

From: Mike Gaither
To: [Saxton, John](#)
Cc: [John Cash](#); [John Cooper](#)
Subject: [External_Sender] RE: Query on depths to various units
Date: Wednesday, January 17, 2018 5:52:08 PM
Attachments: [LCE TR D6-33.pdf](#)
[LCE TR D6-34.pdf](#)
[KM TR 2.6-10.pdf](#)
[KM TR 2.6-11.pdf](#)
[KM TR 2.7-30.pdf](#)
[KM TR 2.7-31.pdf](#)
[LCE TR D5-8.pdf](#)
[LCE TR D5-9.pdf](#)
[LCE TR D6-13.pdf](#)

Attached are the amended pages associated with the corrections made below. Let me know if you need anything else.

Regards,

Michael Gaither
Manager EHS and Regulatory Affairs
Ur-Energy USA Inc.
5880 Enterprise Dr. Suite 200
Casper, WY 82609 USA
(307) 265-2373 ext. 321



From: Mike Gaither
Sent: Wednesday, January 17, 2018 8:59 AM
To: 'Saxton, John' <John.Saxton@nrc.gov>
Cc: John Cash <john.cash@UR-Energy.com>; John Cooper <john.cooper@UR-Energy.com>
Subject: FW: Query on depths to various units

John,

After further review, here is your table with the corrected information provided in highlight. We are amending the affected pages in the application but we wanted to provide you with the correct values now. Let us know if you need any other information.

Horizon	LCE (TR Rev Sept 2017 p. D5-7 - D5-9)		LCE (TR Rev Sept 2017 p. 13)		LCE (TR Rev Sept 2017 p. 33-34)		KM (TR Rev Sept 2017 p. 9-11)		KM (TR Rev Sept 2017 p. 30-31)	
	Thickness	Depth	Thickness	Depth	Thickness	Depth	Thickness	Depth	Thickness	Depth
FG	160-180	0-150	160-180	0-150		0-150	140-175	100-320		100-320
Lost Creek Shale	2-40	0-350	2-40		2-40		5-45	270-500	5-45	
HJ	110-130	0-360	110-130	0-360	avg 115	0-360	120-160	280-510	avg 120	280-510
Sagebrush Shale	1-33	90-500	1-33	90-500	1-33	90-500	1-75	400-680	1-75	400-680
KM	100-130	100-510				100-510	80-110	430-690		430-690
K Shale	1-30	200-610					1-40	510-750		
L	100	210-640			60-120	210-640	100	525-760	60-120	525-760
M	100	300-720					100			
N	100	410-830					100			

Regards,

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From: Saxton, John [<mailto:John.Saxton@nrc.gov>]

Sent: Thursday, January 04, 2018 1:41 PM

To: John Cash <john.cash@UR-Energy.com>

Subject: Query on depths to various units

John,

In reviewing the amendment applications, we have some questions regarding the depths to various units in particular the depth to several shales being the same as the depth to an abutting sandstone (see below).

Horizon	LCE (TR Rev Sept 2017 p. D5-7 - D5-9)		LCE (TR Rev Sept 2017 p. 13)		LCE (TR Rev Sept 2017 p. 33-34)		KM (TR Rev Sept 2017 p. 9-11)		KM (TR Rev Sept 2017 p. 30-31)	
	Thickness	Depth	Thickness	Depth	Thickness	Depth	Thickness	Depth	Thickness	Depth
FG	160-180	0-150	160-180	0-50			140-175	125-300		200-350
Lost Creek Shale	2-40	0-350	2-40		2-40		5-45	280-475	5-45	
HJ	110-130	0-360	120-130	95-360	avg 115	95-260	120-160	280-475	avg 120	300-450
Sagebrush Shale	1-33	100-510	1-33	100-510	1-33	90-285	1-75	425-625	1-75	450-550
KM	100-130	100-510				100-510	80-110	430-650		450-600
K Shale	1-30	200-610					1-40	525-750		
L	100	200-640			60-120	200-640	100	525-750	60-120	200-640
M	100	300-720					100			
N	100	410-830					100			

Also several depths may be incorrect.

Can you provide an explanation/clarification?

