

STATE OF UTAH  
DEPARTMENT OF ENVIRONMENTAL QUALITY  
DIVISION OF WATER QUALITY  
WATER QUALITY BOARD  
P.O. BOX 144870  
SALT LAKE CITY, UTAH 84114-4870

**Ground Water Discharge Permit**  
**Permit No. UGW270010**

In compliance with the provisions of the Utah Water Quality Act, Title 19, Chapter 5, Utah Code Annotated 1953, as amended, the Act,

**Magnum Gas Storage, LLC**  
3165 East Millrock Drive, Suite 330  
Holladay, UT 84121

hereafter referred to as the Permittee, is granted a Ground Water Discharge Permit for brine evaporation ponds in Millard County, Utah. The Magnum facility ponds are located at Latitude 39° 29' 1.76" North, Longitude -112° 35' 1.69" West on the following tracts of land (Salt Lake Base and Meridian):

Name	Section	Township	Range	Allotment
Brine Pond 3	25	15 South	7 West	in South 1/2
Brine Pond 4	25	15 South	7 West	in South 1/2

Lat: 39° 29' 1.76" N Lon: -112° 35' 1.69" W

This permit is based on representation made by the Permittee and other information contained in the administrative record. It is the responsibility of the Permittee to read and understand all provisions of this permit.

The facility shall be constructed and operated in accordance with conditions set forth in the permit and the Utah Administrative Rules for Ground Water Quality Protection (UAC R317-6).

This permit shall become effective on \_\_\_\_\_, 2018.

This permit and authorization to operate shall expire at midnight \_\_\_\_\_, 2023.

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Erica Brown Gaddis, Ph.D.  
Director  
Utah Division of Water Quality

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	Table 2 Interim Ground Water Protection Levels
	Table 3 Maximum Allowable Liner Leakage Rate

**Attachments**

- Appendix A** Construction Permit Plans and Specifications
- Appendix B** Groundwater Monitoring Plan, Magnum Gas Storage, LLC
- Appendix C** Brine Evaporation Ponds Operating Manual (pending publication)

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## **PART I CONSTRUCTION PERMIT ISSUANCE**

### **A. AUTHORIZED DESIGN AND CONSTRUCTION**

As part of this ground water discharge permit, a construction permit is hereby issued to Magnum Gas Storage to construct two brine evaporation ponds (Brine Pond 3 and Brine Pond 4) and ancillary support facilities. Under authority of the Utah Water Quality Act, Section 19-5-108(1) Utah Code Ann. 1953, as amended and Utah Administrative Code R317-1, the authorized facilities will be constructed in accordance with the engineering design plans and specifications attached as Appendix A. Appendix A also includes the construction permit authorized by the Director. Part II.D of this permit describes the Best Available Technology (BAT) standards for these permitted facilities.

The authorized evaporation ponds are constructed in accordance with the engineering design plans and specifications approved by the Construction Permit. The evaporation ponds are constructed with a composite liner system with two leak detection recovery systems. The area to be lined is approximately 176 acres in brine pond 3 and 145 acres in brine pond 4. Design components include:

- 80-mil HDPE Primary Liner – a 80-mil high density polyethylene liner. Specifications for the HDPE liner are provided in the Ground Water Discharge Permit application.
- 60-mil HDPE Secondary Liner – a 60-mil high density polyethylene line with 130-mil raised drainage studs to support the primary liner will be installed.
- Leak Detection Layer – the liners will be separated by either 130-mil raised drainage studs or a 250-mil geonet geomembrane layer drainage gap between the primary and secondary HDPE liners to route leakage to the Leak Collection Recovery System (LCRS) sumps located at low points within the pond floor.
- Process Component Monitoring System (PCMS) – Collection piping and a leak detection sump will be constructed in the soil under the secondary liner of the evaporation pond. Any liquids reporting to the sump can be sampled or returned to the evaporation pond surface.



## **PART II      SPECIFIC CONDITIONS**

### **A.      GROUND WATER CLASSIFICATION**

Based on ground water quality data submitted in the permit application and offsite monitoring wells, ground water at the site is defined as Class II Drinking Water Quality Ground Water.

### **B.      BACKGROUND GROUND WATER QUALITY**

Table 1 provides background ground water quality data from wells completed in the aquifers and zones located in the vicinity of the brine pond.

**Table 1: Background Ground Water Quality**

Aquifer	Water Table (Nov 2017)	Water Table (Nov 2017)	Shallow Artesian (May 2013)	Deep Artesian (May 2013)
Well	B-P1-4	B-P1-9	Egg Farm	IPP
Parameter (mg/l)				
Alkalinity (as CaCO <sub>3</sub> )	229	299		
Chloride	103	157	64	37
Sulfate	39	60	66	27
Total dissolved solids	448	652	328	249
Calcium	20	163	17	15.2
Magnesium	22	58	7	9.2
Potassium	8	13	2	3.5
Sodium	114	149	75	48
pH (units)	8.1	7.7	7.9	7.07
Conductivity (umhos/cm)	808	1090	565	410

units = mg/L

### **C.      GROUND WATER PROTECTION LEVELS**

Ground water quality monitoring of the water table aquifer will be conducted using these monitoring wells following installation and development: GA-3, GA-4, GA-5, GA-6, GA-7, GA-8, GA-9A, GA-17, GA-18, GA-19, GA-20, and GA-21. Following an accelerated sampling program and data evaluation, this list might be modified.

Table 2 provides interim ground water protection levels for the water table aquifer, as measured in brine evaporation pond GA compliance monitoring wells. These protection levels are based on Table 1 and shallow water table aquifer water samples collected from nearby brine evaporation pond monitoring wells. These interim protection levels will be adjusted if necessary following the accelerated sampling period for newly installed monitoring wells. See Part II.H.1 for details.

**Table 2: Interim Ground Water Protection Levels**

Parameter	Protection Level (mg/l)
pH (units)	6.5-8.5 <sup>(a)</sup>
Chloride	150
Sodium	200
Total Dissolved Solids	750

(a) Class II Ground Water Quality Standard

**D. PERMITTED FACILITIES AND BEST AVAILABLE TECHNOLOGY (BAT) STANDARD**

1. Authorized Construction - the project facilities authorized by this permit consist of two brine evaporation ponds, Brine Pond 3 and Brine Pond 4, and ancillary support facilities.
2. BAT Performance Monitoring - Best available technology monitoring will include a minimum vertical freeboard, maximum allowable leakage rate, and maximum allowable head monitoring. These performance standards are based on *Equations for Calculating the Rate of Liquid Migration through Composite Liners due to Geomembrane Defects* (Giroud, 1997).
  - a. Minimum Vertical Freeboard – a minimum of 36 inches of vertical freeboard shall be maintained to ensure total containment of the evaporation/surge pond and peripheral ditches.
  - b. Maximum Allowable Leakage Rate – based on a pond area of 152 acres (three feet below the inside crest of the berm), the maximum allowable leakage rate through the primary HDPE liner of the evaporation/surge pond will be 441 gallons per minute. For the 125-acre pond (three feet below the inside crest of berm), the maximum allowable leakage rate through the primary HDPE liner will be 359 gallons per minute.
  - c. Maximum Allowable Head – the maximum head in each of the leak detection sumps will be managed by pumping leakage collected in the sumps back into the respective pond. Head will be kept below the top of the sump at all times, as described in Appendix C, the Brine Evaporation Ponds Operating Manual. Fluids will be pumped from the sumps such that it is not necessary to pump from the 152-acre pond at a rate greater 353 gallons per minute (21,180 gallons per hour), and from the 125-acre pond at a rate greater than 287 gallons per minute (17,220 gallons per hour). These maximum pumping rates are equivalent to the Action Leakage Rates in Part II.F.3 below.
3. Spill Containment - The permittee shall design, maintain and construct all pipelines and pumping facilities with a spill containment system that shall:
  - a. Prevent any spills or leakage from any contact with the ground surface or ground water.
  - b. Convey all spills or leakage to the evaporation pond.

Any spill that does come into contact with the ground surface or ground water that causes pollution or has the potential to cause pollution to waters of the state shall be reported in accordance with Part III.I.

E. COMPLIANCE MONITORING REQUIREMENTS

1. Compliance Monitoring Points

- a. Leak Detection - The Leak Collection Recovery System (LCRS) and the Process Component Monitoring System (PCMS) installed under the evaporation pond liners will serve as a ground water compliance mechanism and monitoring point.
- b. Compliance Wells – Monitoring wells will serve as ground water compliance monitoring points for the water table aquifer. The monitoring wells will be installed before the ponds are put into operation.
- c. Ground Water Monitoring Plan - All water quality monitoring shall be conducted in accordance with the ground water monitoring plan (Appendix B).
- d. Protection of Monitoring Wells - All compliance monitoring wells must be protected from damage due to surface vehicular traffic or contamination due to surface spills. All compliance monitoring wells shall be maintained in full operational condition for the life of this permit. Any compliance monitoring well that becomes damaged beyond repair or is rendered unusable for any reason will be replaced by the permittee within 90 days or as directed by the Director.

2. Ground Water Compliance Monitoring

- a. Water Level Measurements – water level measurements shall be made in each monitoring well prior to any well purging or collection of ground water samples. These measurements will be made from a surveyed permanent reference point clearly demarcated on the top of the well or surface casing. Water level measurements will be made to the nearest 0.01 foot.
- b. Ground Water Quality Samples - samples of ground water from compliance monitoring wells will be collected for laboratory analysis on a quarterly basis until the compliance schedule requirements of Part II.H.1 are met.
  - 1) Analysis by Certified Laboratories - analysis of all ground water samples shall be performed by a laboratory certified by the Utah Department of Health.
  - 2) Ground Water Analytical Methods - methods used to analyze ground water samples must comply with the following:
    - i) Methods cited in UAC R317-6-6.3L, and
    - ii) Method detection limits are less than Ground Water Protection Levels in Part II.C Table 2
  - 3) Analysis Parameters - the following analyses will be conducted on all ground water samples collected:
    - i) Field Parameters - pH, temperature, and specific conductance.
    - ii) Laboratory Parameters – including:  
Protection Level Parameters in Part II.C Table 2

3. Leak Detection Sump Monitoring

- a. Flow Measurement – When the ponds are initially filling during periods of solution mining, the pumping rate of fluids pumped from the LCRS and PCMS sumps and returned to the brine ponds will be monitored daily and compared to the Maximum Allowable Leakage Rates in Table 3 Part II.F.3. below. After the ponds have been filled and leakage rates stabilize or decline, the pumping rate of fluids pumped from the LCRS and PCMS sumps and returned to the brine ponds will be monitored weekly and compared to the Maximum Allowable Leakage Rates in Table 3 Part II.F.3. below.
- b. Sump Fluids —fluids detected in a leak detection sump will be pumped to the evaporation pond surface to minimize maximum allowable head.

F. NON-COMPLIANCE STATUS

1. Probable Out-of-Compliance Status - The permittee shall evaluate results of each ground water sampling event to determine any exceedance of the Ground Water Protection Levels found in Part I.C above. Upon determination that a Ground Water Protection Level has been exceeded at any downgradient compliance monitoring well, the permittee shall:
  - a. Immediately re-sample the monitoring well(s) found to be in probable out-of-compliance status for laboratory analysis of the exceeded protection level parameter(s). Submit the analytical results thereof, and notify the Director of the probable out-of-compliance status within 30 days of the initial detection.
  - b. Upon exceedance of any one parameter listed in Table 2 for two consecutive sampling events, immediately implement an accelerated schedule of monthly sampling analysis, consistent with the requirements of this permit. This monthly sampling will continue for at least two months or until the compliance status can be determined by the Director. Reports of the results of this sampling will be submitted to the Director as soon as they are available, but not later than 30 days from each date of sampling.
2. Out-of-Compliance Status Based on Confirmed Exceedance of Permit Ground Water Protection Levels
  - a. Out of Compliance Status shall be defined as follows:

For parameters that have been defined as detectable in the ground water and for which protection levels have been established, out-of-compliance shall be defined as two consecutive samples exceeding the protection level.
  - b. Notification and Accelerated Monitoring - upon determination by the permittee or the Director, in accordance with UAC R317-6-6.17, that an out-of-compliance status exists, the permittee shall:
    - 1) Verbally notify the Director of the out-of-compliance status or acknowledge Director Notice that such a status exists within 24 hours of receipt of data, and

- 2) Provide written notice within 5 days of the determination, and
  - 3) Continue an accelerated schedule of monthly ground water monitoring for at least two months and continue monthly monitoring until the facility is brought into compliance, or as determined by the Director.
- c. Source and Contamination Assessment Study Plan - within 30 days after the written notice to the Director required in Part II.F.2.b.2, above, the permittee shall submit an assessment study plan and compliance schedule for:
- 1) Assessment of the source or cause of the contamination, and determination of steps necessary to correct the source.
  - 2) Assessment of the extent of the ground water contamination and any potential dispersion.
  - 3) Evaluation of potential remedial actions to restore and maintain ground water quality, and ensure that the ground water standards will not be exceeded at the compliance monitoring wells.
3. Out-of-Compliance Status Based Upon Failure To Maintain Best Available Technology - In the event that LCRS and PCMS monitoring indicates a violation of any of the construction or performance standards outlined in Part II.D of this permit, including an exceedance of leakage rates from Table 3 below, the permittee shall submit to the Director a notification and description of the violation in accordance with Part III.I of this permit. If the Maximum Allowable Leakage Rates in Table 3 are exceeded, corrective actions will be initiated following the procedures described in the attached Groundwater Monitoring Plan (Section 3.4 of Appendix B) and Brine Evaporation Ponds Operating Manual (Appendix C).

**Table 3 Maximum Allowable Liner Leakage Rates**

Monitoring System Component	Brine Pond 3 <sup>1</sup>	Brine Pond 4 <sup>1</sup>
LCRS sump	441 gallons per minute	359 gallons per minute
PCMS sump	14.9 gallons per minute	12.1 gallons per minute

<sup>1</sup>The LCRS Action Leakage Rate for each pond is 80 percent of the respective Maximum Allowable Leakage Rate. Appendix C, the Brine Evaporation Ponds Operating Manual, describes the corrective action response to an exceedance of the Action Leakage Rate(s).

**G. REPORTING REQUIREMENTS**

1. Quarterly Ground Water Monitoring - monitoring required in Part II.E.2 above shall be reported according to the schedule in Table 4 below, unless modified by the Director:

**Table 4: Compliance Monitoring Report Schedule**

Quarter	Report Due Date
1 <sup>st</sup> (January, February, March)	April 30th
2 <sup>nd</sup> (April, May, June)	July 31 <sup>st</sup>
3 <sup>rd</sup> (July, August, September)	October 31 <sup>st</sup>
4 <sup>th</sup> (October, November, December)	January 31 <sup>st</sup>

2. Water Level Measurements - water level measurements from ground water monitoring wells will be reported as measured depth to ground water from the surveyed casing measuring point, and ground water elevations as converted by casing measuring point elevations.
3. Ground Water Quality Sampling - reporting will include:
  - a. Field Data Sheets - or copies thereof, including the field measurements, required in Part I.E.2.b.3 above, and other pertinent field data, such as: well name/number, date and time, names of sampling crew, type of sampling pump or bail, volume of water purged before sampling.
  - b. Laboratory Analytical Results - including date sampled, date received; and the results of analysis for each parameter, including: value or concentration, units of measurement, reporting limit (minimum detection limit for the examination), analytical method, and the date of the analysis.
4. Monthly Leak Detection Monitoring - reporting will include:
  - a. The volume of fluid pumped from the leak detection sumps, tabulated either daily or monthly, depending on the monitoring interval.
  - b. The disposition of any fluids pumped from the leak detection sump.
5. Electronic Filing Requirements - In addition to submittal of the hard copy data, above, the permittee will electronically submit the required ground water monitoring data in the electronic format specified by the Director. The data may be submitted by e-mail, compact disc, or other approved transmittal mechanism.
6. Monitoring Well As-Built Report - For each well constructed the permittee shall submit diagrams and descriptions of the final completion of the monitoring wells. The report is due within 60 days of the date of well completion. The report shall include:
  - a. Casing: depth, diameter, and type of material.
  - b. Screen: length, depth interval, diameter, material type, slot size.
  - c. Sand Pack: depth interval, material type and grain size.
  - d. Annular Seals: depth interval, material type.
  - e. Surface Casing and Cap: depth, diameter, material type, protection measures constructed.
  - f. Elevation and Well Location: ground surface elevation, elevation of water level measuring point, latitude and longitude in hours, minutes and seconds.
  - g. Well construction description, well completion description, results of well pump tests or slug tests.

#### H. COMPLIANCE SCHEDULE

1. Independent samples will be collected quarterly from each well according to the requirements of Part II.E.2b above, until a total of eight (8) sampling events have been completed. Sampling will then change to a semi-annual compliance monitoring frequency. A summary report of sample results shall be submitted to DWQ and the interim Ground Water Class Protection Levels of Table 2 will be adjusted if necessary to comply with UAC R317-6-4.

2. Final Closure Plan. In the event that the permittee decides to discontinue its operations at the facility the permittee shall notify the Director of such a decision and submit a Final Closure Plan within 180 days prior to the closure of the facility. The permittee shall resubmit Final Closure Plans within 60 days of receipt of written notice of deficiencies therein.

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### **PART III MONITORING, RECORDING AND REPORTING REQUIREMENTS**

- A. REPRESENTATIVE SAMPLING  
Samples taken in compliance with the monitoring requirements established under Part II shall be representative of the monitored activity.
- B. ANALYTICAL PROCEDURES  
Water sample analysis must be conducted according to test procedures specified under UAC R317-6-6.3.L, unless other test procedures have been specified in this permit.
- C. PENALTIES FOR TAMPERING  
The Act provides that any person who falsifies, tampers with, or knowingly renders inaccurate, any monitoring device or method required to be maintained under this permit shall, upon conviction, be punished by a fine of not more than \$10,000 per violation, or by imprisonment for not more than six months per violation, or by both.
- D. REPORTING OF MONITORING RESULTS  
Monitoring results obtained during each reporting period specified in the permit, shall be submitted to the Director, Utah Division of Water Quality at the following address no later than the 30th day of the month following the completed reporting period:  
State of Utah  
Division of Water Quality  
P.O. Box 144870  
Salt Lake City, Utah 84114-4870  
Attention: Ground Water Protection Section  
Electronic reporting:  
<https://deq.utah.gov/ProgramsServices/services/submissions/index.htm>
- E. COMPLIANCE SCHEDULES  
Reports of compliance or noncompliance with, or any progress reports on interim and final requirements contained in any Compliance Schedule of this permit shall be submitted no later than 14 days following each schedule date.
- F. ADDITIONAL MONITORING BY THE PERMITTEE  
If the permittee monitors any pollutant more frequently than required by this permit, using approved test procedures as specified in this permit, the results of this monitoring shall be included in the calculation and reporting of the data submitted. Such increased frequency shall also be indicated.
- G. RECORDS CONTENTS  
Records of monitoring information shall include:
1. The date, exact place, and time of sampling or measurements;
  2. The individual(s) who performed the sampling or measurements;
  3. The date(s) and time(s) analyses were performed;
  4. The individual(s) who performed the analyses;
  5. The analytical techniques or methods used; and,
  6. The results of such analyses.



H. RETENTION OF RECORDS

The permittee shall retain records of all monitoring information, including all calibration and maintenance records and copies of all reports required by this permit, and records of all data used to complete the application for this permit, for a period of at least three years from the date of the sample, measurement, report or application. This period may be extended by request of the Director at any time.

I. TWENTY-FOUR HOUR NOTICE OF NONCOMPLIANCE REPORTING

1. The permittee shall verbally report any noncompliance which may endanger public health or the environment as soon as possible, but no later than 24 hours from the time the permittee first became aware of the circumstances. The report shall be made to the Utah Department of Environmental Quality 24-hour number, (801) 536-4123, or to the Division of Water Quality, Ground Water Protection Section at (801) 536-4300, during normal business hours (Monday through Friday 8:00 am - 5:00 pm Mountain Time).
2. A written submission shall also be provided to the Director within five days of the time that the permittee becomes aware of the circumstances. The written submission shall contain:
  - a. A description of the noncompliance and its cause;
  - b. The period of noncompliance, including exact dates and times;
  - c. The estimated time noncompliance is expected to continue if it has not been corrected; and,
  - d. Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.
3. Reports shall be submitted to the addresses in Part III.D, Reporting of Monitoring Results.

J. OTHER NONCOMPLIANCE REPORTING

Instances of noncompliance not required to be reported within 24 hours, shall be reported at the time that monitoring reports for Part II.E are submitted.

K. INSPECTION AND ENTRY

The permittee shall allow the Director, or an authorized representative, upon the presentation of credentials and other documents as may be required by law, to:

1. Enter upon the permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of the permit;
2. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;
3. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit; and,
4. Sample or monitor at reasonable times, for the purpose of assuring permit compliance or as otherwise authorized by the Act, any substances or parameters at any location.

## **PART IV COMPLIANCE RESPONSIBILITIES**

A. DUTY TO COMPLY

The permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the Act and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or for denial of a permit renewal application. The permittee shall give advance notice to the Director of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.

B. PENALTIES FOR VIOLATIONS OF PERMIT CONDITIONS

The Act provides that any person who violates a permit condition implementing provisions of the Act is subject to a civil penalty not to exceed \$10,000 per day of such violation. Any person who willfully or negligently violates permit conditions is subject to a fine not exceeding \$25,000 per day of violation. Any person convicted under Section 19-5-115(2) of the Act a second time shall be punished by a fine not exceeding \$50,000 per day. Nothing in this permit shall be construed to relieve the permittee of the civil or criminal penalties for noncompliance.

C. NEED TO HALT OR REDUCE ACTIVITY NOT A DEFENSE

It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

D. DUTY TO MITIGATE

The permittee shall take all reasonable steps to minimize or prevent any discharge in violation of this permit which has a reasonable likelihood of adversely affecting human health or the environment.

E. PROPER OPERATION AND MAINTENANCE

The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the conditions of this permit. Proper operation and maintenance also includes adequate laboratory controls and quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems which are installed by a permittee only when the operation is necessary to achieve compliance with the conditions of the permit.

## **PART V      GENERAL REQUIREMENTS**

- A.    PLANNED CHANGES  
The permittee shall give notice to the Director as soon as possible of any planned physical alterations or additions to the permitted facility. Notice is required when the alteration or addition could significantly change the nature of the facility or increase the quantity of pollutants discharged.
- B.    ANTICIPATED NONCOMPLIANCE  
The permittee shall give advance notice of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.
- C.    PERMIT ACTIONS  
This permit may be modified, revoked and reissued, or terminated for cause. The filing of a request by the permittee for a permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance, does not stay any permit condition.
- D.    DUTY TO REAPPLY  
If the permittee wishes to continue an activity regulated by this permit after the expiration date of this permit, the permittee must apply for and obtain a permit renewal or extension. The application should be submitted at least 180 days before the expiration date of this permit.
- E.    DUTY TO PROVIDE INFORMATION  
The permittee shall furnish to the Director, within a reasonable time, any information which the Director may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit, or to determine compliance with this permit. The permittee shall also furnish to the Director, upon request, copies of records required to be kept by this permit.
- F.    OTHER INFORMATION  
When the permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or any report to the Director, it shall promptly submit such facts or information.
- G.    SIGNATORY REQUIREMENTS  
All applications, reports or information submitted to the Director shall be signed and certified.
1.    All permit applications shall be signed as follows:
    - a.    For a corporation: by a responsible corporate officer;
    - b.    For a partnership or sole proprietorship: by a general partner or the proprietor, respectively.
    - c.    For a municipality, State, Federal, or other public agency: by either a principal executive officer or ranking elected official.
  2.    All reports required by the permit and other information requested by the Director shall be signed by a person described above or by a duly authorized representative of that person. A person is a duly authorized representative only if:

- a. The authorization is made in writing by a person described above and submitted to the Director, and,
  - b. The authorization specified either an individual or a position having responsibility for the overall operation of the regulated facility or activity, such as the position of plant manager, operator of a well or a well field, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters for the company. (A duly authorized representative may thus be either a named individual or any individual occupying a named position.)
3. Changes to Authorization. If an authorization under Part IV.G.2 is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of Part IV.G.2 must be submitted to the Director prior to or together with any reports, information, or applications to be signed by an authorized representative.
  4. Certification. Any person signing a document under this section shall make the following certification:

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."
- H. PENALTIES FOR FALSIFICATION OF REPORTS
- The Act provides that any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit, including monitoring reports or reports of compliance or noncompliance shall, upon conviction be punished by a fine of not more than \$10,000 per violation, or by imprisonment for not more than six months per violation, or by both.
- I. AVAILABILITY OF REPORTS
- Except for data determined to be confidential by the permittee, all reports prepared in accordance with the terms of this permit shall be available for public inspection at the offices of the Director. As required by the Act, permit applications, permits, effluent data, and ground water quality data shall not be considered confidential.
- J. PROPERTY RIGHTS
- The issuance of this permit does not convey any property rights of any sort, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of federal, state or local laws or regulations.
- K. SEVERABILITY
- The provisions of this permit are severable, and if any provision of this permit, or the application of any provision of this permit to any circumstance, is held invalid, the application of such

provision to other circumstances, and the remainder of this permit, shall not be affected thereby.

L. TRANSFERS

This permit may be automatically transferred to a new permittee if:

1. The current permittee notifies the Director at least 30 days in advance of the proposed transfer date;
2. The notice includes a written agreement between the existing and new permittee containing a specific date for transfer of permit responsibility, coverage, and liability between them; and,
3. The Director does not notify the existing permittee and the proposed new permittee of his or her intent to modify, or revoke and reissue the permit. If this notice is not received, the transfer is effective on the date specified in the agreement mentioned in paragraph 2 above.

M. STATE LAWS

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, penalties established pursuant to any applicable state law or regulation under authority preserved by Section 19-5-117 of the Act.

N. REOPENER PROVISION

This permit may be reopened and modified (following proper administrative procedures) to include the appropriate limitations and compliance schedule, if necessary, if one or more of the following events occurs:

1. If new ground water standards are adopted by the Board, the permit may be reopened and modified to extend the terms of the permit or to include pollutants covered by new standards. The permittee may apply for a variance under the conditions outlined in R317-6-6.4.D.
2. If alternative compliance mechanisms are required.
3. If subsequent ground water monitoring data reveals the background water quality values in Part I Table 1 are not accurate.

**APPENDIX A**  
**CONSTRUCTION PERMIT**  
**PLANS AND SPECIFICATIONS**

Tiffany A. James  
Executive Vice President  
Magnum Gas Storage Project  
3165 East Millrock Drive #330  
Holliday, Utah 84121

Dear Ms. James:

Subject:     **Construction Permit** for Brine Ponds 3 and 4

On October 9, 2017, the Division of Water Quality (DWQ) received the engineering plans and specifications for the Magnum Gas Storage Project (Magnum) Brine Ponds 3 and 4. These were prepared by Newfields Mining Design and Technical Services (Newfields) and stamped by Kevin N. Jennings a Utah Certified Professional Engineer (PE).

The following is a summary of the proposed major construction projects:

- Construction of Brine Ponds 3 and 4.

The plans and specifications, as submitted, comply with *the Utah Water Quality Rules, (R317, Utah Administrative Code)*. A **Construction Permit** is hereby issued as constituted by this letter, subject to the following conditions:

1. *Any revisions or modifications to the approved plans and specifications must be submitted to DWQ for review and approval, before construction or implementation thereof. Please submit any changes for review and approval directly to Woodrow Campbell, P.E., of the DWQ Ground Water Protection Section.*
2. *A written operations and maintenance manual, containing a description of the functioning of the facilities, an outline of routine maintenance procedures, and all checklists and maintenance logs needed for proper operation of the system, must be submitted and approved before the final inspection and operation of the system.*
3. *The approved facilities must not be placed in service unless DWQ has conducted a final inspection, reviewed and approved the As-Built Construction Certification Report, and provided written authorization to place the constructed facilities in service.*
4. *Construction activities that disturb one acre or more are required to obtain coverage under the Utah Pollutant Discharge Elimination System (UPDES) Storm Water General Permit for Construction Activities. The permit requires the development of a storm water pollution prevention plan (SWPPP) to be implemented and updated from the commencement of any soil disturbing activities at the site until final stabilization of the project. For more information, or to obtain permit coverage on-line, please go to: <http://www.waterquality.utah.gov/UPDES/stormwater.htm>*

The plans and specifications for this project have been stamped and signed by a Professional Engineer currently licensed to practice in the state of Utah. The construction design, inspection supervision, and written construction certification of all work associated with this Construction Permit must be performed by a Professional Engineer licensed to practice in the state of Utah.

This Construction Permit will expire one year from the date of its issuance, as evidenced by the date of this letter, unless substantial progress is made in constructing the approved facilities or the plans and specifications have been resubmitted and the construction permit is reissued. This permit does not relieve you, in any way, of your obligations to comply with other applicable local requirements. You may contact Central Utah Public Health Department at 435-896-5451 ext 342 or John Chartier Central Utah District Engineer at 435-896-5451 ext. 314 for further assistance regarding local matters.

Because of the inherent hazard potential at lagoons and ponds, warning signs should be posted at these facilities to state the dangers of drowning and asphyxiation. Safety ropes, stairs, or equivalent should be available to allow anyone trapped in the ponds to escape.

Please contact Mr. Campbell at the beginning of construction to allow periodic inspections to be scheduled. Upon completion of the project, a final inspection and approval of the As-Built Construction Certification Report is required before the approval to operate the completed facilities can be issued. Please remain in contact with Mr. Campbell to schedule the final inspection. The Construction Certification Report with final as-built drawings must include test results for the following construction quality assurance and quality control (CQA/QC) elements:

Soil Subgrade

- Proctor Curves,
- Soil Classification,
- Field Compaction and Moisture Testing, and
- Subgrade Acceptance Certification.

Concrete

- Concrete Mix Verification,
- Concrete ASTM Testing Method, Frequency, and Results,
- Concrete Testing Pass/Fail Criteria, and
- Crack Inspection and Repair.

Flexible Membrane Liner

- Panel Placement Log,
- Trial Seam Test Log,
- Seaming Record,
- Seam Test Record,
- Repair Log,
- As-Built Drawing,
- Manufactures Certification including QA/QC Testing of the Rolls, and
- Professional Engineer Certification.



Ms. Tiffany James  
Page 3

If we can be of further assistance, please contact Mr. Woodrow Campbell at [wwcampbell@utah.gov](mailto:wwcampbell@utah.gov) or (801) 536-4353.

