RIO ALGOM MINING LLC – AMBROSIA LAKE FACILITY DISCHARGE PERMIT – 169 (DP-169)

Semiannual Report, First Half 2018

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ACRONYMS AND ABBREVIATIONS

ACL	alternate concentration limit
DP-169	Discharge Permit – 169
LTSM	long-term surveillance and maintenance boundary
mg/L	milligrams per liter
NMED	New Mexico Environment Department
NRC	Nuclear Regulatory Commission
pCi/L	picoCuries per liter
PQL	practical quantitation limit
RAML	Rio Algom Mining LLC
Site	Rio Algom Mining LLC Ambrosia Lake facility
SOP	standard operating procedure
TDS	total dissolved solids
SUA-1473	Source Materials License

1.0 REVIEW OF DISCHARGE PERMIT – 169

This report presents the results of monitoring and sampling activities for the first half of 2018 for the Rio Algom Mining LLC (RAML) Ambrosia Lake facility (Site) as required under New Mexico Environment Department (NMED) Discharge Permit – 169 (DP-169). DP-169 was approved on November 15, 1995, and establishes monitoring requirements for the alluvium near the former Ambrosia Lake mill. DP-169 requires semiannual monitoring of alluvial wells for depth to water, total depth, chloride, sulfate, nitrate, and total dissolved solids (TDS). In addition, it requires semiannual and annual reporting to the NMED. In a meeting between RAML and NMED on May 4, 2015, NMED approved eliminating the annual report by including the annual reporting requirements in each of the semiannual reports.

Requirements for annual and semiannual reporting per the July 12, 2000 DP-169 Renewal Request (Quivira, 2000) are listed below with an explanation relative to current conditions at the Site:

1. Analytical results of the 43 alluvial wells for chloride, sulfate, and nitrate.
   - Analytical results for all DP-169 alluvial wells that are still in service and meet the requirements of RAML's Groundwater Monitoring Standard Operating Procedure (SOP) have been included in **Appendix A.**
2. Time versus concentration plots depicting chloride, sulfate and total dissolved solids (TDS) concentrations for all 43 alluvial wells.
   - Time versus concentration plots for chloride, sulfate, and TDS concentrations in all active DP-169 alluvial wells are included in **Appendix B.**
3. Monthly analysis of the reservoir water for chloride, sulfate, and TDS.
   - Monthly analysis of the reservoir is no longer applicable as the reservoir has been reclaimed.
4. Analytical results required under the Nuclear Regulatory Commission (NRC)-approved Corrective Action Program.
   - The NRC-approved Corrective Action Program was terminated in 2006, when Alternate Concentration Limits (ACLs) were approved. Groundwater monitoring for the ACL well network at the Site occurs semiannually. Reports containing analytical results are produced semiannually and submitted to both NRC and NMED. Analytical results from those monitoring events are submitted under separate cover and will not be included in this report.

5. Maps depicting the water level and TDS isopleths for the alluvium.
   - Maps with groundwater elevations and TDS concentrations in alluvial wells are included in **Appendices C** and **D.**
6. Flume discharge volumes.
   - Flume discharge volumes are no longer applicable due to reclamation.
7. Analytical data on computer disc.
   - Laboratory data in CSV and PDF format for the first half of 2018 are included on compact disc with this submittal (**Appendix E**).

2.0 NRC ACLS

The Source Materials License (SUA-1473) specifies the ACLs for alluvial groundwater and the alluvial groundwater monitoring network for determining compliance with the ACLs. Although no DP-169 monitoring wells are included in SUA-1473, the ACLs provide a point of comparison for results from DP-169 wells. The ACLs address byproduct material seepage from the tailings disposal area, including but not limited to chloride, nitrate, sulfate, and TDS. The alluvial ACLs were established through review and consultation between NRC, NMED, and RAML. Alluvial ACLs are presented in **Table 1.**

Table 1 NRC-Approved ACLs for Alluvium

Constituent	ACL
Molybdenum	176 mg/L
Nickel	98 mg/L
Selenium	49 mg/L
Natural Uranium	23 mg/L
Chloride	7,110 mg/L
Nitrate	351 mg/L
Sulfate	12,000 mg/L
TDS	26,100 mg/L
Gross Alpha	8,402 pCi/L
Lead-210	1,247 pCi/L
Radium-226 & 228	3,167 pCi/L
Thorium-230	13,627 pCi/L

Notes:
mg/L = milligrams per liter
pCi/L = picoCuries per liter

3.0 ALLUVIAL GROUNDWATER MONITORING

Semiannual groundwater monitoring in support of DP-169 was performed in February of 2018. **Appendix A** presents the DP-169 groundwater monitoring data for the first half of 2018. Neither DP-169 nor SUA-1473 specify standards that must be met in the DP-169 monitoring wells. However, DP-169 analytical results are less than the non-hazardous ACL's in the SUA-1473 license.

Appendix B contains time-versus-concentration plots for DP-169 wells. **Appendix C** contains a map showing alluvial monitoring well locations with the most recent groundwater elevation measurements. Modeling predictions projected that most of the groundwater in the alluvium will dissipate within 65 years (Maxim, 2001). Decreasing groundwater elevation measurements continue to support this prediction. **Appendix D** contains a map with TDS concentrations plotted for each sampling location. **Appendix E** is the electronic data for the first half of 2018.

4.0 GROUNDWATER MONITORING IMPROVEMENTS

Several alluvial monitoring wells have been replaced in accordance with the NMED-approved Monitoring Well Replacement Work Plan. The well replacement project began in the fall of 2012, and field work was completed on February 2, 2013. The well replacement project is summarized in the Monitoring Well Replacement Report (INTERA, 2013).

In addition to conducting the well replacement program, dedicated bladder pumps have been installed in the alluvial wells that contain enough water to support that method of sample collection. **Appendix F** is a map showing the DP-169 monitoring wells and their status.

5.0 RECLAMATION ACTIVITIES PERFORMED DURING THE FIRST HALF OF 2018

No physical reclamation activities were performed during the first half of 2018. However, additional radiological characterization of soils within the proposed long-term surveillance and monitoring boundary (LTSM) was conducted during the reporting period. The characterization results are being used to identify areas which may require additional reclamation work and to support preparation of the Final Status Survey that will be submitted to the NRC.

6.0 REFERENCES

INTERA, 2013. Monitoring Well Replacement Report, Rio Algom Mining LLC. May 2013

Maxim Technologies, Inc. (Maxim), 2001. Application for Alternate Concentration Limits for the Alluvial Materials, Quivira Mill Facility Ambrosia Lake, New Mexico.

Quivira Mining Company (Quivira), 2000. Discharge Plan – 169 Discharge Plan Renewal Application. Submitted to New Mexico Environment Department Groundwater Section. July 12.

APPENDIX A

Analytical Results for DP-169 Alluvial Wells, First Half 2018

Appendix A

Analytical Results and Field Measurements for DP-169 Monitoring Wells, First Half 2018

Monitoring Well	Sample Date	Status	Depth to Water (ft)	Total Depth (ft)	Specific Cond. (uS/cm)	Temp. (°C)	pH	Cl (mg/l)	NO_3/NO_2 (as N) (mg/l)	SO_4 (mg/l)	TDS (mg/l)
30-03	3/19/2013	OOS	Plugged and abandoned during 2012/2013 Well Replacement Project								
30-04 R	2/13/2018		61.01	72.26	6522	11.92	6.94	672	8.22	2720	5730
30-46	2/16/2018	DRY	--	38.15	--	--	--	--	--	--	--
30-47	2/13/2018		60.71	77.52	4891	11.65	6.75	765	<0.02	1820	3910
30-48*	2/13/2018		63.12	73.14	4680	11.6	3.7	694	<0.02	1930	3730
30-49	2/13/2018	DRY	--	67.40	--	--	--	--	--	--	--
30-53	2/16/2018	DRY	--	44.98	--	--	--	--	--	--	--
30-68 R	2/16/2018	DRY	--	66.06	--	--	--	--	--	--	--
31-05 R	2/14/2018		55.22	66.23	7041	11.94	6.82	588	2.16	3180	6140
31-61 ALL	2/20/2018		17.35	29.04	16032	12.26	6.27	2420	6.69	5630	13800
31-63	7/17/2007	OOS	Removed from service when the interceptor trench was discontinued								
31-65 ALL	2/20/2018		14.51	41.42	17069	10.04	6.16	2610	0.03	6240	15200
31-70 R	2/14/2018		47.84	81.15	7250	11.99	6.78	1030	56.4	2380	5950
31-71	2/14/2018		52.53	63.52	5072	11.67	7.03	565	0.16	2110	4310
32-01 R	2/22/2018		22.48	60.93	20345	11.79	5.65	2510	<0.02	11900	22600
32-02 R	2/13/2018		53.98	70.33	8642	12.28	6.73	764	7.07	3920	8450
32-41	2/13/2018		46.79	59.80	7017	11.63	3.95	1820	<0.02	1370	4420
32-42	2/13/2018	DRY	--	21.85	--	--	--	--	--	--	--
32-43N	2/14/2018		28.99	76.23	11896	12.33	6.17	2070	0.14	3610	10200
32-50 TRB-R**	2/13/2018		57.01	88.55	6598	12.22	6.88	610	3.64	2950	5820
32-51	2/27/2018		38.47	73.80	5289	12.19	7.29	454	6.67	2710	4870
32-52	2/23/2018		31.24	52.42	4180	13.24	8.64	234	<0.02	1880	3450
32-56	2/15/2018	DRY	--	57.37	--	--	--	--	--	--	--
32-57	2/27/2018	INW	50.35	53.00	--	--	--	--	--	--	--
32-58	2/23/2018		21.03	34.52	17212	11.5	6.6	3480	28.1	5860	15100
32-59 ALL	2/23/2018		23.75	28.27	5301	10.47	7.55	448	2.34	2550	4750
32-60	2/20/2018		16.45	27.76	15335	11.07	6.39	2450	9.1	5440	13400
32-69	2/14/2018		59.12	78.28	12561	12.13	6.58	1780	26.4	4450	11800
32-72	2/20/2018		25.04	40.13	12010	12.32	6.24	214	0.09	9220	14500
5-01	2/28/2018		32.3	43.65	4356	11.37	6.57	155	17.8	2620	4210
5-02	2/27/2018		30.8	***	7380	12.28	6.95	1600	0.02	1940	4820
5-03 ALL-R	2/23/2018		28.5	55.81	5272	12.07	7.05	583	0.43	2240	4290
5-04 ALL	2/26/2018		25.72	60.12	5793	12.27	8.47	930	<0.02	2620	4690
5-08 ALL-R	2/26/2018		38.47	76.51	4087	12.61	7.46	174	21.5	2270	3760
5-73 ALL-R	2/26/2018		23.36	35.64	7489	11.48	6.74	1420	2.71	2350	5820
AW-1	2/13/2018		60.05	81.55	7971	12.19	6.7	753	5.15	3560	7230
AW-2	2/22/2018		39.09	85.96	6068	12.47	7.13	393	5.62	3060	5420
C-3	6/13/1995	OOS	Plugged and abandoned to facilitate site reclamation activities								
D-4	2/27/2006	OOS	Plugged and abandoned to facilitate site reclamation activities								
E-5	2/27/2006	OOS	Plugged and abandoned to facilitate site reclamation activities								
MW-24 ALL	3/28/2018	INW	50.15	50.38	--	--	--	--	--	--	--
S-12	2/20/2018		16	27.50	15233	12.21	6.51	2860	0.44	4660	12800
S-9	2/23/2018		11.86	24.62	10602	11.09	7.94	2430	0.42	3990	10400

