AP - 111

SUMMARY REPORT EVAPORATION POND REPAIRS (1)

12/17/2015

December 22, 2015

Certified Mail #7014 1820 0001 7489 1645, Return Receipt Requested

Mr. John E. Kieling, Chief
New Mexico Environment Department
Hazardous Waste Bureau
2905 Rodeo Park Drive East, Bldg. 1
Santa Fe, New Mexico 87505-6303

Mr. Carl J. Chavez, CHMM
New Mexico Energy, Minerals & Natural Resources Department
Oil Conservation Division, Environmental Bureau
1220 South St. Francis Drive
Santa Fe, New Mexico 87505

RE: LETTER REPORT
EVAPORATION POND 7 DIKE BREACH
WESTERN REFINING SOUTHWEST INC., GALLUP REFINERY
EPA ID # NMD000333211
HWB-WRG-15-MISC

Dear Messrs. Kieling and Chavez:

This letter provides the response of Western Refining Southwest, Inc.'s Gallup refinery ("Western") to communication from both the New Mexico Oil Conservation Division ("NMOCD") and New Mexico Environment Department ("NMED") arising from Western's report of a minor release of treated wastewater from Evaporation Pond 7. Specifically, the communications to which this letter responds are:

(i) A March 6, 2015 OCD email to Western; and
(ii) An April 8, 2015 NMED letter entitled "Requirement" that references NMOCD's March 6th email.

Without making any admissions, and reserving all applicable rights and defenses, Western provides below and attached a letter report containing information requested by both NMOCD and NMED in the above communications.

I.
Relevant Background

On September 12, 2014, Western provided to NMED, with a copy to NMOCD, a detailed description of the many proactive steps Western was undertaking in relation to its evaporation pond system. As we noted in that letter, Western and the agencies share the same interest in assuring the evaporation pond system at the Gallup refinery is well-functioning and protective of human health and the environment. Western is a responsible owner and operator of the evaporation pond system and has voluntarily undertaken significant pond berm and other improvements of the system. Our September 12th letter detailed work that was completed in May 2014, and described additional significant upcoming work that, subsequently, was completed in mid-October 2014. In addition, we discussed implementation of new water management practices designed to enhance the operation of the evaporation ponds. Those practices and other work described herein have been ongoing since 2014.

On March 6, 2015, Western received an email from Mr. Carl Chavez of NMOCD. That email noted that NMOCD had communicated with NMED concerning any pond breaches, and required Western to repair any pond that had breached within the past 5 years. Additionally, NMOCD requested an "as built" report on any such pond repairs. NMED then sent its April 8, 2015 letter stating that NMED "has additional requirements beyond the OCD's requirements." In particular, NMED requested a letter report detailing Western's pond berm repairs including geotechnical and compaction data, photo evidence of work, and other details. NMED advised that one letter report could be sent to both agencies to satisfy the various requests for information.

II.
Response to the Agency Requests

A. Contents

Western's letter report consists of this letter, which contains narrative discussions relating to certain of the requested information, and this letter's attachments, which contain the more technical information requested. The attachments are:

- **Attachment 1:** Summary Report – Evaporation Pond Repairs" prepared for Western by Axis Group Inc. ("Axis"). Axis is a third-party civil and environmental engineering design, consulting, and field construction oversight firm assisting Western in evaluating and implementing enhancements and improvements to the evaporation pond system.

- **Attachment 2:** A figure showing the location of four evaporation blower units at the ponds (discussed below).

- **Attachment 3:** Photographs of new staff gauges (discussed below).

B. Ongoing Improvements

Western continually is improving operations at the evaporation ponds. Below are examples of some of the activities Western is conducting on an ongoing basis that focus on maintenance of adequate freeboard in the ponds.

1. Water Use Reduction

Western has implemented several water conservation measures at the process units to minimize water to the evaporation ponds. One such measure included minimizing the flow to Pond 2 by re-directing the majority of the reverse osmosis reject water for re-use by the cooling towers.

2. Additional Evaporation

In 2014, Western added two (2) additional evaporation blowers to improve evaporation rates at the ponds. Western now operates four (4) evaporation blowers at the ponds. As shown in Attachment 2 to this letter, two blower units are located on the west berm of Pond 2, and the two newer blower units are located on the west berm of pond 3. Western continues to evaluate additional improvements to enhance evaporation at the ponds.

3. New Staff Gauges

Western designed and constructed new staff gauges for the evaporation ponds to allow for visual water level measurements by the WWTP operators. The new gauges were installed June 24, 2015 in each of the ponds except for ponds 3 and 4 due to access issues. These staff gauges are used to evaluate current storage, remaining storage volume, and freeboard. Photographs of the staff gauges are attached to this letter as Attachment 3. In addition, Western has developed a spreadsheet to calculate stored water amounts and remaining storage available using readings obtained from the staff gauges.

III. Miscellaneous

A. Pond 7 Breach

To confirm the status of Western's response to the Pond 7 dike breach, on March 10, 2015, Western submitted to NMOCD and NMED a "Remediation Completed" letter report detailing the completion of the remediation taken in response to the incident. Western subsequently responded to follow up inquiries by NMOCD and NMED. At this time, Western is not aware of any additional agency requests for information relating to the Pond 7 dike breach

event and understands that this specific matter is now closed.

B. Pond Integrity

NMED's April 8, 2015 letter states "seepage is likely occurring" and "there is evidence that the berms are still in need of repair." NMED notes that the basis for this observation is information from an August 2014 U.S. Environmental Protection Agency ("EPA") RCRA compliance inspection. EPA's Inspection Report indicated that EPA had observed what it believed was moisture at a pond dike, and included several photographs, all of Pond 6. Western received EPA's Inspection Report in Fall 2014 and completed significant berm improvements on Pond 6 in March 2015, prior to receiving NMED's April 8th letter. Western also completed improvements to other pond dikes during this same time period.

C. Potentially Affected Soils

NMED's April 8, 2015 letter states "Prior to berm repair or maintenance, the Permittee must collect soil samples at the base of the berms where soils were likely affected by seepage. In most instances where Western has conducted berm repair activities, there was no indication that the ponds at issue were seeping and, thus, there were not any "affected soils" to sample. We expect that to continue to be the case with respect to foreseeable routine maintenance and repair work. In the case of Pond 6, as noted above, by the time NMED sent its April 8, 2015 letter, significant berm improvements to the Pond 6 berms potentially affected by seepage already had taken place.

IV.
Conclusion

Western has taken significant steps in 2014 and 2015 to prevent pond breaches and berm seepage, and ensure the integrity of the evaporation pond system at the Gallup refinery. As a responsible owner and operator of a wastewater treatment system that includes evaporation ponds, Western maintains, and as necessary repairs, the evaporation ponds. Additionally, Western has proactively installed more aggressive evaporation system capability, has made extensive improvements to the pond dikes to ensure integrity, and is implementing water conservation measures to help control freeboard levels. Western has engaged third-party consultants and contractors to assist in the comprehensive review and improvements of the pond system as a whole. These measures are proving successful in maintaining appropriate freeboard levels and berm integrity. Western's dedication to improvements is further demonstrated by the over $1 million devoted in 2014 and 2015 alone to enhancing the pond system.

As the combined result of all of the activities described above, in the attachments hereto, and in previous correspondence, Western has no reason to believe that seepage is occurring or likely to occur at the pond system berms. Western continues to evaluate the ponds as well as its

water management practices for opportunities to enhance the operation of the evaporation ponds. If there are any questions or concerns with the preceding, please contact me.

Sincerely,

Ed Riege
Environmental Manager
Western Refining Southwest, Inc. – Gallup Refinery

Cc: A. Allen, Western El Paso
Billy McClain, Jr., Western Gallup
D. Cobrain, NMED HWB (via email)
N. Dhawan, NMED HWB (via email)
K. Van Horn, NMED HWB (via email)
S. Holcomb, NMED SWQB (via email)
L. King, EPA (via email)

47917-v1

AXIS GROUP INC.
1101 West Mineral Avenue
Suite 102
Littleton, CO 80120
Tel: (303) 332-5757
www.axisgroupinc.com

SUMMARY REPORT
EVAPORATION POND REPAIRS

Prepared for:

Western Refining Southwest, Inc.
Gallup Refinery
92 Giant Crossing Road
Gallup, NM 87301

December 17, 2015

TABLE OF CONTENTS

LIST OF TABLES, FIGURES and APPENDICES

TABLES

FIGURES

APPENDICES

ABBREVIATIONS AND ACRONYMS

Axis	Axis Group Inc.
cm/sec	Centimeters per Second
Facility	Western Refining Southwest, Inc. Gallup Refinery
FOS	Factor of Safety
gpm	Gallons per Minute
GSF	Guida Slavich & Flores, P.C.
NMED	New Mexico Environment Department
OCD	Oil Conservation Division of the Energy, Minerals and Natural Resources Department
Ponds	Evaporation Ponds
RCRA	Resource Conservation and Recovery Act
Refinery	Western Refining Southwest, Inc., Gallup Refinery
RO	Reverse Osmosis (a treatment and filter method)
Site	Western Refining Southwest, Inc. Gallup Refinery
Sp.G.	Specific Gravity
STP-1	Sewage Treatment Pond 1
Western	Western Refining Southwest Inc.
WWTP	Waste Water Treatment Plant

EXECUTIVE SUMMARY

Western Refining Southwest Inc. (Western) Gallup Refinery (Refinery) performed a significant amount of work on the evaporation pond earth berms in 2014 and 2015, and is planning additional work in 2016. Work related to the Refinery evaporation pond earth berms includes the following:

1. Geotechnical investigation of borrow soil;
2. Improvements to Ponds 3, 4, 5, 6, 7, 8, 9, 11, 12A, and 12B in 2014;
3. Improvements to Ponds 4, 5, 6, 7, and 8 in 2015;
4. Land surveying for updated topography on all pond berms in 2014 and 2015;
5. Soil boring investigation in Pond 7 and Pond 8 west berm;
6. Drive point piezometers installed in Ponds 6, 7, 8, and 9;
7. Updated numerical slope stability analysis on Pond 6, 7, 8, and 9 in 2015;
8. Improvements to reduce water usage and subsequent storage;
9. Improvements to increase evaporation;
10. Planned improvements to Ponds 9, 11, 12A, and 12B; and
11. Planned improvements to the stormwater channel between Pond 6 and Pond 9.

Previously in 2002, the containment earth berms were numerically evaluated for stability and were determined to be stable with sufficient Factors of Safety. Western updated the slope stability analysis using the recent investigation data and current berm geometry after the construction improvements.

The results indicated that the containment earth berms remain stable with appropriate Factors of Safety. The following report provides additional detail on the work conducted to date and the planned work for 2016.

1.0 INTRODUCTION

Axis Group Inc. (Axis) prepared this letter report to summarize the repair and upgrade work conducted on the evaporation pond containment earth berms at the Western Refining Southwest, Inc. (Western) refinery in Gallup, New Mexico (Site). This report covers work conducted as part of the berm upgrade and repair construction activities that have been ongoing at the Site since January 2014.

Figure 1 illustrates the location of the Site and Figure 2 is a pond location map showing each of the evaporation ponds. As shown on Figure 2, the evaporation ponds lie west of the Refinery process areas and tank fields. In total, the evaporation ponds are approximately 110 acres in aerial extent and are numbered 2, 3, 4, 5, 6, 7, 8, 9, 11, 12A, and 12B. Ponds 7 and 8 are often identified as Pond 7/8.

In summary, the ponds are operated as follows:

1. Water from the Waste Water Treatment Plant (WWTP) and the nearby Pilot Travel Center enters the Sewage Treatment Pond 1 (STP 1);
2. Water is pumped from STP 1 to Pond 2;
3. A portion of the Reverse Osmosis (RO) reject water from the process units flows directly to Pond 2 with the remaining RO water being recycled to the facility cooling towers;
4. As needed, WWTP operators move water from one pond to another using siphons or temporary diesel-powered pumps;
5. Water flows in a cascade fashion from Pond 2 through Ponds 3, 4, 5, then 6;
6. Water is also pumped from Pond 2 to Pond 12B and then flows in a cascade fashion into Ponds 12A, 11, and 7/8.