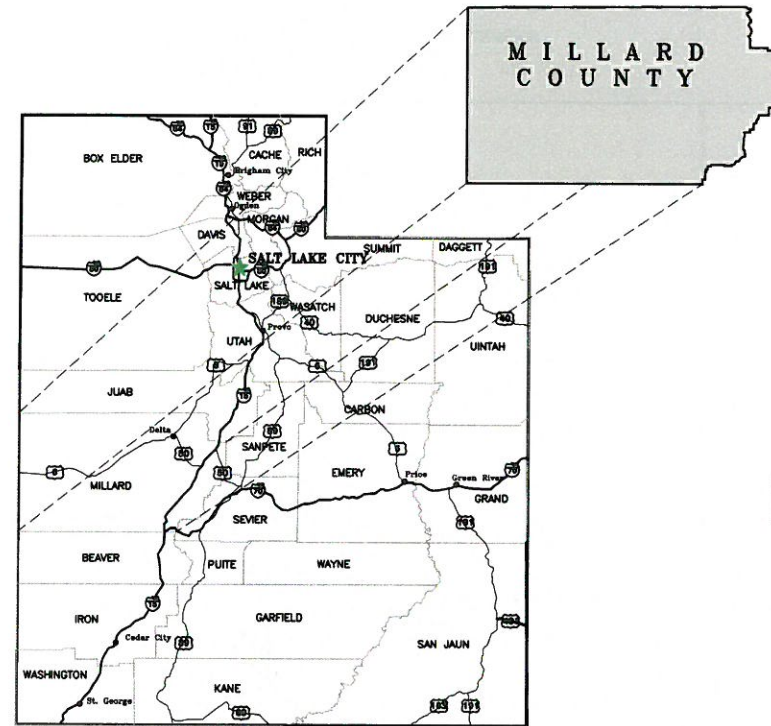
Sincerely,

Erica Brown Gaddis, PhD  
Director

EBG/WWC/DJH:

cc: John Chartier Central Utah District Engineer (via email w/o attachment)  
Central Utah Public Health Department (via email w/o attachment)  
Dave Marble Division of Dam Safety (via email w/o attachment [davemarble@utah.gov](mailto:davemarble@utah.gov))  
Kevin N. Jennings, Newfields (via email w/o attachment [kjennings@newfields.com](mailto:kjennings@newfields.com))

DWQ-2017-011205

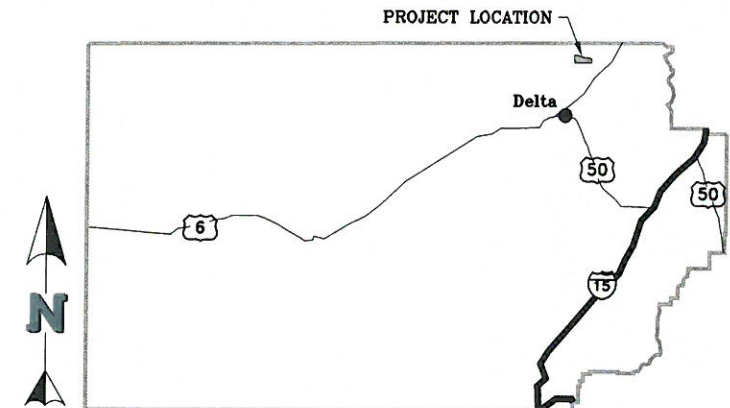


UTAH COUNTY MAP

# MAGNUM DEVELOPMENT SOLUTION MINING

## BRINE PONDS No. 3 & 4

### ISSUED FOR CONSTRUCTION 10/06/17



MILLARD COUNTY VICINITY MAP

DRAWING INDEX		
DWG	TITLE	REV
A000	COVER SHEET & DRAWING INDEX	0
A010	GENERAL ARRANGEMENT	0
A020	STAGE-STORAGE CURVES AND POND PROPERTIES	0
A050	GEOTECHNICAL INVESTIGATION LOCATIONS	0
A100	OVERALL GRADING PLAN	0
A105	OVERALL GRADING ISOPACH	0
A110	TYPICAL EMBANKMENT SECTIONS AND DETAILS SHEET 1 OF 2	0
A115	TYPICAL EMBANKMENT SECTIONS AND DETAILS SHEET 2 OF 2	0
A120	POND 3 NORTHWEST ACCESS RAMP PLAN AND PROFILE	0
A135	POND 4 SOUTHWEST ACCESS RAMP PLAN AND PROFILE	0
A140	BRINE RECOVERY SYSTEM SECTION AND DETAILS	0
A150	POND INLET PLAN	0
A160	POND INLET SECTIONS AND DETAILS	0
A200	POND BASIN PIPING PLAN	0
A205	POND BASIN PIPING SECTIONS AND DETAILS	0
A220	LEAK COLLECTION AND RECOVERY SYSTEM DETAILS	0
A230	PROCESS COLLECTION AND MONITORING SYSTEM PLAN	0
A300	POND SITE GROUNDWATER DEPTHS PLAN AND PROFILE	0
A400	STORMWATER DIVERSION AND SETTLEMENT MONUMENT PLAN	0
A500	BRINE RECOVERY MANIFOLD SECTIONS AND DETAILS	0
A550	BRINE RECOVERY PIPELINE TIE-IN	0
A560	BRINE RECOVERY PIPELINE CONNECTION DETAILS	0
A600	WILDLIFE FENCE DETAILS	0

#### OWNER'S ACCEPTANCE OF THE DRAWINGS




NAME

SIGNATURE

DATE



**MAGNUM DEVELOPMENT SOLUTION MINING**  
 3165 E MILLROCK DRIVE  
 SUITE 330 HOLLADAY, UT 84121  
 PHONE: 801-993-7001

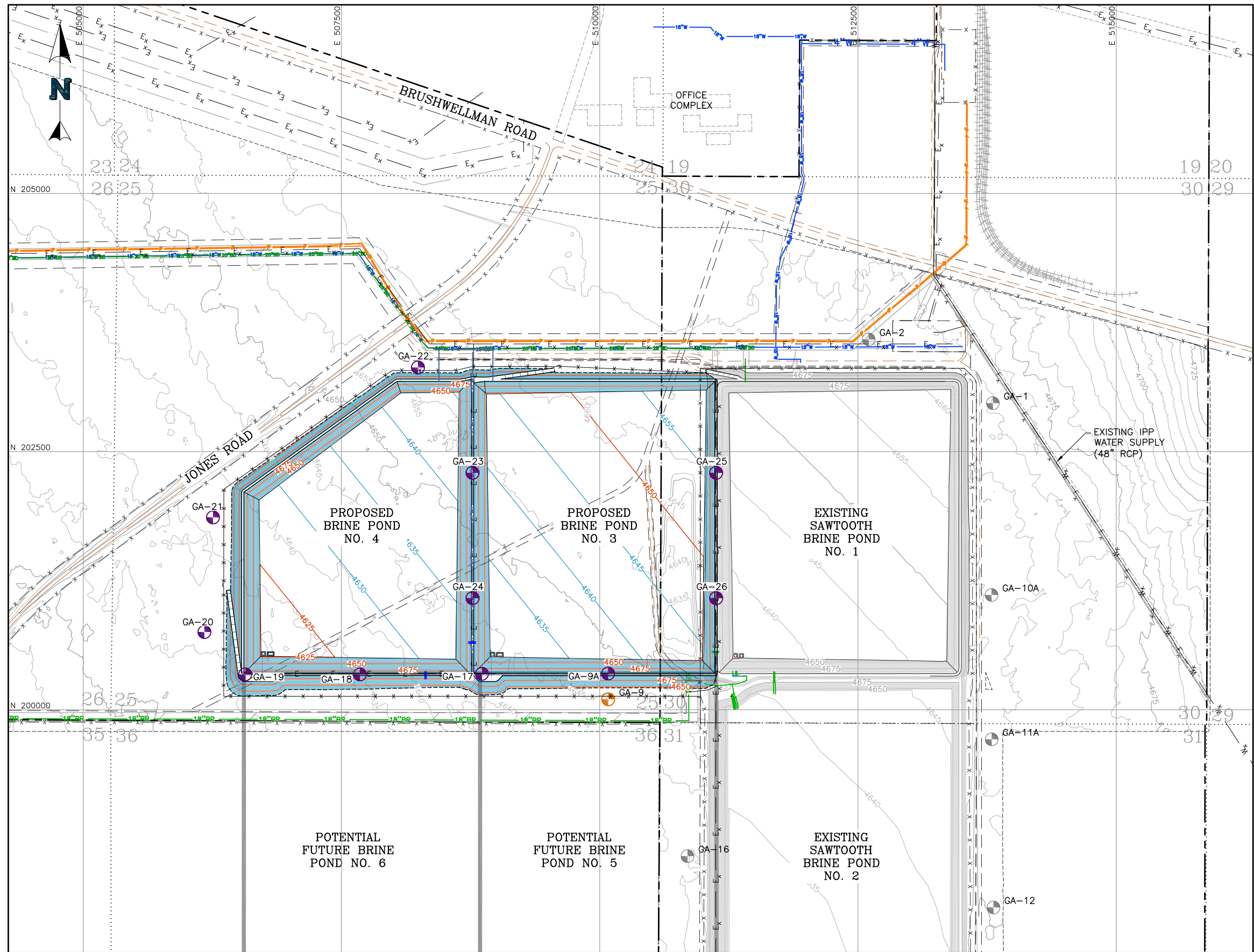


**NewFields**

9400 Station Street, Suite 300, Lone Tree, CO 80124  
 Phone: (720) 508.3300 [www.newfields.com](http://www.newfields.com)



P:\Projects\0093.017 Magnum Brine Ponds 3 & 4\A-CAD\DWGS\93.0017.001M.dwg-10/4/2017 8:44 AM

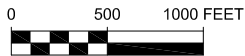
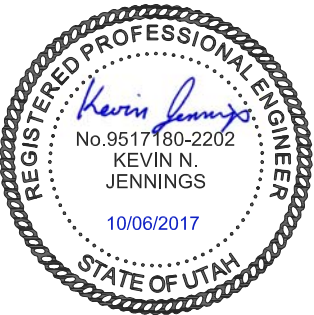


LEGEND:

- EXISTING GROUND CONTOURS
- PROPOSED GROUND CONTOURS
- EXISTING ROADS/TRAILS
- EXISTING EASEMENTS
- MAGNUM SITE BOUNDARY
- SITE BOUNDARY
- SECTION LINES
- SECTION NUMBER
- EXISTING FENCE
- PROPOSED WILDLIFE FENCE
- EXISTING BRINE LINE
- EXISTING BRINE LINE
- EXISTING POWER LINE
- EXISTING WATER LINE
- EXISTING PIPE
- EXISTING 18" WATER
- EXISTING 4" WATER
- PROPOSED 20" HDPE DR11 BRINE INFLUENT LINE
- GA-01 EXISTING GROUND WATER MONITORING WELLS TO REMAIN
- GA-09 EXISTING GROUND WATER MONITORING WELLS TO BE RELOCATED
- GA-12 PROPOSED GROUND WATER MONITORING WELLS

NOTES:

- EXISTING MONITORING WELL GA-9 TO BE ABANDONED PER STATE REGULATION R655-4-14 "ABANDONMENT OF WELLS."
- STAGE-STORAGE CURVES AND POND PROPERTIES TABLE ARE SHOWN ON DRAWING A020.



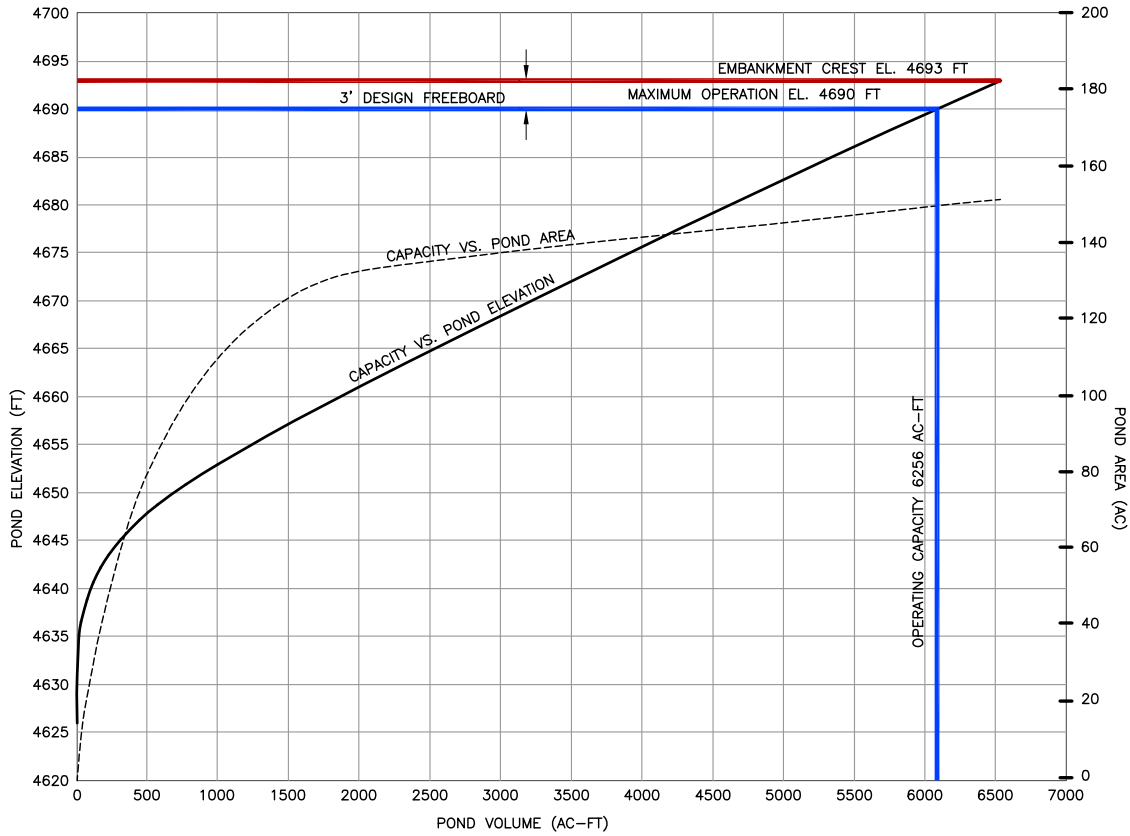
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CHECKED BY:	KNJ	NEWFIELDS PRODUCED THE INFORMATION PRESENTED ON THIS DRAWING THROUGH THE USE OF AVAILABLE TECHNICAL INFORMATION AND EXPERIENCE. RECEIVING THIS DRAWING DOES NOT GUARANTEE ANY RIGHTS TO EITHER SUCH TECHNICAL INFORMATION OR EXPERIENCE. ANY MODIFICATION OR ADAPTATION OF THE DATA OR DRAWING SHALL BE AT USER'S RISK AND WITHOUT ANY LIABILITY OR LEGAL RESPONSIBILITY TO NEWFIELDS.
DESIGNED BY:	JLW	
DRAWN BY:	JLW	

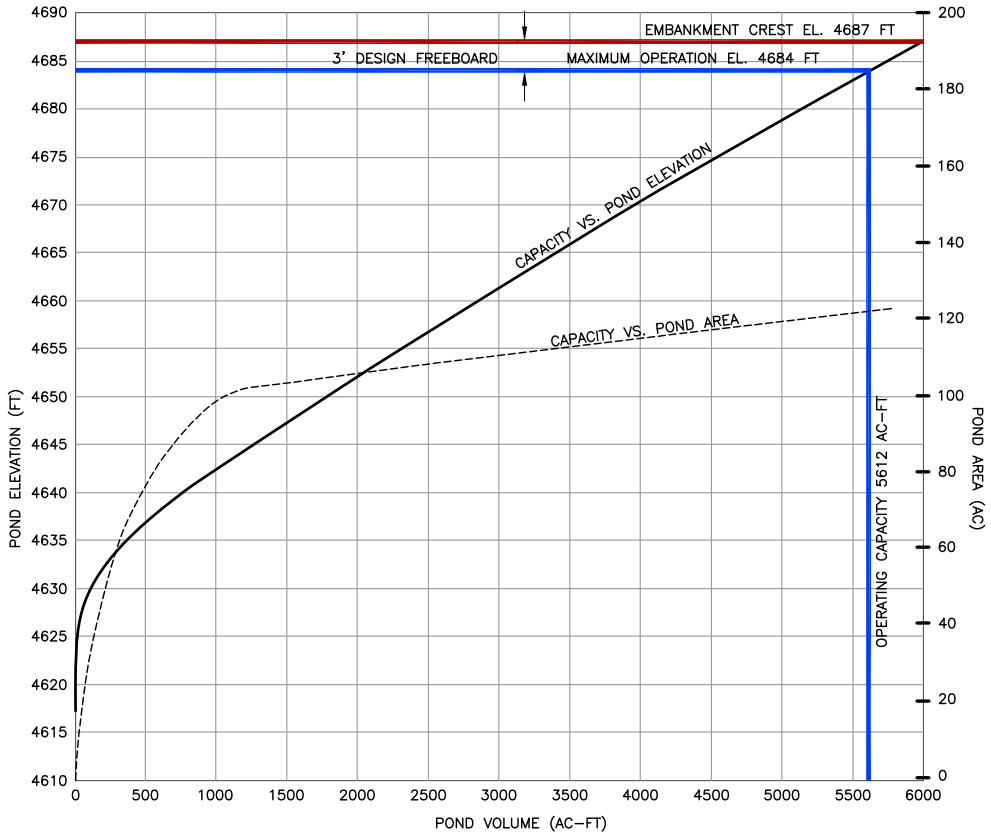
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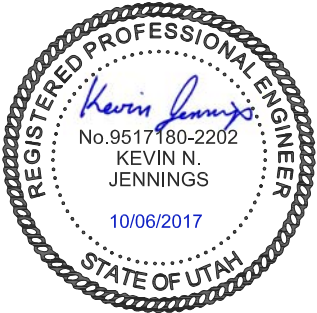
BRINE POND NO. 3 STAGE-STORAGE CURVE




BRINE POND NO. 4 STAGE-STORAGE CURVE



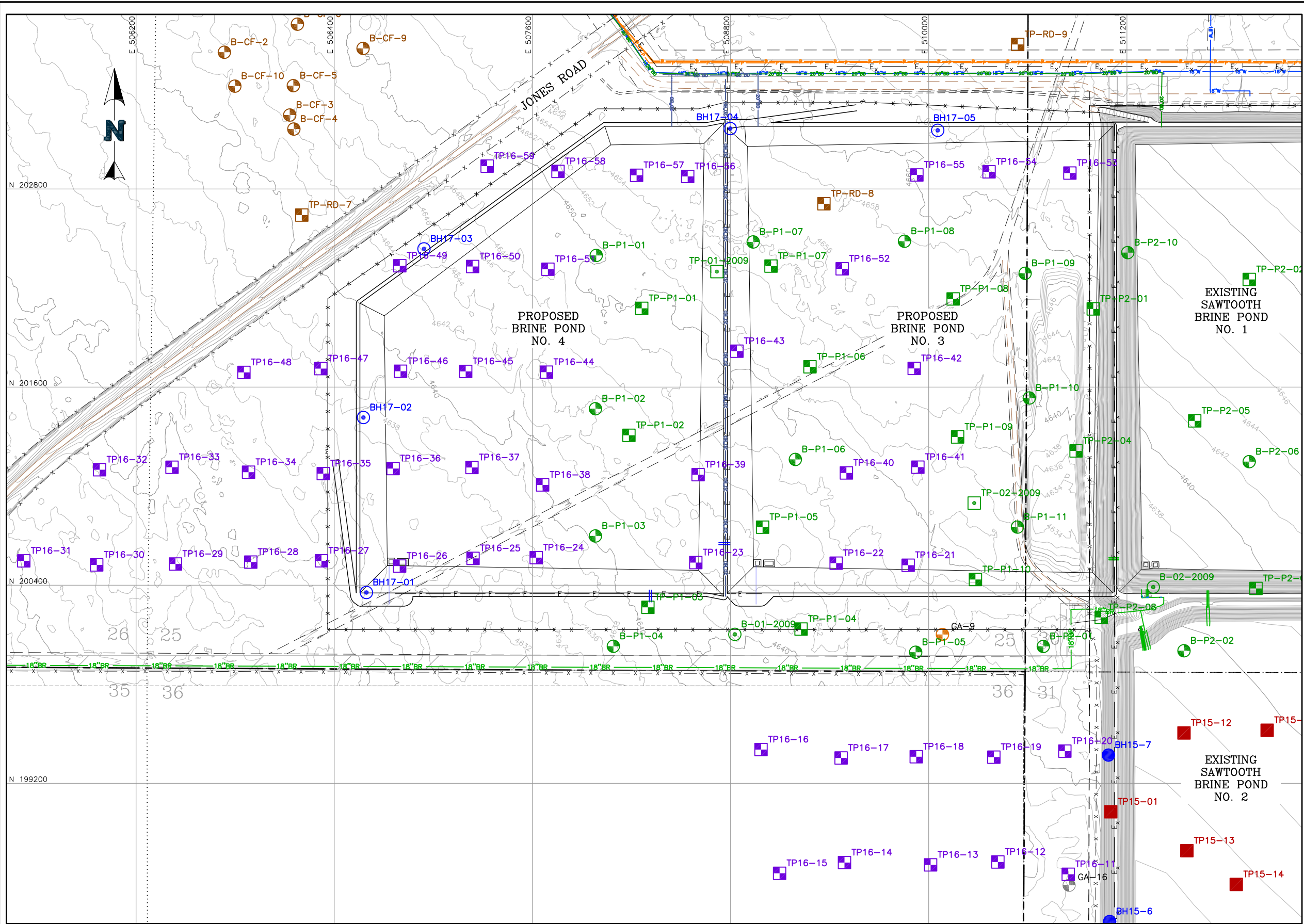
POND PROPERTIES		
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CREST ELEVATION (FT)	4,693	4,687
OPERATING ELEVATION (FT)	4,690	4,684
TOTAL CAPACITY (AC-FT)	6,707	5,980
OPERATING CAPACITY (AC-FT)	6,256	5,612
FREEBOARD CAPACITY (AC-FT)	451	368



						APPROVED BY: KNJ	<div>DISCLAIMER</div> <div>NEWFIELDS PRODUCED THE INFORMATION PRESENTED ON THIS DRAWING THROUGH THE USE OF AVAILABLE TECHNICAL INFORMATION AND EXPERIENCE. RECEIVING THIS DRAWING DOES NOT GUARANTEE ANY RIGHTS TO EITHER SUCH TECHNICAL INFORMATION OR EXPERIENCE. ANY MODIFICATION OR ADAPTATION OF THE DATA OR DRAWING SHALL BE AT USER'S RISK AND WITHOUT ANY LIABILITY OR LEGAL RESPONSIBILITY TO NEWFIELDS.</div>	<div>NewFields</div> <div>CLIENT</div> <div>MAGNUM DEVELOPMENT SOLUTION MINING</div>	
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						DESIGNED BY: JLW			
						DRAWN BY: JLW			
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REV	DATE	DESCRIPTION			TECH	ENG	TITLE		STAGE-STORAGE CURVES AND POND PROPERTIES
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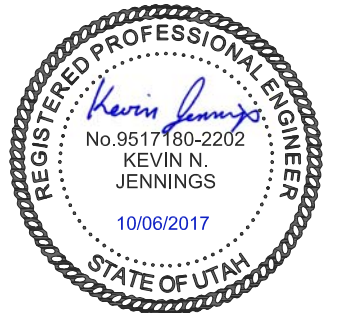
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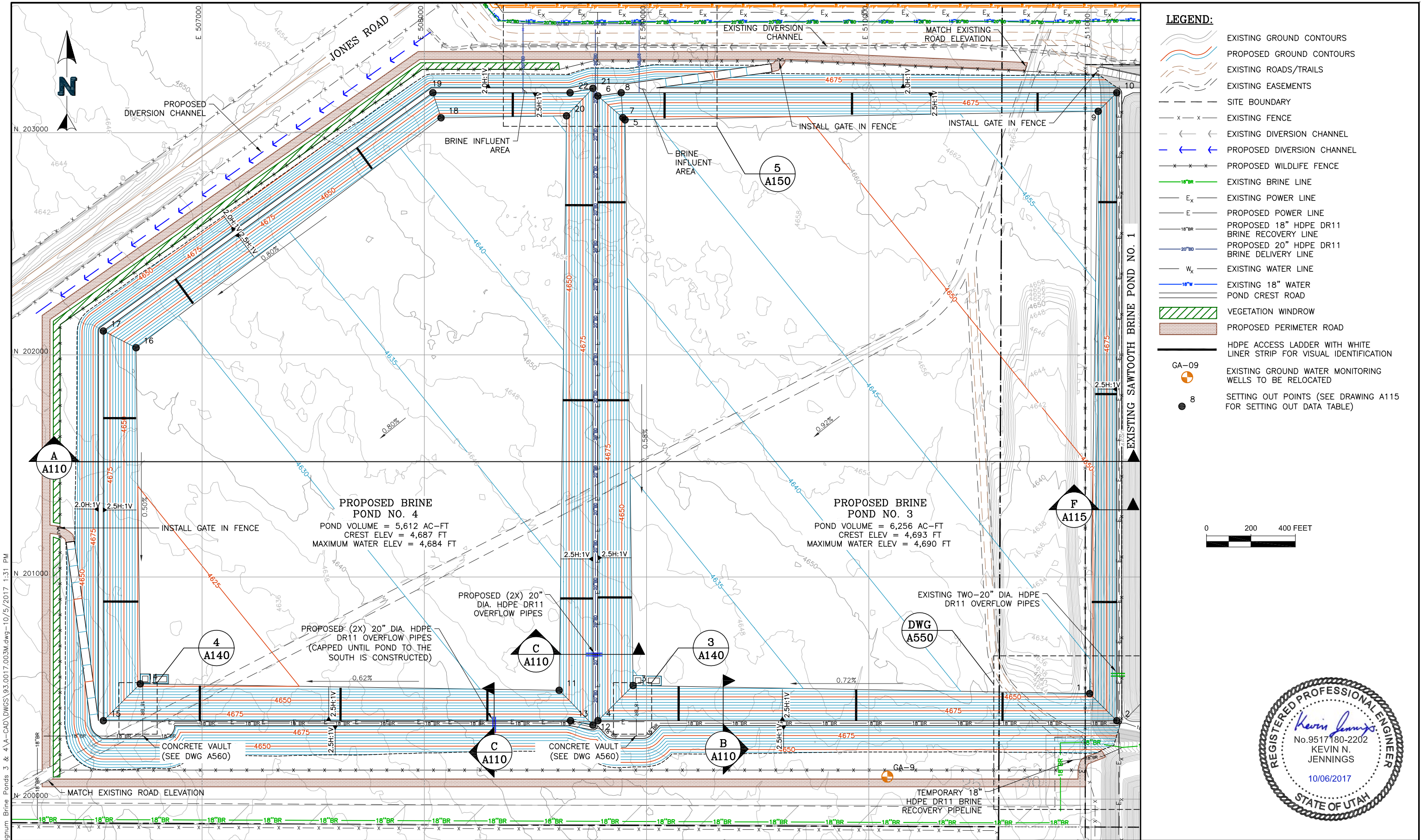
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- EXISTING WATER LINE
- EXISTING PIPE
- EXISTING 18" WATER
- EXISTING GROUND WATER MONITORING WELLS TO BE RELOCATED
- PROPOSED GROUND WATER MONITORING WELLS
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- TEST PIT (IGES, 2009)
- BOREHOLE (IGES, 2010)
- TEST PIT (IGES, 2010)
- BOREHOLE (IGES, 2010 PLANT SITE)
- TEST PIT (IGES, 2010 PLANT SITE)
- BOREHOLE (NEWFIELDS, 2015)
- TEST PIT (NEWFIELDS, 2015)
- PHASE I TEST PIT (NEWFIELDS, 2016)
- BOREHOLE (NEWFIELDS, 2017)

0 300 600 FEET



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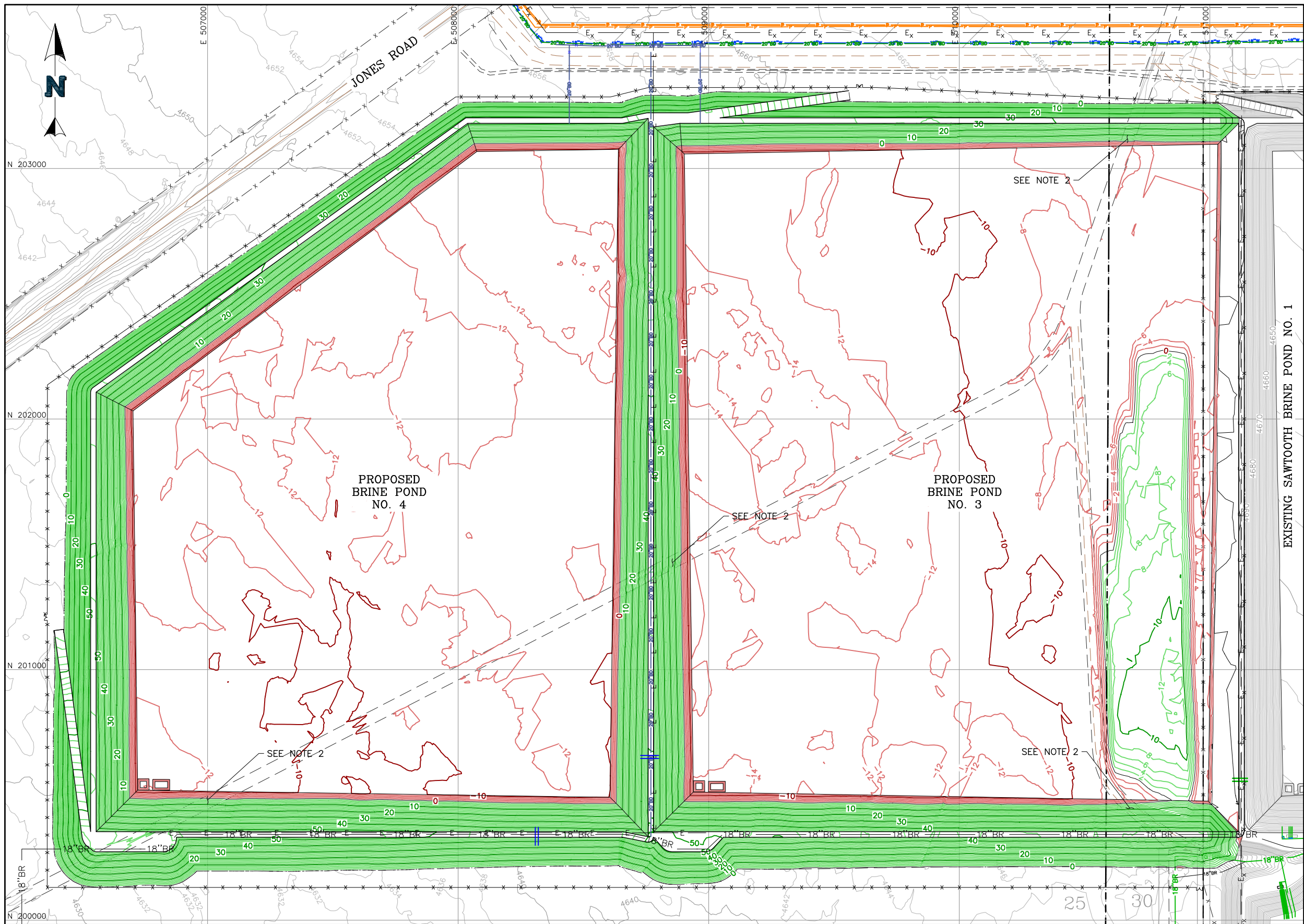