Notes:

Reported wells are in the alluvium formation.
"R" indicated wells were replaced in 2012/2013 during the Monitoring Well Replacement Project.
"ALL" are alluvial wells also reported to the U.S. NRC in accordance with the Alternative Concentration Limit (ACL) criteria.
"<" indicates values are below the minimum detection limit (MDL).
"B" indicates that the analyte concentration was detected at a value between the MDL and the practical quantitation limit (PQL).
"OOS" indicates well is out of service
"DRY" indicates the well is dry
"INW" indicates the well contains insufficient water for sampling
* Grab sample (Failed 90% rule in 2nd Half 2015 with 0% recharge in 24 hr).
** 32-50 TRB-R is screened across the TRB-Alluvial contact.
*** Could not tag bottom due to obstruction or soft mud
# Not measured due to pH meter malfunction, result from 1H 2016

APPENDIX B

Time Concentration Plots for DP-169 Alluvial Wells, First Half of 2018

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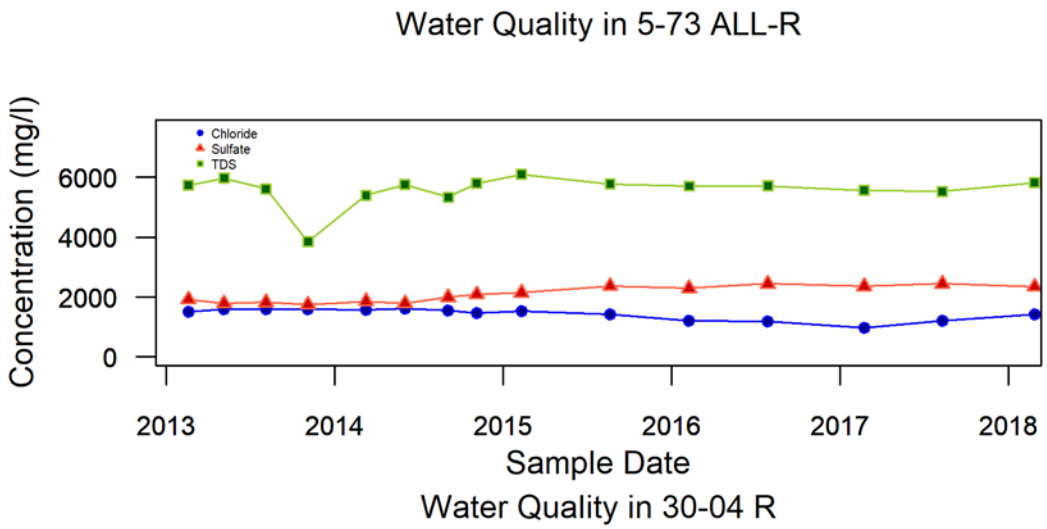

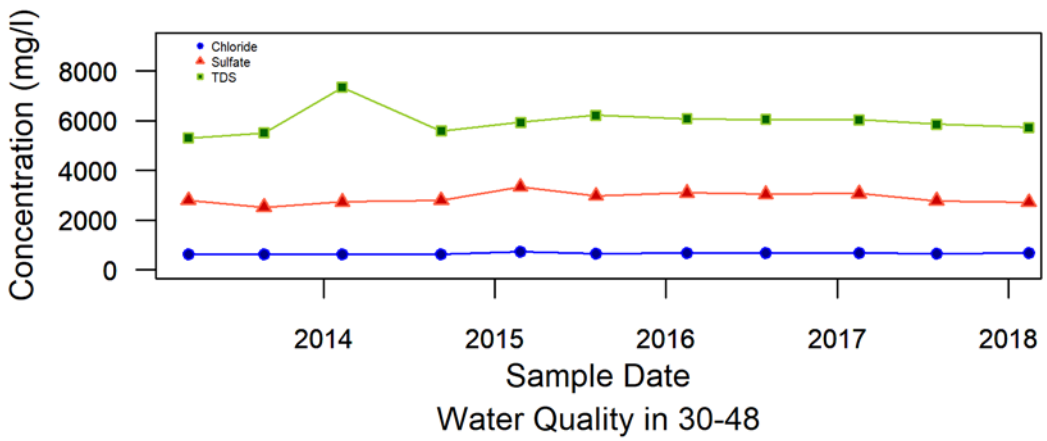

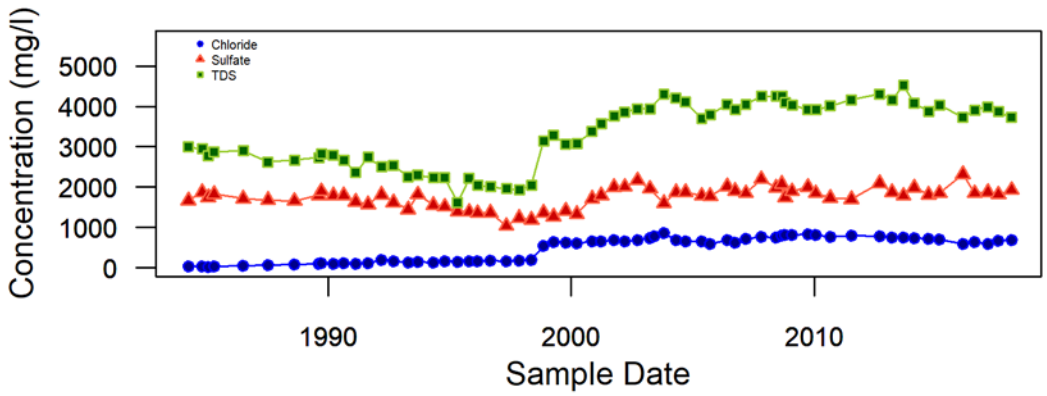

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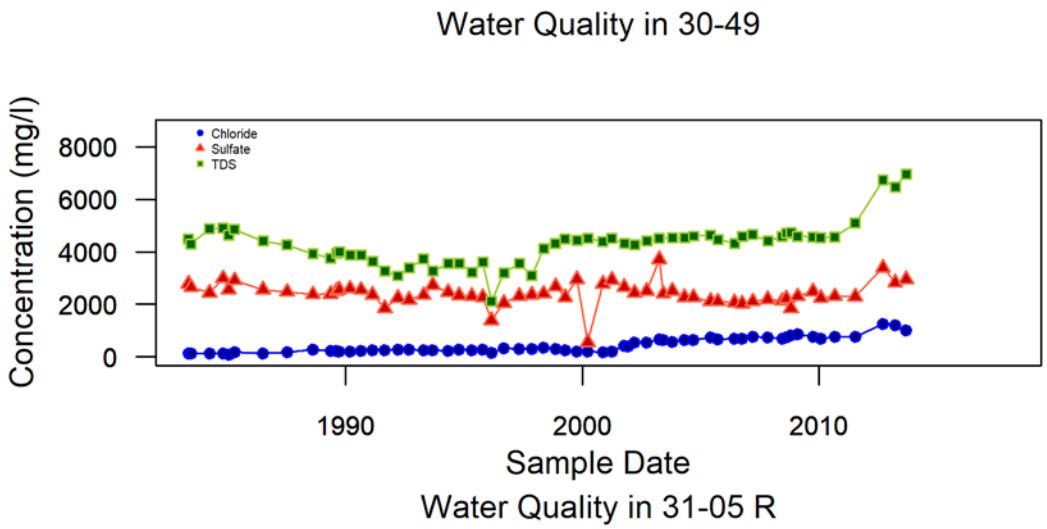