2.0 WORK COMPLETED IN 2014 AND 2015

This section of the report describes the evaporation pond improvement work completed by Western during 2014 and 2015. Photographs of the work are included in Appendix A.

2.1 Summary of 2014 Phase 1 Berm Repair and Upgrades

During January through April 2014 and November through December 2014, Western conducted repairs and upgrades to the containment berms surrounding Ponds 3, 4, 5, 6, 7, 8, 9, 11, 12A, and 12B. These repairs and upgrades included the following:

1. Adding additional new fill material to the outside slopes and crests of the containment berms;
2. Shaping the berm slopes; and
3. Building up the berm crest height and width;

The west berms of Pond 7 and Pond 8 were shaped such that the crest was widened and aligned further to the east so that the overall outer slope would be flatter and more stable.

Western's earth work contractor used on-site borrow areas for fill material (borrow locations shown on Figure 2). Fill material was excavated from the borrow areas using a track hoe and front-end loader, brought to the containment berms via off-road haul trucks, and placed using a Caterpillar D-6 dozer. The dozer was used to place, shape, and compact the fill material. Soil fill material consisted of a silty to sandy clay, similar in character to the soil that was used to construct the original earth berms.

Figures 3a, 3b, and 3c illustrate the pond limits and crest heights prior to the improvements made in 2014. Figures 4a, 4b, and 4c illustrate the pond limits and crest heights after Phase 1 upgrades and repairs were complete. Figure 6b provides cross sections illustrating the limits where additional fill material was placed on the pond containment berms during 2014. Photographs of the 2014 berm upgrade activities are included in Appendix A (Photos #1 through #6).

2.2 Summary of 2015 Phase 2 Berm Repair and Upgrades

During March through October 2015, Western continued conducting repairs and upgrades to the containment berms surrounding Ponds 4, 5, 6, 7, and 8. These repairs and upgrades included the following:

1. Adding additional new fill material to the outside slopes of the containment berms;
2. Shaping the berm slopes; and
3. Building out the berm crest width;

The fill material was taken from an on-site borrow area (see Figure 2) via scraper to the berm area under construction, placed in horizontal lifts, and compacted using the scraper and a sheep-foot vibratory roller. Each soil lift was placed on a horizontal flat surface at a maximum depth of 8-inches loose, keyed into the existing berm slope, and compacted to a minimum of 95-percent (95%) of a standard Proctor. A motor grader shaped the slopes as they were being constructed.

Figures 5a and 5b illustrate the pond limits and crest heights after the Phase 2 upgrades and repairs were complete. Figure 6b provides cross sections illustrating the limits where additional fill material was placed on the pond containment berms during 2015. Photographs of the 2015 berm upgrade activities are included in Appendix A (Photos #7 through #14).

2.3 Soil Geotechnical Properties

Geotechnical properties of the borrow material used include the following:

1. Proctor values (i.e. laboratory maximum compaction and optimum water content);
2. Classification;
3. Sieve analysis (i.e. particle size gradation);
4. Field density and moisture content tests;
5. Permeability via flex-wall permeameter;

The soil used to improve the earth berms is classified as a silty to sandy clay. Based on a flex-wall permeameter test, soil permeability for the borrow material is $1.9X\ 10^{-7}$ cm/sec. Appendix B contains geotechnical tests conducted on the soil fill and borrow material.

2.4 Slope Stability Analysis

Western elected to update the numerical slope stability analysis as the containment earth berm crests have been raised, widened, additional fill material was placed on the outer slopes, and the pond water elevations have increased. The soil material used in constructing and upgrading the earth berms is a uniform material. Accordingly, Western numerically analyzed the slopes using an arc-type or circular slip-type of failure. The output from the slope stability analysis provides a numerical Factor of Safety against a slope stability failure. A Factor of Safety greater than 1.0 indicates that the slope is stable from a typical arc-type slope failure. Based on previous slope stability work, the earth berms at the Site were stable against an arc- or circular slip-type failure with Factor of Safety values ranging from 2.5 to 10.

The analysis was conducted using the program GeoStudio 2012 produced by Geo-slope International. The program uses limit-equilibrium analysis based on the Method of Slices to analyze the Factor of Safety for stability of the slopes.

Based on the updated slope stability modeling, the earth berms remain stable against an arc-type failure with Factor of Safety values ranging from 4.7 to 7.1. The sections below provide a discussion of the methods and soil values used in the updated slope stability modeling work.

2.4.1 2002 Geotechnical and Slope Stability Work

Precision Engineering, Inc. conducted a geotechnical analysis in 2002 which is included in Appendix C. The site investigation conducted as part of that analysis included 10 soil borings and 7 Dutch Cone soundings. Soil samples and Shelby Tube samples were collected from various strata throughout the investigation. Soil geotechnical properties derived from those samples (e.g. triaxial shear strength, cohesion, and unit weights) were used in the slope stability analysis. A summary of the soil geotechnical properties are included in Table 1. A total of 13 cross-sections were evaluated for slope stability and the resulting Factor of Safety ranged from 2.5 to 10. Table 2 summarizes the results from the Precision Engineering Inc. report.

2.4.2 2015 Geotechnical and Slope Stability Investigation

The 2002 Precision Engineering, Inc. slope stability analysis was conducted prior to the recent repair work on the pond containment berms. As shown on Figure 6b, the configurations of the berms (i.e. berm crest widths and outer slopes) were different in many locations in 2014 and 2015 due to the repair work, resulting in new slope cross-sections. The new cross sections as well as higher water levels in the ponds were factored into the updated earth berm slope stability analysis.

Prior to performing the updated slope stability analysis, Western conducted a field investigation to evaluate current soil geotechnical material properties and to locate the phreatic surface (i.e. water table surface) within the berms. To accomplish this work, Western drilled four soil borings along the crest of Pond 7/8 and installed 11 drive points at various locations in Pond 6 and 7/8 berms. Figure 6a illustrates the locations where soil borings and drive-point piezometers were installed. The text below provides more detail on the boring and drive-point programs.

2.4.3 Pond 7/8 West Berm Soil Borings

Western installed soil borings at four locations along the Pond 7/8 west berm at locations that correspond to cross-sections used in the slope stability analysis. The borings were conducted to visually examine the berm soil at various depths, collect soil samples for potential geotechnical analysis, and to locate the phreatic surface within the earth berm (if present).

Samples collected from the soil borings indicated a relatively uniform soil material (i.e. no significant changes in soil type) within each boring from the crest down to the final boring depth. The berm fill soil was characterized as a red, silt to clay moist soil, until the native material was encountered around 12 feet deep. Native material was characterized as gray fine sand overlaying a stiff wet red clay. Boring logs for these four soil borings are included in Appendix D.

2.4.4 Drive Point Piezometers

Western installed 11 drive-point piezometers at locations in the Pond 6 north and west berms, Pond 7 west berm, and Pond 8 south berm at locations that correspond to cross-sections used in the slope stability analysis. The drive-point piezometers were installed to measure the phreatic surface (if present) within the earth berms.

Water levels (if present) have been measured in the drive-point piezometers three times since installation (as of November 11, 2015) and that data is contained in the piezometer logs in Appendix E. Due to the low permeability clay soil in the berms, as of December 2015, the water levels in the piezometers have not yet completely stabilized. Western will continue to monitor the water levels in the piezometers as needed. The drive-point piezometer logs also visually illustrate the location of the phreatic surface.

2.4.5 Slope Stability Modeling

As discussed above, the geometry of the earth berms changed as a result of the earth berm repairs in 2014 and 2015. Accordingly, Western (via Hammon Enterprises Inc.) conducted an updated land survey of the earth berms. The updated topography was used to track the changes to the earth berms and create the cross-section geometry required for the current slope stability analysis described

in this report. Historic survey topography and the cross-sections used in the previous stability analysis were used to establish the historic cross-sections of the earth berms. Figure 6b provides cross-sections that illustrate changes in the geometry of the earth berms with time and shows the current surface at the end of 2015.

Soil properties from the previous investigation (Precision, 2002) were compared to the soil properties from the 2014 and 2015 borrow and berm soil investigations. The 2002 soil investigation results are consistent with the current geotechnical data. Accordingly, the previous soil investigation data were used in the current slope stability analysis.

Slope stability modeling data input includes soil type, unit weight, angle of internal friction (phi angle), shear strength, and cohesion values. The 2002 data included triaxial sheer strength values and were classified into two categories:

1. Berm material ranging from a depth of 5-7 feet; and
2. Subgrade material ranging from 10-17 feet.

This resulted in two sets of soil properties for the berm slope stability analysis:

1. Berm material (unit weight 140 pcf, cohesion 720 psf, phi 8 degrees); and
2. Native soil (unit weight 140 pcf, cohesion 1152 psf, phi 0 degrees).

The phreatic surface used for the analysis was derived from current water level data measured in the drive-point piezometers installed along the cross sections of the berms.

2.4.6 Results

A Factor of Safety greater than 1.0 indicates that the slope is numerically stable from a typical arc-type slope failure. Factors of Safety against a deep slip surface failure in the berms before and after repair work are shown on Table 3.

Based on the slope stability modeling, the berms are stable against an arc-type failure with Factor of Safety values ranging from 4.5 to 7.1. Note that the Factor of Safety from the previous investigation ranged from 2.5 to 10. The change in the Factor of Safety values is largely the result of changes in the berm geometry and the elevation of the water within the ponds. Detailed results from the numerical slope stability modeling are included in Appendix F.

3.0 2016 PHASE 3 POND REPAIR AND UPGRADES

Western plans to continue the ongoing repairs and upgrades to the evaporation ponds during 2016. Planned work includes:

1. Rework and repair the berm material on Ponds 11, 12A, and 12B as required;
2. Improve the Pond 9 north berm;
3. Regrade the stormwater drainage channel between Pond 6 and Pond 9;
4. Improve the west berm along Pond 7 and Pond 8;

3.1 Ponds 11, 12A, and 12B

Western plans to rework and repair the material along the containment berms of Ponds 11, 12A, and 12B. Figure 8 illustrates the design work limits for Ponds 11, 12A, and 12B. Western intends to complete this work in 2016.

3.2 Pond 9 North Berm

The Pond 9 north berm will also be reconstructed to improve integrity and involves adding fill material to the outer slopes of the Pond 9 north berm. Figure 7a illustrates the design work limits for Pond 9 intended to be completed in 2016.

3.3 Stormwater Channel Improvements

Currently, non-contact stormwater is directed from the Refinery areas westward toward the drainage channel between Pond 6 and Pond 9 and exits at the west side of Ponds 6 and 9. The portion of the stormwater channel between Pond 6 and Pond 9 will be improved during the construction of the Pond 9 north berm. Non-contact stormwater flow will be directed in an engineered channel sloped to drain and exit at the west side of Pond 6 and Pond 9. From there, non-contact stormwater will flow toward the small retention pond located south of the south west corner of Pond 8. Figure 7b illustrates the design for this work.

3.4 Ponds 7 and 8 West Berm

Western is evaluating potential improvements to the Pond 7/8 west berm. Potential improvement work may include adding fill material to the outer slope of the west berm. Western intends to complete this evaluation in 2016.

4.0 ONGOING IMPROVEMENT WORK

4.1 Water Use Reduction

Western is continually improving operations at the evaporation ponds. For example, Western has implemented several water saving measures at the process units to minimize water to the evaporation ponds. As of November 2015, the flow rate of water to the evaporation ponds is about 150 gpm, down from a previous average of 340 gpm.

Part of the work included minimizing the reverse osmosis (RO) reject water flows to Pond 2. The majority of RO water is now directed to the cooling towers with the net effect of minimizing RO reject water to Pond 2.

4.2 Additional Evaporation

In 2014, Western added two additional evaporation blowers to improve evaporation rates at the ponds. As shown on Figure 2, two blower units are located on the west berm of Pond 2 and the two newer blower units are located on the west berm of Pond 3. Western is internally evaluating additional improvements to enhance evaporation at the ponds.