<b>GEOSYNTHETIC LINER SYSTEM NOTE:</b> 1. THE LINER SYSTEM SHALL BE A COMPOSITE SYSTEM WITH THE PRIMARY LINER CONSISTING OF 80-mil (2.0MM) SINGLE SIDED TEXTURED HDPE LINER UNDERLAIN BY A SECONDARY LINER CONSISTING OF A 60-mil (1.5MM) DRAIN LINER WITH 130-mil HEIGHT RAISED STUDS FACING UP. 250-mil GEONET MAY BE USED IN LIEU OF THE 130-mil HEIGHT RAISED STUDS.			<b>NOTES:</b> 1. EXISTING MONITORING WELL GA-9 TO BE ABANDONED PER STATE REGULATION R655-4-14 "ABANDONMENT OF WELLS."			<b>APPROVED BY:</b> KNJ <b>CHECKED BY:</b> KNJ <b>DESIGNED BY:</b> JLW <b>DRAWN BY:</b> JLW			<b>DISCLAIMER</b> NEWFIELDS PRODUCED THE INFORMATION PRESENTED ON THIS DRAWING THROUGH THE USE OF AVAILABLE TECHNICAL INFORMATION AND EXPERIENCE. RECEIVING THIS DRAWING DOES NOT GUARANTEE ANY RIGHTS TO EITHER SUCH TECHNICAL INFORMATION OR EXPERIENCE. ANY MODIFICATION OR ADAPTATION OF THE DATA OR DRAWING SHALL BE AT USER'S RISK AND WITHOUT ANY LIABILITY OR LEGAL RESPONSIBILITY TO NEWFIELDS.			<b>NewFields</b> CLIENT <b>MAGNUM DEVELOPMENT SOLUTION MINING</b>		
0 10/06/17			ISSUED FOR CONSTRUCTION			JLW JLW			PROJECT <b>BRINE POND NO. 3 &amp; 4</b>			TITLE <b>OVERALL GRADING PLAN</b>		
REV DATE DESCRIPTION			TECH ENG			FILENAME 93.0017.003M			DRAWING NO. <b>A100</b>			REVISION <b>0</b>		



P:\Projects\0093.017 Magnum Brine Ponds 3 & 4\A-CAD\DWGS\93.0017.004M.dwg-10/5/2017 1:39 PM



- LEGEND:**
- EXISTING GROUND CONTOURS
  - CUT DEPTH CONTOURS
  - FILL DEPTH CONTOURS
  - EXISTING ROADS/TRAILS
  - EXISTING EASEMENTS
  - MAGNUM SITE BOUNDARY
  - SITE BOUNDARY
  - 20 SECTION NUMBER
  - EXISTING FENCE
  - PROPOSED WILDLIFE FENCE
  - PROPOSED POWER LINE
  - PROPOSED 18" HDPE DR11 BRINE RECOVERY LINE
  - PROPOSED 20" HDPE DR11 BRINE DELIVERY LINE
  - EXISTING BRINE LINE
  - EXISTING BRINE LINE
  - EXISTING POWER LINE
  - EXISTING WATER LINE
  - EXISTING PIPE
  - EXISTING 18" WATER



POND EARTHWORKS		
DESCRIPTION	POND NO. 3	POND NO. 4
CUT (CY)	1,942,303	1,817,744
FILL (CY)	1,602,074	1,540,308
COMPACTION RATIO	17.5%	15.3%




**NOTES:**

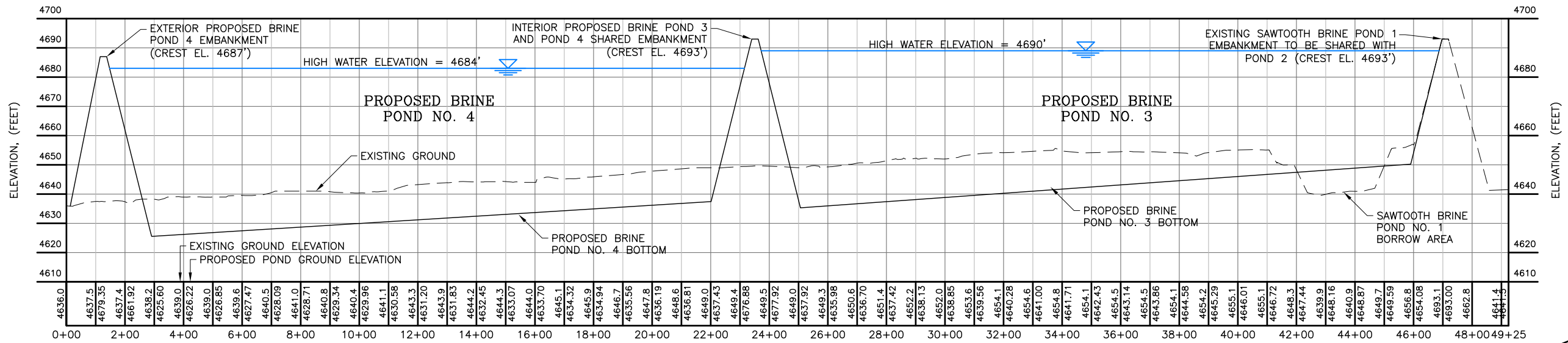
- THE AVERAGE DEPTH OF TOPSOIL IS ASSUMED TO BE 3 INCHES FOR THE EARTHWORK BALANCE.
- EXISTING ROAD WEARING COURSE MATERIAL TO BE REMOVED AND ROAD SURFACE TO BE SCARIFIED PRIOR TO PLACEMENT OF EMBANKMENT FILL. SEE TECHNICAL SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.

REV	DATE	DESCRIPTION	TECH	ENG
0	10/06/17	ISSUED FOR CONSTRUCTION	JLW	JLW

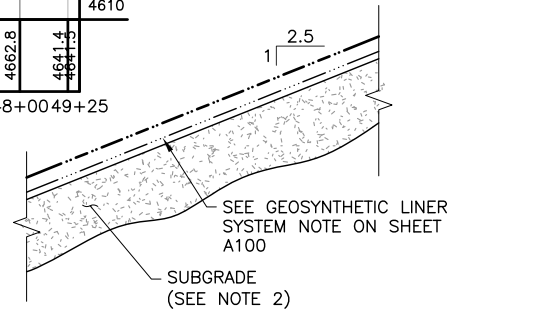
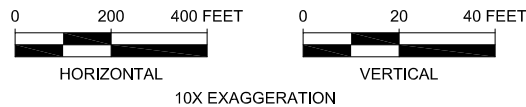
APPROVED BY:	KNJ	<b>DISCLAIMER</b> NEWFIELDS PRODUCED THE INFORMATION PRESENTED ON THIS DRAWING THROUGH THE USE OF AVAILABLE TECHNICAL INFORMATION AND EXPERIENCE. RECEIVING THIS DRAWING DOES NOT GUARANTEE ANY RIGHTS TO EITHER SUCH TECHNICAL INFORMATION OR EXPERIENCE. ANY MODIFICATION OR ADAPTATION OF THE DATA OR DRAWING SHALL BE AT USER'S RISK AND WITHOUT ANY LIABILITY OR LEGAL RESPONSIBILITY TO NEWFIELDS.
CHECKED BY:	KNJ	
DESIGNED BY:	JLW	
DRAWN BY:	JLW	

 <b>NewFields</b>		CLIENT	MAGNUM DEVELOPMENT SOLUTION MINING	
PROJECT		BRINE POND NO. 3 & 4		
TITLE	OVERALL GRADING ISOPACH		FILENAME	
			93.0017.004M	
			DRAWING NO.	REVISION
		A105	0	

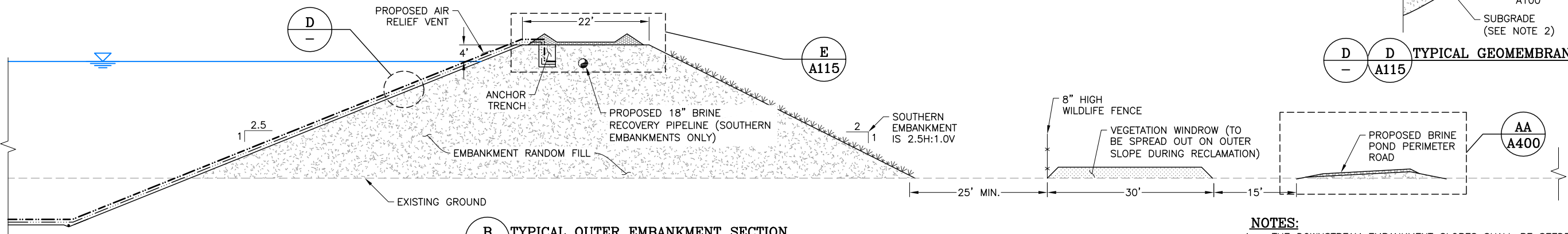
P:\Projects\0093.017 Magnum Brine Ponds 3 & 4\A-CAD\DWGS\93.0017.005D.dwg-10/5/2017 8:22 AM



**A** TYPICAL POND SECTION  
A100



**D** TYPICAL GEOMEMBRANE LINED SLOPE  
A115



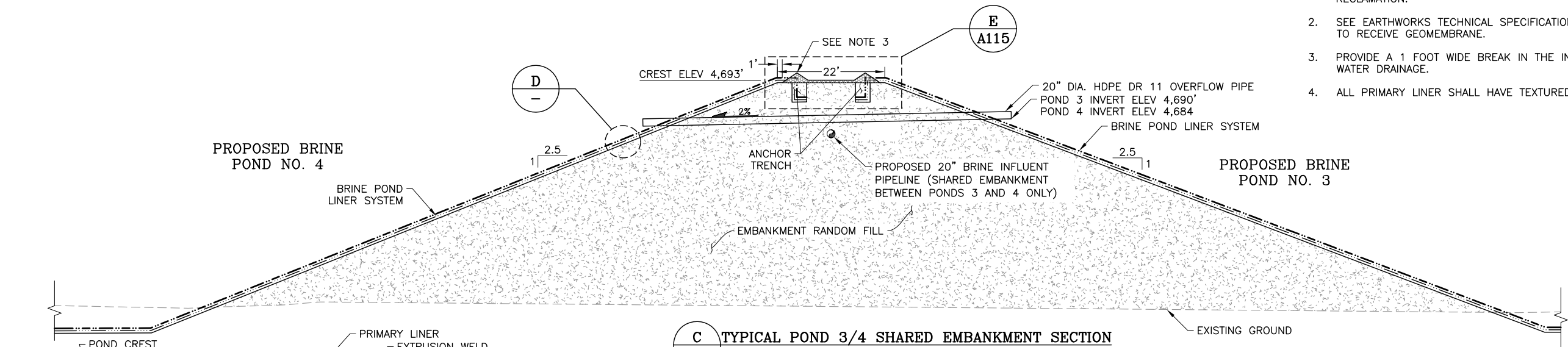
**B** TYPICAL OUTER EMBANKMENT SECTION  
A100

**NOTES:**

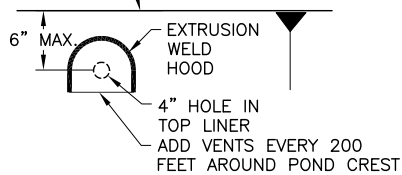
1. THE DOWNSTREAM EMBANKMENT SLOPES SHALL BE SEEDED IN ACCORDANCE WITH THE MILLARD COUNTY ROAD CONSTRUCTION SEMI-DESERT SEED MIX AS BASED ON THE INTERMOUNTAIN PLANTING GUIDE. THE TIMING OF THE SEEDING TO BE DONE WITH RECLAMATION.
2. SEE EARTHWORKS TECHNICAL SPECIFICATIONS SECTION 2.1.5 FOR PREPARING SURFACES TO RECEIVE GEOMEMBRANE.
3. PROVIDE A 1 FOOT WIDE BREAK IN THE INSIDE BERM EVERY 50 FEET FOR SURFACE WATER DRAINAGE.
4. ALL PRIMARY LINER SHALL HAVE TEXTURED SIDE FACING UP.

PROPOSED BRINE POND NO. 4

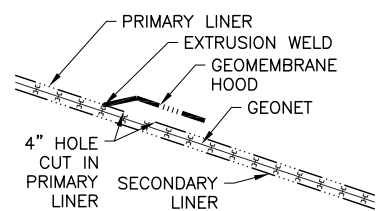
PROPOSED BRINE POND NO. 3



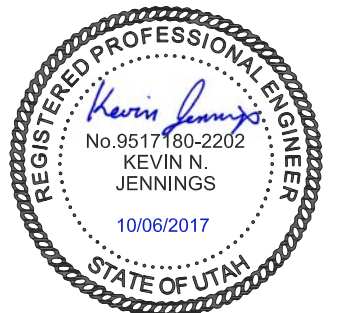
**C** TYPICAL POND 3/4 SHARED EMBANKMENT SECTION  
A100



VENT DETAIL PLAN VIEW

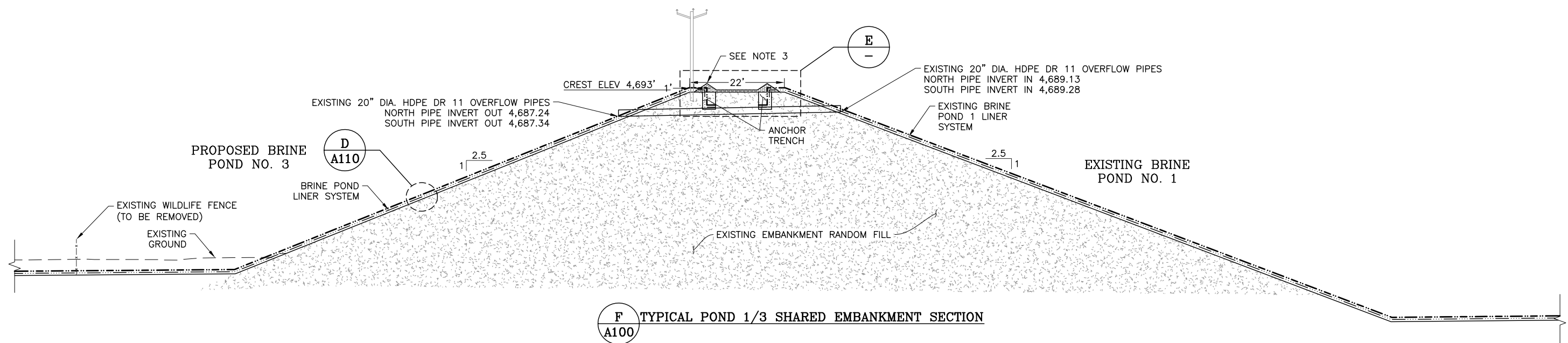
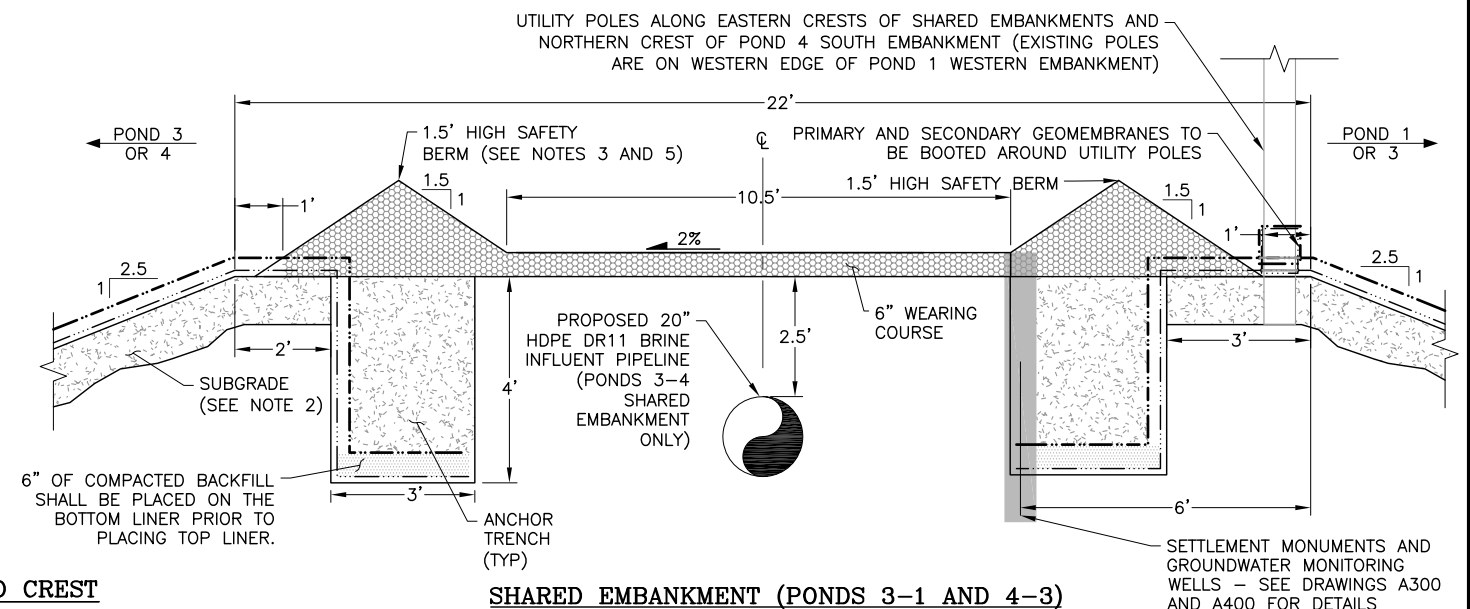
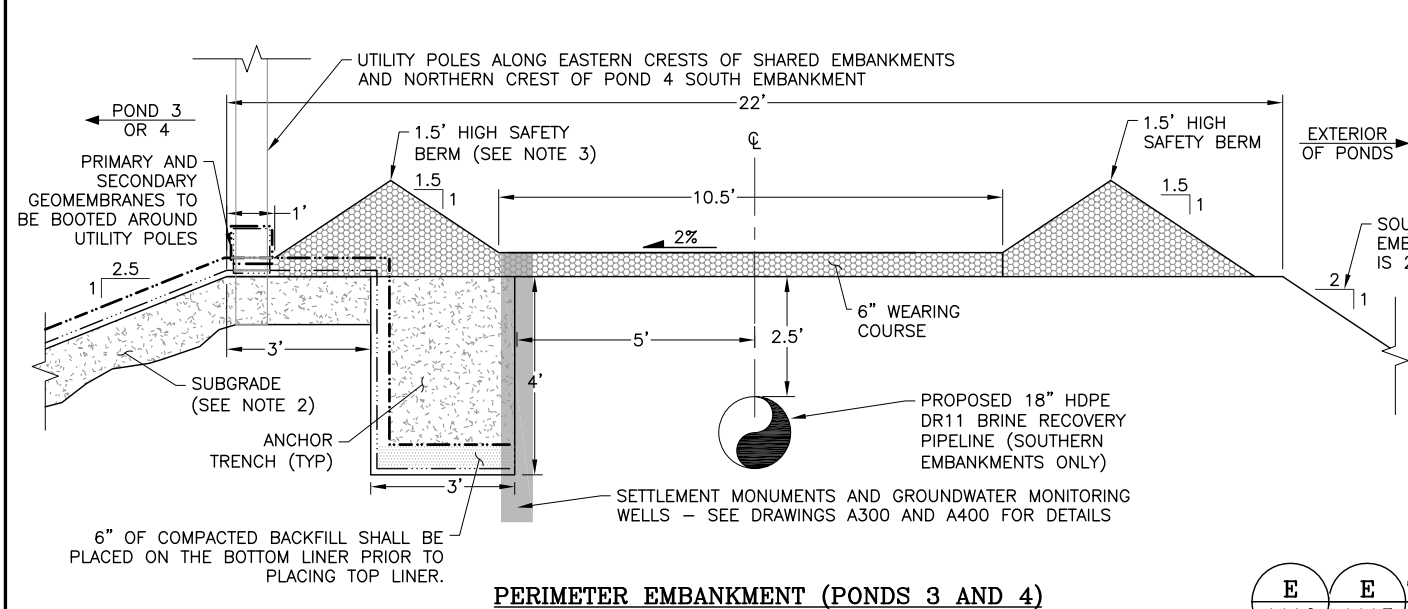


VENT DETAIL SECTION



				APPROVED BY: KNJ		DISCLAIMER		NewFields		CLIENT MAGNUM DEVELOPMENT SOLUTION MINING	
				CHECKED BY: KNJ		NEWFIELDS PRODUCED THE INFORMATION PRESENTED ON THIS DRAWING THROUGH THE USE OF AVAILABLE TECHNICAL INFORMATION AND EXPERIENCE. RECEIVING THIS DRAWING DOES NOT GUARANTEE ANY RIGHTS TO EITHER SUCH TECHNICAL INFORMATION OR EXPERIENCE. ANY MODIFICATION OR ADAPTATION OF THE DATA OR DRAWING SHALL BE AT USER'S RISK AND WITHOUT ANY LIABILITY OR LEGAL RESPONSIBILITY TO NEWFIELDS.		PROJECT		BRINE POND NO. 3 & 4	
				DESIGNED BY: JLW				TITLE		TYPICAL EMBANKMENT SECTIONS AND DETAILS SHEET 1 OF 2	
				DRAWN BY: JLW						FILENAME 93.0017.005D	
0 10/06/17				ISSUED FOR CONSTRUCTION		JLW JLW				DRAWING NO. A110	
REV				DATE		TECH		ENG		REVISION 0	






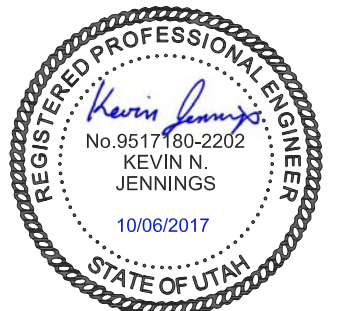
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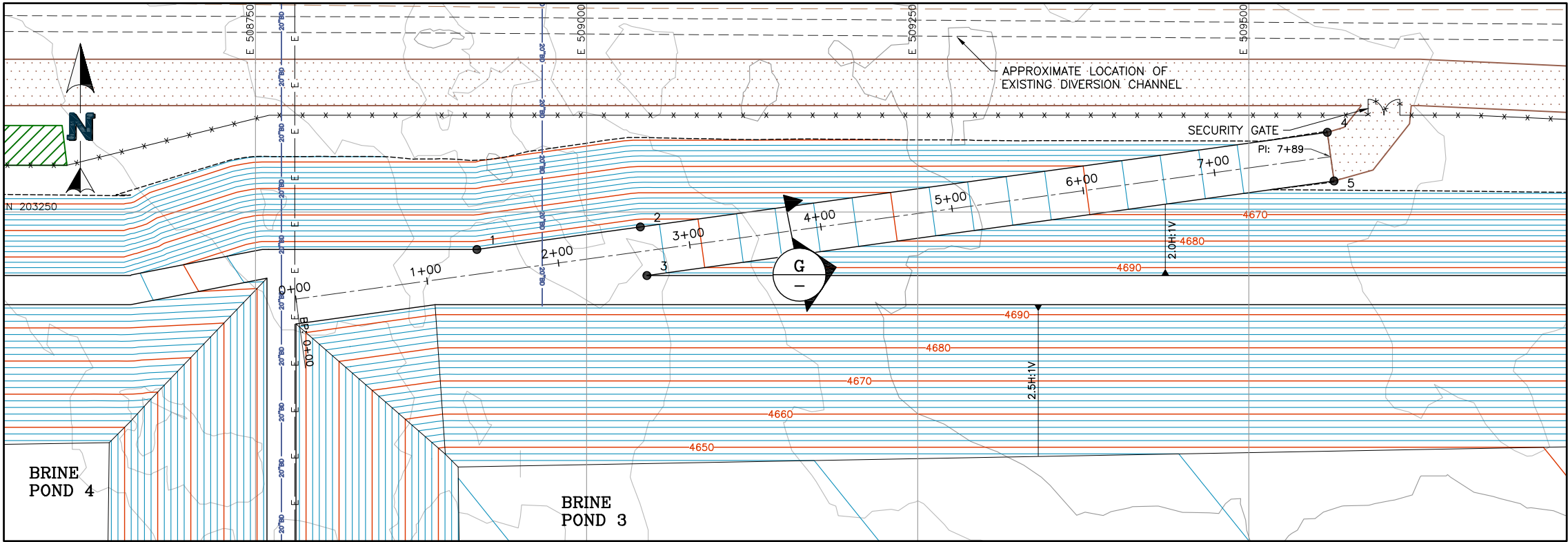
1. THE DOWNSTREAM EMBANKMENT SLOPES SHALL BE SEEDED IN ACCORDANCE WITH THE MILLARD COUNTY ROAD CONSTRUCTION SEMI-DESERT SEED MIX AS BASED ON THE INTERMOUNTAIN PLANTING GUIDE. THE TIMING OF THE SEEDING TO BE DONE WITH RECLAMATION.
2. SEE EARTHWORKS TECHNICAL SPECIFICATIONS SECTION 2.1.5 FOR PREPARING SURFACES TO RECEIVE GEOMEMBRANE.
3. PROVIDE A 1 FOOT WIDE BREAK IN THE INSIDE BERM EVERY 50 FEET FOR SURFACE WATER DRAINAGE.
4. ALL PRIMARY LINER SHALL HAVE TEXTURED SIDE FACING UP.
5. EXISTING BERM SHALL BE REMOVED PRIOR TO POND 3 ANCHOR TRENCH INSTALLATION.

