STATE OF COLORADO

O'Donnell - DNR, Tyler <tyler.odonnell@state.co.us>

Nyholt Mann Pit M-1982-147

3 messages

Kurt Carlson <KCarlson@adcogov.org> Wed, Apr 23, 2014 at 12:15 PM
To: "tyler.odonnell@state.co.us" <tyler.odonnell@state.co.us>

Tyler,

It was a pleasure meeting with you this morning. Attached you will find the certification letters for the reservoirs as well as the clay liner diagram for Lake 1 that we looked at in my office following the site visit.

Let me know if you need any additional information.

Kurt Carlson, MAS

Regional Park Manager
Adams County Parks and Community Resources
9755 Henderson Road
Brighton, CO 80601
Phone 303.637.8013
Fax 303.637.8015

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6 attachments

leaktest approval.pdf
43K

2012_Mann Lakes Lake #2 Leak Test Report Final.pdf
1408K

Lake2_3_Cert_Ltr.July24_2012..pdf
101K

Lake #1 Certification.pdf
49K

Leak Test Approval-SEO (2).pdf
111K

DOCS-#4905733-v1-2014_094_DIAGRAM_ATTACHMENT.PDF
407K

O'Donnell - DNR, Tyler <tyler.odonnell@state.co.us> Wed, Apr 23, 2014 at 3:33 PM
To: Kurt Carlson <KCarlson@adcogov.org>

Kurt
Thank you I will incorporate those items into our records.
Thank you
Tyler
[Quoted text hidden]
--
Tyler O'Donnell
Environmental Protection Specialist
COLORADO
Division of Reclamation, Mining and Safety
Department of Natural Resources

P 303.866.3567 x 8131 | F 303.832.8106 | C 303.319.5842
1313 Sherman Street, Room 215, Denver, CO 80203
Tyler.ODonnell@state.co.us | http://mining.state.co.us

Kurt Carlson <KCarlson@adcogov.org> Thu, Apr 24, 2014 at 4:38 PM
To: "tyler.odonnell@state.co.us" <tyler.odonnell@state.co.us>

Tyler,

I wanted to let you know that we found the signs with the county logo on them and permit number. Somebody removed them to put up the no parking signs. The signs with the permit number were posted at the site entrance today and the old sign (which also had the correct permit number but looked a bit worn) was removed.

Kurt Carlson, MAS

Regional Park Manager
Adams County Parks and Community Resources
9755 Henderson Road
Brighton, CO 80601
Phone 303.637.8013
Fax 303.637.8015

Please consider the environment before printing this email

From: Kurt Carlson

Sent: Wednesday, April 23, 2014 12:15 PM
To: 'tyler.odonnell@state.co.us'
Subject: Nyholt Mann Pit M-1982-147

[Quoted text hidden]

MODIFIED 30-DAY LEAK TEST RESULTS

MANN LAKES, LAKE #2

ADAMS COUNTY, COLORADO

Prepared for:

L&M Enterprises
735 East Hwy 56
Berthoud, CO 80513

Prepared by:

Tetra Tech
1900 S. Sunset Street, Suite 1-F
Longmont, CO 80501

Tetra Tech Job No. 133-60071-12001

July 2011

TETRA TECH

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1.0 BACKGROUND

The Mann Lakes gravel mine has been reclaimed with three lake basins lined with compacted clay slope liners. Construction of the liners at Mann Lakes #1, #2, and #3 was complete as of April 2007. The liners were designed and constructed to meet seepage criteria outlined in the State Engineer Guidelines for Lining Criteria for Gravel Pits. The pit was mined by Lafarge North America (Lafarge).

A 90-day leak test was conducted on Lake #1 during the summer of 2006 by Applegate Group, Inc. Tetra Tech conducted 90-day leak tests on Lakes #2 and #3 between May 21, 2009 and August 28, 2009. All of the tests indicated that the lakes met the design seepage standards of the State Engineer (Appendix A).

Beginning in March 2011, the liners were breached and interconnects were installed by L&M Enterprises between Lakes #1 and #2 and between Lakes #2 and #3. Per conversations with the State Engineer's office and because all three of the lake liners had previously passed leak tests, a modified leak test program was implemented. This modified leak test program included an initial 30-day monitoring period, where after the presentation of the passing results, the State Engineer's Office approved the lining of the lakes.

On or about August 15, 2011, a breach in the Lake #2 slope liner within the Lake #2 to Lake #3 interconnect excavation footprint was discovered. Groundwater flow emanating from the breach into Lake #2 was measured multiple times with a cutthroat flume. The flow was consistently measured to be approximately 85 gpm, approximately 33 gpm more than the allowable design standard of 52 gpm.

Early in 2012, Tetra Tech designed a buttress to stabilize the breach and mitigate the flow into Lake #2. The buttress extends a length of approximately 90 feet (45-feet either side of the interconnect centerline). The buttress has a maximum height of approximately 22 feet. The downstream side of the buttress slopes 3:1 from the top of the buttress to the reservoir floor. The bench at the top of the buttress slopes 2% towards the reservoir allowing for drainage. A dewatering drain consisting of ¾" to 1½" washed rock and a 6" diameter perforated Advanced Drainage Systems (ADS) pipe with a 3' (horizontal) by a 1' (vertical) cross sectional dimension is located at the existing seep. The dewatering drain extends 10-feet horizontal into the existing slope liner. The drain extends via 6-inch PVC from the edge of the existing slope liner, under the buttress to the toe, daylighting on the reservoir floor. A ball valve is located at the interface between the existing slope liner and stability buttress with valve access directly above the valve via an 8-inch diameter PVC riser and removable valve stem. The drain is enclosed in a geotextile fabric to minimize the migration of fines into the drainage layer.

L&M Enterprises constructed the buttress in June 2012. The drain was utilized during construction. The ball valve was closed on June 14, 2012 and the buttress has been performing as designed since that time. The drain pipe and riser are scheduled to be abandoned in place and grouted.

Water that had accumulated within Lake #2 since the occurrence of the breach was pumped back to the South Platte River.

1.1 Site Description

Mann Lakes is located west of the South Platte River and east of the Brantner Ditch in Adams County, Colorado. The site is southeast of the intersection of Riverdale Road and Henderson Road, south of the Adams County Fairgrounds. The site is more particularly described as being located in Section 34, Township 1 South, Range 67 West of the 6th Principal Meridian in Adams County as shown on Figure 1.

1.2 Slope Liners

Mann Lakes is lined with compacted clay embankment seal zone (Zone 1a) adjacent to and protected by gravelly clay zone (Zone 1b). A typical liner section is provided on Figure 2. A plan view of the lined pit is provided on Figure 1. The slope liner typically slopes 3:1 horizontal to vertical (H:V) into the pit.

The liner was designed by others and constructed by Lafarge and Kelley Trucking between 1998 and 2007. Materials used in liner construction consisted of a mixture of clay overburden, clay mud lens and claystone bedrock. Tetra Tech observed construction of parts of the liner and concurs that the liner is constructed to the design standards.

Between March and April 2011, L&M Enterprises constructed interconnects between Lakes #1 and #2 as well as between Lakes #2 and #3. The breach plan, designed by Tetra Tech, included breaching the liners with side slope excavations of 1:1 (H:V), installation of 24-inch pvc interconnect pipes encased in lean concrete, and the backfilling of the breached areas with a homogenous mixture of the material removed from the existing liners. The liner configuration encountered during the excavation differed from the anticipated configuration. A typical liner section encountered during the breach is provided in Figure 3.

1.3 Maximum Allowable Seepage

In June 2012, L&M Enterprises constructed the buttress designed by Tetra Tech. The buttress has effectively stabilized the breach area and mitigated flow into the reservoir. A typical stabilization buttress section is provided in Figure 3.

Per the Performance Standard of the State Engineer Guidelines for Lining Criteria for Gravel Pits, seepage through the liner should not exceed 0.09 cubic feet per day per square foot of liner. Seepage through the bedrock in the floor of the reservoir should not exceed 0.0045 cubic feet per day per square foot of reservoir floor. The liner is approximately 8,190 feet in length with an average height of 26 feet. Thus the curtain area of the liner is approximately 213,000 square feet and the maximum allowable seepage through the liner is approximately 19,170 cubic feet per day (100 gallons per minute). The area of the reservoir floor (inside the cut off key) is approximately 58 acres (2,526,500 square feet). Thus the maximum allowable seepage through the floor of the reservoir floor is approximately 11,370 cubic feet per day (59 gallons per minute). The total allowable seepage into the pit per the performance standard is approximately 30,500 cubic feet per day (158 gallons per minute). The allowable seepage rate per the design standard is one-third that of the performance standard, 10,150 cubic feet per day (52 gallons per minute).

2.0 LINER LEAK TEST

The liner leak test was performed over a period of thirty days per the methods outlined in our technical memorandum dated June 28, 2012. The test included a site reconnaissance, monitoring of ponded water and dewatering trench areas, and monitoring of precipitation and evaporation. A water balance accounting for changes in pond volume as well as precipitation and evaporation was used to evaluate seepage into the pit. The water balance accounted for 100% of the precipitation falling on the pond areas. The precipitation falling on non-ponded areas of the lake floor was incorporated into the water balance as runoff at 30% of the total precipitation volume.