TABLES

Table 1: Summary of Triaxial Shear Results 2002 Investigation

Sample #	Boring	Depth	phi (degrees)	Cohesion (psi)	Unit Weight (pcf)	Description
Shallow Sample Results						
38631	2	5-7	10	5	137.3	Pond 7 West berm
38640	8	5-7	2	6	140.1	Pond 9 Southwest berm
38645	9	5-7	8	5	137.4	Pond 6 South berm
38650	10	5-7	7	5.5	139.5	Pond 6 West berm
Native Ground Sample Results						
38641	8	10-12	0	8	141.3	Pond 9 Southwest berm
38647	9	15-16	0	7	138.9	Pond 6 South berm
38648	9	16-17	2	2	139.9	Pond 6 South berm
38652	10	15-17	0	4	141.4	Pond 6 West berm

Notes:
Results from Precision Engineering investigation 2002.

Table 2: Previous Slope Stability Summary

Section	Location	Height	Width	Freeboard	Factor of Safety FOS
1	9-SW	5	11	2.5	5.5
2	9-W	4	8	2.2	10.0
3	6-SW	7.6	10	2.2	3.0
4	6-W	7.6	10	2.2	3.0
5	*N/A**	4.2	10	0.9	6.2
6	9-N	5.5	7	1	10.0
7	8-W	7.3	16	1	6.0
8	7-W	7.3	12	2.7	4.9
9	7-W	5.5	12	2.6	7.0
10	11-E	3.9	12	3	10.0
11	12A-S	5	10	2	9.4
12	8-S	8.6	9	3	2.5
13	3-N	4	6	1	5.4

Notes:
Summary of Results from Precision Engineering 2002 report.
* Section not shown on figure in Precision Engineering 2002 report. Location unknown.

Table 3: Summary of Recent Slope Stability Analysis

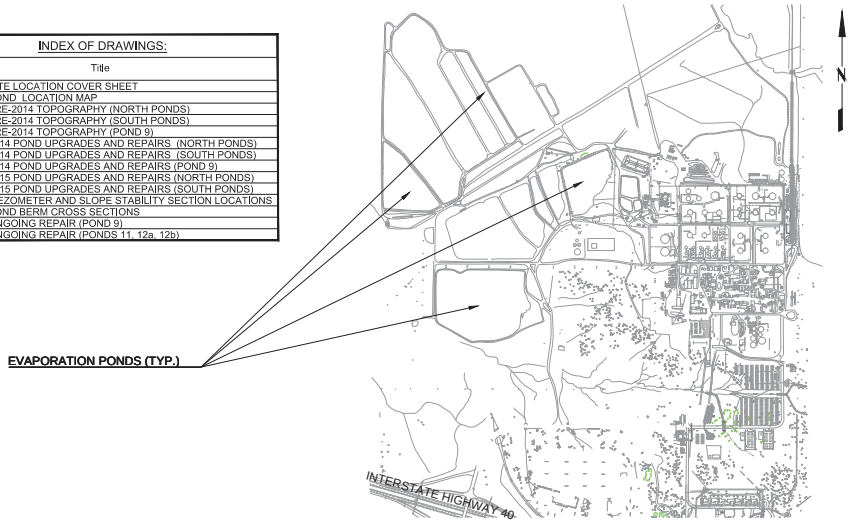
Berm	FOS before repair work	FOS after repair work	Factor of Safety remodeled cross section
Pond 6 North	4.3	4.6	
Pond 6 West	4.2	4.5	
Pond 7 West	4	N/A[1]	
Pond 8 North	4.1	4.6	
Pond 9 North	6.8	7.1	9.3 [2]

Notes:
1. No change in berm conditions.
2. Used inputs from Precision 2002 stability analysis of the same section in the current modeling software.

FIGURES

LOCATION MAP
N.T.S.

INDEX OF DRAWINGS:	
Figure No.	Title
1	SITE LOCATION COVER SHEET
2	POND LOCATION MAP
3a	PRE-2014 TOPOGRAPHY (NORTH PONDS)
3b	PRE-2014 TOPOGRAPHY (SOUTH PONDS)
3c	PRE-2014 TOPOGRAPHY (POND 9)
4a	2014 POND UPGRADES AND REPAIRS (NORTH PONDS)
4b	2014 POND UPGRADES AND REPAIRS (SOUTH PONDS)
4c	2014 POND UPGRADES AND REPAIRS (POND 9)
5a	2015 POND UPGRADES AND REPAIRS (NORTH PONDS)
5b	2015 POND UPGRADES AND REPAIRS (SOUTH PONDS)
6a	PIEZOMETER AND SLOPE STABILITY SECTION LOCATIONS
6b	POND BERM CROSS SECTIONS
7	ONGOING REPAIR (POND 9)
8	ONGOING REPAIR (PONDS 11, 12a, 12b)



VICINITY MAP
1" = 600'

WESTERN REFINING SOUTHWEST INC.
EVAPORATION POND UPGRADES
GALLUP REFINERY, NEW MEXICO

NO.	BY	DATE:	REVISION

AXIS GROUP
1101 WEST MINERAL AVENUE
SUITE 102
LITTLETON, COLORADO. 80120
(303) 332-5757

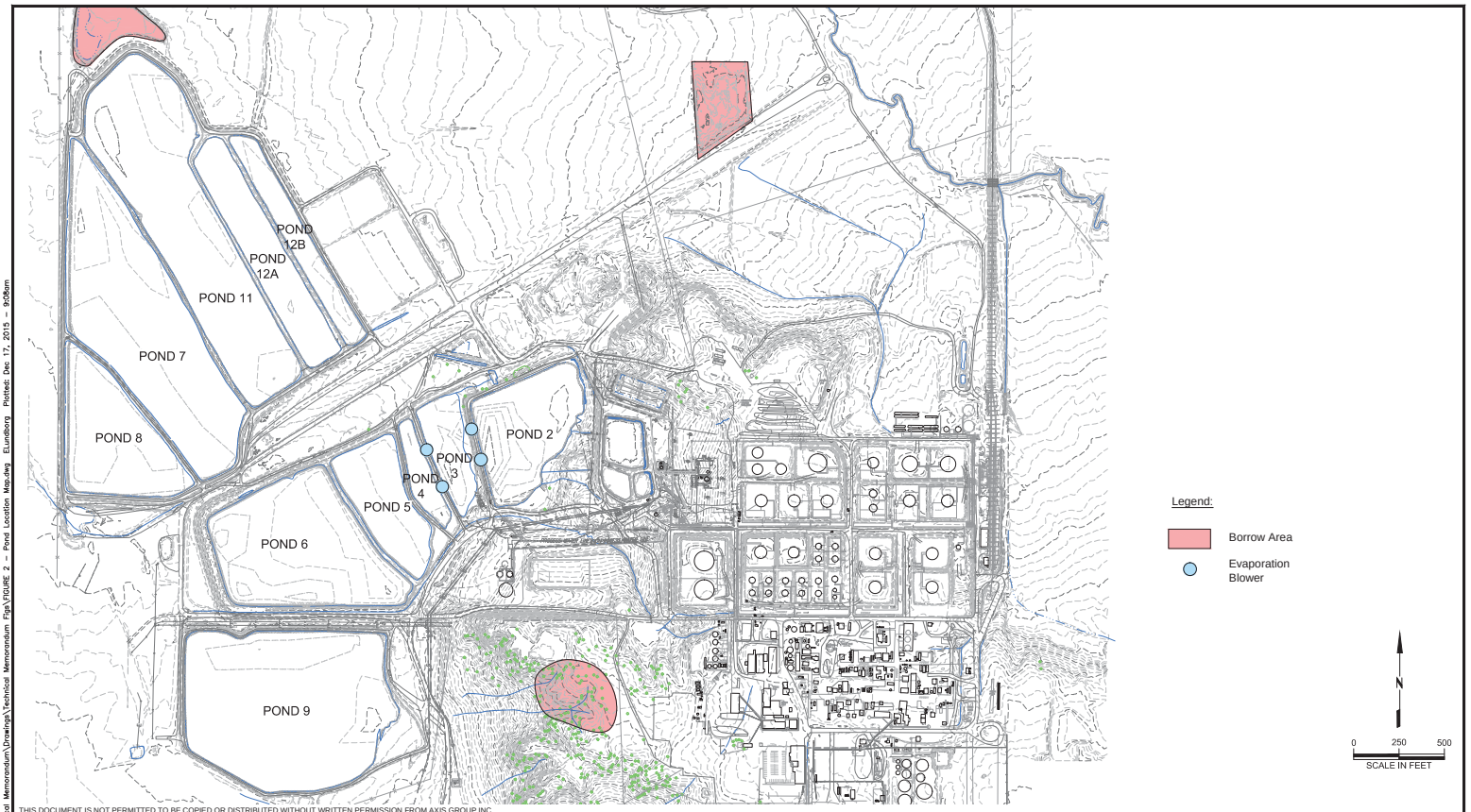
PROJ. NO.: 15-112 | DATE: 11-06-2015 | DRAWN BY: JAY | CHECKED BY: JWB

WESTERN REFINING SOUTHWEST, INC. - GALLUP REFINERY, NEW MEXICO

EVAPORATION PONDS UPGRADE
SITE LOCATION COVER SHEET

DRAWING NO.: 1

X:\15-112 - WNR Technical Memorandum\Drawings\Technical Memorandum Figs\FIGURE 1 - Cover Sheet.dwg Eurofberg Plotted: Dec. 17, 2015 - 9:02am



NO.	BY	DATE:	REVISION

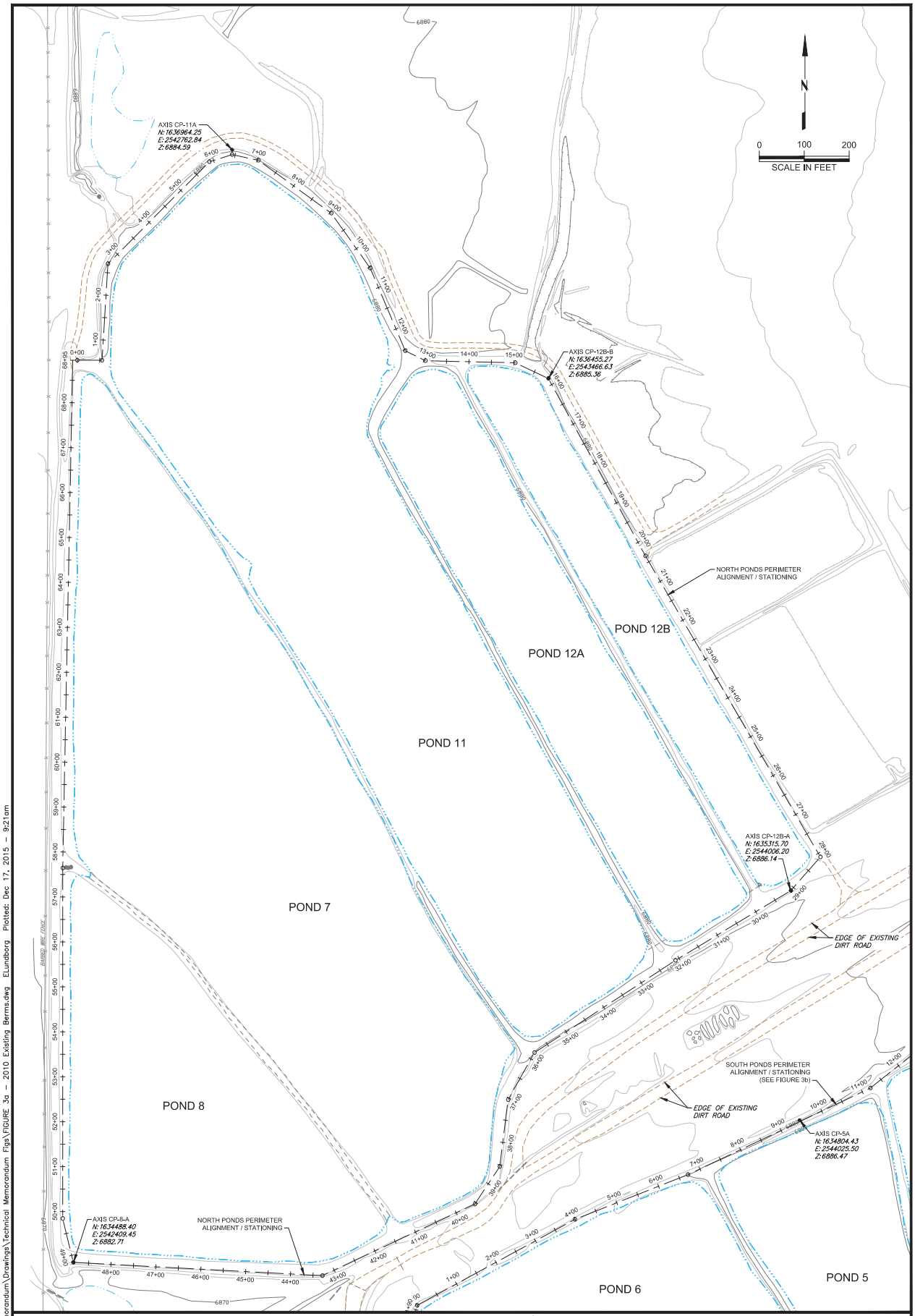
AXIS GROUP
1101 WEST MINERAL AVENUE
SUITE 102
LITTLETON, COLORADO. 80120
(303) 332-5757