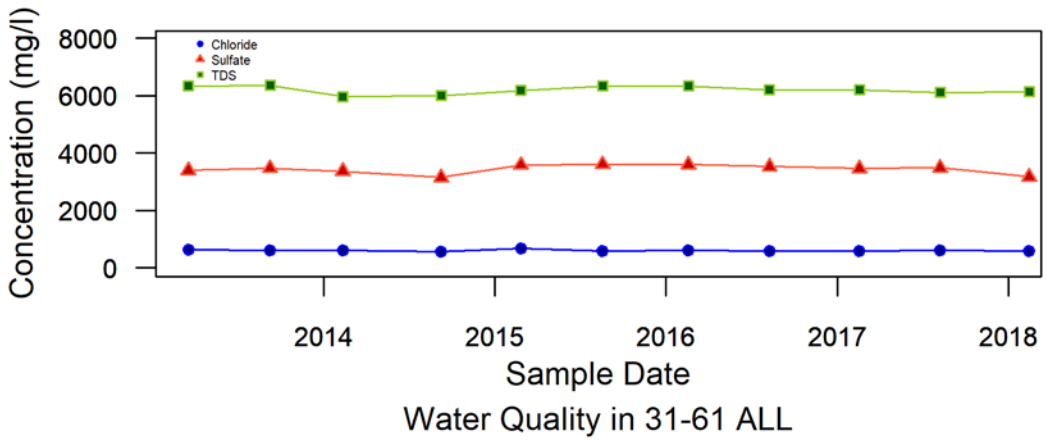

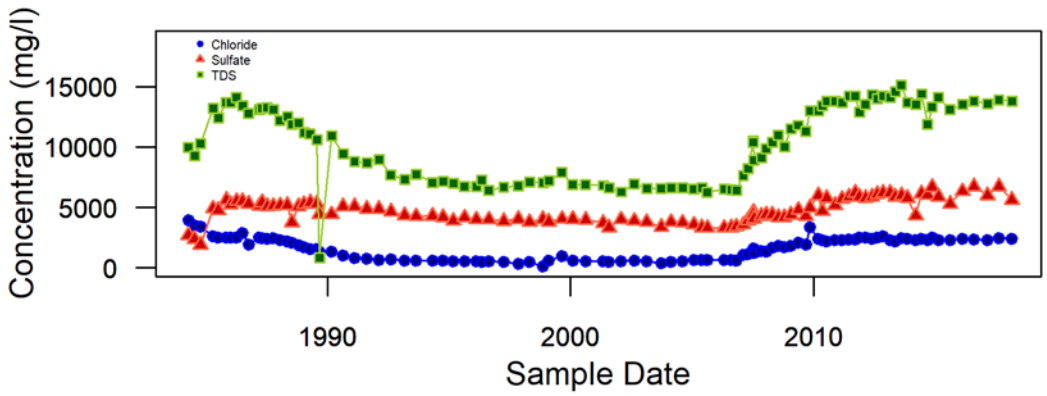

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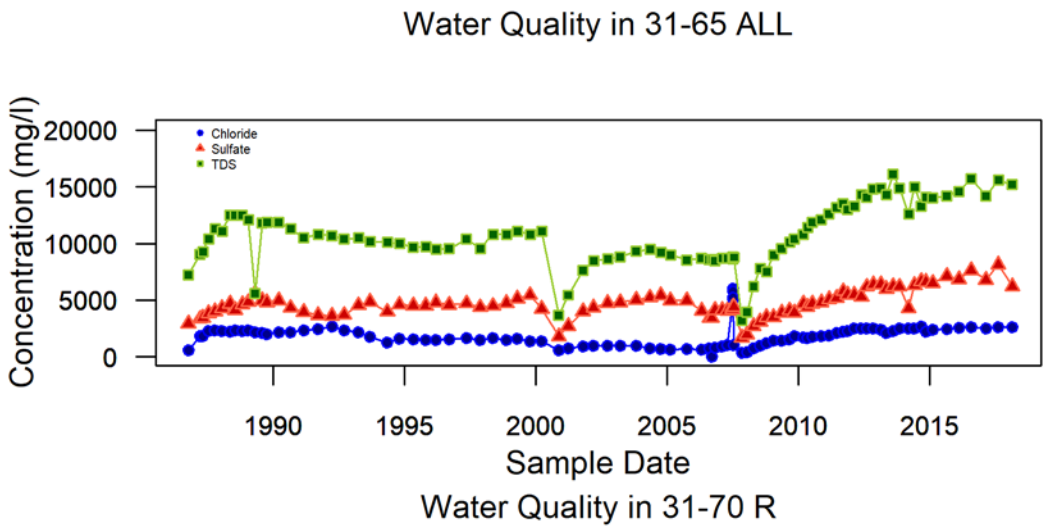

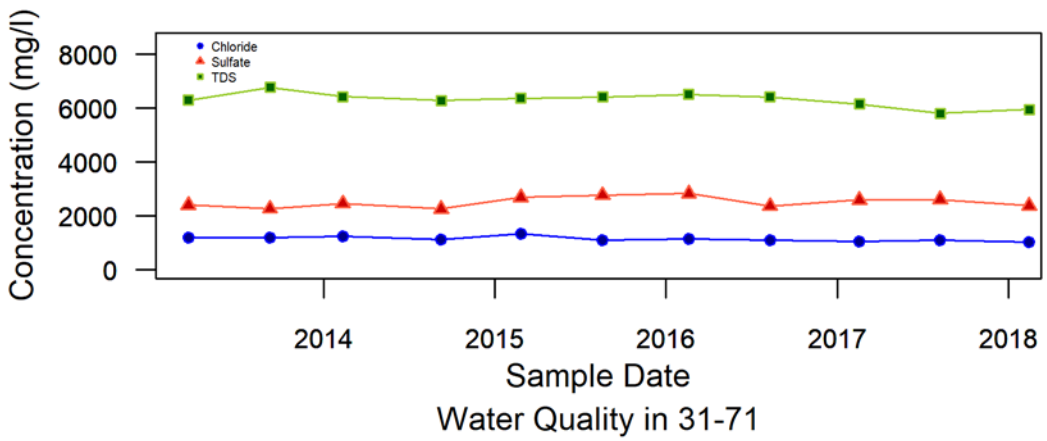

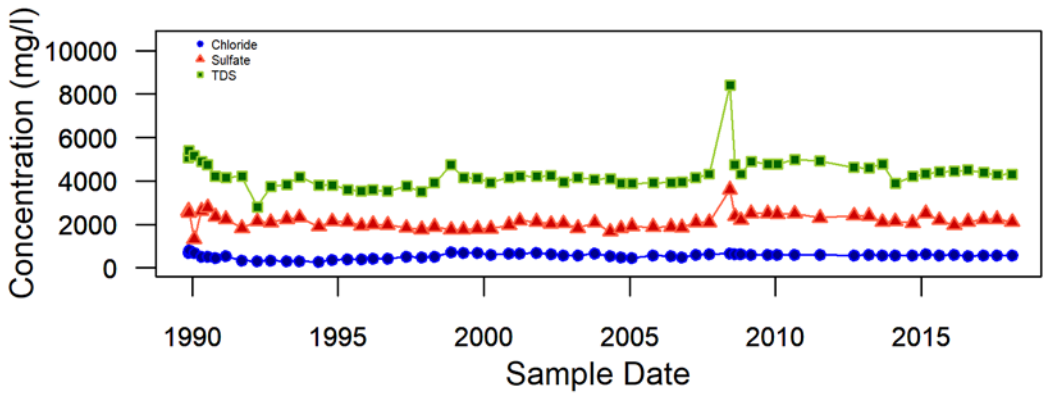

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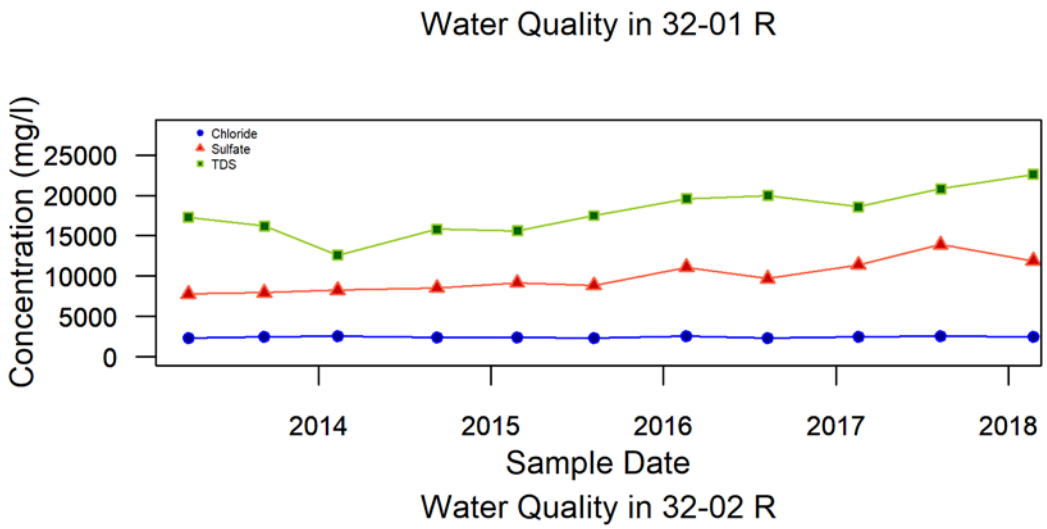