All three lakes have previously passed a 90-day leak test and approval letters by the Colorado State Engineers Office (SEO) were issued. Additionally, all three lakes have previously passed a 30-day modified leak test conducted after the installation of the interconnects and approval letters by the Colorado SEO were issued. Approval letters are provided in Appendix A.

Mr. Jonathan Hernandez of the State Engineer's Office visited the site on February 16, 2011 and again on May 10, 2011. Mr. Hernandez has not visited the site in 2012.

2.1 Reconnaissance and Pond Identification

Site reconnaissance was performed in early June, 2012. Two pond locations and one trench location in Lake #2 were identified for monitoring. The ponds and trench were numbered sequentially, beginning with number 1. The initial pond and trench locations are shown on Figure 4.

2.2 Pond Monitoring and Pumping

Monitoring of the ponds and trench in Lake #2 commenced on June 17, 2012.

Pond surfaces were monitored by installing wooden laths at the initial perimeter of each pond. A steel fence post or wooden lath was placed within the deeper portions of each pond and was used to measure changes in water level surfaces. Water levels were measured using a Solinst water level indicator recording the distance from the top of the fence post to the water surface. Additionally, the wooden laths placed at the initial pond perimeter were utilized to make adjustments to the surface area of each pond by measuring the distance from the existing pond perimeter to the lath.

The trench was monitored for changes in length.

Measurements were performed on a weekly basis, as well as after major precipitation events by Tetra Tech personnel. Photos of Pond #2 and the trench are provided on Figure 5. The last measurements were made July 17, 2012.

2.3 Precipitation and Evaporation

A standard commercial rain gauge was placed between ponds 1 and 2 of Lake #2, within the reservoir. Additional weather and evaporation data was gathered from the Fort Lupton weather station operated by the NCWCD (http://www.northernwater.org/WaterConservation/WeatherandETData.aspx). This station is located at the Coyote Creek Golf Course, approximately 12 miles northeast of the Mann Lakes Pit. Data collected included temperature, relative humidity, precipitation, wind, and solar radiation, and evapotranspiration. Evapotranspiration data was converted to pan evaporation using pan coefficients estimated for fallow ground evaporation pans set back from vegetation. All of the weather station data is presented in Appendix B.

3.0 SEEPAGE EVALUATION

A water balance accounting for precipitation, evaporation, and changes in pond volumes was used to evaluate seepage into each pond and dewatering trench. Total precipitation less total evaporation in the period between measurements was the anticipated pond volume change. Any increase beyond the anticipated pond volume was considered to be due to seepage between measurements. This total seepage was then divided by the time between measurements to calculate seepage rates. Negative seepage values of individual ponds were considered to indicate no seepage and were not included in the total seepage calculations for all the ponds. For the trench, the width of the trench was assumed to remain constant because the sidewalls were nearly vertical, and thus only the wetted length was monitored. The change in trench volume was calculated by accounting for precipitation less evaporation.

The total seepage for the lake was the sum of the seepage values for the individual ponds and the trench. Total seepage was compared to allowable seepage rates. The calculations are provided in Excel spreadsheet format at the back of this report.

3.1 Results and Discussion

Calculated seepage into the pits typically ranged from approximately 3,438 to 15,386 cubic feet per day (17.9 to 79.9 gpm) for Lake #2. The high value is skewed due to heavy rainfall. Table one lists the total calculated seepage for each measurement and Figure 6 graphically illustrates the total calculated seepage compared to the maximum allowable seepage for the design and performance standards. Appendix B contains the weather data and the calculations for each pond. Electronic versions in spread sheet format are provided in the pocket.

Table 1

Calculated Seepage per Day, Mann Lakes Lake #2

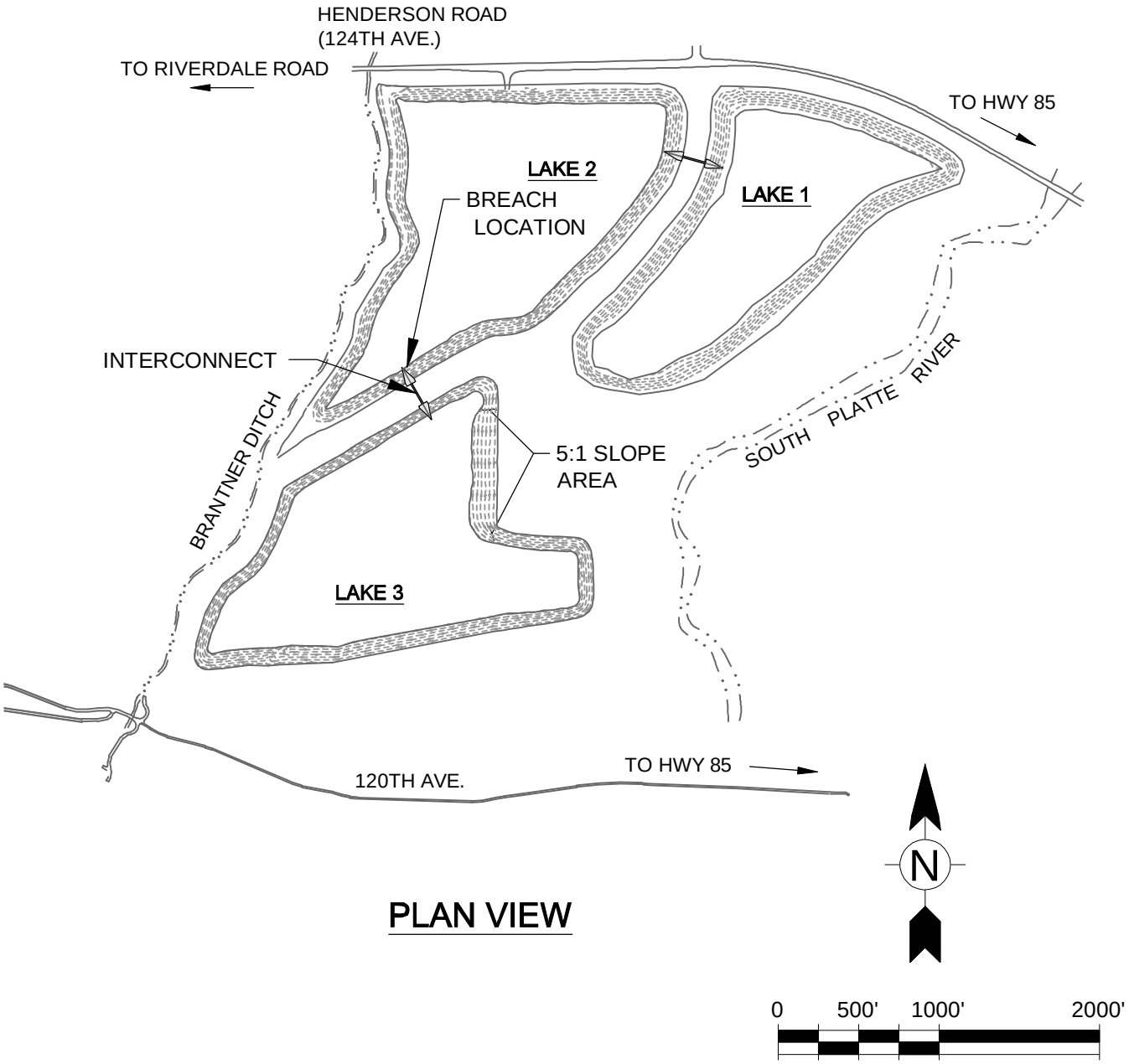
Date	Total Calculated Seepage (cubic feet per day)/(gpm)
6/27/2012	3438/17.9
7/03/2012	4177/21.70
7/09/2012	15,386/79.91
7/17/2012	5045/26.21

Note: Maximum allowable seepage rate per design standard is for Lake #2 is 52.0 gpm (10,150 cfd).

4.0 CONCLUSIONS

Calculated seepage into Mann Lakes, Lake #2 ranged from approximately 3,438 cubic feet per day (17.9 gpm) to 15,386 cubic feet per day (79.9 gpm). Based on observation of the slope liner breach repair and measurements from the leak tests, it is our opinion that the slope liner for Mann Lakes, Lake #2 continue to meet the design seepage standards of the State Engineer.