PROJ. NO.: 15-112 | DATE: 11-06-2015 | DRAWN BY: JAY | CHECKED BY: JWB

WESTERN REFINING SOUTHWEST, INC. - GALLUP REFINERY, NEW MEXICO

POND LOCATION MAP

DRAWING NO.: 2



SEE FIGURE 3b

AXIS GROUP Inc.
1101 WEST MINERAL AVENUE
SUITE 102
LITTLETON, COLORADO. 80120
(303) 332-5757

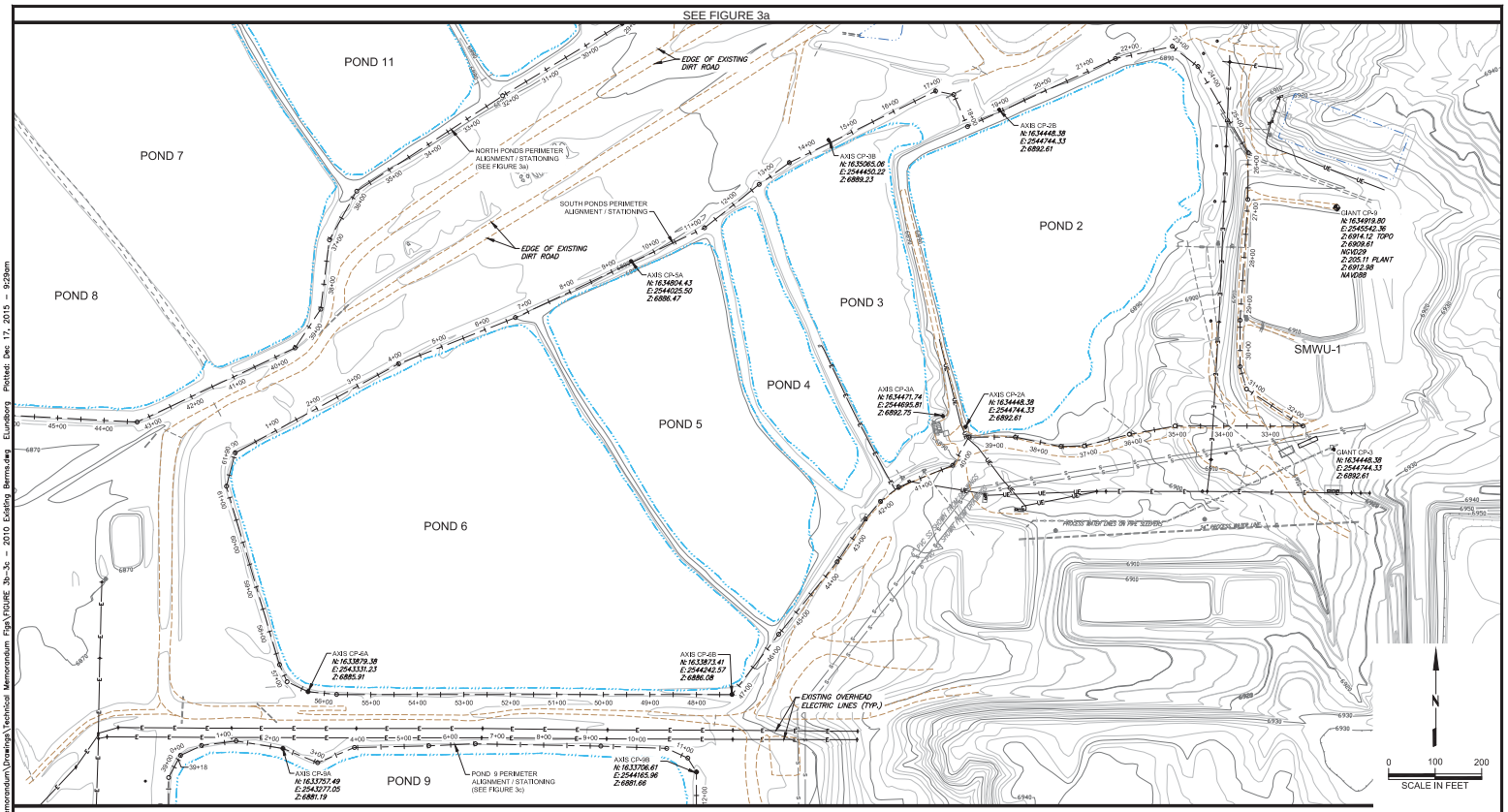
PROJ. NO.: 15-112	DATE: 11-20-2015	DRAWN BY: JAY	CHECKED BY: JWB

WESTERN REFINING SOUTHWEST, INC. - GALLUP REFINERY, NEW MEXICO

PRE-2014 TOPOGRAPHY
NORTH PONDS

DRAWING NO.: 3a

X:\15-112 – WNR Technical Memorandum\Drawings\Technical Memorandum Figs\FIGURE 3a – 2010 Existing Berms.dwg ELundborg Plotted: Dec 17, 2015 – 9:21am



