Sierra Gorda SCM

Santiago, 30 de Agosto de 2016
VPAC-2016-044

Superintendencia de Medio Ambiente
Dominique Hervé Espejo
Fiscal
Teatinos N° 280, piso 8
Santiago
PRESENTE

Ref.: Resolución Exenta N° 722, de fecha 05 de Agosto de 2016.

De mi consideración,

En relación a lo ordenado en el **Resuelvo Segundo** de la Resolución Exenta de la referencia, nos permitimos informar a Ud. lo siguiente:

1. **A lo requerido en el Punto 1.2** *Adicionalmente, se requiere mensualmente un informe en el que se compare la evolución de la superficie del espejo de agua en la cubeta del tranque de relaves (superficie, profundidad, volumen, etc.), la presencia de infiltraciones en zanjas del sistema de infiltraciones de los muros 3 y 4, y la estimación de la dimensión de las zonas de afloramiento de humedad aguas debajo de los muros 3 y 4.*

   En atención a lo consultado por la autoridad, acompaña esta carta el documento "Resolución Exenta Nº722 - Informe Adicional", en el cual se entrega la información solicitada en relación al análisis de evolución de la superficie del espejo de agua en la cubeta del tranque de relaves, la presencia de infiltraciones en zanjas del sistema de infiltraciones de los muros 3 y 4, y la estimación de la dimensión de las zonas de afloramiento de humedad aguas debajo de los muros 3 y 4.

2. **A lo requerido en el Punto 2.2.2** *Remitir el informe de resultados de estudio geofísico que determine zonas de humedad en los alrededores de la piscinas. El informe deberá ser remitido en un plazo de 25 días corridos contados desde la notificación de la resolución que ordena la medida.*

   En relación a los estudios desarrollados para entender el comportamiento de los niveles de agua subterránea registrados en el Pozo CB-9, Sierra Gorda SCM en su carta VPAC-2016-036 del 15 de Julio del presente, informó a la autoridad que para explicar el aumento del nivel del Pozo mencionado se habían desarrollado una serie de estudios hidroquímicos e isotópicos, que si bien no eran concluyentes en identificar la causa, permitían plantear como hipótesis probable de este comportamiento posibles infiltraciones desde la piscina de agua de mar. No obstante, en ese mismo acto, Sierra Gorda SCM informó a la autoridad sobre la necesidad de ejecutar estudios complementarios para validar o descartar esa hipótesis, comprometiendo una serie de actividades complementarias a desarrollar en el área en evaluación, como calicatas y estudios geofísicos.

Como es de conocimiento de la autoridad, a través de carta VPAC-2016-043 del 22 de Agosto de 2016, Sierra Gorda SCM presentó reporte de calicatas ejecutadas en el área en evaluación dando cuenta que éstas estaban secas lo que no resultó consistente con la hipótesis señalada de infiltraciones desde las piscinas.

Por otra parte, y respondiendo a lo requerido por la autoridad, en adjunto se entrega una primera versión de memorándum técnico desarrollado por la empresa HydraMetrix, el cual da cuenta de resultados preliminares de la evaluación geofísica desarrollada con el objetivo de identificar fuentes o cuerpos de agua que pudieran influir en el cambio de los niveles del agua subterránea del pozo CB-9. Para el desarrollo de esta tarea, HydraMetrix consideró analizar cuatro escenarios posibles: i) infiltraciones desde piscina de agua de mar; ii) infiltraciones desde piscina de agua externa; iii) infiltraciones desde acueducto, e iv) infiltraciones desde el depósito de relaves.

A partir de la geofísica desarrollada y la aplicación de un modelo de distribución eléctrica, el reporte concluye que la fuente de agua que por infiltración generaría cambios en los niveles del Pozo CB-9 corresponde al depósito de relaves y no a las piscinas. Sin embargo, cabe señalar que este reporte elaborado por HydraMetrix, que se entrega adjunto en su idioma nativo inglés, requiere ser analizado en profundidad por nuestro equipo asesor hidrogeológico de la empresa ARCADIS para poder poner en el contexto hidrogeológico del área del proyecto, los resultados de este análisis puntual.

En virtud de lo anterior, solicitamos a usted tenga a bien autorizar la entrega del reporte de HydraMetrix traducido al español, junto con un análisis hidrogeológico de sus resultados elaborado por nuestro asesor, en el plazo de 30 días desde la presente carta.

3. Copia de toda la información aquí presentada se entrega en formato físico y digital en CD-ROM.

Sin otro particular y esperando una buena acogida de lo planteado, saluda atentamente a usted,

Miguel Baeza
General Counsel
Sierra Gorda SCM

Cc:

- Gerencia Medio Ambiente Operaciones, SG SCM.
- Gerencia de Asuntos Corporativos y Sostenibilidad, SG SCM.

Respuesta

Resolución Exenta Nº722

Informe Adicional

SMA

Agosto 2016

INFORME TECNICO

Introducción:

El presente documento entrega información asociada a condiciones operacionales del depósito de relaves de Sierra Gorda SCM, en relación a lo solicitado en la Resolución Exenta Nº 722; la cual indica en su Resuelvo Segundo, Numeral 1.2, lo siguiente:

> *"Adicionalmente, se requiere mensualmente un informe en el que se compare la evolución de la superficie del espejo de agua en la cubeta del tranque de relaves (superficie, profundidad, volumen, etc.), la presencia de infiltraciones en zanjas del sistema de infiltraciones de los muros 3 y 4, y la estimación de la dimensión de las zonas de afloramiento de humedad aguas debajo de los muros 3 y 4*."

Sobre la consulta de información antes indicada se entregan los antecedentes en el presente informe.

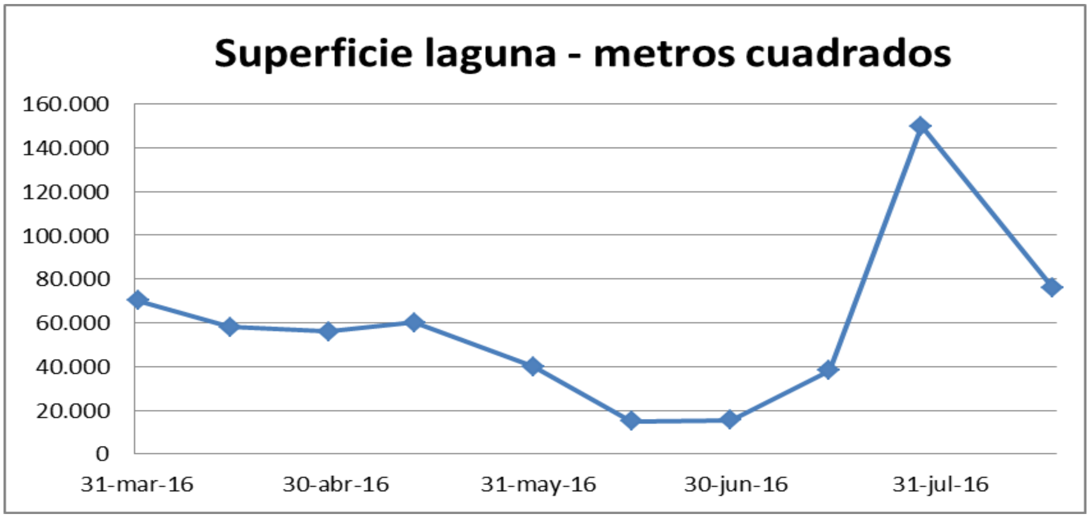
- **Evolución de la superficie del espejo de agua en la cubeta del tranque de relaves (superficie, profundidad, volumen, etc.).**

Respecto de lo consultado por la autoridad, como se ha indicado por medio de los distintos reportes preparados para la autoridad, la evolución del espejo de agua de la laguna se ha mantenido en control, con variaciones puntuales debido a acciones programadas de mantención de los equipos asociados al proceso de generación de relaves o eventos debidamente informados a la autoridad. Un resumen de los datos entre el 30 de Mayo y 17 de Agosto de 2016 se entrega en la tabla y gráfica siguiente.

