to the Mexican Ditch Gage.

Table B-10. Carson River at Dayton Bridge (NAC 445A.156)			
Parameter	**Requirements to Maintain Existing Higher Quality**	**Water Quality Standards For Beneficial Uses**	**Beneficial Uses**
Temperature °C- Maximum ΔT^a	 $\Delta T = 0°C$	Nov.-Mar. : ≤11°C Apr.-Jun. : ≤24°C Jul.-Oct. : ≤28°C $\Delta T \leq 2°C$	Aquatic life[b] and recreation involving contact with the water.
pH Units	7.5 - 8.6 —	 S.V.: 6.5 - 9.0 ΔpH: ±0.5 Max.	Recreation involving contact with the water,[b] propagation of wildlife,[b] aquatic life, irrigation, watering of livestock, municipal or domestic supply and industrial supply.
Total Phosphates (as P) - mg/l	— —	A-Avg. : ≤0.1	Aquatic life,[b] recreation involving contact with the water,[b] municipal or domestic supply and recreation not involving contact with the water.
Nitrogen Species (N) - mg/l	Total Nitrogen A-Avg. : ≤1.2 S.V. : ≤1.6	 Nitrate S.V. : ≤10 Nitrite S.V. : ≤1.0	Aquatic life,[b] municipal or domestic supply,[b] recreation involving contact with the water, watering of livestock, propagation of wildlife and recreation not involving contact with the water.
Total Ammonia (as N) - mg/l	—	e	Aquatic life.[b]
Dissolved Oxygen - mg/l	— —	S.V. : ≥5.0	Aquatic life,[b] recreation involving contact with the water, propagation of wildlife, watering of livestock, municipal or domestic supply and recreation not involving contact with the water.
Suspended Solids - mg/l	— —	S.V. : ≤80	Aquatic life.[b]
Turbidity - NTU	A-Avg. : ≤12 S.V. : ≤25	S.V. : ≤50	Aquatic life[b] and municipal or domestic supply.
Color - PCU	d	S.V. : ≤75	Municipal or domestic supply.[b]
Total Dissolved Solids - mg/l	A-Avg. : ≤250 S.V. : ≤400	A-Avg. : ≤500	Municipal or domestic supply,[b] irrigation and watering of livestock.
Chlorides - mg/l	A-Avg. : ≤10 S.V. : ≤18	S.V. : ≤250	Municipal or domestic supply,[b] propagation of wildlife, irrigation and watering of livestock.
Sulfate - mg/l	— —	S.V. : ≤250	Municipal or domestic supply.[b]
Sodium - SAR	A-Avg. : ≤2	A-Avg. : ≤8	Irrigation[b] and municipal or domestic supply.
Alkalinity (as $CaCO_3$) - mg/l	— —	less than 25% change from natural conditions	Aquatic life[b] and propagation of wildlife.
Fecal Coliform- No./100 ml	A.G.M. : ≤50 S.V. : ≤280	≤200/400[c]	Recreation involving contact with the water,[b] recreation not involving contact with the water, municipal or domestic supply, irrigation, propagation of wildlife and watering of livestock.
E coli - No./100 ml Annual Geometric Mean Single Value	 — —	 ≤126 ≤410	Recreation involving contact with the water[b] and recreation not involving contact with the water.

Control Point at Dayton Bridge. The limits of this table apply from Dayton Bridge to New Empire.

Table B-11. Carson River at Weeks (NAC 445A.157)			
Parameter	**Requirements to Maintain Existing Higher Quality**	**Water Quality Standards For Beneficial Uses**	**Beneficial Uses**
Temperature °C- Maximum ΔT[a]	 ΔT = 0°C	Nov.-Mar. : ≤11°C Apr.-Jun. : ≤24°C Jul.-Oct. : ≤28°C ΔT ≤2°C	Aquatic life[b] and recreation involving contact with the water.
pH Units	7.5 - 8.5 —	S.V. : 6.5 - 9.0 ΔpH : ±0.5 Max.	Recreation involving contact with the water,[b] propagation of wildlife,[b] aquatic life, irrigation, watering of livestock, municipal or domestic supply and industrial supply.
Total Phosphates (as P) - mg/l	— —	A-Avg. : ≤0.1	Aquatic life,[b] recreation involving contact with the water,[b] municipal or domestic supply and recreation not involving contact with the water.
Nitrogen Species (N) - mg/l	Total Nitrogen A- : ≤0.6 Avg. : ≤1.1 S.V.	Nitrate S.V. : ≤10 Nitrite S.V. : ≤1.0	Aquatic life,[b] municipal or domestic supply,[b] recreation involving contact with the water, watering of livestock, propagation of wildlife and recreation not involving contact with the water.
Total Ammonia (as N) - mg/l	—	e	Aquatic life[b]
Dissolved Oxygen - mg/l	— —	S.V. : ≥5.0	Aquatic life,[b] recreation involving contact with the water, propagation of wildlife, watering of livestock, municipal or domestic supply and recreation not involving contact with the water.
Suspended Solids - mg/l	— —	S.V. : ≤80	Aquatic life.[b]
Turbidity - NTU	A- : ≤25 Avg. —	S.V. : ≤50	Aquatic life[b] and municipal or domestic supply.
Color - PCU	d	S.V. : ≤75	Municipal or domestic supply.[b]
Total Dissolved Solids - mg/l	A- : ≤250 Avg. : ≤380 S.V.	A-Avg. : ≤500	Municipal or domestic supply,[b] irrigation and watering of livestock.
Chlorides - mg/l	A- : ≤10 Avg. : ≤18 S.V.	S.V. : ≤250	Municipal or domestic supply,[b] propagation of wildlife, irrigation and watering of livestock.
Sulfate - mg/l	A- : ≤100 Avg. : ≤140 S.V.	S.V. : ≤250	Municipal or domestic supply.[b]
Sodium - SAR	A- : ≤2 Avg.	A-Avg. : ≤8	Irrigation[b] and municipal or domestic supply.
Alkalinity (as $CaCO_3$) - mg/l	— —	less than 25% change from natural conditions	Aquatic life[b] and propagation of wildlife.
Fecal Coliform- No./100 ml	A.G.M. : ≤90 S.V. : ≤240	≤200/400[c]	Recreation involving contact with the water,[b] recreation not involving contact with the water, municipal or domestic supply, irrigation, propagation of wildlife and watering of livestock.
E coli - No./100 ml Annual Geometric Mean Single Value	 — —	 ≤126 ≤410	Recreation involving contact with the water[b] and recreation not involving contact with the water.

Control Point at Weeks (Ft. Churchill). The limits of this table apply from the U.S. Highway 95 Bridge at Weeks to the Dayton Bridge.

Table B-12. Carson River at Lahontan Dam (NAC 445A.158)			
Parameter	**Requirements to Maintain Existing Higher Quality**	**Water Quality Standards For Beneficial Uses**	**Beneficial Uses**
Temperature °C- Maximum ΔT[a]	 ΔT = 0°C	Nov.-Mar. : ≤11°C Apr.-Jun. : ≤24°C Jul.-Oct. : ≤28°C ΔT ≤2°C	Aquatic life[b] and recreation involving contact with the water.
pH Units	— —	S.V. : 6.5 - 9.0 ΔpH : ±0.5 Max.	Recreation involving contact with the water,[b] propagation of wildlife,[b] aquatic life, irrigation, watering of livestock, municipal or domestic supply and industrial supply.
Total Phosphates (as P) - mg/l	— —	S.V. : ≤0.06	Aquatic life,[b] recreation involving contact with the water,[b] municipal or domestic supply and recreation not involving contact with the water.
Nitrogen Species (N) - mg/l	Total Nitrogen A- : ≤1.3 Avg. : ≤1.7 S.V.	Nitrate S.V. : ≤10 Nitrite S.V. : ≤1.0	Aquatic life,[b] municipal or domestic supply,[b] recreation involving contact with the water, watering of livestock, propagation of wildlife and recreation not involving contact with the water.
Total Ammonia (as N) - mg/l	—	e	Aquatic life.[b]
Dissolved Oxygen - mg/l	— —	S.V. : ≥5.0	Aquatic life,[b] recreation involving contact with the water, propagation of wildlife, watering of livestock, municipal or domestic supply and recreation not involving contact with the water.
Suspended Solids - mg/l		S.V. : ≤25	Aquatic life.[b]
Turbidity - NTU	A-: ≤15 Avg. : ≤27 S.V.	S.V. : ≤50	Aquatic life[b] and municipal or domestic supply.
Color - PCU	d	S.V. : ≤75	Municipal or domestic supply.[b]
Total Dissolved Solids - mg/l	A-: ≤175 Avg. : ≤225 S.V.	A-Avg. : ≤500	Municipal or domestic supply,[b] irrigation and watering of livestock.
Chlorides - mg/l	A-: ≤9 Avg. : ≤15 S.V.	S.V. : ≤250	Municipal or domestic supply,[b] propagation of wildlife, irrigation and watering of livestock.
Sulfate - mg/l	A-: ≤35 Avg. : ≤50 S.V.	S.V. : ≤250	Municipal or domestic supply.[b]
Sodium - SAR	A-: ≤2 Avg.	A-Avg. : ≤8	Irrigation[b] and municipal or domestic supply.
Alkalinity (as $CaCO_3$) - mg/l	— —	less than 25% change from natural conditions	Aquatic life[b] and propagation of wildlife.
Fecal Coliform- No./100 ml	A.G.M. : ≤25 S.V. : ≤75	≤200/400[c]	Recreation involving contact with the water[b], recreation not involving contact with the water, municipal or domestic supply, irrigation, propagation of wildlife and watering of livestock.
E coli - No./100 ml Annual Geometric Mean Single Value	 — —	 ≤126 ≤235	Recreation involving contact with the water[b] and recreation not involving contact with the water.

Control Point at Lahontan Dam. The limits of this table apply from Lahontan Dam to the U.S. Highway 95 bridge at Weeks (Ft. Churchill).

The standards presented in Tables B-1 through B-12 include the following notations and technical abbreviations applicable to each reach of the Carson River:

a. Maximum allowable increase in temperature above water temperature at the boundary of an approved mixing zone, but the increase must not cause a violation of the single value standard.

b. The most restrictive beneficial use.

c. Based on the minimum of not less than 5 samples taken over a 30-day period, the fecal coliform bacterial level may not exceed a geometric mean of 200 per 100 milliliter (ml) nor may more than 10 percent of the total samples taken during any 30-day period exceed 400 per 100 ml.

d. Increase in color must not be more than 10 PCU above natural conditions.

e. The ambient water quality criteria for ammonia are specified in NAC 445A.118.

   - Tables for the determination of the acute water quality criteria for total ammonia for freshwater aquatic life, chronic water quality criteria for total ammonia for waters where freshwater fish in early life stages may be present, and chronic water quality criteria for total ammonia for waters where freshwater fish in early life stages are absent are used in conjunction with field pH and temperature measurements to determine the water quality criteria for ammonia at that reach. The value is then compared with the laboratory analytical result for ammonia to determine compliance with the reach standard.