FIGURES



PLAN VIEW

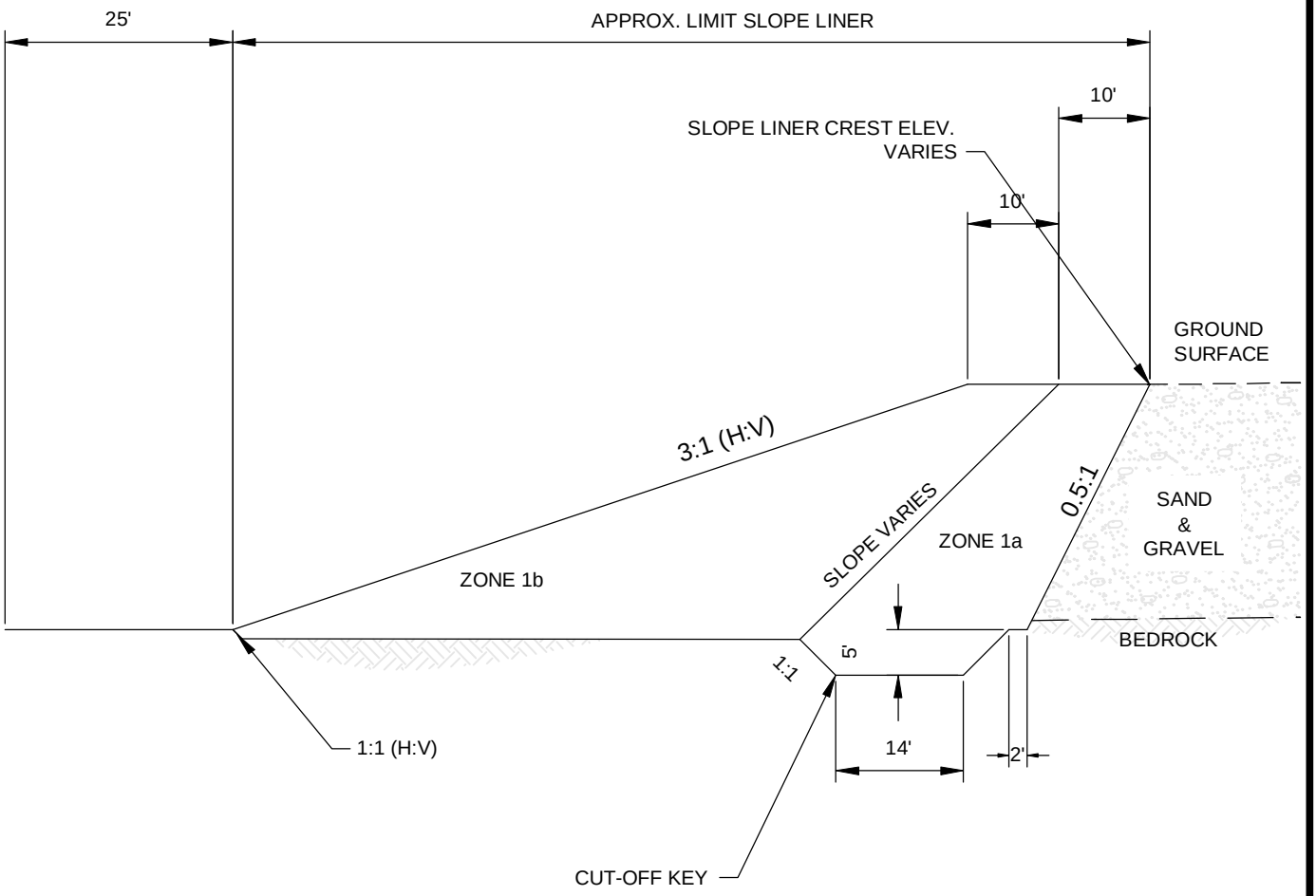
TETRA TECH
www.tetratech.com
1900 S. Sunset Street, Ste. 1-F
Longmont, Colorado 80501
PHONE: (303) 772-5282 FAX: (303) 772-7039

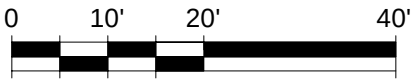
Drawing Description
ADAMS COUNTY MANN LAKES
LAKE 2 LEAK TEST

PLAN VIEW

Project No.:	133-60071-12001
Date:	7-19-2012
Designed By:	JD

FIG 1





SCALE: 1" = 20'

NOTE:

1. DIMENSIONS SHOWN ARE FOR TETRA TECH DESIGNED LOCATIONS ONLY.
2. LINERS CONSTRUCTED BY OTHERS ARE ASSUMED TO BE SIMILAR.

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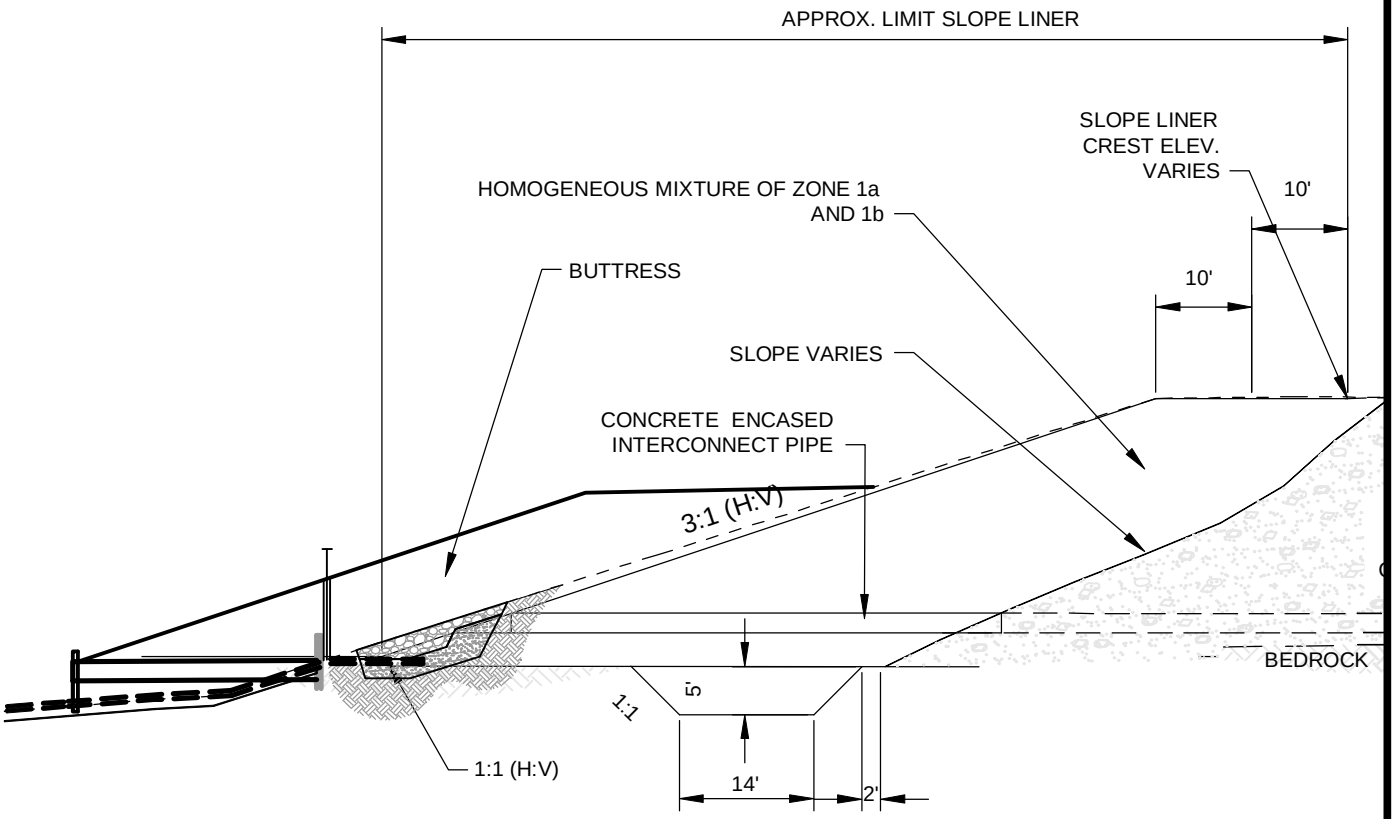
ADAMS COUNTY MANN LAKES

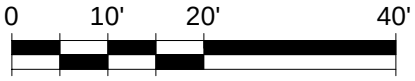
LAKE 2 LEAK TEST

TYPICAL SLOPE LINER SECTION

Project No.:	133-60071-12001
Date:	7-19-2012
Designed By:	JD

FIG 2





SCALE: 1" = 20'

NOTE:

1. KEYWAY LOCATION AND DIMENSIONS ARE APPROXIMATE.

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Drawing Description

ADAMS COUNTY MANN LAKES

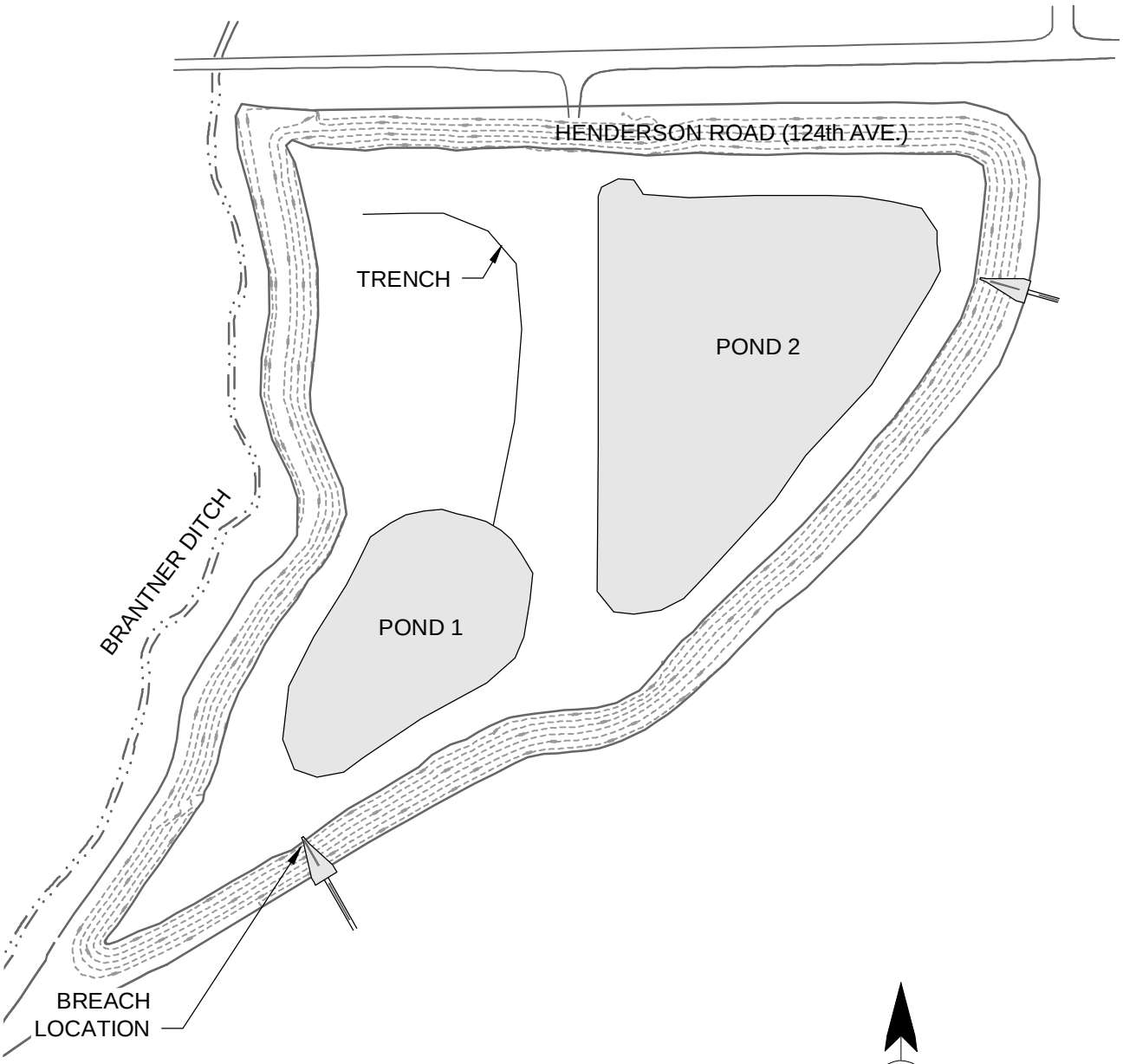
LAKE 2 LEAK TEST

TYPICAL SLOPE LINER

BREACH REPAIR SECTION W/BUTTRESS

Project No.:	133-60071-12001
Date:	7-19-2012
Designed By:	JD

FIG 3



NOTE:

1. POND AND TRENCH APPROXMATELY LOCATED.

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Drawing Description

ADAMS COUNTY MANN LAKES

LAKE 2 LEAK TEST

PLAN VIEW

APPROX. POND AND TRENCH LOCATIONS

Project No.:	133-60071-12001
Date:	7-19-2012
Designed By:	JD

FIG 4

POND 2, LAKE 2

TRENCH, LAKE 2

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Drawing Description

ADAMS COUNTY MANN LAKES

LAKE 2 LEAK TEST

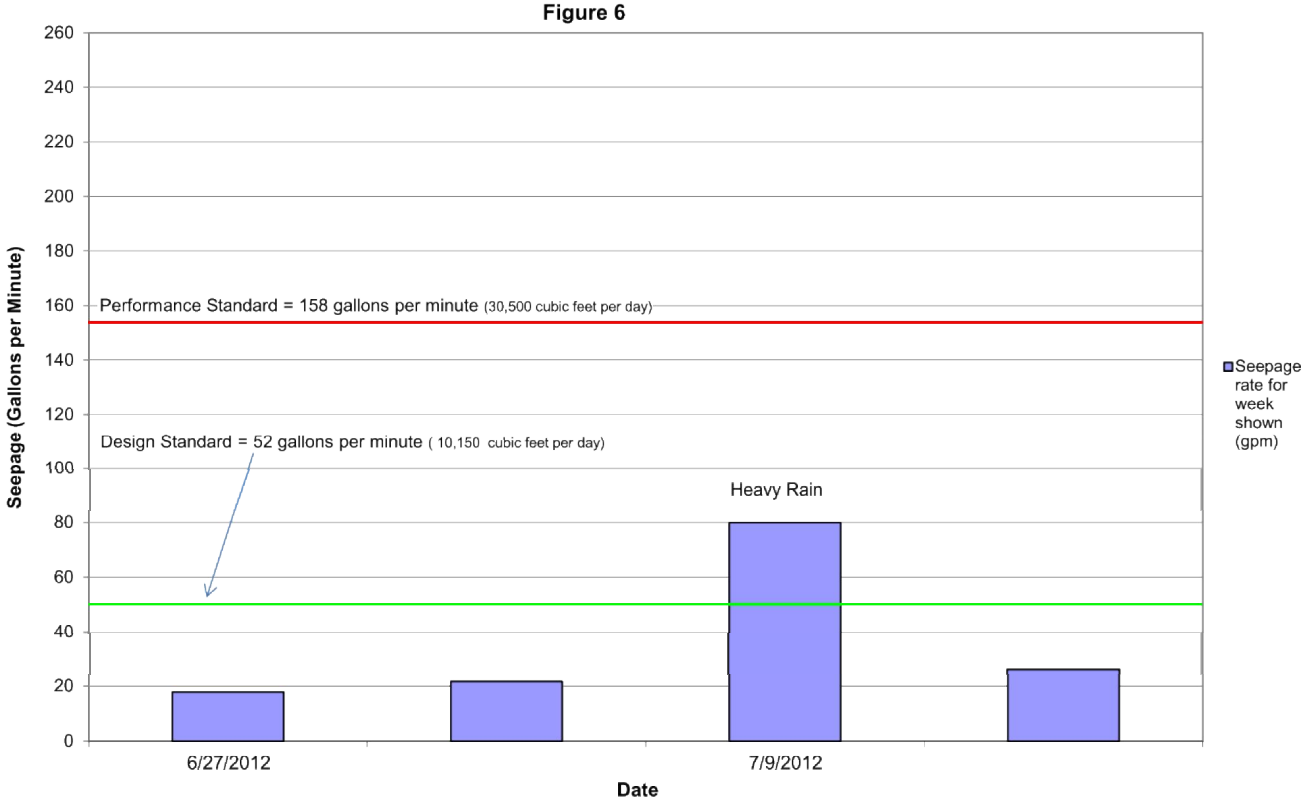
PHOTOS

POND 2 AND TRENCH

Project No.:	133-60071-12001
Date:	7-19-2012
Designed By:	JD

FIG 5

Total Calculated Seepage - Mann Lakes, Lake #2
Figure 6



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Drawing Description
ADAMS COUNTY MANN LAKES
LAKE 2 LEAK TEST
LAKE 2

CALCULATED SEEPAGE

Project No.:	133-60071-12001
Date:	7-19-2012
Designed By:	JD

FIG 6

APPENDIX A

LEAK TEST CERTIFICATION LETTERS

DEPARTMENT OF NATURAL RESOURCES

DIVISION OF WATER RESOURCES

Bill Ritter, Jr.
Governor

Harris D. Sherman
Executive Director

Dick Wolfe, P.E.
Director/State Engineer

September 10, 2009

Gary Linden
Tetra Tech RMC
1900 South Sunset Street, Suite 1-F
Longmont, Colorado 80501

SUBJECT: Mann Lakes #2 and #3 Leak Test
Tetra Tech Job No. 133-23511-09002
Water Division 1, Water District 2
Section 34, Township 1 South, Range 67

Dear Peter:

The purpose of this letter is to approve the lining of the above referenced gravel pit. This approval is based on the information you provided under cover letters dated May 27, 2009 and September 2, 2009 as well as the site inspection conducted on June 8, 2009. The estimated pit inflows from precipitation and groundwater and outflows due to evaporation indicate that **this pit has been lined to the design standard** referenced in the August 1999 State Engineer Guidelines for Lining Criteria for Gravel Pits. **Meeting the design standard requires that all water inflows and outflows for this pond must be accounted for on a monthly basis.**

Please call me if you have any questions.