Tabla 1 Resumen superficie de laguna

Fecha	Superficie m^2
30-may-16	39.900
14-jun-16	15.016
29-jun-16	15.536
14-jul-16	38.097
28-jul-16	149.864
17-ago-16	75.928

Gráfico N°1 Superficie total de laguna de cubeta



Por otra parte, en la tabla N°2 se presenta la variación del volumen de agua en la cubeta del depósito de relaves, registradas a partir de las últimas seis batimetrías. Asimismo, en gráfico N°2 se observa el volumen de agua en laguna de la cubeta, considerando los registros entre el 30 de Mayo y el 17 de Agosto de 2016.

Tabla N°2 Volumen de agua en laguna de cubeta

Batimetría	Volumen m^3
30-may-16	12.216
14-jun-16	3.073
29-jun-16	0
14-jul-16	7.452
28-jul-16	46.471
17-ago-16	25.934

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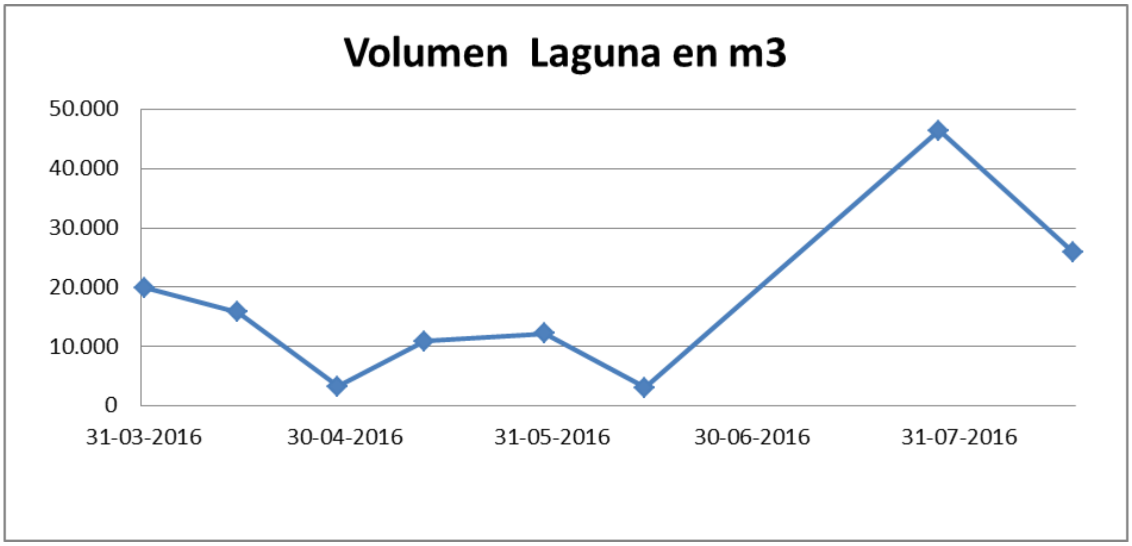
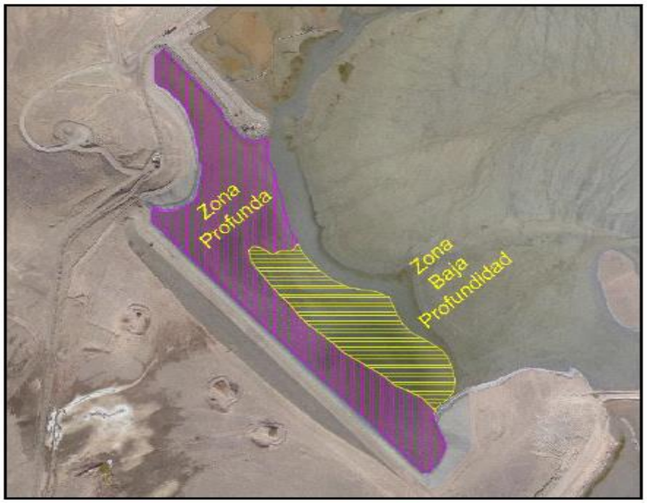
Grafico N°2 Volumen de agua en laguna de cubeta

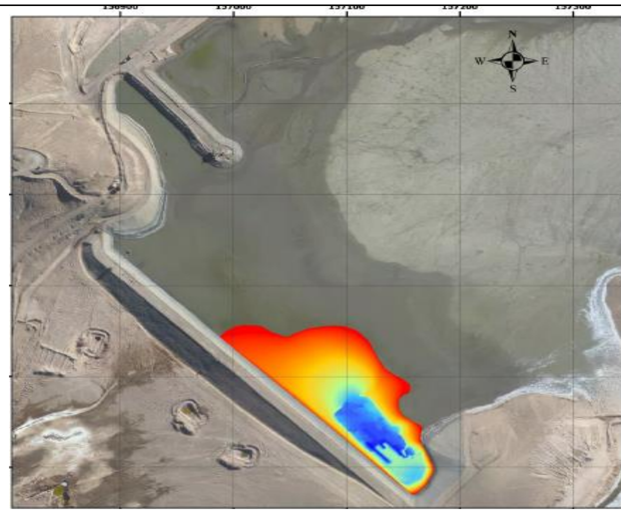


Como se aprecia en tabla y gráfico anteriores, desde la última batimetría se ha reducido considerablemente la superficie de la laguna y el volumen de agua en la cuneta, aproximadamente en 50% y 55% respectivamente, lo que da cuenta del control del volumen de la laguna a través de los proceso de recuperación habilitados. En la siguiente secuencia de imágenes se observa el comportamiento del volumen de laguna.

Imagen N°1 Batimetrías de Mayo a Agosto 2016

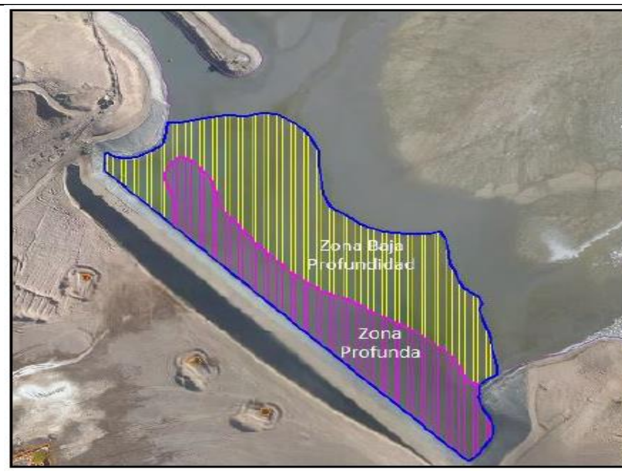


30 Mayo 2016: Volumen (m3)= 12.216,03

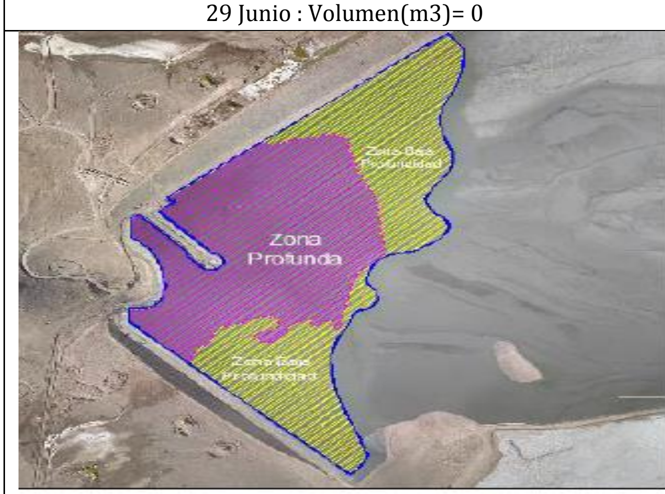


14 Junio 2016: Volumen (m3)= 3.073,25

29 Junio : Volumen(m3)= 0



14 Julio : Volumen (m3)= 7.451,97



28 Julio : Volumen (m3)= 46.471,67

17 Agosto : Volumen (m3)= 25.934,87

Sobre las profundidades, en la siguiente tabla se muestra la variación de las profundidades máxima y promedio registradas en la laguna del depósito de relaves, lo cual se observan dentro de variables que mantienen el mismo orden de magnitud con leve baja a las alturas promedio, variable importante que condiciona las posibilidades de extracción de agua desde la cubeta del depósito.

