Phase II Groundwater Assessment

Otay Mesa Southwest Village

San Diego, CA

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Introduction

This report discusses groundwater conditions under southwest and south facing slopes of Otay Mesa at the request of Geocon Inc. The project area is designated as VTM-1 and VTM-2, and comprises a proposed residential development to be constructed by TriPointe Homes. The lithologic and groundwater data discussed were generated from seven deep geotechnical core borings, specifically B-1, B-2, B-3A, B-4, B-22, B-23, and B-24.

The borings were drilled to investigate geologic and groundwater conditions pertaining to landslides adjacent to the VTM-1 and VTM-2 proposed projects. A map showing the proposed project development areas in relation to the international border, the local freeways, and two landslide complex areas is provided in Figure 1.

This report continues a groundwater investigation begun during the previous Phase I investigation by Geocon of the southwest slope below the VTM-1 area in 2021, during which B-1, B-2, and B-3A coreholes were drilled.

B-3A replaced the B-3 borehole, which was abandoned due to drilling difficulties. The replacement, B-3A was completed with 2.5" flush thread PVC casing as a monitoring well, and will hence be referred to as "B-3". During the initial Phase I effort only B-3 was available as a completed monitoring well.

During a second phase of drilling, additional work was done in the slope below VTM-1. B-1 was completed as a monitoring well, and B-4 was added at the top of the Mesa. In addition, three coreholes were drilled and completed as monitor wells in the VTM-2, Landslide complex "C" area at the south side of Otay Mesa. These monitor wells are numbered B-23, B-22, and B-24 going from lowest to highest in elevation on the slope.

The monitor wells were completed with 2.5" PVC flush thread casings with a lower machine slotted section of casing. The location of the monitor wells is shown in Figure 2.

A principal objective of Geocon's geotechnical work is evaluation of the stability of Landslide Complex A and Landslide Complex C adjacent to the proposed Southwest Village project. These areas of potential concern are identified in Figure 1.

This report is intended to provide specific input regarding the groundwater elevation and variability within landslide complexes A and C of Figure 1, emphasizing groundwater level measurements and monitoring in the six coreholes. In addition to a series of groundwater level measurements presented in this report, groundwater level monitoring is ongoing with dedicated Solinst water level transducer/recorders installed in each well.

Figure 2 is a map showing the location of the deep core borings. They have been completed as monitoring wells by the installation of 2 ½" PVC flush thread casing and screen, placement of cement grout seals, and construction of surface completions. The borings were advanced and completed as monitor wells by Cascade Drilling.

Geologic Conditions

The occurrence and behavior of groundwater beneath Otay Mesa and its side slopes is substantially affected by subsurface geologic conditions in addition to the quantity and distribution of precipitation.

This discussion of geologic conditions relies on current and previous work at Otay Mesa by Geocon (2001, 2021). Our initial 2021 discussion of groundwater conditions at the Mesa was restricted by very limited specific groundwater data available for the project area and specifically the Mesa area, which consisted of a groundwater level measured at core boring B-3, interpretations of groundwater elevation based on geophysical measurements in coreholes B-1, B-2, and B-3 (Geovision 2021), and historic boring data available for groundwater elevation at the toe of slope 2000 feet south of the Area A study section at the San Ysidro Intermodal Transportation Center (Geocon, 2001). For Landslide areas A and C, the subsequent addition of additional monitoring wells in 2021 and 2022 substantially removes those ambiguities.

For Landslide Complex A, monitor wells B-1, B-2, and B-3A were located within a 350 to 400 foot thick slide mass, and were advanced to depth sufficient to penetrate the base of the slide mass. B-4 was drilled uphill of the main Complex A slide head scarp.

For Landslide Complex C, monitor wells B-23 and B-22 are located within the slide mass. Monitor well B-24 is located uphill of the head scarp, outside of the slide mass.

Otay Mesa is an uplifted marine terrace surface. The geologic materials beneath the Mesa terrace surface consist of reworked terrace deposits, sandstone, siltstone, claystone, and gravel/cobble conglomerate layers of the San Diego and Otay formations. Prior to the series of investigations discussed here the deepest holes were two 1500 to 1600 foot deep agricultural wells done by San Diego Pump and Well Drillers with cable tool equipment in 1955 and 1960, and three 1400 foot deep multi-port groundwater monitoring wells built by the USGS using rotary wash tools in mid 1990's at Tijuana Valley and Otay River.

The west, southwest, and south slopes surrounding the relatively flat Otay Mesa surface are complex landslide topography showing various stages of development (Geocon, 2021). Steep-walled, approximately linear canyons cut into the Mesa at several locations. The water table surface creates perennial flow and associated riparian vegetation at the south edge of the site in Spring Canyon adjacent to the International Border.

As encountered in B-1, B-2, and B-3A, the basal shear zone consists of sheared bentonite and remolded clay planes (at B-1), to disturbed mixtures of sand, clay and gravel (at B-2) to a thick zone of viscous deformation in a melange of remolded clay and fine sand (at B-3). The slide plane under Landslide A complex dips approximately 1 degree below horizontal, towards the west away from the scarp. These Landslide A borings were continued beneath the basal slide surface, and advanced into relatively thin bedded undisturbed Otay formation sandstone with a shallow dip angle.

In both the landslide A and landslide C complexes, the cores indicate that substantial thicknesses of the sedimentary rock slide masses are cemented lithic sandstone, siltstone, and/or claystone, or when not lithified, the core samples contain substantial percentages of clay and/or silt. These conditions, in addition to the presence of slide plane surfaces within the slide masses could potentially create localized barriers, steps, or disruption of downgradient groundwater flow.

The field core logs have frequent references to HCL acid bubble reaction to tests, indicating that calcium carbonate cementation of the rock matrix and coating of fractures is common. The consequence of the described lithology for groundwater movement is that it is probable that movement of groundwater recharge down to the main water table occurs substantially by downwards flow within fractures and tension cracks, rather than by porous media percolation flow, such as might occur in loose uncemented sand or soil. The substantially indurated and horizontal bedding characteristics of the rocks beneath Otay Mesa will also have a strong tendency to enable development of “perched” zones of groundwater above the main water table, which will vary in degree of development and persistence, depending on the variations of long term rainfall intensity.

The conclusion that active movement of groundwater within the local Otay Mesa aquifer is sustained by fracture flow is supported by the strongly lithified texture of a large percentage of the recovered core samples, and also by the generally high seismic P wave velocities recorded by GeoVision in their 2021 borehole seismic survey of holes B-1, B-2, and B-3. Below the water table, the seismic velocities measured by Geovision were generally 7500 to 10,000 feet per second, indicating rock rather than soil texture.

A consequence of dominant fracture flow versus porous media groundwater flow is that vertical infiltration through fractures can selectively transport precipitation more rapidly to the groundwater table in some areas, and temporarily block or reroute groundwater transport in other areas where fractures are infrequent or poorly connected.

Monitor Well Completions in Cascade Drilling Diamond Coreholes

The locations of the Geocon Area A and C monitor wells are shown in Figure 2.

Drilling conditions encountered by the Cascade Drilling crew were non-uniform. For instance, during drilling of Borehole B-24 at the Mesa top above Landslide Complex C, it was difficult to maintain fluid and cuttings return to such an extent that several coring runs were completed "blind" with no fluid or cuttings return. For several days drilling on this borehole, as much as two or three 3500 gallon water trucks of drilling water were used during an eight hour drilling shift in order to flush the borehole, re-start, and attempt to maintain circulation. The high rate of fluid loss occurred throughout most of the coring advance for B-24. Attempts by the Cascade driller to mitigate the fluid losses by adding viscosity with drilling polymer were only partially successful.

Conversely, during drilling of B-23 at the base slope in Landslide Complex C, flowing water persisted during drilling and for significant time periods after drilling operations stopped at the end of drilling shifts. This behavior is tentatively attributed to temporary storage and "flow back" of drilling fluid accumulated in fractures above the water table, and also perhaps indicates an "out of balance" drilling fluid density condition.

The coreholes were advanced with diamond tools through flush threaded coring casing, with the core barrels recovered on Christensen and/or CME wireline apparatus. Upon reaching total borehole depth, the borehole drilling fluid was thickened with drilling polymer in order to stabilize loose fractured rock prior to withdrawing the wireline coring casing.

Following removal of the wireline casing, the open boreholes were cased with 2 1/2" flush thread PVC well casing, with .020 inch machine cut slots at bottom. After casing installation, Cemex filter pack sand was installed by free-fall into the outside annular space, and then the top 20 feet of the borehole annulus was sealed with neat cement grout. This was followed by construction of surface completions to protect the wells.

