



NorthMet Site Wetland Hydrology Monitoring Report Summary 2005-2016

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Poly Met Mining, Inc.

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NorthMet Site Wetland Hydrology Monitoring Report
Summary 2005-2016
NorthMet Project

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1.0 Executive Summary

- This report was submitted to the U.S. Army Corps of Engineers (USACE) and the Minnesota Department of Natural Resources in February 2017. It is intended to meet the reporting requirements for baseline wetland hydrology monitoring for the Poly Met Mining, Inc. (PolyMet) NorthMet Project (Project) (Large Figure 1). The Project includes three areas – the Mine Site, Transportation and Utility Corridors, and Plant Site (Large Figure 2).
- The wetland hydrology monitoring study followed the USACE-approved protocols described in the *Wetland Hydrology Study Plan* (Reference (1)), *Addendum to Wetland Hydrology Monitoring Plan* (Reference (2)) and *Addendum to Wetland Hydrology Monitoring Plan* (Reference (3), Reference (4)).
- Data from the first (2005) and second (2006) years of monitoring at the Mine Site were presented in the *Preliminary Wetland Hydrology Study Reports* (Reference (5) and Reference (6)). Data from the third (2007), fourth (2008), and fifth (2009) years of wetland hydrology monitoring at the Mine Site were presented in the *2007-2009 Wetland Hydrology Monitoring Report* (Reference (7)).
- This report presents data for the sixth through twelfth (2010-2016) years of wetland hydrology monitoring in the three Project areas. In addition, cumulative data is presented for the 12 years of wetland hydrology monitoring (2005-2016) which includes water level, precipitation, and climate data.
- At the Mine Site, the monitoring was initiated in 2005 and 2006 with the installation of 19 hydrology monitoring wells, with a partial year of data collected in 2005. Data was collected at these locations from 2005-2007 using four recording wells (with paired manual wells) and the remainder of the wetland locations were monitored using manual wells. In 2008, 13 recording wells were installed at the wetland locations with existing manual wells, wells were installed at four new monitoring locations, including two reference wetlands. Water levels were recorded at four hour intervals in the recording wells and once per month in the manual wells during the monitoring period. In 2008, hydrology monitoring was conducted with 21 recording wells and 22 manual wells. At the end of the 2009 monitoring period, two wells were removed from the study because they were determined to be in areas that will be directly impacted by the Project. Therefore, at the end of 2009, there were 20 manual wells and 19 recording wells in the study. The recording well data was generally collected throughout the entire 2005-2009 growing seasons (May 9-October 6).
- At the Mine Site, at the beginning of 2010, wells were installed at two new wetland locations in areas that will not be directly impacted by the Project. From 2010-2013, hydrology monitoring was conducted with 21 recording wells and 22 manual wells. Water levels were recorded at either two or four hour intervals in the recording wells and once per month in the manual wells during the monitoring period. Documentation is presented in this report for wetland hydrology monitoring during 2010 through 2013 for these wetland locations. The recording well data was

generally collected throughout the entire 2010-2013 growing seasons (May 9-October 6) for most locations.

- At the Plant Site, at the beginning of 2010, eight wetland hydrology monitoring wells were installed in new locations around the northern perimeter of the Plant Site. From 2010 through 2013, there were a total of 8 monitoring locations around the Plant Site. Hydrology monitoring was conducted with eight recording wells and eight manual wells. One of the eight monitoring locations was in a reference wetland. Water levels were recorded at either two or four hour intervals in the recording wells and once per month in the manual wells during the monitoring period. Documentation is presented in this report for the first (2010) through third (2013) year of wetland hydrology monitoring for these wetland locations. The recording well data was collected throughout the 2010-2013 growing seasons (May 9-October 6) for most locations.
- At the Mine Site area, in late June and early July 2014, 22 wetland hydrology monitoring wells were installed in new locations. Two of the new monitoring locations at the Mine Site included reference wetlands. From 2014 through 2016, there were a total of 43 monitoring locations around the Mine Site. Wetland locations were monitoring using recording wells. Water levels were recorded at either one or two hour intervals in the recording wells and measured 2 to 3 times manually during the monitoring period. Documentation is presented in this report for the first (2014) through third (2016) year of wetland hydrology monitoring for these wetland locations. Three of the 43 monitoring locations are in reference wetlands.
- At the Transportation and Utility Corridors area, in late June and early July 2014, three hydrology monitoring wells were installed in new locations. From 2014 through 2016, there were a total of three monitoring locations around the Transportation and Utility Corridors. Wetland locations were monitoring using recording wells. Water levels were recorded at either one or two hour intervals in the recording wells and measured 2 to 3 times manually during the monitoring period. Documentation is presented in this report for the first (2014) through third (2016) year of wetland hydrology monitoring for these wetland locations. The three reference wetlands installed at the Mine Site area are also used for the Transportation and Utility Corridors area.
- At the Plant Site area, in late June and early July 2014, seven wetland hydrology monitoring wells were installed in new locations. One new monitoring location at the Plant Site included a reference wetland. From 2014 through 2016, there were a total of 15 monitoring locations around the Plant Site. Wetland locations were monitoring using recording wells. Water levels were recorded at either one or two hour intervals in the recording wells and measured 2 to 3 times manually during the monitoring period. Documentation is presented in this report for the first (2014) through third (2016) year of wetland hydrology monitoring for these wetland locations. Two of the 15 monitoring locations are in reference wetlands.
- Frozen or inundated conditions prevented installation of the dataloggers for some of the recording wells prior to the start of the growing season in 2005-2016. Wells that were installed after the start of the growing season included Wells 1, 4, 7, and 12 in 2007; Wells 1, 2, 11, 21, and Ref1 in 2009; Wells 11, 13, and 16 in 2010; Wells TB1, 13, 23, and Ref1 in 2011; Wells 11 and Ref1

in 2012; Wells 11, 13, and Ref1 in 2013; Wells 11 and 13 in 2014; Wells 2, 10, 11, 12, 13, 14, 21, and Ref1 in 2015; and Wells TB9, 11, 21, 29, 45, and Ref1 in 2016.

- During the past twelve (2005-2016) water years (October 1-September 30), the annual precipitation was within or below the normal range six of 12 years. Annual precipitation was within the normal range during 2010, 2014, and 2015; below the normal range in 2006, 2009, and 2011; and above the normal range in 2005, 2007, 2008, 2012, 2013, and 2016. Daily and monthly precipitation data were compared to WETS precipitation statistics from the National Weather Station in Babbitt, MN to determine climatic normalcy.
- Precipitation during the growing season influences the number of hydroperiods and length of the cumulative hydroperiod for each monitoring location (not including reference wetlands). For all wetlands (2005-2016), nearly 65% of the monitoring years consisted of cumulative hydroperiods that totaled 90 to 100% of each growing season. The minimum and maximum water level fluctuations during the growing season for all years (2006-2016) were 4.5 inches (Well TB12, coniferous swamp) and 45.6 inches (Well TB1, sedge meadow), respectively. The average annual water level fluctuation for all wells (not including reference wetlands) was 22.9 inches (2006-2016).
- For all reference wetlands (2005-2016), nearly 73% of the monitoring years consisted of cumulative hydroperiods that totaled 90 to 100% of each growing season. The minimum and maximum water level fluctuations during the growing season for all years (2006-2016) were 16.5 inches (Well RefTB1, coniferous swamp) and 26.2 inches (Well Ref2, alder thicket), respectively. The average annual water level fluctuation for all reference wetlands was 19.9 inches (2006-2016).
- The 2005-2016 water level data show the presence of wetland hydrology in all monitored wetlands, except Wells 44 and 46 at the Mine Site. These wells are installed in wetlands that have a bouldery substrate which made it difficult to install the well deep enough to record hydrology. However, based on the presence of hydrophytic vegetation and hydric soils, these areas should be classified as wetlands. For the rest of the 59 monitoring well locations, the water table within the wetlands was within 12 inches of the ground surface for at least one period of more than 14 consecutive days during the growing season in most years, which meets the minimum technical standard for wetland hydrology (Reference (8)).

2.0 Objectives

On behalf of PolyMet, Barr is submitting documentation of the sixth through twelfth years (2010-2016) of wetland hydrology monitoring at the Mine Site, first through third years (2014-2016) of wetland hydrology monitoring at the Transportation and Utility Corridors, and the first through seventh years (2010-2016) of wetland hydrology monitoring at the Plant Site (Large Figure 1 and Large Figure 2). The documentation includes water level, precipitation, and climate data for the Project.

The data from the first and second years (2005-2006) of monitoring at the Mine Site were presented in the *Preliminary Wetland Hydrology Study Reports* (Barr, 2006a and 2006b). The data from the third, fourth, and fifth years (2007-2009) of monitoring at the Mine Site were presented in the *2007-2009 Wetland Hydrology Monitoring Report* (Barr, 2010). The monitoring study has primarily followed the protocols described in the *Wetland Hydrology Study Plan* (Barr, 2005), *Addendum to Wetland Hydrology Monitoring Plan* (Barr, 2008) and *Addendum to Wetland Hydrology Monitoring Plan* (Barr, 2010).

The objectives of the hydrology monitoring study are to:

- Provide a better understanding of the wetland hydrology at the Mine Site, Transportation and Utility Corridors, and Plant Site.
- Collect baseline hydrology data to assess the effect of the Project on wetland hydrology.

3.0 Wetland Hydrology and Climatic Criteria

3.1 Wetland Hydrology Criteria

The minimum technical standard for an area to meet wetland hydrology criteria, in accordance with the *U.S. Army Corps of Engineers 1987 Wetland Delineation Manual* (Reference (9)) and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region* (*Regional Supplement*, Reference (10)), is that inundation or the water table be present within 12 inches of the ground surface (herein referred to as “above the wetland threshold”) for at least 14 consecutive days during the growing season in most years (at least five of ten years). The time period during which the water table is above the wetland threshold for at least 14 consecutive days is referred to as the “hydroperiod” for each wetland monitoring location. The cumulative hydroperiod is the total number of days within a growing season when the water level is within the wetland threshold, including only those periods with at least 14 consecutive days.

4.0 Methods

4.1 Well Construction and Installation

Recording monitoring wells were installed to provide a continuous measurement of water levels during the monitoring periods. The recording wells installed at the Mine Site and Plant Site in 2005-2010 used Ecotone™ WM capacitance water level monitoring dataloggers (ecotones), manufactured by Remote Data Systems, Inc. The well casings consist of a 20-inch or 32-inch length of 1.5-inch diameter, 0.01-inch slotted PVC commercial well screen integrated below 14 inches of solid PVC riser. The well casing depths for the ecotones at installation ranged from 19.8 to 46.6 inches and 23.3 to 40.7 inches at the Mine Site and Plant Site (Large Table 1 and Large Table 2, respectively). All ecotones were programmed to start recording upon installation at the beginning of each monitoring season in 2005-2016.

The recording wells installed at the Mine Site, Transportation and Utility Corridors, and Plant Site in 2014 were Rugged Troll piezoresistive water level monitoring dataloggers, which are non-vented pressure transducers, known as a Rugged Troll® 100, manufactured by In-Situ, Inc. (in-situ troll). The pressure data are corrected for atmospheric pressure recorded by a barometric pressure data logger, known as a BaroTroll® (manufactured by In-Situ, Inc.), which were installed in Wells 43 and TB12 in 2014-2016; attached to the well cap, placed within the well casing, and were never submerged in water. The well casings consist of a 30-inch to 32-inch length of 1.5-inch diameter, 0.01-inch slotted PVC commercial well screen below 30-inch to 32-inch solid PVC risers. The well casing depths range from 18.0 to 41.1 inches, 33.8 to 38.0 inches, and 13.1 to 38.9 inches below the ground surface at the Mine Site, Transportation and Utility Corridors, and Plant Site, respectively (Large Table 1 and Large Table 2). All dataloggers were programmed to start recording upon installation at the beginning of each monitoring season in 2014-2016.

Manual wells installed in 2005-2010 consisted of a 2.5-foot length of 1.25-inch diameter, 0.01-inch slot PVC commercial well screen that was wrapped with a filter sleeve and threaded to a 2.5-foot solid PVC riser. Manual wells were only installed next to wells with an ecotone dataloggers. No manual wells were installed after 2010 because only in-situ troll dataloggers were used in the wells; these wells are also used to record a manual water level measurement.

All well casings were backfilled with native soil, which was mounded at the surface to prevent water from preferentially infiltrating the area surrounding the well. None of the wells were installed through a confining soil layer into a more permeable layer below. The soils encountered were typically peats and mucks; however sand, loam, silty loam, and sandy clay were encountered in some wells (Large Table 1 and Large Table 2). In situations where mineral soils were present at depth, wells were installed into the mineral layer below the peat. Each well was covered with a slip cap, and a breather hole was installed near the top of the riser to equalize pressure. A hole was also drilled in the cap at the bottom of each well to allow water to drain out of the well casing.

4.2 Well Placement

Wetland hydrology was monitored from 2005-2016 at the Mine Site, 2014-2016 at the Transportation and Utility Corridors, and 2010-2016 at the Plant Site using a combination of manual and recording wells (Large Figure 3 and Large Figure 4). The monitoring program was designed to provide baseline information about wetland hydrology for the Project. The following sections present the details on the monitoring program, growing season, and climatic conditions, along with the hydrology monitoring results. For detailed information on the monitoring period for each well for each year, see tables -1 (such as Table 1-1) in Appendix A (Mine Site), Appendix B (Transportation and Utility Corridors), Appendix C (Plant Site), and Appendix D (Reference Wetlands).

4.2.1 Mine Site

Hydrology monitoring wells were initially installed in 2005, with 4 recording wells and 20 manual wells, representing 20 monitoring locations (Large Table 1). Four recording wells were installed in November 2005 (Wells 1, 4, 7, and 12) and water levels were recorded through late November 2005. Twelve manual wells (Wells 4, 4A, 5, 6, 7, 8, 9, 10, 12, 13, 14, and 15) were installed around the perimeter of the Mine Site and eight manual wells (Wells 1, 2, 3, 11, 16, 17, 18, and 19) were installed within the Mine Site. All manual wells were installed on June 28-30, except Wells 10 and 11 which were installed on October 25, and water levels were measured monthly through November. In 2005, changes from the planned well locations in the *Wetland Hydrology Study Plan* (Barr, 2005) included the relocation of Well 18 to the south, the addition of two wells (Wells 4 and 5) in the northwest corner of the Mine Site, and the addition of Well 4A east of Wells 4 and 5. For detailed information on the monitoring period for each well, see tables -1 (such as Table 1-1) in Appendix A.

In 2006-2007, hydrology monitoring was conducted at the same 20 locations as in 2005, with 4 recording wells and 20 manual wells (Large Table 1). In 2006, water levels were recorded from late April through late November. In 2007, water levels were recorded from mid- to late April or mid-May through late November; frozen ground conditions required Wells 4 and 12 to be installed after the start of the growing season. At the end of the 2007 monitoring period, 2 manual wells (Wells 3 and 17) were removed from the study since it was determined they were located within areas that will be directly impacted by the Project. With the removal of these two manual wells, at the end of 2007, there were 4 recording wells and 18 manual wells located in the Mine Site area, representing 18 monitoring locations. For detailed information on the monitoring period for each well, see tables -1 (such as Table 1-1) in Appendix A.

In 2008, hydrology monitoring was conducted with 21 recording wells and 22 manual wells, representing 22 monitoring locations (Large Table 1). These locations included the same monitoring wells as at the end of the 2007 monitoring period (4 recording wells and 18 manual wells, representing 18 monitoring locations) plus the installation of 17 recording wells and 4 manual wells in 2008 (representing four new monitoring locations). In May 2008, 12 recording wells were installed near 12 existing manual wells (Wells 2, 4R, 6, 8, 10, 11, 13, 14, 15, 16, 18, and 19); recording and manual wells were installed at two new wetland locations on the Mine Site (Wells 21 and 22); recording and manual wells were installed in two reference wetlands located west of the Mine Site (Wells Ref1 and Ref2); and recording Well 1 and manual Well 1 were relocated on the Mine Site since it was determined the original location was within an area

that will be directly impacted by the Project. In June 2008, a recording well was installed near manual Well 9. Recording Well 4 was paired with manual Wells 4 and 5. Based on these changes in 2008, hydrology monitoring was conducted with 21 recording wells and 22 manual wells in the Mine Site area, representing 22 monitoring locations. In 2008, water levels were recorded from early May to late June through late November. For detailed information on the monitoring period for each well, see tables -1 (such as Table 1-1) in Appendix A.

In 2009, hydrology monitoring was conducted at the same 22 monitoring locations as in 2008, with 21 recording wells and 22 manual wells (Large Table 1). After the 2009 monitoring period, the recording and manual wells at Wells 18 and 19 were removed from the study because they were determined to be in areas that will be directly impacted by the Project. At the end of 2009, there were 19 recording wells and 20 manual wells located in the Mine Site area, representing 20 monitoring locations. In 2009, water levels were recorded from late April, late May, or late June through late October; frozen ground conditions required Well 1, 2, 11, 21, and Ref1 to be installed after the start of the growing season. For detailed information on the monitoring period for each well, see tables -1 (such as Table 1-1) in Appendix A.

In 2010, hydrology monitoring was conducted with 21 recording wells and 22 manual wells, representing 22 monitoring locations (Large Table 1). These wells included the installation of recording and manual wells at two new wetland locations in May 2010 on the Mine Site (Wells 23 and 24) in areas that will not be directly impacted by the Project. In 2010, water levels were recorded from mid-May or mid-June through late October; frozen ground conditions required Wells 11, 13, and 16 to be installed after the start of the growing season. For detailed information on the monitoring period for each well, see tables -1 (such as Table 1-1) in Appendix A.

In 2011-2013, hydrology monitoring was conducted at the same 22 monitoring locations as in 2010, with 21 recording wells and 22 manual wells (Large Table 1). In 2011, water levels were recorded from early to mid-May or early June to late October; frozen ground conditions required Wells 13 and 23 to be installed after the start of the growing season. In 2012, water levels were recorded from mid-April, mid-May, or late July through late October; frozen ground conditions required Wells 11 and Ref1 to be installed after the start of the growing season. In addition, the logger for Well 4 malfunctioned and required maintenance so was installed in late July 2012. In 2013, water levels were recorded from late May or mid-June through late October; frozen ground conditions required Wells 11, 13, and Ref1 to be installed after the start of the growing season. For detailed information on the monitoring period for each well, see tables -1 (such as Table 1-1) in Appendix A.

In 2014, hydrology monitoring was conducted with 43 recording wells and 22 manual wells, representing 44 monitoring locations (Large Table 1). These locations included the same monitoring wells as in 2010-2013 (21 recording wells and 22 manual wells) and in 2014, installation of recording wells at 22 new wetland locations in the Mine Site area. In June and July 2014, recording wells were installed at 21 new wetland locations (Wells 25-39, 43-48) in the Mine Site area and at one reference wetland located west of the Mine Site (Well Ref3; Table 1). In 2014, water levels were recorded from late May, mid- to late June, or early July through late October. Frozen ground conditions required Wells 11 and 13 to be installed after

the start of the growing season. For detailed information on the monitoring period for each well, see tables -1 (such as Table 1-1) in Appendix A.

In 2015-2016, hydrology monitoring was conducted at the same 44 monitoring locations as in 2014, with 43 recording wells and 22 manual wells (Large Table 1). In 2015, water levels were recorded from late April, mid- to late May, mid-June, or late July through late October; frozen ground conditions required Wells 2, 10, 11, 12, 13, 14, 21, and Ref1 to be installed after the start of the growing season. In 2016, water levels were recorded from late April or early or late May through mid- to late October; frozen ground conditions required Wells 11, 21, and Ref1 to be installed after the start of the growing season. For detailed information on the monitoring period for each well, see tables -1 (such as Table 1-1) in Appendix A.

Large Table 1 provides the Universal Transverse Mercator (UTM) coordinates for each monitoring well and average water depth for each year (2010-2016). Appendix A (monitoring locations) and Appendix D (reference wetlands) provide datasheets for each monitoring well (location, installation date, removal date, monitoring period, precipitation data, hydroperiods, water level fluctuations, cumulative hydrographs, and photographs from each monitoring year).