Thanks

John

FG Horizon – In the Permit Area the top of the FG Horizon occurs at depths of approximately 100 feet in the east to 320 feet in the western regions of the Project. The total thickness of the FG Horizon is typically about 160 feet, ranging between 140 to 175 feet. Stratigraphically, the FG Horizon is subdivided into three sub-horizons: the Upper FG (UFG), Middle FG (MFG) and the Lower FG (LFG), all roughly of equal thickness. The breaks between these are not rigidly defined. Generally they are selected based on significant shales (if present) which separate channel-fill sequences. The character of individual FG sand units tends to be thinner, more erratic and shaly than what is characteristic of lower horizons; and as a whole the FG has a lower Sandstone to Shale (SS/Sh) ratio. The FG contains significant mineralization in the Permit Area.

Lost Creek Shale (LCS) – The Lost Creek Shale separates the FG and HJ Horizons. It is a dominant shaly horizon which has been found to be continuous throughout the proposed wellfield area within the Lost Creek Permit area. For this reason it has been used as the datum for stratigraphic correlation. Thickness ranges from 5 to 45 feet, typically being from 10 to 25 feet. Depth ranges from approximately 270 feet in the east portions of the project to 500 feet in the west. Its lithology is dominated by silty mudstone and dense claystone. It commonly includes siltstone, and may locally be sandy or contain thin lenticular sands. Segments of the LCS commonly interfinger with and undergo rapid facies exchanges with lower sands of the FG Horizon and upper sands of the HJ Horizon. This can complicate correlation and often results in dramatic changes in the thickness of the LCS within short horizontal distances.

HJ Horizon – The HJ Horizon is the dominant host for mineralization in the MMT and is the host to current production development. The HJ Horizon has been subdivided into four sub-horizons: Upper HJ (UHJ), Middle HJ1 (MHJ1), Middle HJ2 (MHJ2) and the Lower HJ (LHJ). The boundaries between the sub-horizons are somewhat arbitrary but selection is guided by sand channel and roll front mineral horizon continuity. Boundaries may be accompanied by a shale break. The bulk of the uranium mineralization is present in the two MHJ sub-horizons. The HJ Horizon characteristically includes noticeably thicker sands and a high SS/Sh ratio compared to most of the other horizons. The total thickness of the HJ Horizon ranges from 120 to 160 feet, averaging approximately 130 feet. Depth to the top of the HJ Horizon within the Permit Area ranges from approximately 280 feet in the east to 510 feet in the west.

Sagebrush Shale (SBS) – The Sagebrush Shale forms the boundary between the HJ Horizon and the underlying KM Horizon. As such it represents the aquitard between the HJ production horizon and the proposed KM production horizon. The SBS is laterally extensive and virtually continuous throughout the proposed well field area within the Permit Area. Within the Permit Area depth to this shale ranges from 400 feet in the eastern portions of the Project to approximately 680 feet in the west. Thickness varies from 1 to 75 feet. Similar to the LCS, segments of the SBS commonly interfinger with and undergo rapid facies exchanges with lower sands of the HJ Horizon and upper sands of the KM

Horizon. This can complicate correlation and often results in dramatic changes in the thickness of the SBS within short horizontal distances, as is evident in the thickness isopach map for the SBS (**Plate 2.6-3a**)

KM Horizon – The KM Horizon is the secondary host to the mineralization in the MMT. Proposed production from the KM is the focus of this document. Nomenclature for the KM was modified in recent years. Initially, and at the time of the original Mine Permit, the KM Horizon was assigned three sub-horizons: the Upper KM (UKM), the Middle KM (MKM) and the Lower KM (LKM). As additional drilling results became available over time it became apparent that the KM is better described as having only two sub-horizons, underlain by the K Shale. Consequently the MKM designation was abandoned and replaced by the LKM such that the current nomenclature employs only the UKM and LKM.

In general the character and lithology of the KM is similar to that of the HJ Horizon. Both the UKM and the LKM sub-horizons host mineralization. A shale unit referred to as the No Name Shale (NNS) commonly divides the two sub-horizons of the KM, but it is not present everywhere within the Project. Depth to the top of the KM Horizon ranges from 430 feet in the eastern portions of the Project to 690 feet in the far western portions. Thickness ranges from 80 feet to 110 feet.

K Shale – The K-Shale represents the lower boundary of the proposed KM production horizon. It occurs throughout the Lost Creek area, but may be sporadically absent locally. Where present, continuity and confinement is not seamless as it may locally be represented by multiple overlapping shales. Average thickness is 10 feet, ranging from 1 feet to 40 feet. A thickness isopach map for the K Shale is presented as **Plate 2.6-3b**. Depth to the K Shale varies from 510 feet in the eastern margins of the Project to 750 feet in the west.