The borehole completions are summarized in Table 1. The order of corehole monitor well construction was as follows:

2021: B-1. This corehole was drilled near the toe of slope in Landslide area A, but not cased.

> B-3. This well was completed after a first drilling attempt failed and the decision was made to move the borehole to a nearby spot and begin again. The second attempted borehole successfully reached target depth, and was then cased and developed as a monitor well.
>
> <u>Geocon Borehole Seismic Measurements</u>: Open-hole borehole P and S wave seismic velocity surveys were conducted by GeoVision Inc. in coreholes B-1, B-2, and B-3 during the Phase I drilling effort to determine approximate formation groundwater depth, and check for occurrences of perched groundwater above main water table.

2022: B-1. This corehole was re-drilled during the second Cascade Drilling mobilization and a monitor well casing installed.

Table 1									
Principal Facts, Otay Mesa Groundwater Monitor Wells									
Geocon Landslide Complex A and Landslide Complex C									
Borehole	**Lattitude, Deg**	**Longitude, Deg**	**State Plane**	**State Plane**	**Surface Elevation**	**Casing Depth**	**Depth to Water**	**Groundwater**	**Completion**
	Degrees	**Degrees West**	**North, Ft**	**East, Ft**	**Ft, NAVD88**	**Feet**	**5/12/2022**	**Elevation**	**Type**
								Feet, NAVD88	
B1	32.55158	-117.03080	1,781,375.0	6,321,070.0	186.00	206.0	67.97	118.03	Monument Casing
B3	32.55348	-117.02745	1,782,058.5	6,322,107.4	360.00	272.4	193.1	166.9	Monument Casing
B4	32.55527	-117.02504	1,782,704.3	6,322,854.9	490.87	501.0	320.81	170.06	Vault
B22	32.54792	-117.01428	1,780,005.6	6,326,150.9	351.00	300.0	173.4	177.6	Vault
B23	32.54555	-117.01342	1,779,141.3	6,326,409.6	229.55	254.5	60.96	168.59	Vault
B24	32.54963	-117.01493	1,780,629.2	6,325,955.1	475.74	400.0	305.57	170.17	Vault
Landslide Complex A Wells are B-1, B-3, and B-4. Landslide Complex C Wells are B-22, B-23, and B-24.									

2022: B-4, B-22, B-23, B-24 were drilled during the second Cascade Drilling mobilization. After reaching total depth in each borehole, the temporary casing was removed and 2 ½” PVC monitor well casing was installed.

The wells were developed by Cascade Drilling with a water well service rig running a 20 foot long bail to efficiently remove borehole fluid from the narrow 2 ½” casing. Considerable residual viscosity remained in the wells due to the polymer addition used to facilitate casing installation. The polymer viscosity did not dissipate rapidly with development by bailing and the residual polymer viscosity was such that electric well sounder cables stuck to the side of the well casings and interfered with efficient water level measurement.

The excess fluid viscosity due the residual drilling polymer was chemically broken down by addition of several gallons of 7.5% sodium hypochlorite solution (bleach) to each well, and thoroughly swabbing the solution into the wells to oxidize the drilling polymer.

During development, the water level was taken down significantly below initial level to maximize replacement of drilling fluid with native formation water. Electrical conductivity of the development fluid was noted as development bailing progressed. In general, fluid electrical conductivity increased during bailing development work to several thousand microSiemens, indicating brackish formation fluid, and removal of introduced drilling fluid, which was obtained from a municipal hydrant.

Groundwater Level Measurements, Geocon Monitoring Wells

Table 2 provides a list manual water level measurements taken through June 12, 2021 with an electric well sounder tape in the Geocon monitoring wells.

The earliest measurements are for B-3, which begin in March 2021 shortly after it was completed. An electronic pressure transducer/datalogger was installed in B-3 on April 2, 2021 to record groundwater level response to rainfall events.

B-1 was redrilled and completed as a monitoring well at the start of the Phase II exploration drilling, and the first water level measurement was taken in October 2021. A pressure transducer/datalogger was installed in B-1 on January 11, 2022.

Water level recorder/transducers were installed in the remaining wells B-4, B-22, B-23, and B-24 on March 11, 2022. The transducers are Solinst Levelogger 5 units, which have an approximate 10 year lithium battery life, and a memory capacity of 150,000 water level/fluid temperature data pairs. The existing B-1 and B-3 transducers were replaced with new dedicated Levelogger 5 units on March 11.

The dataloggers are programmed to record data every half hour and are suspended from the monitor well casing top with stainless steel aircraft cable. The transducers record water levels

TABLE 2
Manual Groundwater Level Measurements
Otay Mesa Monitoring Wells, Landslide Areas A and C

Date	B1 DTW	B1 Water Elev.	B3 DTW	B3 Water Elev.	B4 DTW	B4 Water Elev.	B23 DTW	B23 Water Elev.	B22 DTW	B22 Water Elev.	B24 DTW	B24 Water Elev.	Comments
4/2/2021			193.04	166.96									
10/27/2021	73.51	112.49	193.21	166.79									
12/16/2021			193.33	166.67					*149.52*	*201.48*			
1/5/2022	78.03	107.97			325.85	165.02	58.98	170.57	*152.41*	*198.59*	306.17	169.57	pre development
1/6/2022	67.55	118.45			320.58	170.29	60.68	168.87	173.81	177.19	306.53	169.21	approx. 10 hours after Development
1/11/2022	67.43	118.57	193.43	166.57	320.7	170.17	60.79	168.76	173.83	177.17	306.47	169.27	
3/8/2022			193.04	166.96	320.75	170.12	60.59	168.96	173.31	177.69	306.18	169.56	Post chlorination
3/11/2022	67.64	118.36	193.22	166.78	320.76	170.11	60.65	168.9	173.35	177.65	306.11	169.63	Transducers installed in all Wells
4/14/2022	67.67	118.33	193.12	166.88	320.82	170.05	60.79	168.76	173.38	177.62	305.87	169.87	
5/12/2022	67.97	118.03	193.10	166.90	320.81	170.06	60.96	168.59	173.40	177.60	305.57	170.17	
6/16/2022	67.65	118.35	192.81	167.19	320.58	170.29	61.06	168.49	173.16	177.84	304.90	170.84	

NOTES: all water level measurements above taken with electric sounder tape.
"DTW" = Depth to water
B-22 water levels bracketed with stars, incorrect, affected by drilling polymer

at a nominal accuracy of .05 feet, with a resolution of .02 feet. This measurement frequency and resolution is sufficient to monitor for and detect groundwater levels and transient events that could be important to landslide mass stability. Appendix D provides manufacturer specifications for the dataloggers.

Vent holes were drilled through the well casing tops in order to vent the well casings to convey changes in barometric pressure through the well cap into the wells. A barometric datalogger was installed in Well B-1 to record and facilitate localized correction of the raw transducer pressure measurements for barometric pressure oscillations.

Groundwater measurements for May 12, 2022, are shown as depth-to-water/groundwater elevation pairs on the Figure 2 well location map. This set of water level measurements is also shown in Figure 3 slope cross sections A and B, plotted at a 2X vertical exaggeration. The slope of the water table beneath Otay Mesa Profile A is relatively flat, gradually descending southwest towards Tijuana Valley and the ocean.

Figure 3 also shows groundwater levels under Profile B as almost flat into Spring Canyon, with the highest water level elevation on the profile located at B-22 in mid slope, not at B-24 at the Mesa top, which is the highest topographic elevation point on Profile B, above and outside of the main landslide scarp. The groundwater elevation mid-slope in B-22 was 7.4 feet higher than in B-24 at the Mesa top on May 12, 2022, and continues higher than B-24 through mid September, which is an unexpected result.

The detailed groundwater level records provided by the dataloggers allows observation of the transient impact of local rainfall on the groundwater table within the slide areas.

Plate 1 provides a bar graph plot of daily rainfall recorded at NWS weather station KSDM/3178 located 3 miles east-northeast of the Otay Mesa landslide investigation area at Brown Field airport. The plot includes historic rainfall data from winter 2019 through mid September 2022, in order to provide context for the groundwater level measurements at Otay Mesa.