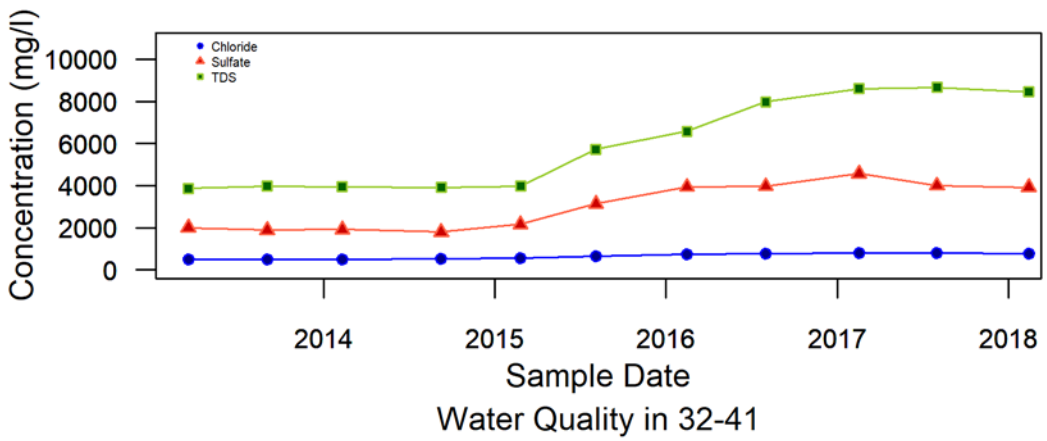

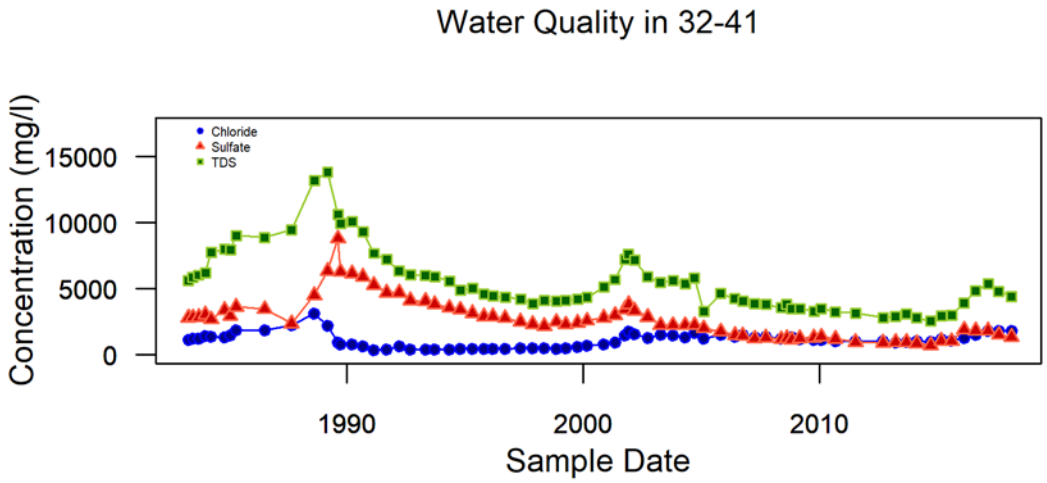

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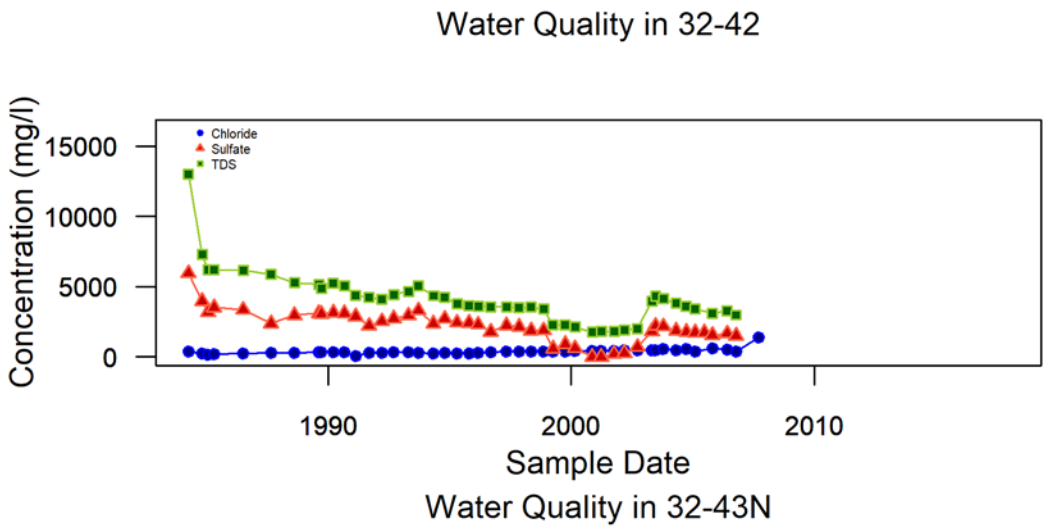