L, M, and N Horizons – These horizons are collectively referred to as the “Deep Horizons” and occur within a 300 to 350 feet interval below the K Shale. Currently they are the targets of exploration activities. Available drill data for these horizons is much sparser than for the shallower horizons. Individually, each horizon is approximately 100 feet thick. They consist of lithologies identical to that of shallower horizons. In general, like the remainder of the Battle Spring Formation, they are composed of multiple, stacked, coarse sands separated by numerous shale intervals. Stratigraphically, shales within these horizons are often relatively thick and more continuous than seen in the shallower horizons, contributing to an overall lower SS/Sh ratio. At the same time, individual sands tend to be thicker and show more regional continuity. This character becomes more dominant with depth.

L Horizon: Depth to the L Horizon varies from 525 feet in the east to approximately 760 feet in the west. Thickness of the L Horizon is locally diminished significantly due to substantial thickening of the underlying LM Shale.

elevated radionuclides (uranium, radium-226 and radon-228). High levels of uranium are common in Tertiary sediments and groundwater of the Great Divide Basin. The Lost Creek Shroekingierite deposit located northwest of the Project is noted for high uranium levels in groundwater. Uranium-bearing coals are present in the Wasatch Formation in the central part of the Great Divide Basin.

As described previously, the Battle Spring Formation outcrops over most of the Permit Area. The Battle Spring is the shallowest occurrence of groundwater within the Permit Area. Water-bearing Quaternary and Tertiary units younger than the Battle Spring Formation are present several miles to the north and east and are hydraulically up-gradient of the Permit Area. Therefore, ISR operations conducted at the Project will have no impact on those shallower hydrostratigraphic units.

2.7.5.2 Site Groundwater Conceptual Model

2.7.5.2.1 Hydrostratigraphic Units

The hydrostratigraphic units of interest within the Battle Spring Formation, with respect to the Project include, from shallowest to deepest:

- DE Horizon (shallowest occurrence of groundwater):
 - sands and discontinuous clay/shale units, top of unit 100 to 200 ft bgs;
 - coalesces with underlying FG Horizon to the south; and
 - water levels in the DE Sand are typically 140 to 200 ft bgs;
- Upper No Name Shale (upper confining unit to the FG Horizon):
 - 0 to 50 feet thick;
- FG Horizon (includes overlying aquifer to HJ Horizon):
 - subdivided into UFG, MFG and LFG Sands;
 - total thickness of Horizon is 100 feet;
 - top of unit is 100 to 320 ft bgs;
 - LFG Sand the overlying aquifer to HJ Horizon;
 - LFG Sand is 20 to 50 feet thick; and
 - water levels in the LFG Sand are typically 160 to 200 ft bgs;
- Lost Creek Shale (upper confining unit to the HJ Horizon):
 - laterally continuous across the proposed well field within the Permit Area;
 - five to 45 feet thick; and
 - confining properties demonstrated from water levels and pump test;
- HJ Horizon (contains the primary production zone):
 - subdivided into UHJ, MHJ, and LHJ Sands, although sands are hydraulically connected;
 - coarse-grained arkosic sands with thin lenticular intervals of fine sand, mudstone and siltstone;

- averages 120 feet thick;
 - top of unit is 280 to 510 feet bgs; and
 - water levels in the HJ Horizon range from 150 to 200 ft bgs;
- Sagebrush Shale (lower confining unit to the HJ Horizon and upper confining unit to the KM Horizon):
 - laterally continuous across the proposed well field within Permit Area;
 - 1 to 75 feet thick;
 - top of unit 400 to 680 ft bgs; and
 - confining properties demonstrated from water levels and pump test;
- KM Horizon (includes secondary production zone, lower confining units, and underlying aquifers):
 - subdivided into UKM and LKM Sands;
 - massive coarse sandstones with thin lenticular fine sandstone intervals;
 - top of unit is 430 to 690 ft bgs;
 - UKM Sand is a secondary production zone and first underlying aquifer;
 - UKM Sand is 30 to 60 feet thick;
 - water levels in the UKM Sand are generally 185 to 220 ft bgs;
 - No Name Shale is the lower confining unit to the UKM Sand;
 - No Name Shale is ten to 30 feet thick and laterally extensive but will require additional characterization; and
- L Horizon (underlying aquifer to the KM production zone)
 - L Horizon is continuous throughout the LC East Project;
 - the horizon commonly exhibits a much more shaley character;
 - top of unit is approximately 760 feet deep in Section 20 and only 525 feet in the far north;
 - total thickness is typically 100, but ranges from 60 to 120 feet;
 - L Horizon is usually confined above by the K Shale throughout the project area, which averages 12 feet in thickness; and
 - K Shale is regionally extensive but not fully contiguous, therefore it is not considered a confining unit.