Tabla 3 Resumen Profundidad de laguna

Fecha	Profundidad de laguna (m) Máxima	Profundidad de laguna (m) Promedio
30-may-16	0,72	0,24
14-jun-16	0,55	0,38
29-jun-16	**No se puede determinar por bajo nivel**	
14-jul-16	0,68	0,46
28-jul-16	1,03	0,49
17-ago-16	1,13	0,46

- **Presencia de infiltraciones en zanjas de los muros 3 y 4.**

Tal como se ha descrito en reportes anteriores, a fines del año 2015 se registraron zonas de afloramiento aguas abajo del Muro 3 y Muro 4, además de detección de agua en la zanja de control ubicada en el Muro 4, no así en la zanja del Muro 3, situación que se ha mantenido.

En relación a la presencia de agua en la zanja del Muro 4, en ese lugar continua operando una bomba de tipo "sumergible", la cual permite la recuperación de esas aguas.

Asimismo, en la zanja ubicada en Muro 4 se aprecia sostenidamente un nivel bajo de agua, condición que se ha mantenido en el tiempo, tal como se observa en la secuencia de imágenes que se han registrado en los meses de Junio a agosto 2016.

Imagen N°2 - Zanja Muro 4

		
Junio 2016	**Julio 2016**	**Agosto 2016**

- **Estimación de la dimensión en m², de las zonas de afloramiento de humedad aguas debajo de los muros 3 y 4 (Comparación con la superficie del período anterior)**

Las áreas de afloramiento aguas abajo de Muro 3 y Muro 4, hasta octubre 2015 presentaban una tendencia al aumento, sin embargo desde ese mismo mes en adelante, la superficie de afloramiento presenta baja variación.

Lo anterior se desprende desde la tabla resumen de datos de afloramientos frente a Muros 3 y 4, donde ambas superficie del afloramiento se mantienen con cambios mínimos, lo que evidencia la adecuada gestión de recuperación de agua y mejor manejo de las infiltraciones lo que se aprecia en las últimas mediciones que se mantienen constantes. En tabla Nº4 se entregan los valores del 30 mayo al 17 Agosto 2016, las que en los últimos 3 registros no muestran variación.

Tabla N°4 Áreas de filtración Muros 3 y 4

AREA FILTRACION MP4 (m^2)	
30 Mayo	15.577
14 Junio	15.604
29 Junio	S/D
14 Julio	17.041
28 Julio	17.041
17 agosto	17.041

Área afloramiento Muro 4 aguas abajo

AREA FILTRACION MP3 (m^2)	
30 Mayo	70.609
14 Junio	70.689
29 Junio	S/D
14 Julio	73.629
28 Julio	73.629
17 agosto	73.629

Área afloramiento Muro 3 aguas abajo

S/D: Sin dato.

August 29, 2016

Señores
Sierra Gorda SCM
Attn.- Mr. Carlos Terrazas Anza - Jefe General de Operaciones Planta
Relaves, Aguas y Servicios
General Borgoño 934 Piso 10
Antofagasta
Chile

E Carlos.terrazas@sgscm.cl

Re: HydraMetrix - Willowstick Groundwater Investigation of Sierra Gorda Mine
Sub: Draft Report

Dear David,

This letter serves as a ***"short report"*** detailing the results of a HydraMetrix - Willowstick groundwater investigation at the Sierra Gorda Mine in Chile.

Introduction

Monitoring Well CB-9 at the Sierra Gorda mine has experienced an unusual and rapid increase in water levels over a relatively short period of time (February 2015 through April 2016, approximately). In that interval, the piezometric water level raised nearly 30 meters and holding. This is highly unusual for a dry and arid region in which meteoric and groundwater are scarce. As a consequence, the Sierra Gorda Mine desires to identify the source of water influencing the well. Due to the arid conditions and the remote location of the mine, there are only a few reasonable sources of water that could possibly influence well levels to the extent described. These possibilities include: 1) leakage from the sea water supply pipeline; 2) leakage from the sea water storage pond; 3) leakage from the fresh water storage pond; and 4) seepage out of the tailings pond (see Figure 1).

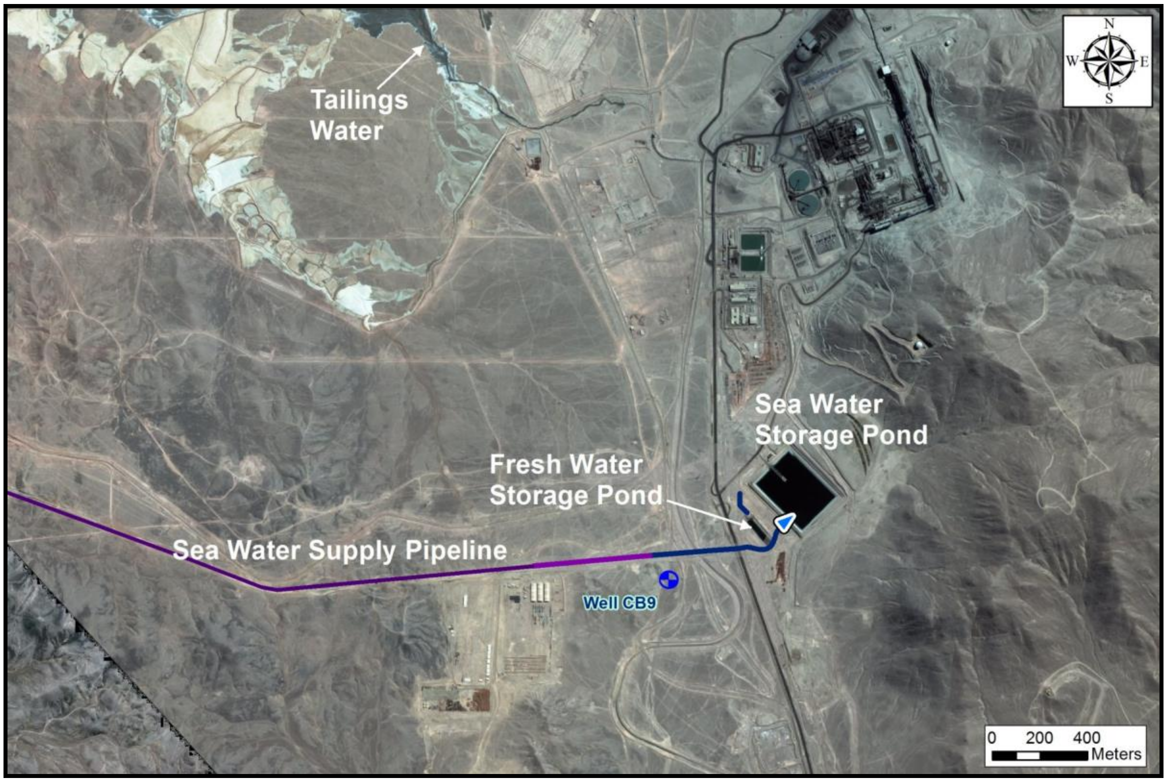


Figure 1 – Sierra Gorda Mine Site
Potential Sources of Groundwater Infiltration

<u>Executive Summary</u>

After careful evaluation and analysis of the geophysical data, as well as further consideration of all possible sources of water that could conceivably influence groundwater levels in well CB-9, three of the four possible water sources were ruled out (details to be given below). The one remaining possibility shows multiple lines of evidence—from which it was concluded that the source of water infiltrating the CB-9 groundwater originates from the Tailings Pond Water. The nearest edge of the Tailing Pond is located approximately 5 km northwest of the well. In summary, the results of the investigation indicate the following:

1) <u>The Sea Water Supply Pipeline is not the source of groundwater infiltration</u>. The reason for this conclusion is:
   a. After careful analysis of the geophysical data and the electric current distribution (ECD) models, there was no evidence in the data that suggests sea water (which is highly conductive) escapes the pipeline into the subsurface along the pipeline corridor. Also, there were no preferential flow paths identified connecting the supply pipeline to the well;
   b. The sea water pipeline is located mostly above ground—the exception being where it crosses beneath the railroad tracks. If a leak or break were to exist in the pipeline large enough to raise the groundwater level 30 meters and sustain that level for a long period of time, it would have been noticed. As such, no significant leak or break has been identified;

   c. Due to the cost of pumping sea water from the ocean to the mine site, it is believed that pumping costs and rates are carefully monitored and that a simple water balance calculation (water-in versus water-out) would confirm whether or not seepage is problematic. No such concerns have been expressed.

