District I
1625 N. French Dr., Hobbs, NM 88240
District II
1301 W. Grand Avenue, Artesia, NM 88210
District III
1000 Rio Brazos Road, Aztec, NM 87410
District IV
1220 S St Francis Dr., Santa Fe, NM 87505

State of New Mexico
Energy Minerals and Natural Resources

Oil Conservation Division
1220 South St. Francis Dr.
Santa Fe, NM 87505

DENIED

Form C-141
Revised October 10, 2003

Submit 2 Copies to appropriate District Office in accordance with Rule 116 on back side of form

Release Notification and Corrective Action

OPERATOR

☐ Initial Report ☒ Final Report

Name of Company Apache Corporation	Contact Travis Carnes
Address P.O. Drawer D, Monument, NM 88265	Telephone No. (432) 425-2962
Facility Name State Q Battery ST Q #1	Facility Type Production

Surface Owner State of New Mexico	Mineral Owner Apache Corporation	~~Lease No.~~ 035591

API 30 025 06116

LOCATION OF RELEASE

Unit Letter	Section	Township	Range	Feet from the	North/South Line	Feet from the	East/West Line	County
J	16	20S	37E	1980	South	2310	East	Lea

Latitude 32.57059 **Longitude** -103.25415

NATURE OF RELEASE

Type of Release Produced Water	Volume of Release UNK Estimate 6-24 Bbls	Volume Recovered 5 Bbls
Source of Release Water discharge line	Date and Hour of Occurrence	Date and Hour of Discovery
Was Immediate Notice Given? ☐ Yes ☐ No ☒ Not Required	If YES, To Whom?	
By Whom?	Date and Hour	
Was a Watercourse Reached? ☐ Yes ☒ No	If YES, Volume Impacting the Watercourse.	

RECEIVED
APR 10 2009
HOBBSOCD

If a Watercourse was Impacted, Describe Fully.*

No watercourse was impacted

Describe Cause of Problem and Remedial Action Taken.*

Corrosion caused a failure in the integrity of the water pump discharge line. The pumper isolated the leak, shut down the wells, and called a vacuum truck. The vacuum truck recovered 5 Bbls produced water. A roustabout gang repaired the line & returned it to service.

Describe Area Affected and Cleanup Action Taken.*

The release was contained inside the berm of the battery and was restricted to the area around the production equipment. The approximate size of the spill footprint was 1700 ft^2. Chloride from the release of produced water at the State Q Battery (recent & historic) may enter ground water but will not cause a measurable increase in ground water chloride concentration. No action is required to protect fresh water, public health, the environment, property or human safety.

I hereby certify that the information given above is true and complete to the best of my knowledge and understand that pursuant to NMOCD rules and regulations all operators are required to report and/or file certain release notifications and perform corrective actions for releases which may endanger public health or the environment. The acceptance of a C-141 report by the NMOCD marked as "Final Report" does not relieve the operator of liability should their operations have failed to adequately investigate and remediate contamination that pose a threat to ground water, surface water, human health or the environment. In addition, NMOCD acceptance of a C-141 report does not relieve the operator of responsibility for compliance with any other federal, state, or local laws and/or regulations.

Signature: Travis Carnes

Printed Name: Travis Carnes

Title: Production Foreman

E-mail Address: travis.carnes@usa.apachecorp.com

Date: 4/7/09 Phone: 432-425-2962

OIL CONSERVATION DIVISION

Approved by District Supervisor: G Johnson ENVIRONMENTAL ENGINEER

DENIED

Approval Date: Expiration Date:

Conditions of Approval:

FGRL0912141699

Attached ☐

IRP # 09.4.2156

* Attach Additional Sheets If Necessary

(3) NEED TO INSTALL MONITOR WELL/WELLS TO PROVIDE IMPACT/NO IMPACT INFO

(1) INADEQUATE DELINEATION

(2) PREVIOUS SPILLS RENDER IMPACT ASSUMPTIONS QUESTIONABLE

District I
1625 N. French Dr., Hobbs, NM 88240
District II
1301 W Grand Avenue, Artesia, NM 88210
District III
1000 Rio Brazos Road, Aztec, NM 87410
District IV
1220 S. St. Francis Dr , Santa Fe, NM 87505

State of New Mexico
Energy Minerals and Natural Resources

Oil Conservation Division
1220 South St. Francis Dr.
Santa Fe, NM 87505

Form C-141
Revised October 10, 2003

Submit 2 Copies to appropriate District Office in accordance with Rule 116 on back side of form

Release Notification and Corrective Action

OPERATOR ☒ Initial Report ☐ Final Report

Name of Company Apache Corporation	Contact Travis Carnes
Address P.O. Drawer D, Monument, NM 88265	Telephone No. (432) 425-2962
Facility Name State Q Battery	Facility Type Production

Surface Owner State of New Mexico	Mineral Owner Apache Corporation	Lease No. 035591

LOCATION OF RELEASE

Unit Letter	Section	Township	Range	Feet from the	North/South Line	Feet from the	East/West Line	County
J	16	20S	37E	1980	South	2310	East	Lea

Latitude 32.57059 **Longitude** -103.25415

NATURE OF RELEASE

Type of Release Produced water	Volume of Release UNK Estimate 6-24 Bbls	Volume Recovered 5 Bbls
Source of Release Water discharge line	Date and Hour of Occurrence 1/20/09 - AM	Date and Hour of Discovery 1/20/09 - 11:00 AM
Was Immediate Notice Given? ☐ Yes ☐ No ☒ Not Required	If YES, To Whom?	
By Whom?	Date and Hour	
Was a Watercourse Reached? ☐ Yes ☒ No	If YES, Volume Impacting the Watercourse.	

If a Watercourse was Impacted, Describe Fully.*

No watercourse was impacted

Describe Cause of Problem and Remedial Action Taken.*

Corrosion caused a failure in the integrity of the water pump discharge line. The pumper isolated the leak, shut down the wells, and called a vacuum truck. The vacuum truck recovered 5 Bbls produced water. A roustabout gang repaired the line & returned it to service.

Describe Area Affected and Cleanup Action Taken.*

The release was contained inside the berm of the battery and was restricted to the area around the production equipment. The approximate size of the spill footprint was 1700 ft^2. Impact to ground water and/or environment is being investigated as described in the attachment..

I hereby certify that the information given above is true and complete to the best of my knowledge and understand that pursuant to NMOCD rules and regulations all operators are required to report and/or file certain release notifications and perform corrective actions for releases which may endanger public health or the environment. The acceptance of a C-141 report by the NMOCD marked as "Final Report" does not relieve the operator of liability should their operations have failed to adequately investigate and remediate contamination that pose a threat to ground water, surface water, human health or the environment. In addition, NMOCD acceptance of a C-141 report does not relieve the operator of responsibility for compliance with any other federal, state, or local laws and/or regulations.

Signature:	OIL CONSERVATION DIVISION
Printed Name: Travis Carnes	Approved by District Supervisor:
Title: Production Foreman	Approval Date: / Expiration Date:
E-mail Address: travis.carnes@usa.apachecorp.com	Conditions of Approval: / Attached ☐
Date: 1/21/09 Phone:432-425-2962	

* Attach Additional Sheets If Necessary

RECEIVED
FEB 03 2009
HOBBSOCD

February 3, 2009

Mr. L.W. Hill
NMOCD District 1
1625 N. French Drive
Hobbs, New Mexico 88240
Via Email and FEDEX

RE: Apache Corporation State Q Battery
Notice of Release T20S, R37E Section 16 UL J, Lat 32.57059 Long -103.25415

Dear Mr. Hill:

Attached to this letter is our original C-141 for a minor release at the above-referenced site. Under separate cover, R.T. Hicks Consultants, Ltd. will submit our final report that uses API's Amigo produced water spill tool to help evaluate the environmental impact. Because this release was quite small, we were not surprised to see that the evaluation determined that the residual chloride in soil does not pose a threat to fresh water or the environment.

Apache believes that the Amigo decision tool can help us to focus our environmental efforts on sites that require action and eliminate unnecessary responses. Because we anticipate using the Amigo tool for larger spills (although we hope such a need does not arise), Hicks Consultants has volunteered to meet with NMOCD in Hobbs to present their findings and conclusions and address any questions. We look forward to working with you.