NO.	BY	DATE:	REVISION

AXIS GROUP
1101 WEST MINERAL AVENUE
SUITE 102
LITTLETON, COLORADO. 80120
(303) 332-5757

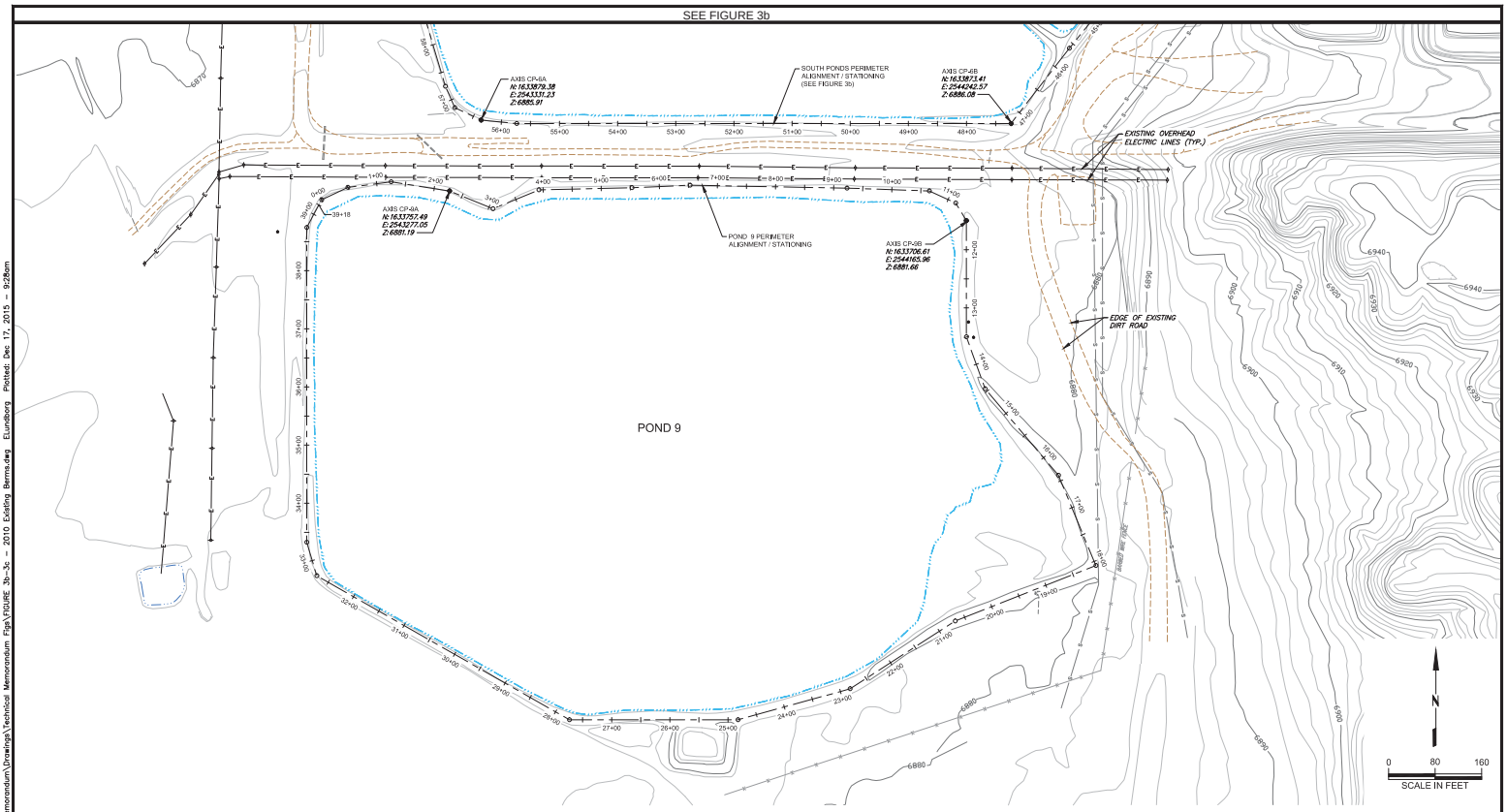
PROJ. NO.: 15-112 | DATE: 11-06-2015 | DRAWN BY: JAY | CHECKED BY: JWB

WESTERN REFINING SOUTHWEST, INC. - GALLUP REFINERY, NEW MEXICO

PRE-2014 TOPOGRAPHY
SOUTH PONDS

DRAWING NO.: 3b

SEE FIGURE 3b



NO.	BY	DATE:	REVISION

1101 WEST MINERAL AVENUE
SUITE 102
LITTLETON, COLORADO. 80120
(303) 332-5757

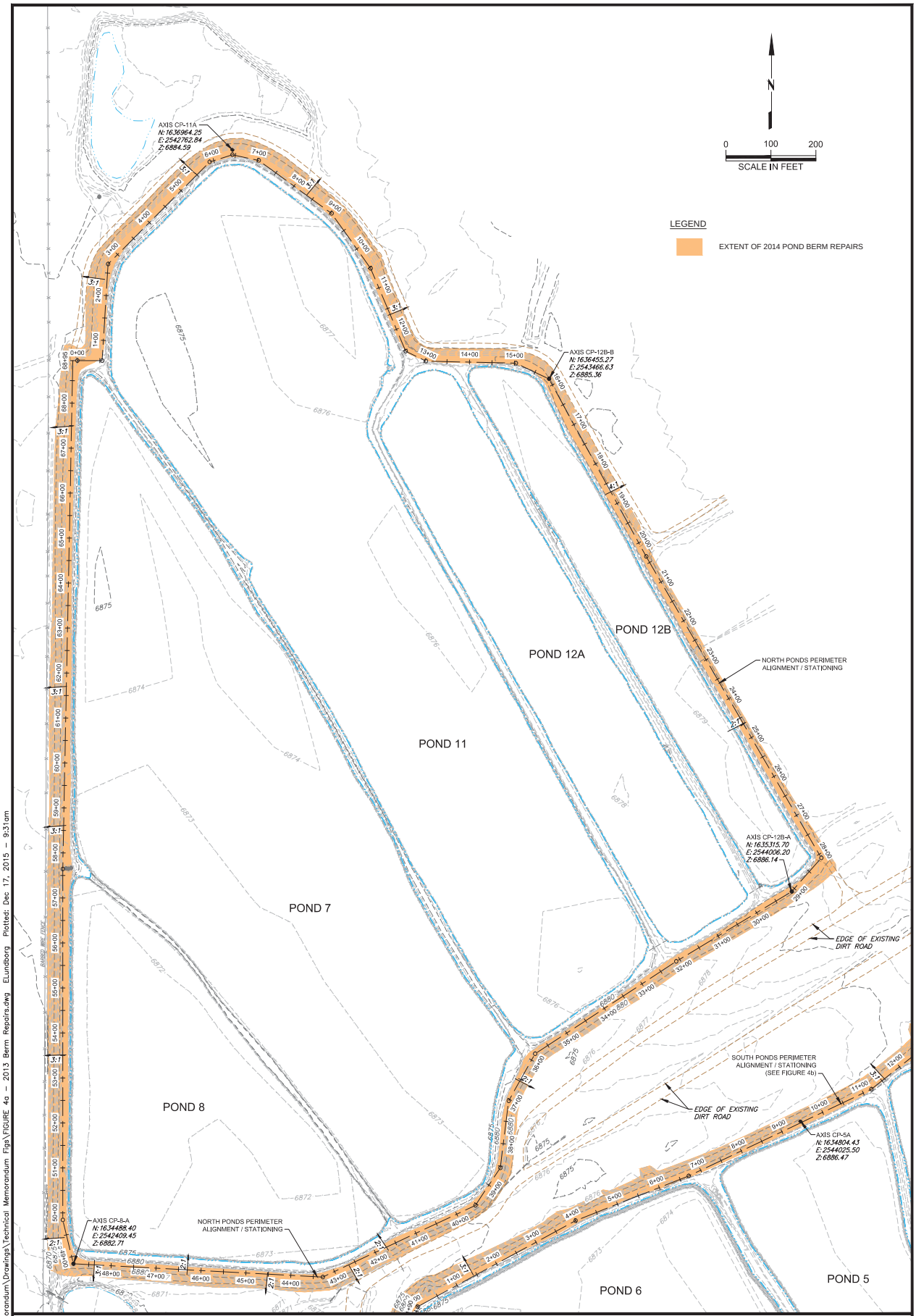
PROJ. NO.: 15-112 | DATE: 11-06-2015 | DRAWN BY: JAY | CHECKED BY: JWB

WESTERN REFINING SOUTHWEST, INC. - GALLUP REFINERY, NEW MEXICO

PRE-2014 TOPOGRAPHY
POND 9

DRAWING NO.: 3c

X:\15-112 - WNR Technical Memorandum\Drawings\Technical Memorandum Figs\FIGURE 3b-3c - 2010 Existing Berms.dwg Eulmdberg Plotted: Dec. 17, 2015 - 9:28am



SEE FIGURE 4b

AXIS GROUP INC.
1101 WEST MINERAL AVENUE
SUITE 102
LITTLETON, COLORADO. 80120
(303) 332-5757

PROJ. NO.: 15-112	DATE: 11-06-2015	DRAWN BY: JAY	CHECKED BY: JWB

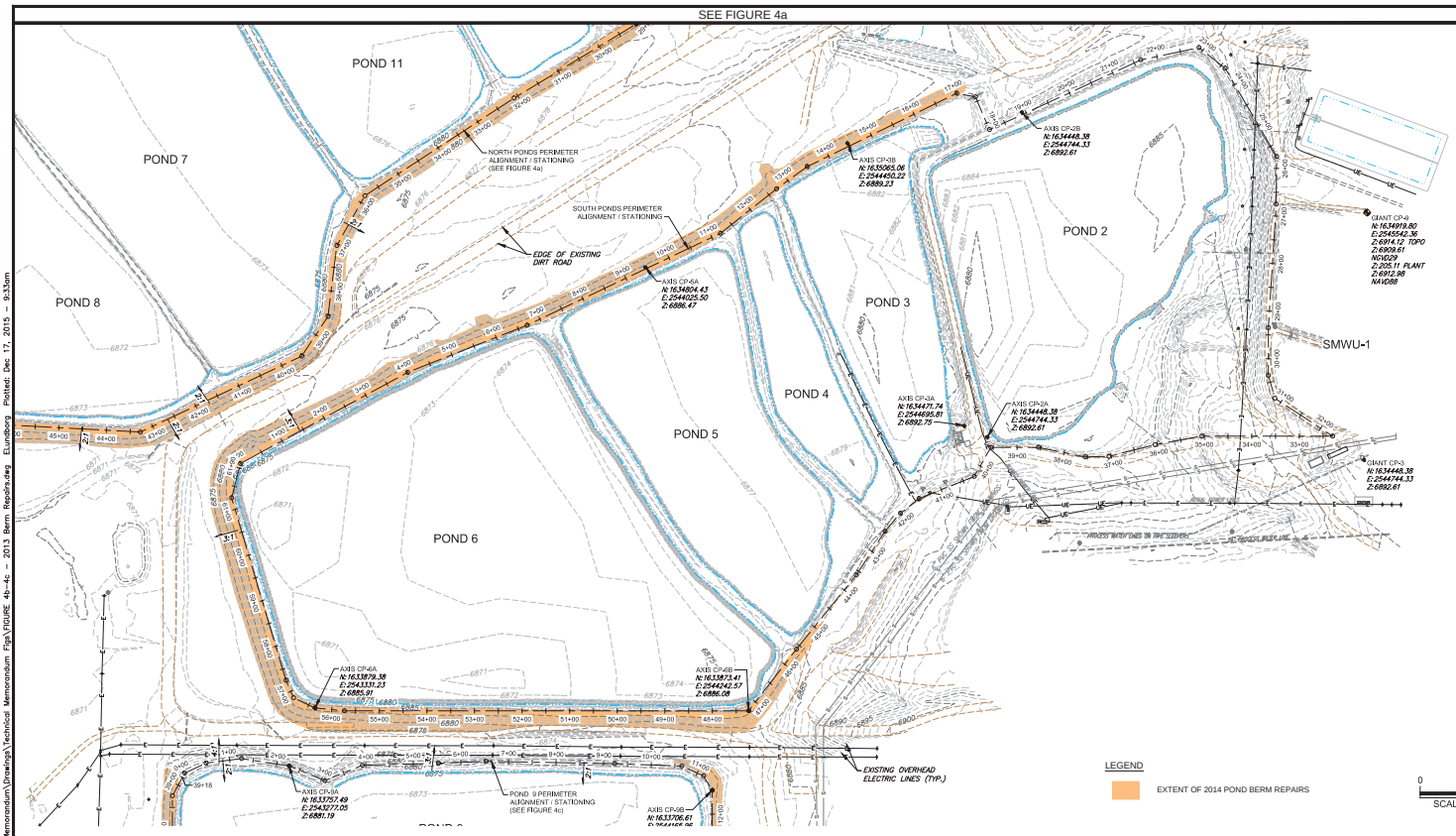
WESTERN REFINING SOUTHWEST, INC. - GALLUP REFINERY, NEW MEXICO

2014 POND UPGRADES AND REPAIRS
NORTH PONDS

DRAWING NO.: 4a

X:\15-112 – WNR Technical Memorandum\Drawings\Technical Memorandum Figs\FIGURE 4a – 2013 Berm Repairs.dwg ELundborg Plotted: Dec 17, 2015 – 9:31am

SEE FIGURE 4a



SEE FIGURE 4c

NO.	BY	DATE:	REVISION

AXIS GROUP
1101 WEST MINERAL AVENUE
SUITE 102
LITTLETON, COLORADO. 80120
(303) 332-5757

PROJ. NO.: 15-112	DATE: 11-06-2015	DRAWN BY: JAY	CHECKED BY: JWB

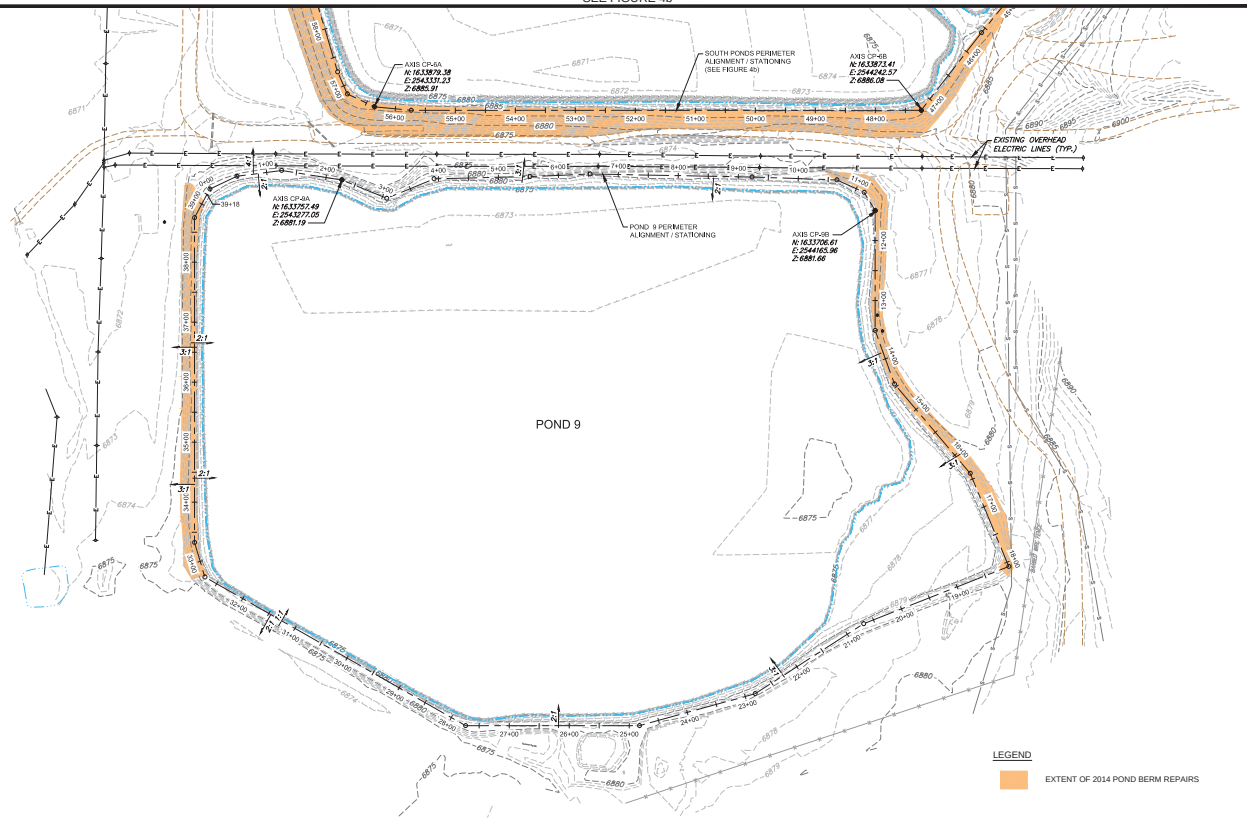
WESTERN REFINING SOUTHWEST, INC. - GALLUP REFINERY, NEW MEXICO

2014 POND UPGRADES & REPAIRS
SOUTH PONDS

DRAWING NO.: 4b

X:\15-112 – WNR Technical Memorandum\Drawings\Technical Memorandum Figs\FIGURE 4b–4c – 2013 Berm Repairs.dwg Eiumdberg Plotted: Dec 17, 2015 – 9:33am