4.2.2 Transportation and Utility Corridors

Hydrology monitoring wells were initially installed in early July 2014, with three recording dataloggers, representing three monitoring locations (Wells 40, 41, and 42; Large Table 1). In 2014, water levels were recorded from early July through late October. For detailed information on the monitoring period for each well, see tables -1 (such as Table 40-1) in Appendix B.

In 2015-2016, hydrology monitoring was conducted at the same locations as in 2014, with three recording wells (Large Table 1). In 2015, water levels were recorded from mid-May through late October. In 2016, water levels were recorded from early May through late October. For detailed information on the monitoring period for each well, see tables -1 (such as Table 40-1) in Appendix B.

Large Table 1 provides the Universal Transverse Mercator (UTM) coordinates for each monitoring well and average water depth for each year (2010-2016). Appendix B (monitoring locations) and Appendix D (reference wetlands) provide datasheets for each monitoring well (location, installation date, removal date, monitoring period, precipitation data, hydroperiods, water level fluctuations, cumulative hydrographs, and photographs from each monitoring year).

4.2.3 Plant Site

Hydrology monitoring wells were initially installed in 2010, with eight recording wells and eight manual wells, representing eight monitoring locations (Large Table 2). Seven paired recording and manual wells (Wells TB1, TB2, TB3, TB4, TB5, TB6, and TB7) were installed at seven wetland locations west and north of the Plant Site on April 26 and 27, 2010. One paired recording and manual well was installed in one reference wetland located north of the Plant Site (Wells RefTB8). In 2010, water levels were recorded from late April through late October; recording wells TB1 and TB2 were re-installed on August 10 due to

instrument malfunction. For detailed information on the monitoring period for each well, see tables -1 (such as Table TB1-1) in Appendix C.

In 2011-2013, hydrology monitoring was conducted at the same eight locations as in 2010, with eight recording wells and eight manual wells (Large Table 2). In 2011, water levels were recorded from mid-May to late October. In 2012, water levels were recorded from mid-April or early June through late October. The logger for Well TB1 was inadvertently programmed to start recording data in early June 2012. In 2013, water levels were recorded from late May through late October. For detailed information on the monitoring period for each well, see tables -1 (such as Table TB1-1) in Appendix C.

In 2014, hydrology monitoring was conducted with 15 recording wells and 8 manual wells, representing 15 monitoring locations (Large Table 2). These locations included the same monitoring wells as at the end of the 2013 monitoring period (8 recording wells and eight manual wells) and in 2014, installation of recording wells at seven new wetland locations in the Plant Site area. In June and July 2014, recording wells were installed at six new wetland locations (Wells TB9-TB14; Large Table 2) in the Plant Site area; and at one reference wetland located north of the Plant Site (Well RefTB1; Large Table 2). In 2014, water levels were recorded from mid- to late May, late June, or early July through late October or early November. For detailed information on the monitoring period for each well, see tables -1 (such as Table TB1-1) in Appendix C.

In 2015-2016, hydrology monitoring was conducted at the same locations as in 2014, with 15 recording wells and 8 manual wells (Large Table 2). In 2015, water levels were recorded from late April or mid- to late May through late October. In 2016, water levels were recorded from late April, early May, or early July through mid-September (Well TB1) or mid- to late October; the water level at TB1 was too high to install the logger until early July due to beaver activity and dam building in the area. For detailed information on the monitoring period for each well, see tables -1 (such as Table TB1-1) in Appendix C.

Large Table 2 provides the Universal Transverse Mercator (UTM) coordinates for each monitoring well and average water depth for each year (2010-2016). Appendix C (monitoring locations) and Appendix D (reference wetlands) provides datasheets for each monitoring well (location, installation date, removal date, monitoring period, precipitation data, hydroperiods, water level fluctuations, cumulative hydrographs, and photographs from each monitoring year).

4.3 Water Level Recording

The data from the recording wells at the Mine Site, Transportation and Utility Corridors, and Plant Site were downloaded from the dataloggers (ecotones) once per month in 2005-2013. In 2014-2016, recording wells installed prior to 2014 were downloaded monthly during the monitoring period and recording wells installed in 2014 were downloaded from the dataloggers (in-situ trolls) once, at the end of the monitoring period (October). The 2005-2016 water level data for the wells are provided in Appendix E.

Water levels were collected at the recording wells at 1, 2, or 4 hour intervals during the monitoring period in 2010-2016. Manual water level measurements also were recorded once per month, or during site visits to download recording well data. For monitoring locations where there was no manual well, manual

measurements were recorded prior to datalogger installation in the spring and after datalogger removal in late fall.

Frost action and shrinking and swelling of peat soils can affect the elevation of the monitoring wells. Therefore, the distance from the top of the well casing to the ground surface was measured during each monitoring event to provide consistent measurement of the water level below the ground surface. The dataloggers for the recording wells were typically removed for the winter at the end of October. The casings for the recording and manual wells were left in place year-round.

4.4 Growing Season

The growing season dates are determined using the 1987 Manual methods: the starting and ending dates of the growing season are estimated using long-term temperature data, as the average first and last dates on which the air temperature drops below or rises above 28° F. In the *Regional Supplement*, the USACE provides two alternative definitions for the growing season. First, the start of the growing season can be defined based on the presence of green and growing non-evergreen vegetation, bud break, or spring emergence of native species. Second, the *Regional Supplement* defines the growing season as the period when the soil temperatures exceed 41° F (5° C) at a depth of 12 inches below the surface.

According to the Minnesota Climatology Working Group (Reference (11)) and Natural Resources Conservation Service (NRCS) WETS data (statistical climate data for determining wetland hydrology), the normal growing season for this area, based on the current climatic normal period from 1981-2010, begins on May 9 and ends on October 6 (151 days). These dates are based on climate data compiled from a network of weather observers. Temperature statistics for nearby Embarrass from 2005-2016 are shown on Large Table 3.

Monitoring was conducted during most of the growing season for the well locations. Tables ending in -1 (such as Table 1-1) in Appendix A, Appendix B, Appendix C, and Appendix D show the total days of monitoring for each year and the total number of days that were monitored during each growing season.

Native plant species were green and growing by the well installation dates in 2005-2016. Two monitoring locations had frozen ground conditions in April and/or May in five years and included Wells 11 and Ref1. The latest date a well was installed was in 2015 when Well 11 was installed in early July. Additional monitoring locations that were frozen during the early growing season included Wells 1, 2, 4, 7, 10, 12, 13, 14, 16, 21, and 23 (see Section 3.1 for details). The green native vegetation is evident in photographs of the Site indicating the beginning of the growing season for most monitoring locations (see photographs for each monitoring location in Appendix A, Appendix B, Appendix C, or Appendix D). Therefore, the long-term average growing season dates of May 9 to October 6 seems reasonable for 2006-2016 monitoring periods.

4.5 Normal Climatic Conditions

Antecedent precipitation conditions are evaluated in the context of "climatic normalcy." Climatic normalcy is defined by the WETS statistics as the middle 40% of precipitation data using the most recent normal

period of 1981-2010. To evaluate antecedent precipitation normalcy for hydrology monitoring, the rolling cumulative precipitation for the previous 30-day daily precipitation is compared to the normal range throughout the growing season using the methodology outlined by the Minnesota Board of Water and Soil Resources (Reference (12))). Precipitation data and 30-day cumulative precipitation relative to normal precipitation levels are also shown on the hydrographs on figures ending in -2 (if data was only recorded from 2014-2016; such as Figure 1-2) and -2a and -2b (if data was recorded prior to 2014; such as Figure 1-2a and Figure 1-2b) for each well in Appendix A, Appendix B, Appendix C, and Appendix D.

Annual water-year precipitation is also evaluated to understand the longer-term context. The table ending in -2 (such as Table 1-2) on the datasheet for each monitoring well in Appendix A, Appendix B, Appendix C, and Appendix D provides the precipitation during each water year (e.g., in 2016 the water year is defined as October 1, 2015 through September 30, 2016) and growing season.

Daily and monthly precipitation data for 2005-2016 were obtained from the Minnesota State Climatology Office High Density Network (Reference (13)) from the closest available station (Babbitt Weather Station 210387, Township 60, Range 13W, Section 1), which is located approximately 6 miles north of the Project. Historic precipitation data and WETS statistics are based on data from the same location (Large Table 4). Data for water years 2010 through 2016 are provide below; data from 2005 through 2009 is provided in the *2007-2009 Wetland Hydrology Monitoring Report* (Reference (7))

4.5.1 Water Year 2010

The data show that the 2010 water year was within the normal range for annual precipitation (Large Table 4). During the 2010 water year, precipitation was within the normal range for 5 months, above the normal range for 3 months, and below the normal range for 4 months. During the growing season in 2010, precipitation was within the normal range in June and September; above the normal range in July and August; and below the normal range in May. For the 2010 growing season, the 30-day cumulative precipitation data were within the normal range for about 68% (102 days) of the growing season (Large Table 5).

4.5.2 Water Year 2011

The data show that the 2011 water year was below the normal range for annual precipitation (Large Table 4). During the 2011 water year, precipitation was within the normal range for 5 months, above the normal range for 3 months, and below the normal range for 4 months. During the growing season in 2011, precipitation was within the normal range in May, June, and August; and below the normal range in July and September. For the 2011 growing season, the 30-day cumulative precipitation data were within the normal range for about 77% (116 days) of the growing season (Large Table 5).

4.5.3 Water Year 2012

The data show that the 2012 water year was above the normal range for annual precipitation (Large Table 4). During the 2012 water year, precipitation was within the normal range for 1 month, above the normal range for 6 months, and below the normal range for 5 months. During the growing season in 2012, precipitation was above the normal range in May, June, and July; and below the normal range in

August and September. For the 2012 growing season, the 30-day cumulative precipitation data were within the normal range for about 23% (35 days) of the growing season (Large Table 5).

4.5.4 Water Year 2013

The data show that the 2013 water year was above the normal range for annual precipitation (Large Table 4). During the 2013 water year, precipitation was within the normal range for 4 months, above the normal range for 6 months, and below the normal range for 2 months. During the growing season in 2013, precipitation was within the normal range in May; above the normal range in June and July; and below the normal range in August and September. For the 2013 growing season, the 30-day cumulative precipitation data were within the normal range for about 72% (108 days) of the growing season (Large Table 5).

4.5.5 Water Year 2014

The data show that the 2014 water year was within the normal range for annual precipitation (Large Table 4). During the 2014 water year, precipitation was within the normal range for 7 months, above the normal range for 4 months, and below the normal range for 1 month. During the growing season in 2014, precipitation was within the normal range in July and August; above the normal range in May and June; and below the normal range in September. For the 2014 growing season, the 30-day cumulative precipitation data were within the normal range for about 60% (90 days) of the growing season (Large Table 5).

4.5.6 Water Year 2015

The data show that the 2015 water year was within the normal range for annual precipitation (Large Table 4). During the 2015 water year, precipitation was within the normal range for 8 months, above the normal range for 1 month, and below the normal range for 3 months. During the growing season in 2015, precipitation was within the normal range in June, August, and September; above the normal range in May; and below the normal range in July. For the 2015 growing season, the 30-day cumulative precipitation data were within the normal range for about 56% (84 days) of the growing season (Large Table 5).

4.5.7 Water Year 2016

The data show that the 2016 water year was above the normal range for annual precipitation (Large Table 4). During the 2016 water year, precipitation was within the normal range for 3 months, above the normal range for 7 months, and below the normal range for 2 months. During the growing season in 2016, precipitation was never within the normal range; above the normal range in June, August, and September; and below the normal range in May and July. For the 2016 growing season, the 30-day cumulative precipitation data were within the normal range for about 40% (61 days) of the growing season (Large Table 5).

5.0 Monitoring Schedule

Wetland hydrology monitoring typically started between April 17 and May 23 in 2006-2016 (see tables ending in -1 (such as Table 1-1) in Appendix A, Appendix B, Appendix C, and Appendix D). The exceptions were the monitoring wells that were installed in late June and early July 2014 at the Mine Site, Transportation and Utility Corridors, and Plant Site (see Section 7.1.1, Section 7.1.2, and Section 7.1.3 for more details). In addition, some wells were installed after May 23 due to frozen ground conditions or datalogger issues (see Section 4.0 for more details).

After installation, water levels were recorded at one, two, or four hour intervals for the recording wells and the data were typically downloaded from the ecotones once every month throughout each monitoring period and from the in-situ trolls at the end of the monitoring period. Water levels in the manual wells were recorded during periodic site visits in all years.

The dataloggers (ecotone or in-situ troll) were removed from each well after the end of the statistical growing season (October 6). At the Mine Site, the monitoring ended between October 11 and November 29 in 2006-2016 (see Section 7.1.1 for more details). The monitoring period for each well is provided in the tables ending in -1 (such as Table 1-1) in Appendix A and Appendix D. At the Transportation and Utility Corridors, the monitoring ended between October 11 and October 29 in 2010-2016 (see Section 7.1.2 for more details) The monitoring period for each well is provided in the tables ending in -1 (such as Table 40-1) in Appendix B and Appendix D. At the Plant Site, the monitoring ended between October 3 and October 30 in 2010-2016; the only exceptions were Well TB1 in 2016 which was inadvertently programmed to stop recording data on September 19 and Well TB13 in 2014, which was removed on November 6 (see Section 7.1.3 for more details) The monitoring period for each well is provided in the tables ending in -1 (such as Table TB1-1) in Appendix C and Appendix D.

6.0 Site Characteristics

This section provides a discussion of the general hydrology and soil characteristics the Mine Site, Transportation and Utility Corridors, and Plant Site.

6.1 Mine Site

6.1.1 General Hydrology

The Mine Site is located in the Upper Partridge River watershed (includes minor watersheds #3155 and #3146) in the St. Louis River Watershed (major watershed #3). The Partridge River is a tributary to the St. Louis River, which is located within the Lake Superior Basin.

The Partridge River is located to the north, east, and south of the Mine Site (Large Figure 2 and Large Figure 3). The proposed Mine Site is located on the north side of the Dunka Road. There is a surface drainage divide oriented generally from southwest to northeast near the northern border of the site (Large Figure 3). The majority of the Mine Site (80%) drains south through culverts under Dunka Road and the adjacent rail line, into the Partridge River through extensive wetland complexes. The remaining 20% of the Mine Site generally drains north into the One Hundred Mile Swamp and associated wetlands along the Partridge River or northeast to the Partridge River. These wetlands form the headwaters of the Partridge River, which meanders around the east end of the Mine Site before turning southwest.

The hydrogeologic setting of the Partridge River watershed consists of a thin veneer of heterogeneous unconsolidated deposits (glacial till) underlain by fractured bedrock (Duluth Complex in most of the Mine Site area and Virginia Formation in the northern portion of the Mine Site area). Across the Mine Site area, saturated conditions exist within the unconsolidated deposits and the depth to groundwater is typically less than 10 feet. The water table is generally a subdued replica of the land surface, with groundwater divides in the area expected to roughly coincide with surface water divides. Wetlands are common, covering approximately 43% of the Mine Site.

6.1.2 Topography

Surface elevations on the Mine Site north of Dunka Road range from 1630 feet above mean sea level (MSL) to 1650 feet MSL in the northern part to 1580 feet MSL along the Dunka Road. Ground elevations south of the Dunka Road range from 1580 feet MSL along Dunka Road to 1540 feet MSL along the Partridge River.

6.1.3 Soil Characteristics

The soils on the Mine Site have formed from loamy drift and the underlying dense Rainy Lobe Till of the Late Wisconsinan glaciation (Natural Resources Conservation Service [NRCS] Reference (14)). The dense underlying till acts as an aquitard that restricts downward water flow, therefore, most of the mineral soils in the depressional and flat-bottom areas of the landscape experience perched water tables during late spring and early summer at depths up to 1 to 3 feet. Mineral soil series present at the Mine Site include

the very poorly-drained Bugcreek, with the more well-drained soils including Babbitt, Eaglesnest, Eveleth, and Wahlsten.

The majority of the extensive wetland complexes on and adjacent to the Mine Site are mapped by the U.S. Forest Service (Appendix B to Reference (15))) as ELT 6-LPN-Lowland Organic Acid to Neutral, which is equivalent to the Rifle mucky peat and Greenwood peat mapping units in the NRCS soil classification system (Large Figure 5). These soils are typically characterized by having fibric peat in the upper horizons underlain by mucky peat to a depth of up to 5 feet or more.

The upland soils at the Mine Site typically have high infiltration rates with little runoff and are usually found on bedrock-controlled uplands. The bedrock surface is variable across the Mine Site with bedrock exposed at the surface in some locations. The soil/till thickness is also variable ranging from a thin layer to up to 60 feet thick over the bedrock.

6.2 Transportation and Utility Corridors

6.2.1 General Site Hydrology

The Transportation and Utility Corridors are located in the Upper Partridge River watershed (includes minor watersheds #3155 and #3146), Wyman Creek watershed (minor watershed #3148), and the Second Creek watershed (minor watershed #3150) in the St. Louis River Watershed (major watershed #3). Wetlegs, Longnose, and Wyman creeks are tributaries to the Partridge River, which is a tributary to the St. Louis River, located within the Lake Superior Basin.

The existing corridor includes Dunka Road, the railroad embankment (with tracks) which parallel a portion of Dunka Road, and a transmission line corridor that also parallels a portion of Dunka Road. There are culverts through Dunka Road and the railroad embankment. The majority of the area drains south through culverts under Dunka Road and on to the Partridge River through extensive wetland complexes. Unnamed (or West Pit Creek), Wetlegs, Longnose, and Wyman creeks cross the Transportation and Utility Corridors from north to south through culverts (Large Figure 2 and Large Figure 4).

6.2.2 Topography

Surface elevations along the Transportation and Utility Corridors range from 1580 feet MSL along the Dunka Road near the Mine Site to 1690 feet MSL along Dunka Road near the Plant Site. Ground elevations north of Dunka Road are typically higher than south of Dunka Road, so surface water flows south to the Partridge River.

6.2.3 Soil Characteristics

Five St. Louis County NRCS soil map units comprise over 70% of Dunka Road and the Utility Corridor; these map units include: the Eaglesnest-Babbitt complex (F12B, partially hydric), Pits, iron mine (1049, hydric status is unknown), Eaglesnest-Wahlsten complex (F2B, hydric status is unknown), Dumps, iron mine (1048, hydric status is unknown), Udorthents, loamy (1003B, hydric status is unknown), and Babbitt boulder-Aquepts rubbly complex (F13A, partially hydric) (Large Figure 5). Approximately 40% of the soils

mapped within the Colby Lake Pipeline Corridor are hydric or partially hydric; the hydric soil status is unknown for approximately 54% of the corridor.

The St. Louis County NRCS mapped two soil types in the Railroad Connection Corridor. The Udorthents, loamy NRCS soil map unit (1003B, hydric status is unknown) represents approximately 79% of the Railroad Connection Corridor and the Pits, iron mine soil map unit (1049, hydric status is unknown) represents the remaining 21% of the Railroad Connection Corridor (Large Figure 5).

6.3 Plant Site

6.3.1 General Site Hydrology

The Plant Site is located in the Embarrass River watershed (minor watershed #3158), Sabin Lake watershed (minor watershed #3153), and the Second Creek watershed (minor watershed #3150) in the St. Louis River Watershed (major watershed #3). Tributaries to the Embarrass River, located between the Plant Site and the Embarrass River, include (east to west): Unnamed (or Mud Lake) Creek, Trimble Creek, and Unnamed Creek. In addition, Second Creek is a tributary to the Partridge River and is located south of the Plant Site (Large Figure 2 and Large Figure 4).

Under existing conditions, groundwater and surface water seepage, from the LTVSMC tailings basin, drains north towards Unnamed (Mud Lake) Creek, northwest to Trimble Creek, and west to Unnamed Creek. Runoff from the outer slopes of the LTVSMC tailings basin is tributary to the surrounding creeks; precipitation falling within the LTVSMC tailings basin is contained in the basin. A small portion of the Plant Site drains south to Second Creek.