Sincerely,
Apache Corporation

Travis Carnes

R. T. HICKS CONSULTANTS, LTD.
901 Rio Grande Blvd NW ▲ Suite F-142 ▲ Albuquerque, NM 87104 ▲ 505.266.5004 ▲ Fax: 505.266-0745

March 31 2009

Mr. Larry Johnson
NMOCD District 1
1625 N. French Drive
Hobbs, New Mexico 88240

RE: Apache Corporation State Q Battery
Amendment to Final Report

Dear Mr. Johnson:

Apache Corporation requested R.T. Hicks Consultants amend the previously-submitted report to include new data that Apache collected at your request.

Release Characteristics

We have amended Plate 2 to show the laboratory results of all sampling. The most recent sampling (see Appendix A of this submission) shows:

1. The chloride concentration at BH-1 is 80 mg/kg at 3-feet below grade
2. Chloride concentrations at BH-4 show additional evidence of past releases at this location
3. Background chloride in soil is less than 16 mg/kg.

Chloride Mass in the Unsaturated Zone

Plate 2 shows the release footprint and sample locations. The recent data showing evidence of historic releases does not change the original estimate of chloride mass for the most recent release. The Massload calculation submitted previously remains

- 0.17 kg/m^2 based upon release volume estimate and chloride in the release and
- 0.19 kg/m^2 using the most representative soil boring data for the recent release

However, inclusion of the recently-acquired data affords a higher degree of certainty regarding the threat to ground water posed by historic releases of produced water.

As we stated in the previous submission, Massload requires that data from borings show a decrease of chloride concentration with depth. New data from BH-1 at 3-feet below grade (80 mg/kg) eliminates the need to assume a chloride concentration of 230 mg/kg at a depth of 3-feet.

The additional sampling at BH-4 shows chloride concentrations in soil from 0-4 feet range from about 500 mg/kg to about 800 mg/kg. Below 4 feet to a depth of 8 feet, chloride

concentrations range from 320 to 400 mg/kg. From these data we conclude that historic releases probably pooled in the area of BH-4 and in the area of BH-3, resulting in chloride concentrations ranging from 320 to 400 mg/kg from below the depth of 4-feet to the capillary fringe (about 18 feet below grade) at both boring locations.

For the purpose of estimating the total chloride load using Massload, we used the values presented in Table 1 below.

Table 1

Chloride Concentration Profiles, Chloride in mg/kg. Extrapolated Values in Yellow.					
Depth [feet]	BH-4	BH-3	BH-2	BH-1	Average
0	592	304	248	192	334
1	592	304	248	192	334
1.5	592	304	148	192	309
2	592	592	48	192	356
2.5	496	496	48	240	320
3	816	816	48	80	440
4	784	784	48	80	424
4.5	352	352	48	80	208
5	368	368	48	80	216
6	400	400	48	80	232
6.5	320	320	48	80	192
7	400	400	48	80	232
8	368	368	48	80	216
18	368	368	48	80	216

All of the values highlighted in yellow represent the concentration we believe exist in the subsurface based upon the sampling and our professional judgment. At BH-4, the average chloride concentration over the depth interval of 4.5-7 feet is 368 mg/kg, therefore we used this value for the concentration at 8 and 18 feet. Because shallow chloride concentration from BH-3 is similar to (albeit less than) BH-4, we assumed in Massload that the deep chloride concentration profile for BH-3 is also similar. For BH-2 and BH-1, we assumed that the chloride values of 48 and 80 will be constant between the deepest sample and ground water. The Massload spreadsheet showing the calculation of mass is presented in Appendix B of this submission. The compact disc provides a copy of the Massload Excel spreadsheet for the site.

Chloride Mass Input for Amigo

The revised calculation presented in the Massload program allows us to conclude that the total mass per unit area is not 0.57 kg/m^2, as previously estimated. The new data input to Massload calculate a total chloride mass of 2.35 kg/m^2.

Texture of the Unsaturated Zone

The surface texture input of caliche remains consistent with the more recent results. However, the deeper samples show fine sand rather than medium sand from 3-7 feet. The chloride concentration profile also suggests that the texture of the unsaturated zone between 3-7 feet is consistent with a finer-grained texture than medium sand.

Unsaturated Zone Input for Amigo

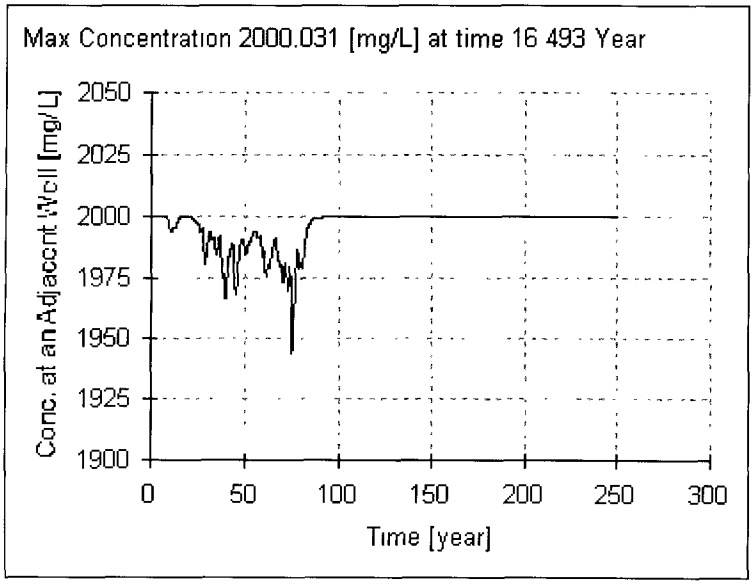
The new data allow us to conclude that employing a texture for the unsaturated zone consisting of 1 part caliche and 5 parts medium sand provides the closest match to observations in the field.

Data Evaluation Using Amigo – Most Probable Scenario

The revised Amigo report (Appendix C) generated by the input of the data identified above and in the previous submission is the predicted chloride concentration in a hypothetical monitoring well located at the down gradient edge of the release site.

Using the new data from BH-4 and the conservative assumptions built-into Amigo, the tool predicts that the chloride mass at the site caused by the historic releases will migrate to ground water and result in no impact to ground water (see Figure 1 below).

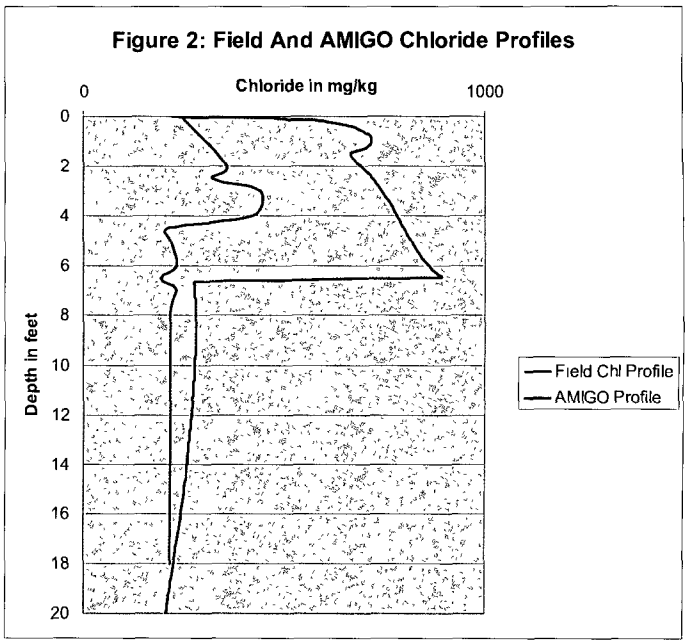
Figure 1



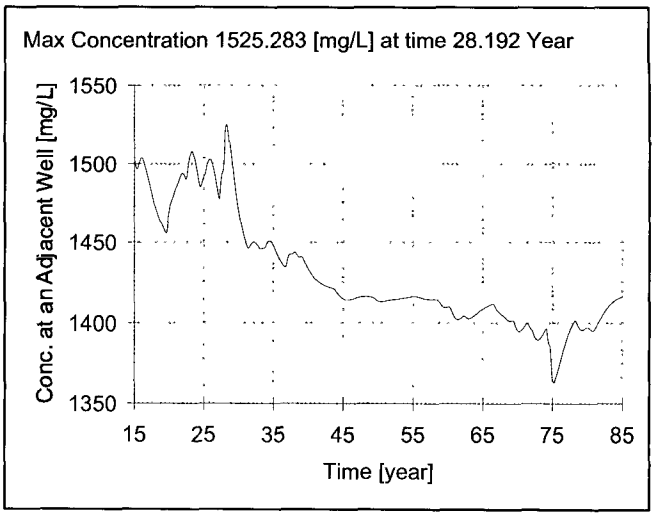
Data Evaluation Using Amigo – Worst Case Scenario

The additional data demonstrate that using "medium sand" as the surface texture and vadose zone does not agree with the observations of texture in the field (caliche, sand and clay in the upper 4-6 feet underlain by fine sand). Additionally, because of the introduction of the new data into Amigo, we could not create a reasonable match between chloride v. depth profiles and the observed values in the field if "medium sand" is used for the texture of the unsaturated zone between 0-7 feet.