BRINE POND 3 & 4 SETTING OUT POINT DATA - SEE DRAWING A100

SETTING OUT DATA				SETTING OUT DATA			
POINT	NORTHING	EASTING	ELEVATION	POINT	NORTHING	EASTING	ELEVATION
1	200,475.34	510,993.36	4,644.09	12	200,333.07	508,758.62	4,693.00
2	200,353.07	511,115.62	4,693.00	13	200,353.07	508,657.77	4,687.00
3	200,511.58	508,939.14	4,629.60	14	200,519.07	506,721.63	4,620.60
4	200,353.07	508,780.62	4,693.00	15	200,353.07	506,555.62	4,687.00
5	203,057.69	508,903.01	4,644.05	16	202,032.10	506,702.91	4,628.08
6	203,165.63	508,780.62	4,693.00	17	202,107.33	506,555.62	4,687.00
7	203,067.35	508,893.34	4,647.91	18	203,067.14	508,074.87	4,641.83
8	203,180.07	508,885.62	4,693.00	19	203,180.07	508,038.30	4,687.00
9	203,096.35	511,031.91	4,659.51	20	203,076.04	508,639.63	4,645.39
10	203,180.07	511,115.62	4,693.00	21	203,200.08	508,758.67	4,693.00
11	200,490.10	508,606.60	4,632.19	22	203,180.07	508,655.67	4,687.00

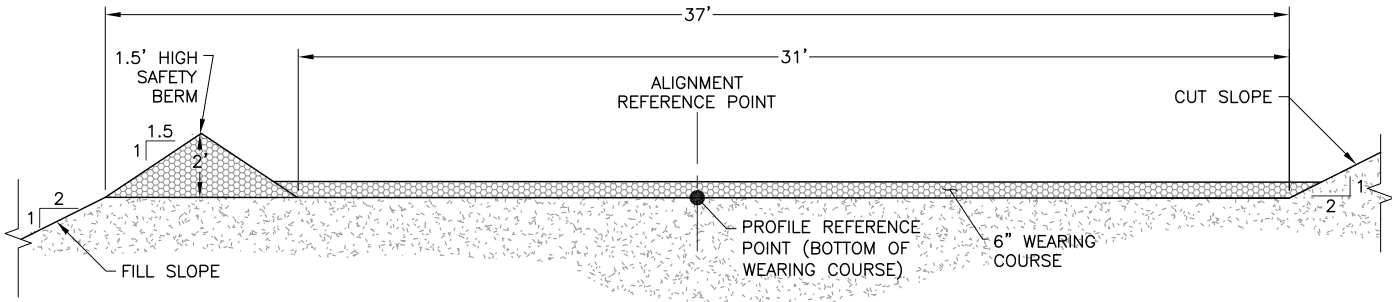
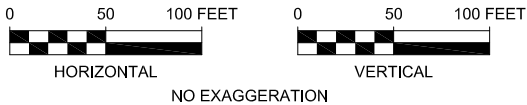
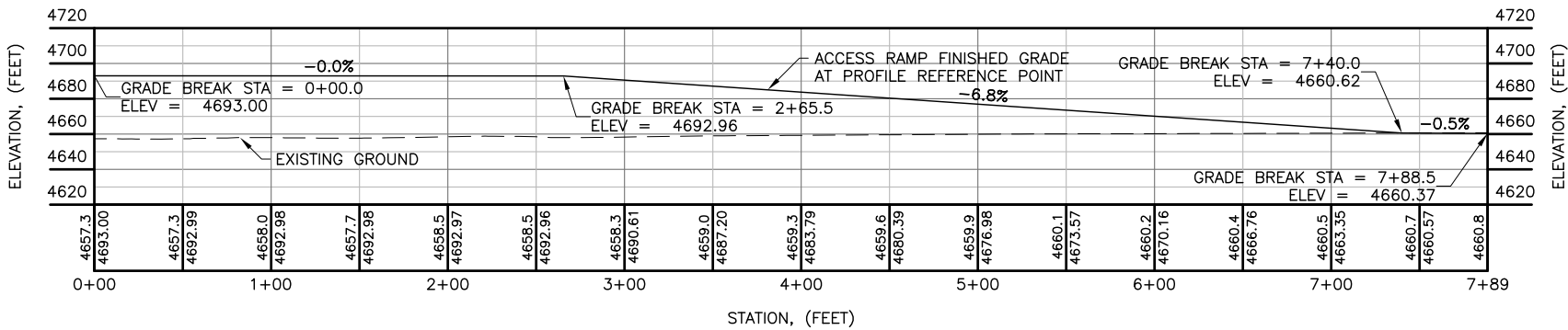
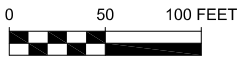
							APPROVED BY: KNJ	DISCLAIMER  NEWFIELDS PRODUCED THE INFORMATION PRESENTED ON THIS DRAWING THROUGH THE USE OF AVAILABLE TECHNICAL INFORMATION AND EXPERIENCE. RECEIVING THIS DRAWING DOES NOT GUARANTEE ANY RIGHTS TO EITHER SUCH TECHNICAL INFORMATION OR EXPERIENCE. ANY MODIFICATION OR ADAPTATION OF THE DATA OR DRAWING SHALL BE AT USER'S RISK AND WITHOUT ANY LIABILITY OR LEGAL RESPONSIBILITY TO NEWFIELDS.	 CLIENT MAGNUM DEVELOPMENT SOLUTION MINING				
						CHECKED BY: KNJ	PROJECT BRINE POND NO. 3 & 4						
						DESIGNED BY: JLW	TITLE TYPICAL EMBANKMENT SECTIONS AND DETAILS SHEET 2 OF 2			FILENAME 93.0017.006D		DRAWING NO. A115	REVISION 0
0	10/06/17	ISSUED FOR CONSTRUCTION				JLW	JLW						
REV	DATE	DESCRIPTION				TECH	ENG						
						DRAWN BY: JLW							





LEGEND:

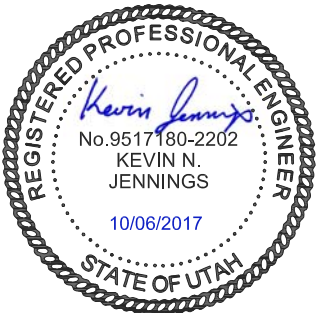
- EXISTING GROUND CONTOURS
- PROPOSED BRINE POND GROUND CONTOURS
- SITE BOUNDARY
- PROPOSED WILDLIFE FENCE
- PROPOSED POWERLINE
- VEGETATION WINDROW
- PROPOSED PERIMETER ROAD
- PROPOSED 20" HDPE DR11 BRINE DELIVERY LINE




G  
-  
G  
A135  
TYPICAL ACCESS RAMP SECTION

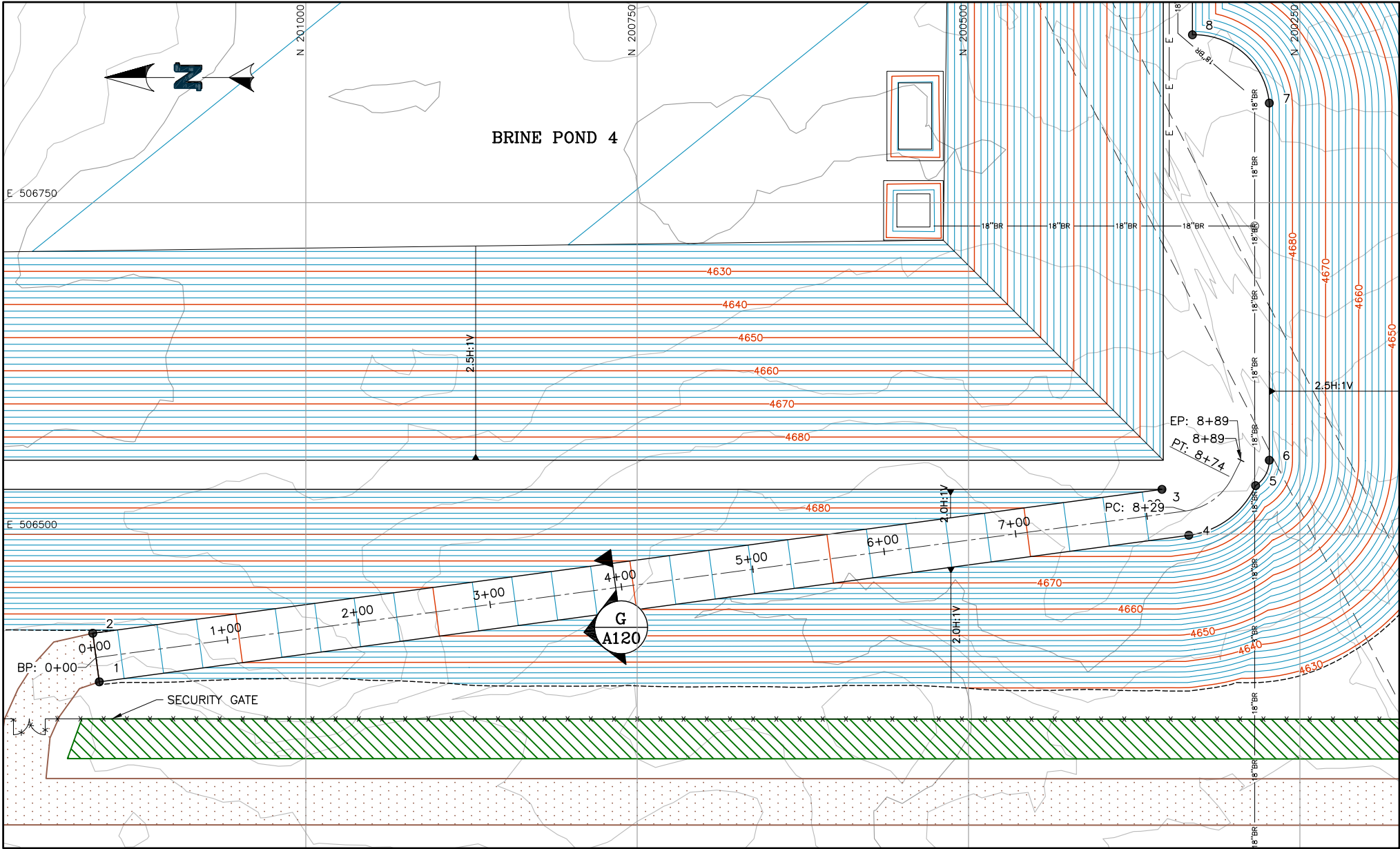
HORIZONTAL LAYOUT DATA			
	STATION	NORTHING	EASTING
PT	0+00.00	203,184.30	508,780.62
PT	7+88.52	203,291.76	509,561.78

SETTING OUT DATA			
POINT	NORTHING	EASTING	ELEVATION
1	203,221.76	508,917.19	4,693.00
2	203,238.74	509,040.58	4,693.00
3	203,202.07	509,045.55	4,693.00
4	203,310.09	509,559.26	4,660.37
5	203,273.43	509,564.31	4,660.37



						APPROVED BY: KNJ	<div>DISCLAIMER</div> <div>NEWFIELDS PRODUCED THE INFORMATION PRESENTED ON THIS DRAWING THROUGH THE USE OF AVAILABLE TECHNICAL INFORMATION AND EXPERIENCE. RECEIVING THIS DRAWING DOES NOT GUARANTEE ANY RIGHTS TO EITHER SUCH TECHNICAL INFORMATION OR EXPERIENCE. ANY MODIFICATION OR ADAPTATION OF THE DATA OR DRAWING SHALL BE AT USER'S RISK AND WITHOUT ANY LIABILITY OR LEGAL RESPONSIBILITY TO NEWFIELDS.</div>		CLIENT	MAGNUM DEVELOPMENT SOLUTION MINING	
						CHECKED BY: KNJ		PROJECT	BRINE POND NO. 3 & 4		
						DESIGNED BY: JLW		TITLE	POND 3 NORTHWEST ACCESS RAMP PLAN AND PROFILE		FILENAME 93.0017.007P
0	10/06/17	ISSUED FOR CONSTRUCTION			JLW	JLW		DRAWN BY: JLW			DRAWING NO. A120
REV	DATE	DESCRIPTION			TECH	ENG					

P:\Projects\0093.017 Magnum Brine Ponds 3 & 4\A-CAD\DWGS\93.0017.010P.dwg--10/5/2017 8:21 AM



LEGEND:

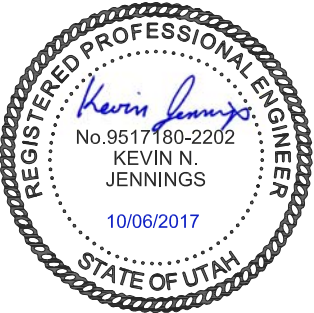
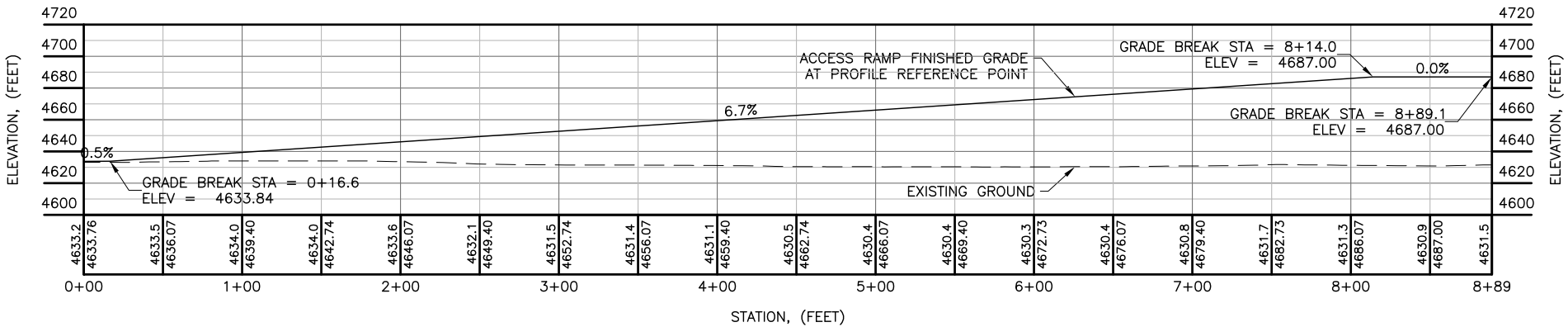
- EXISTING GROUND CONTOURS
- PROPOSED BRINE POND GROUND CONTOURS
- SITE BOUNDARY
- PROPOSED WILDLIFE FENCE
- PROPOSED POWERLINE
- VEGETATION WINDROW
- PROPOSED PERIMETER ROAD
- PROPOSED 18" HDPE DR11 BRINE RECOVERY LINE

HORIZONTAL LAYOUT DATA

	STATION	NORTHING	EASTING	DELTA (D-M-S)	LENGTH (FT)	RADIUS (FT)
PT	0+00.00	201,158.25	506,406.77			
PC	8+29.40	200,336.26	506,517.35	055-38-28	44.85	46.18
PT	8+74.24	200,301.16	506,542.37			
PT	8+89.09	200,294.49	506,555.64			

SETTING OUT DATA

POINT	NORTHING	EASTING	ELEVATION
1	201,155.79	506,388.43	4,633.76
2	201,160.72	506,425.10	4,633.76
3	200,354.07	506,533.62	4,687.00
4	200,333.79	506,499.02	4,687.00
5	200,283.41	506,536.48	4,687.00
6	200,273.07	506,555.62	4,687.00
7	200,273.07	506,825.12	4,687.00
8	200,331.07	506,876.67	4,687.00

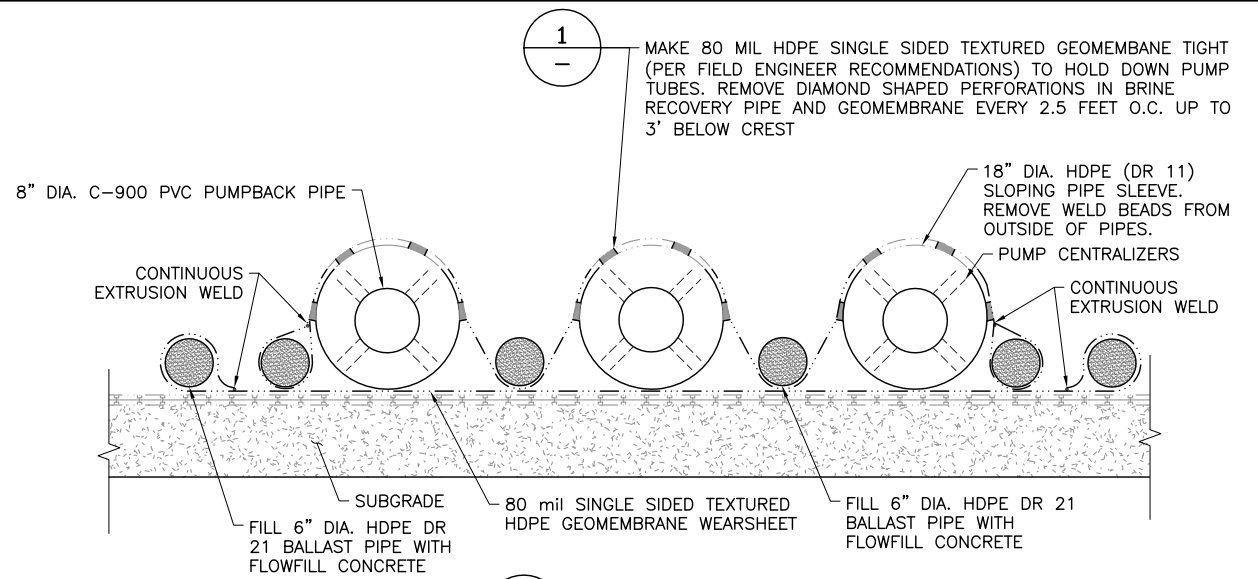


APPROVED BY:	KNJ	DISCLAIMER
CHECKED BY:	KNJ	NEWFIELDS PRODUCED THE INFORMATION PRESENTED ON THIS DRAWING THROUGH THE USE OF AVAILABLE TECHNICAL INFORMATION AND EXPERIENCE. RECEIVING THIS DRAWING DOES NOT GUARANTEE ANY RIGHTS TO EITHER SUCH TECHNICAL INFORMATION OR EXPERIENCE. ANY MODIFICATION OR ADAPTATION OF THE DATA OR DRAWING SHALL BE AT USER'S RISK AND WITHOUT ANY LIABILITY OR LEGAL RESPONSIBILITY TO NEWFIELDS.
DESIGNED BY:	JLW	
DRAWN BY:	JLW	
ISSUED FOR CONSTRUCTION	JLW	JLW
REV	DATE	DESCRIPTION
0	10/06/17	

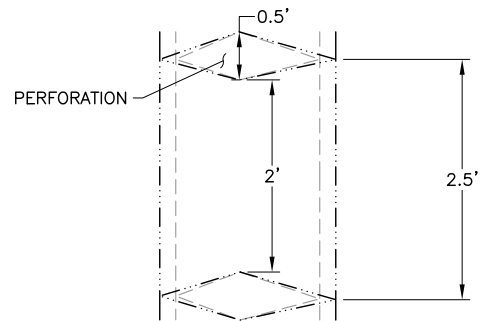
PROJECT	MAGNUM DEVELOPMENT SOLUTION MINING
TITLE	BRINE POND NO. 3 & 4
FILENAME	93.0017.010P
DRAWING NO.	A135
REVISION	0



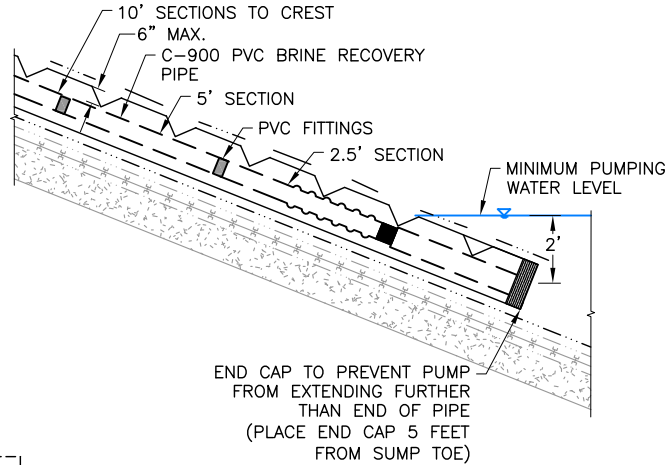
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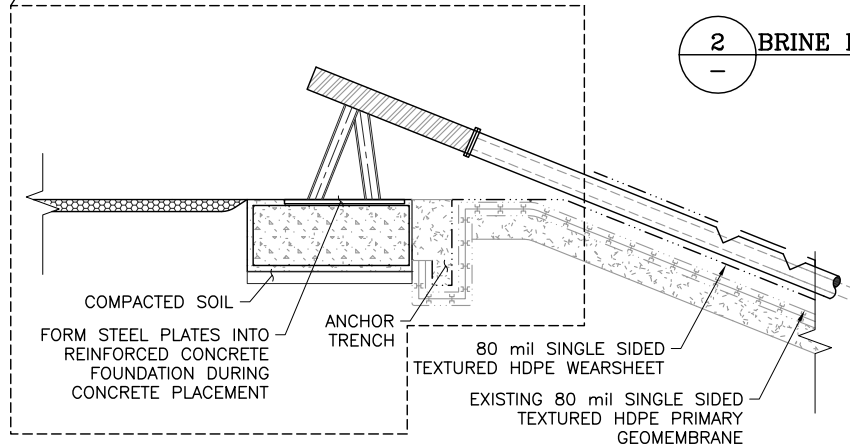
**H PIPE SLEEVE SECTION**



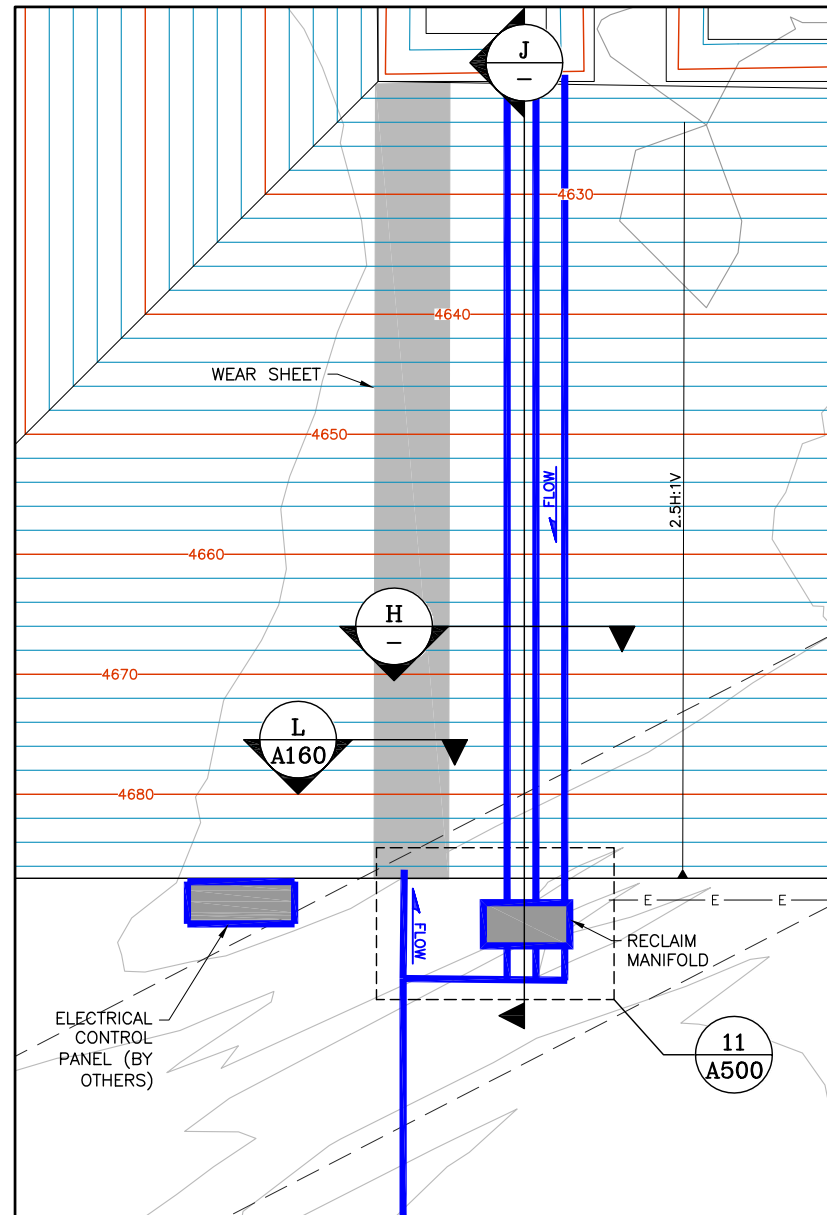
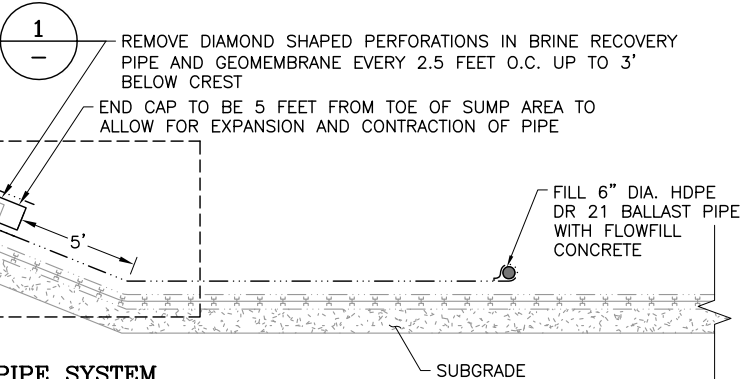
**1 DIAMOND PERFORATION DETAIL**



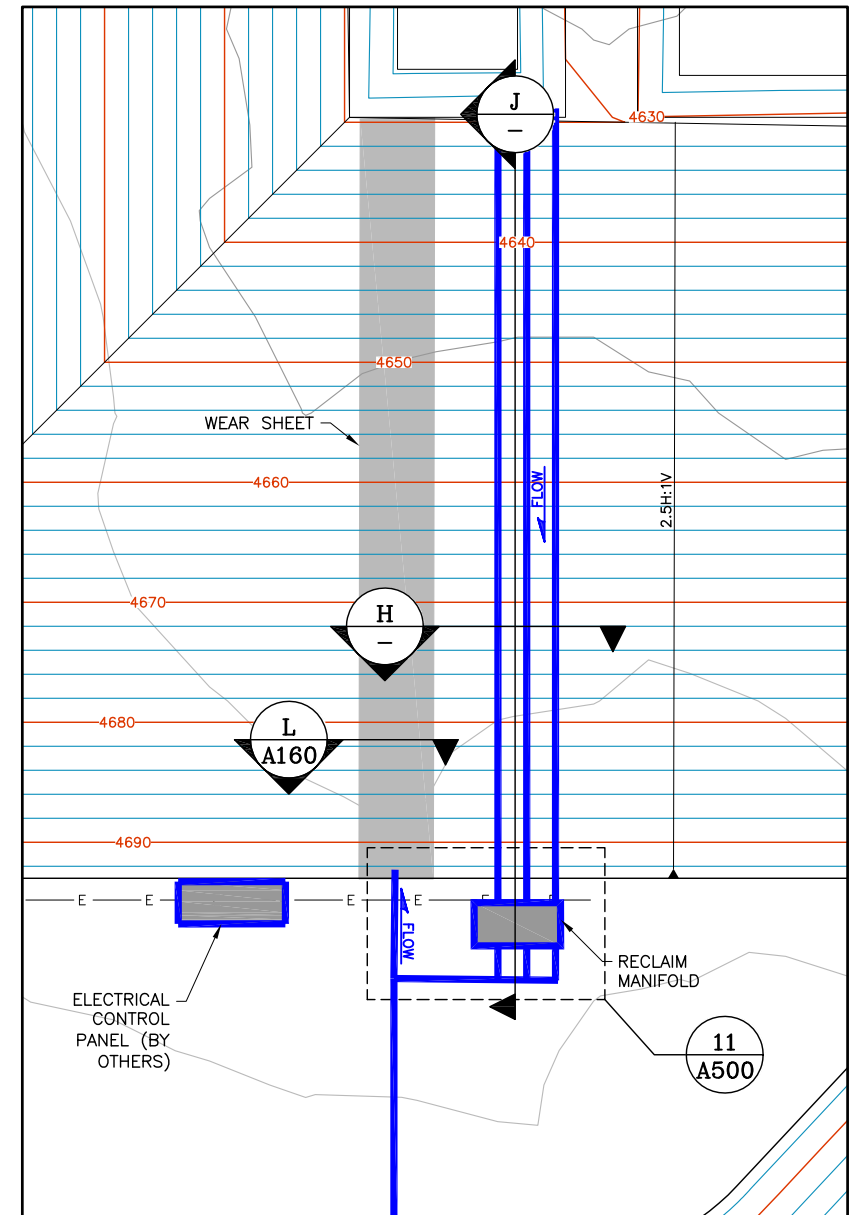
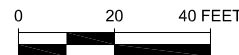
**2 BRINE RECOVERY SYSTEM**



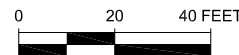
**J BRINE RECOVERY PIPE SYSTEM**



**4 POND 4 RECLAIM PUMPBACK SYSTEM PLAN**

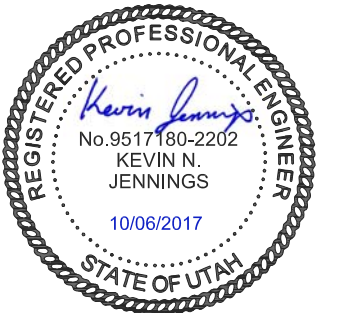


**3 POND 3 RECLAIM PUMPBACK SYSTEM PLAN**



**LEGEND:**

- EXISTING GROUND CONTOURS
- PROPOSED BRINE POND NO. 2 GROUND CONTOURS
- EXISTING ROADS/TRAILS
- SITE BOUNDARY
- EXISTING BRINE LINE
- 18 IN DIA. DR11 HDPE OVERFLOW PIPE



REV	DATE	DESCRIPTION	TECH	ENG
0	10/06/17	ISSUED FOR CONSTRUCTION	JLW	JLW

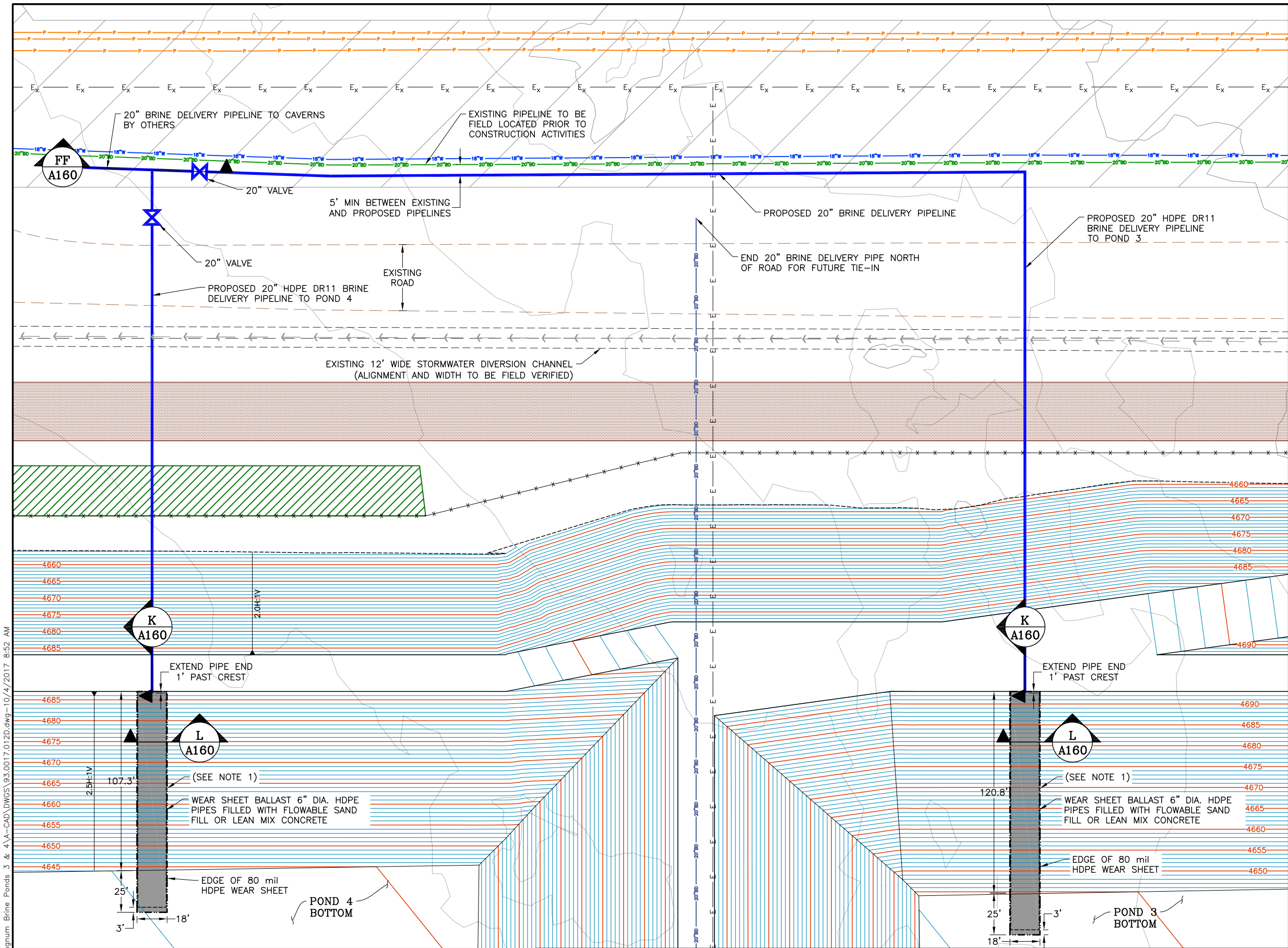
APPROVED BY:	KNJ
CHECKED BY:	KNJ
DESIGNED BY:	JLW
DRAWN BY:	JLW

**DISCLAIMER**

NEWFIELDS PRODUCED THE INFORMATION PRESENTED ON THIS DRAWING THROUGH THE USE OF AVAILABLE TECHNICAL INFORMATION AND EXPERIENCE. RECEIVING THIS DRAWING DOES NOT GUARANTEE ANY RIGHTS TO EITHER SUCH TECHNICAL INFORMATION OR EXPERIENCE. ANY MODIFICATION OR ADAPTATION OF THE DATA OR DRAWING SHALL BE AT USER'S RISK AND WITHOUT ANY LIABILITY OR LEGAL RESPONSIBILITY TO NEWFIELDS.