Abbreviations

- *ΔT* Change in temperature
- *ΔpH* Change in pH
- *A-Avg.* Annual Average
- *A.G.M.* Annual Geometric Mean
- *mg/L* milligrams per liter
- *ml* milliliter
- *NTU* Nephelometric Turbidity Units
- *PCU* Platinum Cobalt Units
- *SAR* Sodium Adsorption Ratio
- *S.V.* Single Value

Table B-13. Carson River Basin Beneficial Uses

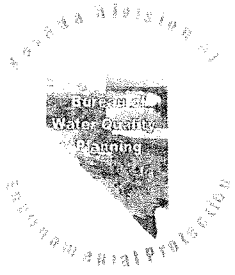
NAC	Segment Name and Number	Description	IRR	STOCK	REC-1	REC-2	IND	MUN	WILD	AQUATIC	Aquatic Species of Concern
445A.147	West Fork Carson River	At Stateline; Monitored at C8	X	X	X	X	X	X	X	X	rainbow trout, brown trout
445A.148	Bryant Creek	At Stateline	X	X	X	X	X	X	X	X	rainbow trout, brown trout
445A.149	East Fork Carson River	At Stateline	X	X	X	X	X	X	X	X	rainbow trout, brown trout
445A.150	East Fork Carson River	Stateline to Highway 395; Monitored at C9	X	X	X	X	X	X	X	X	rainbow trout, brown trout
445A.151	East Fork Carson River	Highway 395 to Muller Lane; Monitored at C16	X	X	X	X	X	X	X	X	rainbow trout, brown trout
445A.152	EF/WF & Carson River	EF at Muller to Genoa Lane & WF at Stateline to Genoa Lane; Monitored at C14	X	X	X	X	X	X	X	X	catfish, rainbow trout, brown trout
445A.153	Carson River	Genoa Lane to Cradlebaugh Bridge; Monitored at C2	X	X	X	X	X	X	X	X	catfish, rainbow trout, brown trout
445A.154	Carson River	Cradlebaugh Bridge to Mexican Ditch Gage; Monitored at C13	X	X	X	X	X	X	X	X	rainbow trout, brown trout
445A.155	Carson River	Mexican Ditch Gage to New Empire; Monitored at C1	X	X	X	X	X	X	X	X	smallmouth bass, rainbow trout, brown trout
445A.156	Carson River	New Empire to Dayton Bridge; Monitored at C11	X	X	X	X	X	X	X	X	walleye, channel catfish, white bass
445A.157	Carson River	Dayton Bridge to Weeks Bridge; Monitored at C10	X	X	X	X	X	X	X	X	walleye, channel catfish, white bass
445A.158	Carson River	Weeks Bridge to Lahontan Dam; Monitored at C18	X	X	X	X	X	X	X	X	walleye, channel catfish, white bass

IRR Irrigation
STOCK Watering of livestock
REC-1 Recreation involving contact with the water
REC-2 Recreation not involving contact with the water
IND Industrial supply
MUN Municipal or domestic supply, or both
WILD Propagation of wildlife
AQUATIC Propagation of aquatic life
EF East Fork
WF West Fork

History of Carson River Water Quality Standards

A supporting document for the Carson River Report Card

December 2004



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History of Carson River Water Quality Standards

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History of Carson River Basin Water Quality Standards

Introduction

In support of our Clean Water Act responsibilities, the Nevada Division of Environmental Protection (NDEP) – Bureau of Water Quality Planning (BWQP) is developing a Carson River Watershed Assessment or Report Card. Drawing upon numerous studies and monitoring efforts, the Report Card will provide a compilation of current knowledge about the chemical, physical and biological health of the Carson River watershed with a focus on aquatic life uses from the Nevada/California stateline to Lahontan Reservoir. It is hoped that the Report Card will be a valuable tool for educating the public, agencies and decisionmakers on the state of the river (from a Clean Water Act perspective), thereby providing direction for their future actions and decisions. The Report Card will also be a key planning tool for BWQP in possible future steps, such as standards revisions, comprehensive Total Maximum Daily Loads (TMDLs), watershed plan development and restoration projects.

The purpose of this report is to provide the reader with a basic understanding of the water quality standards within the Carson River basin and their evolution over the years. An understanding of the regulatory history is important when considering potential future changes.

Background on Water Quality Standards

Under federal legislation such as the Clean Water Act (and its predecessors), Nevada and other states have been directed to develop water quality standards for applicable waters. Following the federal legislation, Nevada passed its own set of statutes requiring the State Environmental Commission to establish water quality standards (Nevada Revised Statutes 445A). Water quality standards are the foundation for water quality management activities. If the standards are flawed or outdated, subsequent management steps may be negatively affected.

In general, a water quality standard defines the water quality goals for a waterbody by first defining a beneficial use (or suite of beneficial uses) and then by defining the numeric water quality criteria necessary to protect the use(s). Following is a brief description of these two components of the water quality standards.

Beneficial Uses

In Nevada, the beneficial uses typically assigned to waters may include the following (depending upon the waterbody):

- Watering of livestock;
- Irrigation;
- Propagation of aquatic life;
- Recreation involving contact with the water;

- Recreation not involving contact with the water;
- Municipal or domestic supply;
- Industrial supply;
- Propagation of wildlife;
- Waters of extraordinary ecological or aesthetic value;
- Enhancement of water quality.

Factors considered in the development and designation of beneficial uses are presented below, but not necessarily in order of priority (NDEP, 2002):

- public needs;
- historical use of the water;
- existing uses in the basin;
- desired potential or future uses as dictated by existing quality of the river, and
- antidegradation requirements.

In assigning beneficial uses, states "...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" (40 CFR 131.10(a). At a minimum, states' water quality standards (and the beneficial uses) are required to provide for the protection and propagation of fish, shellfish, and wildlife and provide for recreation in and on the water. A state must conduct a Use Attainability Analysis (UAA)[1] if it does not wish to include one or more of these minimum required beneficial uses.

In addition to defining minimum requirements for beneficial uses, federal regulations (40 CFR 131.10(g)) recognize two categories of beneficial uses, *existing* and *designated* (defined in 40 CFR 131.3):

> (e) *Existing uses* are those uses actually attained in the waterbody on or after November 28, 1975, whether or not they are included in the water quality standards.
> (f) *Designated uses* are those uses specified in water quality standards for each waterbody or segment whether or not they are being attained.

It is important to understand the distinction between these beneficial use types. An existing use cannot be removed or modified from a state's water quality standards, while a designated use may be changed based upon the findings of a UAA. Nevada's water quality regulations do not identify beneficial uses as either existing or designated. Therefore, if Nevada wishes to pursue a UAA, the first step would be to determine whether or not a use is actually existing or designated.

[1] A Use Attainability Analysis (UAA) is a multi-step scientific assessment of the physical, chemical, biological and economic factors affecting the attainment of a use. This assessment identifies and defines the existing uses of that waterbody, determines whether the uses are impaired, the reasons for the impairment, and whether or not the use can be attained given certain actions in the watershed.

Numeric Criteria

Once beneficial uses are determined for a waterbody, numeric water quality criteria are set to protect these uses. Typically, these criteria are based on either: (1) EPA (U.S. Environmental Protection) water quality criteria, (2) site-specific criteria derived from national criteria modified to reflect site-specific conditions or, (3) site-specific criteria developed solely for unique waters. For waters with multiple beneficial uses, the criteria must protect the most sensitive use (NDEP, 2002).

History of Beneficial Uses and Selected Numeric Criteria

Water quality standards in Nevada and for the Carson River watershed have never been a stagnant feature in the Nevada Administrative Code (NAC) as indicated by summaries provided in Tables 1 and 2[2]. The current water quality standards for waters in the Carson basin are located in NAC 445A.146 through NAC 445A.158 (Designated Waters) and NAC 445A.124 through NAC 445A.127 (Class Waters). The following discusses the main details of these beneficial use and numeric water quality criteria changes over the last 45+ years that led to the current standards. Figure 1 depicts the major waterbodies in the basin along with selected points of interest referred to throughout the following discussion.

Table 1. Chronology of Main Water Quality Standards Revisions for "Designated Waters" in the Carson Basin

Date	Action
1967	Water pollution control regulations were adopted for the East Fork Carson, West Fork Carson, main Carson rivers and Bryant Creek including numeric criteria for numerous parameters (pH, temperature, dissolved oxygen, biological oxygen demand, chlorides, phosphorus, nitrates, total dissolved solids).
1972-75	Numeric criteria for color, turbidity, and fecal coliform were added.
1978-80	Beneficial uses were added. Also, significant changes in the numeric criteria occurred. Nitrite criteria added.
1984	Beneficial uses were reworded (fish species of concern were identified). Tables were reformatted to current form. Antidegradation RMHQs were added. Significant changes in the numeric criteria occurred. Ammonia criteria added.
1994	Some RMHQs (Requirements to Maintain Existing Higher Quality) were revised. pH criteria were revised.
2002	*E. coli* numeric criteria were added and ammonia numeric criteria were revised.

[2] Over the years, the water quality standards for the Carson basin (and other basins in Nevada) have evolved into two different groups in the NAC – the larger rivers upstream of Lahontan (commonly referred to as the "Designated Waters") and the other waters throughout the system (commonly referred to as the "Class Waters"). "Designated Waters" throughout Nevada typically include the larger mainstem streams such as the Carson River, Truckee River, Walker River, Colorado River, and Humboldt River. "Class Waters" are generally the smaller streams that may or may not be tributary to the larger streams.

Table 2. Chronology of Main Water Quality Standards Revisions for "Class Waters" in the Carson Basin

Date	Action
1972	Class Waters (Ash Canyon, Clear Creek, Kings Canyon Creek, Daggett Creek, Genoa Creek, Sierra Canyon Creek, Diagonal Drain, Harmon Reservoir, Indian Lakes, Lower Carson River (below Lahontan Reservoir), Rattlesnake Reservoir, South Carson Lake, Stillwater Marsh, V-Line Canal) were added to the regulations along with beneficial uses and numeric criteria for various parameters (pH, temperature, dissolved oxygen, fecal coliform, phosphorus, TDS).
2004	Tables were reformatted for easier reading. Numeric criteria for pH revised. Waterbodies were identified as "Trout" or "Non-trout" waters.

Beneficial Use History

Pre-1970s Regulations

The Federal Water Pollution Control Act of 1948 was the first comprehensive federal legislation for water pollution control in the United States (Water Environment Federation, 1997). Subsequently on July 16, 1957, the Nevada State Board of Health adopted water pollution control regulations (Nevada Department of Health, 1957). However, these regulations did not set any beneficial uses or water quality criteria (neither narrative nor numeric). It was later under the Federal Water Quality Act of 1965 that states were directed to establish water quality standards for interstate waters (Water Environment Federation, 1997). In response to the 1965 Act, the State Board of Health amended the Nevada Water Pollution Control Regulations on July 1, 1967. These regulations provided the following for a majority of the interstate waters in Nevada, and included:

- Definition of 46 control points[3] for the interstate rivers;
- Numeric criteria for various parameters for each control point; and
- Narrative "free from" standards for each control point.