SEE FIGURE 4b



NO.	BY	DATE:	REVISION

AXIS GROUP
1101 WEST MINERAL AVENUE
SUITE 102
LITTLETON, COLORADO. 80120
(303) 332-5757

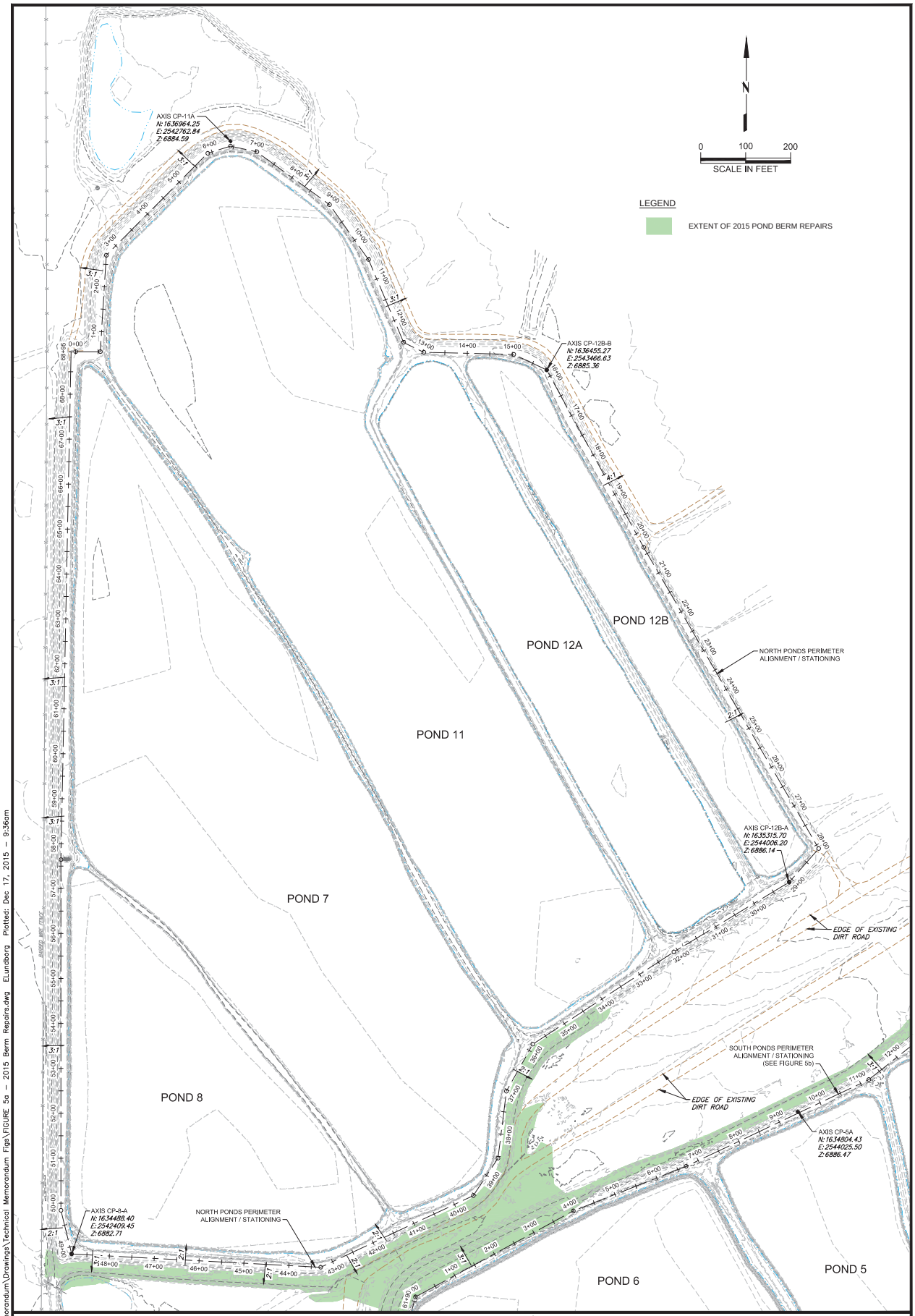
PROJ. NO.: 15-112	DATE: 11-06-2015	DRAWN BY: JAY	CHECKED BY: JWB

WESTERN REFINING SOUTHWEST, INC. - GALLUP REFINERY, NEW MEXICO

2014 POND UPGRADES & REPAIRS
POND 9

DRAWING NO.: 4c

X:\15-112 - WNR Technical Memorandum\Drawings\Technical Memorandum Figs\FIGURE 4b-4c - 2013 Berm Repairs.dwg Eiundberg Plotted: Dec 17, 2015 - 9:33am



AXIS GROUP Inc.
1101 WEST MINERAL AVENUE
SUITE 102
LITTLETON, COLORADO. 80120
(303) 332-5757

PROJ. NO.: 15-112	DATE: 11-06-2015	DRAWN BY: JAY	CHECKED BY: JWB

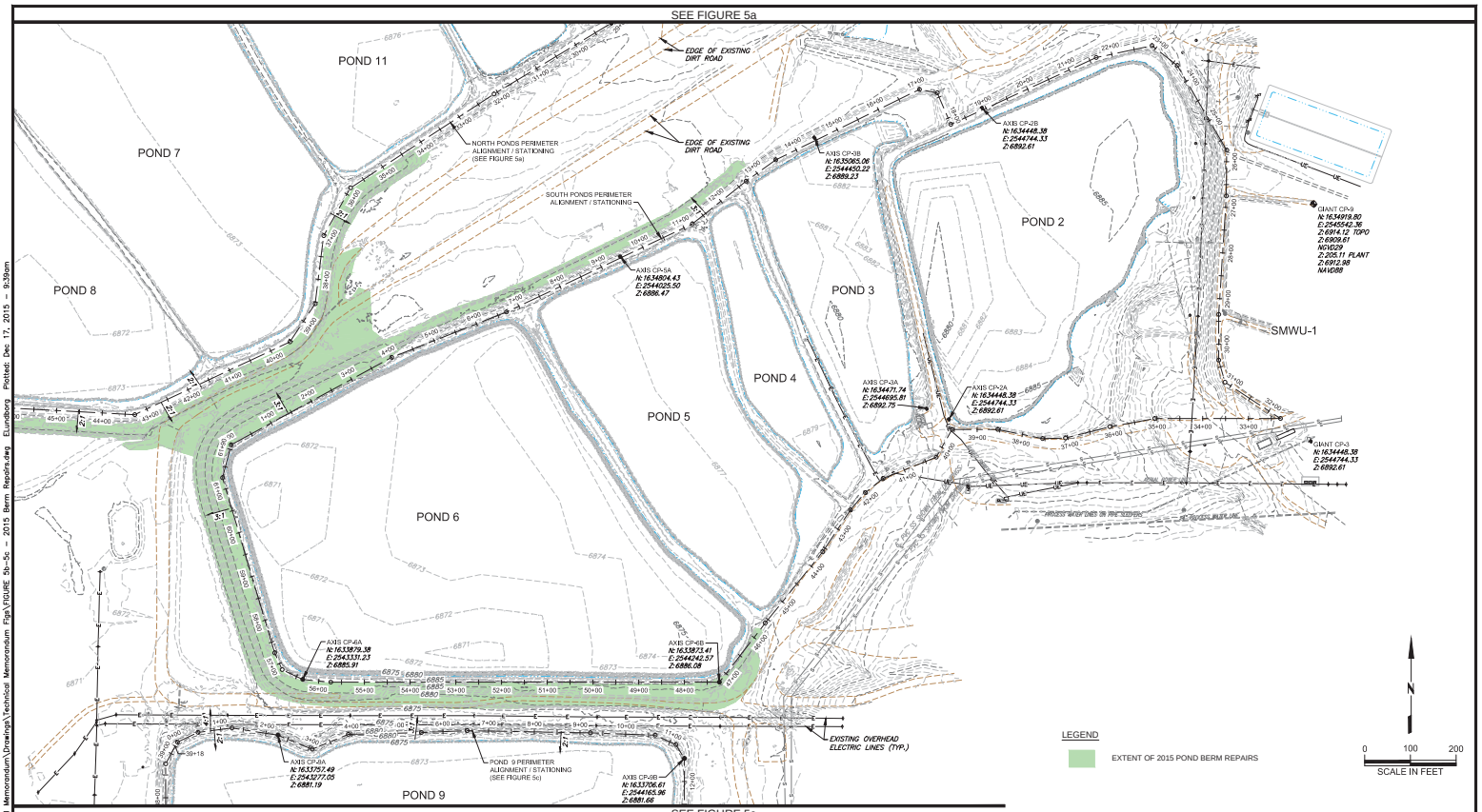
WESTERN REFINING SOUTHWEST, INC. - GALLUP REFINERY, NEW MEXICO

2015 POND UPGRADES & REPAIRS
NORTH PONDS

DRAWING NO.:

5a

X:\15-112 – WNR Technical Memorandum\Drawings\Technical Memorandum Figs\FIGURE 5a – 2015 Berm Repairs.dwg ELundborg Plotted: Dec 17, 2015 – 9:36am



NO.	BY	DATE:	REVISION

AXIS GROUP
1101 WEST MINERAL AVENUE
SUITE 102
LITTLETON, COLORADO. 80120
(303) 332-5757

PROJ. NO.: 15-112 | DATE: 11-06-2015 | DRAWN BY: JAY | CHECKED BY: JWB

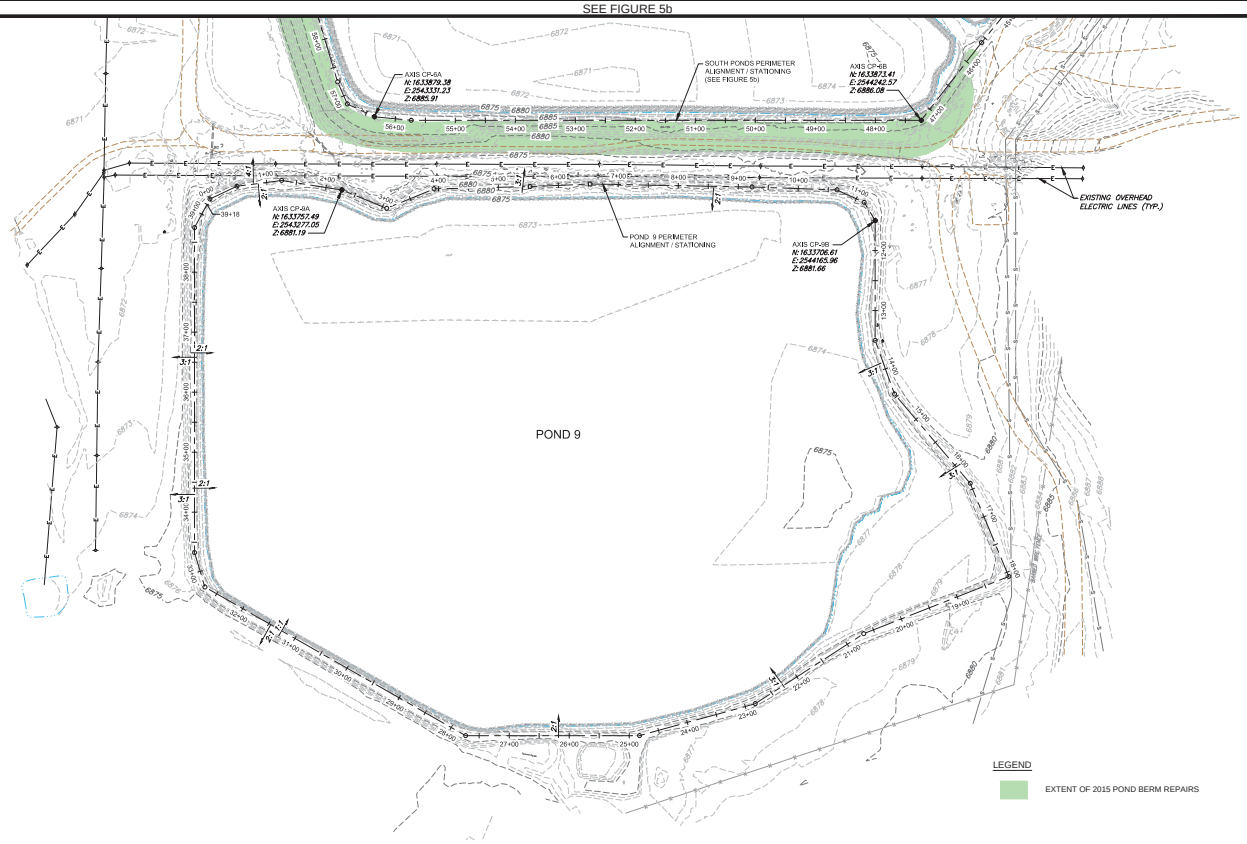
WESTERN REFINING SOUTHWEST, INC. - GALLUP REFINERY, NEW MEXICO

2015 POND UPGRADES & REPAIRS
SOUTH PONDS

DRAWING NO.: 5b

X:\15-112 - WNR Technical Memorandum\Drawings\Technical Memorandum Figs\FIGURE 5b-5c - 2015 Berm Repairs.dwg Eiundberg Plotted: Dec 17, 2015 - 9:39am