Figure 2 presents our interpretation of the chloride concentrations with depth below the spill footprint based upon site analyses as presented in Table 1. Also plotted on Figure 2 is the Amigo-generated profile for the input parameters outlined in Appendix D at Year 15 of the simulation. Simulating a "worst case" scenario with the Amigo tool can involve adjusting certain input parameters such that the shape of the chloride v. depth profiles are similar but the Amigo-generated profile should represent a greater chloride load than measured in the field. The Historic Amigo Massload spreadsheet presented in Appendix D generated Figure 2 and a copy of the spreadsheet is on the attached compact disc. For the worst case scenario, all input data remain the same as the most probable case except



1. the chloride load increased from 2.35 kg/m^3 (measured in the field) to 5.75 kg/m^3
2. the background concentration of chloride in the aquifer at year 15 (the time of the chloride profile match) is 1500 mg/L to account for a 500 mg/L decrease due to natural restoration of ground water in the area.
3. the aquifer mixing zone decreased from 30 to 20 feet
4. the hydraulic conductivity of the aquifer decreased from 80 ft/day to 60 ft/day



The output from this input to Amigo under these worst-case conditions suggests an increased chloride concentration of 25.283 mg/L

Discussion

The revised predictions of Amigo show that changes in chloride concentrations beneath the site cannot be distinguished from natural variation of chloride concentrations in ground water impacted by the brine release(s) from the Climax Chemical site.

Although AMIGO is not designed to predict the impact to ground water caused by recent and historic releases at a site, such is the case here; one can provide a reasonable estimate of the impact to ground water caused by historic releases by using the methods described in Appendix D. Because the tool assumes that all of the chloride in the unsaturated zone was released in a single spill event and migrates to ground water as a single large mass – not as individual releases over time, AMIIGO will generally overestimate the impact to ground water if the input from Massload includes historic events. Using a "chloride profile matching" technique, such as described in Appendix D, can provide a reasonable estimate of the "worst case" scenario.

Conclusions and Recommendation

The conclusions from the previously-submitted report remain unchanged:

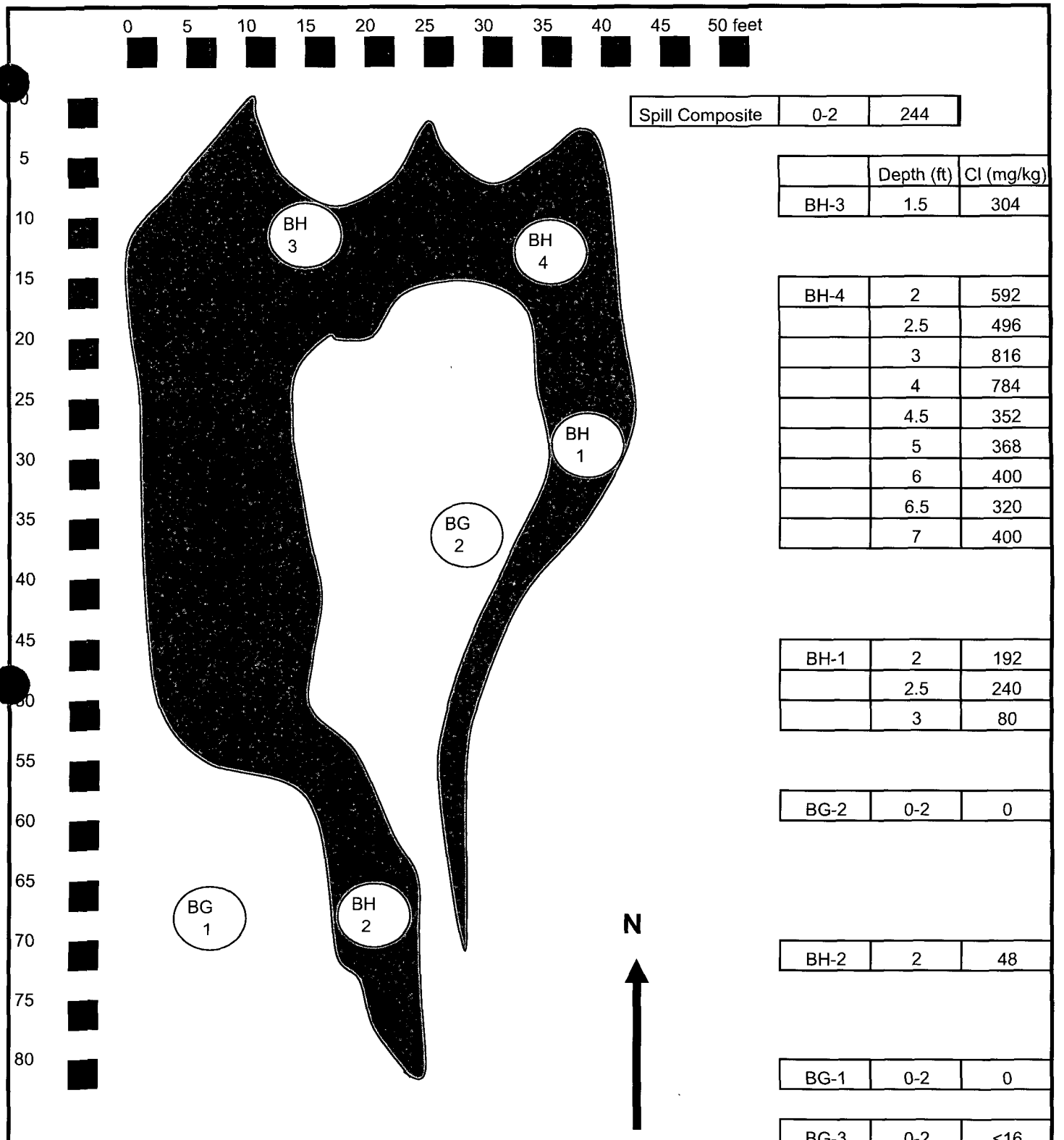
1. Chloride from the release of produced water at the State Q Battery (recent and historic) may enter ground water but will not cause a measurable increase in ground water chloride concentration.
2. Regulated hydrocarbons are not present in sufficient concentration to pose a threat to ground water quality
3. No action is required at this active tank battery site to protect fresh water, public health, the environment, property or human safety.

We respectfully request closure of the regulatory file associated with this recent release. Upon closure of the facility after production ceases, the operator will sample the entire site and re-evaluate the conclusions and recommendations presented herein. Please contact me if you have any questions regarding this submission. We would be pleased to meet with NMOCD in Hobbs to address any concerns.

Sincerely,
R.T. Hicks Consultants

Randall T. Hicks
Principal

Copy: Apache Corporation



Spill Composite	0-2	244

	Depth (ft)	Cl (mg/kg)
BH-3	1.5	304
BH-4	2	592
	2.5	496
	3	816
	4	784
	4.5	352
	5	368
	6	400
	6.5	320
	7	400
BH-1	2	192
	2.5	240
	3	80
BG-2	0-2	0
BH-2	2	48
BG-1	0-2	0
BG-3	0-2	<16

BG-3 is 50-feet east of battery

R.T. Hicks Consultants Albuquerque, New Mexico	Sketch Map of Release - Update	Plate 2
	Apache Corporation - State Q Battery	Mar-09

APPENDIX A

CARDINAL LABORATORIES

PHONE (575) 393-2326 • 101 E. MARLAND • HOBBS, NM 88240

ANALYTICAL RESULTS FOR
APACHE CORPORATION
ATTN: TRAVIS CARNES
P.O. DRAWER D
MONUMENT, NM 88265
FAX TO: (575) 393-1927

Receiving Date: 02/16/09
Reporting Date: 02/16/09
Project Number: NOT GIVEN
Project Name: STATE Q BATTERY
Project Location: NOT GIVEN

Analysis Date: 02/16/09
Sampling Date: NOT GIVEN
Sample Type: SOIL
Sample Condition: COOL & INTACT
Sample Received By: ML
Analyzed By: HM

LAB NUMBER	SAMPLE ID	Cl^- (mg/kg)
H16900-1	BH-1 @ 3'	80
H16900-2	BG #3	< 16
Quality Control		490
True Value QC		500
% Recovery		98.0
Relative Percent Difference		4.0

METHOD: Standard Methods	4500-ClB

Analyses performed on 1:4 w:v aqueous extracts.