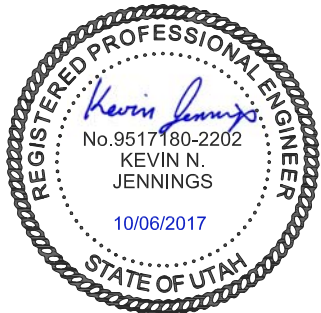
<b>NewFields</b>	CLIENT	MAGNUM DEVELOPMENT SOLUTION MINING
PROJECT	BRINE POND NO. 3 & 4	
TITLE	BRINE RECOVERY SYSTEM SECTION AND DETAILS	FILENAME 93.0017.011D DRAWING NO. A140 REVISION 0

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**NOTES:**

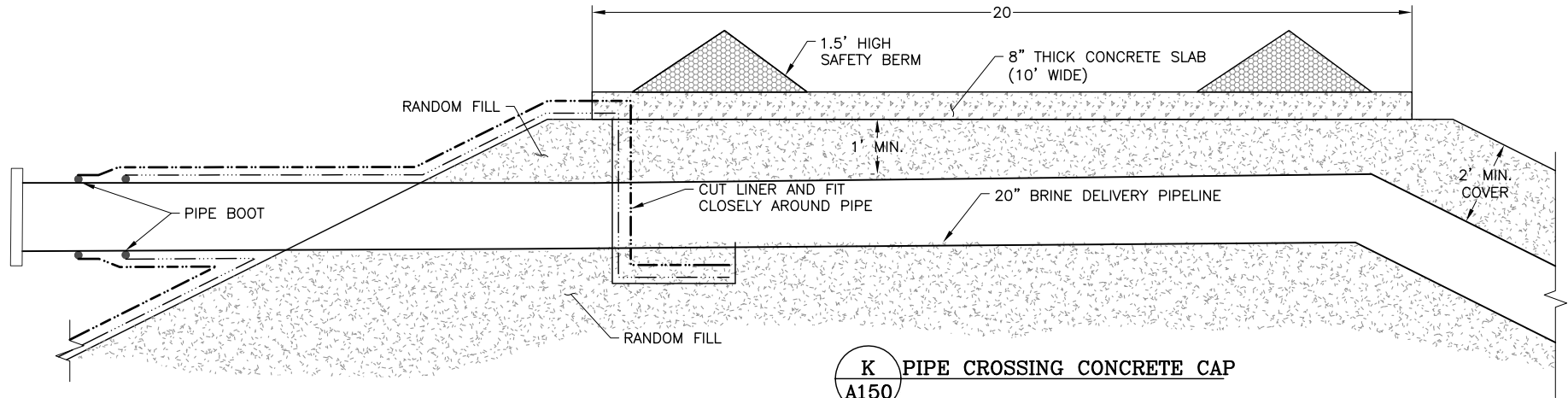
1. PLACE GEOTEXTILE IN THE END OF THE PIPE BEFORE WELDING THE END CAP ON.
2. PIPE BALLASTS ANCHORED AT CREST OF SLOPE BEYOND THE EXTENTS OF THE GEOMEMBRANE.



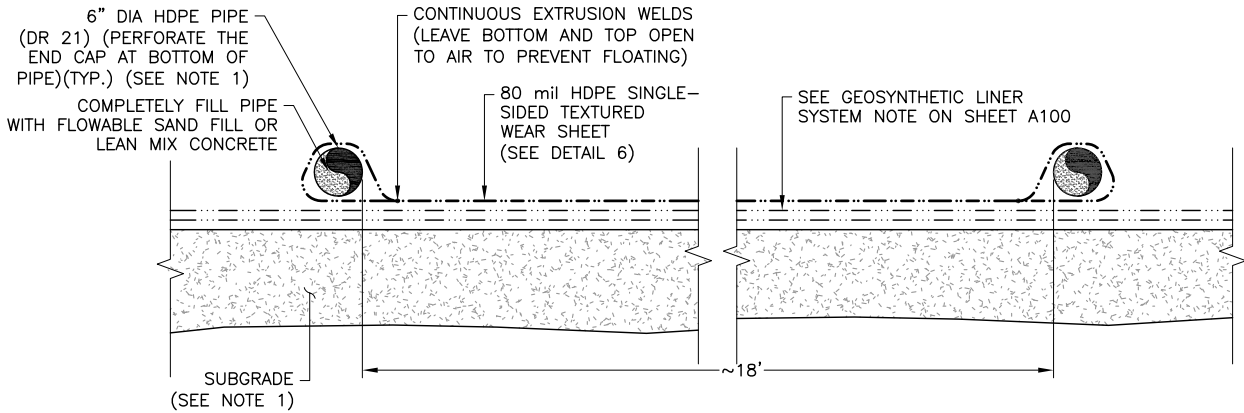
REV	DATE	DESCRIPTION	TECH	ENG
0	10/06/17	ISSUED FOR CONSTRUCTION	JLW	JLW

APPROVED BY:	KNJ	<b>DISCLAIMER</b> NEWFIELDS PRODUCED THE INFORMATION PRESENTED ON THIS DRAWING THROUGH THE USE OF AVAILABLE TECHNICAL INFORMATION AND EXPERIENCE. RECEIVING THIS DRAWING DOES NOT GUARANTEE ANY RIGHTS TO EITHER SUCH TECHNICAL INFORMATION OR EXPERIENCE. ANY MODIFICATION OR ADAPTATION OF THE DATA OR DRAWING SHALL BE AT USER'S RISK AND WITHOUT ANY LIABILITY OR LEGAL RESPONSIBILITY TO NEWFIELDS.
CHECKED BY:	KNJ	
DESIGNED BY:	JLW	
DRAWN BY:	JLW	

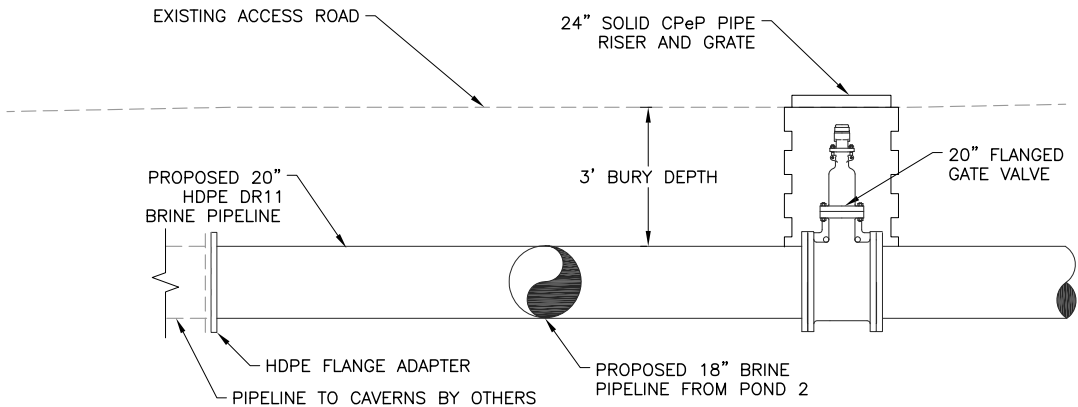
<b>NewFields</b>	CLIENT	MAGNUM DEVELOPMENT SOLUTION MINING	
	PROJECT	BRINE POND NO. 3 & 4	
TITLE	POND INLET PLAN		FILENAME
			93.0017.012D
	DRAWING NO.	REVISION	
	A150	0	



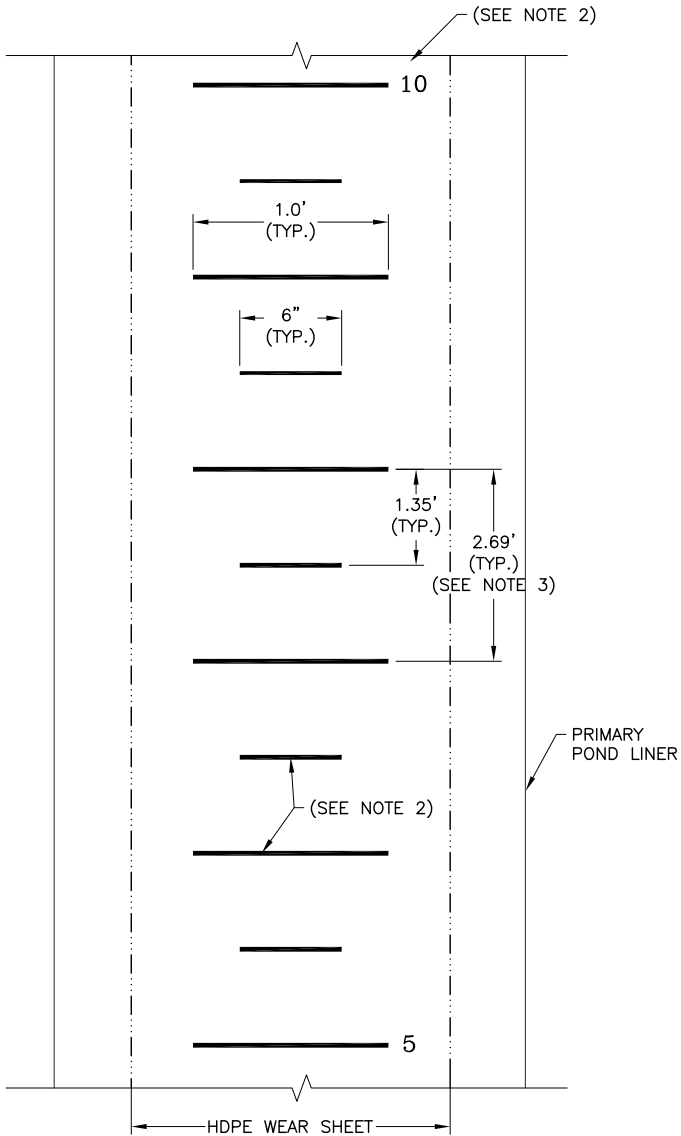
**K** PIPE CROSSING CONCRETE CAP  
A150



**L** POND WEAR SHEET BALLASTING  
A140 A150



**FF** MANHOLE SECTION  
A150




**6** WATER LEVEL GAUGE DETAIL  
—

**NOTE:**

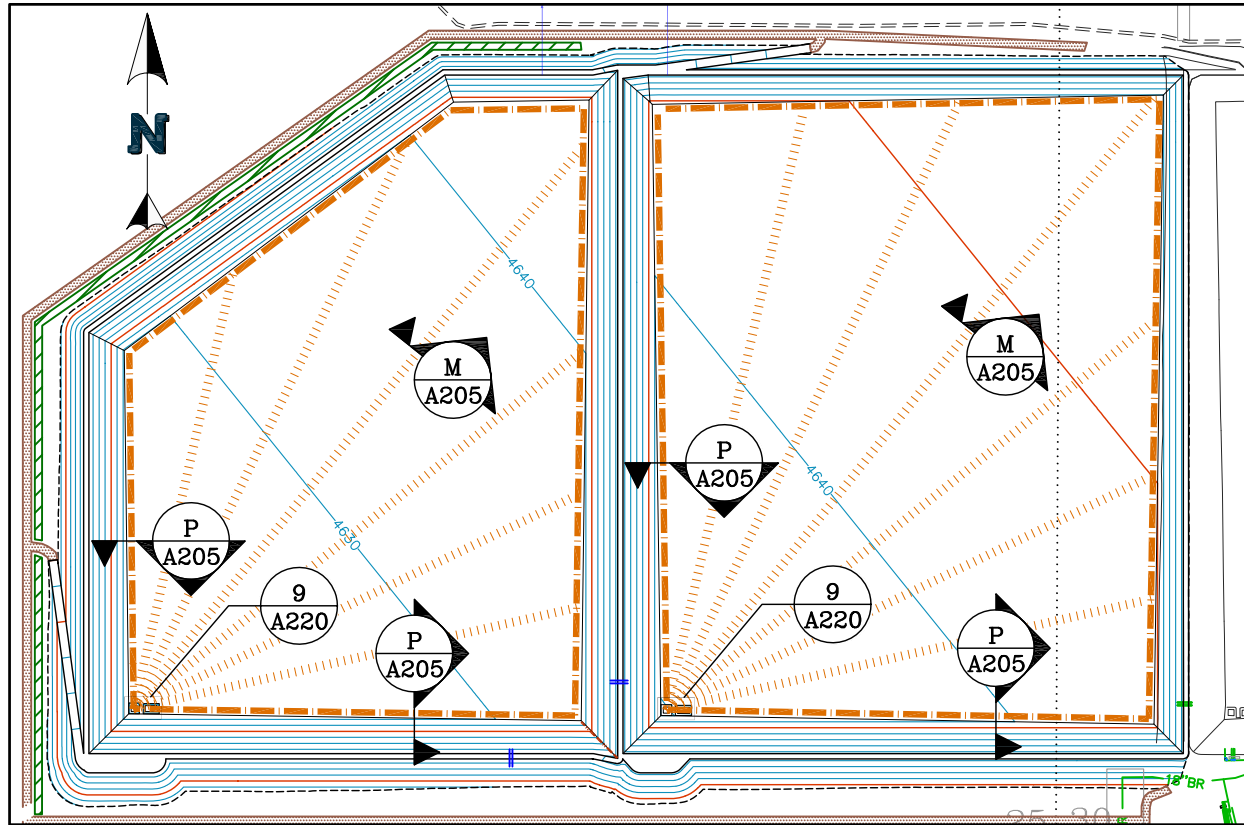
1. PIPE BALLASTS ANCHORED AT CREST OF SLOPE BEYOND THE EXTENTS OF THE GEOMEMBRANE.
2. EXTRUDE INCREMENTS ONTO HDPE WEARSHEET AND APPLY FLUORESCENT COLOR PAINT TO ALL INCREMENTS AND LABEL EVERY 5 FEET.
3. SLOPE DISTANCES SHOWN CORRELATE TO VERTICAL INCREMENTS OF 6" ON A 2.5:1 (HORIZONTAL:VERTICAL) SLOPE (TO BE FIELD VERIFIED BY SURVEY).



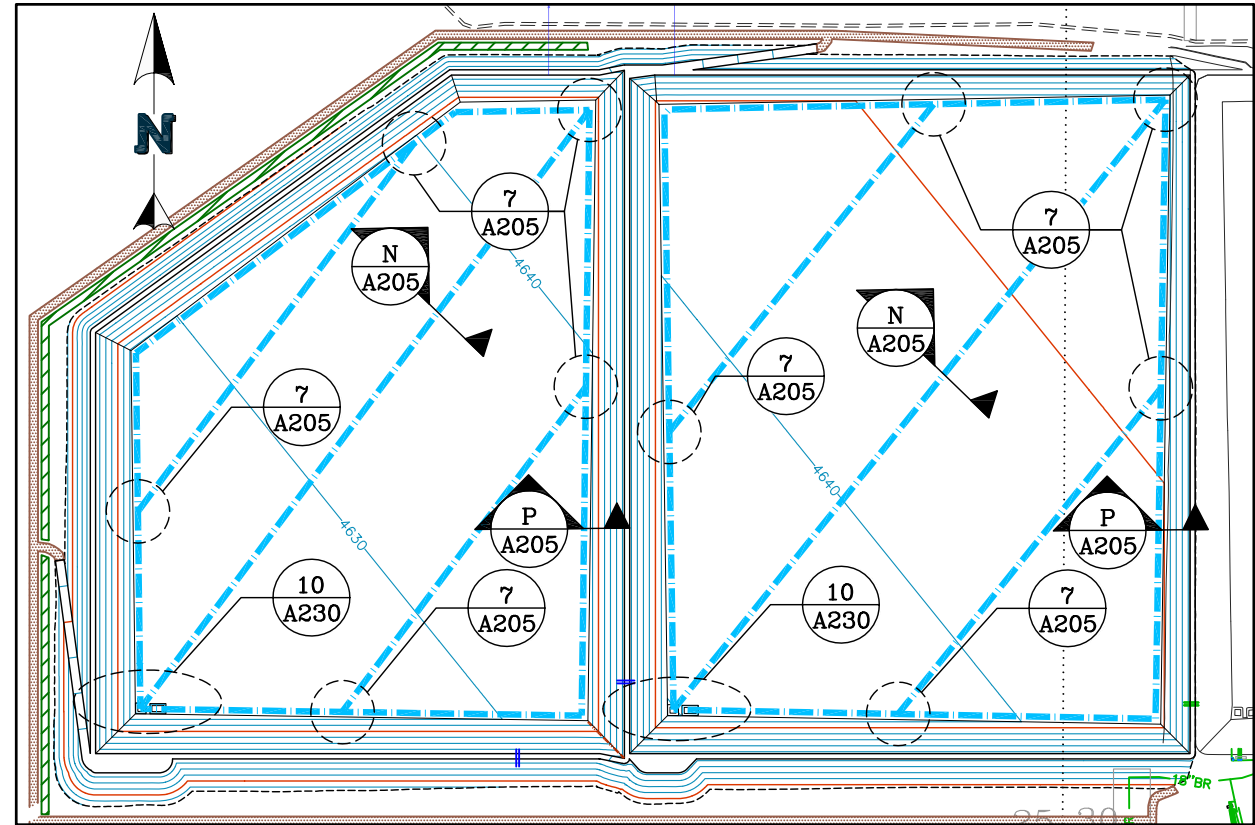
						APPROVED BY: KNJ	DISCLAIMER  NEWFIELDS PRODUCED THE INFORMATION PRESENTED ON THIS DRAWING THROUGH THE USE OF AVAILABLE TECHNICAL INFORMATION AND EXPERIENCE. RECEIVING THIS DRAWING DOES NOT GUARANTEE ANY RIGHTS TO EITHER SUCH TECHNICAL INFORMATION OR EXPERIENCE. ANY MODIFICATION OR ADAPTATION OF THE DATA OR DRAWING SHALL BE AT USER'S RISK AND WITHOUT ANY LIABILITY OR LEGAL RESPONSIBILITY TO NEWFIELDS.		CLIENT	MAGNUM DEVELOPMENT SOLUTION MINING	
						CHECKED BY: KNJ			PROJECT	BRINE POND NO. 3 & 4	
						DESIGNED BY: JLW		TITLE	POND INLET SECTIONS AND DETAILS		FILENAME 93.0017.023D
0	10/06/17	ISSUED FOR CONSTRUCTION			JLW	JLW		DRAWN BY: JLW			DRAWING NO. A160
REV	DATE	DESCRIPTION			TECH	ENG					



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LCRS PIPING AND SUMPS

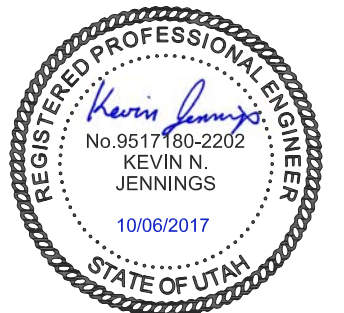


PCMS PIPING AND SUMPS



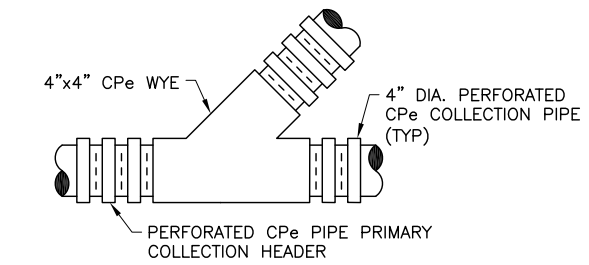
**LEGEND:**

- PROPOSED BRINE POND GROUND CONTOURS
- SECTION LINES
- SECTION NUMBER
- 4 IN DIA. PERFORATED HDPE DR17 COLLECTION LCRS PIPE
- LCRS 18" WIDE STRIP DRAIN
- 4 IN DIA. PERFORATED CP<sub>e</sub> COLLECTION PCMS PIPE
- VEGETATION WINDROW
- PROPOSED PERIMETER ROAD

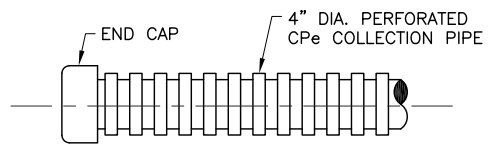


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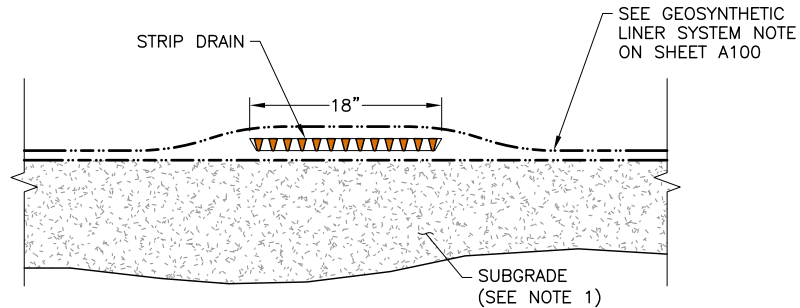
- NOTES:**
- 1. SEE EARTHWORKS MATERIALS AND CONSTRUCTION TECHNICAL SPECIFICATIONS SECTION 2.1.5 FOR PREPARING SURFACES TO RECEIVE GEOMEMBRANE.
  - 2. GEOTEXTILE SOCK SHALL BE NON-WOVEN 10 oz/yd<sup>2</sup>.
  - 3. ALL PRIMARY LINER SHALL HAVE TEXTURED SIDE FACING UP.
  - 4. PIPE PERFORATIONS SHALL BE IN ACCORDANCE WITH CLASS II AASHTO M252 SPECIFICATION OR APPROVED EQUIVALENT. (SLOT LENGTH = 0.875 IN., WIDTH = 0.125 IN.)



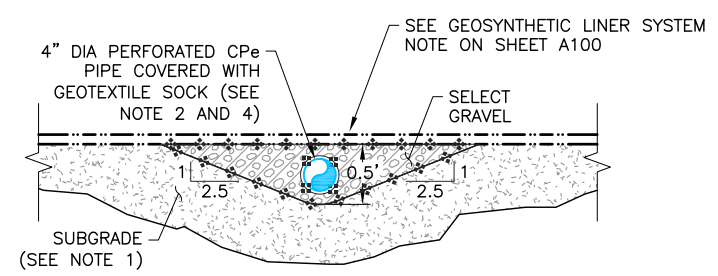
**7**  
**A200** COLLECTION PIPE CONNECTION



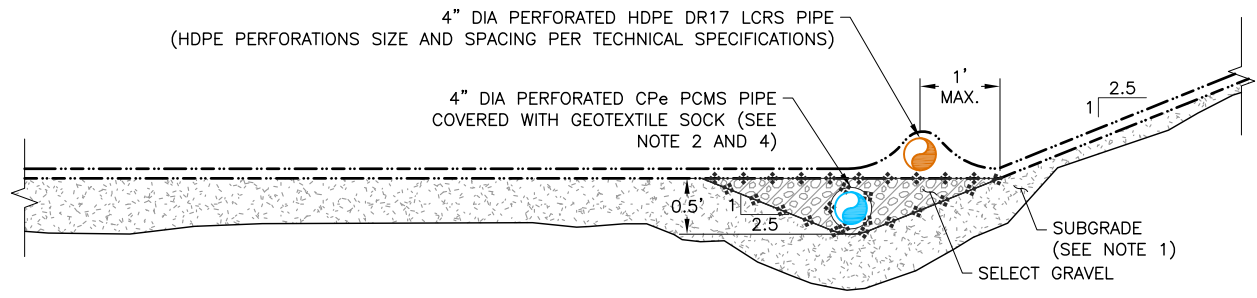
**8**  
**A200** TYPICAL COLLECTION PIPE TERMINATION



**M**  
**A200** TYPICAL LEAK DETECTION STRIP DRAIN



**N**  
**A200** PCMS CHANNEL



**P**  
**A200** TYPICAL WEST AND SOUTH TOE DRAIN SECTION



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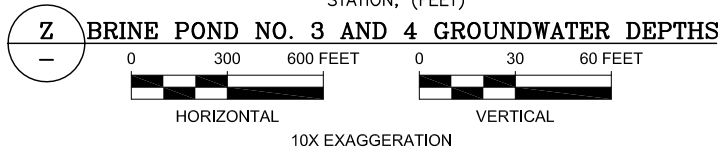
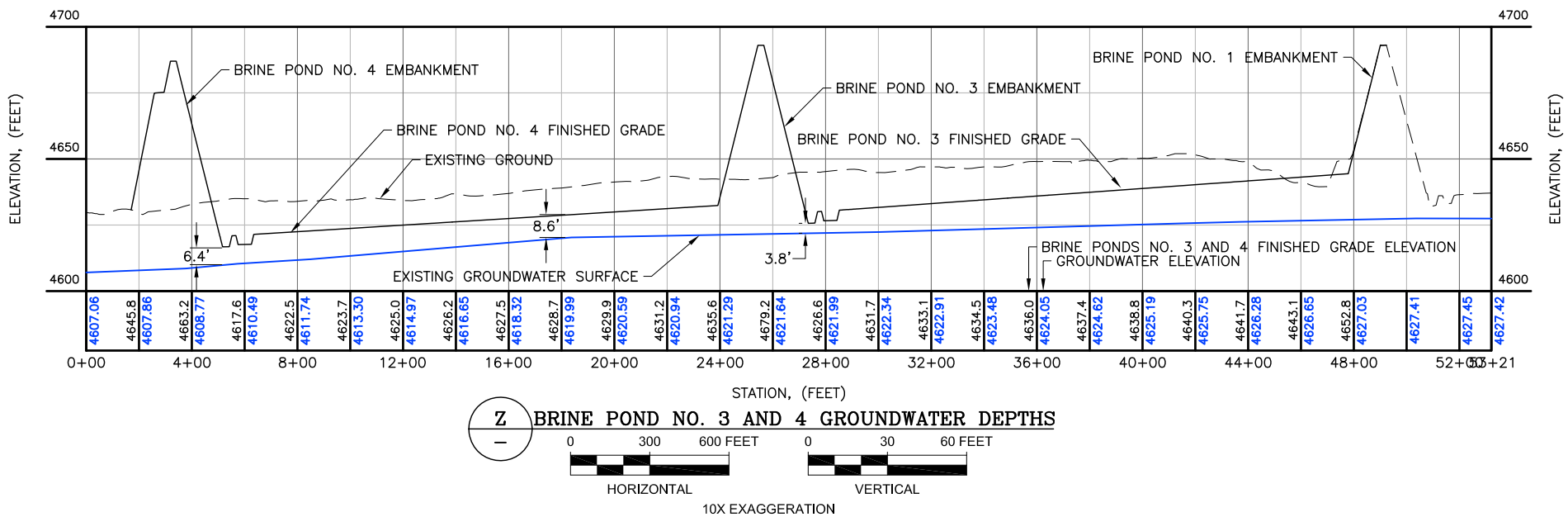
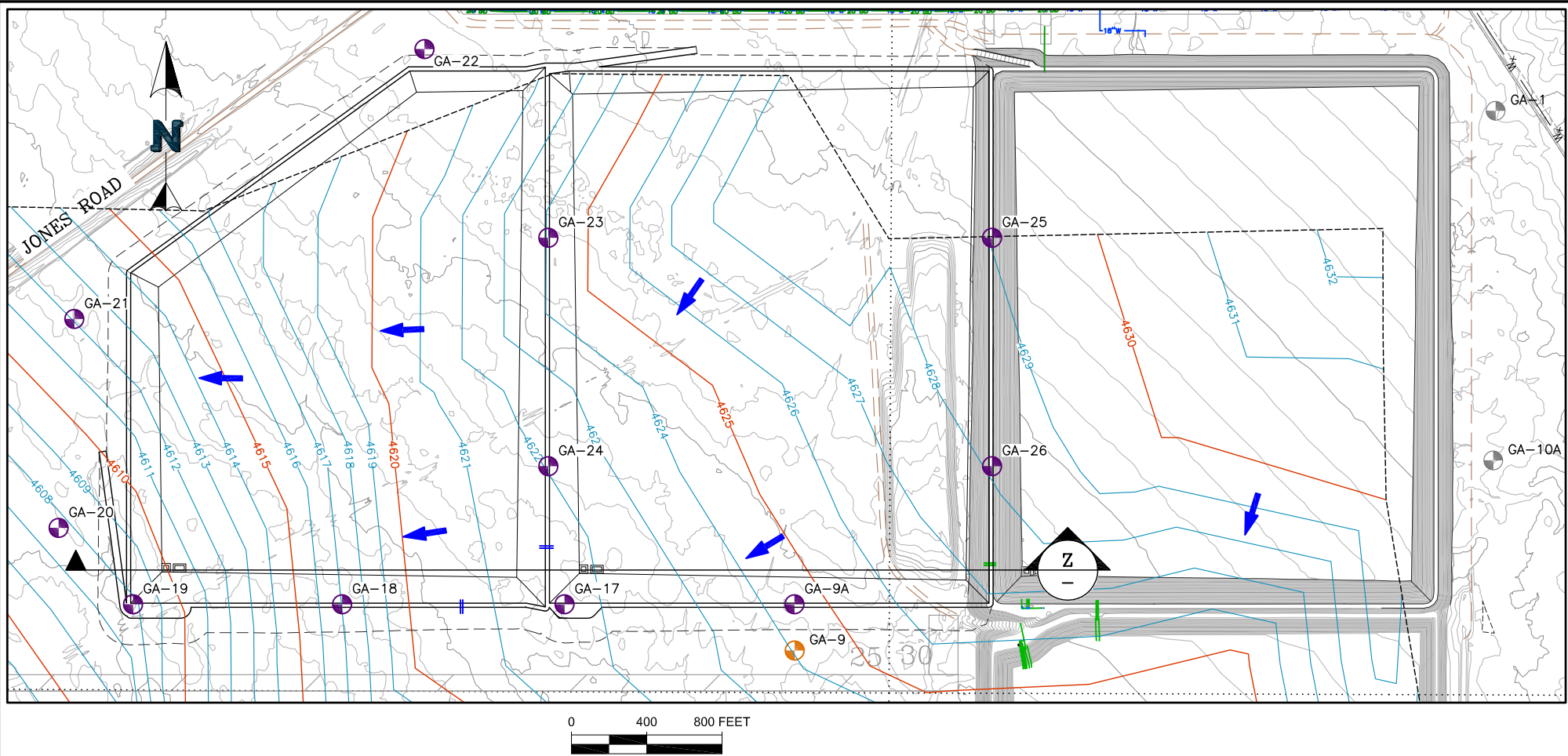