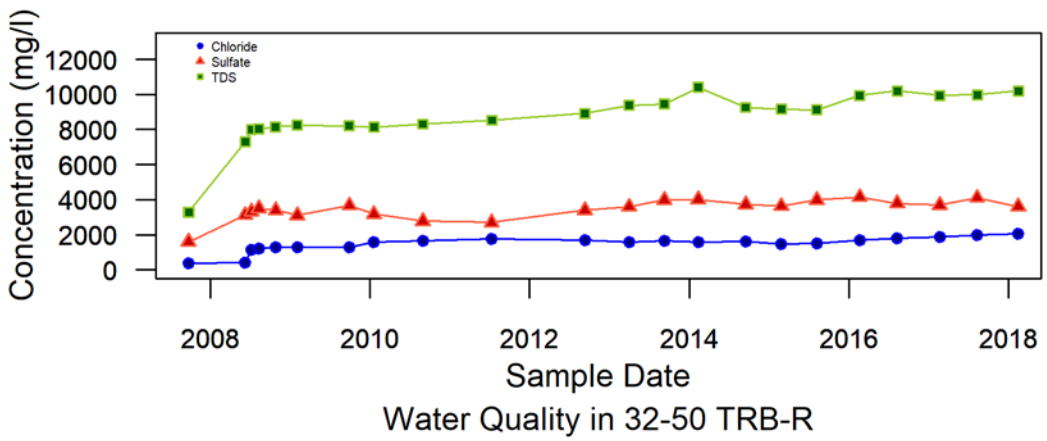

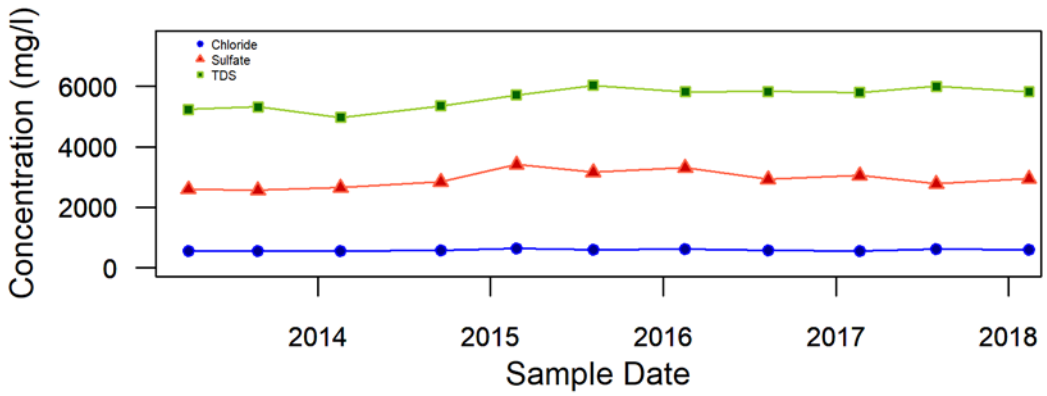

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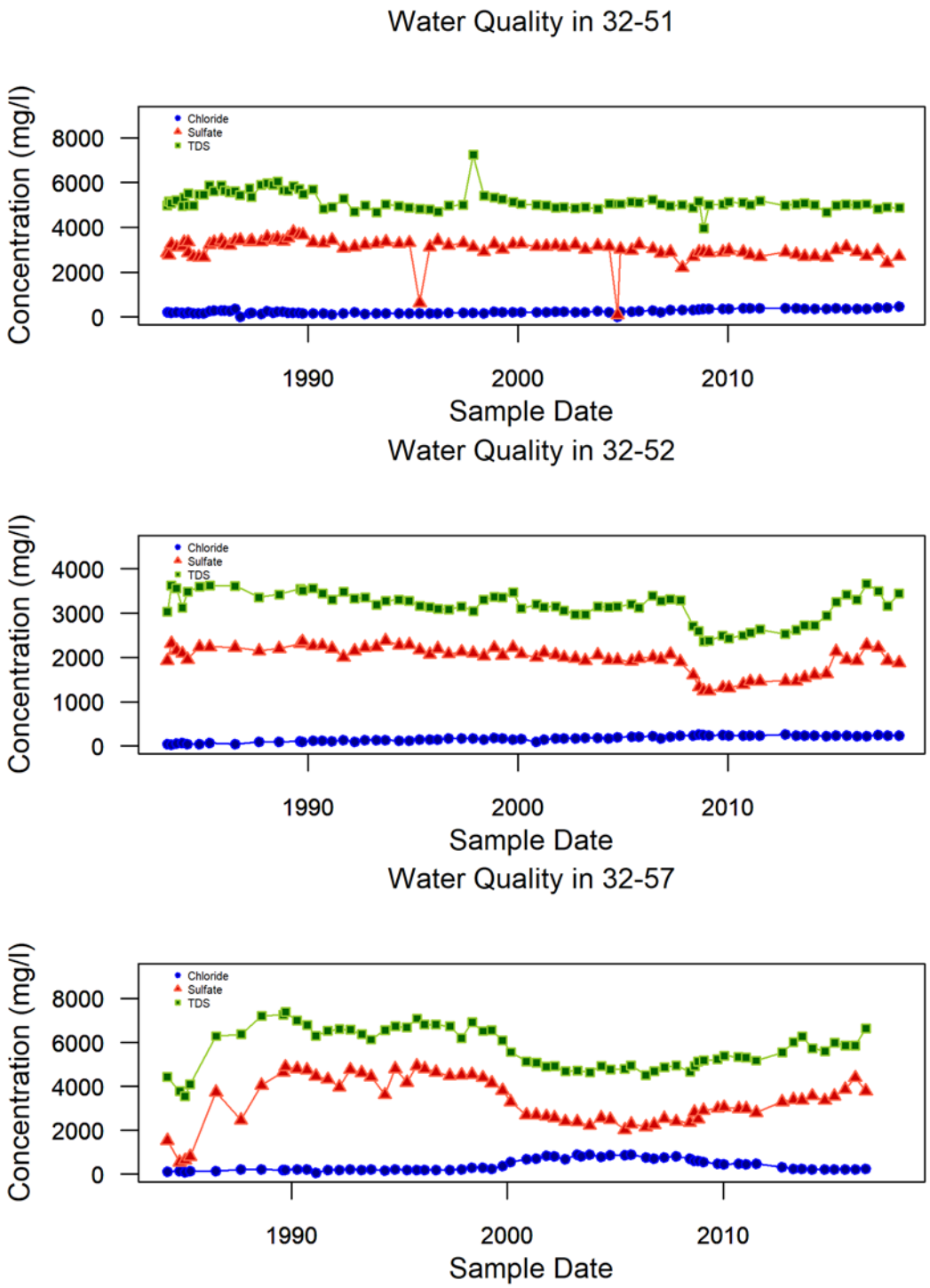

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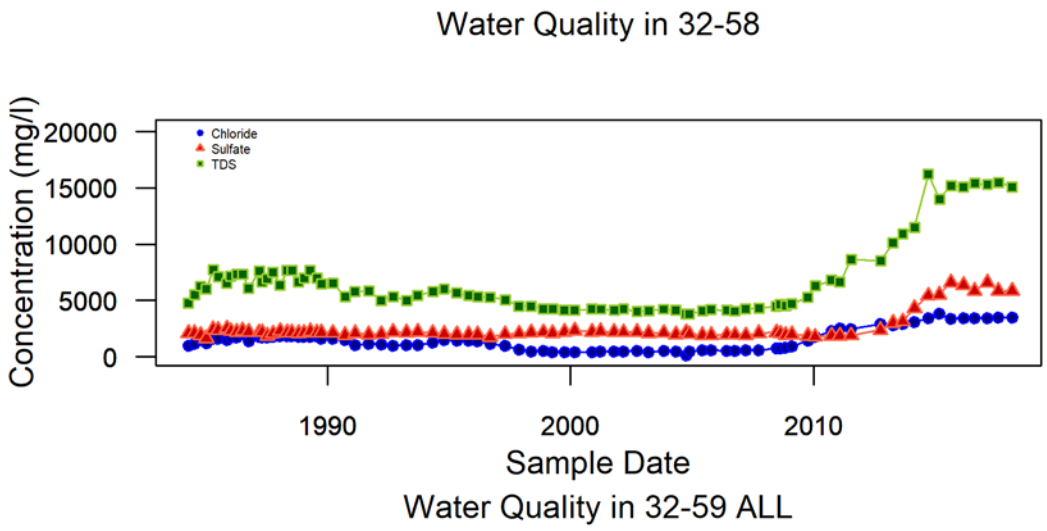

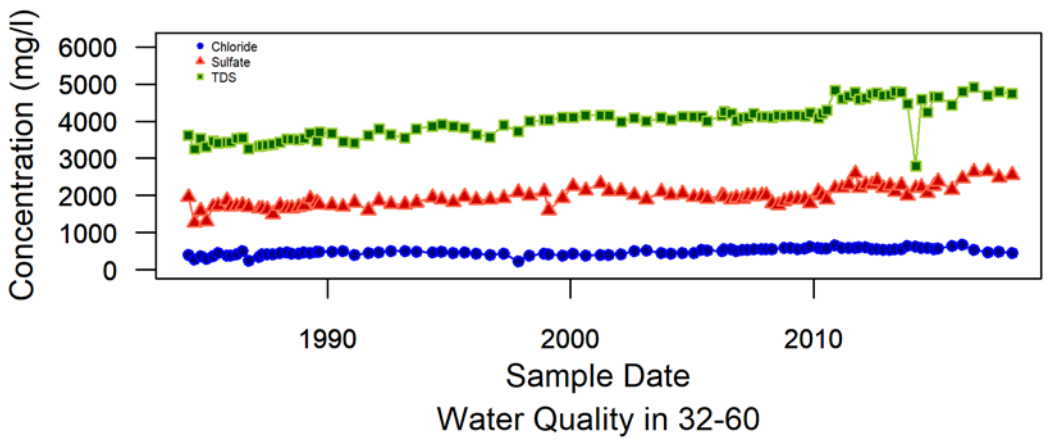

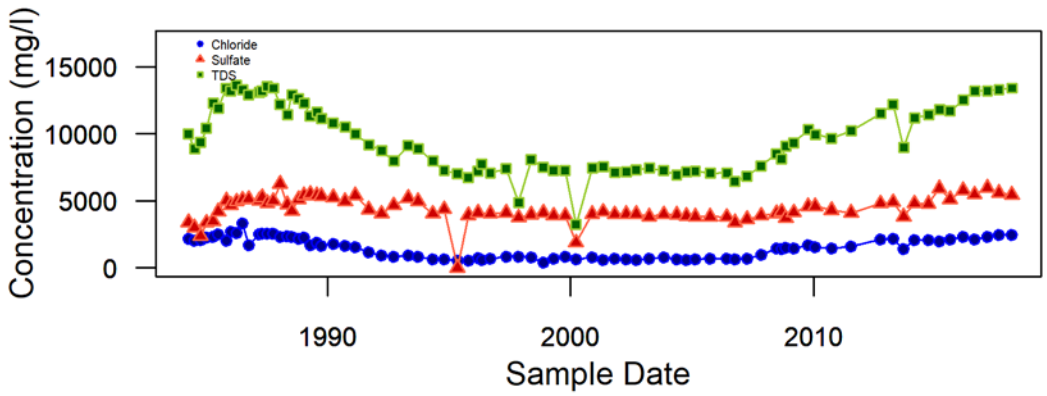

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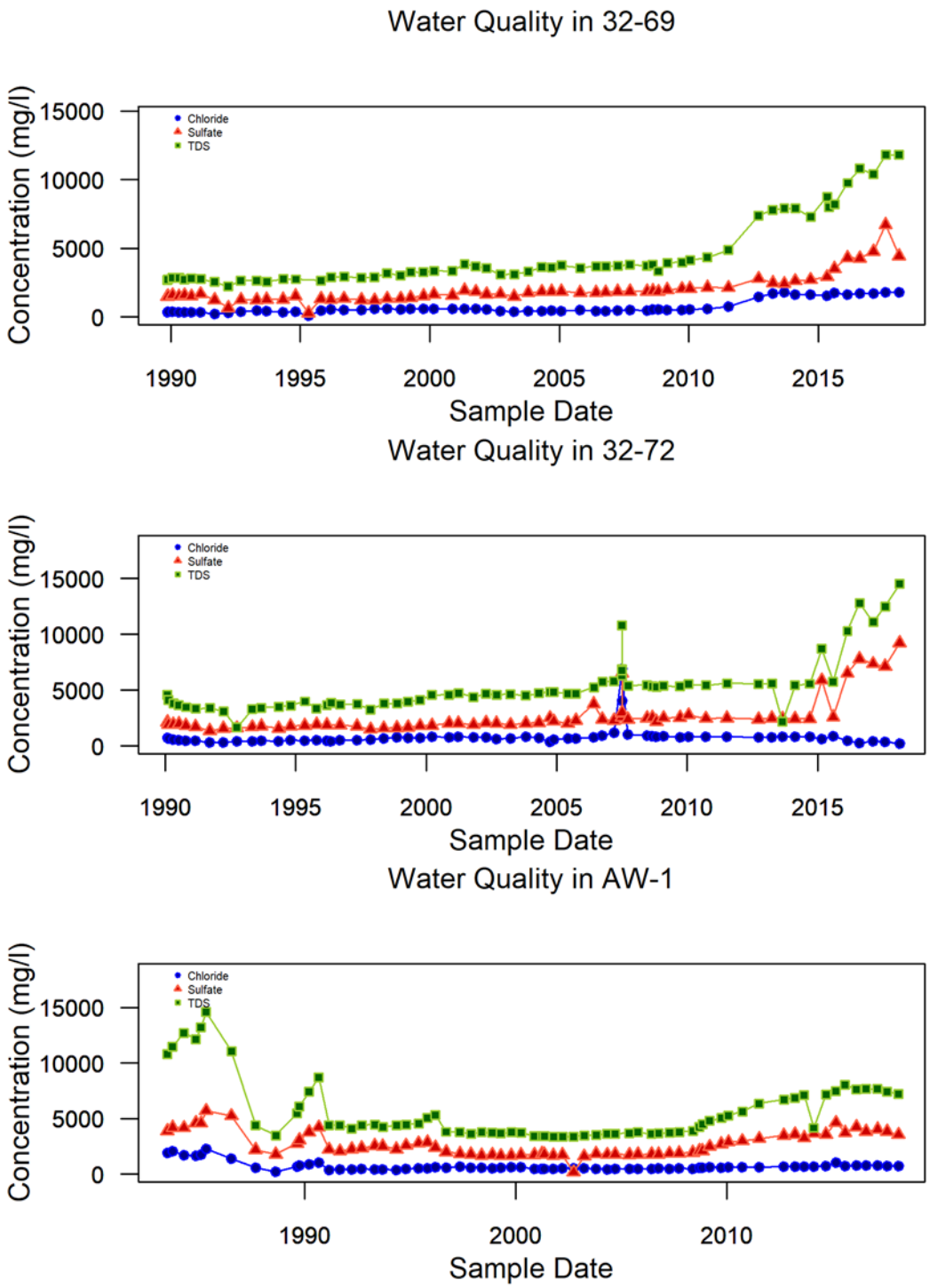