The water levels recorded by the datalogger equipment shown in Plate 1 is provided in six time-aligned plots placed above the rainfall plot to allow determination of groundwater response, if any, at the six monitor well locations to the rainfall events. The manual groundwater level readings taken previous to datalogger installation are also plotted on the graphs as blue triangles. Plate 1 visually summarizes all the available groundwater level measurements for the Otay Mesa monitoring wells. Daily rainfall events for 2021-2022 at Brown Field is listed in the following Table 3 with events of 0.5 inch and greater highlighted in yellow:

TABLE 3

Rainfall Recorded at Brown Field

Date	Precip, In.
9/24/2021	0.06
10/4/2021	0.44
10/5/2021	0.12
10/8/2021	0.10
10/25/2021	0.27
12/7/2021	0.02
12/8/2021	0.00
12/9/2021	0.39
12/14/2021	1.07
12/16/2021	0.01
12/23/2021	0.52
12/24/2021	0.34
12/25/2021	0.21
12/26/2021	0.27
12/27/2021	0.10
12/28/2021	0.40
12/29/2021	0.12
12/31/2021	0.02
1/15/2022	0.04
1/17/2022	0.27
1/18/2022	0.19
2/15/2022	0.19
2/16/2022	0.23
2/21/2022	0.04
2/22/2022	0.54
2/23/2022	0.33
3/4/2022	0.84
3/5/2022	0.02
3/19/2022	0.02
3/20/2022	0.27
3/28/2022	1.19
3/29/2022	0.66
4/2/2022	0.01
4/3/2022	0.03
4/11/2022	0.16
4/21/2022	0.01
4/22/2022	0.16
5/20/2022	0.01
9/9/2022	0.27
9/11/2022	0.01

Response of the water levels in the monitoring wells to the 2021-September 2022 is discussed for each landslide area in the following paragraphs:

Well B-4. B-4 is located on the Mesa top above the Landslide A scarp, outside of the limits of identified landsliding. The groundwater level at B-4 rose approximately 0.3 feet in response to the above rainfall sequence.

Well B-3. A water level transducer/recorder was placed in monitor well B-3 on April 2, 2021, soon after the well was cased and developed. Prior to this, the most recent significant rainfall was on March 3, 2021 (0.77 inch) and March 10, 2021 (0.62 inch). The B-3 groundwater level record begins with essentially level, straight-line data following this, and follows a very gradually decreasing trend until approximately March 10, 2022, when the groundwater level increased approximately 0.3 feet in response to rainfall events. From mid June 2022 through mid September 2022, the groundwater level has remained unchanged at essentially the same elevation.

Well B-1. B-1 is located near the toe of the Landslide A complex. The water level transducer/recorder was placed in this well starting January 11, 2022, soon after well casing installation and development was completed. The initial two months of the hydrograph show a stable groundwater level, which gradually increases approximately 0.15 ft starting approximately March 10, 2022 in response to late February and early March 2022 rain events. This groundwater level change is so small as to be near the limit of what can be reliably detected, given barometric pressure effects on the groundwater table. The groundwater level has remained essentially unchanged from mid June through mid September 2022.

Well B-23. B-23 is located near the bottom of slope in the Landslide C complex area. The first recorded level on the hydrograph is a single manual sounding taken on January 6, 2022. The water level record starting then and thereafter when the transducer/recorder unit was installed on March 11, 2022 shows very slow water level decline from January 6 through June 12, with a span of less than 0.38 feet. From July through early September the B-23 water level continues a slow decline, and then rises approximately 0.1 feet in response to a small rain event on September 9, 2022. The water table elevation in B-23 is consistent with the surface water flow elevation in the adjacent Spring Canyon stream channel.

Well B-22. B-22 is located at mid slope in Landslide Complex C. The combination of the January 11, 2022 and subsequent transducer/recorder electronic record starting March 11, 2022 show gradually increasing water level elevation from January 11 through April 5 of approximately 0.7 feet. Thereafter, the groundwater elevation remained essentially constant through June 12, 2022. The water level rise beginning early in this record may result from cumulative effects of the previous rainfall which occurred in December 2021 in addition to the early spring 2022 rainfall events. An extremely slow trend of gradual groundwater level rise begins at the end of this record, with a small response of approximately 0.1 feet in response to a rainfall event on September 9, 2022. The groundwater elevation in well B-22 is approximately 7 feet greater than well B-24 at the top of slope, an unexpected result.

Well B-24. B-24 is located at the top of Otay Mesa , beyond the slide scarp for Landslide Complex C. The record begins with a single January 6, 2022 manual measurement, followed by the electronic transducer/recorder record from March 11, 2022 through September, 2022. The record shows essentially constant slow groundwater level rise of 1.6 feet during through late June, then drops approximately 0.3 feet, and resumes a slow water level rise of approximately 0.2 feet through the end of the masurement period. B-24 has the greatest response to rainfall of the installed wells.

Conclusions Regarding Groundwater Level Data Recorded at Otay Mesa Landslide Complexes A and C

The following are conclusions based on a limited time span of groundwater level observations at the Mesa.

Approximately 13 months of electronic water level records in Well B-3 in the center of slope in Landslide Complex A show minimal response to rainfall events in 2021 and 2022.

The greatest response to winter 2022 rainfall events is captured by shorter records from monitor wells B-22 and B-24 in Landslide Complex C. These records captured groundwater level rise of 1.0 to 1.6 feet respectively. The maximum daily rainfall immediately preceding these events during the monitoring period were 0.84 and 1.19 inches.

The time delay in groundwater level response in Area C to these 0.84 to 1.2 inch rainfall events, was estimated by qualitative review of the daily rainfall versus groundwater level rise hydrograph data is approximately two to three weeks. The vertical distance travelled by the infiltrating precipitation from land surface to water table in the case of B-22 is 173 feet, and for B-24 it is currently 305 feet. For infiltration of such small quantities of stormwater to reach the water table in that time interval, it is likely that percolation is accommodated by a network of rock fractures and perhaps tension cracks with a relatively low aggregate water storage coefficient, rather than porous media flow of a wetting front through sand.

The relationship of groundwater elevation between wells B-22 and B-24, located at mid slope and top of slope in Landslide Complex C is unexpected as B-22 currently has approximately 7 foot higher groundwater elevation than B-24 as of September17, 2022.

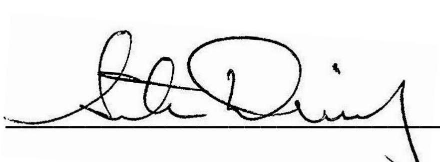
Based on the groundwater data recorded with the monitor wells to date it can be stated that qualitatively, it appears that groundwater level response of wells in Complex A is less than the response to rainfall in Complex C.

The groundwater level responses to rainfall recorded thus far within the Otay Mesa monitoring wells are very small in relation to the range of groundwater levels calculated by Geocon to envelope stable conditions for these slopes. Geocon's geotechnical analysis of these slopes is based on deep exploration borings, lab strength testing of potential failure plane materials, detailed topographic data, and measured groundwater levels discussed herein. These calculations indicate stability remains after significant rise above current water levels.

A basis for a reliable estimation of the maximum possible groundwater level response to rainfall at these slope locations may not be available or confirmed until additional substantial winter rainfall events are recorded, such as sequences containing several 0.5 to 1.5 inch, closely spaced events occur.

The rates of groundwater level rise recorded in the monitor wells to date are not especially rapid or large, or significant to slope stability based on Geocon slope stability modeling for this project. As compared to other areas we have worked where rainfall recharge has occurred via fracture flow, the magnitude and rate of groundwater level rise so far recorded is not comparable or of concern.

The six wells installed in the exploration coreholes will provide a valuable tool to verify and monitor present and future groundwater elevations in the subject landslide areas.



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Senior Hydrogeologist

Attachments: (1) electronic groundwater level and barometric pressure spreadsheet files, (2) electronic spreadsheet NWS daily precipitation file for Station KSDM, Brown Field, San Diego, CA

References:

Geocon, 2021. Supplemental Geotechnical Investigation and Slope Stability Analysis, Southwest Village VTM-1, San Diego, CA. Prepared for Tri-Pointe Homes.

Geocon, 2021. Preliminary Geotechnical Evaluation and Slope Stability Analysis, Southwest Village VTM-2 (Borrow/Fill Site), San Diego, California. Prepared for Tri-Pointe Homes.

Geocon, 2001. Geotechnical Investigation, Intermodal Transportation Center, San Ysidro, CA. Prepared for Kimley-Horn & Associates.