2) <u>The Sea Water Storage Pond is not the source of groundwater infiltration.</u> The reason for this conclusion is:
   a. After careful analysis of the geophysical data and electric current distribution (ECD) models, there is no evidence that suggests sea water (which is highly conductive) escapes the pond into the subsurface influencing water levels in well CB-9. Also, there were no preferential electric current flow paths identified out and away from the pond. If sea water were escaping the pond, the signature electric current would have followed such flow paths and revealed their locations. As such, no preferential pathway was found.
   b. The sea water storage pond has a synthetic liner, and it is highly improbable that enough water could leak through the liner to raise groundwater levels 30 meters and sustain the water level for a long period of time and go unnoticed.

3) <u>The Fresh Water Pond is not the source of groundwater infiltration</u>. The reason for this conclusion is:
   a. After careful analysis of the geophysical data and electric current distribution (ECD) models, there is no evidence to suggest any amount of fresh water escapes the pond into the subsurface that could influence water levels in well CB-9. There were no preferential electric current flow paths observed connecting the pond to the well;
   b. Water samples from the well show increased levels of TDS, suggesting that the source of water influencing the well is not fresh water but that of poorer quality—ruling out any fresh water source.
   c. The fresh water storage pond has a synthetic liner. It is highly improbable that enough water leaks through the liner to raise groundwater levels 30 meters and sustain the water level for a long period of time and go unnoticed.
   d. While performing the geophysical investigation, a long trench was dug the entire length of the fresh water pond and completed to the bottom elevation of the pond. The trench was dry, showing no signs of seepage.

4) <u>The Tailings Pond Water, located approximately 5 km northwest of Well CB-9, is the likely source of water influencing water levels in Well CB-9</u>. The reason for this conclusion is:
   a. After careful analysis of the geophysical data and electric current distribution (ECD) models, there is evidence which indicates a subsurface fracture zone northwest of CB-9, or between the CB-9 well and the Tailing Pond. Two separate ECD Models indicate a preferential concentration of flow occurs to the northwest of well CB-9. This may provide the conduit connecting the tailings water to the groundwater around Well CB-9.
   b. The water level in well CB-9 appears to have found equilibrium at a level near or slightly lower than the tailings water level. It is understood from communications

received that the CB-9 water level began to stabilize somewhere in the elevation range of 1625 to 1630 m. This suggests that the source and supply of water has a constant supply and head at or just above this level. The tailings pond fits this description.

c. Water samples from the well show increased levels of TDS. If the sea water supply pipeline and storage pond do not leak (as concluded), then the only other source of poor water quality is the tailings pond.
d. Unexpected water loses out of the tailings pond and into the subsurface may have been overlooked due to a lack of monitoring—given that the loss of water is desired (by evaporation, but not by seepage into the subsurface).

The Willowstick investigation has provided strong evidence identifying the most likely source of water infiltrating the groundwater in well CB-9. The study objectives have therefore been met.

<u>Background</u>

The Willowstick technology is a quick and nonintrusive geophysical method specifically designed to identify, map and model groundwater flow paths and patterns. The reason the Willowstick Technology is so well suited for identifying preferential groundwater flow paths and patterns in and around well CB-9 is because the technology is based on the principle that water flowing through the subsurface increases the conductivity of earthen materials through which it flows. Please note that from an earth conductivity perspective, groundwater is a relatively good conductor. As a consequence, it conducts the signature electric current very well as it is biased to flow through the subsurface between strategically placed electrodes. Earthen materials are fundamentally electrical insulators with electrical conductivities ranging between 10^{-12} and 10^{-17} mho/m. Yet, in-situ measurements of electrical conductivities range from 10^{-1} to 10^{-8} mho/m—many orders of magnitude higher. This discrepancy is due to the conduction of electrical current primarily by way of ions dissolved in preferential groundwater or seepage flow paths. Therefore, as the signature electric current was biased to flow out and away from well CB-9 through the subsurface, it tends to concentrate along preferential groundwater flow paths influencing groundwater levels. Recognizing that preferential groundwater flow paths are usually the primary facilitator of electric conduction in a typical geologic environment, the Willowstick Technology efficiently and accurately identifies and tracks groundwater flow paths and patterns by detecting differences in the magnetic field intensity arising with changes in electric current density. There is no other geophysical technology better suited to identify the source of water influencing water levels in well CB-9.

<u>Approach to the Work</u>

Survey #1

Survey #1 placed an injection electrode, consisting of a 1.3-cm by 1-meter long stainless steel chain attached to a #12 gauge solid copper insulated wire and lowered down well CB-9 to the bottom of the well—in contact with groundwater (roughly 180 meters below ground surface). A return electrode, consisting of a 1-meter long copper rod was also attached to a #12 gage solid copper insulated wire and driven into the ground on the surface in close proximity to the well. The two wires connecting the electrodes were brought to a central location and connected to a power supply. The wires and electrodes were then energized to create a circuit in the ground, above which the magnetic field is carefully measured and a survey completed (see Figure 2 –

Survey #1 Layout). This configuration constitutes a "vertical dipole" setup wherein the electric current can spread outward from the vertical well as depicted in Figure 3.

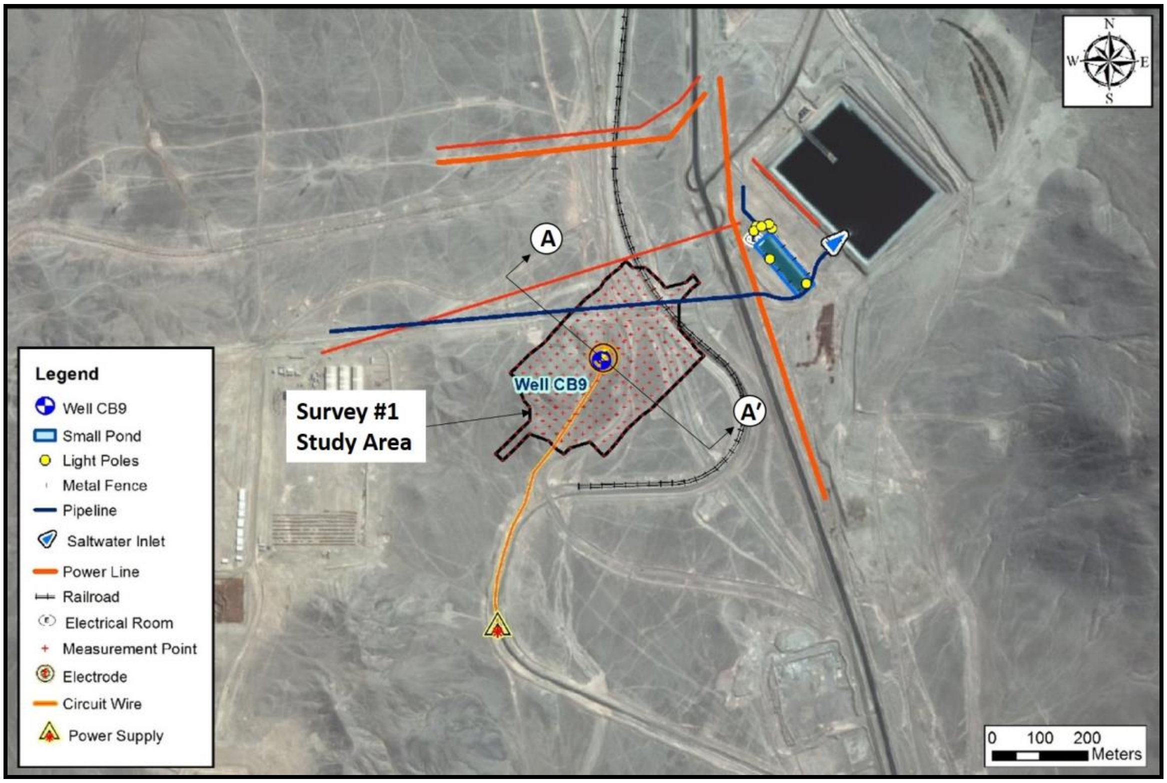


Figure 2 – Survey #1 Layout and Study Area (Plan View)