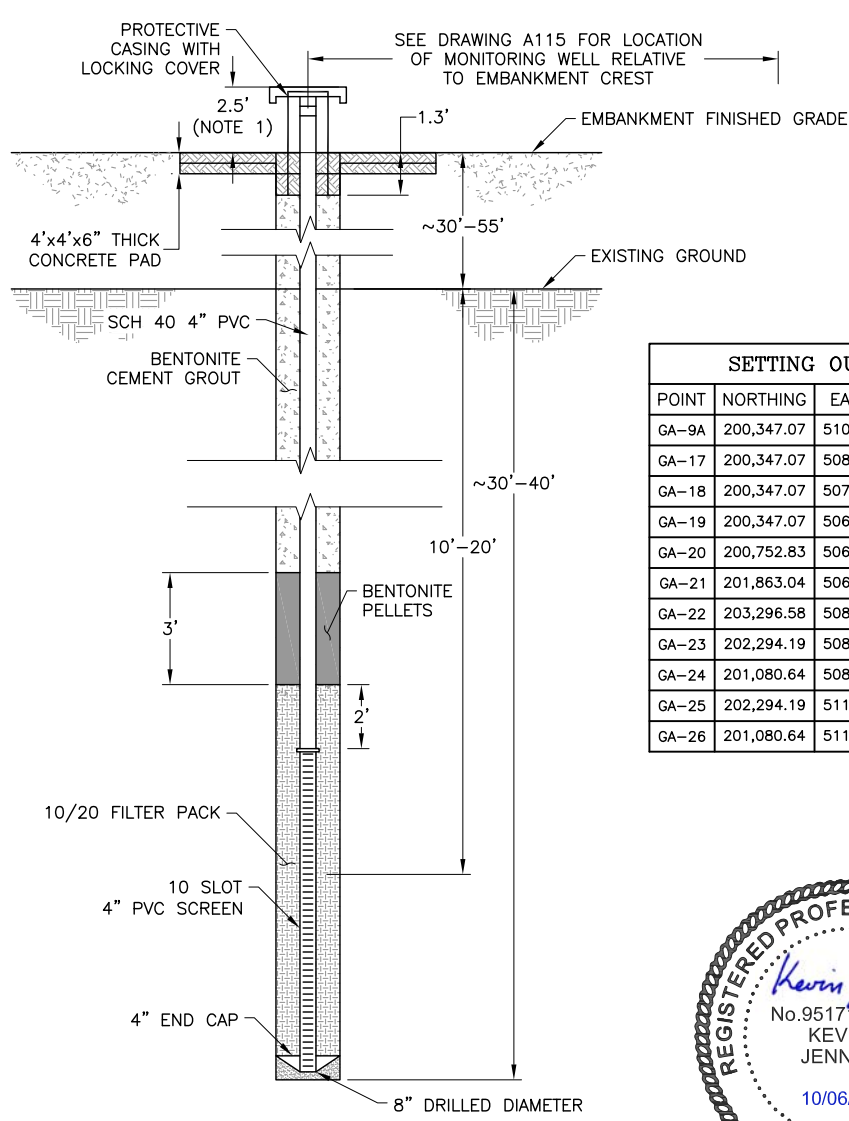
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**NOTES:**

1. MONITORING WELLS INSTALLED ON THE EMBANKMENT CREST SHALL BE FLUSH WITH THE TOP OF THE ROAD WEARING COURSE.

- LEGEND:**
- EXISTING GROUND CONTOURS
  - APPROXIMATE GROUNDWATER CONTOURS BASED ON JUNE 2017 SITE INVESTIGATION, MARCH 2015 SITE INVESTIGATION, AND IGES 2011 SITE INVESTIGATION
  - EXISTING ROADS/TRAILS
  - GA-01 EXISTING GROUND WATER MONITORING WELLS TO REMAIN
  - GA-09 EXISTING GROUND WATER MONITORING WELLS TO BE RELOCATED
  - GA-12 PROPOSED GROUND WATER MONITORING WELLS
  - APPROXIMATE GROUNDWATER FLOW DIRECTION



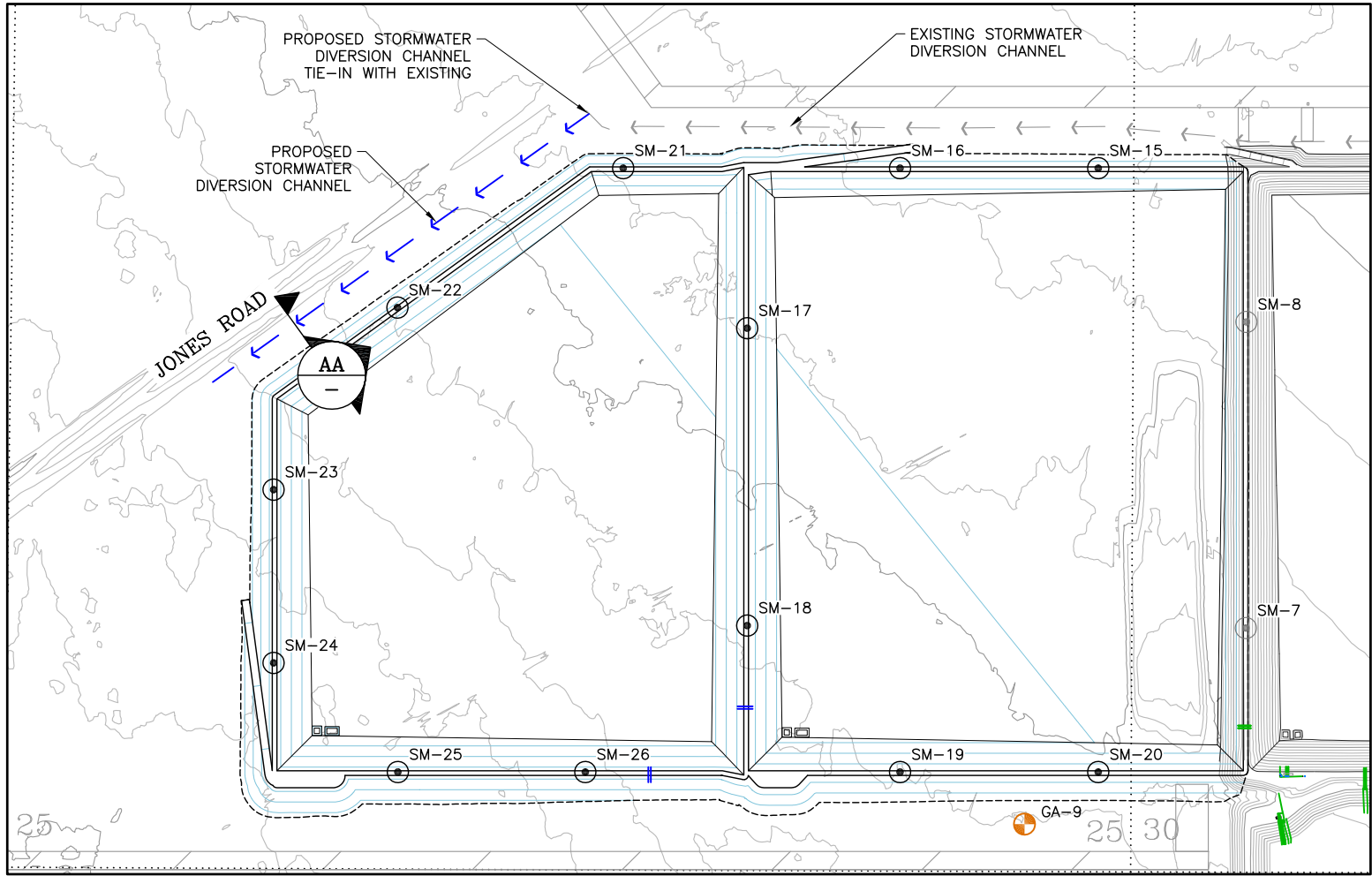
SETTING OUT DATA			
POINT	NORTHING	EASTING	ELEVATION
GA-9A	200,347.07	510,081.80	4,693.00
GA-17	200,347.07	508,860.38	4,693.00
GA-18	200,347.07	507,678.94	4,687.00
GA-19	200,347.07	506,568.54	4,687.00
GA-20	200,752.83	506,173.14	4,631.80
GA-21	201,863.04	506,256.32	4,637.99
GA-22	203,296.58	508,116.80	4,655.65
GA-23	202,294.19	508,774.62	4,693.00
GA-24	201,080.64	508,774.62	4,693.00
GA-25	202,294.19	511,131.62	4,693.00
GA-26	201,080.64	511,131.62	4,693.00



**TYPICAL GROUNDWATER MONITORING WELL DETAIL**

APPROVED BY: KNJ		DISCLAIMER		NewFields		CLIENT MAGNUM DEVELOPMENT SOLUTION MINING	
CHECKED BY: KNJ		NEWFIELDS PRODUCED THE INFORMATION PRESENTED ON THIS DRAWING THROUGH THE USE OF AVAILABLE TECHNICAL INFORMATION AND EXPERIENCE. RECEIVING THIS DRAWING DOES NOT GUARANTEE ANY RIGHTS TO EITHER SUCH TECHNICAL INFORMATION OR EXPERIENCE. ANY MODIFICATION OR ADAPTATION OF THE DATA OR DRAWING SHALL BE AT USER'S RISK AND WITHOUT ANY LIABILITY OR LEGAL RESPONSIBILITY TO NEWFIELDS.		PROJECT		BRINE POND NO. 3 & 4	
DESIGNED BY: JLW		DRAWN BY: JLW		TITLE		POND SITE GROUNDWATER DEPTHS PLAN AND PROFILE	
0 10/06/17		ISSUED FOR CONSTRUCTION		JLW JLW		FILENAME 93.0017.018D	
REV		DATE		TECH ENG		DRAWING NO. A300	
		DESCRIPTION				REVISION 0	

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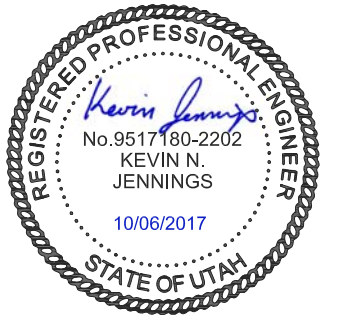
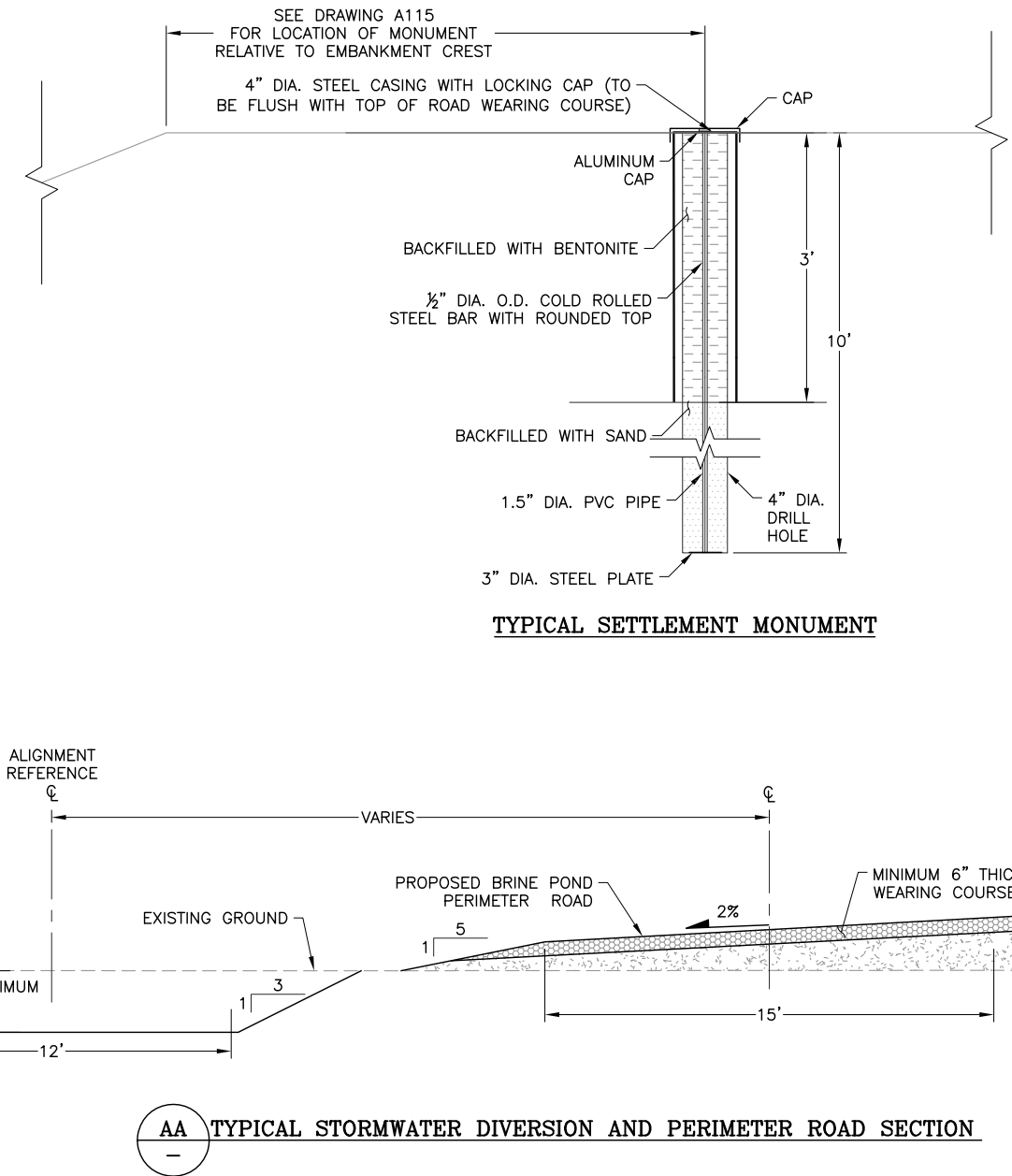
SETTING OUT DATA			
POINT	NORTHING	EASTING	ELEVATION
SM-15	203,196.07	510,431.00	4,693.00
SM-16	203,196.07	509,495.87	4,693.00
SM-17	202,440.91	508,774.62	4,693.00
SM-18	201,038.08	508,774.62	4,693.00
SM-19	200,347.07	509,495.87	4,693.00
SM-20	200,347.07	510,431.00	4,693.00
SM-21	203,196.07	508,189.33	4,687.00
SM-22	202,538.37	507,124.08	4,687.00
SM-23	201,679.23	506,539.62	4,687.00
SM-24	200,861.83	506,539.62	4,687.00
SM-25	200,347.07	507,125.93	4,687.00
SM-26	200,347.07	508,010.51	4,687.00

LEGEND:

- EXISTING GROUND CONTOURS  
PROPOSED BRINE POND GROUND CONTOURS  
EXISTING ROADS/TRAILS  
EXISTING STORMWATER DIVERSION CHANNEL  
PROPOSED STORMWATER DIVERSION CHANNEL  
EXISTING EMBANKMENT SETTLEMENT MONUMENTS  
PROPOSED EMBANKMENT SETTLEMENT MONUMENTS (SEE NOTE 6)

NOTES:

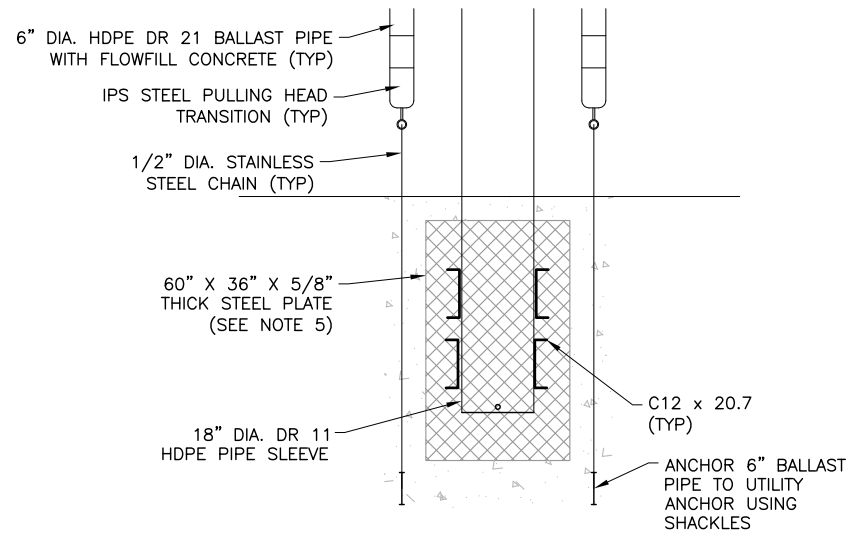
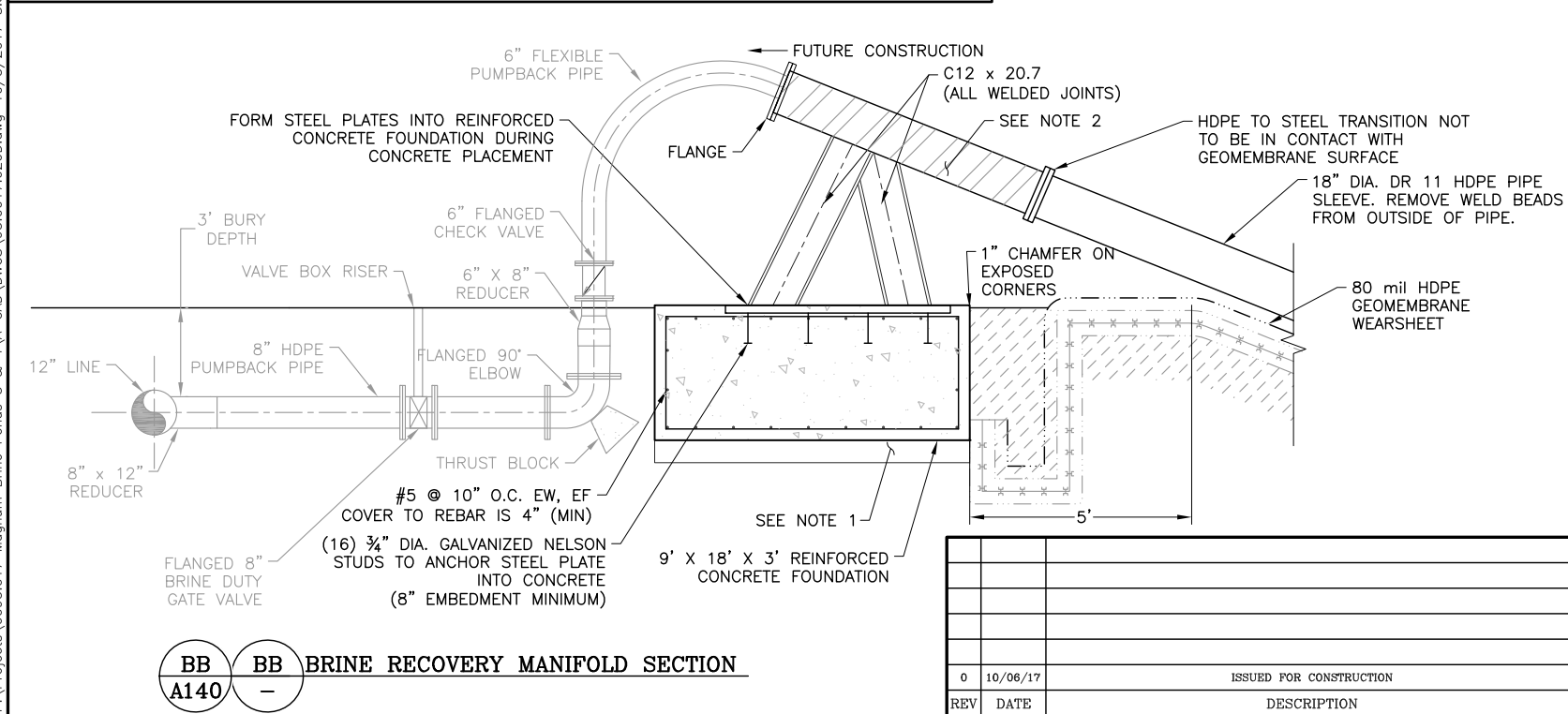
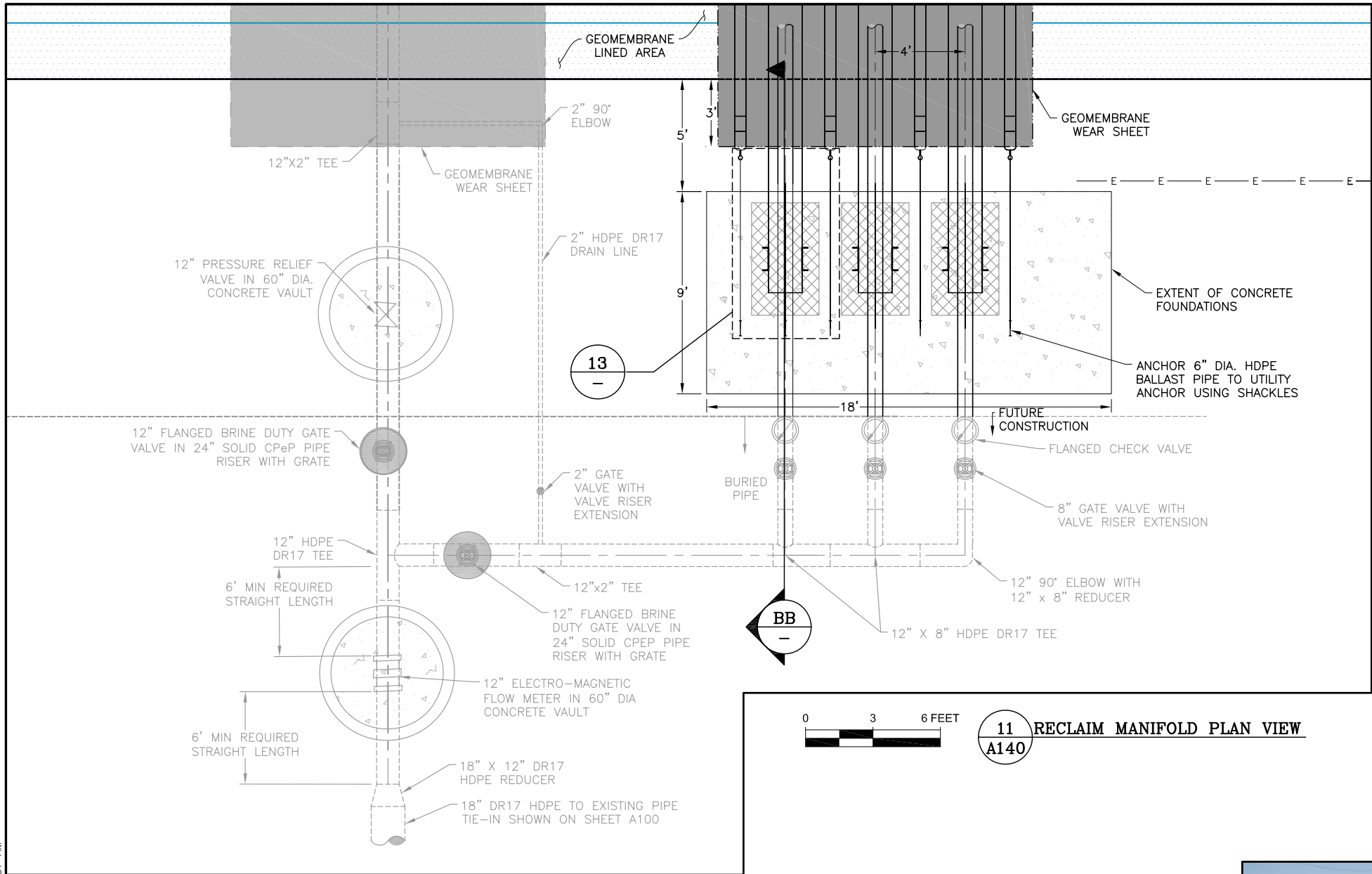
- FINAL LOCATION OF ROAD AND DIVERSION CHANNEL TO BE DETERMINED DURING CONSTRUCTION BY THE FIELD ENGINEER.
- DIVERSION CHANNELS SHALL BE CONSTRUCTED AT A MINIMUM 0.3% SLOPE TO MINIMIZE EARTHWORKS.
- DIVERSION CHANNELS SHALL BE CONSTRUCTED WITH A MINIMUM 2 FOOT DEPTH.
- BRINE POND PERIMETER ROAD SHALL BE CONSTRUCTED WITH A MINIMUM 6" THICK WEARING COURSE.
- CULVERTS AND LOCAL DITCHES SHALL BE CONSTRUCTED AS REQUIRED TO MINIMIZE PONDING OF SURFACE WATER, LOCATIONS TO BE DETERMINED IN THE FIELD.
- FINAL LOCATION OF SETTLEMENT MONUMENTS TO BE DETERMINED DURING CONSTRUCTION BY THE OWNER OR OWNER'S REPRESENTATIVE.
- FIELD VERIFY AND EXTEND CHANNEL IF NECESSARY TO ALLOW PROPER DRAINAGE SLOPE.
- THE DIVERSION CHANEL SHALL BE GRADED AS SUCH TO OUTFALL INTO NATURAL DRAINAGE WAYS WHEN POSSIBLE.



				APPROVED BY: KNJ	DISCLAIMER NEWFIELDS PRODUCED THE INFORMATION PRESENTED ON THIS DRAWING THROUGH THE USE OF AVAILABLE TECHNICAL INFORMATION AND EXPERIENCE. RECEIVING THIS DRAWING DOES NOT GUARANTEE ANY RIGHTS TO EITHER SUCH TECHNICAL INFORMATION OR EXPERIENCE. ANY MODIFICATION OR ADAPTATION OF THE DATA OR DRAWING SHALL BE AT USER'S RISK AND WITHOUT ANY LIABILITY OR LEGAL RESPONSIBILITY TO NEWFIELDS.	CLIENT <b>NewFields</b> MAGNUM DEVELOPMENT SOLUTION MINING	PROJECT BRINE POND NO. 3 & 4	
				CHECKED BY: KNJ			TITLE STORMWATER DIVERSION AND SETTLEMENT MONUMENT PLAN	
				DESIGNED BY: JLW			FILENAME 93.0017.019D	
				DRAWN BY: JLW			DRAWING NO. A400	REVISION 0
0	10/06/17	ISSUED FOR CONSTRUCTION		JLW	JLW			
REV	DATE	DESCRIPTION		TECH	ENG			

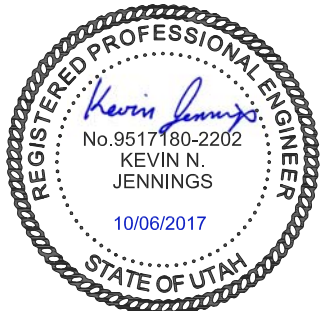


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**NOTES:**

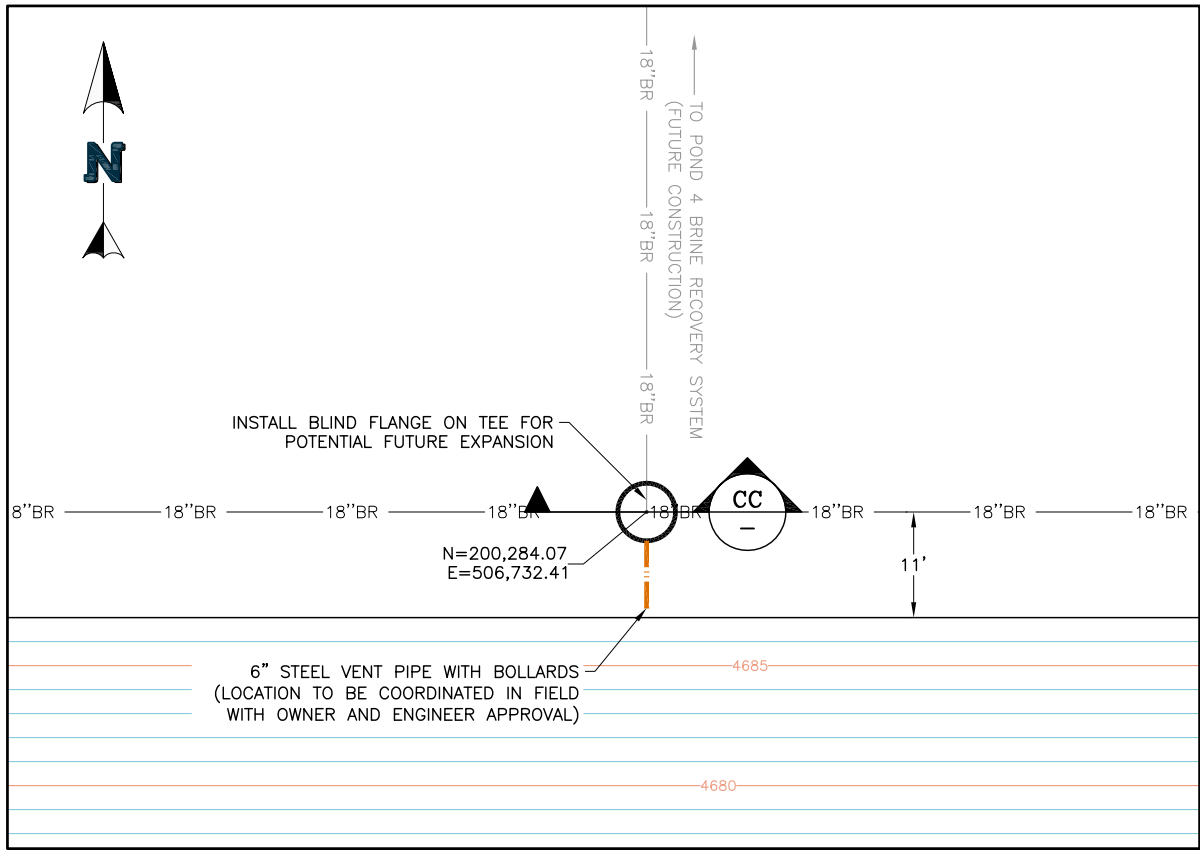
1. COMPACT SOIL TO 95% STANDARD PROCTOR DENSITY UNDER THE CONCRETE FOUNDATION FOOTPRINT.
2. COAT STEEL AND CONCRETE WITH TNEC EPOXOLINE SERIES 141 OR SIMILAR FOR CORROSION PROTECTION.
3. POSITION STEEL PLATE OR PLATES SO THAT CHANNEL LEGS CAN BE WELDED AT PLATE AND SLOPING PIPE SLEEVE.