2.7.5.2.2 Potentiometric Surface and Hydraulic Gradients

Potentiometric surfaces for the L and M Horizons are illustrated as contour maps on **Figures 2.7-11** and **2.7-12**. Depiction of these surfaces on the cross sections were generated by tracking the intersection of the plane of the cross section profile with the potentiometric contours for the given horizons. The Figures show that the groundwater flow direction across the permit area are similar to that seen in the overlying KM and HJ Horizons.

A downward gradient to successively deeper Horizons (KM to L, L to M, and M to N) is consistent with the structural and stratigraphic location of the Project within the Great Divide Basin.

HJ Horizon – The HJ Horizon is a major host for mineralization in the East Mineral Trend (EMT) and is the host to current production at Lost Creek. The HJ Horizon has been subdivided into four sub-horizons: Upper HJ (UHJ), Middle HJ1 (MHJ1), Middle HJ2 (MHJ2) and the Lower HJ (LHJ). The boundaries between the sub-horizons are somewhat arbitrary but selection is guided by sand channel and roll front mineral horizon continuity. Boundaries may be accompanied by a shale break. The bulk of the uranium mineralization is present in the two MHJ sub-horizons. The HJ Horizon characteristically includes noticeably thicker sands and a high SS/Sh ratio compared to most of the other horizons. The total thickness of the HJ Horizon ranges from approximately 120 to 130 feet, thinning northerly slightly to about 110 feet. Depth to the top of the HJ Horizon within the LC East Amendment area ranges from a maximum of approximately 360 feet in the northern parts of Section 20 to outcropping in the northernmost portions of the Amendment area. **Plate D5-3b** is a thickness isopach map for the HJ Horizon.

Sagebrush Shale (SBS) – The Sagebrush Shale forms the boundary between the HJ Horizon and the underlying KM Horizon. The SBS is laterally extensive and virtually continuous throughout the LC East Amendment area. Depth to the top of the SBS within the LC East Amendment area ranges from a maximum of 500 feet in the northern parts of Section 20 to 90 feet in northernmost portions of the Amendment area. Thickness varies from 1 to 33 feet. Similar to the LCS, segments of the SBS commonly interfinger with and undergo rapid facies exchanges with lower sands of the HJ Horizon and upper sands of the KM Horizon. This can complicate correlation and often results in dramatic changes in the thickness of the SBS within short horizontal distances, as is evident in the thickness isopach map for the SBS (**Plate D5-3c**).

KM Horizon – The KM Horizon is also a primary host to the mineralization in the EMT. Nomenclature for the KM was modified in recent years. Initially, and at the time of the original Lost Creek Mine Permit, the KM Horizon was assigned three sub-horizons: the Upper KM (UKM), the Middle KM (MKM) and the Lower KM (LKM). As additional drilling results became available over time it became apparent that the KM is better described as having only two sub-horizons, underlain by the K Shale. Consequently, the MKM designation was abandoned and replaced by the LKM such that the current nomenclature employs only the UKM and LKM.

In, general the character and lithology of the KM is similar to that of the HJ Horizon. Both the UKM and the LKM sub-horizons host mineralization. A shale unit referred to as the No Name Shale (NNS) commonly divides the two sub-horizons of the KM, but it is not always present. Depth to the top of the KM Horizon ranges from approximately 510 feet in the northern parts of Section 20 to about 100 feet in the far northern portions of the Amendment area. Thickness ranges from approximately 100 feet to 130 feet. A thickness isopach map for the KM Horizon is presented as **Plate D5-3d**.

K Shale – The K-Shale represents the lower boundary of the KM horizon. It occurs throughout the LC East Amendment area, and generally exhibits continuity and adequate

confinement. However, it may locally be absent or be represented by multiple overlapping shales. Where this occurs, confinement may not be seamless. Average thickness is 10 feet, ranging from 1 foot to 30 feet. A thickness isopach map for the K Shale is presented as **Plate D5-3e**. Depth to the K Shale varies from approximately 610 feet in the northern portions of Section 20 to approximately 200 feet at the northern limits of the LC East Amendment area.