Chemist

02/16/09
Date

H16900 APACHE

CARDINAL LABORATORIES

101 East Marland, Hobbs, NM 88240
(575) 393-2326 Fax (575) 393-2476

Company Name:	Apache Corp.
Project Manager:	Travis Carnes
Address:	Po Drawer D
City:	Monument State: NM Zip: 88265
Phone #:	575 393-2144 Fax #: 393-1927
Project #:	Project Owner:
Project Name:	St. Q Battery
Project Location:	
Sampler Name:	

BILL TO

P.O. #:	
Company:	
Attn:	
Address:	
City:	
State:	Zip:
Phone #:	
Fax #:	

ANALYSIS REQUEST

Cl

FOR LAB USE ONLY Lab I.D.	Sample I.D.	(G)RAB OR (C)OMP.	# CONTAINERS	MATRIX: GROUNDWATER	WASTEWATER	SOIL	OIL	SLUDGE	OTHER:	PRESERV: ACID/BASE:	ICE / COOL	OTHER:	SAMPLING: DATE	TIME	Cl
90001	BH-1 @ 3'	G	1			1									X
-2	BG #3	G	1			1									X

PLEASE NOTE: Liability and Damages. Cardinal's liability and client's exclusive remedy for any claim arising whether based in contract or tort, shall be limited to the amount paid by the client for the analyses. All claims including those for negligence and any other cause whatsoever shall be deemed waived unless made in writing and received by Cardinal within 30 days after completion of the applicable service. In no event shall Cardinal be liable for incidental or consequential damages, including without limitation, business interruptions, loss of use, or loss of profits incurred by client, its subsidiaries affiliates or successors arising out of or related to the performance of services hereunder by Cardinal, regardless of whether such claim is based upon any of the above stated reasons or otherwise.

Sampler Relinquished:	Date:	Received By:	
	Time:		
Relinquished By:	Date: 2-16-09	Received By:	
	Time: 9:30		
Delivered By: (Circle One)	Temp.	Sample Condition: Cool ☑ Yes ☐ No; Intact ☑ Yes ☐ No	CHECKED BY: (Initials)
Sampler - UPS - Bus - Other:			

Phone Result:	☐	No	Add'l Phone #:
Fax Result:	☐	No	Add'l Fax #:

REMARKS:

travis carnes@apachecorp.com

† Cardinal cannot accept verbal changes. Please fax written changes to 575-393-2476.

CARDINAL LABORATORIES

PHONE (575) 393-2326 • 101 E. MARLAND • HOBBS, NM 88240

ANALYTICAL RESULTS FOR
APACHE CORPORATION
ATTN: TRAVIS CARNES
P.O. DRAWER D
MONUMENT, NM 88265
FAX TO: (575) 393-1927

Receiving Date: 02/17/09
Reporting Date: 02/18/09
Project Number: NOT GIVEN
Project Name: STATE Q BATTERY
Project Location: NOT GIVEN

Analysis Date: 02/18/09
Sampling Date: 02/17/09
Sample Type: SOIL
Sample Condition: INTACT
Sample Received By: ML
Analyzed By: HM

LAB NUMBER	SAMPLE ID	Cl^- (mg/kg)
H16912-1	BH-4 @ 4'	784
H16912-2	BH-4 @ 4.5'	352
H16912-3	BH-4 @ 5'	368
Quality Control		490
True Value QC		500
% Recovery		98.0
Relative Percent Difference		4.0

METHOD: Standard Methods	4500-Cl^-B

Analyses performed on 1:4 w:v aqueous extracts.

Chemist

02/18/09
Date

H16912 APACHE

CARDINAL LABORATORIES

101 East Marland, Hobbs, NM 88240
(575) 393-2326 Fax (575) 393-2476

Page____ of____

Company Name:	APACHE CORP.
Project Manager:	TRAVIS CARNES
Address:	P.O. DRAWER D
City:	MONUMENT State: NM Zip: 88265
Phone #:	(575) 393-2144 Fax #: (575) 393-1927
Project #:	Project Owner:
Project Name:	STATE @ BATTERY
Project Location:	
Sampler Name:	

BILL TO

P.O. #:	
Company:	
Attn:	
Address:	
City:	
State:	Zip:
Phone #:	
Fax #:	

ANALYSIS REQUEST

FOR LAB USE ONLY Lab I.D.	Sample I.D.	(G)RAB OR (C)OMP.	# CONTAINERS	MATRIX: GROUNDWATER	WASTEWATER	SOIL	OIL	SLUDGE	OTHER:	PRESERV: ACID/BASE	ICE / COOL	OTHER:	SAMPLING DATE	TIME	Cl⁻
912-1	BH-4 @ 4'	G	1			✓							2/17/09		X
-2	BH-4 @ 4.5'	G	1			✓									X
-3	BH-4 @ 5'	G	1			✓									X

PLEASE NOTE: Liability and Damages. Cardinal's liability and client's exclusive remedy for any claim arising whether based in contract or tort, shall be limited to the amount paid by the client for the analyses. All claims, including those for negligence and any other cause whatsoever shall be deemed waived unless made in writing and received by Cardinal within 30 days after completion of the applicable service. In no event shall Cardinal be liable for incidental or consequential damages, including without limitation, business interruptions, loss of use, or loss of profits incurred by client, its subsidiaries, affiliates or successors arising out of or related to the performance of services hereunder by Cardinal, regardless of whether such claim is based upon any of the above stated reasons or otherwise.

Sampler Relinquished:	Date:	Received By:	
	Time:		
Relinquished By:	Date: 2-17-09	Received By:	
	Time: 1:28		
Delivered By: (Circle One)	Temp.	Sample Condition: Cool ☐ Yes ☐ No; Intact ☑ Yes ☐ No	CHECKED BY: (Initials) MCB
Sampler - UPS - Bus - Other:			

Phone Result:	☐	No	Add'l Phone #:
Fax Result:	☐	No	Add'l Fax #:
REMARKS:			

travis.carnes@apachecorp.com

† Cardinal cannot accept verbal changes. Please fax written changes to 575-393-2476.

CARDINAL LABORATORIES

PHONE (575) 393-2326 • 101 E. MARLAND • HOBBS, NM 88240

ANALYTICAL RESULTS FOR
APACHE CORPORATION
ATTN: TRAVIS CARNES
P.O. DRAWER D
MONUMENT, NM 88265
FAX TO: (575) 393-1927

Receiving Date: 02/17/09
Reporting Date: 02/17/09
Project Number: NOT GIVEN
Project Name: STATE Q BATTERY
Project Location: NOT GIVEN

Analysis Date: 02/17/09
Sampling Date: 02/17/09
Sample Type: SOIL
Sample Condition: INTACT
Sample Received By: ML
Analyzed By: HM

LAB NUMBER	SAMPLE ID	Cl^- (mg/kg)
H16907-1	BH-4 3'	816
Quality Control		490
True Value QC		500
% Recovery		98.0
Relative Percent Difference		4.0

METHOD: Standard Methods	4500-Cl^-B

Analysis performed on a 1:4 w:v aqueous extract.