Within the Carson basin, numeric criteria were set for a number of control points along the West Fork Carson, East Fork Carson and main Carson rivers from the Nevada/California stateline to Lahontan Reservoir, and also included Bryant Creek (erroneously identified as Leviathan Creek in the regulations) and Lahontan Reservoir. These numeric water quality criteria appear to have been set based upon the water quality that existed at the time. However, it is likely that these criteria were based upon only a handful of water quality samples.

At that time, the regulations did not include any explicit identification of "beneficial uses" in the interstate waters. In 1967, the Nevada Health Division developed a report entitled "Interstate Water Quality Standards and Plan of Implementation" (1967) in which existing and potential uses for the interstate waters were given. According to this report, existing and future uses for the Carson River are as summarized below:

[3] Control points are locations where water quality criteria are specified.

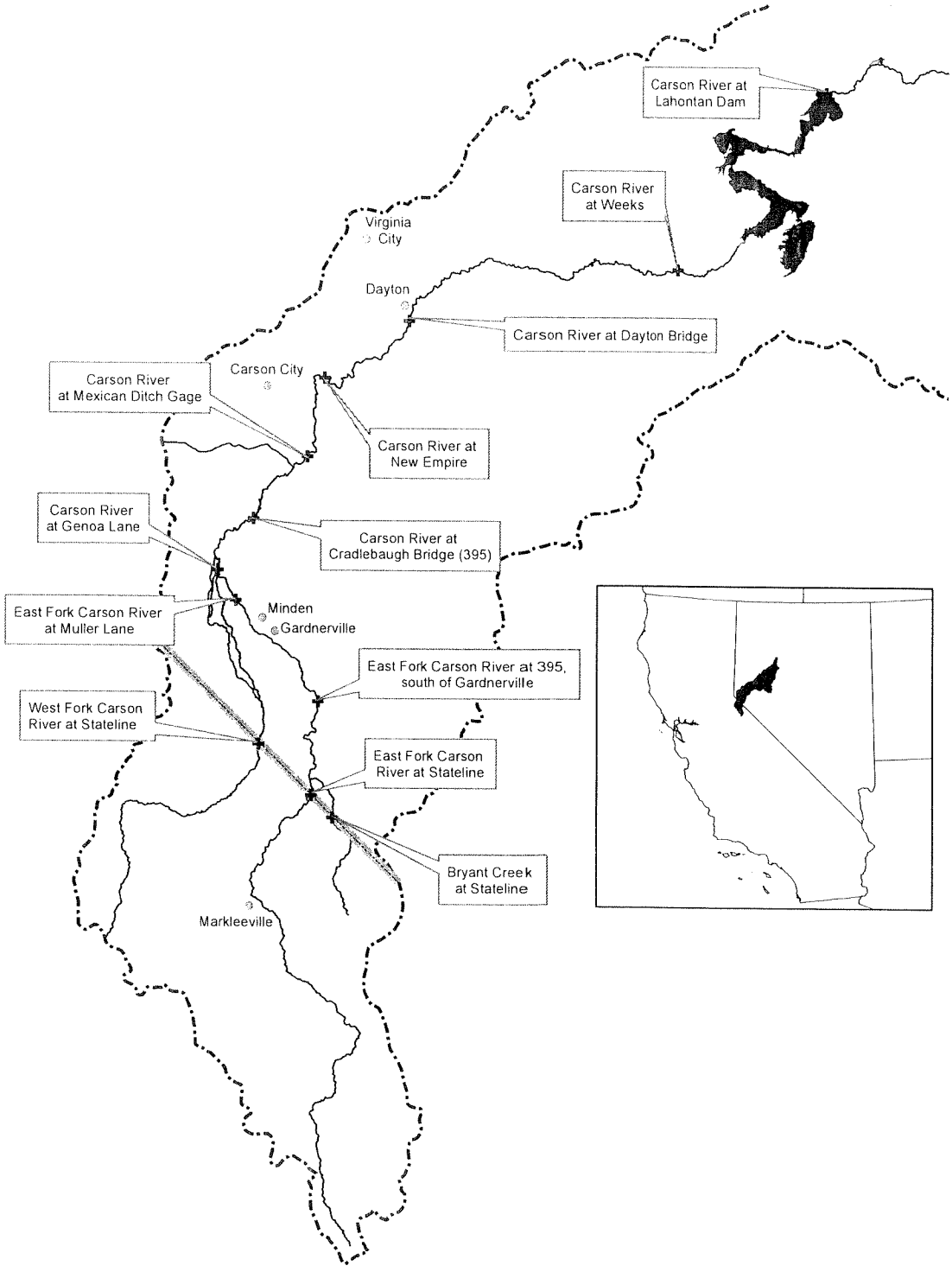

Figure 1. Main Waterbodies in Carson Watershed above Lahontan Dam and Selected Points of Interest

- Existing Carson River uses
  - Fish and wildlife
  - Aesthetics
  - Wastewater assimilation
  - Irrigation and stock watering

- Future Carson River uses
  - Municipal water
  - Industrial water processing and cooling

- Existing Bryant Creek uses
  - Fish and wildlife
  - Aesthetics
  - Irrigation and stockwatering

- Existing Lahontan Reservoir uses
  - Recreation – body contact
  - Fish and wildlife
  - Aesthetics
  - Wastewater assimilation
  - Irrigation and stockwatering
  - Power generation

The process used to develop this list was not described in the 1967 report. Additionally, none of these uses appeared in the 1967 regulations. Regarding future uses, the report stated "Those streams designated as future municipal water supplies or body contact recreation are expected to be used for that purpose by 1977. The Carson River is expected to be used as an industrial supply by 1972."

1970s Regulations Revisions

Passage of the Federal Water Pollution Control Act Amendments of 1972 on October 18, 1972 extended state's water quality standard responsibilities to intrastate waters. On November 14, 1972, the State Commission of Environmental Protection adopted water pollution control regulations which built upon those standards previously adopted by the State Board of Health. The 1972 version established sections dedicated to instrastate Class Waters. In these sections, numerous waterbodies were identified grouped into 4 classes (A, B, C, D) with Class A being the higher quality waters and Class D being the lower quality waters. Each class was assigned a group of beneficial uses. It is believed that these beneficial uses were based upon the input of agency personnel with little or no public input.

The 1972 regulations included a number of smaller waterbodies within the Carson basin under the Class Water standards:

Class A
Ash Canyon, Clear Creek (upper), Kings Canyon, Daggett Creek, Genoa Creek, Sierra Canyon Creek

Class B
Clear Creek (lower)

Class C (all are located below Lahontan Reservoir)
Diagonal Drain, Harmon Reservoir, Indian Lakes, Lower Carson River (below Lahontan Reservoir), Rattlesnake Reservoir, South Carson Lake, Stillwater Marsh (portion), V-Line Canal

Class D
Stillwater Marsh (portion)

In 1972, a suite of beneficial uses were assigned to the Class Waters (Table 3). A few years later, the beneficial uses were reworded to the form that still exists today. While the 1972 Class Waters standards included beneficial uses, the regulations did not differentiate between existing and future uses for these waters. The other main interstate waters (including the Carson River, and its forks) were not assigned beneficial uses at that time.

Table 3. Changes in Beneficial Uses for Class Waters during the 1970s

Class	1972 Beneficial Uses	Late 1970s Beneficial Uses
Class A	Drinking water supply with treatment by disinfection only, suitable for aquatic life habitat, wildlife propagation, agricultural use, recreation, boating and esthetics	Municipal or domestic supply, or both, with treatment by disinfection only, aquatic life, propagation of wildlife, irrigation, watering of livestock, contact recreation, noncontact recreation
Class B	Drinking water supply with treatment by disinfection and filtration only, aquatic life and wildlife propagation, agricultural use, recreation, esthetics and industrial supply	Municipal or domestic supply, or both, with treatment by disinfection and filtration only, aquatic life, propagation of wildlife, irrigation, watering of livestock, contact recreation, noncontact recreation, and industrial supply
Class C	Domestic water supply following complete treatment, aquatic life, wildlife propagation, recreation, esthetics and industrial supply	Municipal or domestic supply, or both, following complete treatment, aquatic life, propagation of wildlife, irrigation, watering of livestock, contact recreation, noncontact recreation, and industrial supply
Class D	Aquatic life, agricultural use, boating, esthetics, and industrial supply except for food processing purposes	Aquatic life, propagation of wildlife, irrigation, watering of livestock, noncontact recreation, and industrial supply except for food processing purposes

It is interesting to note that Class A, B and C waters have the same use of "aquatic life" however, the numeric criteria related to this use varies from class to class. Class A, B and C have different drinking water uses but the numeric standards do not reflect these differences. Classes A, B and C all have "municipal or domestic supply or both" as a beneficial use but with different levels of water treatment needs. While the primary difference between these classes are the level of drinking water treatment needed, none of the numeric criteria reflect the various levels of water quality needed to satisfy these drinking water uses. In fact, the only parameters that have differing numeric water quality criteria are temperature, dissolved oxygen and total phosphates. All of these numeric criteria are for aquatic life **NOT** drinking water. As of September 2004, NDEP is working on restructuring the Class Waters and resolving these problems.

1980s Regulations Revisions

It was not until 1980 that the Water Pollution Control Regulations included beneficial uses for the Carson River. With these regulations, the same beneficial uses were set for each reach even though conditions vary greatly from the stateline to Lahontan Reservoir (Table 4).

Table 4. Changes in Beneficial Uses for Carson River above Lahontan Reservoir and Main Tributaries during the 1980s

Beneficial Uses - 1980	Beneficial Uses – 1984 (Proposed and Approved)
Agriculture use	Irrigation
	Watering of livestock
Aquatic life	Propagation of aquatic life (see Tables 3, 4)
Bathing and water contact sports	Recreation involving contact with water
Boating and esthetics	Recreation not involving contact with water
Drinking water supply	Municipal or domestic supply or both
Industrial water supply	Industrial supply
Wildlife propagation	Propagation of wildlife

The regulations made no differentiation between existing uses and designated (future) uses. However, it appears that this list was considered to be a mixture of both existing and future beneficial uses. In fact, the August 12, 1980 meeting minutes of the State Environmental Commission provide some breakdown between existing and future uses. During this meeting (prior to adoption of the 1980 regulations), Wendell McCurry, NDEP Water Quality Officer, stated that he "*...is proposing beneficial uses whether they are in fact in existence now or foreseen in the future.*" Mr. McCurry also stated that it is the responsibility of the Commission to not just "*look at what is happening today but also look at protection for the future.*" While the beneficial uses presented for Bryant Creek included aquatic life and bathing and water contact sports, Wendell McCurry stated that these uses were not existing due to the conditions of the water (SEC, 1980).

While aquatic life was included in the 1980 regulations as a beneficial use, there was no breakout between coldwater and warmwater fisheries. Mr. McCurry stated that further studies need to be completed before this distinction could be made in the standards (SEC 1980).

In addition to beneficial use changes, part of the 1980 revisions included significant changes to the numeric water quality criteria. The values varied considerably from control point to control point and appear to be primarily based upon the existing water quality at the time, not beneficial use needs.

