



**GROUNDWATER
MOUNDING/SHADOWING PLAN
TURNPIKE MINING RESOURCE
M-2004-009-AM-2**

Prepared by:

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Background

The reclamation plan calls for the placement of shale backfill material into Cell 2. The shale backfill material was previously excavated from the pit floor of Cell 1. Due to the low permeability of the shale backfill material, it is possible that up-gradient groundwater levels could increase (mounding) and down gradient groundwater levels could decrease (shadow). For the purpose of evaluating the extent of mounding/shadowing, installation of 3 observation wells shall be completed as discussed below and shown on Figure 1.

GROUNDWATER MOUNDING / SHADOWING

Background

Due to the low permeability of the backfilled shale material, it is possible that up-gradient groundwater levels may rise to levels that could impact adjoining property owners to the east. The Schell house occurs approximately 250ft up-gradient of the backfill boundary and the Timmreck house occurs approximately 183ft up-gradient of the backfill boundary. The Andreason domestic well occurs west of the Cell 2C backfill area. Currently, pumping is occurring in Cell 2A and therefore establishment of baseline water levels can not be achieved by installing and measuring observation wells in the vicinity of pumping operations presently or in the near future. Instead, this plan will piece together some historic and published data to approximate baseline water levels.

Historic/Baseline Groundwater Levels / Mounding Analysis

Previously, a portion of Cell 2 A had been allowed to fill with groundwater due to shutdown of the pumps. On July 14, 2012 the water level of the pond in Cell 2 A was surveyed at 4938.32ft. July would normally be considered a time when the seasonal groundwater levels would be expected to be near their maximum. This is due to the fact that the local groundwater levels are strongly influenced by regional irrigation and stages of the local ditches. Irrigation ditch diversions in the area typically peak in July and tail off in August-Oct. It should be noted however, that the summer of 2012 was considered a drought year. Additional baseline groundwater levels were measured during a subsurface investigation that was conducted by Rocky Mountain Consultants (RMC) in October 1999. Elevations are given in Figure 1.

For the purpose of estimating historic seasonal high groundwater levels, the July 2012 pond water level in Cell 2 A (July pond) is used to back calculate up-gradient water levels based on the published regional water table gradient given in the USGS Open File Report 02-338. The eastern edge of the pond in Cell 2 A occurred 675 ft down-gradient from the observation well on Schell's property (108A). Multiplying that distance by a gradient of 0.0031 ft/ft (USGS OFR 02-338)

and adding to the July pond elevation yields a water level of 4940.41ft. This elevation compares reasonably well with the observed October 2011 water level of 4938.51 considering that October groundwater levels would be expected to be a few ft lower than July. The October 1999 RMC test hole TH-39 occurs 202.55 ft up-gradient of the July pond. Multiplying that distance by a gradient of 0.0031 ft/ft (USGS OFR 02-338) and adding to the July pond elevation yields a water level of 4938.95ft. This elevation compares reasonably well with the observed October 1999 water level of 4937.5 (+1.44 ft difference) considering that October groundwater levels would be expected to be a few ft lower than July.

The observation well at 108A occurs at approximately the same up-gradient distance from the Schell house and therefore will serve as a good well to observe the influence of the clay backfill material on groundwater levels. It is estimated that the elevation of the lower footing at the Schell house is at 4944.0 ft. The threshold not to exceed groundwater elevation value at well 108A is therefore set at **4942.4 ft**. The value of 4944.0 ft is 2 ft above the predicted seasonal high water table elevation at 108A. If water levels are observed to exceed **4942.4 ft** at 108A, then ASCI shall be required to design and build an engineered groundwater level mitigation system that will alleviate high groundwater levels on the Schell property to levels below **4942.4 ft** at observation well 108A.

Observation well OW-1 and 108A (pending Schell's permission) shall be monitored every 2 months for 1 year following completion of the backfill operation adjacent to the Schell property. Monitoring water levels during pumping in that area shall not be performed.