SEE FIGURE 5b



NO.	BY	DATE:	REVISION

AXIS GROUP
1101 WEST MINERAL AVENUE
SUITE 102
LITTLETON, COLORADO. 80120
(303) 332-5757

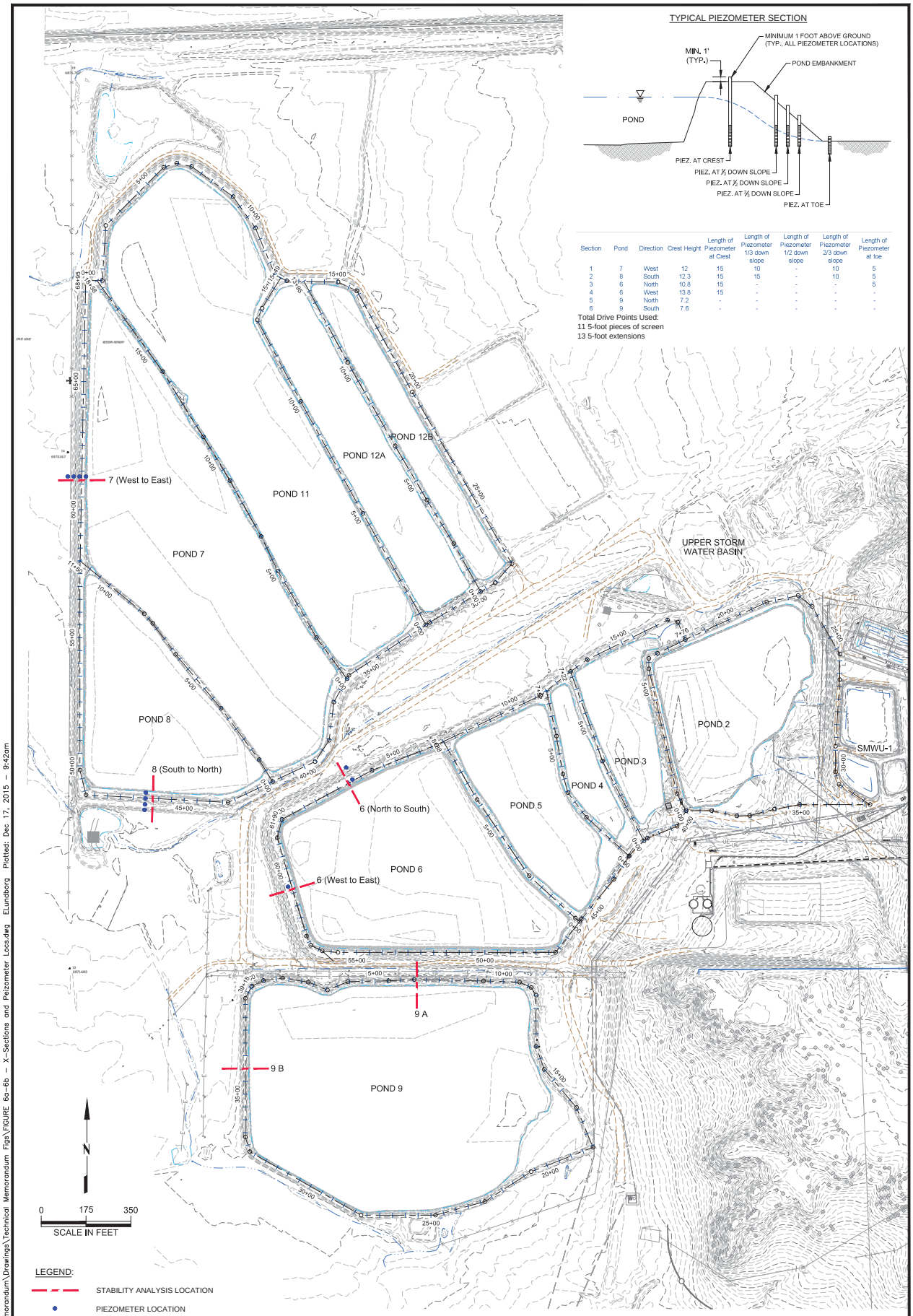
PROJ. NO.: 15-112 | DATE: 11-06-2015 | DRAWN BY: JAY | CHECKED BY: JWB

WESTERN REFINING SOUTHWEST, INC. - GALLUP REFINERY, NEW MEXICO

2015 POND UPGRADES & REPAIRS
POND 9

DRAWING NO.: 5c

X:\15-112 - WNR Technical Memorandum\Drawings\Technical Memorandum Figs\FIGURE 5b-5c - 2015 Berm Repairs.dwg Eiundberg Plotted: Dec 17, 2015 - 9:39am



Section	Pond	Direction	Crest Height	Length of Piezometer at Crest	Length of Piezometer 1/3 down slope	Length of Piezometer 1/2 down slope	Length of Piezometer 2/3 down slope	Length of Piezometer at toe
1	7	West	12	15	10	-	10	5
2	8	South	12.3	15	15	-	10	5
3	6	North	10.8	15	-	-	-	5
4	6	West	13.8	15	-	-	-	-
5	9	North	7.2	-	-	-	-	-
6	9	South	7.6	-	-	-	-	-

Total Drive Points Used:
11 5-foot pieces of screen
13 5-foot extensions

AXIS GROUP INC.
1101 WEST MINERAL AVENUE
SUITE 102
LITTLETON, COLORADO. 80120
(303) 332-5757

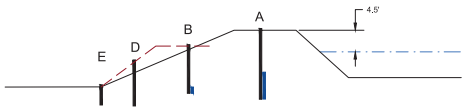
PROJ. NO.: 15-010-04	DATE: 11-06-2015	DRAWN BY: JAY	CHECKED BY: JWB

WESTERN REFINING SOUTHWEST, INC. - GALLUP REFINERY, NEW MEXICO

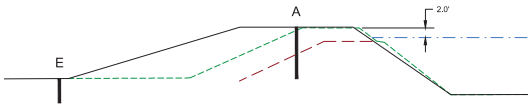
DRIVE POINT PIEZOMETER LOCATIONS AND NUMERICAL SLOPE STABILITY SECTION LOCATIONS

DRAWING NO.: 6a

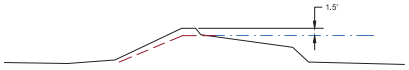
X:\15-112 – WNR Technical Memorandum\Drawings\Technical Memorandum Figs\FIGURE 6a-6b – X-Sections and Peizometer Locs.dwg ELundborg Plotted: Dec 17, 2015 – 9:42am



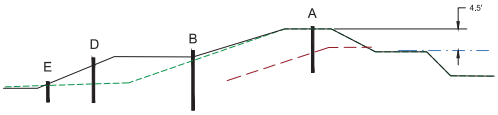
Pond 7 Cross Section (West to East)



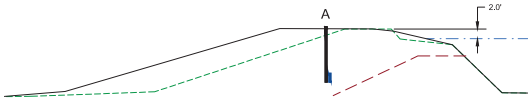
Pond 6 Cross Section (North to South)



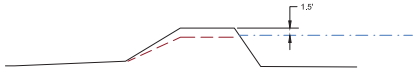
Pond 9 A Cross Section (North to South)



Pond 8 Cross Section (South to North)



Pond 6 Cross Section (West to East)



Pond 9 B Cross Section (East to West)

LEGEND

- 2015 CURRENT BERM SURFACE
- 2014 GRADED SURFACE AFTER REPAIR WORK
- PRE 2014 GRADED SURFACE
- WATER SURFACE
- E — PIEZOMETER, I.D. LABEL AND DETECTED WATER LEVEL

0 10 20
SCALE IN FEET

NO.	BY	DATE:	REVISION

AXIS GROUP
1101 WEST MINERAL AVENUE
SUITE 102
LITTLETON, COLORADO. 80120
(303) 332-5757

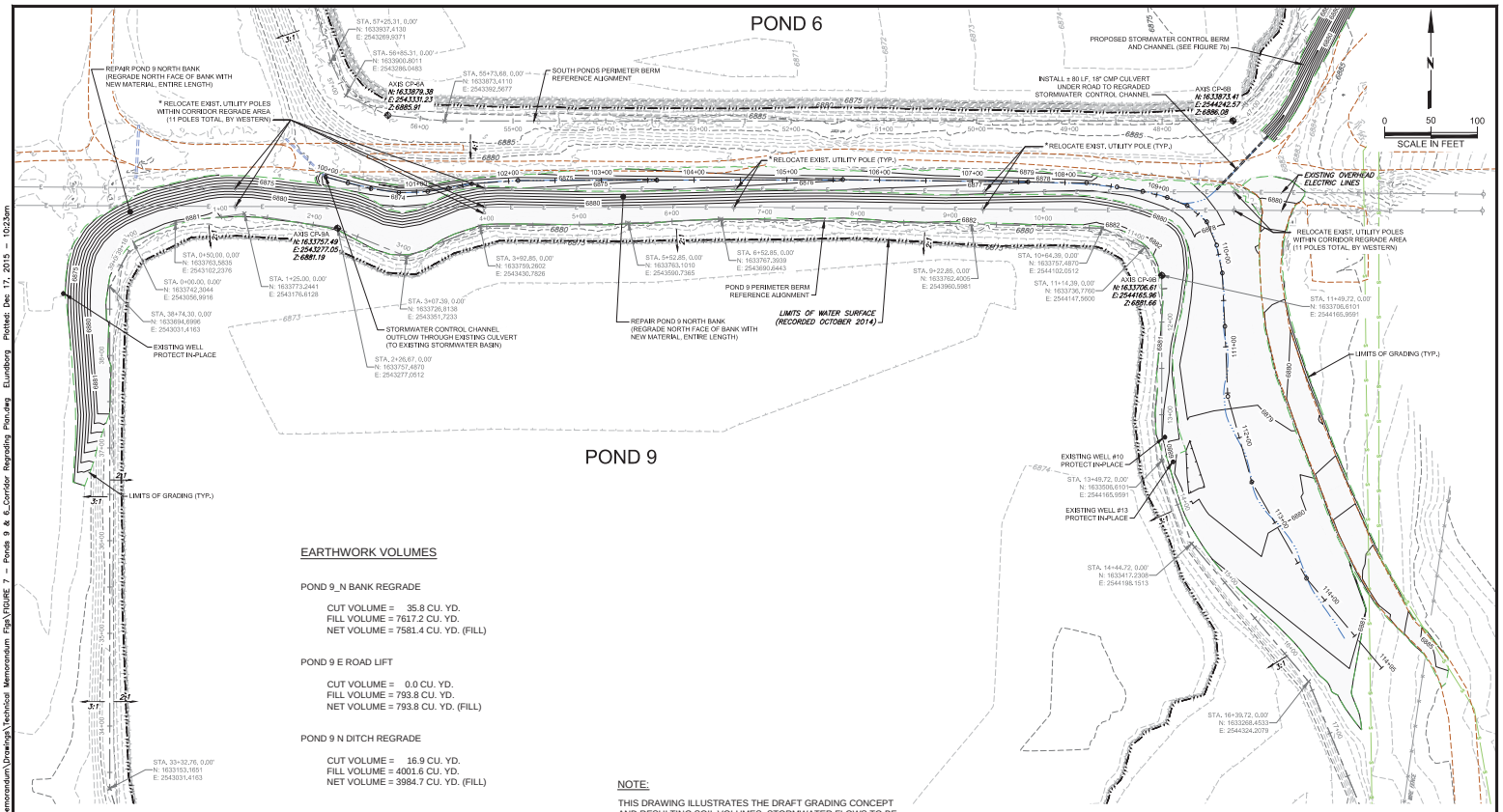
PROJ. NO.: 15-112 | DATE: 11-06-2015 | DRAWN BY: JAY | CHECKED BY: JWB

WESTERN REFINING SOUTHWEST, INC. - GALLUP REFINERY, NEW MEXICO

EVAPORATION POND UPGRADES
POND BERM CROSS SECTIONS

DRAWING NO.: 6b

X:\15-112 - WNR Technical Memorandum\Drawings\Technical Memorandum Figs\FIGURE 6a-6b - X-Sections and Piezometer Locs.dwg ELundberg Plotted: Dec. 17, 2015 - 9:41am



EARTHWORK VOLUMES

POND 9_N BANK REGRADE

CUT VOLUME = 35.8 CU. YD.
FILL VOLUME = 7617.2 CU. YD.
NET VOLUME = 7581.4 CU. YD. (FILL)

POND 9 E ROAD LIFT

CUT VOLUME = 0.0 CU. YD.
FILL VOLUME = 793.8 CU. YD.
NET VOLUME = 793.8 CU. YD. (FILL)

POND 9 N DITCH REGRADE

CUT VOLUME = 16.9 CU. YD.
FILL VOLUME = 4001.6 CU. YD.
NET VOLUME = 3984.7 CU. YD. (FILL)

NOTE:

THIS DRAWING ILLUSTRATES THE DRAFT GRADING CONCEPT AND RESULTING SOIL VOLUMES. STORMWATER FLOWS TO BE CONFIRMED DURING DESIGN REFINEMENT.