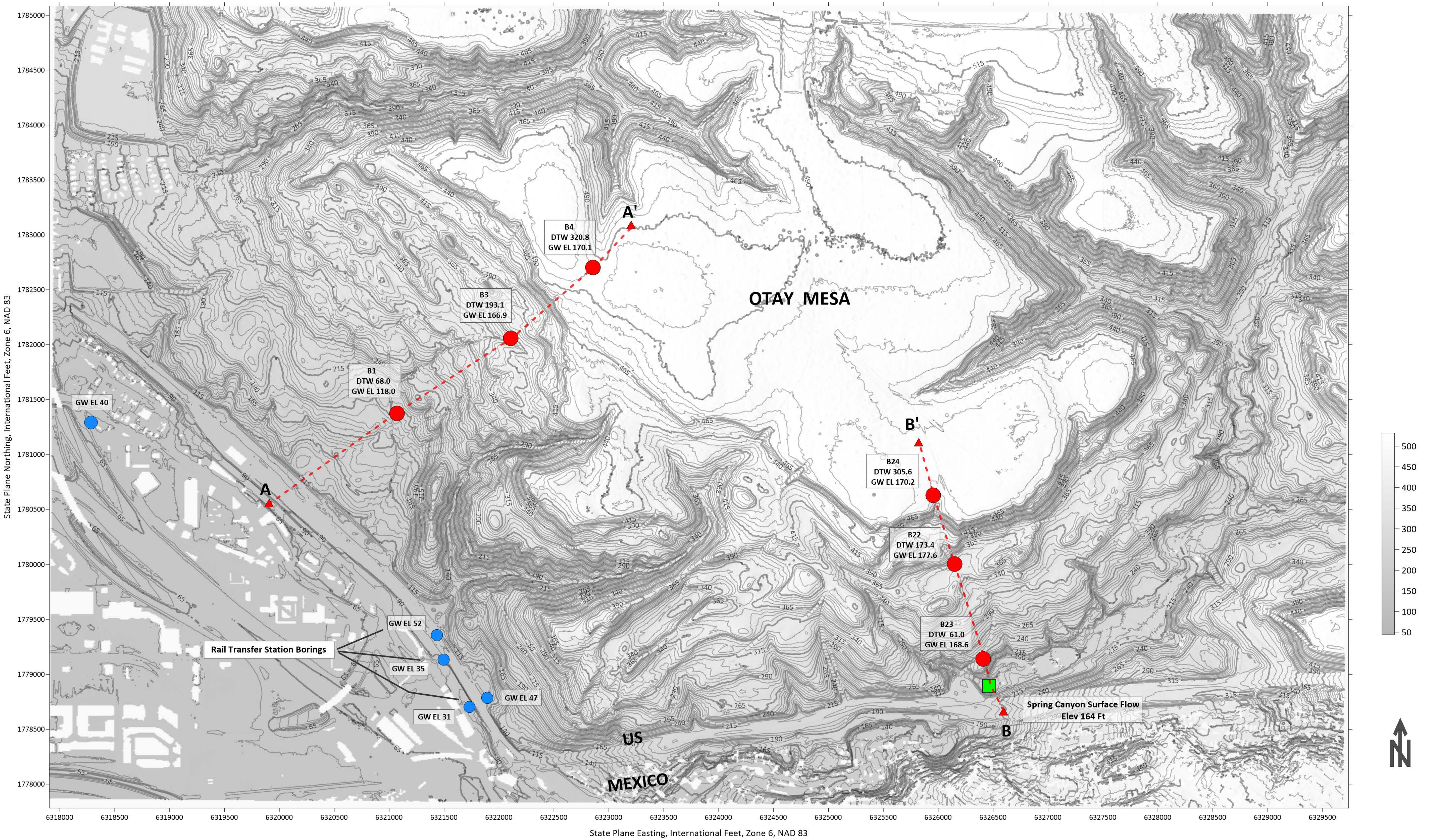
GeoVision, 2021. Borehole Geophysics, San Ysidro, CA.

National Weather Service, daily precipitation data for Brown Field Municipal Airport, NWS Station KSDM/3178, 2010 through June 2022.

Geocon, 2021 – 2022. Draft boring logs for coreholes B-1, B-3, B-4, B-22, B-23, B-24.

Figure Adapted from
Geocon Inc. Work Product

FIGURE 1
LOCATION MAP,
SOUTHWEST VILLAGE
VTM-1 AND VTM-2



Diamond Exploration Corehole And Groundwater Monitoring Well

Historic Water Level From Geocon Boring for Rail Transfer Facility, 2001

Elevation of Surface Water Flow in Spring Canyon at International Border

Groundwater levels in monitor wells Measured 5/12/2022.

Five foot topographic contours and shaded relief topo rendering computed from 2015 NOAA Lidar dataset. Datum is NAVD88, International Feet

0 1000 2000 3000 4000
Distance, Feet

FIGURE 2

Shaded Relief Topographic Map Showing Geocon Landslide Investigation Coreholes and Monitor Well Locations Otay Mesa, San Diego County, CA

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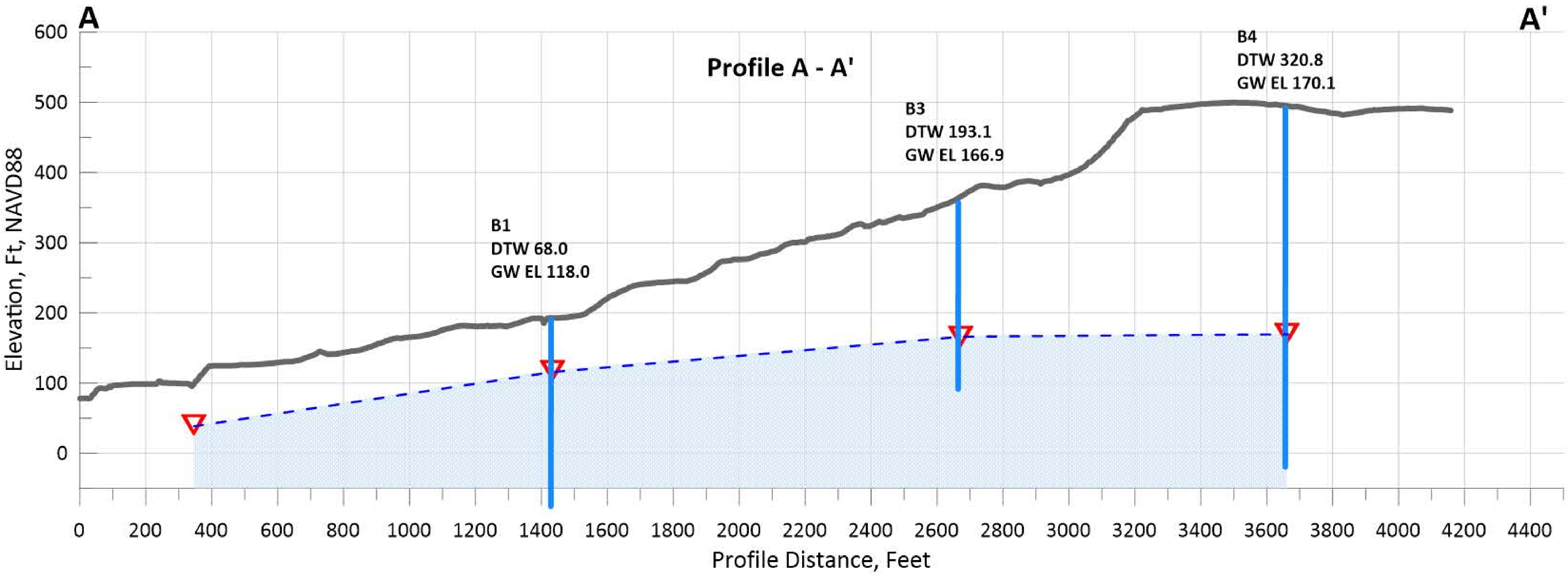
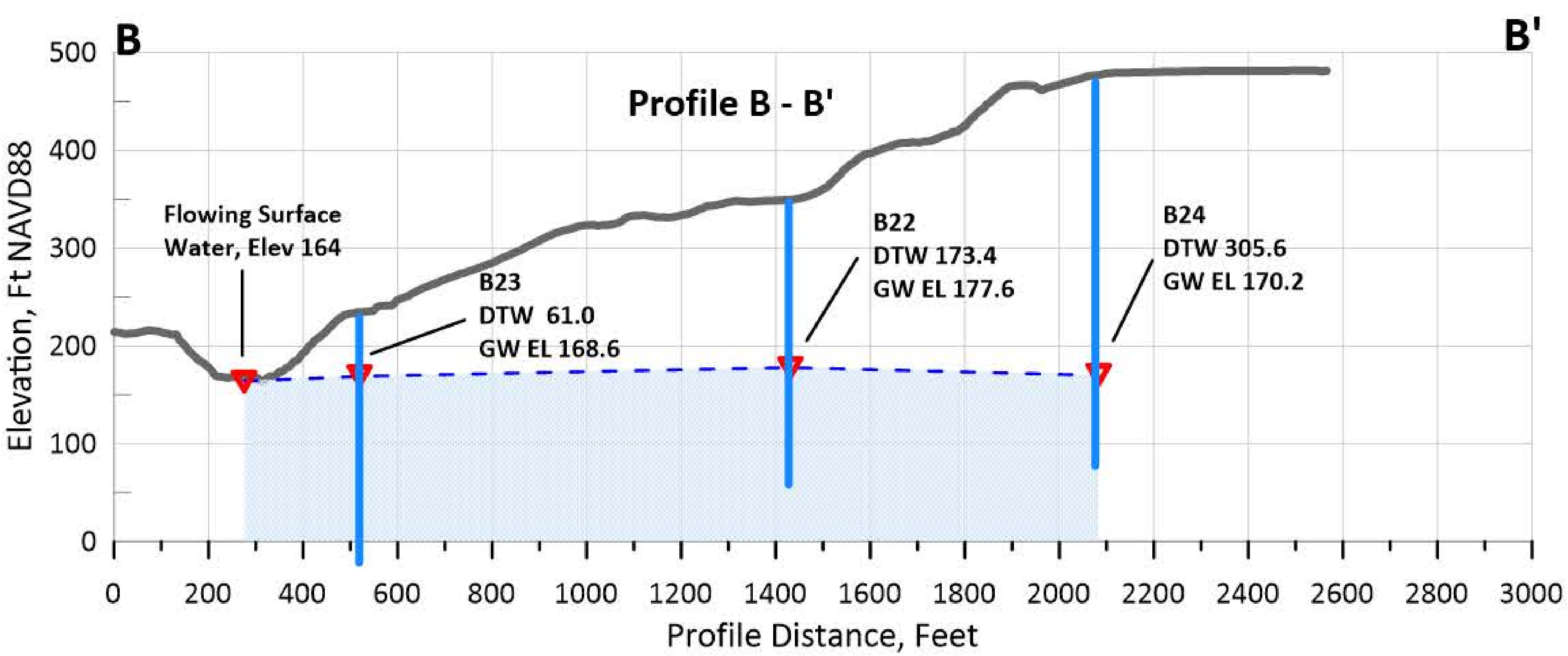