The hydrogeologic setting of the Embarrass River watershed is broadly similar to the Partridge River watershed, although the unconsolidated deposits are generally thicker and more continuous north of the Plant Site area along the Embarrass River valley. The Plant Site is located north of the Laurentian Divide and the area is underlain by granitic rocks of the Giants Range batholith. Although these rocks may be fractured to some extent, they are expected to have significantly lower hydraulic conductivity than the bedrock units at the Mine Site. As is the case at the Mine Site, wetlands are abundant in the Plant Site and saturated conditions generally exist less than 10 feet below the ground surface.

6.3.2 Topography

The Plant Site is constructed on multiple flat terraces that are separated by steep grade changes. Surface elevations on the Plant Site range from about 1780 feet MSL in the south near the existing buildings to 1476 feet MSL at the northern toe of the LTVSMC tailings basin.

6.3.3 Soil Characteristics

The Plant Site is primarily situated on land disturbed from previous mining activities. As such, almost 80% of the soils in the Plant Site are mapped by the St. Louis County NRCS soil survey as the two disturbed soils, "Tailings Basin" map unit (1050; hydric status is unknown) and "Udorthents, loamy" map unit (1003B; hydric status is unknown) (Large Figure 5). Udorthents are areas that have been stripped and are highly

disturbed, such as cut-and-fill operations. Only 9% of the soils in the Plant Site are mapped as hydric or partially hydric; the hydric soil status is unknown for approximately 90% of the Plant Site.

7.0 Hydrology Results

7.1 Hydrology Summary for Project

The wetland hydrology monitoring data from 2005-2016 represents pre-Project baseline conditions. All monitoring locations and reference wetlands in the Project area met the criteria for wetland hydrology, with the exception of Wells 44 and 46 at the Mine Site (see Section 7.1.1).

The hydrographs in Appendix A (Mine Site), Appendix B (Transportation and Utility Corridors), and Appendix C (Plant Site) show water levels in the Project area and hydrographs in Appendix D show water levels in the reference wetlands. The longest annual, single hydroperiod for each well during the growing season (including reference wetlands) ranged from 18 to 151 days (the exceptions are Wells 44 and 46 in the Mine Site which were both zero days; see Section 7.1.1.1). For all reference wetlands, the longest annual, single hydroperiod for each well during the growing season ranged from 43 to 151 days. The longest annual, single hydroperiod for the monitoring wells in the Project area ranged from 13 to 236% of the reference wetlands during the 2005-2016 growing seasons (Large Table 6, Large Table 7, and Large Table 8). The reference wetlands will be used for comparison to wetlands that may be affected by the project during operations.

Precipitation data and 30-day cumulative precipitation relative to normal precipitation levels are also shown on the hydrographs on figures ending in -2 (if data was only recorded from 2014-2016; such as Figure 1-2) and x-2a and -2b (if data was recorded prior to 2014; such as Figure 1-2a and Figure 1-2b) for each well in Appendix A, Appendix B, Appendix C, and Appendix D. In addition, the table ending in -2 (such as Table 1-2) on the datasheet for each monitoring well in Appendix A provides the precipitation during each growing season and water year. The influence of precipitation on wetland hydrology is typically shown on the graphs as a sharp increase in the rising leg of the hydrograph in response to a precipitation event. In contrast, the influence of groundwater on wetland hydrology is typically shown as a gradual increase in the water table or a gradual sustained water table over longer time periods (such as weeks or months). In addition, some of the hydrographs show the influence of beaver dams in the area, causing water levels to increase steadily throughout the monitoring period.

The precipitation during the growing season influences the number of hydroperiods and length of the cumulative hydroperiod for each monitoring location. The number of hydroperiods and the total number of days when the water level was above the wetland threshold for 14 or more consecutive days (cumulative hydroperiod) is shown on the tables ending in -3 (such as Table 1-3) in Appendix A, Appendix B, Appendix C, and Appendix D. All except two monitoring wells (Wells 44 and 46) met the hydrology criteria throughout each year monitored (see Section 7.1.1). The cumulative hydroperiod(s) were 99 to 100% of the growing season for approximately half of the monitoring wells across all years. The cumulative hydroperiod(s) were 80 to 98% of the growing season for 23% of the monitoring wells across all years; 70 to 79% of the growing season for 11% of the monitoring wells across all years; and less than 70% of the growing season for 13% of the monitoring wells across all years.

For the reference wetlands, the number of hydroperiods and the cumulative hydroperiods are shown on the tables ending in -3 (such as Table Ref1-3) in Appendix D. The reference wetlands met the hydrology criteria throughout each year monitored. The cumulative hydroperiod(s) were 99 to 100% of the growing season for approximately 60% of the monitoring wells across all years. The cumulative hydroperiod(s) were 80 to 98% of the growing season for 30% of the reference wetlands across all years, and 70 to 79% of the growing season for 10% of the reference wetlands across all years.

The precipitation during the growing season also influences the water level fluctuations during the growing season for each monitoring location. For the monitoring wells, the minimum water level, maximum water level, and total fluctuation for each year is shown on the tables ending in -4 (such as Table 1-4) in Appendix A, Appendix B, and Appendix C. The total fluctuation during the growing season for all years is provided at the top of each datasheet in Appendix A, Appendix B, and Appendix C. The smallest (minimum) annual water level fluctuation during the growing season for the monitoring wells was 1.8 inches (Well TB12, coniferous swamp, 2014 water year precipitation was below the normal range). The largest (maximum) annual water level fluctuation during the growing season for the monitoring wells was 37.9 inches (Well 35, alder thicket, 2015 water year precipitation was within the normal range). When considering all recorded data, the difference between the lowest and highest recorded water levels in each well ranged from 4.5 inches (Well TB12, coniferous swamp) to 45.6 inches (Well TB1, sedge meadow).

For the reference wetlands, the minimum water level, maximum water level, and total fluctuation for each year is shown on the tables ending in -4 (such as Table Ref1-4) in Appendix D. The total fluctuation during the growing season for all years is provided at the top of each datasheet in Appendix D. The smallest (minimum) annual water level fluctuation during the growing season for the reference wetlands was 5.0 inches (Well Ref1, coniferous bog, 2014 water year precipitation was within the normal range). The largest (maximum) annual water level fluctuation during the growing season for the reference wetlands was 24.8 inches (Well Ref2, alder thicket, 2008 water year precipitation was below the normal range). When considering all recorded data, the difference between the lowest and highest recorded water levels in each well ranged from 16.5 inches (Well RefTB1, coniferous swamp) to 26.2 inches (Well Ref2, alder thicket).

The following sections provide detailed information on the hydrology monitoring that was conducted in the Mine Site area, Transportation and Utility Corridors area, and Plant Site area, including the reference wetlands.

7.1.1 Mine Site

The wetland hydrology monitoring data from 2005-2016 represents pre-Project baseline conditions. The monitoring locations at the Mine Site which are in reference wetlands include Wells Ref1, Ref2, and Ref3. The monitoring data shows the presence of sustained wetland hydrology (above the wetland threshold) in all of the monitored wetlands throughout 2005-2016; the exceptions are Wells 44 and 46 which did not meet hydrologic criteria in any years (Large Table 7). These two wells were installed in areas with a bouldery substrate, which made it difficult to install the wells to an adequate depth to collect hydrology data. While these locations did not exhibit wetland hydrology, they met the vegetation and soil criteria;

therefore these areas were determined to be wetlands (see Well 44 and Well 46 narrative in Section 7.1.1.1).

The hydrographs in Appendix A, Appendix B, and Appendix C show water levels for the monitoring wells in the Project area and hydrographs in Appendix D show water levels in the Mine Site reference wetlands. The longest annual, single hydroperiod for each well during the growing season (including reference wetlands) ranged from 18 to 151 days (the exceptions are Wells 44 and 46 in the Mine Site which were both zero days; see Section 7.1.1.1). For the reference wetlands, the longest annual, single hydroperiod during the growing season ranged from 43 to 151 days. The longest annual, single hydroperiod for the monitoring wells in the Mine Site area (without Wells 44 and 46) ranged from 13 to 228% of the reference wetlands during the 2005-2016 growing seasons (Large Table 6 and Large Table 7). The reference wetlands will be used for comparison to wetlands that may be affected by the project during operations.

The precipitation during the growing season influences the number of hydroperiods and length of the cumulative hydroperiod for each monitoring location. The number of hydroperiods and the total number of days when the water level was above the wetland threshold for 14 or more consecutive days (cumulative hydroperiod) is shown on the tables ending in -3 (such as Table 1-3) in Appendix A. All except two monitoring wells (Wells 44 and 46) met the hydrology criteria throughout each year monitored. The cumulative hydroperiod(s) were 99 to 100% of the growing season for 46% of the monitoring wells across all years. The cumulative hydroperiod(s) were 80 to 98% of the growing season for 28% of the monitoring wells across all years; 70 to 79% of the growing season for 12% of the monitoring wells across all years; and less than 70% of the growing season for 14% of the monitoring wells across all years.

For the Mine Site reference wetlands (Wells Ref1, Ref2, and Ref3), the number of hydroperiods and the cumulative hydroperiods are shown on the tables ending in -3 (such as Table Ref1-3) in Appendix D. The reference wetlands met the hydrology criteria throughout each year monitored. The cumulative hydroperiod(s) were 99 to 100% of the growing season for approximately 65% of the monitoring wells across all years. The cumulative hydroperiod(s) were 80 to 98% of the growing season for 25% of the Mine Site reference wetlands across all years, and 70 to 79% of the growing season for 10% of the Mine Site reference wetlands across all years.

The precipitation during the growing season also influences the water level fluctuations during the growing season for each monitoring location. For the monitoring wells, the minimum water level, maximum water level, and total fluctuation for each year is shown on the tables ending in -4 (such as Table 1-4) in Appendix A, Appendix B, and Appendix C. The total fluctuation during the growing season for all years is provided at the top of each datasheet in Appendix A, Appendix B, and Appendix C. The smallest (minimum) annual water level fluctuation during the growing season for the monitoring wells was 2.0 inches (Well 9, alder thicket, 2009 water year precipitation was below the normal range). The largest (maximum) annual water level fluctuation during the growing season for the monitoring wells was 37.9 inches (Well 35, alder thicket, 2015 water year precipitation was within the normal range). When considering all recorded data, the difference between the lowest and highest recorded water levels in each well ranged from 10.7 inches (Well 46, coniferous swamp) to 40.0 inches (Well 6, alder thicket).

For the Mine Site reference wetlands (Wells Ref1, Ref2, and Ref3), the minimum water level, maximum water level, and total fluctuation for each year is shown on the tables ending in -4 (such as Table Ref1-4) in Appendix D. The total fluctuation during the growing season for all years is provided at the top of each datasheet in Appendix D. The smallest (minimum) annual water level fluctuation during the growing season for the reference wetlands was 5.0 inches (Well Ref1, coniferous bog, 2014 water year precipitation was within the normal range). The largest (maximum) annual water level fluctuation during the growing season for the reference wetlands was 24.8 inches (Well Ref2, alder thicket, 2008 water year precipitation was below the normal range). When considering all recorded data, the difference between the lowest and highest recorded water levels in each well ranged from 19.7 inches (Well Ref3, coniferous swamp) to 26.2 inches (Well Ref2, alder thicket).

The following sections provide detailed information on the hydrology monitoring that was conducted in the Mine Site area and reference wetlands in the Mine Site area.

7.1.1.1 Monitoring Locations in the Mine Site Area

Well 1

Well 1 is located on the south-central portion of the Mine Site in Wetland 48, a coniferous bog (Type 8) (Large Figure 3). Hydrology has been monitored in this wetland during the 2005-2016 growing seasons (12 years) using a recording data logger (ecotone) and a manual well (Table 1-1 in Appendix A). Eleven of the 12 years of monitoring were completed during the growing season; the exception was the first year (2005) when the monitoring was conducted in November, which was not within the growing season (Table 1-1 in Appendix A). Therefore, during the 12 years of monitoring, there were 11 full growing seasons and one partial growing season when water levels were collected using a recording well (2006-2016).

In 2006-2016, the water level was above the wetland threshold for 1 to 3 periods each year for a cumulative, annual, growing season hydroperiod ranging from 108 to 151 days (Table 1-3 in Appendix A). The longest contiguous period each year when water levels were above the wetland threshold ranged from 78 to 151 days. Typically, the water level was below the wetland threshold by August to early September (6 of 11 monitoring years; see Figure 1-1 in Appendix A). Water levels ranged from 52 to 123% of the reference wetland (Well Ref1; Large Table 6 and Large Table 7). The water levels for this monitoring location ranged from -20.4 to 10.2 inches, with a total fluctuation over the monitoring period of 30.6 inches (Table 1-4 and Figure 1-1 in Appendix A). The data indicate that the well has met the criteria for wetland hydrology in all 11 years of monitoring (Large Table 6 and Large Table 7; Figure 1-2 in Appendix A).

Well 2

Well 2 is located on the north-central portion of the Mine Site in Wetland 100, a coniferous bog (Type 8) (Large Figure 3). Hydrology has been monitored in this wetland during the 2008-2016 growing seasons (9 years) using a recording data logger (ecotone) and from 2005-2016 using a manual well (Table 2-1 in Appendix A); the exception is 2005 when the manual well was installed on June 30. Therefore, during the 12 years of monitoring, there were 11 full growing seasons and one partial growing season when water

levels were collected using a manual well (2005-2016) and nine years when water levels were recorded using a recording well (2008-2016).

In 2008-2016, the water level was above the wetland threshold for 1 to 3 periods each year for a cumulative, annual, growing season hydroperiod ranging from 108 to 151 days (Table 2-3 in Appendix A). The longest contiguous period each year when water levels were above the wetland threshold ranged from 60 to 151 days. Water levels ranged from 41 to 123% of the reference wetland (Well Ref1; Large Table 6 and Large Table 7). The water levels for this monitoring location ranged from -16.1 to 2.0 inches, with a total fluctuation over the monitoring period of 18.1 inches (Table 2-4 and Figure 2-1 in Appendix A). The data from the manual wells in 2005-2007 met the criteria for wetland hydrology in all three years; the data from the recording wells in 2008-2016 also met the criteria for wetland hydrology in all nine years. Therefore, the data indicate that the well has met the criteria for wetland hydrology in all 12 years of monitoring (Large Table 6 and Large Table 7; Figure 2-2 in Appendix A).

Well 3

Well 3 was located on the west-central portion of the Mine Site in Wetland 103, a coniferous bog (Type 8) (Large Figure 3). Hydrology was monitored in this wetland during the 2005-2008 growing seasons (3 years) using a manual well (Table 3-1, Figure 3-1, and Figure 3-2 in Appendix A). The well was removed from the study on November 27, 2007. During the 3 years of monitoring, there were three full growing seasons when water levels were collected using a manual well (2005-2008). The data indicate that the well met the criteria for wetland hydrology in all 3 years of monitoring (Large Table 6 and Large Table 7; Figure 3-2 in Appendix A).

Well 4

Well 4 is located on the northwest portion of the Mine Site in Wetland 887, a coniferous bog (Type 8) (Large Figure 3). Hydrology has been monitored in this wetland during the 2005-2016 growing seasons (12 years) using a recording data logger (ecotone) and a manual well (Table 4-1 in Appendix A). Eleven of the 12 years of monitoring were completed during the growing season; the exception was the first year (2005) when the monitoring was conducted in November, which was not within the growing season (Table 4-1 in Appendix A). Therefore, during the 12 years of monitoring, there were 11 full growing seasons and 1 partial growing season when water levels were collected using a recording well (2006-2016).

In 2006-2016, the water level was above the wetland threshold for 1 period each year for a cumulative, annual, growing season hydroperiod ranging from 71 to 151 days (Table 4-3 in Appendix A). The longest contiguous period each year when water levels were above the wetland threshold ranged from 73 to 151 days. Water levels ranged from 51 to 196% of the reference wetland (Well Ref1; Large Table 6 and Large Table 7). The water levels for this monitoring location ranged from -8.1 to 5.6 inches, with a total fluctuation over the monitoring period of 13.7 inches (Table 4-4 and Figure 4-1 in Appendix A). The data indicate that the well has met the criteria for wetland hydrology in all 11 years of monitoring (Large Table 6 and Large Table 7; Figure 1-2 in Appendix A).

Well 4A

Well 4A is located northwest of the Mine Site in Wetland 889, a coniferous bog (Type 8) (Large Figure 3). Hydrology has been monitored in this wetland during the 2008-2016 growing seasons (9 years) using a recording data logger (ecotone) and from 2005-2016 using a manual well (Table 4A-1 in Appendix A); the exception is 2005 when the manual well was installed on June 29. Therefore, during the 12 years of monitoring, there were 11 full growing seasons and one partial growing season when water levels were collected using a manual well (2005-2016) and nine years when water levels were recorded using a recording well (2008-2016).

In 2008-2016, the water level was above the wetland threshold for 1 period each year for a cumulative, annual, growing season hydroperiod ranging from 138 to 151 days (Table 4A-3 in Appendix A). The longest contiguous period each year when water levels were above the wetland threshold ranged from 138 to 151 days. Water levels ranged from 100 to 196% of the reference wetland (Well Ref1; Large Table 6 and Large Table 7). The water levels for this monitoring location ranged from -11.0 to 7.7 inches, with a total fluctuation over the monitoring period of 18.7 inches (Table 4A-4 and Figure 4A-1 in Appendix A). The data from the manual wells in 2005-2007 met the criteria for wetland hydrology in all three years; the data from the recording wells in 2008-2016 also met the criteria for wetland hydrology in all nine years. Therefore, the data indicate that the well has met the criteria for wetland hydrology in all 12 years of monitoring (Large Table 6 and Large Table 7; Figure 4A-2 in Appendix A).

Well 5

Well 5 is located northwest of the Mine Site in Wetland 887, a coniferous bog (Type 8) (Large Figure 3). Hydrology was monitored in this wetland during the 2005-2016 growing seasons (12 years) using a manual well (Table 5-1, Figure 5-1, and Figure 5-2 in Appendix A). The data indicate that the well met the criteria for wetland hydrology in all 12 years of monitoring (Large Table 6 and Large Table 7; Figure 5-2 in Appendix A).

Well 6

Well 6 is located southwest of the Mine Site in Wetland 54, an alder thicket (Type 6) (Large Figure 3). Hydrology has been monitored in this wetland during the 2008-2016 growing seasons (9 years) using a recording data logger (ecotone) and from 2005-2016 using a manual well (Table 6-1 in Appendix A); the exception is 2005 when the manual well was installed on June 29. Therefore, during the 12 years of monitoring, there were 11 full growing seasons and one partial growing season when water levels were collected using a manual well (2005-2016) and nine years when water levels were recorded using a recording well (2008-2016).

In 2008-2016, the water level was above the wetland threshold for 1 to 2 periods each year for a cumulative, annual, growing season hydroperiod ranging from 101 to 151 days (Table 6-3 in Appendix A). The longest contiguous period each year when water levels were above the wetland threshold ranged from 74 to 151 days. Water levels ranged from 54 to 100% of the reference wetland (Well Ref2; Large Table 6 and Large Table 7). The water levels for this monitoring location ranged from -32.2 to 7.8 inches, with a total fluctuation over the monitoring period of 40.0 inches (Table 6-4 and Figure 6-1 in

Appendix A). The data from the manual wells in 2005-2007 met the criteria for wetland hydrology in all three years; the data from the recording wells in 2008-2016 also met the criteria for wetland hydrology in all nine years. Therefore, the data indicate that the well has met the criteria for wetland hydrology in all 12 years of monitoring (Large Table 6 and Large Table 7; Figure 6-2 in Appendix A).

Well 7

Well 7 is located southwest of the Mine Site in Wetland 53, an alder thicket (Type 6) (Large Figure 3). Hydrology has been monitored in this wetland during the 2005-2016 growing seasons (12 years) using a recording data logger (ecotone) and a manual well (Table 7-1 in Appendix A). Eleven of the 12 years of monitoring were completed during the growing season; the exception was the first year (2005) when the monitoring was conducted in November, which was not within the growing season (Table 7-1 in Appendix A). Therefore, during the 12 years of monitoring, there were 11 full growing seasons and one partial growing season when water levels were collected using a recording well (2006-2016).