L, M, N, and P Horizons – These horizons are collectively referred to as the “Deep Horizons” and occur within a 300 to 350 feet interval below the K Shale. Currently, they are the targets of exploration activities. Available drill data for these horizons is much sparser than for the shallower horizons. Individually, each horizon is approximately 100 feet thick. They consist of lithologies identical to that of overlying horizons. In general, like the remainder of the Battle Spring Formation, they are composed of multiple, stacked, coarse sands separated by numerous shale intervals. Stratigraphically, shales within these horizons are often relatively thick and more continuous than seen in the shallower horizons, contributing to an overall lower SS/Sh ratio. At the same time, individual sands tend to be thicker and show more regional continuity. This character becomes more dominant with depth.

L Horizon: Depth to the L Horizon varies from approximately 640 feet in Section 20 to approximately 210 feet in the far north. Commonly the L Horizon exhibits a much more shaley character with more shale interbeds, thinner sands and a much lower SS/Sh ratio than the vertically adjacent horizons.

M Horizon: The M Horizon typically exhibits thick shales with thick well developed sands. Depth to the top of the M Horizon ranges from approximately 720 feet in Section 20 to approximately 300 feet in the far north.

N and P Horizons: The character of these horizons is similar to that of the M Horizon, commonly exhibiting thick shales with well developed sands. Data is relatively limited, particularly in the southern portions of the project, as drilling generally has not penetrated these units. Depth to the top of the N Horizon ranges from 830 to 410 feet and from 930 to 520 feet for the P Horizon.

LM, MN, and NP Shales – These shales represent the lower boundaries of the L, M and N Horizons respectively. Designation of these shales as horizon boundaries was arbitrarily established on roughly 100 foot intervals below the K Shale. As such they do not present unique characteristics compared to any other shales within this stratigraphic interval. Thickness of the shales varies considerably, reaching up to 30 feet with an average of approximately 10 feet. Although these shales have regional extent, continuity is unconfirmed. In many areas drill data spacing is insufficient to confirm correlation.

sequence of sands and discontinuous clay/shale units. The DE Horizon is the shallowest occurrence of groundwater within the Permit Amendment Area; although the horizon is not saturated in all portions of the Project area.

FG Horizon

Underlying the DE Horizon is the FG Horizon, which is continuous throughout the LC East Project. Due to the regional dip and trend length, the top of the FG Horizon outcrops over the eastern one-third of the Project Area deepening to 150 feet at the west property boundary. The total thickness is typically about 180 feet, but ranges between 160 and 180 feet. The FG Horizon transitions from confined to unconfined aquifer conditions moving southwest to northeast along Cross-Section B-B' included in **Attachment D6-4** as **Figure 2-3**.

Lost Creek Shale

Underlying the FG Horizon is the Lost Creek Shale. The Lost Creek Shale appears continuous across the Permit Amendment Area, ranging from 2 to 40 feet in thickness. Typically, this unit has a thickness of 10 to 20 feet. The Lost Creek Shale is the confining unit between the overlying aquifer FG Horizon and the HJ Horizon. The confining characteristics of the Lost Creek Shale have been demonstrated with pump tests, as described later in this application.

HJ Horizon

The HJ Horizon is one of the primary target for uranium production at the LC East Project. The HJ Horizon sands are generally composed of coarse-grained arkosic sands with thin lenticular intervals of fine sand, mudstone and siltstone. The sands are generally separated by thin clayey units that are not laterally extensive and, based on pump test results, do not act as confining units to prevent groundwater movement vertically between the HJ sand units. The total thickness of the HJ Horizon ranges from 110 to 130 feet, averaging approximately 120 feet. The HJ Horizon crops out in the north eastern most portion of the Permit Amendment Area deepening to 360 feet below ground surface (bgs) in the western part of the Permit Amendment Area. The underlying aquifer to the HJ Horizon is the KM Horizon, which is also a likely uranium production zone. Therefore, the deepest sand within the HJ Horizon, is also designated as the overlying aquifer to the KM Horizon.

Sagebrush Shale

Underlying the HJ Horizon is the Sagebrush Shale. It occurs at depths ranging from 90 to 500 feet bgs. The Sagebrush Shale is laterally extensive and ranges from 1 to 33 feet thick. The Sagebrush Shale is the lower confining unit to the HJ Production Zone. The confining characteristics of this unit have been demonstrated through pumping tests, as described in later sections of this application.

more calcium-sulfate dominated. Notable exceptions to the relatively good water quality include waters with elevated radionuclides (uranium, Ra-226 and Ra-228). High levels of uranium are common in Tertiary sediments and groundwater of the Great Divide Basin. The Lost Creek Shroeckingerite deposit located northwest of the Project is noted for high uranium levels in groundwater. Uranium-bearing coals are present in the Wasatch Formation in the central part of the Great Divide Basin.