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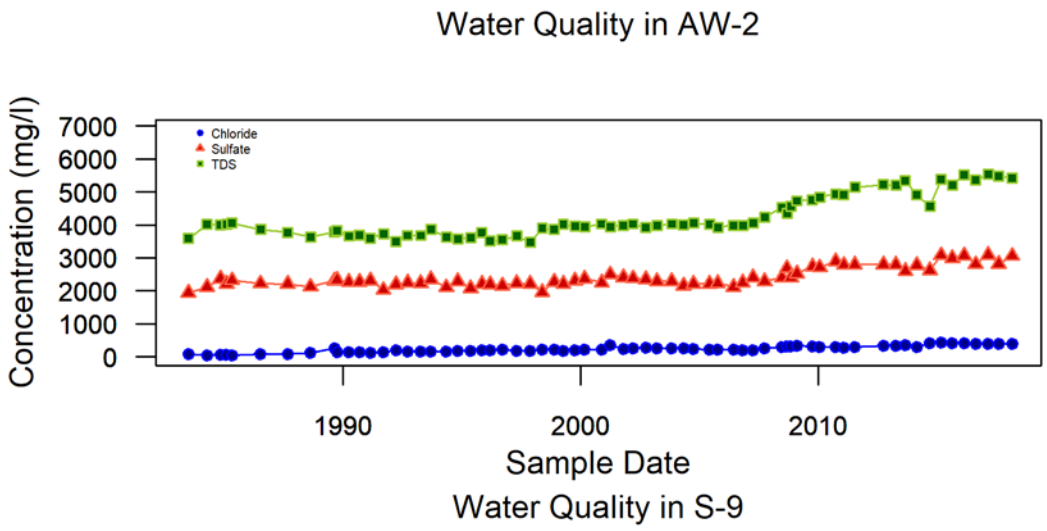