During 1984, NDEP again reviewed the Carson River beneficial uses and standards and proposed revisions to the regulations similar to the Class Waters changes in the 1970s (Table 4). In addition to changing "aquatic life" to "propagation of aquatic life", NDEP (1984) also recommended "*spelling out for the hearing record exactly which critical species of aquatic life are being maintained or are intended to be maintained for each reach.*" According to the *Carson River Water Quality Standards Revisions Rationale* (*Rationale*) (NDEP, 1984), the aquatic life beneficial uses developed for the regulation revisions were based on input provided by the Nevada Department of Wildlife (NDOW), as specified in a June 4, 1984 letter. This letter presented beneficial uses as developed from NDOW's basic fisheries management objectives established by reach. These objectives are what NDOW had been working toward or had reached. For the purposes of the regulations, NDEP (1984) proposed slightly different beneficial uses (Table 5).

It is interesting to note certain characteristics of the proposed aquatic beneficial uses. Most important was the proposal's wide-spread recognition of trout stocking activities in the river and their importance for maintaining the trout fishery. Additionally, NDEP's proposal varied somewhat from NDOW's recommendations. For instance at Cradlebaugh, NDOW recommended that the uses include warmwater fisheries with no mention of any coldwater fish (neither naturally occurring nor hatchery supplied). NDEP's proposal applied the Genoa Lane uses to the Cradlebaugh control point which include stocked salmonids. Another important difference is how the West Fork Carson River from stateline to the confluence was handled. While NDOW did not mention this reach in their proposal, NDEP presented a use for this reach that was the same as the Carson River at Genoa Lane[4].

While a search of the available records appear to indicate that the State Environmental Commission approved the proposed wording changes (Table 4) and aquatic beneficial uses (Table 5), the aquatic life use description found in the final state regulations contained no recognition of Table 5. The final regulations included the identification of the various species of concern within a reach with no recognition of the stocking practices needed to maintain these fisheries (Table 6). A search of the SEC records and conversation with past agency personnel yielded no information as to why the final codified regulations varied from the NDEP recommendations and the SEC approval.

[4] For nearly a century, the waters of the West Fork Carson River have been redirected into Brockliss Slough leaving little in the West Fork channel except return flows and groundwater inflow (Pugsley, August 23, 2004).

Table 5. Aquatic Beneficial Uses Recommended by NDEP (1984)

Control Point (from upstream to downstream)	Beneficial Use per NDOW	Beneficial Use Proposed by NDEP (1984)
Bryant Creek	Not mentioned	
West Fork Carson River at stateline	Spring and fall spawning salmonids – rainbow and brown trout. Supplemented by hatchery trout.	
West Fork Carson River at confluence	Not mentioned	Warmwater fisheries – catfish – year-around. Stocking spring and summer of salmonids
East Fork Carson River at stateline	Spring and fall spawning salmonids – rainbow and brown trout – occasional Lahontan cutthroat. Supplemented by hatchery trout.	
East Fork Carson River - 395 south of Gardnerville	Spring and fall spawning salmonids – rainbow and brown trout. Supplemented by hatchery trout.	
East Fork Carson River - Muller Lane		
Carson River - Genoa Lane	Warmwater fisheries – catfish – year-around. Stocking spring and summer of salmonids	Warmwater fisheries – catfish – year-around. Stocking spring and summer of salmonids
Carson River - Cradlebaugh Bridge (Highway 395)	Warmwater fisheries – catfish – year-around	
Carson River - Mexican Ditch Gage	Spring and fall spawning salmonids (marginal) – rainbow and brown trout. Supplemented by hatchery trout.	
Carson River - New Empire	Warmwater fish – smallmouth bass – year-around. Coldwater trout stocked spring and summer	
Carson River - Dayton Bridge	Reach not mentioned	
Carson River - Weeks	Warmwater fisheries, year-around. Walleye, channel catfish, white bass.	
Lahontan Dam		

Note: Use applies from control point to the next control point upstream

As during the 1980 revisions, NDEP again recognized during the 1984 revisions that the standards were intended to protect both existing and designated beneficial uses. Though the adopted regulations have not provided any breakdown between existing and designated uses, the record provides some limited information on which uses were considered existing or designated at that time. During the October 25, 1984 workshop in Fallon, it was stated "*...that in some instances such as Bryant Creek, the beneficial uses merely reflect goals that are not currently being achieved.*" In the *Rationale* (1984) temperature standards were recommended with the following statement:

Table 6. Fish Species of Major Concern as Listed in the Current Water Quality Standards (NAC 445A.146)

Reach	Fish Species of Major Concern
West Fork Carson River at stateline	Rainbow trout, brown trout
Bryant Creek	
East Fork Carson River at stateline	
East Fork Carson River from stateline to near Highway 395	
East Fork Carson River from near Highway 395 to Muller Lane	
West Fork Carson River from stateline to confluence, East Fork Carson River from Muller Lane to confluence, Carson River from confluence to Genoa Lane	Rainbow trout, brown trout, catfish
Carson River from Genoa Lane to Cradlebaugh Bridge (Highway 395)	
Carson River from Cradlebaugh Bridge (Highway 395) to Mexican Ditch Gage	Rainbow trout, brown trout
Carson River from Mexican Ditch Gage to New Empire	Rainbow trout, brown trout, smallmouth bass
Carson River from New Empire to Dayton Bridge	Walleye, channel catfish, white bass
Carson River from Dayton Bridge to Weeks	
Carson River from Weeks to Lahontan Reservoir at Lahontan Dam	

> *"The recommendations are intended to sustain the designated beneficial uses except for the intermediate trout life stages within the Mexican Ditch to East Fork Muller Lane and West Fork reaches where attainment problems will frequently occur in Summer."*

According to Jim Curran, NDOW (October 2, 1984 correspondence), the "*...water temperatures on the Carson River system are felt to be the limiting factor on maintaining or improving the cold water fisheries in the river.*"

It is interesting to note that the beneficial uses as adopted in 1984 do not include any mention of hatchery fish as a supplement to any natural propagation in the system, though stocking was obviously a part of NDOW's management plan at the time. Also, the NDOW management plan listed the Carson River at Cradlebaugh as a warmwater fishery, while the current regulations have also included rainbow and brown trout as fish species of major concern.

In a letter from Lew Dodgion, NDEP Administrator at the time, to EPA (October 4, 1985) describing the SEC approved regulation changes, the following statement was made regarding aquatic life uses at Cradlebaugh Bridge:

"SEC adopted the aquatic life use which included a year-round warm-water fishery typified by catfish and a 'put and take' cold-water fishery. This translates into criteria protective of the adult salmonids at all times. The only life stage not protected is cold-water spawning and incubation. This level of protection is more than adequate for any warm water species."

1994 Regulation Revisions

While the 1994 regulations revisions did not include any changes to the beneficial use definitions, the rationale developed at the time include an interesting paragraph on standard attainability:

"Due to high temperatures and degraded water quality, a self-sustaining cold-water fishery is not being attained downstream from Muller Lane. The Nevada Division of Wildlife manages this portion of the river as a put and take fishery – the river is stocked with the expectation that the fish will be caught by fisherman because they will not survive for a year."

2004 Revisions

Since their inception, the Class B and C water quality standards have included numeric dissolved oxygen and temperature criteria for trout and nontrout waters. However, the regulations never identified which waterbodies were to be considered trout and nontrout. In 2004, the SEC approved regulatory changes which included trout and nontrout designations for these waters as generated through NDOW publications and contacts with NDOW (Table 7).

Table 7. Current Aquatic Life Beneficial Use Wording for Class Waters

Class/Waterbody	Current Aquatic Life Beneficial Use
Class A: Ash Canyon, Clear Creek (upper), Kings Canyon, Daggett Creek, Genoa Creek, Sierra Canyon Creek	Aquatic life
Class B: Clear Creek (lower)	Aquatic life (trout)
Class C: Diagonal Drain, Harmon Reservoir, Indian Lakes, Lower Carson River (below Lahontan Reservoir), Rattlesnake Reservoir, South Carson Lake, Stillwater Marsh (portion), V-Line Canal	Aquatic life (nontrout)
Class D: Stillwater Marsh (portion)	Aquatic life

Summary

While the regulations do not specify which beneficial uses are considered "existing" and which are "designated", the supporting information in NDEP files provides some information on the existing and designated beneficial uses. During workshops and hearings, NDEP repeatedly

stated that the standards are intended to protect both existing and designated beneficial uses. Nevertheless, the available information is a little cloudy on what uses have been considered as existing and designated in the past. It is interesting to note that the record indicated only minimal discussions of Lahontan cutthroat trout during the development of the beneficial uses (see Table 5).

It appears that some additional work is needed to consolidate the available information and bring together new information if BWQP desires to differentiate between existing and designated beneficial uses. NDOW's involvement in any such effort will be mandatory. In fact, recent work by NDOW provides evidence of existing use in the Carson River. According to NDOW's East Carson River Draft Fisheries Management Plan (Sollberger, May 2000), *"[w]ild salmonid populations and fishing in the East [Fork] Carson River (in Nevada) historically have been poor and the fishery has been managed mostly as put-and-take."* NDOW states that put-and-take fishery management "*...is directed towards providing fishing opportunity for hatchery stocked catchable sized fish with rapid harvest turnover in the fish population structure*". The 2000 Management Plan states that a put-and-take management strategy is "*...adopted when there is less natural opportunity for fish to reproduce or where harvest is great in a limited resource.*"

Following passage of the Clean Water Act (over 30 years ago), Nevada like many other states adopted broad use designations rather than a finely graded scale of uses. Efforts to adopt a more finely graded system would have required exhaustive studies, and states were encouraged to adopt the highest possible uses. The adoption of broad use designations was the result (Clean Water Network website, August 2003). However in some instances, states have provided some differentiation in their aquatic life uses, such as coldwater or warmwater fisheries; self-supporting fisheries or stocked fisheries; high quality aquatic life or marginal aquatic life.

History of Selected Numeric Water Quality Criteria

Following is a discussion on the history of numeric water quality criteria appearing in Nevada's regulations for the main Carson waterbodies. The focus is on those most frequent constituents identified in the 2002 Nevada's 303(d) List (temperature, total suspended solids, turbidity, total phosphorus, iron, mercury). However given concerns with potential eutrophication, additional discussion is provided on nitrates and dissolved oxygen.

Temperature Standards

In 1967, the State Board of Health amended the Nevada Water Pollution Control Regulations to include numeric water quality criteria, including temperature, for the main Carson basin waters. The regulations defined maximum allowable temperatures for the winter and summer and allowable averages for June-September. It is unknown if these criteria were set to protect aquatic life uses or to maintain existing water quality. During the 1980 regulation revisions, a beneficial use of aquatic life was applied to the major waters and the temperature criteria were modified so that maximum allowable temperatures were set for every month of the year. The June-September average criteria were removed at that time.

In 1984, NDEP pursued a significant update in the water quality standards including modifications to the beneficial uses and the numeric criteria. As stated earlier, the beneficial use recommendations included more detail on the specific fish species of concern and fish stocking operations. In the 1984 *Rationale* (NDEP, 1984), NDEP presented temperature requirements (as compiled by NDOW) for various coldwater and warmwater fish at different life stages (Table 8). However, the Rationale does not explicitly state which criteria should be applicable to the various reaches based upon the varying aquatic life use definition. One is left to surmise that the State Environmental Commission would have taken the most restrictive criteria as appropriate for the specific fish and life stage to be supported. However, the uses proposed in Table 5 were not codified into the regulations. Nevertheless, it seems that the codified temperature criteria (Table 9) attempt to recognize some of the real variations in the system, even though the final beneficial use descriptions did not.