In 2006-2016, the water level was above the wetland threshold for 1 to 2 periods each year for a cumulative, annual, growing season hydroperiod ranging from 138 to 151 days (Table 7-3 in Appendix A). The longest contiguous period each year when water levels were above the wetland threshold ranged from 42 to 151 days. Water levels ranged from 100 to 168% of the reference wetland (Well Ref2; Large Table 6 and Large Table 7). In 2006, the logger malfunctioned and there was no data collected from mid-June through early August. The water levels for this monitoring location ranged from -15.9 to 5.1 inches, with a total fluctuation over the monitoring period of 21.0 inches (Table 7-4 and Figure 7-1 in Appendix A). The data indicate that the well has met the criteria for wetland hydrology in all 11 years of monitoring (Large Table 6 and Large Table 7; Figure 7-2 in Appendix A).

Well 8

Well 8 is located southeast of the Mine Site in Wetland 106, a coniferous bog (Type 8) (Large Figure 3). Hydrology has been monitored in this wetland during the 2008-2016 growing seasons (9 years) using a recording data logger (ecotone) and from 2005-2016 using a manual well (Table 8-1 in Appendix A); the exception is 2005 when the manual well was installed on June 30. Therefore, during the 12 years of monitoring, there were 11 full growing seasons and one partial growing season when water levels were collected using a manual well (2005-2016) and nine years when water levels were recorded using a recording well (2008-2016).

In 2008-2016, the water level was above the wetland threshold for 1 to 4 periods each year for a cumulative, annual, growing season hydroperiod ranging from 86 to 147 days (Table 8-3 in Appendix A). The longest contiguous period each year when water levels were above the wetland threshold ranged from 61 to 109 days. Water levels ranged from 41 to 94% of the reference wetland (Well Ref1; Large Table 6 and Large Table 7). The water levels for this monitoring location ranged from -28.7 to 8.0 inches, with a total fluctuation over the monitoring period of 36.7 inches (Table 8-4 and Figure 8-1 in Appendix A). The data from the manual wells in 2005-2007 met the criteria for wetland hydrology in all three years; the data from the recording wells in 2008-2016 also met the criteria for wetland hydrology in

all nine years. Therefore, the data indicate that the well has met the criteria for wetland hydrology in all 12 years of monitoring (Large Table 6 and Large Table 7; Figure 8-2 in Appendix A).

Well 9

Well 9 is located on the southeastern portion of the Mine Site in Wetland 58, an alder thicket (Type 6) (Large Figure 3). Hydrology has been monitored in this wetland during the 2008-2016 growing seasons (9 years) using a recording data logger (ecotone) and from 2005-2016 using a manual well (Table 9-1 in Appendix A); the exception is 2005 when the manual well was installed on June 30. Therefore, during the 12 years of monitoring, there were 11 full growing seasons and one partial growing season when water levels were collected using a manual well (2005-2016) and nine years when water levels were recorded using a recording well (2008-2016).

In 2008-2016, the water level was above the wetland threshold for 1 to 2 periods each year for a cumulative, annual, growing season hydroperiod ranging from 101 to 151 days (Table 9-3 in Appendix A). The longest contiguous period each year when water levels were above the wetland threshold ranged from 101 to 151 days. Water levels ranged from 67 to 112% of the reference wetlands (Well Ref2; Large Table 6 and Large Table 7). The water levels for this monitoring location ranged from -12.2 to 7.9 inches, with a total fluctuation over the monitoring period of 20.1 inches (Table 9-4 and Figure 9-1 in Appendix A). The data from the manual wells in 2005-2007 met the criteria for wetland hydrology in all three years; the data from the recording wells in 2008-2016 also met the criteria for wetland hydrology in all nine years. Therefore, the data indicate that the well has met the criteria for wetland hydrology in all 12 years of monitoring (Large Table 6 and Large Table 7; Figure 9-2 in Appendix A).

Well 10

Well 10 is located north of the Mine Site in Wetland 888, a coniferous bog (Type 8) (Large Figure 3). Hydrology has been monitored in this wetland during the 2008-2016 growing seasons (9 years) using a recording data logger (ecotone) and from 2005-2016 using a manual well (Table 10-1 in Appendix A); the exception is 2005 when the manual well was installed on June 25. Therefore, during the 12 years of monitoring, there were 11 full growing seasons and one partial growing season when water levels were collected using a manual well (2005-2016) and nine years when water levels were recorded using a recording well (2008-2016).

In 2008-2016, the water level was above the wetland threshold for 1 to 2 periods each year for a cumulative, annual, growing season hydroperiod ranging from 94 to 151 days (Table 10-3 in Appendix A). The longest contiguous period each year when water levels were above the wetland threshold ranged from 76 to 151 days. Water levels ranged from 60 to 99% of the reference wetland (Well Ref1; Large Table 6 and Large Table 7). The water levels for this monitoring location ranged from -20.9 to -0.6 inches, with a total fluctuation over the monitoring period of 20.3 inches (Table 10-4 and Figure 10-1 in Appendix A). The data from the manual wells in 2005-2007 met the criteria for wetland hydrology in all three years; the data from the recording wells in 2008-2016 also met the criteria for wetland hydrology in all nine years. Therefore, the data indicate that the well has met the criteria for wetland hydrology in all 12 years of monitoring (Large Table 6 and Large Table 7; Figure 10-2 in Appendix A).

Well 11

Well 11 is located on the north-central portion of the Mine Site in Wetland 100, a coniferous bog (Type 8) (Large Figure 3). Hydrology has been monitored in this wetland during the 2008-2016 growing seasons (9 years) using a recording data logger (ecotone) and from 2005-2016 using a manual well (Table 11-1 in Appendix A); the exception is 2005 when the manual well was installed on June 25. Therefore, during the 12 years of monitoring, there were 11 full growing seasons and one partial growing season when water levels were collected using a manual well (2005-2016) and nine years when water levels were recorded using a recording well (2008-2016).

In 2008-2016, the water level was above the wetland threshold for 1 to 2 periods each year for a cumulative, annual, growing season hydroperiod ranging from 48 to 134 days (Table 11-3 in Appendix A). The longest contiguous period each year when water levels were above the wetland threshold ranged from 34 to 134 days. Water levels ranged from 23 to 65% of the reference wetland (Well Ref1; Large Table 6 and Large Table 7). The water levels for this monitoring location ranged from -25.9 to -0.4 inches, with a total fluctuation over the monitoring period of 25.5 inches (Table 11-4 and Figure 11-1 in Appendix A). The data from the manual wells in 2005-2007 met the criteria for wetland hydrology in all three years; the data from the recording wells in 2008-2016 also met the criteria for wetland hydrology in all nine years. Therefore, the data indicate that the well has met the criteria for wetland hydrology in all 12 years of monitoring (Large Table 6 and Large Table 7; Figure 11-2 in Appendix A).

Well 12

Well 12 is located on the northeast-central portion of the Mine Site in Wetland 888, a coniferous bog (Type 8) (Large Figure 3). Hydrology has been monitored in this wetland during the 2005-2016 growing seasons (12 years) using a recording data logger (ecotone) and a manual well (Table 12-1 in Appendix A). Eleven of the 12 years of monitoring were completed during the growing season; the exception was the first year (2005) when the monitoring was conducted in November, which was not within the growing season (Table 12-1 in Appendix A). Therefore, during the 12 years of monitoring, there were 11 full growing seasons and one partial growing season when water levels were collected using a recording well (2006-2016).

In 2006-2016, the water level was above the wetland threshold for 1 to 3 periods each year for a cumulative, annual, growing season hydroperiod ranging from 65 to 151 days (Table 12-3 in Appendix A). The longest contiguous period each year when water levels were above the wetland threshold ranged from 35 to 151 days. Water levels ranged from 63 to 100% of the reference wetland (Well Ref1; Large Table 6 and Large Table 7). The water levels for this monitoring location ranged from -20.0 to 0.1 inches, with a total fluctuation over the monitoring period of 20.1 inches (Table 12-4 and Figure 12-1 in Appendix A). The data indicate that the well has met the criteria for wetland hydrology in all 11 years of monitoring (Large Table 6 and Large Table 7; Figure 12-2 in Appendix A).

Well 13

Well 13 is located northeast of the Mine Site in Wetland 84, a coniferous bog (Type 8) (Large Figure 3). Hydrology has been monitored in this wetland during the 2008-2016 growing seasons (9 years) using a

recording data logger (ecotone) and from 2005-2016 using a manual well (Table 13-1 in Appendix A); the exception is 2005 when the manual well was installed on June 29. Therefore, during the 12 years of monitoring, there were eleven full growing seasons and one partial growing season when water levels were collected using a manual well (2005-2016) and nine years when water levels were recorded using a recording well (2008-2016).

In 2008-2016, the water level was above the wetland threshold for 1 to 4 periods each year for a cumulative, annual, growing season hydroperiod ranging from 54 to 141 days (Table 13-3 in Appendix A). The longest contiguous period each year when water levels were above the wetland threshold ranged from 31 to 103 days. Water levels ranged from 15 to 72% of the reference wetland (Well Ref1; Large Table 6 and Large Table 7). The water levels for this monitoring location ranged from -24.6 to 1.4 inches, with a total fluctuation over the monitoring period of 26.0 inches (Table 13-4 and Figure 13-1 in Appendix A). The data from the manual wells in 2005-2007 met the criteria for wetland hydrology in all three years; the data from the recording wells in 2008-2016 also met the criteria for wetland hydrology in all nine years. Therefore, the data indicate that the well has met the criteria for wetland hydrology in all 12 years of monitoring (Large Table 6 and Large Table 7; Figure 13-2 in Appendix A).

Well 14

Well 14 is located east of the Mine Site in Wetland 90, a coniferous bog (Type 8) (Large Figure 3). Hydrology has been monitored in this wetland during the 2008-2016 growing seasons (9 years) using a recording data logger (ecotone) and from 2005-2016 using a manual well (Table 14-1 in Appendix A); the exception is 2005 when the manual well was installed on June 29. Therefore, during the 12 years of monitoring, there were 11 full growing seasons and one partial growing season when water levels were collected using a manual well (2005-2016) and nine years when water levels were recorded using a recording well (2008-2016).

In 2008-2016, the water level was above the wetland threshold for 1 to 3 periods each year for a cumulative, annual, growing season hydroperiod ranging from 41 to 144 days (Table 14-3 in Appendix A). The longest contiguous period each year when water levels were above the wetland threshold ranged from 34 to 89 days. Water levels ranged from 23 to 103% of the reference wetland (Well Ref1; Large Table 6 and Large Table 7). The water levels for this monitoring location ranged from -23.1 to -1.3 inches, with a total fluctuation over the monitoring period of 21.8 inches (Table 14-4 and Figure 14-1 in Appendix A). The data from the manual wells in 2005-2007 met the criteria for wetland hydrology in all three years; the data from the recording wells in 2008-2016 also met the criteria for wetland hydrology in all nine years. Therefore, the data indicate that the well has met the criteria for wetland hydrology in all 12 years of monitoring (Large Table 6 and Large Table 7; Figure 14-2 in Appendix A).

Well 15

Well 15 is located east of the Mine Site in Wetland 693, a coniferous bog (Type 8) (Large Figure 3). Hydrology has been monitored in this wetland during the 2008-2016 growing seasons (9 years) using a recording data logger (ecotone) and from 2005-2016 using a manual well (Table 15-1 in Appendix A); the exception is 2005 when the manual well was installed on June 29. Therefore, during the 12 years of

monitoring, there were 11 full growing seasons and one partial growing season when water levels were collected using a manual well (2005-2016) and nine years when water levels were recorded using a recording well (2008-2016).

In 2008-2016, the water level was above the wetland threshold for 1 to 2 periods each year for a cumulative, annual, growing season hydroperiod ranging from 118 to 151 days (Table 15-3 in Appendix A). The longest contiguous period each year when water levels were above the wetland threshold ranged from 79 to 151 days. Water levels ranged from 57 to 123% of the reference wetland (Well Ref1; Large Table 6 and Large Table 7). The water levels for this monitoring location ranged from - 22.1 to 4.8 inches, with a total fluctuation over the monitoring period of 26.9 inches (Table 15-4 and Figure 15-1 in Appendix A). The data from the manual wells in 2005-2007 met the criteria for wetland hydrology in all three years; the data from the recording wells in 2008-2016 also met the criteria for wetland hydrology in all nine years. Therefore, the data indicate that the well has met the criteria for wetland hydrology in all 12 years of monitoring (Large Table 6 and Large Table 7; Figure 15-2 in Appendix A).

Well 16

Well 16 is located on the eastern portion of the Mine Site in Wetland 90, a coniferous bog (Type 8) (Large Figure 3). Hydrology has been monitored in this wetland during the 2008-2016 growing seasons (9 years) using a recording data logger (ecotone) and from 2005-2016 using a manual well (Table 16-1 in Appendix A); the exception is 2005 when the manual well was installed on June 30. Therefore, during the 12 years of monitoring, there were 11 full growing seasons and one partial growing season when water levels were collected using a manual well (2005-2016) and nine years when water levels were recorded using a recording well (2008-2016).

In 2008-2016, the water level was above the wetland threshold for 1 to 2 periods each year for a cumulative, annual, growing season hydroperiod ranging from 112 to 151 days (Table 16-3 in Appendix A). The longest contiguous period each year when water levels were above the wetland threshold ranged from 86 to 151 days. Water levels ranged from 62 to 123% of the reference wetland (Well Ref1; Large Table 6 and Large Table 7). The water levels for this monitoring location ranged from - 15.6 to 3.8 inches, with a total fluctuation over the monitoring period of 19.4 inches (Table 16-4 and Figure 16-1 in Appendix A). The data from the manual wells in 2005-2007 met the criteria for wetland hydrology in all three years; the data from the recording wells in 2008-2016 also met the criteria for wetland hydrology in all nine years. Therefore, the data indicate that the well has met the criteria for wetland hydrology in all 12 years of monitoring (Large Table 6 and Large Table 7; Figure 16-2 in Appendix A).

Well 17

Well 17 was located northwest of the Mine Site in Wetland 103, a coniferous bog (Type 8) (Large Figure 3). Hydrology was monitored in this wetland during the 2005-2008 growing seasons (3 years) using a manual well (Table 17-1, Figure 17-1, and Figure 17-2 in Appendix A). The well was removed from the study on November 27, 2007. During the 3 years of monitoring, there were three full growing seasons when water

levels were collected using a manual well (2005-2008). The data indicate that the well met the criteria for wetland hydrology in all 3 years of monitoring (Large Table 6 and Large Table 7; Figure 17-2 in Appendix A).

Well 18

Well 18 is located on the north-central portion of the Mine Site in Wetland 100, a coniferous bog (Type 8) (Large Figure 3). Hydrology has been monitored in this wetland during the 2008-2009 growing seasons (2 years) using a recording data logger (ecotone) and from 2005-2009 using a manual well (Table 18-1 in Appendix A); the exception is 2005 when the manual well was installed on June 25. Therefore, during the five years of monitoring, there were four full growing seasons and one partial growing season when water levels were collected using a manual well (2005-2009) and two years when water levels were recorded using a recording well (2008-2009).

In 2008-2009, the water level was above the wetland threshold for 1 to 2 periods each year for a cumulative, annual, growing season hydroperiod ranging from 102 to 119 days (Table 18-3 in Appendix A). The longest contiguous period each year when water levels were above the wetland threshold ranged from 77 to 119 days. Water levels ranged from 56 to 91% of the reference wetland (Well Ref1; Large Table 6 and Large Table 7). The water levels for this monitoring location ranged from -16.8 to -0.7 inches, with a total fluctuation over the monitoring period of 16.1 inches (Table 18-4 and Figure 18-1 in Appendix A). The data from the manual wells in 2005-2007 met the criteria for wetland hydrology in all three years; the data from the recording wells in 2008-2009 also met the criteria for wetland hydrology in both years. Therefore, the data indicate that the well has met the criteria for wetland hydrology in all 5 years of monitoring (Large Table 6 and Large Table 7; Figure 18-2 in Appendix A).

Well 19

Well 19 is located on the southwest portion of the Mine Site in Wetland 107, a coniferous bog (Type 8) (Large Figure 3). Hydrology has been monitored in this wetland during the 2008-2009 growing seasons (2 years) using a recording data logger (ecotone) and from 2005-2009 using a manual well (Table 19-1 in Appendix A); the exception is 2005 when the manual well was installed on June 28. Therefore, during the 5 years of monitoring, there were four full growing seasons and one partial growing season when water levels were collected using a manual well (2005-2009) and two years when water levels were recorded using a recording well (2008-2009).

In 2008-2009, the water level was above the wetland threshold for 1 to 2 periods each year for a cumulative, annual, growing season hydroperiod ranging from 105 to 139 days (Table 19-3 in Appendix A). The longest contiguous period each year when water levels were above the wetland threshold ranged from 80 to 139 days. Water levels ranged from 58 to 106% of the reference wetland (Well Ref1; Large Table 6 and Large Table 7). The water levels for this monitoring location ranged from -25.5 to 2.4 inches, with a total fluctuation over the monitoring period of 27.9 inches (Table 19-4 and Figure 19-1 in Appendix A). The data from the manual wells in 2005-2007 met the criteria for wetland hydrology in all three years; the data from the recording wells in 2008-2009 also met the criteria for

wetland hydrology in both years. Therefore, the data indicate that the well has met the criteria for wetland hydrology in all 5 years of monitoring (Large Table 6 and Large Table 7; Figure 19-2 in Appendix A).

Well 21

Well 21 is located on the central portion of the Mine Site in Wetland 48, a coniferous bog (Type 8) (Large Figure 3). Hydrology has been monitored in this wetland during the 2008-2016 growing seasons (9 years) using a recording data logger (ecotone) and a manual well (Table 21-1 in Appendix A). Therefore, during the 9 years of monitoring, there were nine full growing seasons when water levels were collected using a recording well (2008-2016).

In 2008-2016, the water level was above the wetland threshold for 1 to 2 periods each year for a cumulative, annual, growing season hydroperiod ranging from 124 to 151 days (Table 21-3 in Appendix A). The longest contiguous period each year when water levels were above the wetland threshold ranged from 85 to 151 days. Water levels ranged from 62 to 173% of the reference wetland (Well Ref1; Large Table 6 and Large Table 7). The water levels for this monitoring location ranged from -14.6 to 3.9 inches, with a total fluctuation over the monitoring period of 18.5 inches (Table 21-4 and Figure 21-1 in Appendix A). The data indicate that the well has met the criteria for wetland hydrology in all 9 years of monitoring (Large Table 6 and Large Table 7; Figure 21-2 in Appendix A).

Well 22

Well 22 is located on the central portion of the Mine Site in Wetland 48, a coniferous bog (Type 8) (Large Figure 3). Hydrology has been monitored in this wetland during the 2008-2016 growing seasons (9 years) using a recording data logger (ecotone) and a manual well (Table 22-1 in Appendix A). Therefore, during the 9 years of monitoring, there were nine full growing seasons when water levels were collected using a recording well (2008-2016).

In 2008-2016, the water level was above the wetland threshold for 1 to 3 periods each year for a cumulative, annual, growing season hydroperiod ranging from 103 to 151 days (Table 22-3 in Appendix A). The longest contiguous period each year when water levels were above the wetland threshold ranged from 76 to 151 days. Water levels ranged from 51 to 103% of the reference wetland (Well Ref1; Large Table 6 and Large Table 7). The water levels for this monitoring location ranged from -28.4 to 4.6 inches, with a total fluctuation over the monitoring period of 33.0 inches (Table 22-4 and Figure 22-1 in Appendix A). The data indicate that the well has met the criteria for wetland hydrology in all 9 years of monitoring (Large Table 6 and Large Table 7; Figure 22-2 in Appendix A).

Well 23

Well 23 is located on the western portion of the Mine Site in Wetland 45, an alder thicket (Type 6) (Large Figure 3). Hydrology has been monitored in this wetland during the 2010-2016 growing seasons (7 years) using a recording data logger (ecotone) and a manual well (Table 23-1 in Appendix A). Therefore, during the 7 years of monitoring, there were seven full growing seasons when water levels were collected using a recording well (2010-2016).