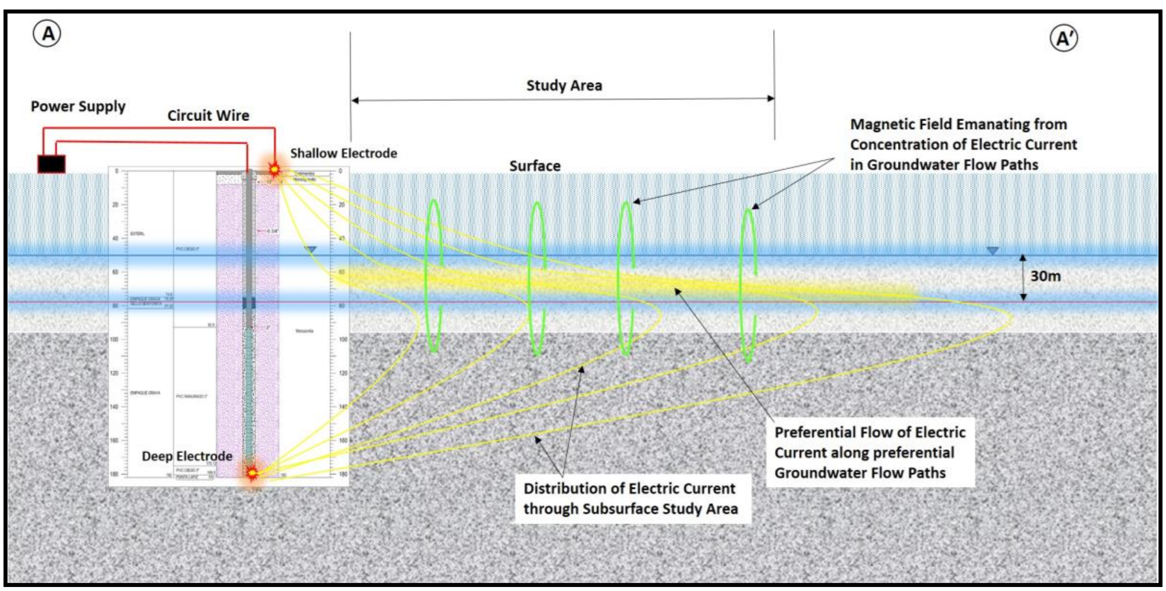


Figure 3 – Survey #1 Electrode Configuration (Section A-A′)

Due to the resistive nature of the shallow soils (being extremely dry at the time of the investigation), an electric circuit could not at first be established between the strategically placed electrodes. In an effort to overcome surface resistance (dry ground), a hole was dug around the surface electrode and filled with roughly 200 gallons of salt water to help increase the conductivity of the soils. After four hours of soaking, the electrodes were again energized but a sufficient circuit could not be established. As a consequence, the surface electrode was attached directly to the outer steel casing of the well. The outer casing extends down into the earth in contact with groundwater (see Figure 3). Although this was not the ideal electrode configuration (due to the close proximity of the bottom of the steel casing with the deep electrode) a circuit was established and it enabled a survey to be conducted. The signature electric current, however, was not able to flow out horizontally into the subsurface very far (only 100 meters maximum) due to the steel casing and its partial "short-circuiting" effect. Nevertheless, evaluation of the survey results shows a slight preferential flow of electric current to the northwest, as shown. There was little if any evidence to suggest a connection with the sea water pond or the fresh water pond to the northeast. Areas influenced by conductive culture (or too near to circuit wire and electrodes) were shaded or "masked" to indicate where interpretation was "blinded".

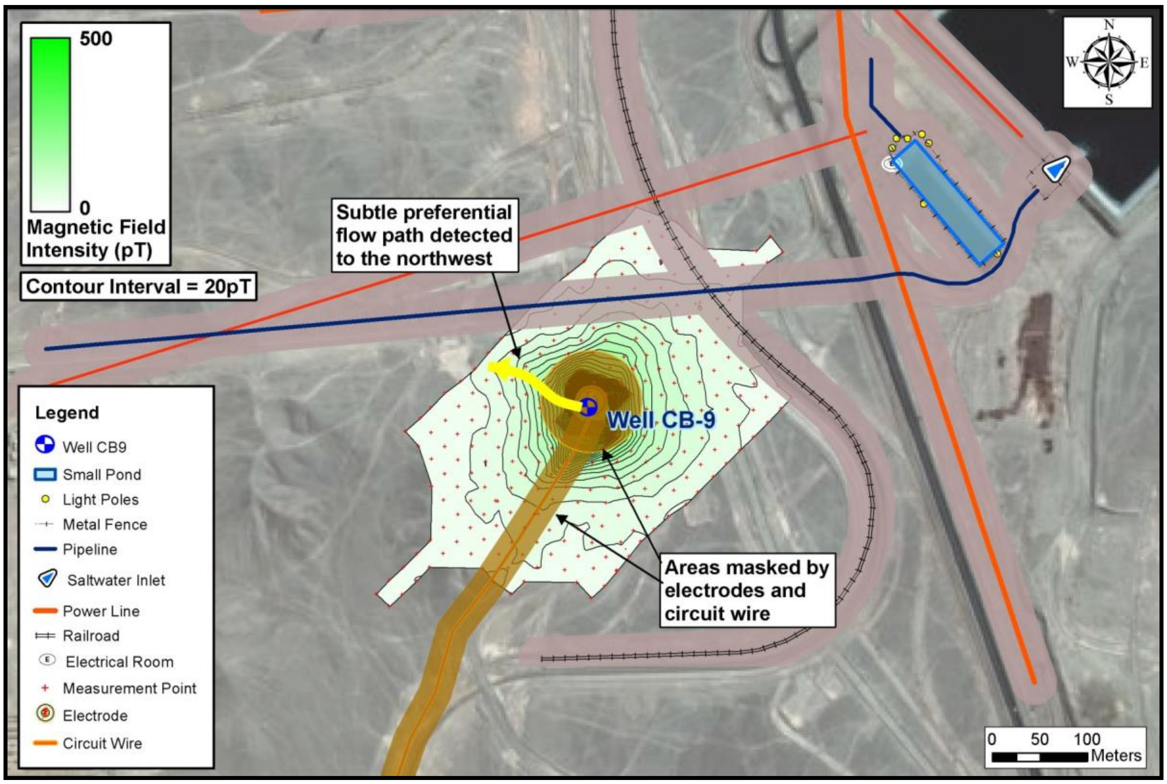


Figure 4 – Survey #1 Magnetic Field Map with Interpretive Markings

Although Survey #1 showed an indication of preferential flow to the northwest, a better survey setup was needed to provide more conclusive evidence regarding the source of water infiltrating the CB-9 groundwater. With this in mind, Survey #2 was proposed and completed, which is presented next.

<u>Survey #2</u>

Layout

The electrode at the bottom of well CB-9 was also used for Survey #2. This was coupled with a return electrode placed nearly 2000 meters north/northwest of the well in contact with some tailings water which runs into the Tailing Pond located further northwest. Figure 5 shows the layout for Survey #2 with map features pertinent to the investigation.