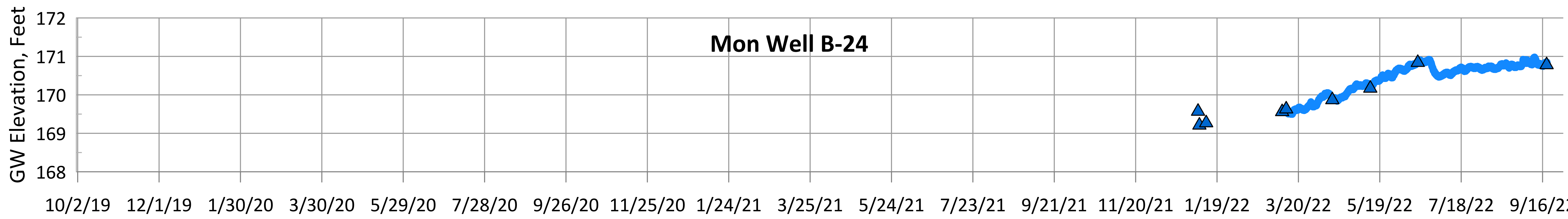
NOTES:

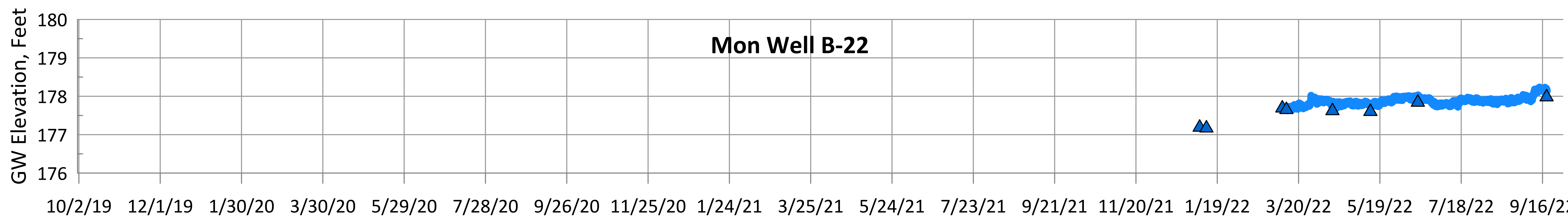
1. Groundwater levels in wells measured 5/12/2022.

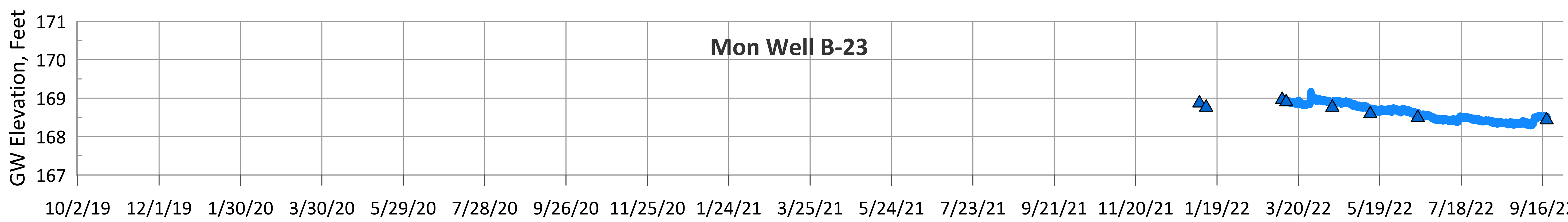
2. Topography derived from 2015 USGS/NOAA Lidar data.

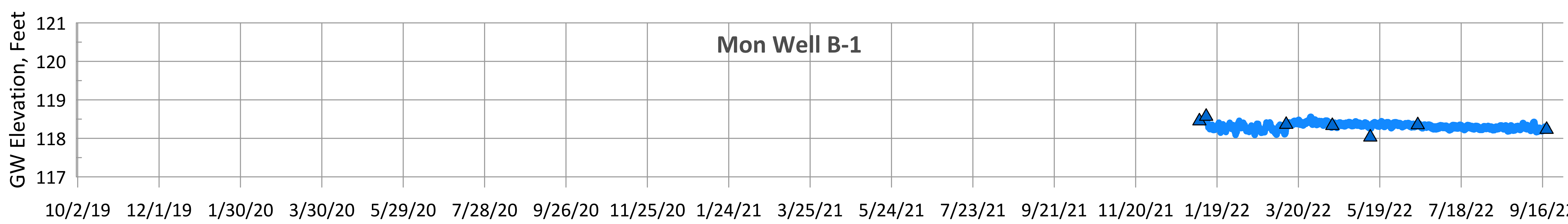
3. Vertical Scale Exaggeration is 2X Horizontal

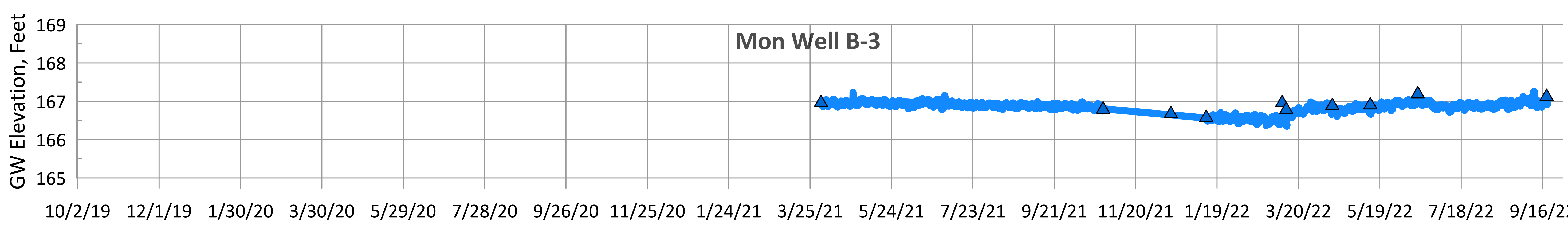
Figure 3
Monitor Well Profiles A and B
Otay Mesa, Geocon Landslide Areas A and C
San Diego County, CA