Sincerely,

Jana C Ash

Jana C. Ash, P.E.
Water Resource Engineer

CC: Scott Edgar, Water Commissioner
Jeff Deatherage, Denver SEO
Dave Nettles, Denver SEO

STATE OF COLORADO

WATER DIVISION ONE
OFFICE OF THE STATE ENGINEER
Division of Water Resources
Department of Natural Resources

810 9th Street, Suite 200
Greeley, Colorado 80631
Phone (970) 352-8712
Fax (970) 392-1816

www.water.state.co.us

November 21, 2006

Jennifer Lee
Applegate Group, Inc.
1499 West 120th Avenue, Suite 200
Denver, CO 80234-2728

Re: Lining of Mann Lake No 1. Pit, DMG #82147
Section 34, T1S, R67W
Water Division 1, Water District 2

Dear Jennifer:

The purpose of this letter is to approve the lining of the above referenced site. This approval is based on the site inspection conducted on May 24, 2006 and on the information you provided under cover letters dated May 30, and September 12, 2006. The estimated site groundwater and precipitation inflows and the outflows due to evaporation indicate that **this site has been lined to the design standard** referenced in the August, 1999 State Engineer Guidelines for Lining Criteria for Gravel Pits. **Meeting the design standard requires that all water inflows and outflows for this site must be accounted for on at least a monthly basis.**

Please call me if you have any questions.

Sincerely,

David L. Nettles, P.E.
Assistant Division Engineer

MannLakeNo1PitLineOK.doc

CC: Bob Stahl, Water Commissioner
Joanna Williams, Denver SEO

DEPARTMENT OF NATURAL RESOURCES

DIVISION OF WATER RESOURCES

May 25, 2011

TETRA TECH
JEREMY DEUTO, P.G.
1900 S. SUNSET STREET, SUITE 1-F
LONGMONT, CO 80501

RE: COMPACTED CLAY LINER APPROVAL
MANN LAKES, WDID 0203911,
S34-T1S-R67W, WATER DIVISION 1, WATER DISTRICT 2

Dear Jeremy:

The purpose of this letter is to approve the lining of the Mann Lakes Reservoir. Mann Lakes Reservoir is comprised of Mann Lakes #1, #2, & #3 and is located in the SW¼, S½NW¼, SW¼NE¼, NW¼SE¼ in Section 34, and in the SE¼SE¼ in Section 33, all in Township 1 South, Range 67 West and was originally a part of the Mann Lakes Pit (DRMS M-1982-147). The compacted clay liner test commenced April 8, 2011 and concluded on May 10, 2011. A site inspection was performed by our office on May 10, 2011 to review site conditions and preliminary leak test data. All three lakes were previously tested and approved at the design standard. The purpose of this test was to analyze the liner performance after being intentionally breached as part of an interconnect project. For these reasons, the test duration was modified to 30-days.

Your report dated May 2011 provides the liner summary and 30-day leak test result. The test data provided indicates that **the pit has been lined to the design standard** referenced in the August 1999 State Engineer Guidelines for Lining Criteria for Gravel Pits (1999 SEO Guidelines). **Meeting the design standard requires that all water inflows and outflows for the liner perimeter enclosed area must be accounted for on a monthly basis**.

With this liner approval, Mann Lakes Reservoir may be used to store water in accordance with the 1999 SEO Guidelines. Prior to **ANY** use of this site, the owner or operator will need to coordinate with the District 2 Water Commissioner to review operations and accounting.

Please contact me at the number below if you have any questions.

Sincerely,

Jonathan M. Hernandez, P.E.
Water Resource Engineer

ec: Scott Edgar, District 2 Water Commissioner
Joanna Williams, Denver SEO

APPENDIX B

LEAK TEST DATA

Appendix A
Mann Lakes, Lake #2 Leak Test
Weather Station Data
Northern Colorado Water Conservancy District
Fort Lupton Station
http://www.ncwcd.org/ims/ims_weather_form.asp

Station Name	Date/Time	Max Air Temp (°F)	Min Air Temp (°F)	Ave Air Temp (°F)	Rel Humidity (%)	Vapor Pressure (kPa)	Dewpoint Temp (°F)	Rain (TB) (in)	Catch (WB) (in)	Precip (WB) (in)	Max Wind Speed (3m) (mph)	Ave Wind Speed (3m) (mph)	Ave Wind Speed (2m) (mph)	WindVec Vel (3m) (mph)	WindVec Dir (3m) (°)	WindVec Std Dev Dir (°)	Wind Travel Tot (mph)	Ave Soil Temp (°F)	Solar Rad Tot (cal/cm2)	Rso Clear Sky (cal/cm2)	ETrs Alfalfa Tot (in)	ETos Grass Tot (in)	kp EvapPan (in)	Pan Evaporation (Eto/Kp) (inch)	Pan Evaporation Total for Measurement Days (inch)
Fort Lupton	6/17/2012 0:00	96.90	54.60	78.51	32.20	0.85	39.60	0.00	3.43	-0.01	25.00	5.85	5.38	3.34	247.60	53.10	140.30	65.80	758.90		0.44	0.33	0.74		
Fort Lupton	6/18/2012 0:00	100.80	65.20	83.10	21.10	0.75	36.80	0.00	3.44	0.01	18.50	6.29	5.79	2.64	219.90	61.70	150.90	67.40	747.60		0.46	0.35	0.71	0.49	
Fort Lupton	6/19/2012 0:00	95.80	65.90	80.90	23.00	0.78	37.90	0.00	3.44	0.00	29.10	9.83	9.05	6.68	92.60	45.90	235.80	67.50	738.60		0.55	0.40	0.67	0.59	
Fort Lupton	6/20/2012 0:00	78.10	56.60	66.99	51.30	1.09	46.40	0.00	3.45	0.01	22.60	6.51	6.00	5.12	53.80	37.50	156.30	66.70	535.50		0.27	0.21	0.76	0.28	
Fort Lupton	6/21/2012 0:00	90.00	59.30	74.80	34.70	0.99	44.20	0.00	3.45	0.00	24.10	7.75	7.13	6.18	167.50	36.40	186.00	68.40	727.40		0.42	0.32	0.71	0.45	
Fort Lupton	6/22/2012 0:00	103.40	55.20	80.94	34.20	0.99	43.20	0.00	3.45	0.00	24.70	4.99	4.60	2.34	307.00	59.10	119.90	69.30	684.40		0.39	0.30	0.76	0.39	
Fort Lupton	6/23/2012 0:00	103.90	59.20	85.33	28.00	0.90	40.70	0.00	3.43	-0.02	23.10	5.86	5.40	2.93	113.60	57.30	140.70	70.70	759.10		0.46	0.35	0.74	0.48	
Fort Lupton	6/24/2012 0:00	103.00	61.50	84.81	28.00	1.02	44.90	0.00	3.44	0.01	45.50	5.97	5.49	1.78	334.50	67.90	143.20	71.10	703.70		0.44	0.34	0.73	0.46	
Fort Lupton	6/25/2012 0:00	105.20	66.10	85.77	31.30	1.08	45.60	0.00	3.43	0.00	21.60	6.53	6.01	3.95	193.10	50.90	156.60	71.80	724.50		0.48	0.36	0.73	0.49	
Fort Lupton	6/26/2012 0:00	101.40	68.00	85.63	23.60	0.93	42.70	0.00	3.44	0.00	33.60	7.17	6.60	4.04	243.60	53.50	172.20	70.00	579.30		0.50	0.35	0.70	0.50	
Fort Lupton	6/27/2012 0:00	98.10	62.90	80.24	36.80	1.21	49.20	0.00	3.44	0.00	31.70	6.17	5.68	3.38	180.30	54.40	148.10	69.80	457.00		0.35	0.26	0.74	0.35	4.47
Fort Lupton	6/28/2012 0:00	93.10	58.30	76.42	43.60	1.17	47.90	0.00	3.44	0.00	24.30	4.78	4.40	2.17	200.80	59.90	114.80	68.80	420.60		0.28	0.21	0.77	0.27	
Fort Lupton	6/29/2012 0:00	97.30	57.00	78.51	35.70	1.00	44.00	0.00	3.44	0.00	33.40	5.38	4.95	1.70	198.10	67.00	129.10	69.80	628.90		0.42	0.31	0.75	0.41	
Fort Lupton	6/30/2012 0:00	98.60	60.50	80.26	29.90	0.92	41.90	0.00	3.43	-0.01	24.60	4.34	4.00	1.12	11.10	69.80	104.20	70.40	681.90		0.37	0.29	0.75	0.38	
Fort Lupton	7/1/2012 0:00	100.50	60.30	81.75	29.30	0.95	42.50	0.00	3.45	0.01	31.60	7.24	6.66	5.06	157.40	44.40	173.70	71.70	740.70		0.47	0.35	0.72	0.49	
Fort Lupton	7/2/2012 0:00	99.10	63.90	80.19	39.70	1.25	50.20	0.00	3.44	0.00	30.90	6.73	6.19	2.51	22.90	64.10	161.50	72.40	695.00		0.45	0.34	0.74	0.45	
Fort Lupton	7/3/2012 0:00	94.30	63.70	78.44	40.30	1.22	49.50	0.00	3.45	0.01	23.90	6.56	6.04	3.43	210.40	55.90	157.40	71.60	461.90		0.36	0.26	0.74	0.35	2.37
Fort Lupton	7/4/2012 0:00	96.80	60.40	80.31	35.30	1.07	45.90	0.00	3.44	-0.01	22.10	5.37	4.94	2.41	65.40	60.10	128.80	70.60	617.90		0.39	0.29	0.75	0.39	
Fort Lupton	7/5/2012 0:00	96.80	66.80	78.28	50.90	1.58	56.60	0.00	3.45	0.00	26.40	5.89	5.42	2.21	68.00	64.10	141.40	72.60	619.00		0.36	0.28	0.77	0.36	
Fort Lupton	7/6/2012 0:00	87.80	60.80	71.88	60.50	1.54	56.00	0.00	3.78	0.33	31.80	8.25	7.60	5.58	0.20	46.10	198.00	70.90	548.30		0.32	0.24	0.76	0.32	
Fort Lupton	7/7/2012 0:00	80.90	60.80	67.50	79.40	1.75	59.80	0.00	4.25	0.47	30.10	5.16	4.75	1.21	111.70	70.90	123.80	69.80	370.90		0.19	0.15	0.82	0.18	
Fort Lupton	7/8/2012 0:00	76.80	60.90	67.37	79.60	1.79	60.30	0.00	4.23	-0.01	21.00	3.26	3.00	1.95	57.80	51.50	78.30	70.30	382.50		0.16	0.14	0.85	0.16	
Fort Lupton	7/9/2012 0:00	82.10	61.00	70.32	68.80	1.67	58.20	0.00	4.24	0.01	16.40	6.34	5.83	5.65	111.50	26.60	152.10	71.30	473.30		0.21	0.18	0.79	0.22	1.63
Fort Lupton	7/10/2012 0:00	84.30	60.80	72.97	51.20	1.31	51.20	0.00	4.23	-0.01	18.20	6.04	5.56	4.90	129.20	35.30	144.90	71.90	710.10		0.35	0.27	0.77	0.36	
Fort Lupton	7/11/2012 0:00	90.70	58.80	75.41	49.50	1.36	52.70	0.00	4.23	0.01	19.20	3.68	3.38	1.18	319.50	66.80	88.20	72.20	630.00		0.28	0.23	0.79	0.29	
Fort Lupton	7/12/2012 0:00	92.10	61.80	77.92	41.20	1.22	49.50	0.00	4.23	-0.01	19.00	4.80	4.42	2.01	25.10	61.80	115.20	72.10	650.10		0.35	0.27	0.77	0.35	
Fort Lupton	7/13/2012 0:00	95.40	61.20	79.15	36.60	1.11	46.50	0.00	4.22	0.00	19.50	5.31	4.89	2.54	135.00	58.50	127.50	72.60	687.60		0.39	0.30	0.75	0.41	
Fort Lupton	7/14/2012 0:00	94.40	62.10	78.89	34.90	1.06	45.30	0.00	4.22	-0.01	28.00	5.98	5.50	3.74	158.80	49.50	143.50	71.50	560.00		0.40	0.29	0.74	0.39	
Fort Lupton	7/15/2012 0:00	95.50	63.20	78.82	39.20	1.24	50.20	0.00	4.23	0.01	30.90	5.35	4.93	1.71	305.30	66.80	128.40	71.90	625.90		0.37	0.28	0.75	0.38	
Fort Lupton	7/16/2012 0:00	93.70	62.20	74.72	49.80	1.35	52.40	0.00	4.26	0.03	30.80	7.03	6.47	2.98	237.40	61.50	168.70	72.00	588.30		0.35	0.27	0.76	0.35	
Fort Lupton	7/17/2012 0:00	88.90	62.50	75.83	47.50	1.33	51.90	0.00	4.26	0.00	22.60	5.05	4.65	1.70	1.90	66.00	121.10	71.20	649.80		0.34	0.27	0.77	0.35	2.88