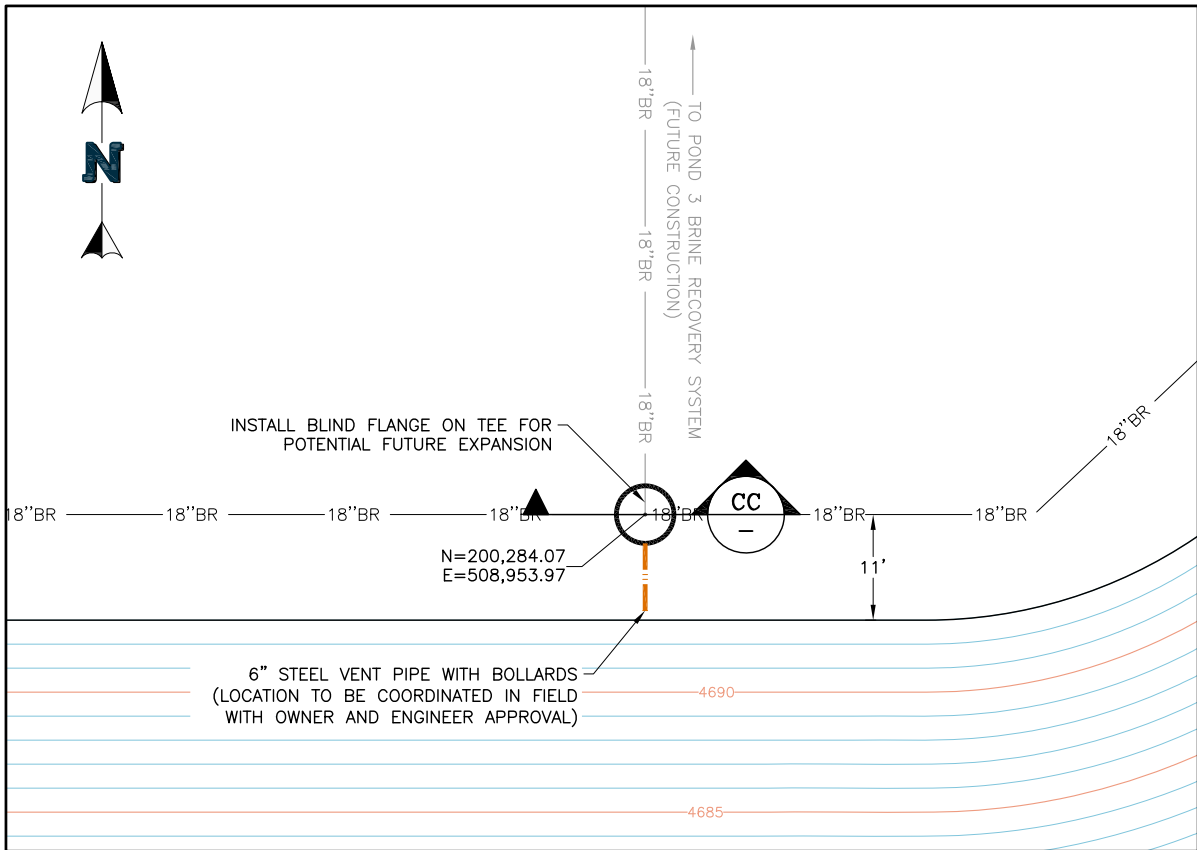
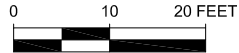
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CHECKED BY: KNJ		NEWFIELDS PRODUCED THE INFORMATION PRESENTED ON THIS DRAWING THROUGH THE USE OF AVAILABLE TECHNICAL INFORMATION AND EXPERIENCE. RECEIVING THIS DRAWING DOES NOT GUARANTEE ANY RIGHTS TO EITHER SUCH TECHNICAL INFORMATION OR EXPERIENCE. ANY MODIFICATION OR ADAPTATION OF THE DATA OR DRAWING SHALL BE AT USER'S RISK AND WITHOUT ANY LIABILITY OR LEGAL RESPONSIBILITY TO NEWFIELDS.		PROJECT		BRINE POND NO. 3 & 4	
DESIGNED BY: JLW		DRAWN BY: JLW		TITLE		BRINE RECOVERY MANIFOLD SECTIONS AND DETAILS	
0 10/06/17		ISSUED FOR CONSTRUCTION		JLW JLW		FILENAME 93.0017.020D	
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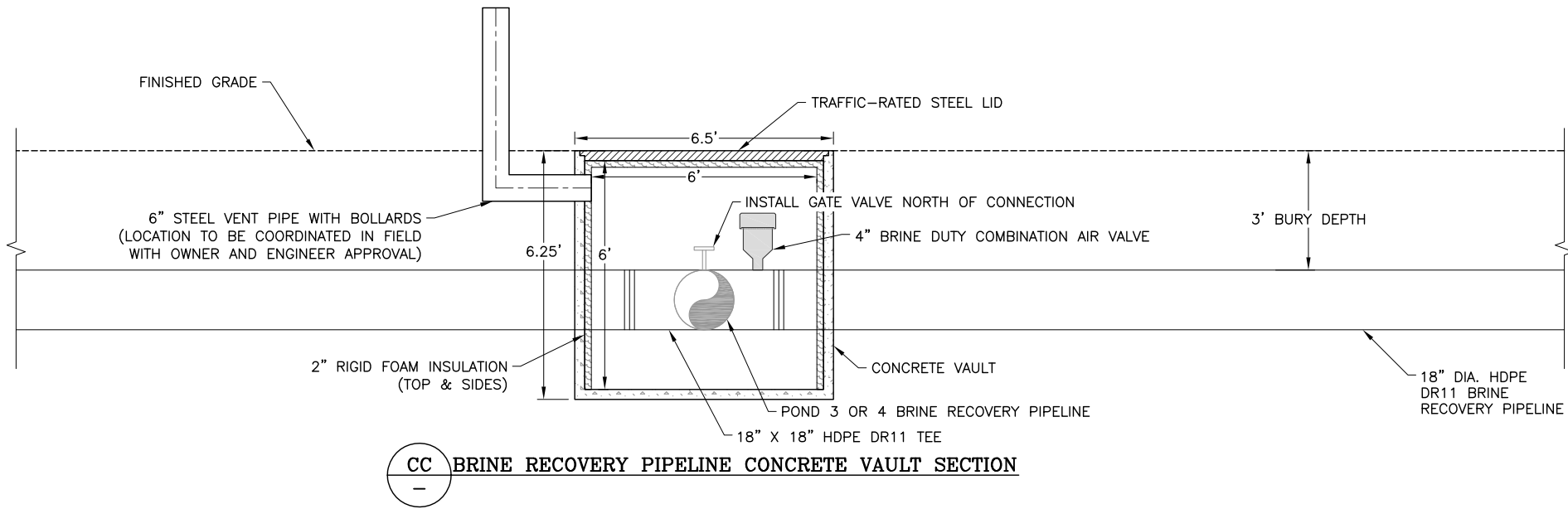
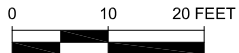
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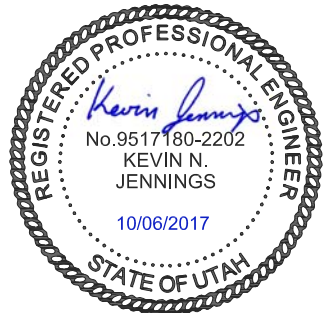
SOUTHWEST CORNER OF BRINE POND 4




SOUTHWEST CORNER OF BRINE POND 3



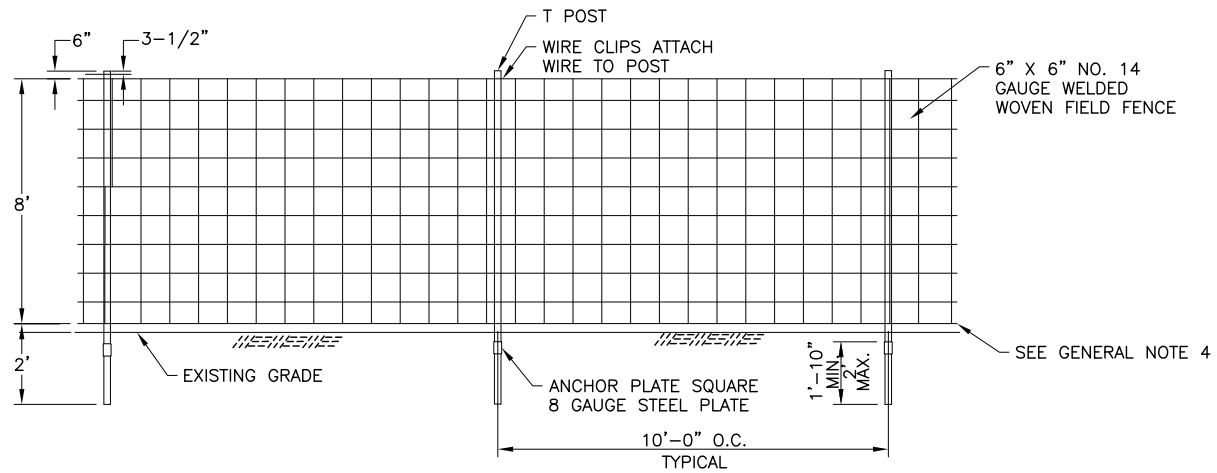
CC BRINE RECOVERY PIPELINE CONCRETE VAULT SECTION



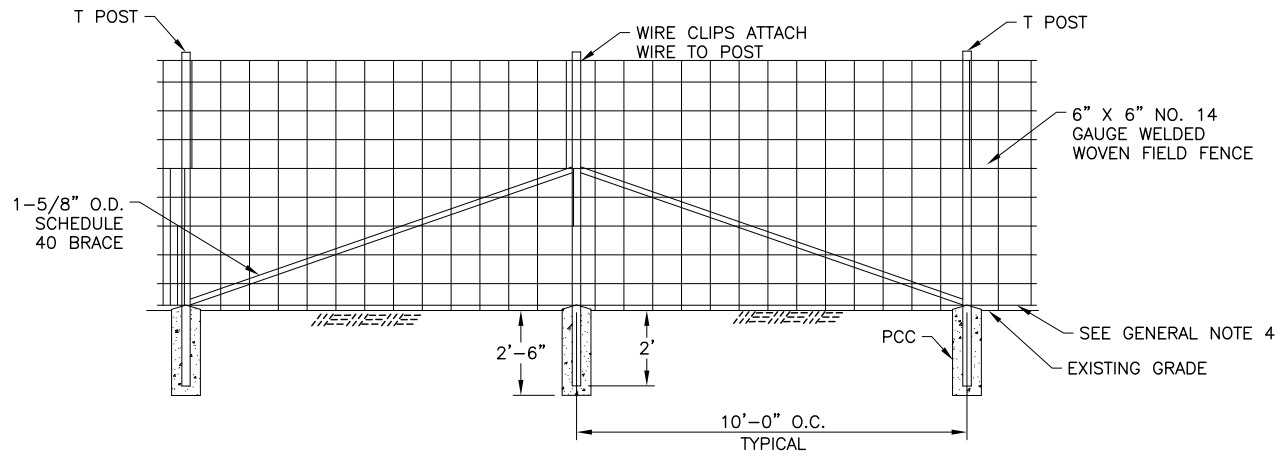
						APPROVED BY: KNJ	DISCLAIMER  NEWFIELDS PRODUCED THE INFORMATION PRESENTED ON THIS DRAWING THROUGH THE USE OF AVAILABLE TECHNICAL INFORMATION AND EXPERIENCE. RECEIVING THIS DRAWING DOES NOT GUARANTEE ANY RIGHTS TO EITHER SUCH TECHNICAL INFORMATION OR EXPERIENCE. ANY MODIFICATION OR ADAPTATION OF THE DATA OR DRAWING SHALL BE AT USER'S RISK AND WITHOUT ANY LIABILITY OR LEGAL RESPONSIBILITY TO NEWFIELDS.	 CLIENT <b>MAGNUM DEVELOPMENT SOLUTION MINING</b>		
						CHECKED BY: KNJ				
						DESIGNED BY: JLW				
						DRAWN BY: JLW				
0	10/06/17	ISSUED FOR CONSTRUCTION			JLW	JLW			PROJECT <b>BRINE POND NO. 3 &amp; 4</b>	
REV	DATE	DESCRIPTION			TECH	ENG			TITLE <b>BRINE RECOVERY PIPELINE CONNECTION DETAILS</b>	FILENAME 93.0017.025D
									DRAWING NO. <b>A560</b>	REVISION <b>0</b>



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LINE PANELS



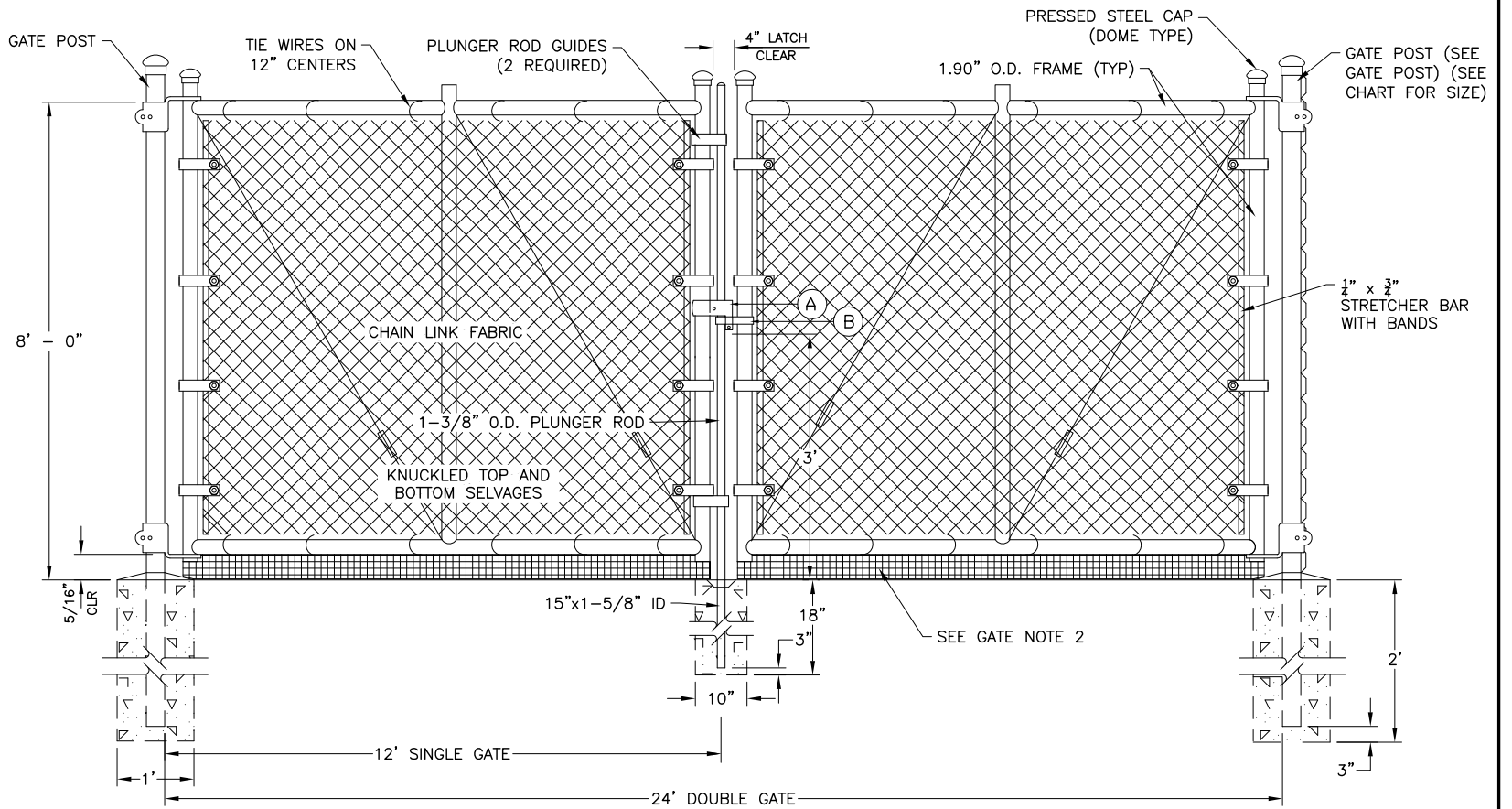
END PANEL

PANEL NOTES:

1. END PANELS SHALL BE PLACED EVERY 1000' ON TANGENTS.
2. END PANELS SHALL BE USED WHEREVER A BREAK IN THE FENCE OCCURS, (I.E. GATES, CATTLE GUARDS) AND AT THE BEGINNING AND END OF ALL CURVES
3. WIRES ARE TO BE TIED OFF AT STRETCH POINTS. WRAP AND SPLICE TO SELF WITH AT LEAST 4 TURNS AT OPPOSITE END OF PANELS.
4. FENCE SHALL BE INSTALLED TIGHT TO THE GROUND.

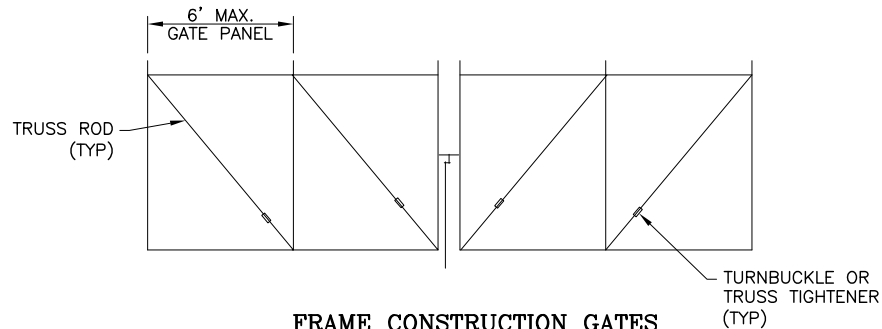
WILDLIFE FENCE  
NTS

GATE POST				
GATE OPENING IN FEET		ROUND GATE POLES O.D. (INCHES)	MIN. WEIGHT POUNDS/LIN. FEET	
SINGLE GATE	DOUBLE GATE		CLASS 1	CLASS 2
7 THRU 13	13 THRU 26	4.000	9.11	6.56



SWING GATE

NTS



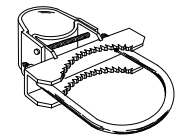
FRAME CONSTRUCTION GATES  
OVER 12'-0" TO 24'-0" OPENING

GATE NOTES:

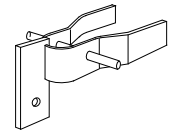
1. 3/8" ADJUSTABLE TRUSS RODS SHALL BE INSTALLED ON ALL GATES OVER 6 FEET IN WIDTH (SEE DETAIL B, SHEET C3.09, FOR TRUSS TIGHTENER DETAIL).
2. 1/2" x 1/2" NO. 12-1/2 GAUGE WIRE MESH OR 11-1/2 GAUGE CHAIN LINK FABRIC TO BE INSTALLED AT THE BOTTOM OF GATES AS REQUIRED TO CLOSE GAP BETWEEN GATE FRAME AND GROUND.

GENERAL NOTES:

1. DIAMETERS AND WEIGHTS LISTED ABOVE ARE MINIMUMS. LARGER SIZES MAY BE USED ON APPROVAL OF ENGINEER
2. 3-1/2" x 3-1/2" TYPE II POST (4.65 LBS/FT) CAN BE USED IN PLACE OF 2.875" O.D. ROUND GATE POST.
3. CONCRETE SHALL BE CLASS A OR AA.
4. FENCE FABRIC IS TO BE PLACED FLUSH WITH THE EXISTING GROUND.



HINGE FOR TUBULAR POSTS



(A) LOCK KEEPER



(B) LOCK KEEPER GUIDE



				APPROVED BY: KNJ		DISCLAIMER		NewFields		CLIENT MAGNUM DEVELOPMENT SOLUTION MINING	
				CHECKED BY: KNJ		NEWFIELDS PRODUCED THE INFORMATION PRESENTED ON THIS DRAWING THROUGH THE USE OF AVAILABLE TECHNICAL INFORMATION AND EXPERIENCE. RECEIVING THIS DRAWING DOES NOT GUARANTEE ANY RIGHTS TO EITHER SUCH TECHNICAL INFORMATION OR EXPERIENCE. ANY MODIFICATION OR ADAPTATION OF THE DATA OR DRAWING SHALL BE AT USER'S RISK AND WITHOUT ANY LIABILITY OR LEGAL RESPONSIBILITY TO NEWFIELDS.		PROJECT		BRINE POND NO. 3 & 4	
				DESIGNED BY: JLW				TITLE		WILDLIFE FENCE DETAILS	
				DRAWN BY: JLW						FILENAME 93.0017.021D	
0		10/06/17		ISSUED FOR CONSTRUCTION		JLW JLW				DRAWING NO. A600	
REV		DATE		DESCRIPTION		TECH ENG				REVISION 0	



APPENDIX B  
GROUNDWATER MONITORING PLAN  
MAGNUM GAS STORAGE, LLC



A.1.1

# Groundwater Monitoring Plan

Final





# Groundwater Monitoring Plan

## Final

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February 22, 2018

*Prepared by*

**Magnum**

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Holladay, Utah 84121

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## Section 1

# Introduction

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### 1.1 Plan Purpose

This Groundwater Monitoring Plan has been developed to describe the processes and procedures for groundwater monitoring and agency reporting for the Magnum Gas Storage, LLC (Magnum) natural gas storage facility. The Magnum gas storage facility is located approximately ten miles north of Delta in Millard County, Utah on lands leased from the School and Institutional Trust Lands Administration (SITLA). The storage facility consists of a Storage Cavern Field; two brine ponds, one with a 176-acre footprint, the other with a 145-acre footprint; a gas compression facility; a substation; an office and warehouse building; water production wells; and associated buried piping and utilities. The monitoring procedures in this Plan pertain only to the monitoring of potential effects to groundwater relative to the construction and operation of storage caverns within the Storage Cavern Field and the operation of the brine evaporation ponds.

Magnum has committed to groundwater monitoring within the confines of the storage facility using a network of existing and proposed groundwater production, observation and monitoring wells. Groundwater monitoring activities for the storage facility are under the jurisdiction of the Department of Environmental Quality, Division of Water Quality (DWQ). The Plan is written to comply with the requirements of all project permits.

### 1.2 Local Hydrogeology

Groundwater beneath the gas storage facility occurs in unconsolidated sediments within the Sevier Desert Basin aquifer system. Four aquifers units are of interest (from shallowest to deepest):

- the water table aquifer;
- the shallow artesian aquifer;
- the deep artesian aquifer; and
- the basement artesian aquifer.

Table 1 provides a summary of the four aquifers. Figure 1 is a graphical depiction of the aquifers' hydrostratigraphy.

Magnum has a network of groundwater production, observation and monitoring wells for monitoring groundwater levels and groundwater quality within the aquifers depicted in Figure 1. Magnum also has permission from two adjacent landowners to monitor groundwater levels in their respective water production wells. Figure 2 depicts the location of the network of groundwater wells that will be used for groundwater monitoring.



Table 1: Summary of Local Hydrology

Depth (feet bgs)	Aquifer Name	Aquifer Description and Use
0 to 150	Unconfined Water table aquifer	The water table aquifer is unconfined and generally not used within the area due to high total dissolved solids and poor quality conditions. (GA wells to monitor water levels and quality)
150 to 700	Shallow Artesian Aquifer	Confining zones vary in thickness and location and can include several hundred feet of the identified depths. This aquifer is generally used for agricultural and drinking water purposes. (DA wells and off-site wells to monitor water levels)
700 to 1,400	Deep Artesian Aquifer	Confining zones vary in thickness and location and can include several hundred feet of the identified depths. This aquifer is generally used for industrial and drinking water purposes. (DA wells and off-site well to monitor water levels)
> 1,400 to 3,000	Basement Artesian Aquifer	This aquifer extends to bedrock or the salt structure and includes several small inter-bedded sand and gravel units within significant silt and clay zones. This is the aquifer from which Magnum will be produce water. (GS-MH to monitor water levels and quality and DA wells to monitor water levels)

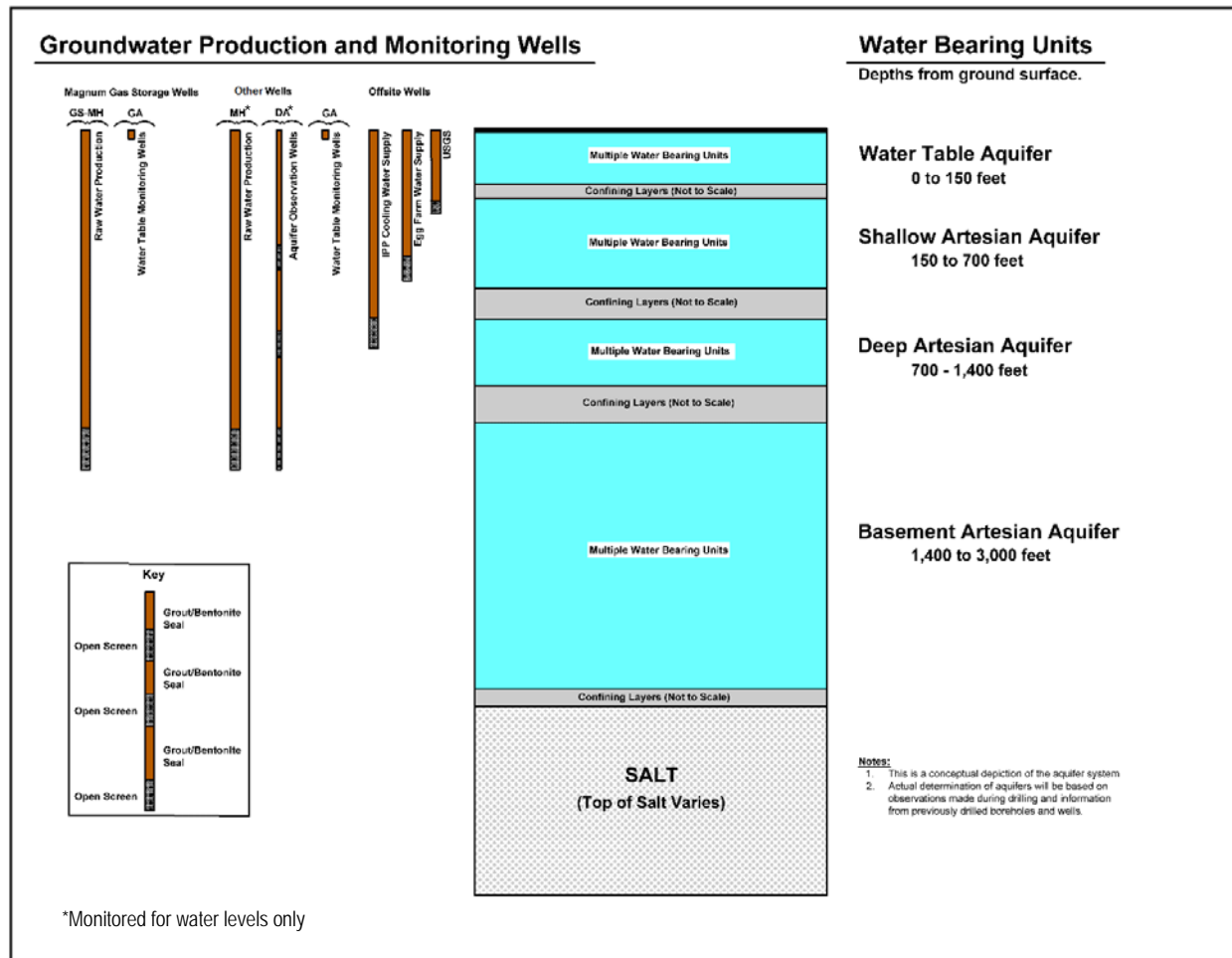


Figure 1 Hydrostratigraphy of the Project Area

### 1.3 Storage Cavern Field Groundwater Monitoring

Groundwater monitoring activities associated with the storage caverns will entail both groundwater level and groundwater quality monitoring. The storage caverns will be constructed in a salt formation that is located approximately 3,000 feet below the ground surface (bgs) using standard solution mining technology. Water for the solution mining process will be obtained from five water production wells (GS-MH-1, GS-MH-2, GS-MH-3, GS-MH-4, and GS-MH-5; see Figure 2) that supply groundwater from the basement artesian aquifer. While multiple hydrological analyses indicate that Magnum's production from the basement artesian aquifer will not drawdown the overlaying aquifers, Magnum has committed to monitoring all three artesian aquifers to ensure groundwater levels are not negatively affected by solution mining activities (see Table 1 and Figure 1).

In addition to water level monitoring, Magnum has also committed to monitoring groundwater quality in the basement artesian aquifer during solution mining and storage cavern operations.

### 1.4 Brine Evaporation Pond Groundwater Monitoring

Groundwater monitoring activities associated with the brine evaporation ponds will entail groundwater quality monitoring and leak detection system monitoring to protect the water table aquifer. The 176-acre and 145-acre ponds will be constructed with a double geomembrane liner system with a leak detection system composed of a Leak Collection and Recovery System (LCRS) between the liners and a Process Component Monitoring System (PCMS) below the liners. The purpose of monitoring the leak detection system is to ensure that the system is working in accordance with the ponds design, thereby reducing the potential for significant leaks through the bottom ponds liner. In addition, groundwater monitoring wells around the perimeter and on the berms of the ponds will be installed in the water table aquifer, as shown in Figure 2. The purpose of the monitoring wells is to monitor water level and for elevated conductivity, sodium, or chloride levels that could indicate a leak in the double liner system. In sum, the design provides for three levels of protection to ensure groundwater quality in the water table aquifer is not negatively affected by the brine ponds: 1) the double geomembrane liner system; 2) the dual leak detection and collection system; and 3) the network of groundwater monitoring wells.