Chemist

02/17/09
Date

H16907 APACHE

CARDINAL LABORATORIES

101 East Marland, Hobbs, NM 88240
(575) 393-2326 Fax (575) 393-2476

Page____ of ____

Company Name:	APACHE CORP.	**BILL TO**	
Project Manager:	TRAVIS CARNES	P.O. #:	
Address:	P.O. DRAWER D	Company:	
City:	MONUMENT State: NM Zip: 88265	Attn:	
Phone #:	(575) 393-2144 Fax #: (575) 393-1927	Address:	
Project #:	Project Owner:	City:	
Project Name:	STATE Q BATTERY	State: Zip:	
Project Location:		Phone #:	
Sampler Name:		Fax #:	

ANALYSIS REQUEST

FOR LAB USE ONLY Lab I.D.	Sample I.D.	(G)RAB OR (C)OMP.	# CONTAINERS	MATRIX: GROUNDWATER	WASTEWATER	SOIL	OIL	SLUDGE	OTHER	PRESERV: ACID/BASE:	ICE / COOL	OTHER	SAMPLING: DATE	TIME	Cl-
907-1	BH-4 3'	G	1			✓							2/17/09		X

PLEASE NOTE: Liability and Damages. Cardinal's liability and client's exclusive remedy for any claim arising whether based in contract or tort, shall be limited to the amount paid by the client for the analyses. All claims including those for negligence and any other cause whatsoever shall be deemed waived unless made in writing and received by Cardinal within 30 days after completion of the applicable service. In no event shall Cardinal be liable for incidental or consequential damages, including without limitation, business interruptions, loss of use, or loss of profits incurred by client, its subsidiaries affiliates or successors arising out of or related to the performance of services hereunder by Cardinal, regardless of whether such claim is based upon any of the above stated reasons or otherwise.

Sampler Relinquished:	Date:	Received By:		Phone Result: ☐ No	Add'l Phone #:
	Time:			Fax Result: ☐ No	Add'l Fax #:
Relinquished By:	Date: 2-17-09	Received By:		REMARKS:	
	Time: 7:50			travis.carnes@apachecorp.com	
Delivered By: (Circle One) Sampler - UPS - Bus - Other:	Temp	Sample Condition Cool: ☐ Yes ☐ No Intact: ☑ Yes ☐ No	CHECKED BY: (Initials) MCBB		

† Cardinal cannot accept verbal changes. Please fax written changes to 575-393-2476.

CARDINAL LABORATORIES

PHONE (575) 393-2326 • 101 E. MARLAND • HOBBS, NM 88240

ANALYTICAL RESULTS FOR
APACHE CORPORATION
ATTN: TRAVIS CARNES
P.O. DRAWER D
MONUMENT, NM 88265
FAX TO: (575) 393-1927

Receiving Date: 02/18/09
Reporting Date: 02/19/09
Project Number: NOT GIVEN
Project Name: STATE Q BATTERY
Project Location: NOT GIVEN

Analysis Date: 02/19/09
Sampling Date: 02/18/09
Sample Type: SOIL
Sample Condition: INTACT
Sample Received By: AB
Analyzed By: HM

LAB NUMBER	SAMPLE ID	Cl^- (mg/kg)
H16922-1	6'	400
H16922-2	6.5'	320
H16922-3	7'	400
Quality Control		500
True Value QC		500
% Recovery		100
Relative Percent Difference		< 0.1

METHOD: Standard Methods	4500-Cl^-B

Analyses performed on 1:4 w:v aqueous extracts.

Chemist

02/20/09
Date

H16922 Apache

CARDINAL LABORATORIES

101 East Marland, Hobbs, NM 88240
(575) 393-2326 Fax (575) 393-2476

Page____ of____

Company Name:	Apache Corp.	**BILL TO**	
Project Manager:	Travis Carnes	P.O. #:	
Address:	PO. Drawer D	Company:	
City:	Monument State: NM Zip: 88265	Attn:	
Phone #:	(575)393-2144 Fax #: (575)393-1927	Address:	
Project #:	Project Owner:	City:	
Project Name:	State Q Battery	State: Zip:	
Project Location:		Phone #:	
Sampler Name:		Fax #:	

FOR LAB USE ONLY Lab I.D.	Sample I.D.	(G)RAB OR (C)OMP.	# CONTAINERS	MATRIX: GROUNDWATER	WASTEWATER	SOIL	OIL	SLUDGE	OTHER:	PRESERV: ACID/BASE:	ICE / COOL	OTHER:	SAMPLING: DATE	TIME	ANALYSIS REQUEST: Cl-
922-1	6'					X							2/18/09		X
-2	6.5'					X									X
-3	7'					X							↓		X

PLEASE NOTE: Liability and Damages. Cardinal's liability and client's exclusive remedy for any claim arising whether based in contract or tort, shall be limited to the amount paid by the client for the analyses. All claims including those for negligence and any other cause whatsoever shall be deemed waived unless made in writing and received by Cardinal within 30 days after completion of the applicable service. In no event shall Cardinal be liable for incidental or consequential damages, including without limitation, business interruptions, loss of use, or loss of profits incurred by client, its subsidiaries, affiliates or successors arising out of or related to the performance of services hereunder by Cardinal, regardless of whether such claim is based upon any of the above stated reasons or otherwise.

Sampler Relinquished:	Date:	Received By:		Phone Result: ☐	No Add'l Phone #:
	Time:			Fax Result: ☐	No Add'l Fax #:
Relinquished By:	Date: 2/18/09	Received By:		REMARKS:	
	Time: 4:30			travis.carnes@apachecorp.com	
Delivered By: (Circle One)		Temp.	Sample Condition: Cool ☐ Yes ☒ No; Intact ☒ Yes ☐ No	CHECKED BY: (Initials)	
Sampler - UPS - Bus - Other:					

† Cardinal cannot accept verbal changes. Please fax written changes to 575-393-2476.

Appendix B

User Input (not both)	Depth to Water	Meters		Feet	20	609 60
User Input (optional)	User provided moist bulk density (rho_m)				kg/M^3	
User Inputs (optional)	Dry Bulk Density (rho_ 1415 is default value) =				1415	kg/m^3
	Vol Moist Content (Theta_v, 0 135 is default value) =				0 135	
	Calculated moist bulk density (rho_m) =				1550	kg/m^3

1550 kg/m^3 - Moist bulk density used in calculations

Boring 1 **Boring ID** BH-1

Sample Number (increasing depth)	If a Composite Sample from a Depth Interval: Feet Top of Sample	Feet Bottom of Sample	Feet Ave Depth	Meters Top of Sample	Meters Bottom of Sample	Meters Ave Depth	Grab Samples: Z Feet	Z Meters	Z Assigned depth in cm	Chl Conc mg/kg
1			0			0	2		60 96	192
2			0			0	2 5		76 2	240
3			0			0	3		91 44	81
4			0			0	18		548 64	79
5			0			0			0	
6			0			0			0	
7			0			0			0	
8			0			0			0	
9			0			0			0	
10			0			0			0	
11			0			0			0	
12			0			0			0	
13			0			0			0	
14			0			0			0	
15			0			0			0	
16			0			0			0	
17			0			0			0	
18			0			0			0	
19			0			0			0	
20			0			0			0	
21			0			0			0	
22			0			0			0	
23			0			0			0	
24			0			0			0	
25			0			0			0	
26			0			0			0	
27			0			0			0	
28			0			0			0	
29			0			0			0	
30			0			0			0	

User Inputs

For Depths, use feet or meters **(not both)**

Up to 10 Borings are allowed

Chloride load for Boring 1 in kg/m^2 = 0 91

		Proportional Area Weights	Chl Load of each Borehole	Equal Area Weights	
User Input (Optional)	Boring 1	BH-1	0 91	1 00	
	Boring 2		0 00	0 00	
	Boring 3	BH-3	3 82	1 00	
	Boring 4	BH-4	4 06	1 00	
	Boring 5	BH-2	0 59	1 00	
Pro Area Weights must sum to between 0 975 and 1 025	Boring 6		0 00	0 00	
	Boring 7		0 00	0 00	
	Boring 8		0 00	0 00	
	Boring 9		0 00	0 00	
	Boring 10		0 00	0 00	
	Sum of weights	0		4	
Output for AMIGO	**Averaged Chloride Load of All Boreholes**			2 39	kg/m^2

Boring 2	Boring ID	VOID										
	If a Composite Sample from a Depth Interval						Grab Samples					
	Feet			Meters			z		z		Z	
Sample Number (increasing depth)	Top of Sample	Bottom of Sample	Ave Depth	Top of Sample	Bottom of Sample	Ave Depth	feet		meters		Assigned depth in cm	
1			0			0					0	
2			0			0					0	
3			0			0					0	
4			0			0					0	
5			0			0					0	
6			0			0					0	
7			0			0					0	
8			0			0					0	
9			0			0					0	
10			0			0					0	
11			0			0					0	
12			0			0					0	
13			0			0					0	
14			0			0					0	
15			0			0					0	
16			0			0					0	
17			0			0					0	
18			0			0					0	
19			0			0					0	
20			0			0					0	
21			0			0					0	
[illegible]			0			0					0	
[illegible]			0			0					0	
24			0			0					0	
25			0			0					0	
26			0			0					0	
27			0			0					0	
28			0			0					0	
29			0			0					0	
30			0			0					0	