L&M Enterprises

Mann Lakes, Lake #2

133-60071-11001

Measurements for Pond #1

Date	Elapsed time since last measurement (minutes)	Initial Area (feet)				Change in Area (feet)			New Surface Area (sq feet)	Staff Gauge Reading (feet from top of post)	Change in Water Height (feet, Δh)	Rain Gauge Reading (inch)	Rain Gauge Reading (feet)	Precipitation Volume over Non- ponded Surfaces (30% Total Precip)	Pan Evaporation from Weather Station (feet)	Precipitation Minus Evaporation (feet, Δw)	Seepage (feet, Δh - Δw)	Seepage (feet, Δh - Δw)	Seepage Volume for Average Area (cubic feet, Δva)	Seepage Rate (cubic feet per minute)	Seepage Rate (cubic feet per day)
		Length	Width	Perimeter	Surface Area (sq feet)	Length	Width	Perimeter													
6/17/12 0:00		1100	770		847000.0				847000	2.10											
6/27/12 0:00	14400	1100	770		847000.0	-125	-6	-262	744900	2.52	-0.42	0.00	0.0000	0	0.373	-0.37	-0.047	0.000	0.0	0.000	0.00
7/3/12 0:00	8640	1100	770		847000.0	-140	-12	-304	727680	2.69	-0.17	0.000	0.0000	0	0.197	-0.20	0.027	0.027	20148.3	2.332	3358.05
7/9/2012 0:00	8640	1100	770		847000.0	-145	-15	-320	721025	2.55	0.14	1.400	0.1167	55623	0.135	-0.02	0.159	0.159	59397.0	6.875	9899.50
7/17/2012 0:00	11520	1100	770		847000.0	-165	-30	-390	691900	2.72	-0.17	0.200	0.0167	8028	0.240	-0.22	0.053	0.053	29616.6	2.571	3702.07

L&M Enterprises

Mann Lakes, Lake #2

133-60071-11001

Measurements for Pond #2

Date	Elapsed time since last measurement (minutes)	Initial Area (feet)				Change in Area (feet)			New Surface Area (sq feet)	Staff Gauge Reading (feet from top of post)	Change in Water Height (feet, Δh)	Rain Gauge Reading (inch)	Rain Gauge Reading (feet)	Pan Evaporation from Weather Station (feet)	Precipitation Minus Evaporation (feet, Δw)	Seepage (feet, Δh - Δw)	Seepage Volume for Average Area (cubic feet, Δva)	Seepage Rate (cubic feet per minute)	Seepage Rate (cubic feet per day)
		Length	Width	Perimeter	Surface Area (sq feet)	Length	Width	Perimeter											
6/17/12 0:00		470	350		164500.0				164500	2.10									
6/27/12 0:00	14400	470	350		164500.0	-45	-15	-120	142375	2.25	-0.15	0.000	0.0000	0.373	-0.37	0.223	34185.0	2.374	3418.50
7/3/12 0:00	8640	470	350		164500.0	-70	-25	-190	130000	2.42	-0.17	0.000	0.0000	0.197	-0.20	0.027	3726.7	0.431	621.12
7/9/12 0:00	8640	470	350		164500.0	-72	-32	-208	126564	2.29	0.13	0.117	0.0097	0.135	-0.13	0.256	32806.2	3.797	5467.70
7/17/12 0:00	11520	470	350		164500.0	-85	-50	-270	115500	2.45	-0.16	0.017	0.0014	0.240	-0.24	0.079	9508.7	0.825	1188.58

L&M Enterprises

Mann Lakes, Lake #2

133-60071-11001

Measurements for Trench

Date	Elapsed time since last measurement (minutes)	Initial Area (feet)				Change in Area (feet)				Staff Gauge Reading (feet from top of post)	Change in Water Height (feet, Δh)	Rain Gauge Reading (inch)	Rain Gauge Reading (feet)	Pan Evaporation from Weather Station (feet)	Precipitation Minus Evaporation (feet, Δw)	Seepage (feet, Δh - Δw)	Seepage (feet, Δh - Δw)	Seepage Volume for Average Area (cubic feet, Δva)	Seepage Rate (cubic feet per minute)	Seepage Rate (cubic feet per day)
		Length	Width	Perimeter	Surface Area (sq feet)	Length	Width	Perimeter												
6/17/12 0:00		1200	5		6000				6000	1.00		0	0							
6/27/12 0:00	14400	1200	5		6000	-20	0	-40	5900	1.00	0	0.00	0.34	0.373	-0.03	0.033	0.033	196.8	0.014	19.68
7/3/12 0:00	8640	1200	5		6000	-75	0	-150	5625	1.00	0	0.00	0.0000	0.197	-0.20	0.197	0.197	1184.2	0.137	197.36
7/9/12 0:00	8640	1200	5		6000	-75	0	-150	5625	1.00	0	1.40	0.1167	0.135	-0.02	0.019	0.019	112.7	0.013	18.79
7/17/12 0:00	11520	1200	5		6000	-115	0	-230	5425	1.00	0	0.20	0.0167	0.240	-0.22	0.223	0.223	1233.7	0.107	154.21

L&M Enterprises

Mann Lakes, Lake #2

133-60071-11001

Total Seepage (CFD)