Table 8. Nevada Department of Wildlife's Temperature Requirement Recommendations for Coldwater and Warmwater Fish (1984)

Species	Life stage	Value (Degrees C)	Date Range	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rainbow Trout (RT)	Spawning (S)	13.3	3/1-5/15			13.3									
	Incubate (I)	16.6	3/1-7/1			16.6			16.6						
	Nursery (N)	21.1	4/1-8/1				21.1			21.1					
	Juvenile (J)	22.2	5/1-9/15					22.2			22.2				
	Adult (A)	23.3	1/1-12/31	23.3									23.3	23.3	
Brown Trout (BT)	Spawning (S)	13.3	10/15-12/15											13.3	
	Incubate (I)	13.3	10/15-3/15	13.3										13.3	
	Nursery (N)	21.1	11/15-4/15	21.1											21.1
	Juvenile (J)	22.2	2/15-6/30			22.2									
	Adult (A)	23.3	1/1-12/31	23.3									23.3	23.3	
Summary of Most Restrictive Coldwater Criteria						13.3			16.6	21.1	22.2		23.3	13.3	
Catfish (CT)	Spawning (S)	24	6/15-7/15							24					
	Incubate (I)	29	none given												
	Juvenile (J)	32	none given												
	Adult (A)	32	none given												
Smallmouth Bass (SB)	Spawning (S)	18	none given												
	Incubate (I)	23	none given												
	Juvenile (J)	29	none given												
	Adult (A)	29	none given												
White Bass (WB)	Spawning (S)	17	none given												
	Incubate (I)	26	none given												
Walleye (WA)	Spawning (S)	11	10/15/-4/15	11										11	
	Adult (A)	28	4/15-10/15					28		28		28			
Summary of Most Restrictive Warmwater Criteria				11				28		24		28		11	

13.3 Most Restrictive Temperature Requirement

13.3 Less Restrictive Temperature Requirement

While criteria protective for all rainbow and brown trout life stages (except for brief period in October) were adopted for: 1) East Fork Carson River from stateline to Muller Lane; 2) West Fork Carson River at stateline; and 3) Bryant Creek from stateline to confluence, less restrictive criteria were codified for the other lower reaches. For instance, the May and July-October criteria were less restrictive for 1) East Fork Carson River from Muller Lane to confluence; 2) West Fork Carson River above confluence; and 3) Carson River above Mexican Dam Gage. This represented a decrease in the level of protection afforded rainbow trout during spawning, and a decrease in the level of support for rainbow trout in the incubation/nursery/juvenile stages. According to the *Rationale* (NDEP, 1984), these reaches have problems attaining the temperature criteria but that "...young fry and fingerlings are expected to either seek deep pools within the reaches or to migrate upstream to cooler reaches, since there are no physical barriers to prevent such out-migration." While some deep pools may

exist in these reaches, some physical barriers (mainly diversion dams) to migration to upstream reaches do in fact exist in these areas.

Table 9. Final Temperature Criteria (° C) for Carson Basin and Fish Species and Life Stages Not Being Supported

Waterbody	Reach	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
West Fork Carson River	Stateline	13 (None)				13 (None)	17 (None)	21 (None)	22 (BT-S)			13 (None)	
Bryant Creek	Stateline to confluence												
East Fork Carson River	Stateline to Mulller Lane												
	Muller Lane to confluence					17 (RT-S)		23 (RT-I, RT-N, RT-J, BT-S, BT-I)					
West Fork Carson River	Above confluence												
Carson River	From confluence to Cradlebaugh												
	From Cradlebaugh to Mexican Gage												
	From Mexican Gage to Deer Run Rd	18 (RT-S, RT-I, BT-I)					23 (RT-I, RT-N, RT-J, BT-J)					18 (BT-S, BT-I)	
	From Deer Run Rd to Dayton Bridge	11 (None)			24 (None)			28 (None)				11 (None)	
	From Dayton Bridge to Weeks												
	From Weeks to Lahontan Dam												

RT = rainbow trout
BT = brown trout
CT = catfish
WA = walleye

S = spawning
I = incubate
N= nursery
J = juvenile
A = adult

Period of time that life stage is not supported

While criteria protective for all rainbow and brown trout life stages (except for brief period in October) were adopted for: 1) East Fork Carson River from stateline to Muller Lane; 2) West Fork Carson River at stateline; and 3) Bryant Creek from stateline to confluence, less restrictive criteria were codified for the other lower reaches. For instance, the May and July-October criteria were less restrictive for 1) East Fork Carson River from Muller Lane to confluence; 2) West Fork Carson River above confluence; and 3) Carson River above Mexican Dam Gage. This represented a decrease in the level of protection afforded rainbow trout during spawning, and a decrease in the level of support for rainbow trout in the incubation/nursery/juvenile stages. According to the Rationale (NDEP, 1984), these reaches have problems attaining the temperature criteria but that "...young fry and fingerlings are expected to either seek deep pools within the reaches or to migrate upstream to cooler reaches, since there are no physical barriers to prevent such out-migration." While some deep pools may exist in these reaches, some physical barriers (mainly diversion dams) to migration to upstream reaches do in fact exist in these areas.

For the Carson River from Mexican Dam Gage to Deer Run Road, significant deviations from the most restrictive requirements were made. With these deviations, the criteria do not provide any protection for rainbow and brown trout spawning and incubation, but provide varying levels of protection for nursery, juvenile and adult rainbow and brown trout.

While the codified temperature criteria vary from reach to reach, overall the criteria do not seem to be based solely upon the beneficial uses proposed by NDOW/NDEP (Table 3) or solely upon the codified beneficial uses (Table 4). Rather, it appears that the codified temperature criteria were based upon a combination of the two. The result is a set of temperature criteria that are inconsistent with the beneficial uses that remain today in the State's regulations.

Total Suspended Solids and Turbidity Criteria

Total Suspended Solids Criteria: Total suspended solids (TSS) numeric criteria were not added to the NAC until 1984 as part of significant revisions to the beneficial uses and criteria. Interestingly, the criteria that were proposed and ultimately adopted by the SEC included a TSS standard of 25 mg/l for both forks of the Carson at the stateline and for the Weeks-Lahontan Reservoir reach, and a much higher standard of 80 mg/l for the other reaches. According to the Rationale (NDEP, 1984), this difference in criteria is "...due to the excessively high [TSS] values determined for most reaches in the data analysis. Lower values are expected at the upper reaches due to high quality water, and in Lahontan due to the settling of solids in the upper end of the lake."

While not stated in the Rationale, it appears that the TSS criteria were derived from guidance provided in "Water Quality Criteria" (National Academy of Sciences, 1972) commonly referred to as the "Blue Book". According to the Blue Book, aquatic communities are provided a high level of protection with a TSS level of 25 mg/l and a moderate level of protection with a level of 80 mg/l.

Turbidity Criteria: Turbidity numeric criterion for the Carson River basin first appeared in the state regulations around 1973. For the all the main waters in the Carson basin, the standard called for turbidity levels not to exceed "...that characteristic of natural conditions by more than 10 Jackson Turbidity Units." (Bureau of Environmental Health (1973)). The source of this criterion is uncertain. Existing guidance (FWPCA, 1968) at the time did not recommend this criterion.

During the 1980 regulation revisions, a beneficial use of aquatic life was applied to the major waters and the turbidity criteria were modified to include single values and annual average values not to be exceeded. The criteria varied throughout the system with single value/annual averages as low as 8 NTUs (Nephelometric Turbidity Units)/5 NTUs mg/l at East Fork Carson River at the stateline to as high as 31 NTUs/12 NTUs at Carson River at Cradlebaugh Bridge (Hwy 395). Based upon this variability, it seems that these criteria were based upon existing water quality and not necessarily levels needed to support the beneficial uses.

As stated earlier, in 1984 NDEP pursued a significant update in the water quality standards including modifications to the beneficial uses and the numeric criteria, with specificity added to the aquatic life beneficial use. During the 1984 revisions, the turbidity standards were changed to 10 NTUs for the coldwater fishery reaches (stateline to Deer Run Road) and 50 NTUs for the warmwater fishery reaches (Deer Run Road to Lahontan Dam. It appears these criteria were based upon recommendations in the "Report of the Committee on Water Quality Criteria" (FWPCA, 1968) commonly referred to as the "Green Book."

Summary: The TSS and turbidity standards for waters throughout the state are based upon outdated national guidance and may not be appropriate for all waters. Research has shown that the duration and frequency of elevated TSS/turbidity levels are factors in determining aquatic life impairment and need to be accounted for in the standards. The shortcomings of sediment-related criteria throughout the nation have been recognized and EPA is developing a strategy for improved criteria (2003). NDEP lacks the resources to develop more appropriate criteria and is relying on EPA to provide updated criteria.

Nutrient Criteria

Total Phosphorus Criteria: In 1967, the Nevada Water Pollution Control Regulations were amended for the Carson waters to include numeric water quality criteria for total phosphates (as PO_4). In this action criteria were set as single values and annual averages, with single values ranging from 0.15 mg/l at East Fork Carson River at Muller Lane to 2.0 mg/l at Carson River at Deer Run Road; and annual average values ranging from 0.1 mg/l at East Fork Carson River at stateline to 1.0 mg/l at Carson River at Deer Run Road. It is unknown if these criteria were set to protect aquatic life uses or to maintain existing water quality.

In 1980, the total phosphate criteria were set in terms of single values and annual average values based upon the existing water quality. These revised nitrate criteria were considerably higher than those adopted in 1973.

During the 1984 standards revisions, the total phosphates standard was changed to be in terms of P (phosphorus) instead of PO_4 (phosphates) because "... the majority of literature and all of the State Laboratory results are reported as P" (NDEP, 1984). Additionally, the single values were eliminated as it was believed that annual average beneficial use standards adequately protect the beneficial uses. For all reaches from the stateline to Weeks, the annual average total phosphorus standard was set at 0.1 mg/l. Though not stated in the Rationale, it appears that the total phosphate criteria were taken from the "Quality Criteria for Water" (EPA, 1976) otherwise known as the "Red Book". The Red Book states that total P levels of 0.1 mg/l are a desired goal for the prevention of plant nuisances in streams or other flowing waters not discharging directly to lakes.

In the early 1980s, extensive work had been conducted on Lahontan Reservoir with the phosphorus loading to the reservoir being identified as the major contributor to the eutrophic (highly productive) conditions in the reservoir. The Rationale (1984) states that "[the] goal at Lahontan Reservoir will be to achieve a meso-eutrophic level of productivity that would be characterized by a summer mean chlorophyll-a value of less than 10 µg/l." According to the Rationale, a chlorophyll-a threshold of 10 µg/l was selected as some research has shown that lakes and reservoirs with chlorophyll-a levels above this value usually have excessive growths of algae that significantly impair beneficial uses.