In 2010-2016, the water level was above the wetland threshold for 1 period each year for a cumulative, annual, growing season hydroperiod ranging from 122 to 151 days (Table 23-3 in Appendix A). The longest contiguous period each year when water levels were above the wetland threshold ranged from 122 to 151 days. Water levels ranged from 81 to 103% of the reference wetland (Well Ref2; Large Table 6 and Large Table 7). The water levels for this monitoring location ranged from -9.8 to 8.1 inches, with a total fluctuation over the monitoring period of 17.9 inches (Table 23-4 and Figure 23-1 in Appendix A). The data indicate that the well has met the criteria for wetland hydrology in all 7 years of monitoring (Large Table 6 and Large Table 7; Figure 23-2 in Appendix A).

Well 24

Well 24 is located on the western portion of the Mine Site in Wetland 33A, an alder thicket (Type 6) (Large Figure 3). Hydrology has been monitored in this wetland during the 2010-2016 growing seasons (7 years) using a recording data logger (ecotone) and a manual well (Table 24-1 in Appendix A). Therefore, during the 7 years of monitoring, there were seven full growing seasons when water levels were collected using a recording well (2010-2016).

In 2010-2016, the water level was above the wetland threshold for 1 to 3 periods each year for a cumulative, annual, growing season hydroperiod ranging from 114 to 151 days (Table 24-3 in Appendix A). The longest contiguous period each year when water levels were above the wetland threshold ranged from 76 to 151 days. Water levels ranged from 51 to 100% of the reference wetland (Well Ref2; Large Table 6 and Large Table 7). The water levels for this monitoring location ranged from -20.2 to 5.8 inches, with a total fluctuation over the monitoring period of 26.0 inches (Table 24-4 and Figure 24-1 in Appendix A). The data indicate that the well has met the criteria for wetland hydrology in all 7 years of monitoring (Large Table 6 and Large Table 7; Figure 24-2 in Appendix A).

Well 25

Well 25 is located in the central portion of the Mine Site in Wetland 68, a coniferous swamp (Type 7) (Large Figure 3). Hydrology has been monitored in this wetland during the 2014-2016 growing seasons (3 years) using a recording data logger (in-situ troll) (Table 25-1 in Appendix A); the exception is 2014 when the recording well was installed on June 30. Therefore, during the 3 years of monitoring, there were 2 full growing seasons and 1 partial growing season when water levels were collected using a recording well (2014-2016).

In 2014-2016, the water level was above the wetland threshold for 1 to 2 periods each year for a cumulative, annual, growing season hydroperiod ranging from 51 to 151 days (Table 25-3 in Appendix A). The longest contiguous period each year when water levels were above the wetland threshold ranged from 35 to 151 days, which was 81 to 100% of the reference wetland (Well Ref3; Large Table 7). The water levels for this monitoring location ranged from -33.5 to 4.2 inches, with a total fluctuation over the monitoring period of 37.7 inches (Table 25-4 and Figure 25-1 in Appendix A). The data indicate that the well has met the criteria for wetland hydrology in all 3 years of monitoring (Large Table 7; Figure 25-2 in Appendix A).

Well 26

Well 26 is located in the north-central portion of the Mine Site in Wetland 315, an alder thicket (Type 6) (Large Figure 3). Hydrology has been monitored in this wetland during the 2014-2016 growing seasons (3 years) using a recording data logger (in-situ troll) (Table 26-1 in Appendix A); the exception is 2014 when the recording well was installed on July 1. Therefore, during the 3 years of monitoring, there were 2 full growing seasons and 1 partial growing season when water levels were collected using a recording well (2014-2016).

In 2014-2016, the water level was above the wetland threshold for 1 period each year for a cumulative, annual, growing season hydroperiod ranging from 97 to 151 days (Table 26-3 in Appendix A). The longest contiguous period each year when water levels were above the wetland threshold ranged from 97 to 151 days, which was 70 to 100% of the reference wetland (Well Ref2; Large Table 7). The water levels for this monitoring location ranged from -3.9 to 6.9 inches, with a total fluctuation over the monitoring period of 10.8 inches (Table 26-4 and Figure 26-1 in Appendix A). The data indicate that the well has met the criteria for wetland hydrology in all 3 years of monitoring (Large Table 7; Figure 26-2 in Appendix A).

Well 27

Well 27 is located in the central portion of the Mine Site in Wetland 48A, a coniferous swamp (Type 7) (Large Figure 3). Hydrology has been monitored in this wetland during the 2014-2016 growing seasons (3 years) using a recording data logger (in-situ troll) (Table 27-1 in Appendix A); the exception is 2014 when the recording well was installed on June 30. Therefore, during the 3 years of monitoring, there were 2 full growing seasons and 1 partial growing season when water levels were collected using a recording well (2014-2016).

In 2014-2016, the water level was above the wetland threshold for 1 to 2 periods each year for a cumulative, annual, growing season hydroperiod ranging from 94 to 151 days (Table 27-3 in Appendix A). The longest contiguous period each year when water levels were above the wetland threshold ranged from 48 to 151 days, which was 59 to 228% of the reference wetland (Well Ref3; Large Table 7). The water levels for this monitoring location ranged from -20.6 to 4.5 inches, with a total fluctuation over the monitoring period of 25.1 inches (Table 27-4 and Figure 27-1 in Appendix A). The data indicate that the well has met the criteria for wetland hydrology in all 3 years of monitoring (Large Table 7; Figure 27-2 in Appendix A).

Well 28

Well 28 is located in the central portion of the Mine Site in Wetland 33A, an alder thicket (Type 6) (Large Figure 3). Hydrology has been monitored in this wetland during the 2014-2016 growing seasons (3 years) using a recording data logger (in-situ troll) (Table 28-1 in Appendix A); the exception is 2014 when the recording well was installed on July 2. Therefore, during the 3 years of monitoring, there were 2 full growing seasons and 1 partial growing season when water levels were collected using a recording well (2014-2016).

In 2014-2016, the water level was above the wetland threshold for 2 periods each year for a cumulative, annual, growing season hydroperiod ranging from 49 to 144 days (Table 28-3 in Appendix A). The longest contiguous period each year when water levels were above the wetland threshold ranged from 32 to 106 days, which was 23 to 70% of the reference wetland (Well Ref2; Large Table 7). The water levels for this monitoring location ranged from -26.6 to -0.1 inches, with a total fluctuation over the monitoring period of 26.5 inches (Table 28-4 and Figure 28-1 in Appendix A). The data indicate that the well has met the criteria for wetland hydrology in all 3 years of monitoring (Large Table 7; Figure 28-2 in Appendix A).

Well 29

Well 29 is located in the northeast portion of the Mine Site in Wetland 90, a coniferous bog (Type 8) (Large Figure 3). Hydrology has been monitored in this wetland during the 2014-2016 growing seasons (3 years) using a recording data logger (in-situ troll) (Table 29-1 in Appendix A); the exception is 2014 when the recording well was installed on July 2. Therefore, during the 3 years of monitoring, there were 2 full growing seasons and 1 partial growing season when water levels were collected using a recording well (2014-2016).

In 2014-2016, the water level was above the wetland threshold for 1 to 3 periods each year for a cumulative, annual, growing season hydroperiod ranging from 31 to 146 days (Table 29-3 in Appendix A). The longest contiguous period each year when water levels were above the wetland threshold ranged from 31 to 84 days, which was 29 to 40% of the reference wetland (Well Ref1; Large Table 7). The water levels for this monitoring location ranged from -25.7 to -6.0 inches, with a total fluctuation over the monitoring period of 19.7 inches (Table 29-4 and Figure 29-1 in Appendix A). The data indicate that the well has met the criteria for wetland hydrology in all 3 years of monitoring (Large Table 7; Figure 29-2 in Appendix A).

Well 30

Well 30 is located in the southwest portion of the Mine Site in Wetland 57, a coniferous swamp (Type 7) (Large Figure 3). Hydrology has been monitored in this wetland during the 2014-2016 growing seasons (3 years) using a recording data logger (in-situ troll) (Table 30-1 in Appendix A); the exception is 2014 when the recording well was installed on June 30. Therefore, during the 3 years of monitoring, there were 2 full growing seasons and 1 partial growing season when water levels were collected using a recording well (2014-2016).

In 2014-2016, the water level was above the wetland threshold for 1 to 2 periods each year for a cumulative, annual, growing season hydroperiod ranging from 72 to 151 days (Table 30-3 in Appendix A). The longest contiguous period each year when water levels were above the wetland threshold ranged from 45 to 151 days, which was 89 to 105% of the reference wetland (Well Ref3; Large Table 7). The water levels for this monitoring location ranged from -22.7 to 6.3 inches, with a total fluctuation over the monitoring period of 29.0 inches (Table 30-4 and Figure 30-1 in Appendix A). The data indicate that the well has met the criteria for wetland hydrology in all 3 years of monitoring (Large Table 7; Figure 30-2 in Appendix A).

Well 31

Well 31 is located in the southern portion of the Mine Site area in Wetland 54G, a coniferous swamp (Type 7) (Large Figure 3). Hydrology has been monitored in this wetland during the 2014-2016 growing seasons (3 years) using a recording data logger (in-situ troll) (Table 31-1 in Appendix A); the exception is 2014 when the recording well was installed on June 30. Therefore, during the 3 years of monitoring, there were 2 full growing seasons and 1 partial growing season when water levels were collected using a recording well (2014-2016).

In 2014-2016, the water level was above the wetland threshold for 1 to 2 periods each year for a cumulative, annual, growing season hydroperiod ranging from 97 to 151 days (Table 31-3 in Appendix A). The longest contiguous period each year when water levels were above the wetland threshold ranged from 58 to 151 days, which was 42 to 135% of the reference wetland (Well Ref1, Well Ref2, and Well Ref3; Large Table 7). The water levels for this monitoring location ranged from -21.4 to 1.5 inches, with a total fluctuation over the monitoring period of 22.9 inches (Table 31-4 and Figure 31-1 in Appendix A). The data indicate that the well has met the criteria for wetland hydrology in all 3 years of monitoring (Large Table 7; Figure 31-2 in Appendix A).

Well 32

Well 32 is located in the southwest portion of the Mine Site in Wetland 107, a coniferous bog (Type 8) (Large Figure 3). Hydrology has been monitored in this wetland during the 2014-2016 growing seasons (3 years) using a recording data logger (in-situ troll) (Table 32-1 in Appendix A); the exception is 2014 when the recording well was installed on July 2. Therefore, during the 3 years of monitoring, there were 2 full growing seasons and 1 partial growing season when water levels were collected using a recording well (2014-2016).

In 2014-2016, the water level was above the wetland threshold for 1 to 2 periods each year for a cumulative, annual, growing season hydroperiod ranging from 96 to 151 days (Table 32-3 in Appendix A). The longest contiguous period each year when water levels were above the wetland threshold ranged from 77 to 151 days, which was 73 to 100% of the reference wetland (Well Ref1; Large Table 7). The water levels for this monitoring location ranged from -20.9 to 7.1 inches, with a total fluctuation over the monitoring period of 28.0 inches (Table 32-4 and Figure 32-1 in Appendix A). The data indicate that the well has met the criteria for wetland hydrology in all 3 years of monitoring (Large Table 7; Figure 32-2 in Appendix A).

Well 33

Well 33 is located in the southern portion of the Mine Site area in Wetland 53D, an alder thicket (Type 6) (Large Figure 3). Hydrology has been monitored in this wetland during the 2014-2016 growing seasons (3 years) using a recording data logger (in-situ troll) (Table 33-1 in Appendix A); the exception is 2014 when the recording well was installed on July 1. Therefore, during the 3 years of monitoring, there were 2 full growing seasons and 1 partial growing season when water levels were collected using a recording well (2014-2016).

In 2014-2016, the water level was above the wetland threshold for 1 to 2 periods each year for a cumulative, annual, growing season hydroperiod ranging from 97 to 151 days (Table 33-3 in Appendix A). The longest contiguous period each year when water levels were above the wetland threshold ranged from 83 to 151 days, which was 55 to 100% of the reference wetland (Well Ref2; Large Table 7). The water levels for this monitoring location ranged from -15.4 to 8.8 inches, with a total fluctuation over the monitoring period of 24.2 inches (Table 33-4 and Figure 33-1 in Appendix A). The data indicate that the well has met the criteria for wetland hydrology in all 3 years of monitoring (Large Table 7; Figure 33-2 in Appendix A).

Well 34

Well 34 is located in the south-central portion of the Mine Site in Wetland 53C, a coniferous swamp (Type 7) (Large Figure 3). Hydrology has been monitored in this wetland during the 2014-2016 growing seasons (3 years) using a recording data logger (in-situ troll) (Table 34-1 in Appendix A); the exception is 2014 when the recording well was installed on July 1. Therefore, during the 3 years of monitoring, there were 2 full growing seasons and 1 partial growing season when water levels were collected using a recording well (2014-2016).

In 2014-2016, the water level was above the wetland threshold for 2 to 3 periods each year for a cumulative, annual, growing season hydroperiod ranging from 63 to 139 days (Table 34-3 in Appendix A). The longest contiguous period each year when water levels were above the wetland threshold ranged from 37 to 82 days, which was 54 to 86% of the reference wetland (Well Ref3; Large Table 7). The water levels for this monitoring location ranged from -18.2 to -2.0 inches, with a total fluctuation over the monitoring period of 16.2 inches (Table 34-4 and Figure 34-1 in Appendix A). The data indicate that the well has met the criteria for wetland hydrology in all 3 years of monitoring (Large Table 7; Figure 34-2 in Appendix A).

Well 35

Well 35 is located in the southern portion of the Mine Site area in Wetland 53D, an alder thicket (Type 6) (Large Figure 3). Hydrology has been monitored in this wetland during the 2014-2016 growing seasons (3 years) using a recording data logger (in-situ troll) (Table 35-1 in Appendix A); the exception is 2014 when the recording well was installed on July 2. Therefore, during the 3 years of monitoring, there were 2 full growing seasons and 1 partial growing season when water levels were collected using a recording well (2014-2016).

In 2014-2016, the water level was above the wetland threshold for 1 to 2 periods each year for a cumulative, annual, growing season hydroperiod ranging from 70 to 151 days (Table 35-3 in Appendix A). The longest contiguous period each year when water levels were above the wetland threshold ranged from 38 to 151 days, which was 27 to 100% of the reference wetland (Well Ref2; Large Table 7). The water levels for this monitoring location ranged from -26.3 to 11.6 inches, with a total fluctuation over the monitoring period of 37.9 inches (Table 35-4 and Figure 35-1 in Appendix A). The data indicate that the well has met the criteria for wetland hydrology in all 3 years of monitoring (Large Table 7; Figure 35-2 in Appendix A).

Well 36

Well 36 is located in the south-central portion of the Mine Site in Wetland 53, an alder thicket (Type 6) (Large Figure 3). Hydrology has been monitored in this wetland during the 2014-2016 growing seasons (3 years) using a recording data logger (in-situ troll) (Table 36-1 in Appendix A); the exception is 2014 when the recording well was installed on July 2. Therefore, during the 3 years of monitoring, there were 2 full growing seasons and 1 partial growing season when water levels were collected using a recording well (2014-2016).

In 2014-2016, the water level was above the wetland threshold for 1 to 2 periods each year for a cumulative, annual, growing season hydroperiod ranging from 18 to 116 days (Table 36-3 in Appendix A). The longest contiguous period each year when water levels were above the wetland threshold ranged from 18 to 77 days, which was 13 to 51% of the reference wetland (Well Ref2; Large Table 7). The water levels for this monitoring location ranged from -25.2 to 1.6 inches, with a total fluctuation over the monitoring period of 26.8 inches (Table 36-4 and Figure 36-1 in Appendix A). The data indicate that the well has met the criteria for wetland hydrology in all 3 years of monitoring (Large Table 7; Figure 36-2 in Appendix A).

Well 37

Well 37 is located in the southeast portion of the Mine Site in Wetland 58, an alder thicket (Type 6) (Large Figure 3). Hydrology has been monitored in this wetland during the 2014-2016 growing seasons (3 years) using a recording data logger (in-situ troll) well (Table 37-1 in Appendix A); the exception is 2014 when the recording well was installed on July 2. Therefore, during the 3 years of monitoring, there were 2 full growing seasons and 1 partial growing season when water levels were collected using a recording well (2014-2016).

In 2014-2016, the water level was above the wetland threshold for 1 to 2 periods each year for a cumulative, annual, growing season hydroperiod ranging from 92 to 151 days (Table 37-3 in Appendix A). The longest contiguous period each year when water levels were above the wetland threshold ranged from 54 to 151 days, which was 39 to 100% of the reference wetland (Well Ref2; Large Table 7). The water levels for this monitoring location ranged from -23.7 to 3.6 inches, with a total fluctuation over the monitoring period of 27.3 inches (Table 37-4 and Figure 37-1 in Appendix A). The data indicate that the well has met the criteria for wetland hydrology in all 3 years of monitoring (Large Table 7; Figure 37-2 in Appendix A).

Well 38

Well 38 is located in the east portion of the Mine Site in Wetland 11, a coniferous bog (Type 8) (Large Figure 3). Hydrology has been monitored in this wetland during the 2014-2016 growing seasons (3 years) using a recording data logger (in-situ troll) (Table 38-1 in Appendix A); the exception is 2014 when the recording well was installed on July 1. Therefore, during the 3 years of monitoring, there were 2 full growing seasons and 1 partial growing season when water levels were collected using a recording well (2014-2016).

In 2014-2016, the water level was above the wetland threshold for 1 to 2 periods each year for a cumulative, annual, growing season hydroperiod ranging from 97 to 151 days (Table 38-3 in Appendix A). The longest contiguous period each year when water levels were above the wetland threshold ranged from 74 to 105 days, which was 99 to 226% of the reference wetland (Well Ref1; Large Table 7). The water levels for this monitoring location ranged from -23.1 to 9.4 inches, with a total fluctuation over the monitoring period of 32.5 inches (Table 38-4 and Figure 38-1 in Appendix A). The data indicate that the well has met the criteria for wetland hydrology in all 3 years of monitoring (Large Table 7; Figure 38-2 in Appendix A).

Well 39

Well 39 is located in the east portion of the Mine Site in Wetland 29, a shallow marsh (Type 3) (Large Figure 3). Hydrology has been monitored in this wetland during the 2014-2016 growing seasons (3 years) using a recording data logger (in-situ troll) (Table 39-1 in Appendix A); the exceptions are 2014, when the recording well was initially installed on July 1 and 2016, when the logger malfunctioned and no data were collected after June 30. Therefore, during the 3 years of monitoring, there was 1 full growing season and 2 partial growing seasons when water levels were collected using a recording well (2014-2016).

In 2014-2016, the water level was above the wetland threshold for 1 period each year for a cumulative, annual, growing season hydroperiod ranging from 48 to 151 days (Table 39-3 in Appendix A). The longest contiguous period each year when water levels were above the wetland threshold ranged from 48 to 151 days, which was 32 to 226% of the reference wetland (Well Ref1, Well Ref2, and Well Ref3; Large Table 7). The water levels for this monitoring location ranged from -8.8 to 4.6 inches, with a total fluctuation over the monitoring period of 13.4 inches (Table 39-4 and Figure 39-1 in Appendix A). The data indicate that the well has met the criteria for wetland hydrology in all 3 years of monitoring (Large Table 7; Figure 39-2 in Appendix A).

Well 43

Well 43 is located in the central portion of the Mine Site in Wetland 48, a coniferous bog (Type 8) (Large Figure 3). Hydrology has been monitored in this wetland during the 2014-2016 growing seasons (3 years) using a recording data logger (in-situ troll) (Table 43-1 in Appendix A); the exception is 2014 when the recording well was installed on July 2. Therefore, during the 3 years of monitoring, there were 2 full growing seasons and 1 partial growing season when water levels were collected using a recording well (2014-2016).

In 2014-2016, the water level was above the wetland threshold for 1 to 2 periods each year for a cumulative, annual, growing season hydroperiod ranging from 86 to 151 days (Table 43-3 in Appendix A). The longest contiguous period each year when water levels were above the wetland threshold ranged from 51 to 151 days, which was 66 to 73% of the reference wetland (Well Ref1; Large Table 7). The water levels for this monitoring location ranged from -20.2 to -4.0 inches, with a total fluctuation over the monitoring period of 16.2 inches (Table 43-4 and Figure 43-1 in Appendix A). The data indicate that the

well has met the criteria for wetland hydrology in all 3 years of monitoring (Large Table 7; Figure 43-2 in Appendix A).