As described previously, the Battle Spring Formation crops out over most of the Permit and Amendment Area. The Battle Spring is the shallowest occurrence of groundwater within the Amendment Area. Water-bearing Quaternary and Tertiary units younger than the Battle Spring Formation are present several miles to the north and east and are hydraulically up-gradient of the Permit Amendment Area. Therefore, ISR operations conducted at the Project will have no impact on those shallower hydrostratigraphic units.

D6.5.2 Site Groundwater Conceptual Model

D6.5.2.1 Hydrostratigraphic Units

The hydrostratigraphic units of interest within the Battle Spring Formation, with respect to the Project include, from shallowest to deepest:

- FG Horizon (overlying aquifer to HJ Horizon):
 - subdivided into UFG, MFG and LFG Sands;
 - total thickness of horizon is 180 feet;
 - top of unit outcrops on the east side of the Permit Amendment Area and is present at a depth of 150 feet bgs on the west side;
 - LFG Sand is the overlying aquifer to HJ Horizon;
 - LFG Sand is 20 to 50 feet thick;
 - the FG Horizon is unconfined on the east side of the Permit Amendment Area becoming confined as you move westerly in a down dip direction; and
 - water level depths range from 110 feet bgs in the center of the Permit Amendment Area to 125 feet bgs on the west side.
- Lost Creek Shale (upper confining unit to the HJ Horizon):
 - laterally continuous across the Permit Amendment Area;
 - two to 40 feet thick; and
 - confining properties demonstrated from water levels and pump tests.
- HJ Horizon (primary production zone):
 - subdivided into UHJ, MHJ and LHJ Sands, although sands are hydraulically connected;
 - coarse-grained arkosic sands with thin lenticular intervals of fine sand, mudstone and siltstone;

- averages 115 feet thick;
 - top of unit is 0 to 360 feet bgs;
 - the HJ Horizon is unconfined on the east side of the Permit Amendment Area becoming confined as you move westerly in a down dip direction; and
 - water levels in the HJ Horizon range from 90 to 160 feet bgs.
- Sagebrush Shale (lower confining unit to the HJ Horizon and upper confining unit to the UKM Horizon):
 - laterally continuous across Permit Amendment Area;
 - one to 33 feet thick;
 - top of unit 90 to 500 feet bgs; and
 - confining properties demonstrated from water levels and pump tests.
- KM Horizon (production zone):
 - subdivided into UKM and LKM Sands;
 - massive coarse sandstones with thin lenticular fine sandstone intervals;
 - top of unit is 100 to 510 feet bgs;
 - UKM Sand is a targeted production zone and first underlying aquifer to the HJ production zone;
 - UKM Sand is 30 to 60 feet thick;
 - water levels in the UKM Sand are generally 145 to 175 feet bgs;
 - L Horizon is the underlying aquifer to the KM Horizon.
- L Horizon (underlying aquifer to the KM production zone)
 - L Horizon is continuous throughout the LC East Project;
 - the horizon commonly exhibits a much more shaley character;
 - top of unit is approximately 640 feet deep in Section 20 and only 210 feet in the far north;
 - total thickness is typically 100, but ranges from 60 to 120 feet;
 - L Horizon is usually confined above by the K Shale throughout the project area, which averages 12 feet in thickness; and
 - K Shale is regionally extensive but not fully contiguous, therefore it is not considered a confining unit.

D6.5.2.2 Potentiometric Surface and Hydraulic Gradients

Potentiometric surfaces for the FG, HJ, KM, and N Horizons are illustrated as contour maps on **Figures 2-5 to 2-8, Attachment D6-4**. Depiction of these surfaces on the cross sections were generated by tracking the intersection of the plane of the cross section profile with the potentiometric contours for the given horizons.

Potentiometric surfaces of the HJ and KM Horizons indicates that groundwater flow across the Permit Amendment Area is to the west-southwest under hydraulic gradients between 0.005 to 0.018 ft/ft (29 to 95 ft/mi), which is generally consistent with the regional flow system. **Figures 2-6 and 2-7, Attachment D6-4**, show the groundwater flow direction across the Permit Amendment Area based on the potentiometric surface.