Date	Seepage (cubic feet per day)			Total Seepage (cubic feet per day)	Allowable Seepage (performance, cubic feet per day)	Difference (Measured Seepage - Allowable Seepage)
	Pond # 1	Pond # 2	Trench			
6/17/2012						
6/27/2012	0.00	3418.50	19.68	3438.18	10150	-6711.82
7/3/2012	3358.05	621.12	197.36	4176.54	10150	-5973.46
7/9/2012	9899.50	5467.70	18.79	15385.99	10150	5235.99
7/17/2012	3702.07	1188.58	154.21	5044.86	10150	-5105.14

L&M Enterprises

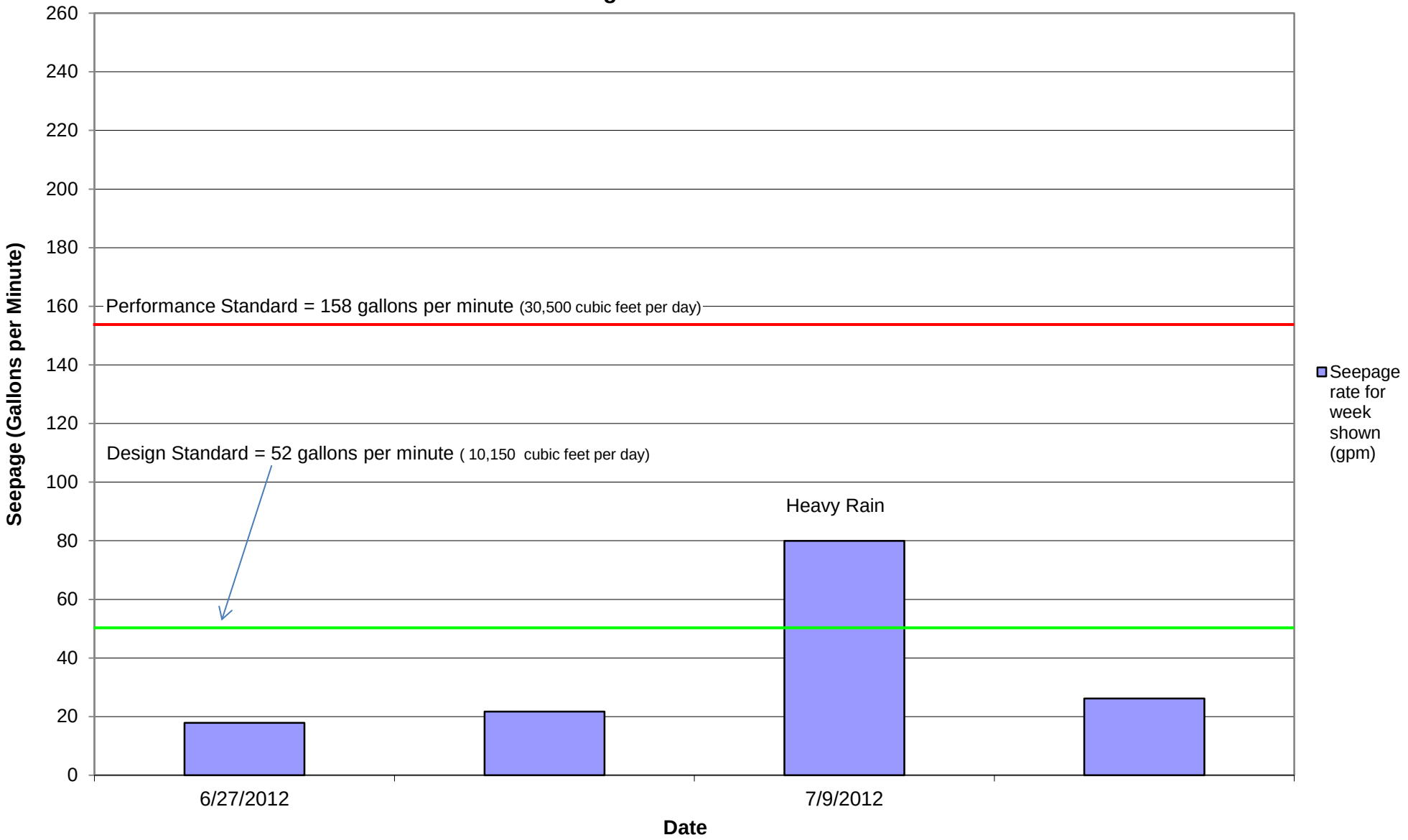
Mann Lakes, Lake #2

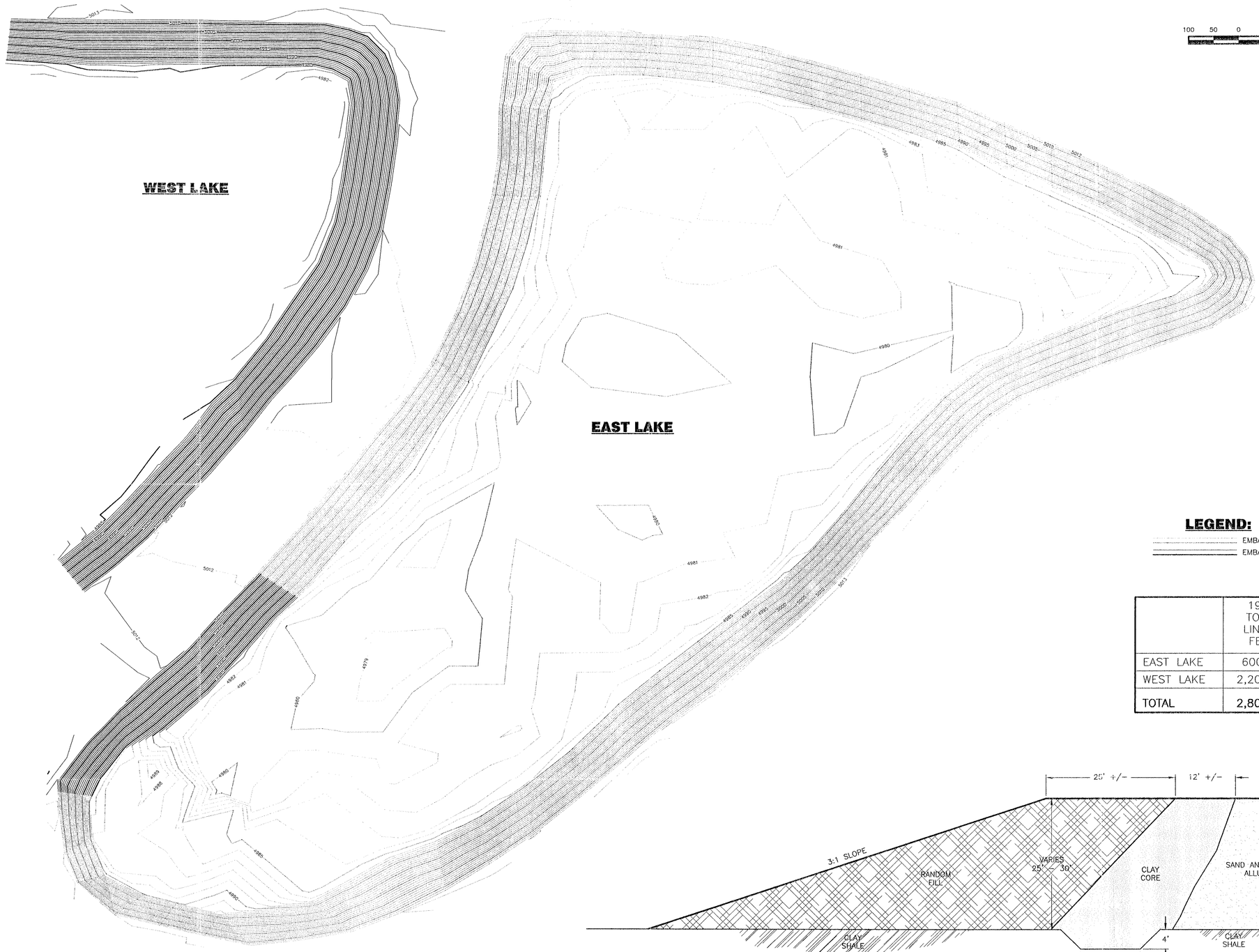
133-60071-11001

Total Seepage (GPM)

Date	Pond # 1	Pond # 2	Trench	Total Seepage (gal/min)	Allowable Seepage (performance, gal/min)	Difference (Measured Seepage - Allowable
6/17/2012						
6/27/2012	0.000	17.758	0.102	17.86	52	-34.14
7/3/2012	17.444	3.227	1.025	21.70	52	-30.30
7/9/2012	51.426	28.404	0.098	79.93	52	27.93
7/17/2012	19.232	6.174	0.801	26.21	52	-25.79

Total Calculated Seepage - Mann Lakes, Lake #2
Figure 6



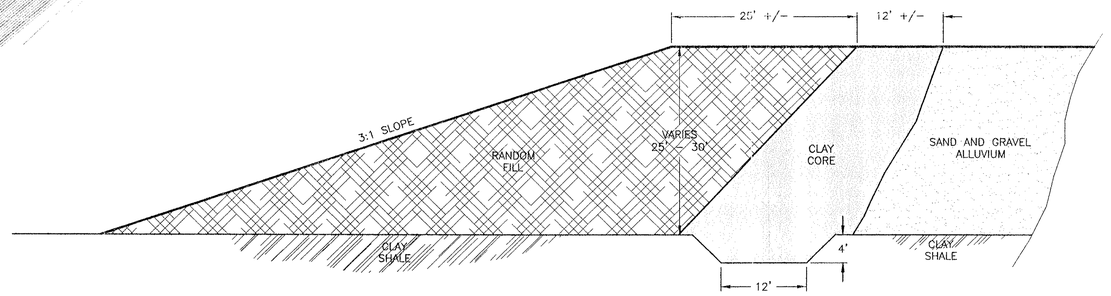


LEGEND:

EMBANKMENT PLACED PRIOR TO 1998

EMBANKMENT PLACED IN 1998

	1998 TOTAL LINEAR FEET	1998 TOTAL COMPACTED LINER
EAST LAKE	600 ft.	54,024 cy
WEST LAKE	2,200 ft.	151,319 cy.
TOTAL	2,800 ft.	205,343 cy



TYPICAL SECTION

SCALE 1" = 10'

TuttleApplegate, Inc.