Well 44

Well 44 is located in the central portion of the Mine Site in Wetland 68, a coniferous swamp (Type 7) (Large Figure 3). Hydrology has been monitored in this wetland during the 2014-2016 growing seasons (3 years) using a recording data logger (in-situ troll) (Table 44-1 in Appendix A); the exception is 2014 when the recording well was installed on July 1. Therefore, during the 3 years of monitoring, there were 2 full growing seasons and 1 partial growing season when water levels were collected using a recording well (2014-2016).

Wells 44, 25, and 46 are installed in different areas of Wetland 68. Wells 44 and 46 did not meet the hydrology criteria during the 3 years of monitoring; however, Well 25 meets the hydrology criteria for all 3 years of monitoring (Large Table 7). All three wells were installed in areas with rocky to bouldery substrates and well placement was difficult at Wells 44 and 46 due to the presence of boulders, rocks, and shallow depths to refusal (rock). The ground elevation at Well 46 is about 4 feet higher in elevation than Wells 44 and 25; Well 46 is located in the upper portion of the wetland (Large Figure 2).

The soil profile at Wells 46 and 25 included 5 to 6 inches of muck over mineral substrate (silty loam or fine sandy clay); Well 44 had mineral soil (fine sandy clay loam over fine sandy clay) throughout the profile with forest duff on the surface. Wells were installed within or above a confining soil layer. In some cases, multiple borings were completed to determine the thickness of the confining soil layer so that the well was installed within that layer. Soils met multiple hydric soil indicators at the three locations including Black Histic (A3), Depleted Matrix (F3), and/or Depleted Below Dark Surface (A11) (Reference (10)).

Dominant vegetation at Well 44 included black spruce (40%; FACW), speckled alder (2%; FACW), and Labrador tea (80%; OBL); at Well 25 included balsam fir (70%; FAC), club moss (20%; FAC), Canadian bunchberry (10%; FAC), and sphagnum moss (40%; OBL); and at Well 46 included black spruce (70%; FACW), small cranberry (20%; OBL), and sphagnum moss (90%; OBL). Vegetation at all locations met hydrophytic vegetation Indicator 2: Dominance Test using the 50/20 rule (more than 50% of the dominant plant species across all strata are rated OBL, FACW, or FAC) (Reference (10)).

In 2014-2016, water levels for this monitoring location ranged from -26.4 to -8.2 inches, with a total fluctuation over the monitoring period of 18.2 inches (Table 44-4 and Figure 44-1 in Appendix A). During 2014, the water level in Well 44 never rose to above the wetland threshold. In 2015, the water levels in Well 44 were periodically above the wetland threshold for less than one day. In 2016, the water level was above the wetland threshold for three separate periods during the growing season that ranged from 2 to 5 days each (Figure 44-1 and Figure 44-2 in Appendix A). Based on the 3 years of monitoring data, Well 44 has not met the minimum criteria for wetland hydrology (Large Table 7; Figure 44-2 in Appendix A). While the water level is not above the wetland threshold early in the growing season, given that the well is installed in fine soils, capillarity may keep the soil saturated for periods long enough to support the hydric soils and hydrophytic vegetation that are present at the site.

Well 45

Well 45 is located in the east portion of the Mine Site in Wetland 90A, an open bog (Type 8) (Large Figure 3). Hydrology has been monitored in this wetland during the 2014-2016 growing seasons (3 years) using a recording data logger (in-situ troll) (Table 45-1 in Appendix A); the exception is 2014 when the recording well was installed on July 2. Therefore, during the 3 years of monitoring, there were 2 full growing seasons and 1 partial growing season when water levels were collected using a recording well (2014-2016).

In 2014-2016, the water level was above the wetland threshold for 2 to 3 periods each year for a cumulative, annual, growing season hydroperiod ranging from 76 to 136 days (Table 45-3 in Appendix A). The longest contiguous period each year when water levels were above the wetland threshold ranged from 38 to 71 days, which was 27 to 88% of the reference wetland (Well Ref1, Well Ref2, and Well Ref3; Large Table 7). The water levels for this monitoring location ranged from -20.1 to -4.4 inches, with a total fluctuation over the monitoring period of 15.7 inches (Table 45-4 and Figure 45-1 in Appendix A). The data indicate that the well has met the criteria for wetland hydrology in all 3 years of monitoring (Large Table 7; Figure 45-2 in Appendix A).

Well 46

Well 46 is located in the central portion of the Mine Site in Wetland 68, a coniferous swamp (Type 7) (Large Figure 3). Hydrology has been monitored in this wetland during the 2014-2016 growing seasons (3 years) using a recording data logger (in-situ troll) (Table 46-1 in Appendix A); the exception is 2014 when the recording well was installed on July 1. Therefore, during the 3 years of monitoring, there were 2 full growing seasons and 1 partial growing season when water levels were collected using a recording well (2014-2016).

Wells 46, 25, and 44 are installed in different areas of Wetland 68. Wells 46 and 44 did not meet the hydrology criteria during the 3 years of monitoring; however, Well 25 meets the hydrology criteria for all 3 years of monitoring (Large Table 7). All three wells were installed in areas with rocky to boulder substrates and well placement was difficult at Wells 46 and 44 due to the presence of boulders, rocks, and shallow depths to refusal (rock). The ground elevation at Well 46 is about 4 feet higher in elevation than Wells 44 and 25; Well 46 is located in the upper portion of the wetland watershed (Large Figure 2).

The soil profile at Wells 46 and 25 included 5 to 6 inches of muck over mineral substrate (silty loam or fine sandy clay; Well 44 had mineral soil at the surface with forest duff on the surface. Wells were installed within or above confining soil layer. In some cases, multiple borings were completed to determine the thickness of the confining soil layer so that the well was installed within that layer. Soils met multiple hydric soil indicators at the three locations including Black Histic (A3), Depleted Matrix (F3), and/or Depleted Below Dark Surface (A11) (Reference (10)).

Dominant vegetation at Well 46 included black spruce (70%; FACW), small cranberry (20%; OBL), and sphagnum moss (90%; OBL); Well 25 included balsam fir (70%; FAC), club moss (20%; FAC), Canadian bunchberry (10%; FAC), and sphagnum moss (40%; OBL); and Well 44 included black spruce (40%; FACW), speckled alder (2%; FACW), and Labrador tea (80%; OBL). Vegetation at all locations met Indicator 2:

Dominance Test using the 50/20 rule (more than 50% of the dominant plant species across all strata are rated OBL, FACW, or FAC) for hydrophytic vegetation (Reference (10)).

In 2014-2016, the water levels for this monitoring location ranged from -29.6 to -18.9 inches, with a total fluctuation over the monitoring period of 10.7 inches (Table 46-4 and Figure 46-1 in Appendix A). The water levels in Well 46 were below the wetland threshold for all years during the growing season (Figure 46-1 and Figure 46-2 in Appendix A). There is water present in the well through early to mid-July in 2014-2016; however, in 2014, there was no water in the well after mid-July. In 2015, water was present until mid-July and again in early September after one inch of rainfall on September 3. In 2016, water was present in the well throughout the entire monitoring period. Since this well was installed in a bouldery area, soils are clay loam and clay (restrict water movement), and the bottom of the well is on rock; it is likely that there is little or no groundwater contribution to the wetland and that precipitation and surface water are the primary supporting sources of hydrology for this portion of the wetland. The hydrographs for 2015 and 2016 support this hypothesis since the water level increases when there is a precipitation event (Figure 46-2 in Appendix A). Therefore, while the water level is never above the wetland threshold during the growing season, given that the well is installed in fine soils, capillarity may keep the soil saturated for periods long enough to support the hydric soils and hydrophytic vegetation present. The data indicate that the well has not met the criteria for wetland hydrology in all 3 years of monitoring (Large Table 7; Figure 46-2 in Appendix A).

Well 47

Well 47 is located in the northern portion of the Mine Site area in Wetland 315, an alder thicket (Type 6) (Large Figure 3). Hydrology has been monitored in this wetland during the 2014-2016 growing seasons (3 years) using a recording data logger (in-situ troll) (Table 47-1 in Appendix A); the exception is 2014 when the recording well was installed on July 1. Therefore, during the 3 years of monitoring, there were 2 full growing seasons and 1 partial growing season when water levels were collected using a recording well (2014-2016).

In 2014-2016, the water level was above the wetland threshold for 1 to 2 periods each year for a cumulative, annual, growing season hydroperiod ranging from 73 to 151 days (Table 47-3 in Appendix A). The longest contiguous period each year when water levels were above the wetland threshold ranged from 38 to 151 days, which was 27 to 100% of the reference wetland (Well Ref2; Large Table 7). The water levels for this monitoring location ranged from -18.2 to 8.0 inches, with a total fluctuation over the monitoring period of 26.2 inches (Table 47-4 and Figure 47-1 in Appendix A). The data indicate that the well has met the criteria for wetland hydrology in all 3 years of monitoring (Large Table 7; Figure 47-2 in Appendix A).

Well 48

Well 48 is located in the southern portion of the Mine Site area in Wetland 53D, an alder thicket (Type 6) (Large Figure 3). Hydrology has been monitored in this wetland during the 2014-2016 growing seasons (3 years) using a recording data logger (in-situ troll) (Table 48-1 in Appendix A); the exception is 2014 when the recording well was installed on July 2. Therefore, during the 3 years of monitoring, there were 2 full

growing seasons and 1 partial growing season when water levels were collected using a recording well (2014-2016).

In 2014-2016, the water level was above the wetland threshold for 1 to 2 periods each year for a cumulative, annual, growing season hydroperiod ranging from 65 to 151 days (Table 48-3 in Appendix A). The longest contiguous period each year when water levels were above the wetland threshold ranged from 36 to 151 days, which was 26 to 100% of the reference wetland (Well Ref2; Large Table 7). The water levels for this monitoring location ranged from -31.1 to 1.9 inches, with a total fluctuation over the monitoring period of 33.0 inches (Table 48-4 and Figure 48-1 in Appendix A). The data indicate that the well has met the criteria for wetland hydrology in all 3 years of monitoring (Large Table 7; Figure 48-2 in Appendix A).

7.1.1.2 Reference Wetlands in the Mine Site Area

Well Ref1

Well Ref1 is located west of the Mine Site in Wetland 900, a coniferous bog (Type 8) (Large Figure 4). Hydrology has been monitored in this wetland during the 2008-2015 growing seasons (8 years) using a recording data logger (ecotone) and a manual well during the growing season (Table Ref1-1 in Appendix D). There was no data recorded in 2016 because the logger malfunctioned and the data was not useable. Therefore, during the 8 years of monitoring, there were eight full growing seasons when water levels were collected using a recording well (2008-2015).

In 2008-2015, the water level was above the wetland threshold for 1 to 2 periods each year for a cumulative, annual, growing season hydroperiod ranging from 111 to 149 days (Table Ref1-3 in Appendix D). The longest contiguous period each year when water levels were above the wetland threshold in the reference wetland ranged from 77 to 149 days (Large Table 6 and Large Table 7). The water levels for this monitoring location ranged from -16.0 to 4.1 inches, with a total fluctuation over the monitoring period of 20.1 inches (Table Ref1-4 and Figure Ref1-1 in Appendix D). The data indicate that the well has met the criteria for wetland hydrology in all 8 years of monitoring (Large Table 6 and Large Table 7; Figure Ref1-2 in Appendix D).

Well Ref2

Well Ref1 is located west of the Mine Site in Wetland 900, a coniferous bog (Type 8) (Large Figure 4). Hydrology has been monitored in this wetland during the 2008-2016 growing seasons (9 years) using a recording data logger (ecotone) and a manual well during the growing season (Table Ref2-1 in Appendix D). Therefore, during the 9 years of monitoring, there were nine full growing seasons when water levels were collected using a recording well (2008-2016).

In 2008-2016, the water level was above the wetland threshold for 1 to 2 periods each year for a cumulative, annual, growing season hydroperiod ranging from 124 to 151 days (Table Ref2-3 in Appendix D). The longest contiguous period each year when water levels were above the wetland threshold in the reference wetland ranged from 90 to 151 days (Large Table 6 and Large Table 7). The water levels for this monitoring location ranged from -17.1 to 9.1 inches, with a total fluctuation over the

monitoring period of 26.2 inches (Table Ref2-4 and Figure Ref2-1 in Appendix D) The data indicate that the well has met the criteria for wetland hydrology in all 9 years of monitoring (Large Table 6 and Large Table 7; Figure Ref2-2 in Appendix D).

Well Ref3

Well Ref3 is located on the southwest of the Mine Site in Wetland 394A, a coniferous swamp (Type 7) (Large Figure 4). Hydrology has been monitored in this wetland during the 2014-2016 growing seasons (3 years) using a recording data logger (in-situ troll) (Table Ref3-1 in Appendix D); the exception is 2014 when the recording well was installed on July 1. Therefore, during the 3 years of monitoring, there were two full growing seasons and one partial growing season when water levels were collected using a recording well (2014-2016).

In 2014-2016, the water level was above the wetland threshold for 1 to 2 periods each year for a cumulative, annual, growing season hydroperiod ranging from 81 to 151 days (Table Ref3-3 in Appendix D). The longest contiguous period each year when water levels were above the wetland threshold ranged from 43 to 151 days (Large Table 7). The water levels for this monitoring location ranged from -14.3 to 5.4 inches, with a total fluctuation over the monitoring period of 19.7 inches (Table Ref3-4 and Figure Ref3-1 in Appendix D) The data indicate that the well has met the criteria for wetland hydrology in all 7 years of monitoring (Large Table 7; Figure Ref3-2 in Appendix D).

7.1.2 Transportation and Utility Corridors

The wetland hydrology monitoring data from 2014-2016 represents pre-Project baseline conditions. The monitoring locations at the Transportation and Utility Corridors which are in reference wetlands include Wells Ref1, Ref2, and Ref3; these are the same reference wetlands for the Mine Site (Mine Site reference wetlands). The monitoring data shows the presence of sustained wetland hydrology (above the wetland threshold) in all of the monitored wetlands throughout 2014-2016 (Large Table 7).

The hydrographs in Appendix B show water levels for the monitoring wells in the Transportation and Utility Corridors area and the hydrographs in Appendix D show water levels in reference wetlands (Wells Ref1, Ref2, and Ref3). The longest annual, single hydroperiod for each well during the growing season ranged from 30 to 151 days. For the reference wetlands, the longest annual, single hydroperiod for each well during the growing season ranged from 43 to 151 days. The longest annual, single hydroperiod for the monitoring wells in the Transportation and Utility Corridors area ranged from 56 to 226% of the reference wetlands during the 2014-2016 growing seasons (Large Table 7). The reference wetlands will be used for comparison to wetlands that may be affected by the project during operations.

The precipitation during the growing season influences the number of hydroperiods and length of the cumulative hydroperiod for each monitoring location. The number of hydroperiods and the total number of days when the water level was above the wetland threshold for 14 or more consecutive days (cumulative hydroperiod) is shown on the tables ending in -3 (such as Table 41-3) in Appendix B. All monitoring wells met the hydrology criteria throughout each year monitored. The cumulative hydroperiod(s) were 99 to 100% of the growing season for 67% of the monitoring wells across all years.

The cumulative hydroperiod(s) were 80 to 98% of the growing season for 11% of the monitoring wells across all years; 70 to 79% of the growing season for 11% of the monitoring wells across all years; and less than 70% of the growing season for 11% of the monitoring wells across all years.

For the reference wetlands (Wells Ref1, Ref2, and Ref3), the number of hydroperiods and the cumulative hydroperiods are shown on the tables ending in -3 (such as Table Ref1-3) in Appendix D. The reference wetlands met the hydrology criteria throughout each year monitored. The cumulative hydroperiod(s) were 99 to 100% of the growing season for approximately 65% of the monitoring wells across all years. The cumulative hydroperiod(s) were 80 to 98% of the growing season for 25% of the reference wetlands across all years, and 70 to 79% of the growing season for 10% of the reference wetlands across all years.

The precipitation during the growing season also influences the water level fluctuations during the growing season for each monitoring location. For the monitoring wells, the minimum water level, maximum water level, and total fluctuation for each year is shown on the tables ending in -4 (such as Table 1-4) in Appendix A, Appendix B, and Appendix C. The total fluctuation during the growing season for all years is provided at the top of each datasheet in Appendix A, Appendix B, and Appendix C. The smallest (minimum) annual water level fluctuation during the growing season for the monitoring wells was 5.5 inches (Well 41, shallow marsh, 2016 water year precipitation was above the normal range). The largest (maximum) annual water level fluctuation during the growing season for the monitoring wells was 26.5 inches (Well 40, coniferous swamp, 2015 water year precipitation was below the normal range). When considering all recorded data, the difference between the lowest and highest recorded water levels in each well ranged from 11.8 inches (Well 41, coniferous swamp) to 29.0 inches (Well 40, coniferous swamp).

For the reference wetlands (Wells Ref1, Ref2, and Ref3), the minimum water level, maximum water level, and total fluctuation for each year is shown on the tables ending in -4 (such as Table Ref1-4) in Appendix D. The total fluctuation during the growing season for all years is provided at the top of each datasheet in Appendix D. The smallest (minimum) annual water level fluctuation during the growing season for the reference wetlands was 5.0 inches (Well Ref1, coniferous bog, 2014 water year precipitation was within the normal range). The largest (maximum) annual water level fluctuation during the growing season for the reference wetlands was 24.8 inches (Well Ref2, alder thicket, 2008 water year precipitation was below the normal range). When considering all recorded data, the difference between the lowest and highest recorded water levels in each well ranged from 19.7 inches (Well Ref3, coniferous swamp) to 26.2 inches (Well Ref2, alder thicket).

The following sections provide detailed information on the hydrology monitoring that was conducted in the Transportation and Utility Corridors area and reference wetlands in the Mine Site area.

7.1.2.1 Monitoring Locations in the Transportation and Utility Corridors Area

Well 40

Well 40 is located in the Transportation and Utility Corridors area in Wetland 571, a coniferous swamp (Type 7) (Large Figure 4). Hydrology has been monitored in this wetland during the 2014-2016 growing seasons (3 years) using a recording data logger (in-situ troll) (Table 40-1 in Appendix B); the exception is

2014 when the recording well was installed on July 1. Therefore, during the 3 years of monitoring, there were 2 full growing seasons and 1 partial growing season when water levels were collected using a recording well (2014-2016).

In 2014-2016, the water level was above the wetland threshold for 1 to 3 periods each year for a cumulative, annual, growing season hydroperiod ranging from 30 to 143 days (Table 40-3 in Appendix B). The longest contiguous period each year when water levels were above the wetland threshold ranged from 30 to 84 days, which was 56 to 79% of the reference wetland (Well Ref3; Large Table 7). The water levels for this monitoring location ranged from -27.3 to 1.7 inches, with a total fluctuation over the monitoring period of 29.0 inches (Table 40-4 and Figure 40-1 in Appendix B). The data indicate that the well has met the criteria for wetland hydrology in all 3 years of monitoring (Large Table 7; Figure 40-2 in Appendix B).

Well 41

Well 41 is located in the Transportation and Utility Corridors area in Wetland R-7A, a shallow marsh (Type 3) (Large Figure 4). Hydrology has been monitored in this wetland during the 2014-2016 growing seasons (3 years) using a recording data logger (in-situ troll) (Table 41-1 in Appendix B); the exception is 2014 when the recording well was installed on July 2. Therefore, during the 3 years of monitoring, there were 2 full growing seasons and 1 partial growing season when water levels were collected using a recording well (2014-2016).

In 2014-2016, the water level was above the wetland threshold for 1 period each year for a cumulative, annual, growing season hydroperiod ranging from 96 to 151 days (Table 41-3 in Appendix B). The longest contiguous period each year when water levels were above the wetland threshold ranged from 96 to 151 days, which was 69 to 223% of the reference wetland (Well Ref1, Well Ref2, and Well Ref3; Large Table 7). The water levels for this monitoring location ranged from -8.5 to 3.3 inches, with a total fluctuation over the monitoring period of 11.8 inches (Table 41-4 and Figure 41-1 in Appendix B). The data indicate that the well has met the criteria for wetland hydrology in all 3 years of monitoring (Large Table 7; Figure 41-2 in Appendix B).