To achieve the chlorophyll-a goal of 10 µg/l, it was estimated that the total phosphorus levels in the lower basin (closest to the dam)[5] of the reservoir needed to be at or below 0.06 mg/l (60 µg/l) based upon the following equation presented by Grieb et al. (1981):

$$Mean\ Summer\ Chlorophyll\text{-}a\ (\mu g/l) = 0.9*(P)^{0.6}$$

Where:

P = mean summer in-lake total phosphorus concentration (µg/l)

As a result of this work, the Lahontan Reservoir total phosphorus standard was changed to a single value of 0.06 mg/l.

The 1984 revisions for phosphorus remain in the regulations today. It must be noted that while the regulations use the term "total phosphates" as P, this has been taken to mean "total phosphorus" (as P), which is consistent with standards for many other Nevada streams.

Nitrogen Criteria: In 1967, the Nevada Water Pollution Control Regulations were amended for the Carson waters to include numeric water quality criteria for nitrate. In this action tentative criteria were set as single values ranging from 2 mg/l (as NO_3)[6] at East Fork Carson River at stateline to 4 mg/l (as NO_3) at Lahontan Reservoir. By 1973, some of these values were increased to 4 mg/l (as NO_3) for all control points between the stateline and New Empire (Deer Run Road Bridge). The nitrate criteria for the New Empire site was increased to 5 mg/l (as NO_3). It is unknown if these criteria were set to protect aquatic life uses or to maintain existing water quality.

In 1980, the nitrate criteria were set in terms of single values and annual average values based upon the existing water quality. With the exception of one location, these revised nitrate criteria were lower than those adopted in 1973. Four years later (1984), major regulation changes occurred for nitrates and other constituents. The State adopted an approach which included two sets of numeric criteria: 1) RMHQs for antidegradation concerns; and 2) criteria needed to support the beneficial uses. As part of this action, RMHQs were set for total nitrogen based upon existing quality; and beneficial use criteria for nitrate was increased to 10 mg/l (nitrate as N) for the protection of drinking water uses.

Summary: There are significant concerns about the validity of the current phosphorus and nitrate standards within the Nevada regulations and with other states throughout the country. It has long been recognized that one standard does not apply to all waters yet Nevada has assigned a phosphorus standard of 0.1 mg/l to most of the waters in the regulations. Given the native soil conditions in the Great Basin and the natural occurrence of phosphorus over much of Nevada, the suitability of the total phosphorus water quality standard must be questioned. Additionally, the Carson water quality standards do not recognize the potential contribution nitrates can play in creating eutrophication problems. Currently, nitrate standards in the Carson watershed have been set to protect the municipal or domestic supply beneficial use. Yet nutrient concentrations

[5] Cooper and Vigg (1983) found the lower basin near the dam to be more productive with summer chlorophyll-a levels about 4 to 5 time higher than in the upper basin of the reservoir.

[6] Divide nitrate (as NO_3) values by 4.4 to calculate nitrate (as N) concentrations

alone may not be appropriate standards. Recent work by TetraTech is indicating that levels of phosphorus and nitrogen alone are not good predictors of eutrophication problems (TetraTech, 2004). Other conditions (such as physical conditions, biological responses, etc.) within the waterbody need to be considered to ascertain impairment. As part of this study, it is hoped that TetraTech will be developing methods for states to improve their nutrient criteria.

Dissolved Oxygen Criteria

Dissolved oxygen criteria first appeared in the Nevada Water Pollution Control Regulations in 1967. Single values (applicable any time of the year) and average values (for June through September) were set. The single values ranged from 5.5 to 7.0 mg/l and the average values ranged from 6.5 to 8.0 mg/l. In 1980, these criteria were revised to include an interesting combination of values: annual average values (daylight), single values (daylight), and single values (any time). The daylight values were derived from existing data while the single values (set at 5mg/l for all sites) (effective any time) were taken from EPA (1976) guidance for the maintenance of "good fish populations."

In 1984, dissolved oxygen criteria were set at 6.0 mg/l (November through April or May) and 5.0 mg/l (for the remainder of the year). The proposed value of 6.0 mg/l was intended to assure sufficient intergravel dissolved oxygen levels for the protection of incubating salmonid eggs and fry. These 1984 revisions remain today in Nevada's water quality standards.

More recent EPA guidance (1986) incorporates a more detailed approach with varying levels for warmwater and coldwater species and for varying time periods (1-day, 7-day, 30-day). These new recommendations need to be considered for possible inclusion in the NAC.

Total Iron Criterion

A total iron numeric standard of 1.0 mg/l for the protection of aquatic life throughout Nevada (not just the Carson basin) first appeared in Nevada's water quality regulations around 1980. The criterion was taken from the Red Book (EPA, 1976) which states that the main problems associated with elevated iron levels include toxicity to fish and macroinvertebrates; and iron precipitates covering stream bottoms thereby destroying bottom-dwelling invertebrates, plants or incubating fish eggs.

The iron criterion remains in place today (NAC 445A.144) though there are significant concerns regarding its applicability. Upon closer examination, it becomes obvious that the Red Book criterion of 1.0 mg/l was based upon minimal information and its appropriateness needs to be questioned. In more recent years, EPA has been following a rather rigorous analysis in setting criteria for toxics. This same approach needs to be taken in revising the iron criterion. However, Nevada lacks the resources for such an undertaking and is relying on EPA to develop an updated iron criterion.

Mercury Criteria

Around 1980, mercury standards of 0.0017 µg/l (single value) and 0.00057 µg/l (24-hour average) for the protection of aquatic life throughout Nevada were incorporated into the State's water quality regulations. Within a few years, the criteria were modified to 4.1 µg/l (single value) and 0.2 µg/l (24-hour average). In 1990, the mercury standards were again revised to 2.4 µg/l (1-hour average) and 0.012 µg/l (96-hour average). At that point, the 1990 regulations and previous versions did not differentiate between dissolved concentrations or total concentrations. In 1994, the 1-hour (acute) mercury criteria was revised to 2.0 µg/l and identified as the dissolved concentration. The 96-hour (chronic) criteria remained at 0.012 µg/l, but was identified as the total concentration.

All of the various criteria throughout the years were based upon federal guidance documents available at the time. The 1994 mercury criteria changes remain in Nevada's Administrative Code (NAC 445A.144) today and are subject to change yet again. Recent EPA guidance (2002) has recommended new 1-hour and 96-hour criteria (Table 10) which Nevada is reviewing for possible inclusion in the regulations.

Table 10. Current Nevada Standard for Mercury and Latest EPA Guidance

Duration	Current NAC	New Guidance
1-hour Criteria	2.0 µg/l	1.4 µg/l
96-hour Criteria	0.012 µg/l (total mercury)	0.7 µg/l

Note: Concentrations are for dissolved mercury unless otherwise noted

Summary

The purpose of this report has been to provide the reader with a basic understanding of the water quality standards within the Carson River basin and their evolution over the years. An understanding of the regulatory history is important when considering potential future changes. The main points discussed in this report include:

1. Water quality standards (consisting of both beneficial uses and numeric water quality criteria) are the foundation for water quality management activities. If these standards are not appropriate or outdated, subsequent actions taken may be negatively affected.

2. Water quality standards in Nevada and the Carson River watershed have never been a stagnant feature in the Nevada Administrative Code. Revisions have been made over the years in response to changing statutory requirements, changing EPA guidance, and improved understanding of various water quality constituents and their impacts on the beneficial uses.

3. The aquatic beneficial uses assigned in the Carson River regulations need to be reviewed for appropriateness. The possibility of explicitly recognizing NDOW's stocked fishery

management approach needs to be considered. However before such revisions could be pursued, a Use Attainability Analysis may be needed. As part of the Report Card, NDEP will be determining the need to pursue beneficial use revisions.

4. Some of Nevada's numeric water quality criteria are outdated and in need of revision. The shortcomings of some of these criteria throughout the country have been recognized and EPA is continuing to work toward improved water quality criteria. Developing improved criteria can be an expensive and time consuming process. In many cases, Nevada lacks the resources to develop more appropriate criteria and is relying on EPA guidance for future revision guidance. Some key constituents of concern in the Carson basin include: temperature, total suspended solids, turbidity, total phosphorus (nutrients), iron and mercury. Future publications will evaluate the standards for some of these constituents.

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APPENDIX C
NDEP TMDL REPORTS

Carson River TMDL Status Report
Prepared by Randy Pahl, Nevada Division of Environmental Protection
February 1, 2002

Introduction

In 1982, Carson River TMDLs were developed by NDEP and were presented in the 208 Plan (*Water Quality Management Plan for the Carson River Basin, Nevada*) for the basin. Recently, frequent inquiries have being made on the status of this TMDL. In response, this issue paper has been developed to summarize the 1982 TMDL and future efforts for updating the TMDL.

Summary of Existing TMDL

As required by the Clean Water Act (CWA), NDEP completed the *Water Quality Management Plan for the Carson River Basin, Nevada* in 1982. Section 208 of the CWA was promulgated for the purpose of encouraging and facilitating the development and implementation of areawide waste treatment management plans. One portion of the 208 Plan presents maximum allowable daily loads for dissolved oxygen (DO), biochemical oxygen demand (BOD), orthophosphate phosphorus, nitrate nitrogen and total dissolved solids (TDS) as developed by Ott Water Engineers.

In support of the 208 Plan, Ott Water Engineers performed a detailed water quality modeling study as described in *Carson River Basin 208 Regional Water Quality Study* (February 1981). The purpose of this study was to determine the sources of pollution to the Carson River, the allowable maximum loads these sources can contribute without violating instream water quality standards, and to allocate pollutant loads to various beneficial users on the river.

The Ott report presents a number of tables showing allowable maximum loads for various reaches under different management scenarios. Typically, a TMDL provides an estimate of **all loads** (background, nonpoint and point sources) that can enter a waterbody without exceeding the water quality standards. However, the Ott report seems to have taken a different approach. Although the report is somewhat confusing in this regard, it appears that the reported allowable maximum loads represent estimates of the **amount of point source loading that could be added to the existing background and nonpoint source loads** without exceeding the standards. As a result, some of the maximum daily loads are negative numbers. According to the report, "[t]his means that the background low flow water quality (without point source contribution) already violates the State of Nevada annual average standards."

While the loads provided by Ott Water Engineers do not represent traditional TMDLs, more appropriate TMDL values can be interpreted from the information developed by Ott and presented in the 208 Plan. In developing the allowable maximum loads, Ott Water Engineers used the QUAL III model to simulate water quality under two flow conditions (7Q2 (7 day, 2-year recurrence) and 7Q10 (7 day, 10-year recurrence – See Table 1)) and for various management scenarios. These management scenarios included various types of point source treatment and some nonpoint source reductions. The water quality standards that existed at the

time were also considered in the analysis. By applying the following equation to the 7Q2/7Q10 flow values and water quality standards (that existing in 1982), traditional TMDL values can be calculated:

Total Maximum Daily Load (in lbs/day) = 5.4 x Flow (in cfs) x Concentration (in mg/l) *[Eq. 1]*

While the Ott report did calculate maximum allowable daily loads for dissolved oxygen (DO), biochemical oxygen demand (BOD), orthophosphate phosphorus, nitrate nitrogen and total dissolved solids (TDS), the remainder of this issue paper focuses on the orthophosphate TMDL. Since 1982, all of the wastewater treatment plant discharges have been removed from the Carson River. As a result, the Carson River is no longer impaired for DO, BOD, nitrates and TDS. However, the river still appears on Nevada's 303(d) List for total phosphorus.