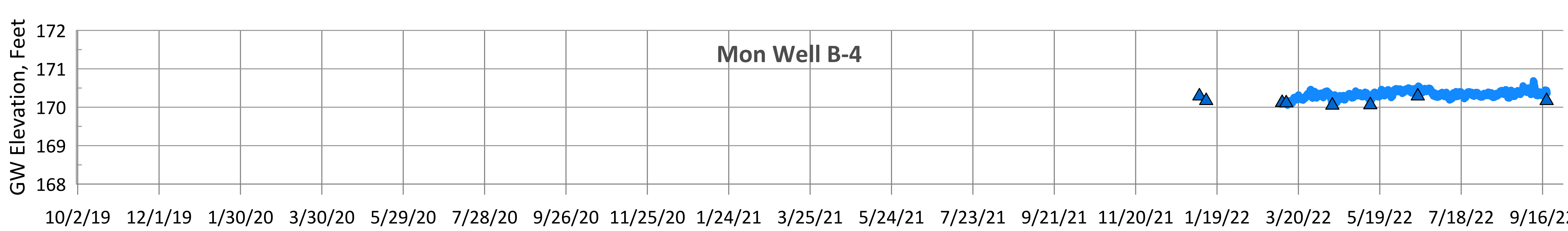


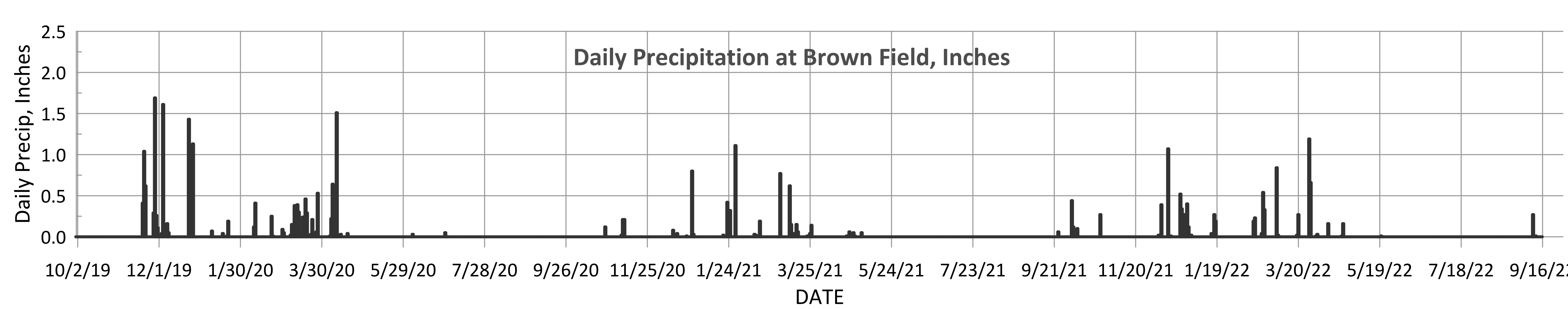












NOTES:

B-23 — Water level elevation, logged by Solinst transducer/recorder

B23 — [illegible]nual water level, measured with electric water level sounder

Daily rainfall recorded at NWS weather station 3178, Brown Field Airport

PLATE 1

Daily Rainfall 2020, 2021,2022
And Groundwater Elevations In
Geocon Exploration Core Borings
Through September 19, 2022
Otay Mesa, San Diego County, CA