Well 42

Well 42 is located in the Transportation and Utility Corridors area in Wetland 1041, a shrub-carr (Type 6) (Large Figure 4). Hydrology has been monitored in this wetland during the 2014-2016 growing seasons (3 years) using a recording data logger (in-situ troll) (Table 42-1 in Appendix B); the exception is 2014 when the recording well was installed on July 1. Therefore, during the 3 years of monitoring, there were 2 full growing seasons and 1 partial growing season when water levels were collected using a recording well (2014-2016).

In 2014-2016, the water level was above the wetland threshold for 1 to 2 periods each year for a cumulative, annual, growing season hydroperiod ranging from 97 to 149 days (Table 42-3 in Appendix B). The longest contiguous period each year when water levels were above the wetland threshold ranged from 97 to 146 days, which was 70 to 226% of the reference wetland (Well Ref1, Well Ref2, and Well Ref3; Large Table 7). In 2015, the water level in this wetland increased in June and July while all other wetland

locations showed decreasing water levels; therefore, this wetland was likely influenced by the building of a beaver dam or the culvert under the railroad track was blocked. By mid-August, water levels had returned to levels comparable to other wetland water levels. The water levels for this monitoring location ranged from -12.3 to 9.6 inches, with a total fluctuation over the monitoring period of 21.9 inches (Table 42-4 and Figure 42-1 in Appendix B). The data indicate that the well has met the criteria for wetland hydrology in all 3 years of monitoring (Large Table 7; Figure 42-2 in Appendix B).

7.1.2.2 Reference Wetlands

See the descriptions of the reference wetlands in Section 7.1.1.2.

7.1.3 Plant Site

The wetland hydrology monitoring data from 2010-2016 represents pre-Project baseline conditions. The monitoring locations at the Plant Site which are in reference wetlands include Wells RefTB1 and RefTB8. The monitoring data shows the presence of sustained wetland hydrology (above the wetland threshold) in all of the monitored wetlands throughout 2010-2016 (Large Table 7).

The hydrographs in Appendix C show water levels for the monitoring wells in the Plant Site area and the hydrographs in Appendix D show water levels in Plant Site reference wetlands. The longest annual, single hydroperiod for each well during the growing season ranged from 34 to 151 days. For the reference wetlands, the longest annual, single hydroperiod for each well during the growing season ranged from 64 to 151 days. The longest annual, single hydroperiod for the monitoring wells in the Transportation and Utility Corridors area ranged from 23 to 236% of the reference wetlands during the 2010-2016 growing seasons (Large Table 8). The reference wetlands will be used for comparison to wetlands that may be affected by the project during operations.

The precipitation during the growing season influences the number of hydroperiods and length of the cumulative hydroperiod for each monitoring location. The number of hydroperiods and the total number of days when the water level was above the wetland threshold for 14 or more consecutive days (cumulative hydroperiod) is shown on the tables ending in -3 (such as Table TB1-3) in Appendix C. All monitoring wells met the hydrology criteria throughout each year monitored. The cumulative hydroperiod(s) were 99 to 100% of the growing season for 76% of the monitoring wells across all years. The cumulative hydroperiod(s) were 80 to 98% of the growing season for 9% of the monitoring wells across all years; 70 to 79% of the growing season for 6% of the monitoring wells across all years; and less than 70% of the growing season for 9% of the monitoring wells across all years.

For the Plant Site reference wetlands (Wells RefTB1 and RefTB8), the number of hydroperiods and the cumulative hydroperiods are shown on the tables ending in -3 (such as Table RefTB1-3) in Appendix D. The reference wetlands met the hydrology criteria throughout each year monitored. The cumulative hydroperiod(s) were 99 to 100% of the growing season for approximately half of the monitoring wells across all years. The cumulative hydroperiod(s) were 80 to 98% of the growing season for 40% of the reference wetlands across all years, and 70 to 79% of the growing season for 10% of the reference wetlands across all years.

The precipitation during the growing season also influences the water level fluctuations during the growing season for each monitoring location. For the monitoring wells, the minimum water level, maximum water level, and total fluctuation for each year is shown on the tables ending in -4 (such as Table RefTB1-4) in Appendix C. The total fluctuation during the growing season for all years is provided at the top of each datasheet in Appendix C. The smallest (minimum) annual water level fluctuation during the growing season for the monitoring wells was 1.8 inches (Well 12, coniferous swamp, 2014 water year precipitation was within the normal range). The largest (maximum) annual water level fluctuation during the growing season for the monitoring wells was 17.0 inches (Well TB14, sedge meadow, 2016 water year precipitation was above the normal range). When considering all recorded data, the difference between the lowest and highest recorded water levels in each well ranged from 4.5 inches (Well TB12, coniferous swamp) to 45.6 inches (Well TB1, shallow marsh).

For the Plant Site reference wetlands (Wells RefTB1 and RefTB8), the minimum water level, maximum water level, and total fluctuation for each year is shown on the tables ending in -4 (such as Table RefTB1-4) in Appendix D. The total fluctuation during the growing season for all years is provided at the top of each datasheet in Appendix D. The smallest (minimum) annual water level fluctuation during the growing season for the reference wetlands was 5.3 inches (Well RefTB8, coniferous bog, 2010 water year precipitation was within the normal range and 2016 water year precipitation was above the normal range). The largest (maximum) annual water level fluctuation during the growing season for the reference wetlands was 17.0 inches (Well RefTB8, coniferous bog, 2011 water year precipitation was below the normal range). When considering all recorded data, the difference between the lowest and highest recorded water levels in each well ranged from 16.5 inches (Well RefTB1, coniferous swamp) to 17.2 inches (Well RefTB8, coniferous bog).

The following sections provide detailed information on the hydrology monitoring that was conducted in the Plant Site area and reference wetlands in the Plant Site area.

7.1.3.1 Monitoring Locations

Well TB1

Well TB1 is located northwest of the Plant Site in Wetland 923, a sedge meadow (Type 2) (Large Figure 4). Hydrology has been monitored in this wetland during the 2010-2016 growing seasons (7 years) using a recording data logger (ecotone) and a manual well (Table TB1-1 in Appendix C). In July 2014, the water level in this wetland started to increase while all other wetland locations showed stable or decreasing water levels; field notes indicated that water levels in this wetland are influenced by the building of a beaver dam. In 2016, the water level at TB1 was too high to install the logger until early July due to beaver activity and dam building in the area. Water levels continued to increase in 2015 and 2016. Therefore, during the 7 years of monitoring, there were seven full growing seasons when water levels were collected using a recording well (2010-2016).

In 2010-2016, the water level was above the wetland threshold for 1 to 2 periods each year for a cumulative, annual, growing season hydroperiod ranging from 34 to 151 days (Table TB1-3 in Appendix C). The longest contiguous period each year when water levels were above the wetland

threshold ranged from 34 to 151 days. Water levels ranged from 23 to 236% of the reference wetlands (Wells Ref1, Ref2, Ref3; Large Table 8). The water levels for this monitoring location ranged from -28.0 to 17.6 inches, with a total fluctuation over the monitoring period of 45.6 inches (Table TB1-4 and Figure TB1-1 in Appendix C) The data indicate that the well has met the criteria for wetland hydrology in all 7 years of monitoring (Large Table 8; Figure TB1-2 in Appendix C).

Well TB2

Well TB2 is located northwest of the Plant Site in Wetland 917, a coniferous bog (Type 8) (Large Figure 4). Hydrology has been monitored in this wetland during the 2010-2016 growing seasons (7 years) using a recording data logger (ecotone) and a manual well (Table TB2-1 in Appendix C). Therefore, during the 7 years of monitoring, there were seven full growing seasons when water levels were collected using a recording well (2010-2016).

In 2010-2016, the water level was above the wetland threshold for 1 to 2 periods each year for a cumulative, annual, growing season hydroperiod ranging from 103 to 151 days (Table TB2-3 in Appendix C). The longest contiguous period each year when water levels were above the wetland threshold ranged from 117 to 151 days. Water levels ranged from 90 to 236% of the reference wetlands (Well RefTB8; Large Table 8). In 2016, the logger malfunctioned and there was no data collected for short periods in May, July and October. The water levels for this monitoring location ranged from -15.7 to 6.8 inches, with a total fluctuation over the monitoring period of 22.5 inches (Table TB2-4 and Figure TB2-1 in Appendix C) The data indicate that the well has met the criteria for wetland hydrology in all 7 years of monitoring (Large Table 8; Figure TB2-2 in Appendix C).

Well TB3

Well TB3 is located on the western portion of the Plant Site in Wetland 260, a shallow marsh (Type 3) (Large Figure 4). Hydrology has been monitored in this wetland during the 2010-2016 growing seasons (7 years) using a recording data logger (ecotone) and a manual well (Table TB3-1 in Appendix C). Therefore, during the 7 years of monitoring, there were seven full growing seasons when water levels were collected using a recording well (2010-2016).

In 2010-2016, the water level was above the wetland threshold for 1 period each year for a cumulative, annual, growing season hydroperiod ranging from 136 to 151 days (Table TB3-3 in Appendix C). The longest contiguous period each year when water levels were above the wetland threshold ranged from 136 to 151 days. Water levels ranged from 100 to 236% of the reference wetlands (Wells RefTB1 and RefTB8; Large Table 8). The water levels for this monitoring location ranged from 2.9 to 12.0 inches, with a total fluctuation over the monitoring period of 9.1 inches (Table TB3-4 and Figure TB3-1 in Appendix C) The data indicate that the well has met the criteria for wetland hydrology in all 7 years of monitoring (Large Table 8; Figure TB3-2 in Appendix C).

Well TB4

Well TB4 is located north of the Plant Site in Wetland 260, shallow marsh (Type 3) (Large Figure 4). Hydrology has been monitored in this wetland during the 2010-2016 growing seasons (7 years) using a

recording data logger (ecotone) and a manual well (Table TB4-1 in Appendix C). Therefore, during the 7 years of monitoring, there were seven full growing seasons when water levels were collected using a recording well (2010-2016).

In 2010-2016, the water level was above the wetland threshold for 1 period each year for a cumulative, annual, growing season hydroperiod ranging from 42 to 151 days (Table TB4-3 in Appendix C). The longest contiguous period each year when water levels were above the wetland threshold ranged from 42 to 151 days. Water levels ranged from 28 to 236% of the reference wetlands (Wells RefTB1 and RefTB8; Large Table 8). In 2014, the logger malfunctioned and there was no data collected for a short period in June. The water levels for this monitoring location ranged from 2.4 to 16.1 inches, with a total fluctuation over the monitoring period of 13.7 inches (Table TB4-4 and Figure TB4-1 in Appendix C). The data indicate that the well has met the criteria for wetland hydrology in all 7 years of monitoring (Large Table 8; Figure TB4-2 in Appendix C).

Well TB5

Well TB5 is located northeast of the Plant Site in Wetland 868, a hardwood swamp (Type 7) (Large Figure 4). In 2015 and 2016, the water levels in this wetland were influenced by the building of a beaver dam. Hydrology has been monitored in this wetland during the 2010-2016 growing seasons (7 years) using a recording data logger (ecotone) and a manual well (Table TB5-1 in Appendix C). Therefore, during the 7 years of monitoring, there were seven full growing seasons when water levels were collected using a recording well (2010-2016).

In 2010-2016, the water level was above the wetland threshold for 1 period each year for a cumulative, annual, growing season hydroperiod ranging from 139 to 151 days (Table TB5-3 in Appendix C). The longest contiguous period each year when water levels were above the wetland threshold ranged from 139 to 151 days. Water levels ranged from 100 to 236% of the reference wetlands (Wells RefTB1 and RefTB8; Large Table 8). The water levels for this monitoring location ranged from -0.6 to 24.0 inches, with a total fluctuation over the monitoring period of 24.6 inches (Table TB5-4 and Figure TB5-1 in Appendix C). The data indicate that the well has met the criteria for wetland hydrology in all 7 years of monitoring (Large Table 8; Figure TB5-2 in Appendix C).

Well TB6

Well TB6 is located north of the Plant Site in Wetland 1151, a coniferous swamp (Type 7) (Large Figure 4). Hydrology has been monitored in this wetland during the 2010-2016 growing seasons (7 years) using a recording data logger (ecotone) and a manual well (Table TB6-1 in Appendix C). Therefore, during the 7 years of monitoring, there were seven full growing seasons when water levels were collected using a recording well (2010-2016).

In 2010-2016, the water level was above the wetland threshold for 1 period each year for a cumulative, annual, growing season hydroperiod ranging from 136 to 151 days (Table TB6-3 in Appendix C). The longest contiguous period each year when water levels were above the wetland threshold ranged from 136 to 151 days. Water levels ranged from 100 to 147% of the reference wetland (Well RefTB1; Large Table 8). The water levels for this monitoring location ranged from -1.0 to 9.6 inches, with a total

fluctuation over the monitoring period of 10.6 inches (Table TB6-4 and Figure TB6-1 in Appendix C) The data indicate that the well has met the criteria for wetland hydrology in all 7 years of monitoring (Large Table 8; Figure TB6-2 in Appendix C).

Well TB7

Well TB7 is located on the western portion of the Plant Site in Wetland 915, an alder thicket (Type 6) (Large Figure 4). Hydrology has been monitored in this wetland during the 2010-2016 growing seasons (7 years) using a recording data logger (ecotone) and a manual well (Table TB7-1 in Appendix C). Therefore, during the 7 years of monitoring, there were seven full growing seasons when water levels were collected using a recording well (2010-2016).

In 2010-2016, the water level was above the wetland threshold for 1 period each year for a cumulative, annual, growing season hydroperiod ranging from 136 to 151 days (Table TB7-3 in Appendix C). The longest contiguous period each year when water levels were above the wetland threshold ranged from 136 to 151 days. Water levels ranged from 100 to 236% of the reference wetland (Well RefTB1 and TB8; Large Table 8). The water levels for this monitoring location ranged from -1.3 to 11.4 inches, with a total fluctuation over the monitoring period of 12.7 inches (Table TB7-4 and Figure TB7-1 in Appendix C) The data indicate that the well has met the criteria for wetland hydrology in all 7 years of monitoring (Large Table 8; Figure TB7-2 in Appendix C).

Well TB9

Well TB9 is located south of the Plant Site in Wetland 1162, a shallow marsh (Type 3) (Large Figure 4). Hydrology has been monitored in this wetland during the 2014-2016 growing seasons (3 years) using a recording data logger (in-situ troll) (Table TB9-1 in Appendix C); the exception is 2014 when the recording well was installed on June 30. Therefore, during the 3 years of monitoring, there were 2 full growing seasons and 1 partial growing season when water levels were collected using a recording well (2014-2016).

In 2014-2016, the water level was above the wetland threshold for 1 to 2 periods each year for a cumulative, annual, growing season hydroperiod ranging from 79 to 151 days (Table TB9-3 in Appendix C). The longest contiguous period each year when water levels were above the wetland threshold ranged from 79 to 151 days, which was 64 to 145% of the reference wetlands (Well Ref TB1 and Well Ref TB8; Large Table 8). The water levels for this monitoring location ranged from -14.4 to 13.4 inches, with a total fluctuation over the monitoring period of 27.8 inches (Table TB9-4 and Figure TB9-1 in Appendix C). The data indicate that the well has met the criteria for wetland hydrology in all 3 years of monitoring (Large Table 8; Figure TB9-2 in Appendix C).

Well TB10

Well TB10 is located west of the Plant Site in Wetland 1176, a hardwood swamp (Type 7) (Large Figure 4). Hydrology has been monitored in this wetland during the 2014-2016 growing seasons (3 years) using a recording data logger (in-situ troll) (Table TB10-1 in Appendix C); the exception is 2014 when the recording well was installed on June 30. Therefore, during the 3 years of monitoring, there were 2 full

growing seasons and 1 partial growing season when water levels were collected using a recording well (2014-2016).

In 2014-2016, the water level was above the wetland threshold for 1 period each year for a cumulative, annual, growing season hydroperiod ranging from 74 to 151 days (Table TB10-3 in Appendix C). The longest contiguous period each year when water levels were above the wetland threshold ranged from 74 to 151 days, which was 78 to 228% of the reference wetlands (Well Ref TB1 and Well Ref TB8; Large Table 8). The water levels for this monitoring location ranged from -16.1 to 10.0 inches, with a total fluctuation over the monitoring period of 26.1 inches (Table TB10-4 and Figure TB10-1 in Appendix C). The data indicate that the well has met the criteria for wetland hydrology in all 3 years of monitoring (Large Table 8; Figure TB10-2 in Appendix C).

Well TB11

Well TB11 is located west of the Plant Site in Wetland 282A, a shallow marsh (Type 3) (Large Figure 4). Hydrology has been monitored in this wetland during the 2014-2016 growing seasons (3 years) using a recording data logger (in-situ troll) (Table TB11-1 in Appendix C); the exception is 2014 when the recording well was installed on July 3. Therefore, during the 3 years of monitoring, there were 2 full growing seasons and 1 partial growing season when water levels were collected using a recording well (2014-2016).

In 2014-2016, the water level was above the wetland threshold for 1 to 2 periods each year for a cumulative, annual, growing season hydroperiod ranging from 56 to 146 days (Table TB11-3 in Appendix C). The longest contiguous period each year when water levels were above the wetland threshold ranged from 38 to 146 days, which was 37 to 228% of the reference wetlands (Well Ref TB1 and Well Ref TB8; Large Table 8). The water levels for this monitoring location ranged from -21.3 to 0.3 inches, with a total fluctuation over the monitoring period of 21.6 inches (Table TB11-4 and Figure TB11-1 in Appendix C). The data indicate that the well has met the criteria for wetland hydrology in all 3 years of monitoring (Large Table 8; Figure TB11-2 in Appendix C).

Well TB12

Well TB12 is located north of the Plant Site in Wetland 968, a coniferous swamp (Type 7) (Large Figure 4). Hydrology has been monitored in this wetland during the 2014-2016 growing seasons (3 years) using a recording data logger (in-situ troll) (Table TB12-1 in Appendix C); the exception is 2014 when the recording well was installed on June 30. Therefore, during the 3 years of monitoring, there were 2 full growing seasons and 1 partial growing season when water levels were collected using a recording well (2014-2016).

In 2014-2016, the water level was above the wetland threshold for 1 period each year for a cumulative, annual, growing season hydroperiod ranging from 98 to 151 days (Table TB12-3 in Appendix C). The longest contiguous period each year when water levels were above the wetland threshold ranged from 98 to 151 days, which was 100 to 103% of the reference wetlands (Well Ref TB1; Large Table 8). The water levels for this monitoring location ranged from 5.3 to 9.8 inches, with a total fluctuation over the monitoring period of 4.5 inches (Table TB12-4 and Figure TB12-1 in Appendix C). The data indicate that

the well has met the criteria for wetland hydrology in all 3 years of monitoring (Large Table 8; Figure TB12-2 in Appendix C).

Well TB13

Well TB13 is located north of the Plant Site in Wetland 584, a shallow marsh (Type 3) (Large Figure 4). Hydrology has been monitored in this wetland during the 2014-2016 growing seasons (3 years) using a recording data logger (in-situ troll) (Table TB13-1 in Appendix C); the exception is 2014 when the recording well was installed on July 3. Therefore, during the 3 years of monitoring, there were 2 full growing seasons and 1 partial growing season when water levels were collected using a recording well (2014-2016).

In 2014-2016, the water level was above the wetland threshold for 1 period each year for a cumulative, annual, growing season hydroperiod ranging from 95 to 151 days (Table TB13-3 in Appendix C). The longest contiguous period each year when water levels were above the wetland threshold ranged from 95 to 151 days, which was 100 to 228% of the reference wetlands (Well Ref TB1 and Well Ref TB8; Large Table 8). The water levels for this monitoring location ranged from 0 to 5.5 inches, with a total fluctuation over the monitoring period of 5.5 inches (Table TB13-4 and Figure TB13-1 in Appendix C). The data indicate that the well has met the criteria for wetland hydrology in all 3 years of monitoring (Large Table 8; Figure TB13-2 in Appendix C).