Consultants for Land, Minerals, and Water

11990 Grant Street - Suite 304
Denver, Co. 80233
(303)452-6611 Fax: (303)452-2759
email: tuttapp@aol.net FTP: ftp.ssd.net/users/tuttapple

MANN LAKES

1998 RESERVOIR LINER VOLUME CHECK

LAFARGE

NO	DATE	BY	CHK'D	DESCRIPTION

REVISIONS

Date: 12/10/98
Job No: 98-201
Drawn: TPY
Design:
Checked: TLM
File: volume check.dwg
Scale: 1"=100'

Sheet: 1 Of: 1

0:\Drawings\98201\Volumes\volume check.dwg Wed Dec 16 11:03:33 1998 LLD

STATE OF COLORADO

WATER DIVISION ONE
OFFICE OF THE STATE ENGINEER
Division of Water Resources
Department of Natural Resources

810 9th Street, Suite 200
Greeley, Colorado 80631
Phone (970) 352-8712
Fax (970) 392-1816

www.water.state.co.us

November 21, 2006

Jennifer Lee
Applegate Group, Inc.
1499 West 120th Avenue, Suite 200
Denver, CO 80234-2728

Re: Lining of Mann Lake No 1. Pit, DMG #82147
Section 34, T1S, R67W
Water Division 1, Water District 2

Dear Jennifer:

The purpose of this letter is to approve the lining of the above referenced site. This approval is based on the site inspection conducted on May 24, 2006 and on the information you provided under cover letters dated May 30, and September 12, 2006. The estimated site groundwater and precipitation inflows and the outflows due to evaporation indicate that **this site has been lined to the design standard** referenced in the August, 1999 State Engineer Guidelines for Lining Criteria for Gravel Pits. **Meeting the design standard requires that all water inflows and outflows for this site must be accounted for on at least a monthly basis.**

Please call me if you have any questions.

Sincerely,

David L. Nettles, P.E.
Assistant Division Engineer

MannLakeNo1PitLineOK.doc

CC: Bob Stahl, Water Commissioner
Joanna Williams, Denver SEO

DEPARTMENT OF NATURAL RESOURCES

DIVISION OF WATER RESOURCES

John W. Hickenlooper
Governor

Mike King
Executive Director

Dick Wolfe, P.E.
Director/State Engineer

David L. Nettles, P.E.
Division Engineer

July 24, 2012

TETRA TECH
JEREMY DEUTO, P.G.
1900 S. SUNSET STREET, STE 1-F
LONGMONT, CO 80501

RE: COMPACTED CLAY LINER APPROVAL
MANN LAKES RESERVOIR (WDID 0203911)
S34-T1S-R67W, WATER DIVISION 1, WATER DISTRICT 2

Dear Jeremy:

The purpose of this letter is to approve the lining of the Mann Lakes Reservoir. This reservoir is located in comprised of Mann Lakes # 1, #2, & #3 and is located in the SW¼, S½NW¼, SW¼NE¼, NW¼SE¼ in Section 34, and in the SE¼SE¼ in Section 33, all in Township 1 South, Range 67 West and was originally a part of the Mann Lakes Pit (DRMS M-1982-147). The reservoir was tested and approved on May 25, 2011 as meeting the design standard. In August of 2011 a localized leak in the liner developed at Lake #2's interconnect and was subsequently repaired in early 2012. The purpose of this test was to analyze the liner repair and re-verify the previously approved liner once again met the design standard. For these reasons, the test duration was modified to 30-days. The liner test commenced June 17, 2012 and concluded on July 17, 2012. Only the liner for Lake #2 was re-tested.

Your report dated July 23, 2012 provides the liner summary and 30-day leak test result. The test data provided indicates that **the reservoir liner meets the design standard** referenced in the August 1999 State Engineer Guidelines for Lining Criteria for Gravel Pits (1999 SEO Guidelines). **Meeting the design standard requires that all water inflows and outflows for the liner perimeter enclosed area must be accounted for on a monthly basis**.

With this liner approval, Mann Lakes Reservoir is again classified as a lined reservoir in accordance with the 1999 SEO Guidelines. Water shall not be impounded by the reservoir except pursuant to lawful diversions allowed by statute or decree. At all other times, all inflow of water into the reservoir from any source, including precipitation and ground water inflows shall be removed by the reservoir operator. Prior to ANY use of this site, the owner or operator will need to coordinate with Bill Schneider, District 2 Water Commissioner, to review operations, measurement structures, and accounting.

Please contact me at the number below if you have any questions.

Sincerely,

Jonathan M. Hernandez, P.E.
Water Resource Engineer

ec: Bill Schneider, District 2 Water Commissioner (william.schneider@state.co.us)
WDID File (0203911)

DEPARTMENT OF NATURAL RESOURCES

DIVISION OF WATER RESOURCES

May 25, 2011

TETRA TECH
JEREMY DEUTO, P.G.
1900 S. SUNSET STREET, SUITE 1-F
LONGMONT, CO 80501

RE: COMPACTED CLAY LINER APPROVAL
MANN LAKES, WDID 0203911,
S34-T1S-R67W, WATER DIVISION 1, WATER DISTRICT 2

Dear Jeremy:

The purpose of this letter is to approve the lining of the Mann Lakes Reservoir. Mann Lakes Reservoir is comprised of Mann Lakes #1, #2, & #3 and is located in the SW¼, S½NW¼, SW¼NE¼, NW¼SE¼ in Section 34, and in the SE¼SE¼ in Section 33, all in Township 1 South, Range 67 West and was originally a part of the Mann Lakes Pit (DRMS M-1982-147). The compacted clay liner test commenced April 8, 2011 and concluded on May 10, 2011. A site inspection was performed by our office on May 10, 2011 to review site conditions and preliminary leak test data. All three lakes were previously tested and approved at the design standard. The purpose of this test was to analyze the liner performance after being intentionally breached as part of an interconnect project. For these reasons, the test duration was modified to 30-days.

Your report dated May 2011 provides the liner summary and 30-day leak test result. The test data provided indicates that **the pit has been lined to the design standard** referenced in the August 1999 State Engineer Guidelines for Lining Criteria for Gravel Pits (1999 SEO Guidelines). **Meeting the design standard requires that all water inflows and outflows for the liner perimeter enclosed area must be accounted for on a monthly basis.**

With this liner approval, Mann Lakes Reservoir may be used to store water in accordance with the 1999 SEO Guidelines. Prior to **ANY** use of this site, the owner or operator will need to coordinate with the District 2 Water Commissioner to review operations and accounting.

Please contact me at the number below if you have any questions.

Sincerely,

Jonathan M. Hernandez, P.E.
Water Resource Engineer

ec: Scott Edgar, District 2 Water Commissioner
Joanna Williams, Denver SEO

DEPARTMENT OF NATURAL RESOURCES

DIVISION OF WATER RESOURCES

Bill Ritter, Jr.
Governor

Harris D. Sherman
Executive Director

Dick Wolfe, P.E.
Director/State Engineer

September 10, 2009

Gary Linden
Tetra Tech RMC
1900 South Sunset Street, Suite 1-F
Longmont, Colorado 80501

SUBJECT: Mann Lakes #2 and #3 Leak Test
Tetra Tech Job No. 133-23511-09002
Water Division 1, Water District 2
Section 34, Township 1 South, Range 67

Dear Peter:

The purpose of this letter is to approve the lining of the above referenced gravel pit. This approval is based on the information you provided under cover letters dated May 27, 2009 and September 2, 2009 as well as the site inspection conducted on June 8, 2009. The estimated pit inflows from precipitation and groundwater and outflows due to evaporation indicate that **this pit has been lined to the design standard** referenced in the August 1999 State Engineer Guidelines for Lining Criteria for Gravel Pits. **Meeting the design standard requires that all water inflows and outflows for this pond must be accounted for on a monthly basis.**

Please call me if you have any questions.

Sincerely,

Jana C Ash

Jana C. Ash, P.E.
Water Resource Engineer

CC: Scott Edgar, Water Commissioner
Jeff Deatherage, Denver SEO
Dave Nettles, Denver SEO