UPDATED September 20, 2022

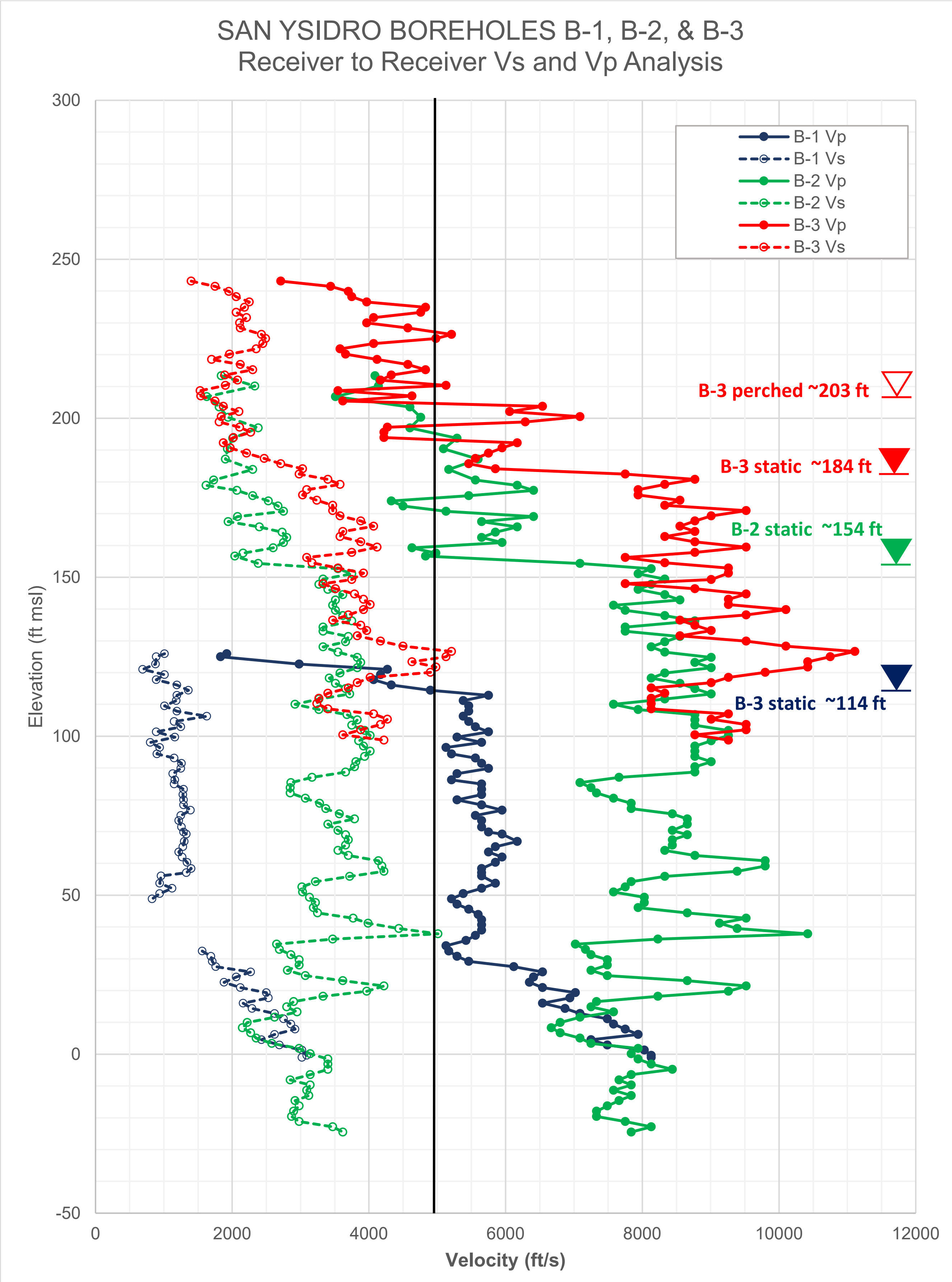
DUDEK

Appendix A

Results, Geovision Borehole Seismic Measurements in B-1, B-2, B-3

Phase I Exploration Drilling, 2021

Caterpillar Performance Handbook Seismic Velocity Rippability Chart

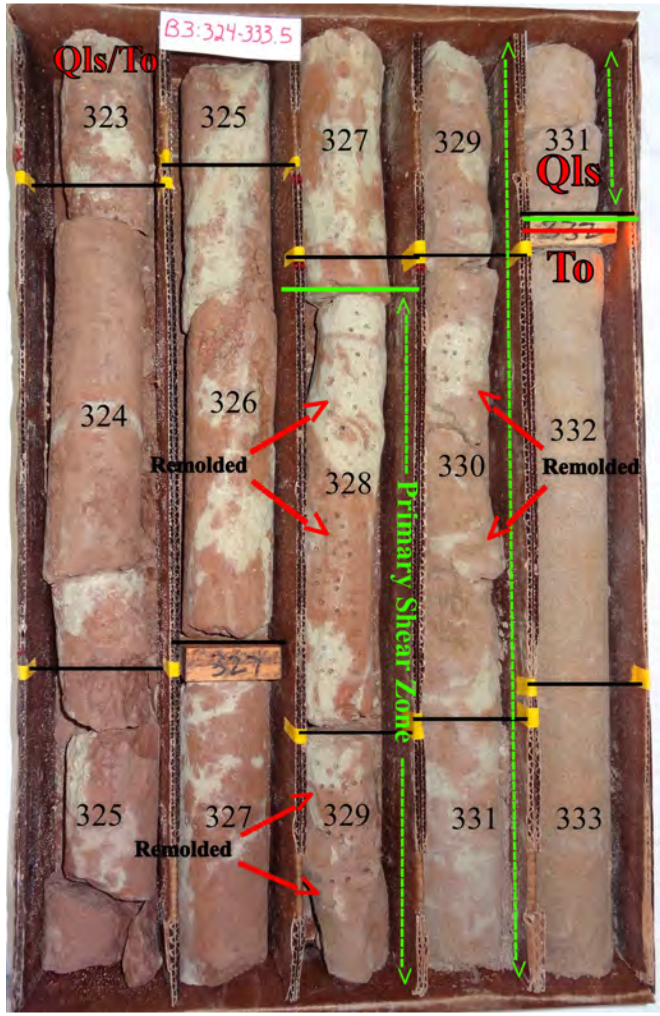

SAN YSIDRO BOREHOLES B-1, B-2, & B-3
Receiver to Receiver Vs and Vp Analysis
B-1 Vp
B-1 Vs
B-2 Vp
B-2 Vs
B-3 Vp
B-3 Vs
B-3 perched ~203 ft
B-3 static ~184 ft
B-2 static ~154 ft
B-3 static ~114 ft
Elevation (ft msl)
Velocity (ft/s)
300
250
200
150
100
50
0
-50
0
2000
4000
6000
8000
10000
12000

Appendix B

CORE PHOTOGRAPHS, EXPLORATION BOREHOLE B-3

Claystone (282’ - 396’ bgs)

Sandstone (324’ - 333.5’ bgs)



Sandstone (382’ - 392’ bgs)

Figure 7
Lithology photographs of Borehole CB-3

Note: Photographs by Geocon

APPENDIX C

SPECIFICATION SHEET, SOLINST LEVELOGGER 5

WATER LEVEL PRESSURE TRANSDUCER AND DATALOGGER

Levelogger® 5

Model 3001

The Levelogger 5 records highly accurate groundwater and surface water level and temperature measurements. It combines a pressure sensor, temperature detector, 10-year lithium battery, and datalogger, sealed within a 22 mm x 160 mm (7/8" x 6.3") stainless steel housing with a corrosion-resistant coating baked-on using polymerization technology.

The Levelogger 5 measures absolute pressure using a Hastelloy® pressure sensor, offering high resolution and an accuracy of 0.05% FS. Readings are stable in extreme pressure and temperature conditions. The Hastelloy sensor can withstand 2 times over-pressure without permanent damage. Combined with the durable coating inside and out, the Levelogger 5 has high corrosion and abrasion resistance in harsh environments.

The Levelogger 5 uses a Faraday cage design, which protects against power surges or electrical spikes caused by lightning. Its durable maintenance-free design, high accuracy and stability, make the Levelogger 5 the most reliable instrument for long-term, continuous water level recording.

Applications

- Aquifer characterization: pumping tests, slug tests, etc.
- Watershed, drainage basin and recharge monitoring
- Stream gauging, lake and reservoir management
- Harbour and tidal fluctuation measurement
- Wetlands and stormwater run-off monitoring
- Water supply and tank level measurement
- Mine water and landfill leachate management
- Long-term water level monitoring in wells, surface water bodies and seawater environments

Fast communication and downloading speeds with a high speed Field Reader 5

Get Quote

Upgraded Features

- Increased stability for communication: single-eye optical interface—easier to clean, more scratch resistant
- Increased memory: 150,000 sets of data
- Stronger, more robust design: double o-ring seals for increased leakage protection
- Better thermistor sensitivity: upgraded platinum RTD
- Superior protection in harsh environments: corrosion and abrasion resistant coating—inside and out
- Enhanced Levelogger Software: improved Diagnostic Utility for more proactive user "self-tests"

Single-eye optical interface

The Levelogger 5 features a smooth, single-eye optical interface, which allows for easy cleaning and more reliable, faster communication. Using a Solinst USB device, including the new Field Reader 5, and Levelogger PC Software, programming and data downloading speeds are 57,600 bps.

Flexible Communication

Levelogger Software is streamlined, making it easy to program dataloggers, and view and compensate data in the office or the field. Data compensation is made simple; multiple data files can be barometrically compensated at once.

The Levelogger 5 App Interface on your in-field Leveloggers creates a *Bluetooth*® connection between your dataloggers and the Solinst Levelogger App on your smart device. The Solinst Readout Unit (SRU) connects to your deployed Leveloggers to display and save real-time water level readings that are automatically barometrically compensated. Also an option, the DataGrabber 5 is a field-ready USB data transfer unit.

Remote monitoring options include the LevelSender 5, a simple and compact device that fits right in a 2" well, STS Telemetry Systems, and the RRL Remote Radio Link. In addition, Levelogger 5 Series dataloggers are SDI-12 compatible.

Levelogger Setup

Programming Leveloggers is extremely intuitive. Simply connect to a PC using an Optical Reader (Desktop Reader 5 or Field Reader 5) or PC Interface Cable. Use a single screen to fill in your project information and sampling regime. Templates of settings can be saved for easy re-use.

The Levelogger time may be synchronized to the computer clock. There are options for immediate start or future start and stop times. The percentage battery life remaining and the amount of free memory are indicated on the settings screen.

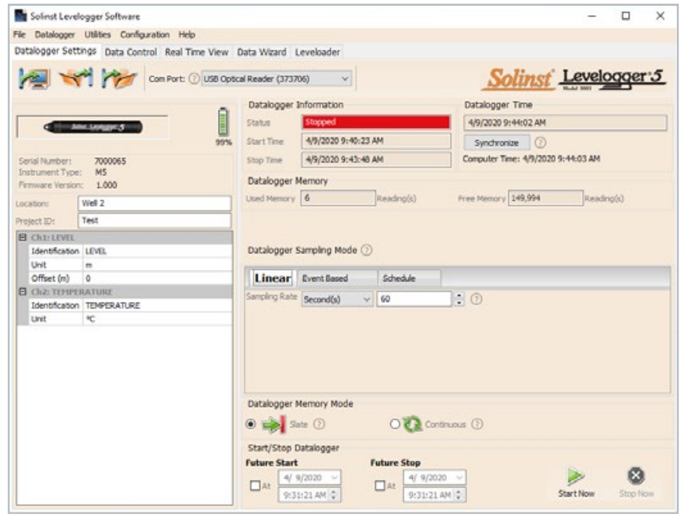
Leveloggers can also be programmed with a sampling regime and start/stop times using the Solinst Levelogger App on your smart device.

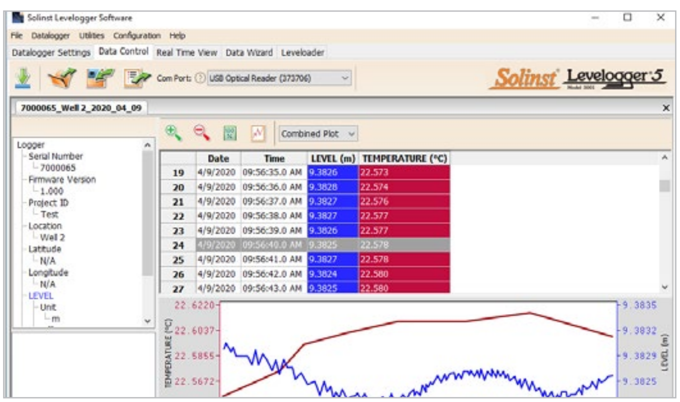
Convenient Sampling Options

Leveloggers can be programmed with linear, event-based, or a user-selectable sampling schedule. Linear sampling can be set from 1/8 second to 99 hours.

Event-based sampling can be set to record when the level changes by a selected threshold. Readings are checked at the selected time interval, but only recorded in memory if the condition has been met. A default reading is taken every 24 hours if no "event" occurs.

The Schedule option allows up to 30 schedule items, each with its own sampling rate and duration. For convenience, there is an option to automatically repeat the schedule.





Data Download, Viewing and Export

Data is downloaded to a PC with the click of a screen icon. There are multiple options for downloading data, including 'Append Data' and 'All Data'. The software also allows immediate viewing of the data in graph or table format using 'Real Time View'.