Chloride load for Boring 2 in kg/m^2 = 0.00

Boring 3	Boring ID BH-3									
	If a Composite Sample from a Depth Interval						Grab Samples		Z	
Sample Number (increasing depth)	Feet			Meters				z		
	Top of Sample	Bottom of Sample	Ave Depth	Top of Sample	Bottom of Sample	Ave Depth	feet	meters	Assigned depth in cm	
1			0			0	1 5		45 72	304
2			0			0	2		60 96	592
3			0			0	2 5		76 2	496
4			0			0			91 44	816
5			0			0	4		121 92	784
6			0			0	4 5		137 16	352
7			0			0	5		152 4	368
8			0			0	6		182 88	400
9			0			0	6 5		198 12	320
10			0			0	7		213 36	400
11			0			0	8		243 84	369
12			0			0	18		548 64	367
13			0			0			0	
14			0			0			0	
15			0			0			0	
16			0			0			0	
17			0			0			0	
18			0			0			0	
19			0			0			0	
20			0			0			0	
21			0			0			0	
22			0			0			0	
23			0			0			0	
24			0			0			0	
25			0			0			0	
26			0			0			0	
27			0			0			0	
28			0			0			0	
29			0			0			0	
30			0			0			0	
								Chloride load for Boring 3 in kg/m^2 =		3 82

Boring 4	Boring ID BH-4										
	If a Composite Sample from a Depth Interval						Grab Samples				
	Feet			Meters				z			
Sample Number (increasing depth)	Top of Sample	Bottom of Sample	Ave Depth	Top of Sample	Bottom of Sample	Ave Depth	feet		meters	Z Assigned depth in cm	Soil Temp. (Deg C)
1			0			0	2			60 96	592
2			0			0	2 5			76 2	496
3			0			0	3			91 44	416
4			0			0	4			121 92	784
5			0			0	4 5			137 16	352
6			0			0	5			152 4	368
7			0			0	6			182 88	400
8			0			0	6 5			198 12	320
9			0			0	7			213 36	400
10			0			0	8			243 84	369
11			0			0	18			548 64	367
12			0			0				0	
13			0			0				0	
14			0			0				0	
15			0			0				0	
16			0			0				0	
17			0			0				0	
18			0			0				0	
19			0			0				0	
20			0			0				0	
21			0			0				0	
22			0			0				0	
23			0			0				0	
24			0			0				0	
25			0			0				0	
26			0			0				0	
27			0			0				0	
28			0			0				0	
29			0			0				0	
30			0			0				0	

Chloride load for Boring 4 in kg/m^2 = 4 06

Boring 5	Boring ID BH-2										
	If a Composite Sample from a Depth Interval						Grab Samples				
	Feet			Meters			z		z	Z	Phi Comp.
Sample Number (increasing depth)	Top of Sample	Bottom of Sample	Ave. Depth	Top of Sample	Bottom of Sample	Ave. Depth	(feet)		meters	Assigned depth in cm	Depth
1			0			0	1			30.48	248
2			0			0	2			60.96	48
3			0			0	18			548.64	47
4			0			0				0	
5			0			0				0	
6			0			0				0	
7			0			0				0	
8			0			0				0	
9			0			0				0	
10			0			0				0	
11			0			0				0	
12			0			0				0	
13			0			0				0	
14			0			0				0	
15			0			0				0	
16			0			0				0	
17			0			0				0	
18			0			0				0	
19			0			0				0	
20			0			0				0	
21			0			0				0	
22			0			0				0	
23			0			0				0	
24			0			0				0	
25			0			0				0	
26			0			0				0	
27			0			0				0	
28			0			0				0	
29			0			0				0	
30			0			0				0	

Chloride load for Boring 5 in kg/m^2 = 0.59

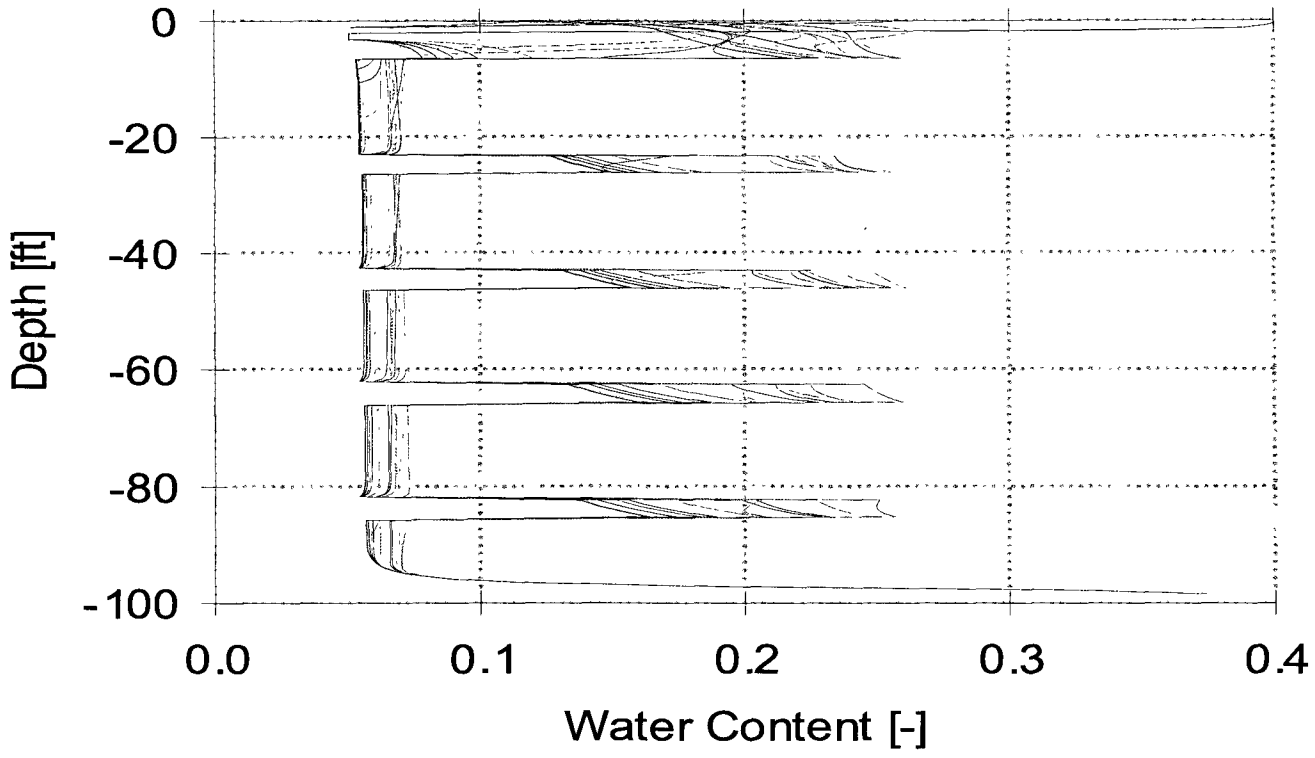
Appendix C

Project: StateQMostProbabNewMass.ami
Path: P:\Apache State Q Battery\Modeling\StateQMostProbabNewMass.ami
Date: 3/10/2009
Units: English (inches)
Climate: Arid Hot (NM/W.Texas, Hobbs)
Plant Uptake Trigger: 1% Input Concentration