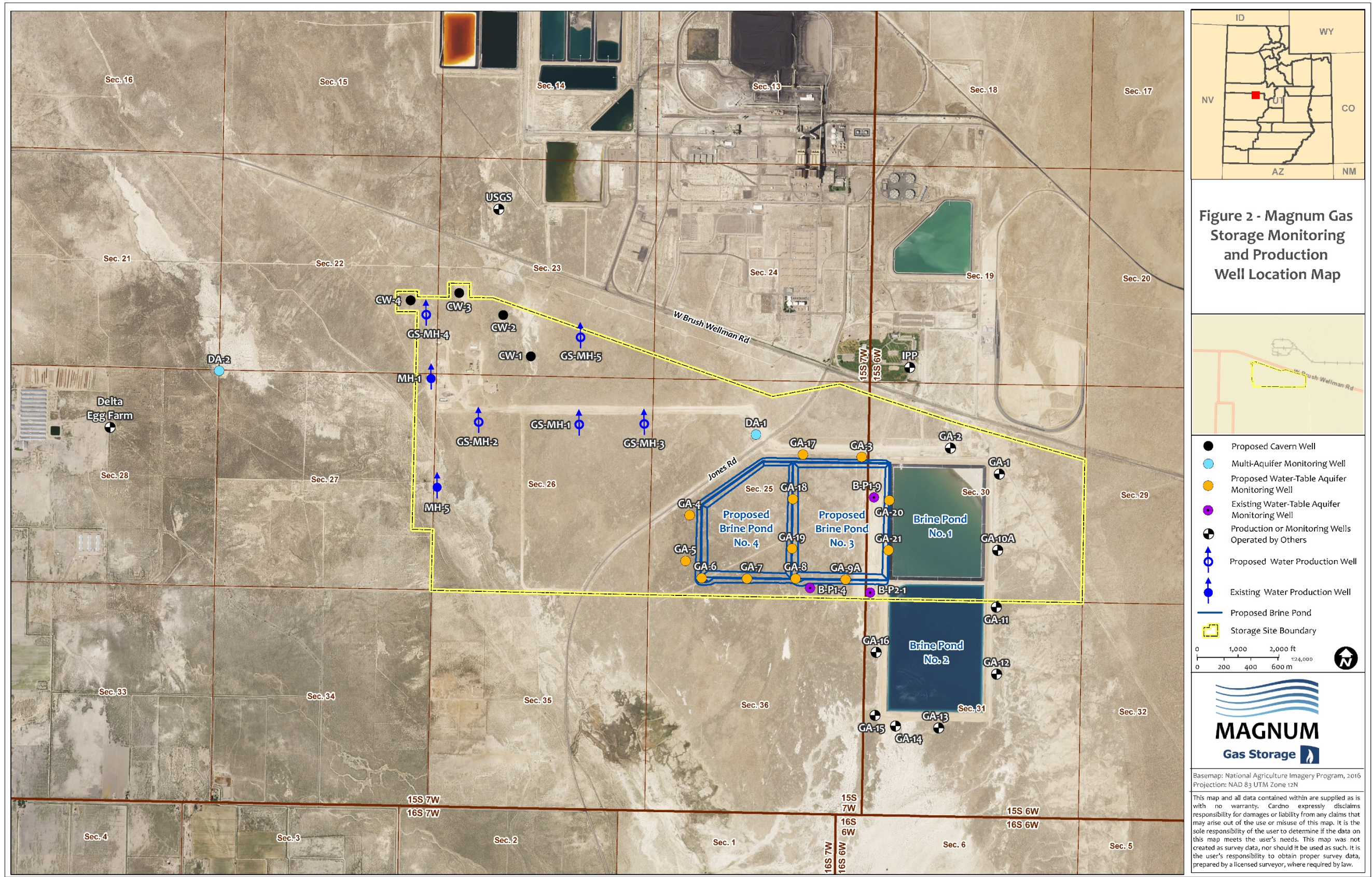


Figure 2 Magnum Gas Aquifer Monitoring Well Network



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## Section 2

# Groundwater Monitoring Methods

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Baseline data for groundwater levels and quality have been collected since 2009. Baseline groundwater levels in the shallow, deep, and basement aquifers were established during the drilling and development of the MH-1, MH-5, DA-1, and DA-2 wells. Baseline data collection for groundwater level conditions in these aquifers was initiated in 2009 when MH-1 was drilled and developed, and has continued as MH-5, DA-1 and DA-2 have been drilled and developed. (Water production wells MH-1 and MH-2, and multi-aquifer monitoring wells DA-1 and DA-2, are now owned by Sawtooth NGL Caverns, LLC [Sawtooth]). Data collection for groundwater level baseline conditions also includes data from an Intermountain Power Agency (IPA) industrial water well, a private commercial water well owned by the Delta Egg Farm, and a well installed and monitored by the U.S. Geological Survey (USGS). Baseline data for groundwater levels and quality of the water table aquifer directly beneath the brine evaporation ponds have been collected since 2010. These baseline conditions are kept on file by Magnum and are incorporated into the required agency reporting as necessary.

## 2.1 Storage Cavern Field Groundwater Level Monitoring Methods

Magnum will conduct groundwater level monitoring in association with the storage caverns using a network of proposed groundwater production wells and existing observation wells that are located both within the storage facility and off-site. The wells within the storage facility that will be used to monitor groundwater levels are the planned production wells GS-MH-1 through GS-MH-5 as they are drilled and put into service, and observation well DA-1. The off-site wells that will be used to monitor groundwater levels include observation well DA-2, an industrial water well owned by the Intermountain Power Agency (IPA), and a private commercial water well owned by the Delta Egg Farm. Figure 2 depicts the location of all the wells that will be used for groundwater level monitoring. This network of wells will allow Magnum to monitor groundwater levels in the shallow, deep, and basement artesian aquifers. Figure 1 illustrates the individual well depths and monitoring points in relation to the groundwater system. Note that Magnum will only be able to monitor the groundwater aquifer conditions from the off-site locations with landowner cooperation.

Existing monitoring wells are equipped with transducers to measure groundwater levels; future wells will be similarly equipped. The transducers are installed within monitoring tubes located within the well casings of the individual wells. The Delta Egg Farm water well and the IPA water well each have a single monitoring tube installed to monitor the respective aquifer in which each well is completed. DA-1 and DA-2 are equipped with monitoring tubes that enable monitoring of all three artesian aquifers.

The data loggers connected to each transducer have been set to record groundwater level measurements daily. Data from the transducers at each monitoring well will be downloaded and analyzed monthly during periods of solution mining. Groundwater level measurements will be documented to the nearest 0.1 foot. The functionality of transducers will be checked monthly the

first year of operations and quarterly thereafter; adjustments to transducer settings will be made accordingly. Table 2 summarizes the groundwater level monitoring schedule as described above.

Table 2: Storage Cavern Field Groundwater Level Monitoring Schedule

Well	Aquifer Monitoring Point	Data Collection Interval	Data Download and Analysis Frequency <sup>1</sup>
GS-MH-1 – GS-MH-5 Water Production Wells <sup>3</sup>	Basement Artesian	Daily	Monthly
DA-1 and DA-2 Observation Wells <sup>2</sup>	Shallow, Deep and Basement Artesian	Daily	Monthly
IPA Water Production Well <sup>4</sup>	Deep Artesian	Daily	Monthly
Delta Egg Farm Water Production Well <sup>5</sup>	Shallow Artesian	Daily	Monthly
USGS Well	Shallow Artesian	Daily	As available <sup>6</sup>

<sup>1</sup>Data will be downloaded and analyzed monthly during periods of solution mining, quarterly otherwise.

<sup>2</sup>Wells owned by Sawtooth NGLs, LLC. Owner permission required to monitor.

<sup>3</sup>Planned Magnum-owned wells.

<sup>4</sup>Well owned by Intermountain Power Agency. Owner permission required to monitor.

<sup>5</sup>Well owned by Delta Egg Farm. Owner permission required to monitor.

<sup>6</sup>Data recorded daily by USGS but made publicly available at irregular intervals, approximately every six months.

## 2.2 Storage Cavern Field Groundwater Quality Monitoring Methods

Magnum will conduct groundwater quality monitoring in association with the gas storage caverns using the planned production wells GS-MH-1 through GS-MH-5. These wells are proximal to the Gas Storage Cavern Field and will produce water from the basement artesian aquifer at elevations between 1,700 to 3,000 feet bgs (see Figures 1 and 2). Because the top of gas storage caverns within the salt dome are located between 3,700 and 4,000 feet bgs, best industry practices indicate any potential groundwater contamination would first be detected in the GS-MH wells.

- Groundwater samples will be collected monthly from GS-MH-1, GS-MH-2, GS-MH-3, GS-MH-4, and GS-MH-5. Groundwater sampling methods will be per the Groundwater Sampling Quality Assurance Procedures included as Appendix A. The sampling methods include
- Water samples will be collected from the sample port that is closest to each wellhead.
- A hand-held multi-gas meter will be used to monitor the headspace of each well for the presence of combustible gas prior to sampling.
- The water level will be measured prior to sampling.
- Samples will be collected directly into laboratory-provided containers and delivered per the laboratory-required protocols.
- Information pertinent to the sampling effort will be documented on preprinted field sheets.

- The handling of all samples collected will be traceable from the time of collection, through analysis, until final disposition. Documentation of the sample history is referred to as chain-of-custody.
- Samples will be sent to and analyzed by a State of Utah certified laboratory for the analysis of sodium, chloride, and total dissolved solids.

Table 3 summarizes the groundwater quality monitoring schedule associated with the storage caverns as described above.

Table 3: Storage Cavern Field Groundwater Quality Monitoring Schedule

Well	Aquifer Monitoring Point	Water Sample Frequency
GS-MH-1 – GS-MH-5 Water Production wells <sup>1</sup>	Basement Artesian	Monthly

<sup>1</sup> Planned Magnum-owned wells.

## 2.3 Brine Evaporation Ponds Groundwater Quality Monitoring Methods

Magnum will conduct groundwater quality monitoring of the water table aquifer in association with the brine evaporation ponds using the proposed monitoring wells GA-3, GA-4, GA-5, GA-6, GA-7, GA-8, GA-9A, GA-17, GA-18, GA-19, GA-20, and GA-21. These wells are placed in an array around and on the berms of the brine evaporation ponds (see Figure 2). All wells will be installed to a depth within the water table aquifer zone (see Figure 1 and Figure 2). GA-3 and GA-17 are intended to monitor groundwater quality upgradient of the brine evaporation ponds; the remaining wells are intended to monitor groundwater quality downgradient of the ponds. Water level measurements also will be taken during monitoring events.

Groundwater monitoring of the water table aquifer will be conducted in accordance with the requirements of the DWQ GWDP. Magnum's water table aquifer groundwater monitoring plan includes

- Monthly field data collection for salinity, pH, temperature, TDS, and conductivity; and,
- Quarterly laboratory analysis for the parameters identified in Table 4.

In accordance with DWQ GWDP #UGW270010, Magnum will conduct field monitoring monthly for the parameters above. Monthly field monitoring will be conducted for a period of 24 months after the initiation of commercial operations. After the first 24 months of commercial operations, the frequency of field monitoring will be reduced to quarterly.

In addition, the DWQ GWDP requires Accelerated Background Monitoring on a quarterly basis for a period of 24 months to establish ground water protection levels for the storage facility. Accelerated Background Monitoring will initially include both the collection of field parameters and collection of groundwater samples for laboratory analysis on a quarterly basis for the parameters above. Analysis of all groundwater samples will be performed by laboratories certified by the Utah Department of Health, will follow methods cited in Utah Administrative Code (UAC) R317-6-6.3L, and will ensure that method detection limits are less than the Interim Ground Water Protection Levels for the water table aquifer zone described in Table 4.



After completion of the Accelerated Background Monitoring, Magnum will submit an Accelerated Background Monitoring Report to the DWQ. After review and approval of the Accelerated Background Monitoring Report, the Director of DWQ (the Director) will establish well-specific groundwater protection levels for each parameter in accordance with R317-6-4 of the Ground Water Quality Protection Rules. After specific well protection measures have been identified, sampling will be reduced to a semi-annual frequency.

Table 4: DWQ Interim Groundwater Protection Levels

Parameter	Protection Level (mg/L)
pH (units)	6.5 – 8.5 <sup>1</sup>
Chloride	150
Sodium	200
Total Dissolved Solids	750

<sup>1</sup>Class II Groundwater Quality Standard

Table 5 summarizes the groundwater quality monitoring schedule for the evaluation of the DWQ Groundwater Quality Standards in the vicinity of the brine evaporation pond.

Table 5: Brine Evaporation Pond Groundwater Quality Monitoring Schedule

Well	Aquifer	Field Monitoring (0-24 mos.)	Field Monitoring (after 24 mos.)	Accelerated Background Monitoring (0-24 mos.)	Compliance Monitoring (after 24 mos.)
GA Water Table Monitoring Wells	Unconfined Water table aquifer	Monthly	Quarterly	Quarterly	Semi-annual

### 2.3.1 Exceedances

Upon exceedance in a downgradient monitoring well of any one parameter listed in Table 4, the monitoring well(s) in which the exceedance was(were) detected will immediately be resampled for laboratory analysis of the exceeded protection level parameter(s). The analytical results will be submitted to the DWQ, and the Director will be notified of a probable out-of-compliance status within 30 days of the initial detection.

Upon exceedance of any one parameter listed in Table 4 for two consecutive sampling events, Magnum will immediately notify the DWQ and Millard County and implement an accelerated schedule of monthly sampling and analysis. This monthly schedule will continue for at least two months or until the compliance status can be determined by the Director. Reports of the results of this sampling will be submitted to the Director as soon as they are available, but not later than 30 days from each date of sampling.

If the protection level for a parameter listed in Table 4 is exceeded in two consecutive samples from a compliance monitoring well, the well is out of compliance. The Director will be notified

verbally of the within 24 hours of the receipt of data demonstrating out-of-compliance status; written notice will be provided within 5 days. Accelerated monthly groundwater monitoring will continue for at least two months, and until the facility is brought into compliance, or as determined by the Director.

Within 30 days after the written notice to the Director of out-of-compliance status, Magnum will submit an assessment study plan and compliance schedule for:

- 1) Assessment of the source or cause of the contamination, and determination of steps necessary to correct the source.
- 2) Assessment of the extent of the ground water contamination and any potential dispersion.
- 3) Evaluation of potential remedial actions to restore and maintain ground water quality and ensure that the ground water standards will not be exceeded at the compliance monitoring wells.

Millard County will be immediately notified of any monitoring well that is out of compliance.

## Section 3

# Agency Reporting and Notification

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### 3.1 Storage Cavern Field Groundwater Level Reporting and Notification

During the first year of solution mining, Magnum will submit monthly water level measurement reports to FERC, the State Engineer, Millard County, and the USGS, then quarterly thereafter as applicable. The reports will include water level as measured in depth to ground water from the surveyed casing measuring point, and ground water elevations as converted by casing measuring point elevations. The report will also include a graphical depiction of the water level data from all monitored wells. Magnum will also submit an annual Water Rights and Water Usage Summary and Analysis to the State Engineer and Millard County by April 30 for the previous year in which solution mining activities have been conducted.

Magnum management will initiate a detailed internal review with a professional engineer/hydrogeologist if a sustained change in water levels greater than 12 feet below the historic recorded low is documented within the shallow and deep artesian aquifers in off-site monitoring wells. Once Magnum's internal review is complete, Magnum will meet with the owner of the off-site well, Magnum's professional engineer/hydrogeologist, and the State Engineer to review and coordinate any necessary action. Magnum will notify Millard County of any official determination made by the State Engineer.

### 3.2 Storage Cavern Field Groundwater Quality Reporting and Notification

Magnum will prepare and file quarterly groundwater quality monitoring reports with the required agencies. The reports will include the groundwater analysis results and groundwater level measurements for each monitoring well. Reports will be submitted per the following schedule:

- First Quarter Report (January, February, March) – Due April 30.
- Second Quarter Report (April, May, June) – Due July 31.
- Third Quarter Report (July, August, September) – Due October 31.
- Fourth Quarter Report (October, November, December) – Due Jan 31.

Magnum will immediately consult with agencies on an appropriate course of action if:

- Sodium or chloride concentrations measured in a groundwater sample are higher than the baseline concentrations by a factor of two.
- Combustible gases traceable to storage products are detected in the headspace of a well.

### 3.3 Brine Evaporation Pond Groundwater Quality Reporting and Notification

Quarterly groundwater quality monitoring reports will be submitted to the required agencies per the following schedule:

- First Quarter Report (January, February, March) – Due April 30.

- Second Quarter Report (April, May, June) – Due July 31.
- Third Quarter Report (July, August, September) – Due October 31.
- Fourth Quarter Report (October, November, December) – Due Jan 31.

Magnum will also submit an Accelerated Background Monitoring Report to the required agencies per the requirements of the DWQ GWDP after eight quarterly sample events have been completed. The report will include all field data sheets (see Appendix B), laboratory analytical reports, and the following statistical calculations by well, presented in spreadsheet format for the interim groundwater protection parameters listed in Table 4.

- Non-detect values converted to the detection limit times 0.25
- Mean concentration
- Standard deviation
- Mean concentration plus 2 standard deviations
- Mean total dissolved solids concentration times 1.25
- Mean concentration of all other parameters times 1.25
- Ground water quality standard times 1.25

After Accelerated Background Monitoring is completed and the Director establishes well-specific groundwater protection parameters, ongoing groundwater quality monitoring reports will include the following information:

- Field Data Sheets (see Appendix B), or copies thereof, including the field measurements required as identified in Section 3.3 above, and other pertinent field data, such as well name/number, date and time, names of sampling crew, depth to water, type of sampling pump or bail, volume of water purged before sampling.
- Laboratory Analytical Results, including date sampled, date received; and the results of analysis for each parameter, including the value or concentration, units of measurement, reporting limit (minimum detection limit for the examination), analytical method, and the date of the analysis.
- A summary table of the analytical results from the current and previous monitoring events, a discussion of whether the monitoring wells comply with groundwater protection parameters, an evaluation of temporal and spatial trends in the data, a discussion laboratory data quality assurance/quality control, and any other information pertinent to the monitoring even.

DWQ will be notified within 24 hours of any non-compliance per the GWDP if a leak in the brine evaporation ponds is indicated from an immediate resampling of the water table aquifer groundwater quality.

If conductivity or dissolved chloride levels in a monitoring well exceed background samples by more than a factor of two, applicable agencies will be immediately notified.

### 3.4 Brine Evaporation Pond Leak Detection System Reporting, Notification, and Corrective Action

Leak detection system monitoring will be reported in the quarterly groundwater monitoring reports. The reports will be submitted to the required agencies per the schedule outlined above and will include:

- A verification that the inspection schedule is being maintained;
- A verification that the measured LCRS and PCMS Maximum Allowable Leakage rates have not been exceeded; and,
- If the Maximum Allowable Leakage Rates have been exceeded, the Director will be notified verbally as soon as possible, but no later than 24 hours after Magnum becomes aware of the exceedance. The report shall be made to the Utah Department of Environmental Quality 24-hour number, (801) 536-4123, or to the Division of Water Quality, Ground Water Protection Section at (801) 536-4300, during normal business hours (Monday through Friday 8:00 am - 5:00 pm Mountain Time).
- A written submission will also be provided to the Director within five days of the time that Magnum becomes aware of the exceedance. The written submission will contain:
  - A description of the exceedance and its cause;
  - The period of exceedance, including exact dates and times;
  - The estimated time the exceedance is expected to continue if it has not been corrected; and,
  - Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the exceedance.
- Out-of-compliance conditions will be evaluated by daily monitoring of pumping rates from the LCRS sumps during the filling of the ponds.
  - A sudden spike in flows indicates one or more leaks. Filling will be halted and the pond will be inspected to determine the source of the leaks.
  - After the leak(s) is(are) identified and repaired, filling will continue, while continuing to monitor flows.
- If a leak develops after filling the pond, the first step will be to monitor head in the space between the liners to narrow the location of the leak(s) to allow focused inspections and to confirm that head has been controlled between the liners.
  - If elevated head between the liners is identified as the source of leakage, head control will be reestablished as described in the Brine Evaporation Ponds Operating Manual (Appendix C to Permit UGW270010).
  - If excessive leakage occurs because of a liner failure, the liner will be repaired prior to introducing additional fluids into the pond.



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## Section 4

# Record Retention

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### 4.1 Records

Magnum will retain copies at the storage facility of all monitoring data sheets, laboratory analyses and agency reports associated with groundwater level, water quality, and leak detection system monitoring. These records will be kept for the operational life of the facility.

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# Appendix A

## Groundwater Sampling Quality Assurance Procedures





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## GROUNDWATER SAMPLING QUALITY ASSURANCE PROCEDURES

### 1.0 SAMPLING PROCEDURES

Groundwater samples will be collected monthly from production wells GS-MH-1, GS-MH-2, GS-MH-3, GS-MH-4, and GS-MH-5, and analyzed for sodium, chloride, total dissolved solids, and dissolved gases. Groundwater samples from the water table aquifer monitoring wells GA-3, GA-4, GA-5, GA-6, GA-7, GA-8, GA-9A, GA-17, GA-18, GA-19, GA-20, and GA-21 will be collected monthly initially, moving to semi-annually. Sampling events will be documented on field forms and reported in quarterly reports. Basic sampling procedures are as follows:

- Prior to sampling GS-MH-1, GS-MH-2, GS-MH-3, GS-MH-4, and GS-MH-5, a hand-held multi-gas meter will be used to monitor the headspace of each well for the presence of combustible gas.
- Prior to sampling all monitoring wells, water levels also will be measured.
- Groundwater sampling will be performed by collecting a sample directly from the sample port that is closest to each wellhead in the case of MH-1, MH-5, GS-MH-1, GS-MH-2, GS-MH-3, GS-MH-4, and GS-MH-5. In the case of the GA wells, sampling will be performed directly from the well.
- Each well will be purged prior to sampling. A minimum of three volumes of water in the well casing will be removed, unless the well runs dry. A well that runs dry will be revisited and sampled once the water level has recovered and sufficient water is available for sampling.
- Because exact flow rates are unknown, the well pumping and sampling point purge rates will be recorded.

### 2.0 SAMPLING QUALITY CONTROL

The quality control (QC) objective is to ensure that data are not biased by contamination or sampling error.

To meet this objective, the following QC samples will be collected in the field:

- Field duplicates will be collected with a minimum of 1 for every 10 samples. Field duplicates will be collected from the same source at the same time as the primary sample. The field duplicate will be labeled differently than the parent sample in order to appear as a separate sample to the analytical laboratory.

Matrix spike/matrix spike duplicate (MS/MSD) samples will not be collected. MS/MSDs will be analyzed by the analytical laboratory for each batch of samples run, but not necessarily from the samples collected at the site.

### 3.0 FIELD DOCUMENTATION

Information pertinent to the sampling effort will be documented on preprinted field sheets or bound logbooks. All entries will be made in indelible ink and all corrections will be made by drawing one line through the error and initialing and dating the correction.

At a minimum, entries on field documentation will include the following:

- Date,
- Project,
- Identification of sampling team members, and,
- Location and description of sampling points.
- Static water levels,
- Date and time of sample collection,
- Sample identification,
- Sampling methodology,
- Field observations, and
- Field instrument calibration results.

Documentation will contain sufficient information to reconstruct the sampling activity without relying on the sampler's memory. The field documentation will be kept on file at the sampling contractor's office.

## **4.0 DECONTAMINATION PROCEDURES**

Because no field equipment will come into contact with groundwater samples, decontamination procedures are not required.

## **5.0 SAMPLE ANALYSIS AND CONTAINERS**

Samples will be analyzed by a Utah certified laboratory for the following:

- Sodium by USEPA Method 200.7;
- Chloride by USEPA Method 300.0;
- Total Dissolved Solids by USEPA Method SM2540C; and
- Dissolved Gases by USEPA Method
- or equivalent.

## **6.0 SAMPLE HANDLING**

At the time of sample collection, labels will be affixed to the sample containers. These labels will contain the following information:

- Sample identification number,
- Date and time of sampling,
- Preservative,
- Analyses requested, and
- Name of sampler.

Samples will be collected directly into laboratory-provided containers and placed on ice in an insulated cooler. All samples will be identified, labeled, and logged onto a chain-of-custody (COC) form, and handled under standard COC protocol. Samples will be considered to be under a person's custody if they remain:

- In a person's physical possession,
- In view of the person after he/she has taken possession,
- Secured by that person so that no one can tamper with the sample, or
- In a secure area accessible only to authorized personnel.

To establish the documentation necessary to trace sample possession from the time of collection, the COC record must be completed and accompany every sample shipment. At a minimum, COC records should contain the following information:

- Project name,
- Sample identification,
- Date and time of sample collection,
- Type of matrix,
- Number of containers,
- Preservative,
- Analyses requested,
- Method of shipment,
- Signature of sampler, and
- Date and time of each change in custody.

Each person who has custody of the samples will sign the record. The completed COC record will be sealed in a waterproof plastic bag and placed inside the sample cooler. The sampler will keep a copy of each COC record. Custody seals will be affixed to the front and back of the cooler and covered with clean tape during storage and shipping operations.

The laboratory will assess the integrity of the custody seals upon sample arrival. The laboratory will also verify and document the following information upon sample receipt:

- Condition of the shipping container,
- Condition of the sample container(s),

- Condition of the custody seals,
- Presence/absence of custody seals,
- Presence/absence of custody records,
- Presence/absence of sample labels,
- Agreement/non-agreement of documents,
- Cross-reference of laboratory numbers, and
- Temperature inside the shipping container.

The laboratory will document any problems or discrepancies with the samples or custody documents, contact the sampling organization, and document the resolution to the problems or discrepancies.

The laboratory completing chemical analyses will be required to maintain samples in a secure location with limited access from the time of sample receipt through sample disposal. Samples collected during this investigation will be either shipped to the laboratory via an overnight carrier or will be hand delivered to the analytical laboratory. If the samples are shipped via an overnight carrier, the following procedure will be used for packaging:

- Inert cushioning material will be placed in the bottom of the cooler.
- The cooler will be lined with a large plastic bag.
- Each sample container will be sealed in a resealable plastic bag and placed upright in the cooler.
- For all coolers containing samples that require 4°C preservation, blue ice or wet ice and additional packaging materials will be placed around the containers. Wet ice will be double bagged.
- A temperature blank will be included in each cooler containing samples that require 4°C preservation.
- Pertinent paperwork such as the COC form will be placed in a re-sealable plastic bag and taped to the inside lid of the cooler.
- Signed custody seal will be attached to the cooler in two places and covered with clear tape in such a way that the custody seal must be broken to open the cooler.
- The cooler will be sealed with packaging tape.

A shipping label will be affixed to the outside of the cooler.

# Appendix B

## Monitoring Forms



**BRINE EVAPORATION POND MONITORING FORM**  
**MGNUM GAS STORAGE, LLC**  
**DELTA, UTAH**

Well I.D. and Depth of Well (DOW)	DATE mm/dd/yy	DTW (feet)	Water Column Thickness	Total Gallons Removed	TEMP. (°C)	Specific Conductance ( $\mu\text{S}/\text{cm}^3$ )	Conductivity (ohms)	Salinity (ppt)	TDS (mg/L)	pH	NOTES
GA-3 (TBD)											
GA-4 (TBD)											
GA-5 (TBD)											
GA-6 (TBD)											
GA-7 (TBD)											
GA-8 (TBD)											
GA-9A (TBD)											
GA-17 (TBD)											
GA-18 (TBD)											
GA-19 (TBD)											
GA-20 (TBD)											
GA-21 (TBD)											

Brine Pond Sump Monitoring									
<b>LCRS Sump</b>									
Water Present Y / N	Conductivity (ohms)		Salinity (ppt)		Flow Rate (GPM)		Meter Reading (gal)		
<b>PCMS Sump</b>									
Water Present Y / N	Conductivity (ohms)		Salinity (ppt)		Flow Rate (GPM)		Meter Reading (gal)		
Sump Equipment Inspection and Performance Verified			Y / N	Allowable Leakage Rate for the Pond Liner System Verified				Y / N	

Field Data Collection and Sample Collection Instructions	
<b>Field Data Parameter Collection Instructions</b>	
Step 1) Calibrate YSI meter prior to each use (follow instructions in manual)	
Step 2) Measure depth to groundwater with water interface probe	
Step 3) Calculate well volume to be removed from each well using Purge Volume Table and remove the calculated volume	
Step 4) Collect field parameter readings upon completion of Step 3 and record any unusual circumstances in the "NOTES" column above	
Step 5) Collect field parameter readings from sumps	
<b>Groundwater Sampling Instructions</b>	
Step 6) Upon completion of Step 4 collect groundwater samples from each well	
Step 7) Fill appropriate laboratory provided containers	
Step 8) Complete Laboratory Chain of Custody (see attached example)	
<b>Laboratory Analysis Requirements</b>	
Sodium by Method 200.7, Plastic Pint Container Preserved with $\text{HNO}_3$	
Chloride by Method 300, Total Dissolved Solids (TDS) by Method SM-2540C, and pH, all collected in a 1/2 gallon plastic container with no preservative.	
<b>COMMENTS</b>	

**STORAGE CAVERN FIELD MONITORING FORM  
MAGNUM GAS STORAGE, LLC  
DELTA, UTAH**

Well I.D.	DATE mm/dd/yy	DTW (feet)	Flow Rate (gpm)	Draw Down (ft)	Headspace Gas (LEL)	TEMP. (°C)	Specific Conductance (µS/cm³)	Conductivity (ohms)	Salinity (ppt)	TDS (mg/L)	pH	NOTES									
GS-MH-1																					
GS-MH-2																					
GS-MH-3																					
GS-MH-4																					
GS-MH-5																					
DA-1 Shallow																					
Deep																					
Basement																					
DA-2, Shallow																					
Deep																					
Basement																					
Delta Egg Farm Well																					
IPA																					
<b>Field Data Collection and Sample Collection Instructions</b>																					
<b>Field Data Parameter Collection Instructions</b>																					
Step 1) Calibrate YSI meter prior to each use (follow instructions in the equipment manual)																					
Step 2) Calibrate combustible gas meter prior to each use (follow instructions in the equipment manual)																					
Step 3) Measure combustible gas levels in GS-MH-1, GS_MH-2, GS-MH-3, GS-MH-4, and GS-MH-5 with portable combustible gas meter																					
Step 4) Measure depth to groundwater manually using the water interface probe in GS-MH-1, GS_MH-2, GS-MH-3, GS-MH-4, and GS-MH-5																					
Step 5) Collect field parameter readings and record any unusual circumstances in the "NOTES" column above																					
Step 6) Confirm functionality of the water level transducers and download water table elevation data from each well to the laptop computer																					
Step 7) Manually record WTE data from DA wells, and the Egg Farm and IPA Wells																					
<b>Groundwater Sampling Instructions</b>																					
Step 7) Follow Steps 1-6 above. Collect groundwater samples from GS-MH-1, GS_MH-2, GS-MH-3, GS-MH-4, and GS-MH-5 in the laboratory-provided containers																					
Step 8) Complete Laboratory Chain of Custody (see attached example)																					
<b>Laboratory Analysis Requirements</b>																					
Sodium by Method 200.7, Plastic Pint Container Preserved with HNO <sub>3</sub>																					
Chloride by Method 300, Total Dissolved Solids (TDS) by Method SM-2540C, and pH, all collected in a 1/2 gallon plastic container with no preservative.																					
<b>Data Submittal</b>																					
At the completion of each monthly data collection effort send electronic depth-to-water data to ATC Associates (jim.coletta@atcassociates.com).																					
<b>COMMENTS</b>																					

## APPENDIX C

### BRINE EVAPORATION PONDS OPERATING MANUAL (PENDING PUBLICATION)