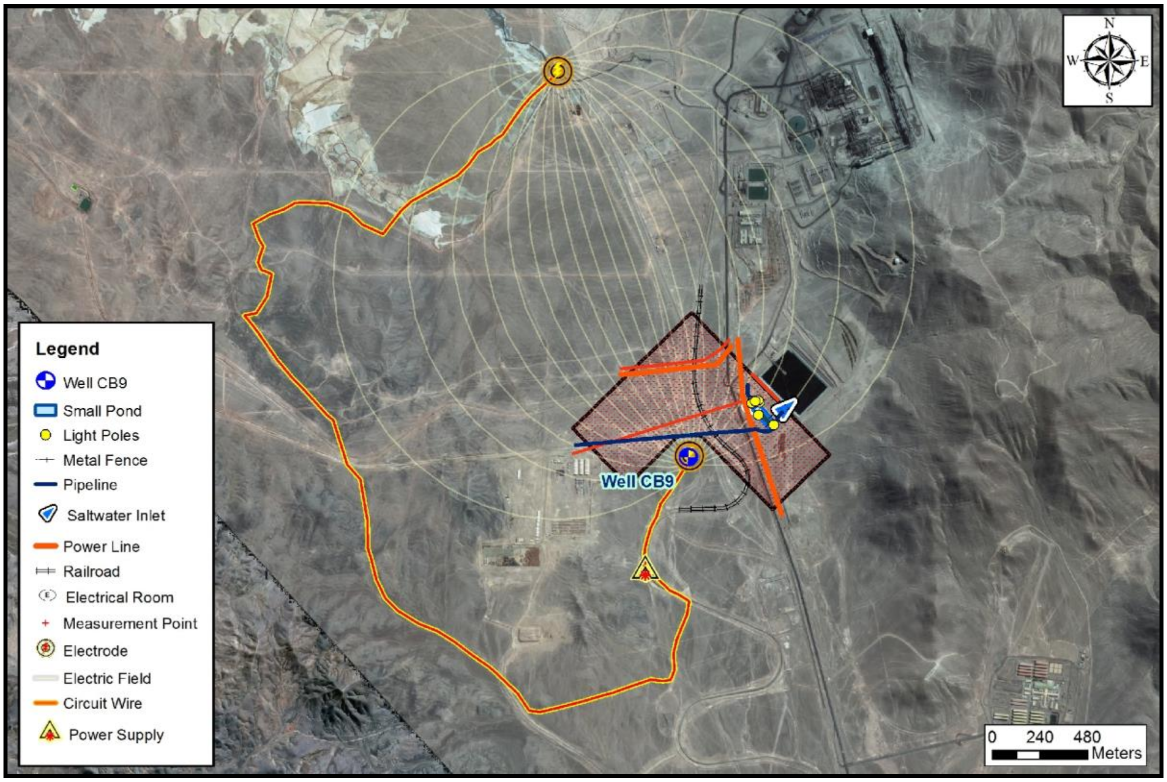


Figure 5 – Survey #2 Layout

Numerous small red "+" symbols denote measurement stations, which were established on a 20 meter grid. Some measurement stations were occupied repeatedly for quality control purposes. The position and elevation of each measurement station was recorded as part of the fieldwork, which is critical to quality control measures, data processing, modeling and interpretation. The grid spacing was adequate to obtain sufficient detail and resolution for identifying preferential electric current flow paths while at the same time optimizing funds available for the investigation in order to adequately explore areas of interest. The red/orange circuit wire—connecting the strategically placed electrodes—was positioned in a large loop around the study area. The electrodes and circuit wire are located outside the study area as much as possible due to the strong magnetic field influence around them. Because 100% of the electric current must pass through the circuit wire and electrodes, the magnetic field intensifies near these appurtenances. The thin yellow lines show the general distribution of electric current.

Predicted (*or theoretical*) Magnetic Field

To identify areas of greater or lesser conductivity through the subsurface study area, a model was created to predict the magnetic field response expected at each measurement station given the position of the circuit wire and electrodes. This prediction is made under the assumption of a homogenous subsurface conductivity environment. The prediction also includes the effects of the electrodes, circuit wire, and topography on the magnetic field (see Figure 6).

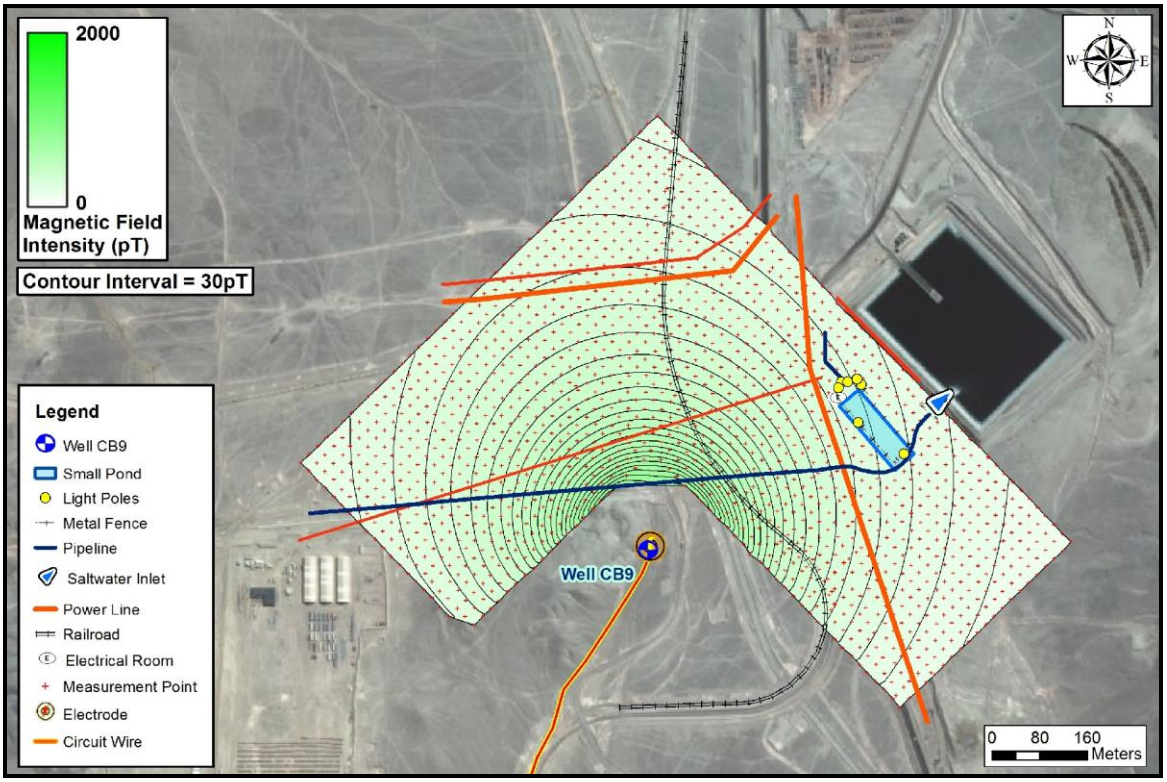


Figure 6 – Survey #2 Predicted Magnetic Field Map

The predicted magnetic field is based on a homogeneous-earth model, which generates a certain uniform distribution of electric current through the subsurface.

Observed Magnetic Field Map

Figure 7 presents the magnetic field observed (measured) when Survey #2's study area was energized with the signature electric current.