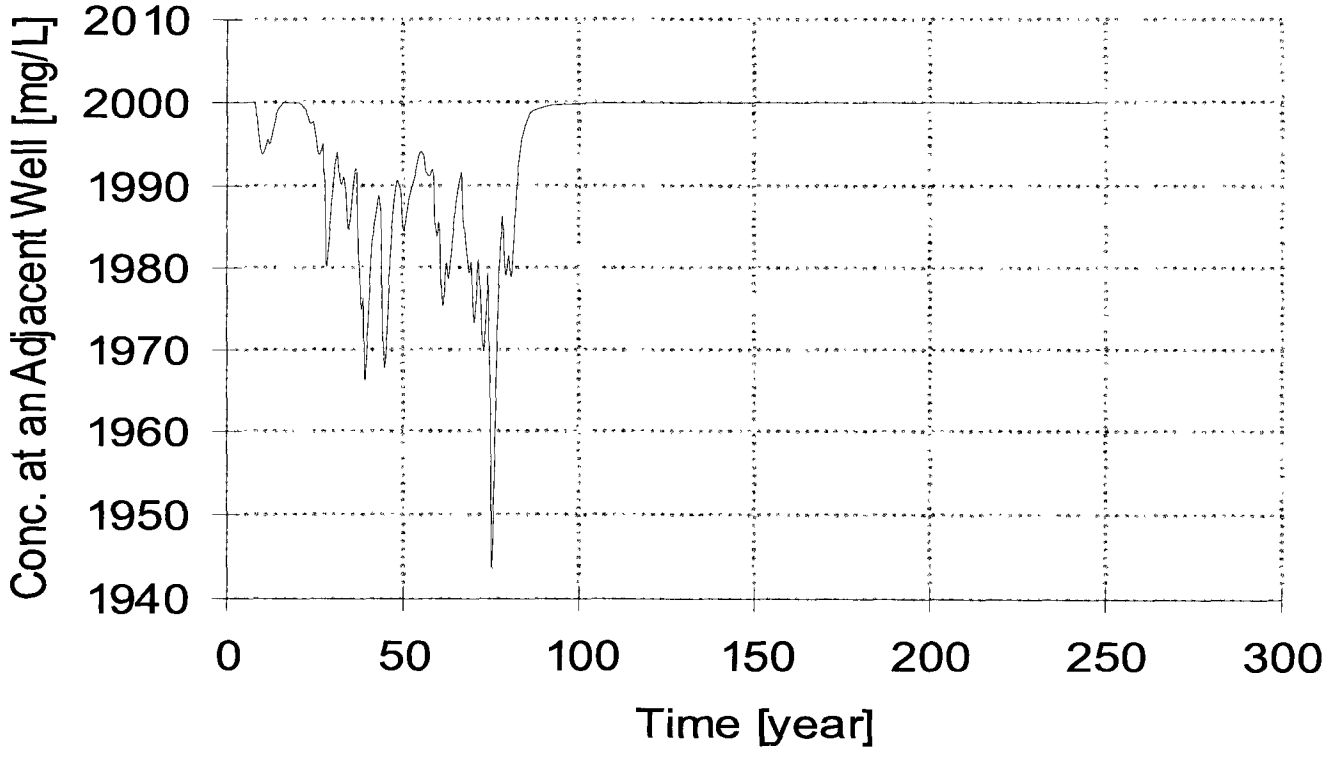
Groundwater Characteristics
Background Cl Concentration in Aquifer: 2000 [mg/L]
Aquifer porosity: 0.3 [-]
Groundwater Table Depth: 20 [ft]
Aquifer Thickness: 30 [ft]
Slope of Water Table: 0.001 [-]
Hydraulic Conductivity: 80 [ft/d]
Groundwater Flux: 2.4 [ft2/d]

Source Characteristics
Chloride Load:: 2.35 [kg/m2]
Max. length of the spill in direction of GW flow:: 80 [ft]

Soil Profiles
Surface Layer: Caliche
Soil Profile: P4 - Caliche (1) + Medium Sand (5)



Max Concentration 2000.031 [mg/L] at time 16.493 Year



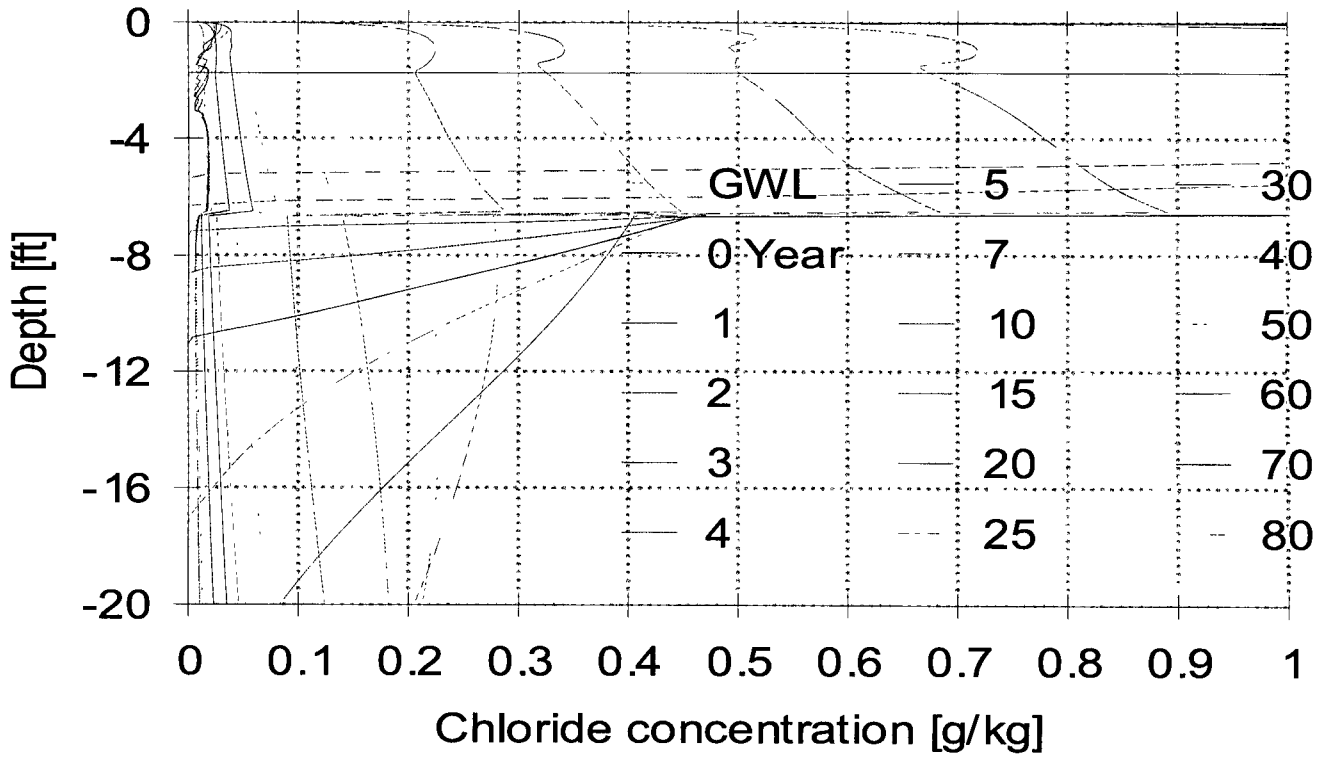
Appendix D

Project: StateQWorstCase2.ami
Path: P:\Apache State Q Battery\Modeling\StateQWorstCase2.ami
Date: 3/10/2009
Units: English (inches)
Climate: Arid Hot (NM/W.Texas, Hobbs)
Plant Uptake Trigger: 1% Input Concentration