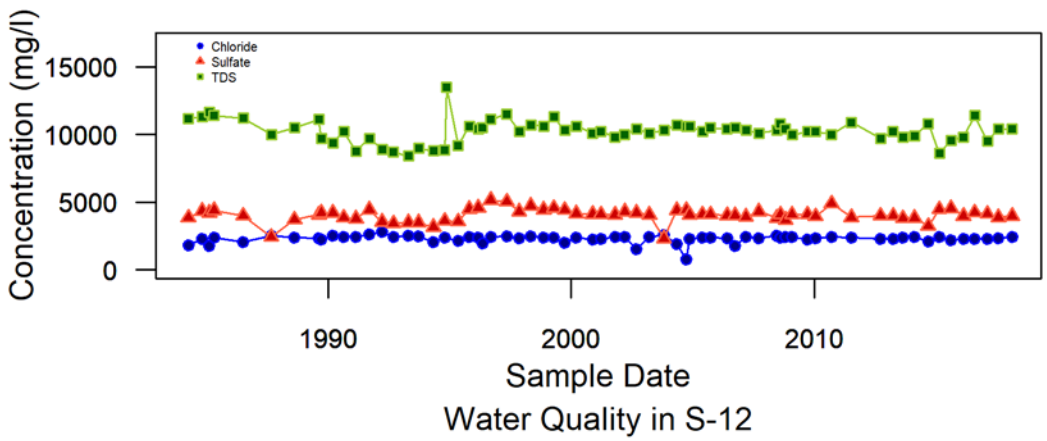

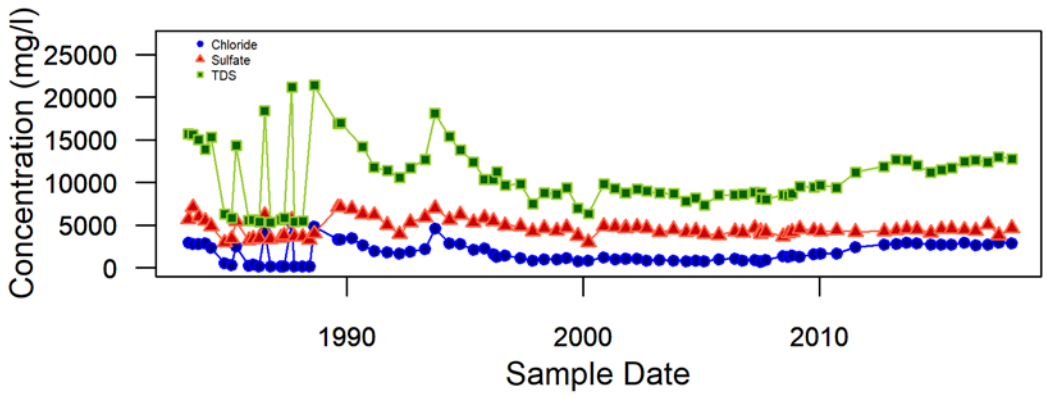

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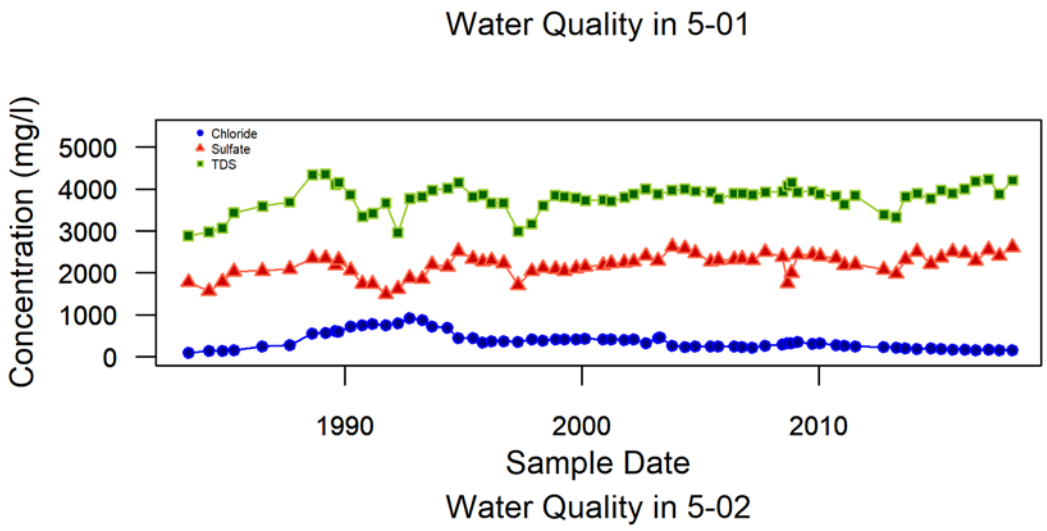
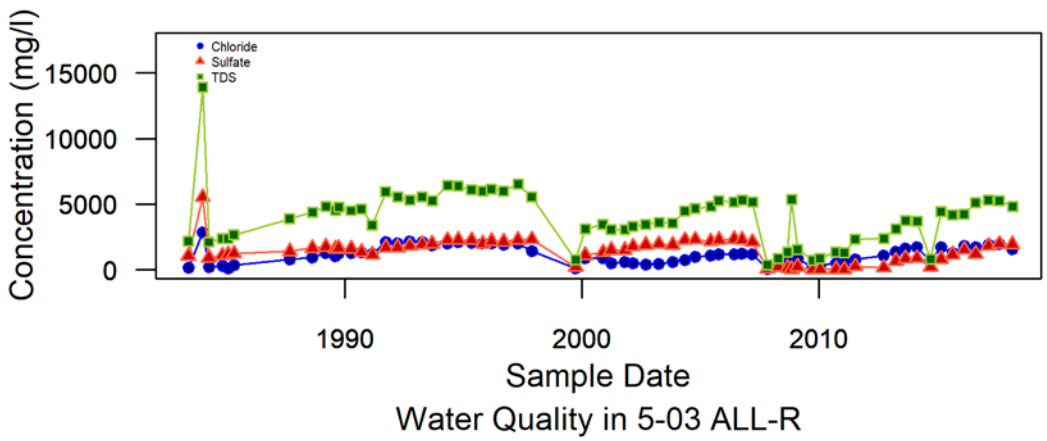
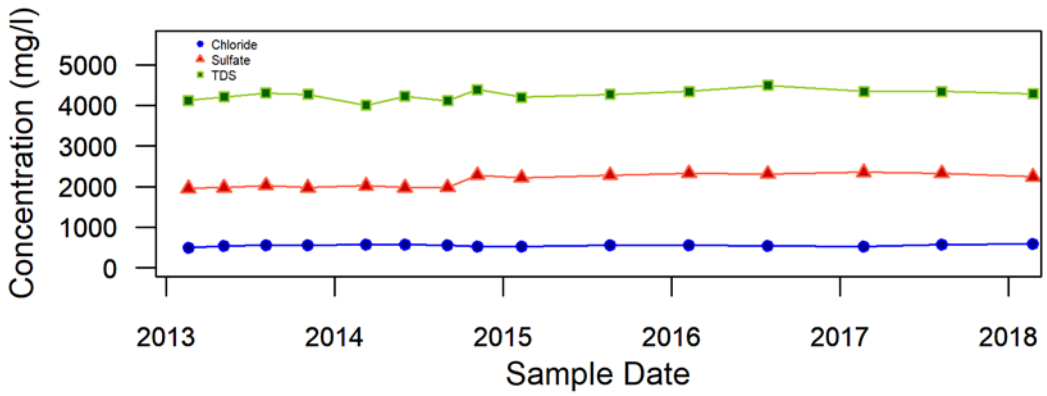
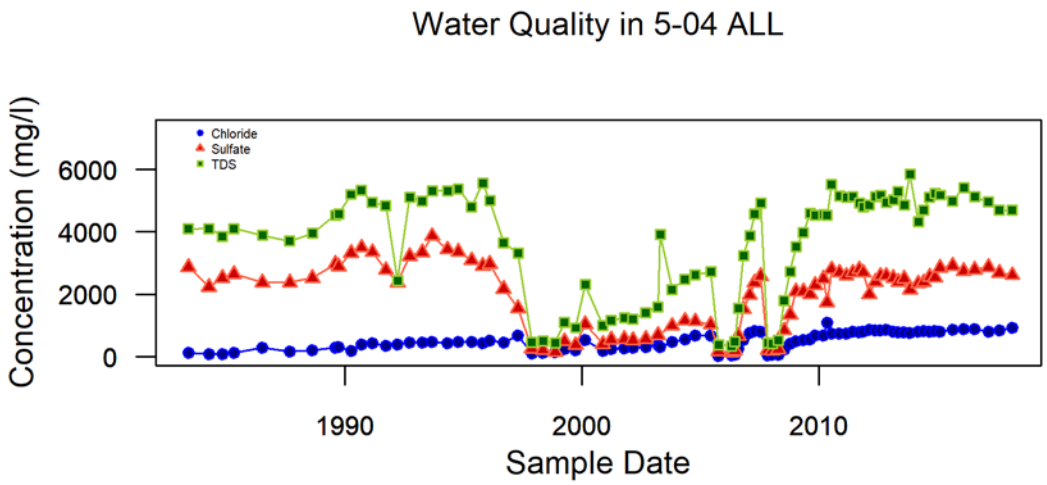


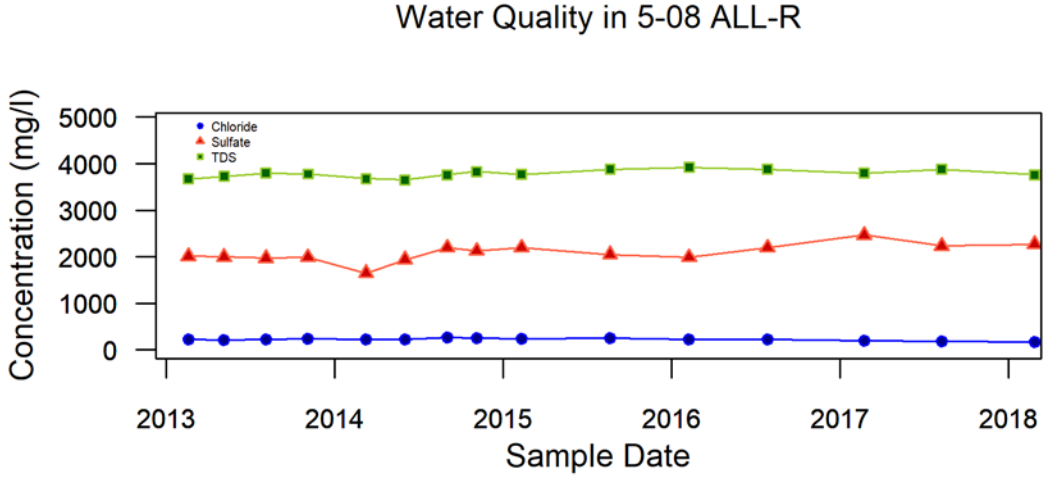




APPENDIX B

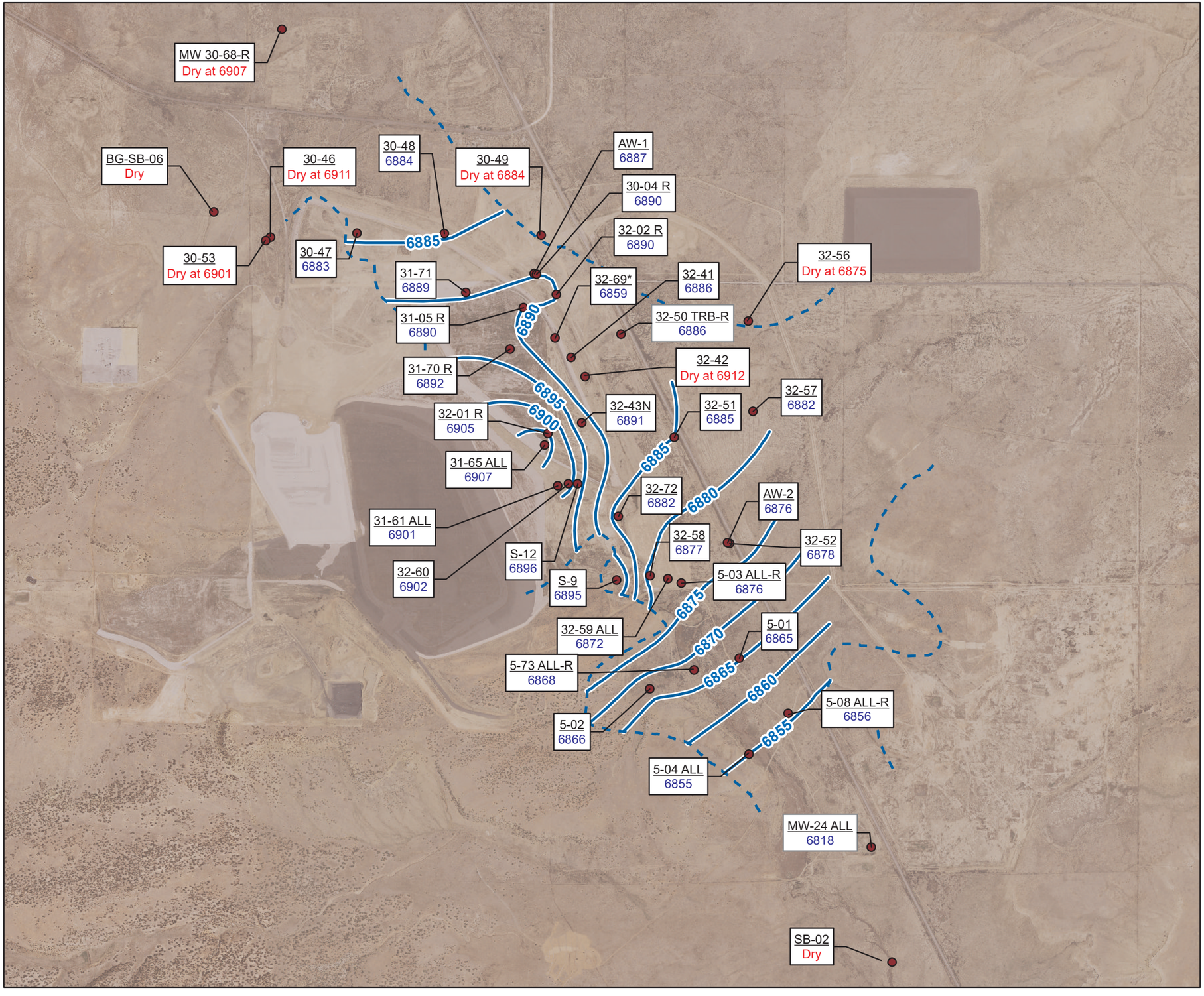
Time Concentration Plots for DP-169 Alluvial Wells, First Half of 2018





APPENDIX C

Alluvial Groundwater Elevation Contour Map



INTERA

N

0 1,800 3,600

Feet

Aerial – NAIP imagery, dated 2016

Legend

- Alluvial Monitoring Well Location
- Alluvial Groundwater Surface Elevation (ft amsl)
- Estimated Boundary of Saturated Alluvium

Well ID
Groundwater Surface Elevation (ft amsl)