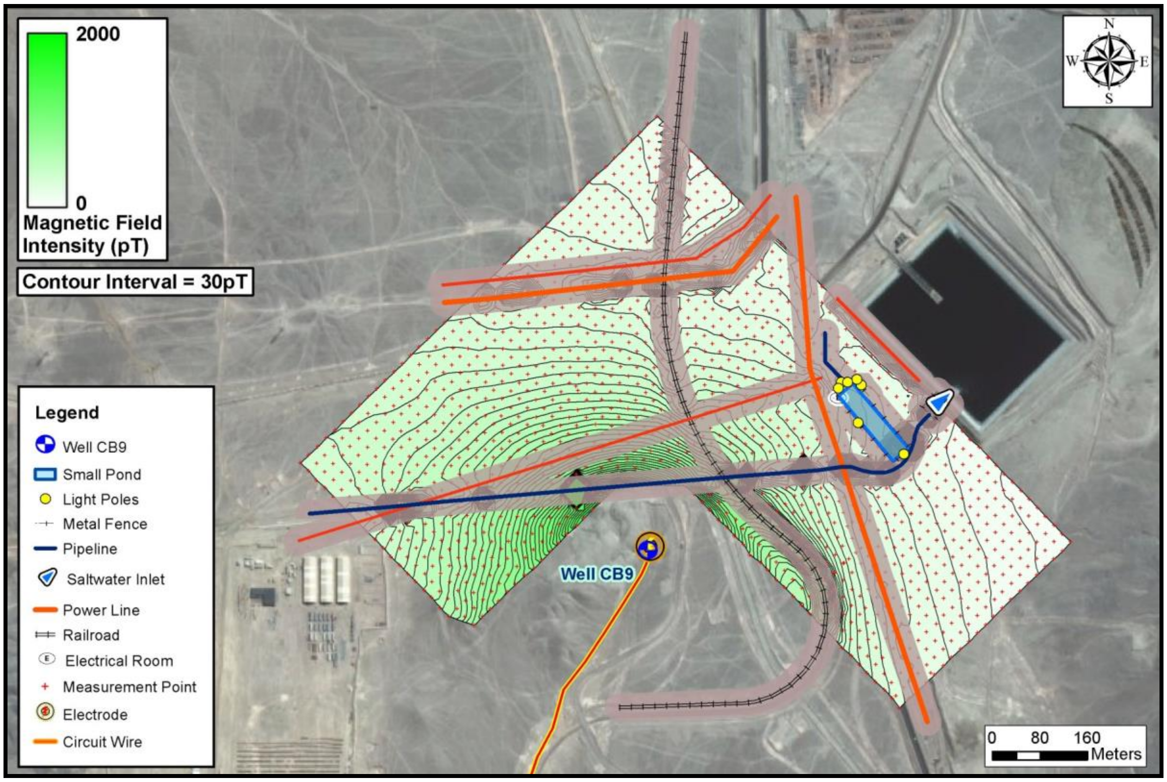


Figure 7 – Survey #2 Observed Magnetic Field Map

Note the Survey #2 electrodes were spaced nearly 2000 meters apart, yet a strong electrical circuit was established between the two electrodes in Survey #2. This suggests that the two electrodes in Survey #2 are not only electrically connected, but hydraulically connected as well (recall that no circuit initially could be established through the subsurface in Survey #1, although electrodes were only 180 m apart). This indicates a connection between the tailing water and the groundwater in well CB-9.

As can be seen in Figure 7, electric current gathers on much of the conductive culture running through the study area as evident by the dark green (almost black) magnetic field contours. Transparent gray masks have been placed over these conductive features. Aside from this one observation, the "observed" magnetic field data is not meant to be interpreted directly before the proper corrections have been made, and modeling is conducted. To better interpret the data, it must be compared to the predicted (*theoretical*) magnetic field model based on uniform flow in an electrically homogeneous earth. This causes the concentration of electric current due to heterogeneity—or changes in conductivity (such as seepage conditions)—to stand out, which greatly facilitates interpretation and modeling.

Ratio Response Map

By dividing the observed magnetic field data by the predicted (*theoretical*) magnetic field data, a ratio response map is created which removes electric current bias from the data set and shows areas of anomalous electric current flow—greater or lesser than predicted (see Figure 8).

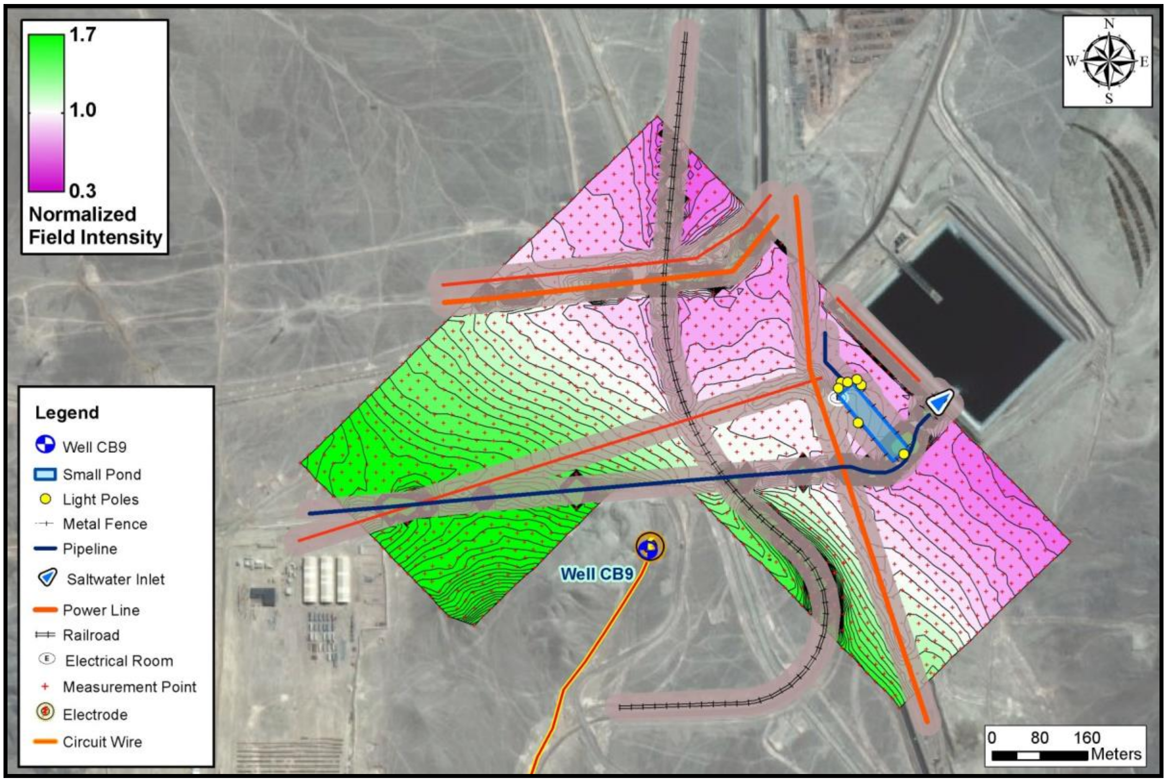


Figure 8 – Survey #2 Ratio Response Map

In Figure 8, the white shaded contours (where the ratio is approximately 1:1) shows where the magnetic field intensity is equivalent to that predicted by the homogeneous model. Areas shaded purple indicate magnetic field is less than predicted, and areas shaded green indicate magnetic field is greater than predicted. As noted, some electric current flows onto conductive culture (masked with gray shading). Also of significant importance is the amount of electric current that flows and concentrates northwest of the well as evident by the green shading. There is little if any indication that electric current preferentially flows to the northeast (toward the fresh and salt water ponds) other than along conductive culture. In summary, the ratio response map is simply a "***footprint***" map indicating the relative intensity of the magnetic field, or where electric current flow is stronger (green) or weaker (purple) than predicted based on a homogeneous background model.

Electric Current Distribution (ECD) Model

At this point, the horizontal and vertical alignment of preferential electric current flow through the subsurface study area remains unknown until filtering and modeling is performed. Gradient and distance filtering reduces the negative influence of the conductive culture based on their near-surface and high-gradient anomalous signatures.

To estimate horizontal and vertical position of preferential electric current flow paths, the filtered data is processed by an inversion algorithm designed to predict the distribution of electric current flow in three dimensional space within the subsurface study area. The inversion result is referred to as an Electric Current Distribution or ECD model. The inversion results are presented in Figures 9 and 10.