NO.	BY	DATE:	REVISION

AXIS GROUP
1101 WEST MINERAL AVENUE
SUITE 102
LITTLETON, COLORADO. 80120
(303) 332-5757

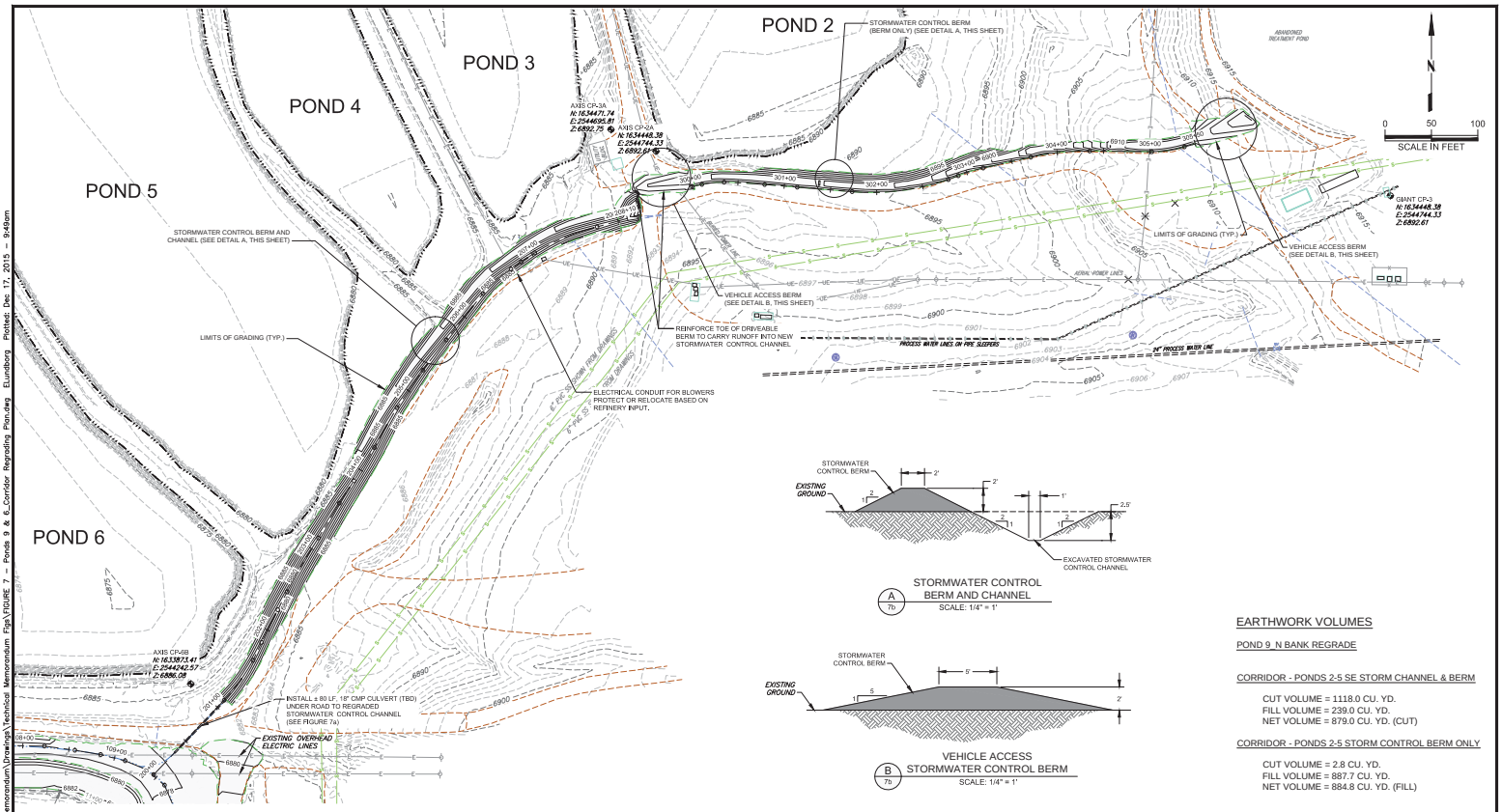
PROJ. NO.: 15-112 | DATE: 11-06-2015 | DRAWN BY: JAY | CHECKED BY: JWB

WESTERN REFINING SOUTHWEST, INC. - GALLUP REFINERY, NEW MEXICO

EVAPORATION PONDS UPGRADE - PLANNED REPAIR
PONDS 9 / 6 REGRADING PLAN

DRAWING NO.: 7a

X:\15-112 - WNR Technical Memorandum\Drawings\Technical Memorandum Figs\FIGURE 7 - Ponds 9 & 6_Corridor Regrading Plan.dwg Plotted: Dec 17, 2015 - 10:23am



A 7b
STORMWATER CONTROL BERM AND CHANNEL
SCALE: 1/4" = 1'

B 7b
VEHICLE ACCESS STORMWATER CONTROL BERM
SCALE: 1/4" = 1'

EARTHWORK VOLUMES

POND 9_N BANK REGRADE

CORRIDOR - PONDS 2-5 SE STORM CHANNEL & BERM

CUT VOLUME = 1118.0 CU. YD.
FILL VOLUME = 239.0 CU. YD.
NET VOLUME = 879.0 CU. YD. (CUT)

CORRIDOR - PONDS 2-5 STORM CONTROL BERM ONLY

CUT VOLUME = 2.8 CU. YD.
FILL VOLUME = 887.7 CU. YD.
NET VOLUME = 884.8 CU. YD. (FILL)

NO.	BY	DATE:	REVISION

AXIS GROUP
1101 WEST MINERAL AVENUE
SUITE 102
LITTLETON, COLORADO. 80120
(303) 332-5757

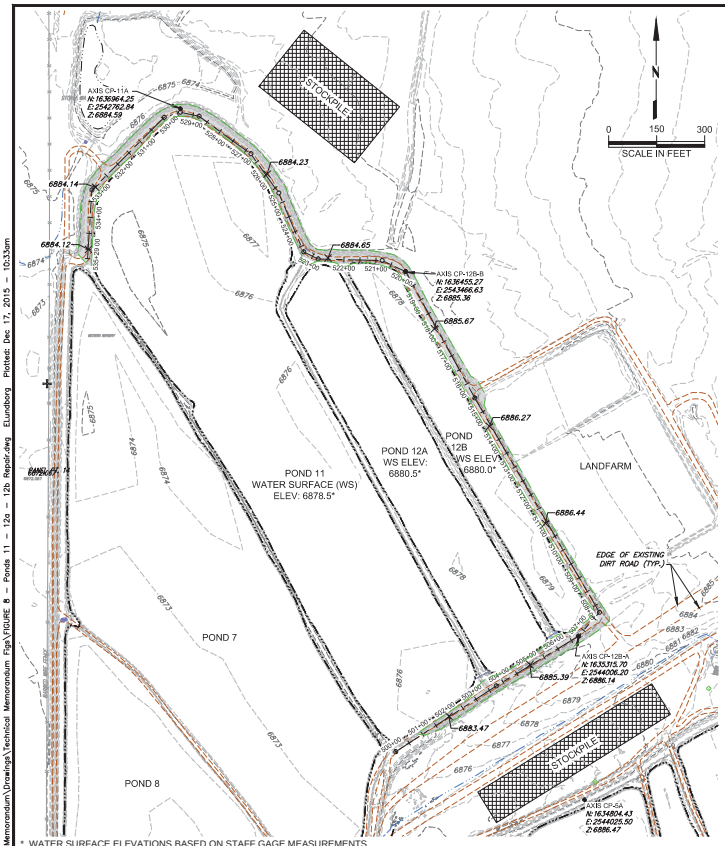
PROJ. NO.: 15-112 | DATE: 11-06-2015 | DRAWN BY: JAY | CHECKED BY: JWB

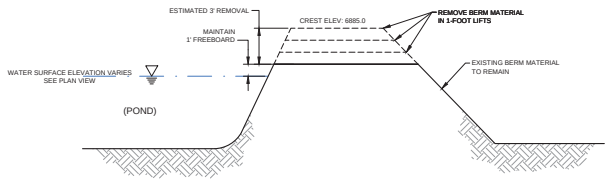
WESTERN REFINING SOUTHWEST, INC. - GALLUP REFINERY, NEW MEXICO

EVAPORATION PONDS UPGRADE - PLANNED REPAIR
STORMWATER CONTROL CHANNEL IMPROVEMENTS

DRAWING NO.: 7b

X:\15-112 - WNR Technical Memorandum\Drawings\Technical Memorandum Figs\FIGURE 7 - Ponds 9 & 6_Corridor Regrading Plan.dwg ELundborg Plotted: Dec 17, 2015 - 9:49am





MATERIAL REMOVAL
SCHEMATIC SECTION
(NO SCALE)

NOTES:

1. REMOVE SOIL IN 1-FOOT LIFTS
2. FINAL FINISHED GRADE TO MATCH EXISTING GRADE
3. APPROXIMATE AREA OF REMOVAL 3.05 acres
4. APPROXIMATE PERIMETER OF REMOVAL 3500 ft.
5. ANTICIPATED VOLUME OF SOIL REMOVAL 11,000 BCY.

LEGEND:

ESTIMATED LIMITS OF MATERIAL REMOVAL / REPLACEMENT

POTENTIAL TEMPORARY MATERIAL STOCKPILE LOCATIONS

6883.47 EXISTING GROUND SPOT ELEVATION

* WATER SURFACE ELEVATIONS BASED ON STAFF GAGE MEASUREMENTS

NO.	BY	DATE:	REVISION

AXIS GROUP
1101 WEST MINERAL AVENUE
SUITE 102
LITTLETON, COLORADO. 80120
(303) 332-5757

PROJ. NO.: 15-112 | DATE: 11-06-2015 | DRAWN BY: JAY | CHECKED BY: JWB

WESTERN REFINING SOUTHWEST, INC. - GALLUP REFINERY, NEW MEXICO

DRAWING NO.: 8

EVAPORATION PONDS UPGRADE - PLANNED REPAIR
PONDS 11, 12A & 12B REPAIR DESIGN

X:\15-112 - WNR Technical Memorandum\Drawings\Technical Memorandum Figs\FIGURE 8 - Ponds 11 - 12a - 12b Repair.dwg Plotted: Dec 17, 2015 - 10:33am Lundborg