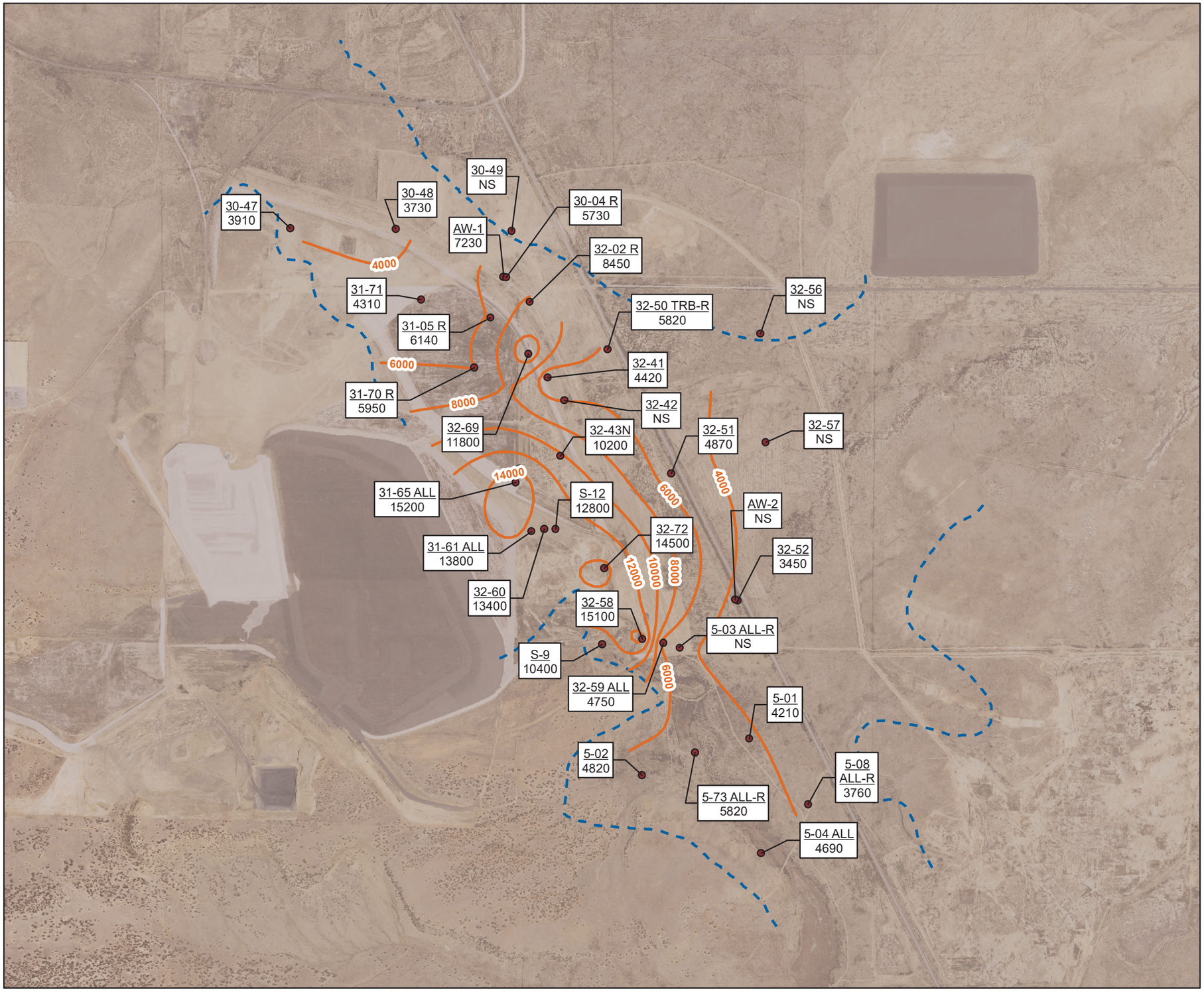
Notes:
All data collected 1st half, 2018.
* = Water level at well not used for contouring due to inaccurate TOC survey.

Appendix C
Alluvial Groundwater Elevation Contour Map
Rio Algom DP-169 Semi-Annual Report

S:\ABQ\RIOAL.RioAlgom\Graphics\Ambrosia_Lake\MapDocs\NMED\SemiAnnual_Reporting\2018\1H\DP169_alluvial-contour-map_1H2018.mxd

APPENDIX D

Total Dissolved Solids Iso-Contour Map



INTERA

N

0 750 1,500 3,000

Feet

Aerial – NAIP imagery, dated 2016

Legend

- Monitoring Well Location
- TDS Iso-Contour (2000 mg/L)
- Estimated Boundary of Saturated Alluvium
- **Well ID** Total Dissolved Solids (mg/L)

Notes:
All data collected 1st Half, 2018.
NS = Not Sampled

Appendix D
Alluvial Total Dissolved Solids Iso-Contour Map
Rio Algom DP-169 Semi-Annual Report

S:\ABQ\RIOAL.RioAlgom\Graphics\Ambrosia_Lake\MapDocs\NMED\SemiAnnual_Reporting\2018\1H\DP169_TDS-contour-map_1H2018.mxd

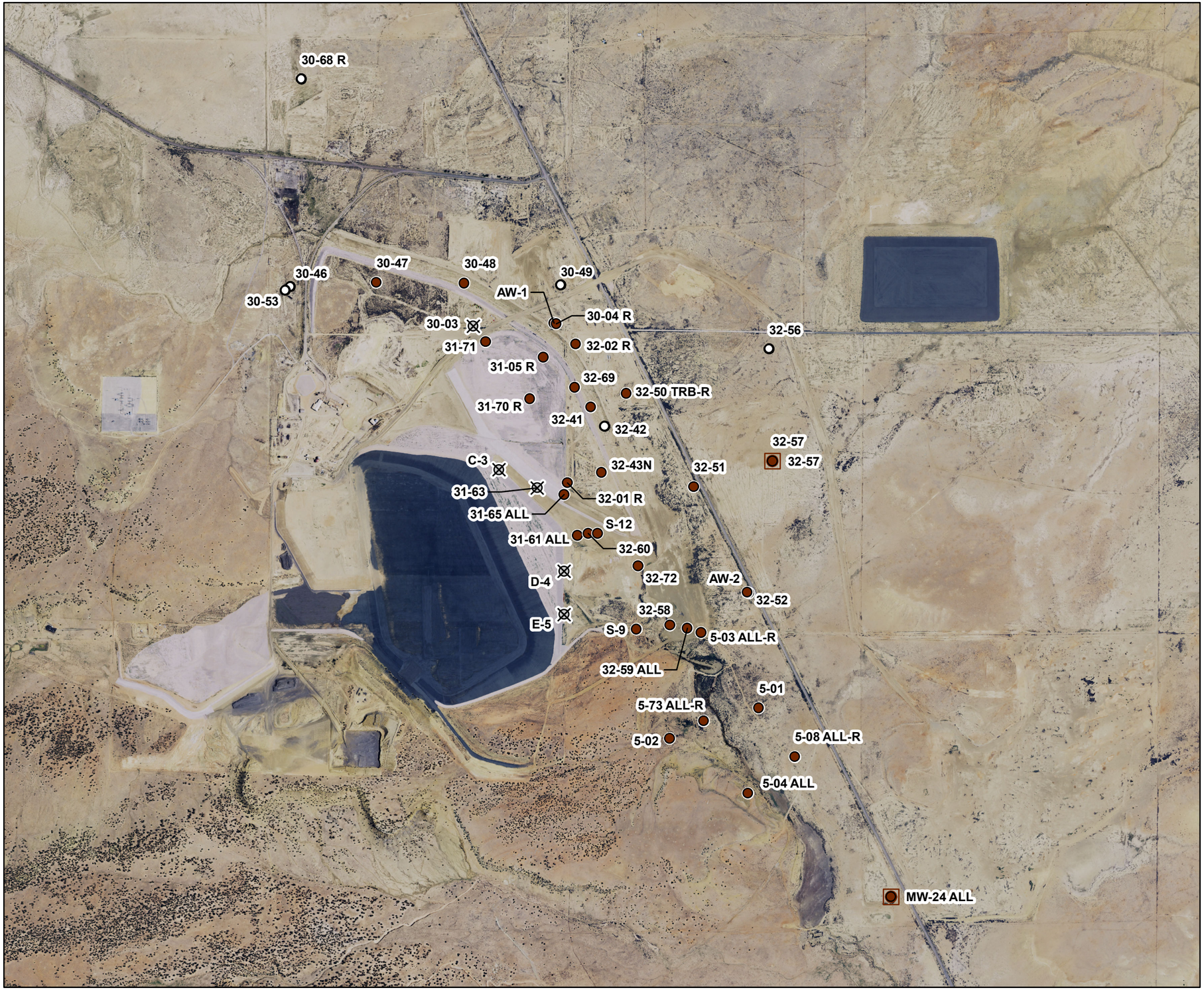
APPENDIX E

DP-169 Electronic Data – First Half 2018

(CD is included in a pocket on the inside of the front cover.)

APPENDIX F

DP-169 Well Status Map



INTERA

N

0 1,800 3,600

Feet

Aerial – NAIP imagery, dated 2014

Legend

- In Service - Dedicated Pump
- Out of Service
- In Service - Dry
- In Service - Insufficient Water

Appendix F
DP-169 Well Status Map
Rio Algom DP-169 Semi-Annual Report

S:\ABQ\RIOAL.RioAlgom\Graphics\Ambrosia_Lake\MapDocs\NMED\SemiAnnual_Reporting\2017\H2\DP169_wellStatus-map.mxd