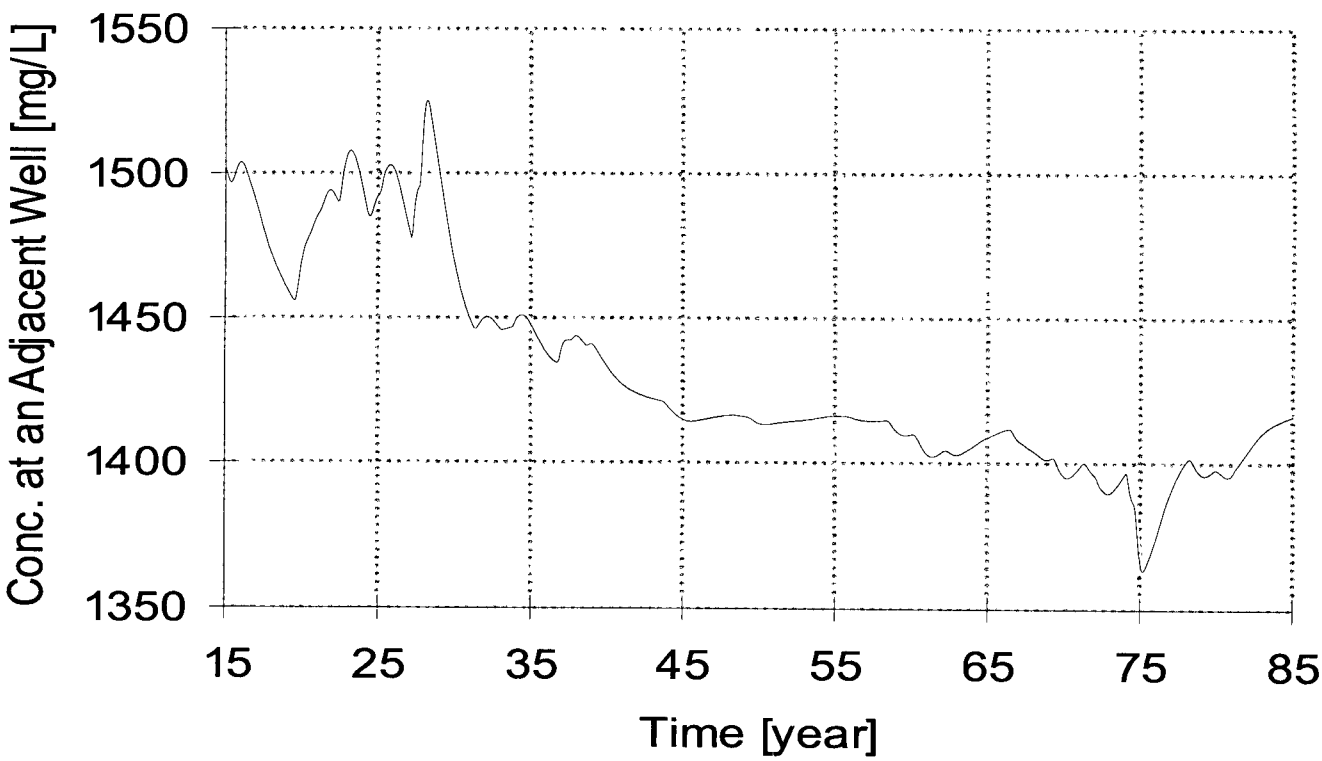
Groundwater Characteristics
Background Cl Concentration in Aquifer: 1420 [mg/L]
Aquifer porosity: 0.3 [-]
Groundwater Table Depth: 20 [ft]
Aquifer Thickness: 20 [ft]
Slope of Water Table: 0.001 [-]
Hydraulic Conductivity: 60 [ft/d]
Groundwater Flux: 1.2 [ft2/d]

Source Characteristics
Chloride Load:: 5.75 [kg/m2]
Max. length of the spill in direction of GW flow:: 80 [ft]

Soil Profiles
Surface Layer: Caliche
Soil Profile: P4 - Caliche (1) + Medium Sand (5)



Max Concentration 1525.283 [mg/L] at time 28.192 Year



How to Use

0) Copy excel spreasheet and rename with the site name in place of "SiteName" Work in this sheet

1) Export chloride concentration [g/kg] data set from AMIGO This will arrive as a file called Chart1 txt Be sure that you use a chloride load of 1 0 in the Amigo tool prior to exporting the data to Chart1 txt

2) **Starting** in an Excel workbook use the open command to open Chart1 txt (don't forget to ask it to show you all file types) This will get you to the Text Import Wizard

2a) In step 1, choose "Fixed Width"

2b) Just accept "Next" "Next", and "Finish"

3) Starting in the upper left Excel box, use "Control A" and "Control C" to copy the entire data set

4) In the "Chart 1" sheet of the HistoricAMIGOPro_SiteName xls select the upper left cell of the sheet and paste in the data set "Control V" or your favorite command

Note

If Step 3 and Step 4 do not start in the upper left cell the links will be to the wrong data

5) Choose the year of the profile to be seen and enter in Cell I5 Only the inputs listed in the pink cells will result in a choice If nothing is input or some other input besides 0,1 5 ,30, the profile from **Year 40 is shown by default**

Choose the profile year that "best" mimics the shape of the field chloride data

6) Change the Concentration factor (cell I6) such that the AMIGO profile is greater than or equal to all of the values of the field data Then change the input year to determine if the concentration factor may be lowered without causing the Amigo-generate profile to become less than the field data profile

Note

Should the choice of Concentration factor be too small to meet the condition of Step 6 the model is an opinion without the benefit of mathematical support

7) Enter cell L11 the chloride load in AMIGO

8) Output Chart 2 (particularly "Conc at an Adjacent Well") can be used to represent the site of interest with resetting of time such that the year of the profile selected (cell I5) is subtracted from time

8a) Export this dataset make a graph in Excel and correct time by starting Time at the year chosen

Note

Call with questions It is almost certain that this does not answer all questions

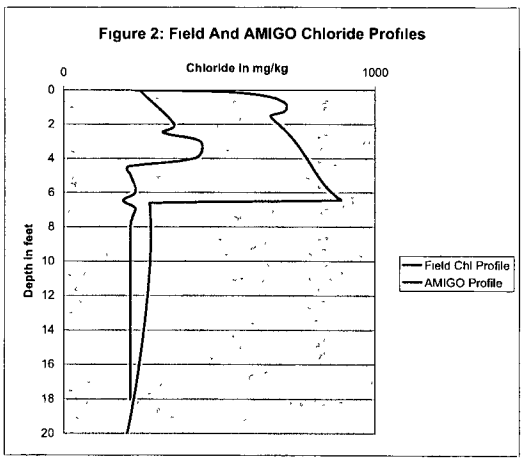
Input	Year	15
Input -	Conc Factor	5750

Multiplier	5750	Do not Touch

Output for Chl Load: 5 75 kg/m^2

Available Profiles		Value to input in Cell I5
Year	0	0
	1	1
	5	5
	10	10
	20	20
	25	25
	30	30
	40	

Depth [feet]	Chl Conc [mg/kg]
0 00	221 1
0 02	329 1
0 05	428 2
0 08	489 1
0 11	529 9
0 15	560 6
0 18	586 6
0 22	606 3
0 26	625 0
0 31	640 6
0 35	653 1
0 40	665 4
0 45	676 6
0 50	685 5
0 56	692 6
0 62	698 5
0 67	705 5
0 74	710 6
0 80	714 2
0 87	716 5
0 94	717 4
1 01	717 1
1 08	716 5
1 16	714 6
1 23	710 0
1 31	701 2
1 40	681 3
1 48	665 6
1 57	666 4
1 66	670 5
1 75	675 5
1 85	680 7
1 94	686 9
2 04	693 1
2 14	699 3
2 25	705 2
2 35	711 1
2 46	716 9
2 57	722 5
2 68	728 1
2 80	733 5
2 92	738 8
3 03	744 1
3 16	749 2
3 28	754 2
3 41	759 1
3 53	763 9
3 66	768 6
3 79	773 3
3 92	778 0
4 06	782 6
4 19	787 3
4 33	792 0
4 47	796 8
4 61	801 6
4 76	806 6
4 90	811 8
5 05	817 2
5 20	822 9
5 35	828 8
5 51	835 1
5 66	842 3



5 82	850 3
5 98	859 0
6 14	868 5
6 30	878 9
6 47	890 1
6 64	276 9
6 81	277 5
6 98	278 1
7 15	278 7
7 33	279 1
7 50	279 5
7 68	279 9
7 86	280 2
8 05	280 4
8 23	280 6
8 42	280 7
8 61	280 7
8 80	280 6
8 99	280 4
9 19	280 2
9 38	279 9
9 58	279 5
9 78	279 1
9 99	278 6
10 19	278 0
10 40	277 3
10 61	276 5
10 82	275 7
11 03	274 8
11 24	273 9
11 46	272 9
11 68	271 8
11 90	270 7
12 12	269 6
12 35	268 4
12 57	267 1
12 80	265 8
13 03	264 4
13 26	263 0
13 50	261 6
13 73	260 1
13 97	258 5
14 21	256 9
14 45	255 3
14 70	253 6
14 94	251 9
15 19	250 0
15 44	248 2
15 69	246 2
15 94	244 3
16 20	242 2
16 46	240 1
16 72	237 9
16 98	235 6
17 24	233 3
17 51	230 9
17 77	228 4
18 04	225 8
18 32	223 2
18 59	220 4
18 86	217 6
19 14	214 7
19 42	211 7
19 70	208 6
19 98	205 4
20 27	202 1
20 56	198 7