Using Equation 1 and the data presented in the Ott Engineers report, traditional TMDL values for orthophosphates were calculated. The flow data and standards data used as input to these calculations are shown in Tables 1 and 2. Table 3 presents the resulting orthophosphate TMDLs. As the table shows, the 7Q10 and 7Q2 flows and the orthophosphate standards varied greatly throughout the river system. The result is TMDLs ranging from 0.5 to 1,770 lbs/day depending upon the reach and the flow conditions.

Table 1. Summary of 7Q10 and 7Q2 Flows used by Ott Engineers

Control Point	Flow at Control Point (cfs)	
	7Q10	7Q2
WF Carson River at stateline	4.25	28
EF Carson River at stateline	59	117
EF Carson River at Highway 395	60	120
EF Carson River at Muller Lane	1	4
Carson River at Genoa Lane	4	10
Carson River at Cradlebaugh Bridge	4.5	16
Carson River at Mexican Ditch Gage	6	19
Carson River near New Empire	6.3	16
Carson River at Weeks	1	1.5
Lake Lahontan at Lahontan Dam	640	820

Table 2. Carson River Water Quality Standards for Orthophosphates - 1982

Control Point	Orthophosphates (as PO_4)	
	Annual Average (mg/l)	Single Value (mg/l)
WF Carson River at stateline	0.05	0.10
EF Carson River at stateline	0.10	0.20
EF Carson River at Highway 395	0.10	0.20
EF Carson River at Muller Lane	0.10	0.15
Carson River at Genoa Lane	None	None
Carson River at Cradlebaugh Bridge	0.50	1.00
Carson River at Mexican Ditch Gage	None	None
Carson River near New Empire	1.0	2.0
Carson River at Weeks	0.30	0.50
Lake Lahontan at Lahontan Dam	0.40	0.60

Table 3. Carson River Total Maximum Daily Loads for Orthophosphates as Interpreted from *Water Quality Management Plan for the Carson River Basin, Nevada (1982)*

Control Point	Flow at Control Point (cfs)		Standard for Orthophosphates (as PO_4) - annual average, mg/l	Total Maximum Daily Load – Orthophosphates as PO_4 (lbs/day)	
	7Q10	7Q2		7Q10	7Q2
WF Carson River at stateline	4.25	28	0.05	1.2	7.6
EF Carson River at stateline	59	117	0.10	31.8	63.1
EF Carson River at Highway 395	60	120	0.10	32.4	64.8
EF Carson River at Muller Lane	1	4	0.10	0.5	2.2
Carson River at Genoa Lane	4	10	None	Not calculated	Not calculated
Carson River at Cradlebaugh Bridge	4.5	16	0.50	12.1	43.2
Carson River at Mexican Ditch Gage	6	19	None	Not calculated	Not calculated
Carson River near New Empire	6.3	16	1.0	34.0	86.3
Carson River at Weeks	1	1.5	0.30	1.6	2.4
Lake Lahontan at Lahontan Dam	640	820	0.40	1,382	1,770

Current Water Quality Standards versus the Existing TMDL

Since 1982, the Carson River water quality standards have undergone significant revisions. Twenty years ago the standards addressed orthophosphates, while current standards are set in relation to total phosphorus levels. Historically only a portion of the total phosphorus in the river can be attributed to orthophosphate. Based upon a cursory examination of the data, typically about 25 to 75 percent of the total phosphorus in the Carson River is due to orthophosphate. Table 4 provides a comparison of 1982 orthophosphate standards and the current total phosphorus standards. The original 1982 standards were reported in terms of PO_4 concentrations but have been converted to P concentrations for Table 4 so as to be more comparable with the current standards.

Table 4. Comparison of 1982 Orthophosphate and Current Total Phosphorus Standards

Control Point	Orthophosphates (as P)		Total Phosphorus
	Annual Average (mg/l)	Single Value (mg/l)	Annual Average (mg/l)
WF Carson River at stateline	0.017	0.033	0.1
EF Carson River at stateline	0.033	0.067	
EF Carson River at Highway 395	0.033	0.067	
EF Carson River at Muller Lane	0.033	0.050	
Carson River at Genoa Lane	None	None	
Carson River at Cradlebaugh Bridge	0.167	0.333	
Carson River at Mexican Ditch Gage	None	None	
Carson River near New Empire	0.333	0.667	
Carson River at Weeks	0.100	0.167	
Lake Lahontan at Lahontan Dam	0.133	0.200	0.06*

*Single value criteria

In general, the current phosphorus standards appear to be less restrictive than the 1982 orthophosphate standards for the Carson River above Genoa Lane (assuming orthophosphate contribute around 50 percent of the total phosphorus concentrations). For the lower river, the current standards are more restrictive. If TMDLs were calculated using the current standards with the 1982 7Q10 and 7Q2 Flows, the same conclusions could be made (Table 5). That is, allowable loads based upon existing standards are less restrictive than the current TMDLs for the Carson River above Genoa Lane, and more restrictive for the remaining sections.

Table 5. Comparison of Existing Orthophosphates TMDLs (1982) and Allowable Loads based upon Existing Total Phosphorus Water Quality Standards

Control Point	Existing Total Maximum Daily Load – Orthophosphates as P (lbs/day)		Allowable Load based upon Existing Standards – Total Phosphorus as P (lbs/day)	
	7Q10	7Q2	7Q10	7Q2
WF Carson River at stateline	0.4	2.5	2.3	15.1
EF Carson River at stateline	10.6	21.0	31.9	63.2
EF Carson River at Highway 395	10.8	21.6	32.4	64.8
EF Carson River at Muller Lane	0.2	0.7	0.5	2.2
Carson River at Genoa Lane	Not calculated	Not calculated	2.2	5.4
Carson River at Cradlebaugh Bridge	4.0	14.4	2.4	8.6
Carson River at Mexican Ditch Gage	Not calculated	Not calculated	3.2	10.3
Carson River near New Empire	11.3	28.8	3.4	8.6
Carson River at Weeks	0.5	0.8	0.5	0.8
Lake Lahontan at Lahontan Dam	461	590	207	266

Future TMDL Efforts for the Carson River

As NDEP has not undergone any formal process to update the Carson River TMDLs, the TMDLs presented in Table 3 (as interpreted from *Water Quality Management Plan for the Carson River Basin, Nevada* (1982)) stand as the existing Carson River TMDLs for orthophosphates.

The Bureau of Water Quality Planning (BWQP) recognizes the need to update the Carson River TMDL but is desirous of establishing a TMDL that is well grounded with sufficient characterizations of river health, impairments, and pollutant sources. Without such information, effective implementation plans are not possible. Currently, BWQP is working towards identifying and implementing projects needed to complete these characterizations (or assessments).

Conceptual Plan for Water Quality Standard Evaluations and TMDL Development in Nevada
Nevada Division of Environmental Protection
March 2004

Introduction

In 2002, the Nevada Division of Environmental Protection – Bureau of Water Quality Planning (BWQP) issued its latest 303(d) List. Primarily due to modifications in the listing methodology, the 2002 303(d) List represented a significant expansion from the previous list. Including EPA amendments, the 2002 List contains over 300 waterbody/pollutant combinations. From the beginning, BWQP has viewed this list as a planning tool to guide our other activities such as monitoring, water quality standards evaluations, assessments, TMDLs, etc. Figure 1 provides a breakdown of the various waterbody/pollutant combinations identified in the 2002 303(d) List and significant issues associated with each.

Of particular interest are the technical issues associated with our water quality standards. The water quality standards – consisting of beneficial use definitions and numeric criteria – are the foundation upon which a state builds its TMDLs. Any deficiencies in the standards will translate into inappropriate and ineffective TMDLs. According to the National Research Council (2001):

> *"Water quality standards are the benchmark for establishing whether a waterbody is impaired; if the standards are flawed (as many are), all subsequent steps in the TMDL process will be affected".*

Recognizing these issues, the National Research Council (2001) goes on to recommend that:

> *"States should develop appropriate use designations for waterbodies in advance of assessment and refine these use designations prior to TMDL development"*
>
> *"To ensure that designated uses are appropriate, use attainability analysis should be considered for all waterbodies before a TMDL is developed."*

The need to re-evaluate water quality standards prior to TMDL development is not a new concept. As part of a discussion on a "water quality-based approach to pollution control", EPA (1994) presents a framework that states can follow to meet the needs of the Clean Water Act with standards evaluations preceding TMDL development. This document provides justification for standards evaluations by stating:

> *"...many States have not conducted in-depth analyses of appropriate uses and criteria for all water bodies but have designated general fishable/swimmable use classifications and statewide criteria on a 'best professional judgment' basis to many waters...It is possible that these generally applied standards, although meeting the minimum requirements of the CWA and WQS regulation, may be inappropriate (either over- or under-protective) for a specific water body that has not had an in-depth standards analysis."*