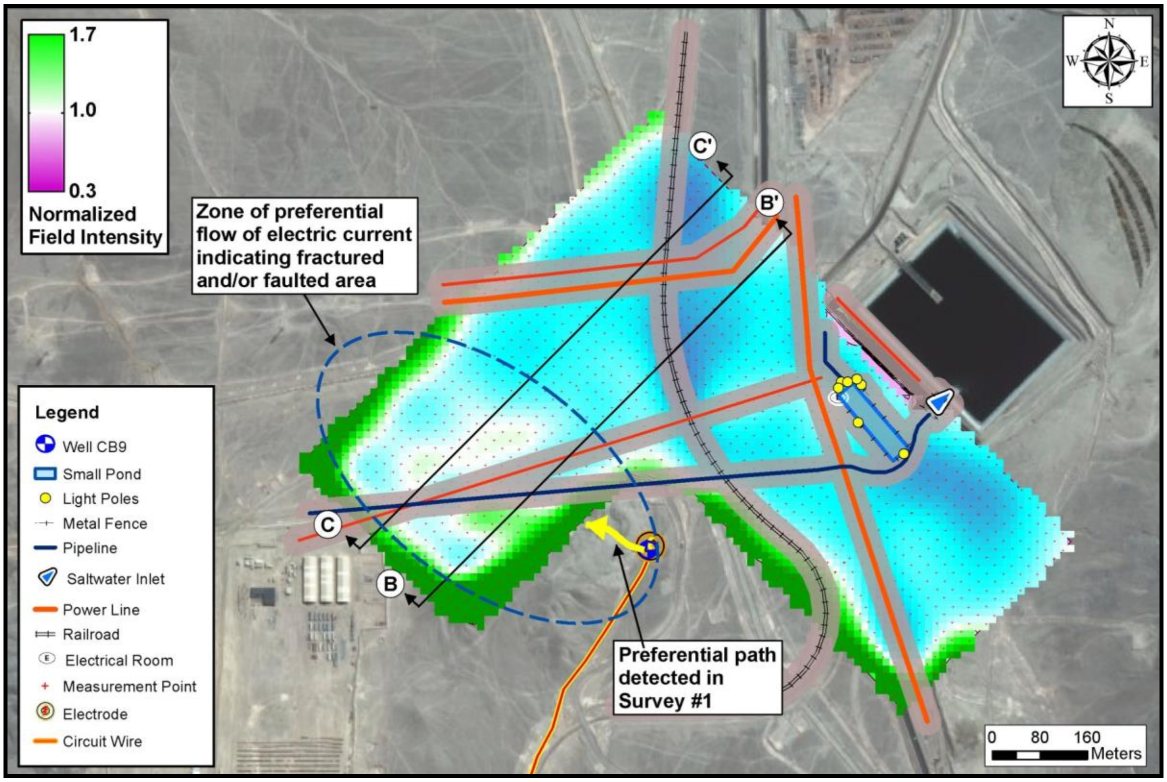


Figure 9 – Survey #2 ECD Model Slice at Elevation 1640m.

In Figure 9, the white to green shading highlight areas where electric current density is more concentrated than predicted and the light blue to dark purple shading identifies areas where electric current is less concentrated. As electric current is biased to flow from well CB-9 to the north/northwest electrode, it concentrates to the west and then northwest as denoted by the yellow arrow (from Survey #1 results) and the blue outline shown with interpretive labels. Note that the area to the northeast is shaded blue to dark purple suggesting that electric current does not preferentially flow between the well and the seawater/freshwater ponds. It should also be noted that the green shading identified along the southern edges of the ECD model is considered edge effects (or model dispersion), and caution should be taken when interpreting edges of the model due to lack of constraining data outside the survey area.

Figures 10 present cross the sectional views B-B′ and C-C′.

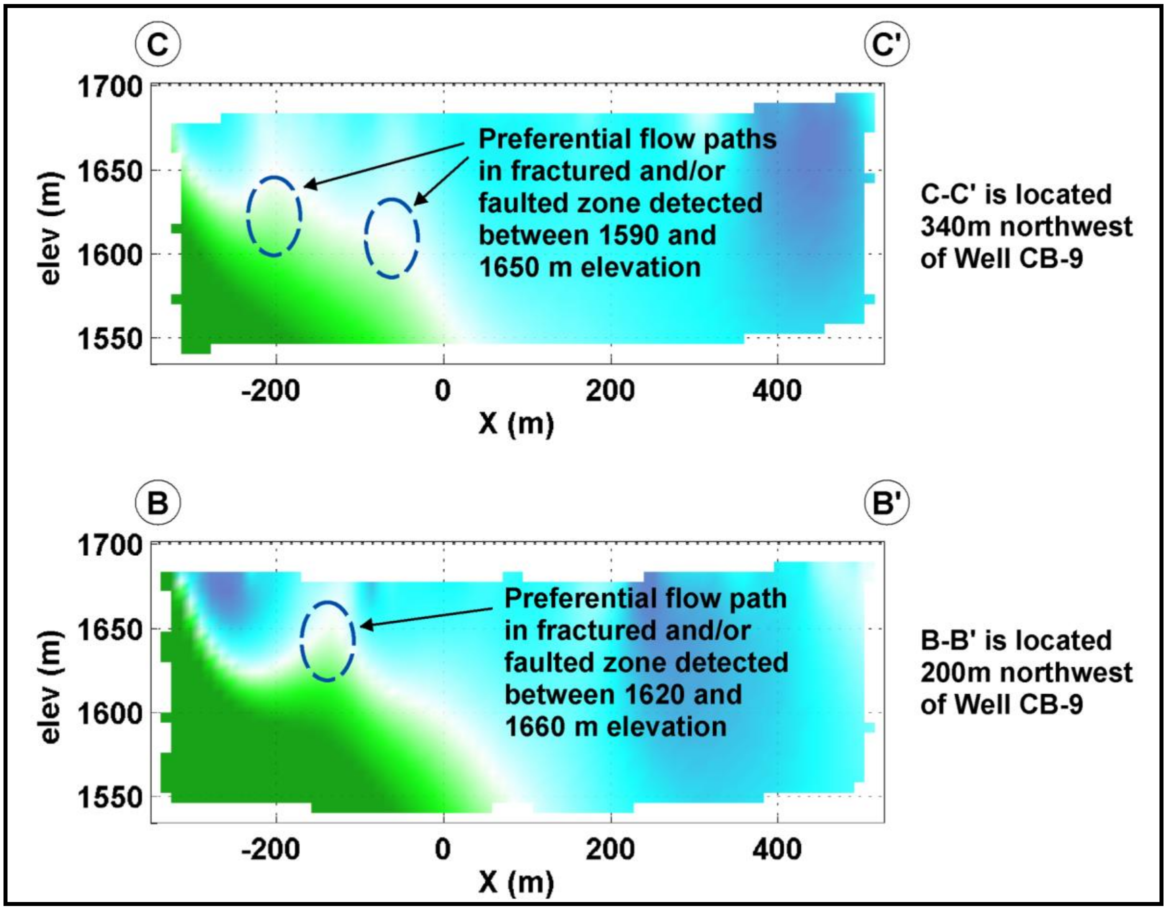


Figure 10 – Survey #2 ECD Model Slice Sections B-B′ and C-C′

In Figure 10, anomalous features are noted where the distribution of electric current is greater than predicted. By identifying the peak areas of each green shaded anomaly, one can identify where electric current is most concentrated. Also note how the green shading spreads out beneath the peak areas. This is called the "shadow effect", which often occurs below an electric current flow path. A good analogy for explaining the shadow effect is to think of the survey as shining a flashlight at something from above. If there is a solid object (a flow path or conductive pathway) the top will be illuminated but a shadow will be cast below the object. The anomalous features observed in Sections B-B′ and C-C′ identify what is likely a water-bearing fractured and/or faulted zone through which water seeping out of the tailings pond may migrate and influence groundwater levels in Well CB-9. Well CB-9 happens to be located along the path of this fractured and/or faulted zone. There were no other anomalous areas observed in the data that would suggest otherwise.

Conclusions

The Willowstick investigation has detected some preferential flow paths indicating that subsurface water migration occurs between the Tailing Pond and Well CB-9 area through fractured and/or faulted rock. In addition, the data shows no connections or preferential flow occurs between Well CB-9 and the seawater pond, nor between CB-9 and the freshwater pond. The results corroborate with other information at the site that has been shared with Willowstick.

It is recommended that all the Willowstick results be further compared with all known site information within the client's hands.