Level data is automatically compensated for temperature; the temperature data is also downloaded. Barometric compensation of Levelogger data is performed using the Data Wizard, which can also be used to input manual data adjustments, elevation, offsets, density, and adjust for Barometric efficiency. The Levelogger Software allows easy export of the data into a spreadsheet or database for further processing.

The Solinst Levelogger App also allows you to view and save real-time or logged data right on your smart device, or you can view and save the data using an SRU.

Helpful Utilities

The Diagnostic Utility can be used in case of an unexpected problem. It checks the functioning of the program, calibration, backup and logging memories, the pressure transducer, temperature sensor and battery voltage, as well as enabling a complete Memory Dump, if required. A firmware upgrade will be available from time to time, to allow upgrading of the Levelogger 5, as new features are added.

Levelogger 5 App Interface

The Levelogger 5 App Interface uses *Bluetooth*® technology to connect your Levelogger to your smart device. With the Solinst Levelogger App, you can download data, view real-time data, and program your Leveloggers. Data can be e-mailed from your smart device directly to your office (see Model 3001 Levelogger 5 App Interface data sheets).

Download on the App Store

GET IT ON Google play

Standard Cable Deployment

Leveloggers may be suspended on a stainless steel wireline or Kevlar® cord. This is a very inexpensive method of deployment, and if in a well, allows the Levelogger to be easily locked out of sight and inaccessible. Solinst offers wireline and cord assemblies in a variety of lengths.

Solinst 3001 Well Cap Assembly

The 2" Locking Well Caps are designed for both standard and Direct Read Cable deployment options.

The well cap has a convenient eyelet for suspending Leveloggers using wireline or Kevlar cord. The Well Cap insert has two openings to accommodate direct read cables for both a Levelogger and Barologger. Adaptors are available to fit 4" wells.

The cap is vented to equalize atmospheric pressure in the well. It slips over the casing, and can be secured using a lock with a 9.5 mm (3/8") shackle diameter.

Levelogger 2" Locking Well Cap Installations (see Well Caps data sheet for more details)

L5 Direct Read Cables

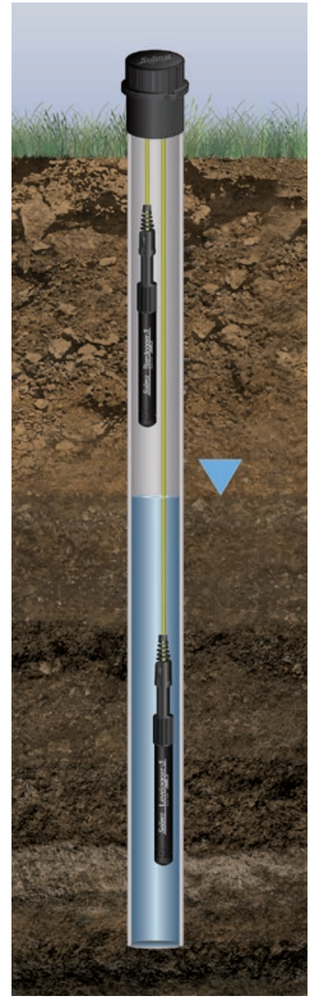
When it is desired to get real-time data and communicate with Leveloggers without removal from the water, they can be deployed using L5 Direct Read Cables. This allows viewing of data, downloading, and programming in the field using a portable PC, or Solinst Levelogger 5 App Interface. You can view and save data to an SRU, or just download data with a DataGrabber 5.

Leveloggers can be connected to an SDI-12 datalogger using the Solinst SDI-12 Interface Cable attached to a L5 Direct Read Cable.

Cable Specifications

L5 Direct Read Cables are available for attachment to any Levelogger in lengths up to 1500 ft. The 3.175 mm dia. (1/8") coaxial cable has an outer polyurethane jacket for strength and durability. The stranded stainless steel conductor gives non-stretch accuracy.

Barologger 5 and Levelogger 5 installed in Well Using L5 Direct Read Cables



Levelogger 5 Specifications

Level Sensor:	Piezoresistive Silicon with Hastelloy Sensor
Accuracy:	± 0.05% FS (Barologger 5: ± 0.05 kPa)
Stability of Readings:	Superior, low noise
Resolution:	0.002% FS to 0.0006% FS
Units of Measure:	m, cm, ft., psi, kPa, bar, ºC. ºF (Barologger 5: psi, kPa, mbar, ºC, ºF)
Normalization:	Automatic Temperature Compensation
Temp. Comp. Range:	0º to 50ºC (Barologger 5: -10 to +50ºC)
Temperature Sensor:	Platinum Resistance Temperature Detector (RTD)
Temp. Sensor Accuracy:	± 0.05ºC
Temp. Sensor Resolution:	0.003°C
Battery Life:	10 Years – based on 1 reading/minute
Clock Accuracy (typical):	± 1 minute/year (-20ºC to 80ºC)
Operating Temperature:	-20ºC to 80ºC
Maximum # Readings:	150,000 sets of readings
Memory Mode:	Slate and Continuous
Communication:	Optical high-speed: USB, SDI-12 57,600 bps with USB
Size:	22 mm x 160 mm (7/8" x 6.3")
Weight:	146 grams (5.2 oz)
Corrosion Resistance:	Baked-on coating using polymerization technology (inside and out)
Other Wetted Materials:	Delrin®, Viton®, 316L stainless steel, Hastelloy, PFAS-free PTFE coating
Sampling Modes:	Linear, Event & User-Selectable with Repeat Mode, Future Start, Future Stop, Real-Time View
Measurement Rates:	1/8 sec to 99 hrs
Barometric Compensation:	Software Wizard and one Barologger 5 in local area (approx. 30 km/20 miles radius)

Models	Full Scale (FS)	Accuracy	Resolution
Barologger	Air only	± 0.05 kPa	0.002% FS
M5	5 m (16.4 ft.)	± 0.3 cm (0.010 ft.)	0.001% FS
M10	10 m (32.8 ft.)	± 0.5 cm (0.016 ft.)	0.0006% FS
M20	20 m (65.6 ft.)	± 1 cm (0.032 ft.)	0.0006% FS
M30	30 m (98.4 ft.)	± 1.5 cm (0.064 ft.)	0.0006% FS
M100	100 m (328.1 ft.)	± 5 cm (0.164 ft.)	0.0006% FS
M200	200 m (656.2 ft.)	± 10 cm (0.328 ft.)	0.0006% FS

Low Cost Datalogging: See Levelogger 5 Junior data sheet.
Vented Dataloggers: See LevelVent 5 & AquaVent 5 data sheets.
Conductivity Datalogging: See Levelogger 5 LTC data sheet.

® Delrin and Viton are registered trademarks of DuPont Corp.

DataGrabber 5

The DataGrabber 5 is a field-ready data transfer device that allows you to copy data from a Levelogger onto a USB flash key (Dual USB & USB-C key provided).The DataGrabber 5 is compact and very easy to transport. It connects to the top end of a Levelogger's Direct Read Cable, or directly to a Levelogger using an adaptor. One push-button is used to download all of the data in a Levelogger's memory to a USB device.

Solinst Readout Unit (SRU)

Connect an SRU to an in-field Levelogger via an L5 Direct Read Cable or L5 Threaded or Slip Fit Adaptor to display instant water level readings, Levelogger status, save a real-time logging session, and download data to the SRU memory.

LevelSender 5 Telemetry

The LevelSender 5 is a simple, low cost telemetry system designed to send data from Leveloggers in the field, to your smart device and PC database via cellular communication.

Initial set up is done through a user-friendly software wizard at the Home Station. There is two-way communication between the LevelSender 5 and Home Station, allowing remote updates.

Each LevelSender 5 device has a single port to connect one Levelogger with an optional splitter that allows the connection of two.

LevelSender 5 stations are compact in design, which allows them to be discreetly installed inside a 2" (50 mm) well (see Model 9500 data sheet).

STS Telemetry

STS Telemetry provides an efficient method to send Levelogger data from the field to your desktop. Cellular communication options give the flexibility to suit any project. STS Systems are designed to save costs by enabling the self-management of data. Alarm notification, remote firmware upgrades and diagnostic reporting make system maintenance simple (see Model 9100 data sheet).

RRL Remote Radio Link

The RRL Remote Radio Link is ideal for closed-loop, short range applications up to 30 km (20 miles). The RRL can be linked to an STS telemetry station to change from a closed-loop telemetry system to one which can be accessed from anywhere through internet connectivity. (see Model 9200 data sheet).