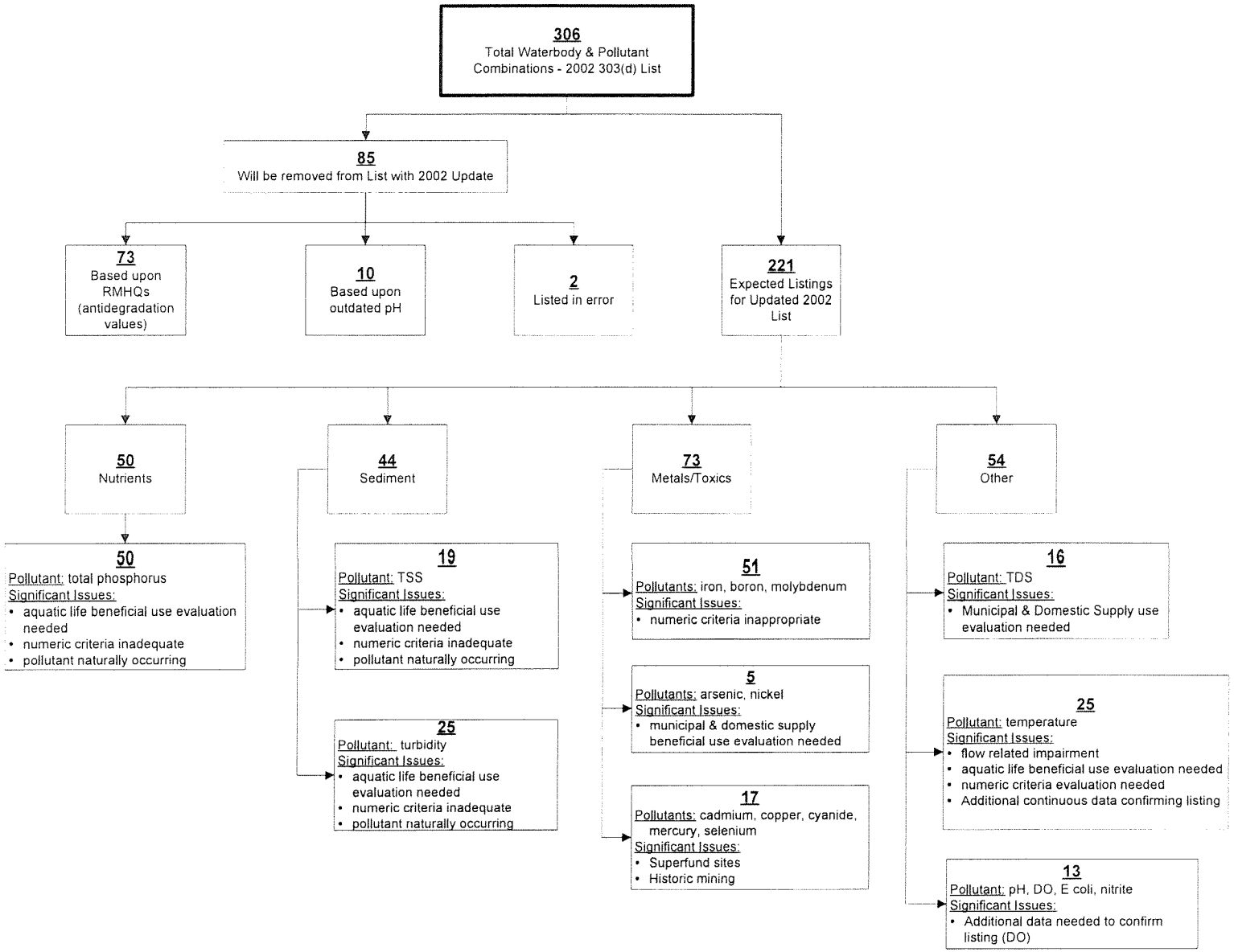

Figure 1. Breakdown of Waterbody/Pollutant Combinations in 2002 303(d) List

As shown on Figure 1, a majority of the 303(d) listings have significant issues relating to beneficial use and numeric criteria appropriateness. Nevada desires to first address these issues in order to establish a sound foundation for TMDLs. Following is a summary of BWQP's conceptual plan for addressing these issues and meeting its TMDL development responsibilities. This framework will provide for scientifically defensible decisions within the various water programs and potentially eliminate costly and unnecessary requirements.

Conceptual Plan Framework

As part of a rotating basin approach to address the above issues, BWQP is proposing to select a watershed and concentrate its resources with a team of staff representing each of the three branches: Nonpoint Source, Standards and Monitoring. For the selected basin, a strategic plan will be developed to guide the activities. As the focused efforts in this basin are concluding, BWQP will select another watershed and begin transitioning its efforts towards that particular waterbody. Use of the term "transition" must be emphasized as it is not expected that BWQP will be abruptly moving its focused efforts from one basin to the next. During the transition phase, significant monitoring may be needed upfront to help design the project needs for the next watershed.

The basic framework upon which BWQP will build its water quality standard and TMDL activities within the selected watershed are as follows (also see Figure 2):

1) **Beneficial Use & Criteria Evaluation**

   The first phase in this approach is to evaluate whether or not the particular beneficial use is appropriate (currently exists or is attainable under certain circumstances) or needs to be revised. Much of this phase could involve use attainability analyses (UAA), with water quality standards revisions pursued as needed. The specifics of Phase 1 will vary greatly depending upon the waterbody, and the beneficial use and pollutant of concern. In some cases, a use impairment determination (Phase 2) will be needed as part of Phase 1. It must be realized that many of the projects needed to support Phase 1 will also support work under Phase 3 (TMDL Development).

2) **Use Impairment Determination**

   As the original 303(d) listings may have been based upon inappropriate or outdated criteria, or limited data, impairment of the beneficial use needs to be confirmed during the next phase. If no impairment of the appropriate use is determined or impairment found to be due solely to pollution but not a pollutant, then the waterbody will be removed from the 303(d) List during the next listing cycle. If impairment found to be due to a pollutant(s), then the next phase (TMDL development) is pursued.

   In recent EPA guidance (2003), states are being encouraged to develop an Integrated Report which meets the needs of both the 303(d) List and the 305(b) Report. The integrated report is to consist of 5 parts. Of particular interest are Part 4C and Part 5:

Part 4C: Waters should be listed in this subcategory when an impairment is not caused by a pollutant[1] but by pollution. TMDLs are not required for these waters.

Part 5: Waters should be placed in this category when it is determined that a pollutant is causing the impairment. TMDLs are required for these waters.

3) TMDL Development

If beneficial use impairment from a pollutant is confirmed, the next phase is the development of the TMDL. It is likely that a majority of the information generated during Phases 1 and 2 will be useful in the TMDL development. Another significant task could involve characterization of the impairment sources followed by load allocations.

It is important to recognize that for each of the above phases, significant data compilation, monitoring and research efforts may be needed. However, the activities needed for one phase may very well be useful for the other steps in the process.

While BWQP believes that following these 3 phases are key to creating realistic and defensible water quality criteria and TMDLs, it is recognized that significant resources (time, money, etc.) are needed to meet these needs. As a result, strict adherence to this 3-phase approach will delay our ability to develop TMDLs in the near future and increase NDEP's and EPA's liability under the Clean Water Act. For that reason, NDEP will also pursue selected simplified TMDLs concurrent with its "3 Phase" activities.

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[1] Pollution, as defined by the CWA, is "the man-made or man-induced alteration of the chemical, physical, biological, and radiological integrity of water" (Section 502(19)). In some cases, the pollution is caused by the presence of a pollutant and a TMDL is required. In other cases, pollution does not result from a pollutant and a TMDL is not required.

The following are two examples of pollution caused by pollutants. The discharge of copper from an NPDES regulated facility is the introduction of a pollutant into a water. To the extent that this pollutant alters the chemical or biological integrity of the water, it is also an example of pollution. (Copper is not likely to cause an alteration to the water's physical integrity). Similarly, actions that modify the landscape and may result in the introduction of sediment into a water constitute pollution when sediment (which is a pollutant) results in an alteration of the chemical, physical, biological or radiological integrity of the water. TMDLs would have to be established for each of these waters.

EPA does not believe that flow, or lack of flow, is a pollutant as defined by CWA Section 502(6). Low flow can be a man-induced condition of a water (i.e., a reduced volume of water) which fits the definition of pollution. Lack of flow sometimes leads to the increase of the concentration of a pollutant (e.g., sediment) in a water. In the situation where a pollutant is present a TMDL, which may consider variations in flow, is required for that pollutant.

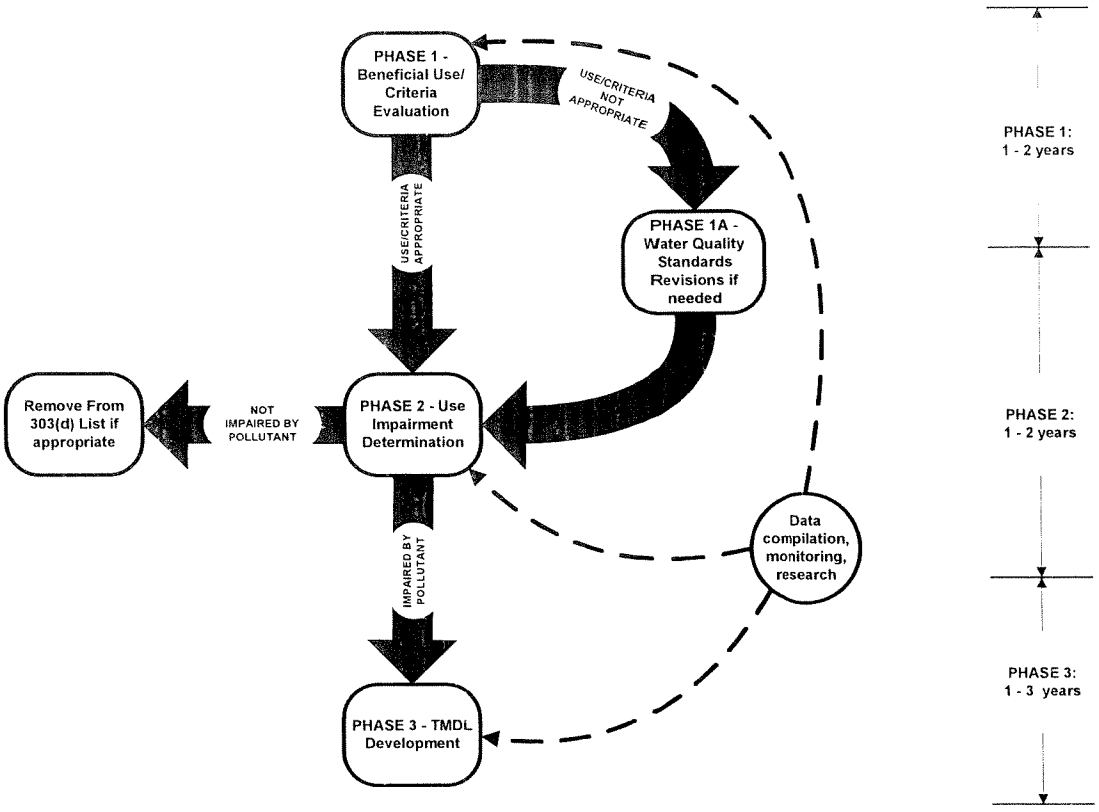

Figure 2. Schematic of Conceptual Plan Framework

Near Term Activities under this Framework

Following are brief descriptions of near-term activities BWQP will pursue under the framework discussed above:

- In early 2000, the Bureau of Water Quality Planning (BWQP) formed an internal watershed group to focus on Carson River basin water quality issues. Since inception of the group, staff from the Bureau's three branches (Nonpoint Source, Standards, and Monitoring) have been strategizing and implementing activities for dealing with the variety of water quality issues within the basin. Numerous monitoring and research efforts are underway to assist us in evaluating the beneficial uses, criteria and impairment in the watershed (Step 1, Figure 2). It is BWQP's intention to continue through with these efforts on the Carson River. Currently, BWQP is developing a detailed plan outlining current and future project needs, funding needs, and an expected timeline. Upon completion, this document will be distributed to EPA for review. As the issues within the Carson basin are varied and complex, completion of the Carson basin activities under this framework may take several years. In the interim, BWQP is planning to

develop simplified TMDLs using load duration curves for several of the listed pollutants within the Carson basin.

- The current focus of BWQP's watershed group is currently the Carson River, but the team is hoping to begin moving into the upper Humboldt basin in Fiscal Year 2005. It has been decided that the entire upper Humboldt River is too large of an area for the watershed team to address, and that the group needs to focus on a subwatershed for future focused efforts. Staff will begin developing a preassessment of the waters of the upper Humboldt to serve as a tool in selecting a subwatershed for focused study. Completion of the preassessment is targeted for Fiscal Year 2005.

- By Consent Decree, EPA agreed to establish a Walker Lake total dissolved solids (TDS) TMDL by 3/15/2005. It is anticipated that BWQP will begin working on this TMDL in late spring of 2004 with completion/approval targeted for 3/15/2005.

- In addition to the above activities, BWQP may also contract for professional services associated with assessments and TMDL if funds become available.

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