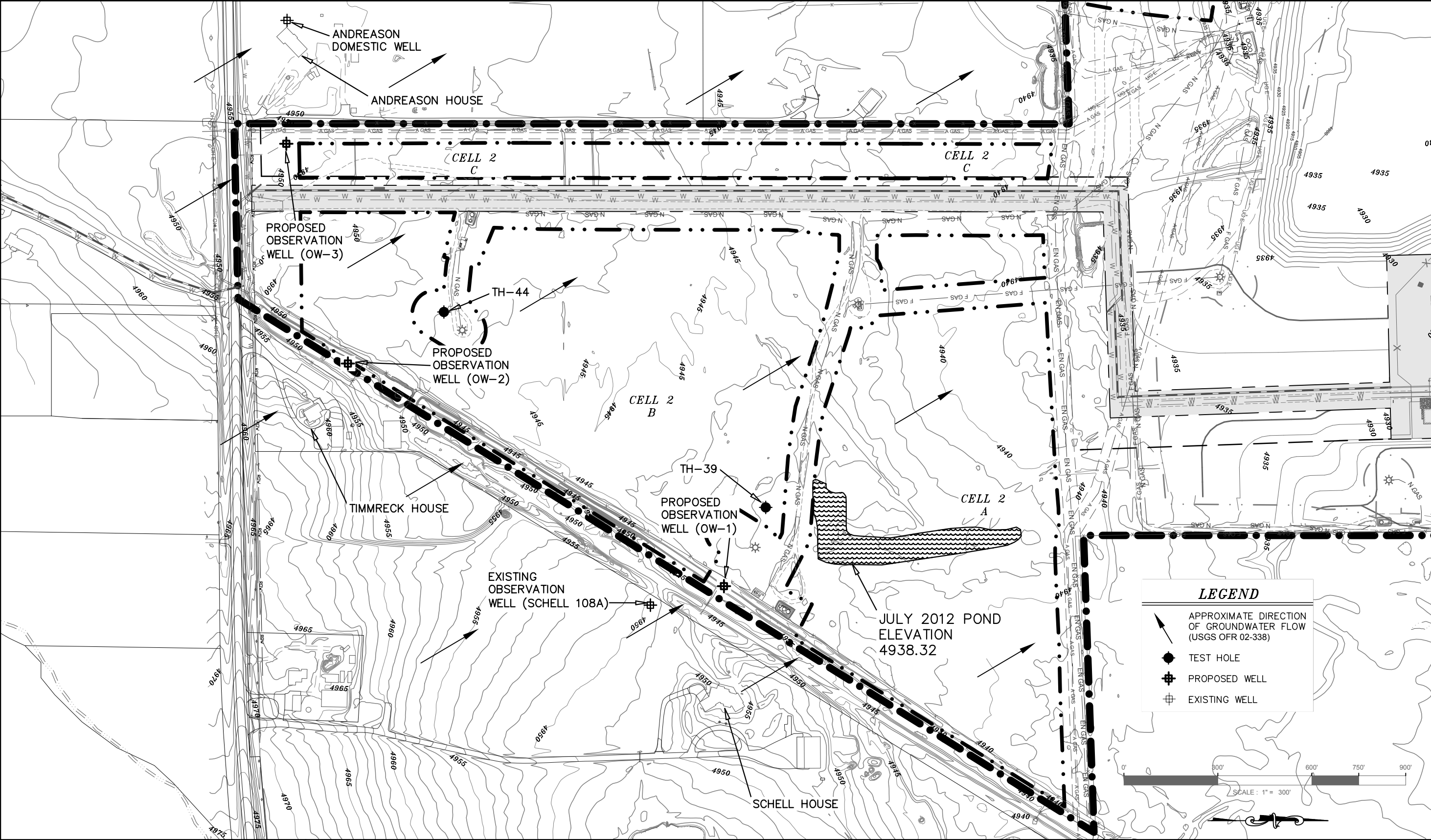
Table 1. Observed Groundwater elevations

Site	Date	Elevation	
Cell 2 A pond	July 2012	4938.32	
TH-39	Oct 1999	4937.5	
Schell 108a	Oct 2011	4938.51	
TH-44	Oct 1999	4942.0	

In order to estimate the seasonal high groundwater elevation in the vicinity of the Timmreck house, the Oct 99 observed water level at TH-44 is adjusted by 1.44 ft from 4942.0 ft to 4943.44. This adjustment is based on the predicted July elevation for TH-39 based on the discussion above. The distance from TH-44 to the Timmreck house is 493.52 ft. Multiplying that distance by a gradient of 0.0031 ft/ft (USGS OFR 02-338) and adding to the adjusted TH-44 elevation yields a water level of 4944.96 ft. The approximate threshold not to exceed water level at the Timmreck house is therefore 4,946.96 ft, which is 2ft above the predicted seasonal high water level. The finished floor elevation of the Timmreck House appears to be 4956.2 ft, which would put the bottom of the footing at approximately 4954.0 ft.

The proposed observation well OW-2 will occur 146 ft down-gradient from the Timmreck house. Multiplying that distance by a gradient of 0.0031 ft/ft (USGS OFR 02-338) and subtracting from 4946.96 ft elevation yields a water level of **4946.5 ft**. The threshold not to exceed groundwater elevation value at well OW-2 is therefore set at **4946.5 ft**. If water levels are observed to exceed **4946.5 ft** at OW-2, then ASCI shall be required to design and build an engineered groundwater level mitigation system that will alleviate high groundwater levels on the Timmreck property to levels below **4946.96 ft** or **4946.5 ft** at OW-2. Since the proposed OW-2 is a significant distance from the existing pumping, ASCI would like to reserve the right to document additional seasonal high water elevation data and potentially revise the threshold value. Water level elevations at OW-2 will be monitored quarterly until pumping occurs within 300ft and every 2 months for 1 year following completion of backfilling adjacent to the Timmreck property.

Although the Andreason domestic well appears to be out of the shadow of the clay backfill area, OW-3 shall be installed and monitored quarterly to establish baseline data prior to pumping within 300ft and every 2 months for 1 year following completion the backfill operation. Furthermore, ASCI will enter into an agreement with Andreason to drill a new well or provide a potable water supply, should the operation dry up the existing well. This is required by the office of the state engineer pursuant to the 600ft well spacing rule.



REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



Welland, Inc.
Environmental & Engineering

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TURNPIKE MINING RESOURCE
REGULAR 112 PERMIT M-2004-009-AM-2
WELD COUNTY, CO

PREPARED FOR:
ASPHALT SPECIALTIES CO., INC.

FIGURE 1
SITE PLAN - GROUNDWATER

SCALE 1"=300'	DWG NO. GW.DWG	REV REV
DRAWN BY: CTW	CHECKED BY: PFW	DATE: 03/13/13
		SHEET SHEET#