Well TB14

Well TB14 is located north of the Plant Site in Wetland T13A, a shallow marsh (Type 3) (Large Figure 4). This wetland has a culver that is frequently blocked by a beaver dam; it has been removed several times but is rebuilt each year. In 2014, the well was installed in over 21 inches of water; the beaver dam was removed and the water level decreased through the monitoring period. In 2015, there was no beaver dam initially; but it was rebuilt as indicated by increasing water levels through June and was also removed in June as water levels decreased again through July. In 2016, the beaver dam was again present at the beginning of the monitoring period, but removed in June when water levels decreased over 30 inches by late August. Hydrology has been monitored in this wetland during the 2014-2016 growing seasons (3 years) using a recording data logger (in-situ troll) well (Table TB14-1 in Appendix C); the exception is 2014 when the recording well was installed on July 3. Therefore, during the 3 years of monitoring, there were 2 full growing seasons and 1 partial growing season when water levels were collected using a recording well (2014-2016).

In 2014-2016, the water level was above the wetland threshold for 1 period each year for a cumulative, annual, growing season hydroperiod ranging from 47 to 151 days (Table TB14-3 in Appendix C). The longest contiguous period each year when water levels were above the wetland threshold ranged from 47 to 151 days, which was 49 to 228% of the reference wetlands (Well Ref TB1 and Well Ref TB8; Large Table 8). The water levels for this monitoring location ranged from -8.8 to 33.9 inches, with a total fluctuation over the monitoring period of 42.7 inches (Table TB14-4 and Figure TB14-1 in Appendix C). The data indicate that the well has met the criteria for wetland hydrology in all 3 years of monitoring (Large Table 8; Figure TB14-2 in Appendix C).

7.1.3.2 Reference Wetlands

Well RefTB8

Well RefTB8 is located north of the Plant Site in Wetland 974, a coniferous bog (Type 8) (Large Figure 4). Hydrology has been monitored in this wetland during the 2010-2016 growing seasons (7 years) using a recording data logger (ecotone) and a manual well (Table RefTB8-1 in Appendix D). Therefore, during the 7 years of monitoring, there were seven full growing seasons when water levels were collected using a recording well (2010-2016).

In 2010-2016, the water level was above the wetland threshold for 1 to 2 periods each year for a cumulative, annual, growing season hydroperiod ranging from 104 to 151 days (Table RefTB8-3 in Appendix D). The longest contiguous period each year when water levels were above the wetland threshold ranged from 64 to 151 days (Large Table 8). The water levels for this monitoring location ranged from -19.5 to -2.3 inches, with a total fluctuation over the monitoring period of 17.2 inches (Table RefTB8-4 and Figure RefTB8-1 in Appendix D) The data indicate that the well has met the criteria for wetland hydrology in all 7 years of monitoring (Large Table 8; Figure RefTB8-2 in Appendix D).

Well RefTB1

Well RefTB1 is located on the southwest of the Plant Site in Wetland 989, a coniferous swamp (Type 7) (Large Figure 4). Hydrology has been monitored in this wetland during the 2014-2016 growing seasons (3 years) using a recording data logger (in-situ troll) (Table RefTB1-1 in Appendix D); the exception is 2014 when the recording well was installed on July 3. Therefore, during the 3 years of monitoring, there were two full growing seasons and one partial growing season when water levels were collected using a recording well (2014-2016).

In 2014-2016, the water level was above the wetland threshold for 1 period each year for a cumulative, annual, growing season hydroperiod ranging from 95 to 151 days (Table RefTB1-3 in Appendix D). The longest contiguous period each year when water levels were above the wetland threshold ranged from 95 to 151 days (Large Table 8). The water levels for this monitoring location ranged from -3.4 to 13.1 inches, with a total fluctuation over the monitoring period of 16.5 inches (Table RefTB1-4 and Figure RefTB1-1 in Appendix D) The data indicate that the well has met the criteria for wetland hydrology in all 7 years of monitoring (Large Table 8; Figure RefTB1-2 in Appendix D).

8.0 Future Actions

The wetland hydrology monitoring will continue in 2017 on a monthly basis from late April or early May through October.

9.0 References

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Large Tables

Large Table 2
Wetland Hydrology Monitoring Summary
Plant Site
2010-2016
Poly Met Mining, Inc.
Hoyt Lakes, Minnesota

Well ID ¹	Wetland ID	Circular 39 Type	Eggers & Reed Wetland Type	Date Installed	UTM Coordinates		2010			2011			2012			2013			2014				2015				2016				Logger Depth (in)	Stratigraphy Notes ²
					Northing X (meters)	Easting Y (meters)	Top of Casing to Ground (in)	Well Length (in)	Casing Below Ground Length (in)	Top of Casing to Ground (in)	Well Length (in)	Casing Below Ground Length (in)	Top of Casing to Ground (in)	Well Length (in)	Casing Below Ground Length (in)	Top of Casing to Ground (in)	Well Length (in)	Casing Below Ground Length (in)	Top of Casing to Ground (in)	Top of cap to bottom of logger (in.) ²	Well Length (in)	Casing Below Ground Length (in)	Top of Casing to Ground (in)	Top of cap to bottom of logger (in.) ²	Well Length (in)	Casing Below Ground Length (in)	Top of Casing to Ground (in)	Top of cap to bottom of logger (in.) ²	Well Length (in)	Casing Below Ground Length (in)		
Well TB1M	923	2	Sedge Meadow	4/26/2010	562437	527595	27.2	60.5	33.3	27.5	60.5	33.0	28.0	60.5	32.5	28.0	60.5	32.5	28.0	---	60.5	32.5	26.2	---	60.5	34.3	28.0	---	60.5	32.5	---	2" Oa; 32" gravelly clay
Well TB1	923	2	Sedge Meadow	4/26/2010	562438	5275792	15.4	47.5	32.1	16.1	47.5	31.4	18.4	47.5	29.1	19.0	47.5	28.5	18.9	---	47.5	28.6	18.3	---	47.5	29.2	16.3	---	47.5	31.2	---	2" Oa; 32" gravelly clay
Well TB2M	917	8	Coniferous bog	4/26/2010	561770	5276074	17.1	60.4	43.3	18.0	60.4	42.4	19.1	60.4	41.3	19.4	60.4	41.0	19.1	---	60.4	41.3	19.3	---	60.4	41.1	18.9	---	60.4	41.6	---	44" Oa
Well TB2	917	8	Coniferous bog	4/26/2010	561772	5276073	6.7	47.5	40.8	6.8	47.5	40.7	7.6	47.5	39.9	7.5	47.5	40.0	7.3	---	47.5	40.3	8.0	---	47.5	39.5	8.3	---	47.5	39.3	---	40" Oa
Well TB3M	260	3	Shallow marsh	4/26/2010	564897	5276249	21.0	60.5	39.5	21.8	60.5	38.8	22.6	60.5	37.9	22.4	60.5	38.2	22.4	---	60.5	38.2	22.0	---	60.5	38.5	22.3	---	60.5	38.2	---	40" Oi
Well TB3	260	3	Shallow marsh	4/26/2010	564896	5276248	10.3	47.5	37.3	12.5	47.5	35.0	11.5	47.5	36.0	12.3	47.5	35.3	12.6	---	47.5	34.9	13.1	---	47.5	34.4	14.7	---	47.5	32.8	---	37" Oi
Well TB4M	260	3	Shallow marsh	4/27/2010	565470	5276942	27.3	60.1	32.9	27.5	60.1	32.6	29.5	60.1	30.6	29.8	60.1	30.4	29.2	---	60.1	30.9	27.7	---	60.1	32.4	27.6	---	60.1	32.5	---	4" Oa; 28" clay
Well TB4	260	3	Shallow marsh	4/27/2010	565471	5276420	24.2	47.5	23.3	21.9	47.5	25.6	22.5	47.5	25.0	22.6	47.5	24.9	24.9	---	47.5	22.7	23.5	---	47.5	24.0	21.9	---	47.5	25.6	---	4" Oa; 22" clay
Well TB5M	868	7	Hardwood swamp	4/26/2010	566987	5276709	19.7	60.1	40.4	19.6	60.1	40.5	19.9	60.1	40.2	18.9	60.1	41.2	19.8	---	60.1	40.4	26.9	---	60.1	33.3	41.2	---	60.1	18.9	---	43" Oa
Well TB5	868	7	Hardwood swamp	4/26/2010	566986	5276708	17.2	47.5	30.3	16.0	47.5	31.5	16.1	47.5	31.4	16.5	47.5	31.0	16.5	---	47.5	31.0	21.1	---	47.5	26.4	32.0	---	47.5	15.5	---	33" Oa
Well TB6M	1151	7	Coniferous swamp	4/27/2010	566224	5277008	13.4	60.1	46.7	13.5	60.1	46.6	16.4	60.1	43.7	16.6	60.1	43.5	16.6	---	60.1	43.5	17.0	---	60.1	43.1	17.6	---	60.1	42.5	---	48" Oi/Oe
Well TB6	1151	7	Coniferous swamp	4/27/2010	566225	5277005	10.5	47.5	37.0	10.5	47.5	37.0	10.6	47.5	36.9	11.4	47.5	36.1	11.5	---	47.5	36.0	11.2	---	47.5	36.3	10.9	---	47.5	36.6	---	38" Oi/Oe
Well TB7M	915	6	Alder thicket	4/27/2010	565420	5277516	8.6	60.1	51.6	10.5	60.1	49.6	10.8	60.1	49.3	14.7	60.1	45.4	14.6	---	60.1	45.5	15.0	---	60.1	45.1	15.3	---	60.1	44.8	---	50" Oa
Well TB7	915	6	Alder thicket	4/27/2010	565419	5277519	8.3	47.5	39.2	10.3	47.5	37.2	12.5	47.5	35.0	13.1	47.5	34.5	13.3	---	47.5	34.2	13.9	---	47.5	33.6	14.3	---	47.5	33.3	---	39" Oa
Well TB9	1162	3	Shallow marsh	6/30/2014	565286	5270895	---	---	---	---	---	---	---	---	---	---	---	---	26.4	55.8	63.6	37.2	25.8	58.9	62.8	33.1	28.6	61.2	62.8	32.6	-32.6	15" Oe; 17" Oa
Well TB10	1176	7	Hardwood swamp	6/30/2014	563425	5273484	---	---	---	---	---	---	---	---	---	---	---	---	24.6	55.7	63.0	38.4	29.2	61.8	62.2	32.6	26.4	61.4	62.2	35.0	-35.0	10" silt loam; 22" coarse sandy loam; 6" clay; 4" sandy loam
Well TB11	282A	3	Shallow marsh	7/3/2014	563268	5274944	---	---	---	---	---	---	---	---	---	---	---	---	29.5	55.3	63.3	33.8	30.1	61.3	63.0	31.2	30.0	61.2	63.0	31.2	-31.2	2" Oa; 8" silt loam; 26" coarse sandy loam
Well TB12	968	7	Coniferous swamp	6/30/2014	566166	5276029	---	---	---	---	---	---	---	---	---	---	---	---	27.2	54.1	62.5	35.3	28.6	55.0	61.6	26.4	28.0	61.4	61.6	33.4	-33.4	39" Oa
Well TB13	584	3	Shallow marsh	7/3/2014	564338	5275981	---	---	---	---	---	---	---	---	---	---	---	---	29.4	58.8	63.8	34.4	26.6	58.4	63.0	31.8	27.1	60.2	63.0	33.1	-33.1	20" Oi, 5" Oe, 7" Oa, 4" Oa with silt loam
Well TB14	T13A	3	Shallow marsh	7/3/2014	568028	5273955	---	---	---	---	---	---	---	---	---	---	---	---	50.0	58.0	63.1	13.1	32.8	60.1	62.2	27.4	36.7	59.8	62.2	23.0	-23.0	6" Oa with fine sandy loam, 4" loamy coarse sand, 2" loamy coarse sand/loamy fine sand
Well RefTB8M	974	8	Coniferous bog	4/26/2010	564733	5279400	13.9	60.1	46.2	15.0	60.1	45.1	15.1	60.1	45.0	15.1	60.1	45.1	15.3	---	60.1	44.8	15.6	---	60.1	44.5	15.4	---	60.1	44.7	---	47" Oa
Well RefTB8	974	8	Coniferous bog	4/26/2010	564734	5279401	10.9	47.5	36.6	11.5	47.5	36.0	11.5	47.5	36.0	11.4	47.5	36.1	11.3	---	47.5	36.3	10.8	---	47.5	36.8	10.7	---	47.5	36.8	---	38" Oa
Well RefTB1	989	7	Coniferous Swamp	7/3/2014	567361	5279442	---	---	---	---	---	---	---	---	---	---	---	---	24.3	52.8	61.5	37.3	31.8	58.4	61.3	26.6	21.5	60.5	61.3	38.9	-38.9	27" Oa, 9" Oe

¹ Well IDs with "M" are manual wells. Well IDs that do not have a "M" are electronic recording wells.

² Oa, muck; Oe, mucky peat; Oi, peat.

Large Table 3
Temperature Statistics
Poly Met Mining, Inc.
Hoyt Lakes, Minnesota

	Average	Average Daily		2005		2006		2007		2008		2009		2010		2011		2012		2013		2014		2015		2016	
		Minimum	Maximum	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
	Degrees Fahrenheit			Degrees Fahrenheit																							
January	2.1	-11.0	15.3	-15.1	9.0	8.7	25.7	-7.6	14.4	-9.2	17.3	-28.0	9.6	-8.7	16.0	-11.5	9.4	1.5	21.8	-6.0	16.1	-23.0	6.4	-6.0	15.9	-1.1	16.3
February	7.7	-6.2	21.7	-5.3	22.8	-11.2	17.9	-13.7	12.0	-14.1	19.0	-5.6	22.3	-11.9	24.6	-9.6	20.2	3.3	27.4	-10.5	19.0	-20.6	11.7	-20.3	9.2	-2.4	23.2
March	21.0	7.9	34.0	-1.0	30.8	8.4	33.6	10.6	36.2	-0.7	30.7	5.4	32.3	18.4	46.7	2.8	32.5	23.1	47.5	0.6	30.1	-6.1	25.4	9.3	36.5	15.2	38.4
April	36.1	22.1	50.0	25.4	51.7	26.8	57.6	21.6	51.3	21.2	45.6	25.3	46.9	25.0	59.5	22.4	46.7	22.6	49.7	14.5	40.3	18.1	41.9	21.0	50.8	22.9	45.6
May	48.1	32.9	63.4	32.7	54.0	36.1	62.6	38.5	66.5	27.8	56.3	29.3	59.9	36.3	65.3	33.2	61.1	37.8	63.3	32.3	60.4	36.2	60.1	33.2	60.0	35.9	64.0
June	56.7	42.5	70.9	46.3	70.8	40.6	70.1	47.2	76.4	42.0	66.8	40.0	67.9	43.6	69.6	43.0	67.1	45.9	74.9	43.5	69.1	46.4	69.3	42.8	70.7	44.4	68.4
July	61.5	47.2	75.8	48.0	76.4	48.5	78.0	47.0	78.4	45.4	72.8	40.6	65.6	50.3	77.1	49.9	78.9	50.2	81.8	49.7	75.6	47.3	72.9	49.8	76.6	49.0	75.3
August	59.6	45.8	73.4	44.0	72.9	44.0	73.6	44.0	75.1	39.3	72.9	42.8	69.7	50.4	77.1	44.2	74.9	44.2	75.5	47.5	75.7	47.7	72.0	46.3	70.5	48.8	73.8
September	50.8	37.8	63.8	39.2	65.8	33.4	61.4	41.4	63.4	37.5	62.1	42.5	71.1	35.7	59.9	34.5	64.5	32.4	63.5	41.2	67.6	41.8	63.2	45.9	69.1	45.4	66.9
October	37.7	26.8	48.5	28.6	50.0	22.9	43.0	33.7	53.1	27.6	48.1	26.4	40.8	26.5	55.6	31.1	53.0	26.8	46.8	30.4	48.7	31.1	50.0	27.1	51.7	<u>32.6</u>	53.1
November	23.3	13.8	32.8	15.6	32.9	18.5	33.9	17.2	33.2	14.9	32.2	21.6	38.9	17.8	34.8	15.9	35.8	20.4	36.8	16.1	32.4	7.2	25.1	24.3	41.1	<u>23.9</u>	40.2
December	7.8	-3.1	18.7	5.1	17.8	7.6	25.1	-0.8	19.3	-13.6	11.5	-4.1	14.1	-2.5	16.6	8.0	24.3	2.0	20.9	-15.7	8.6	9.4	23.5	14.3	27.4	<u>1.4</u>	17.3
Annual Average	34.4	21.4	47.4	22.0	46.2	23.7	48.5	23.3	48.3	18.2	44.6	19.7	44.9	23.4	50.2	22.0	47.4	25.9	50.8	20.3	45.3	19.6	43.5	24.0	48.3	26.3	48.5
Overall Annual Average	34.4			34.1		36.1		35.8		31.4		32.3		36.8		34.7		38.3		32.8		31.5		36.1		37.4	

Data is from the Embarrass National Weather Station
Bold=greater than maximum average,
Italics=less than minimum average
Underlined=Some missing data

Large Table 4
Precipitation Summary Compared to WETS Data
1999-2016
Poly Met Mining, Inc.
Hoyt Lakes, Minnesota

	30% chance			1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
	Average	Less than	More than																		
	Inches																				
January	0.96	0.68	1.16	0.73	0.55	1.21	0.12	0.19	1.23	2.15	0.42	1.56	0.69	1.09	1.02	2.15	0.76	1.55	1.06	0.81	0.69
February	0.72	0.42	0.75	0.60	0.71	1.77	0.26	0.44	0.23	0.50	0.88	0.34	0.17	1.13	0.10	0.46	1.17	1.58	1.87	0.46	1.96
March	1.06	0.71	1.31	1.01	1.11	0.22	0.96	0.82	0.64	0.95	1.69	2.39	0.33	2.81	0.29	0.58	1.35	1.88	1.13	0.61	2.90
April	1.97	1.22	2.26	1.70	0.94	5.07	0.47	1.56	1.63	1.91	1.82	3.56	4.46	3.36	0.25	2.02	3.87	5.36	2.01	1.51	2.05
May	3.20	2.15	3.52	5.13	3.65	6.69	1.72	2.16	4.53	9.01	3.35	4.31	2.77	1.54	1.88	3.54	7.13	2.95	3.76	3.79	1.69
June	3.97	3.21	4.98	3.96	5.89	3.79	4.28	3.36	1.45	5.78	1.71	4.88	5.58	2.30	3.92	4.62	5.72	5.11	5.99	4.54	6.25
July	4.00	2.89	4.88	13.51	4.08	4.91	5.13	5.51	3.23	1.42	4.92	1.22	1.31	2.38	5.12	1.78	5.58	5.70	3.06	2.79	2.22
August	3.81	2.79	4.55	4.91	5.14	9.59	4.90	1.90	3.01	1.77	2.10	1.05	1.07	3.56	6.92	3.40	1.41	1.82	2.85	4.29	5.55
September	3.76	2.83	4.25	5.33	2.23	1.41	3.74	5.42	4.04	2.79	2.13	12.75	4.87	1.12	3.65	1.24	1.49	2.29	1.74	3.88	4.89
October	2.76	1.88	3.24	1.48	2.34	4.07	2.16	1.50	3.08	2.78	1.98	6.43	2.28	3.08	1.84	1.36	2.39	2.61	1.35	2.82	1.59
November	1.68	0.99	2.07	0.09	1.33	2.02	0.29	1.49	0.34	3.44	0.82	0.77	0.75	1.45	2.00	0.43	1.99	1.14	1.08	2.95	3.47
December	1.00	0.68	1.16	0.19	0.81	0.67	0.50	0.88	1.96	0.90	1.03	2.21	1.92	1.38	1.45	0.24	0.68	2.29	0.87	1.83	3.06
Annual	28.89	25.97	30.63	38.64	28.78	41.42	24.53	25.23	25.37	33.40	22.85	41.47	26.20	25.20	28.44	21.82	33.54	34.28	26.77	30.28	36.32
Water Year	28.83	26.43	30.33	--	26.06	39.14	28.34	24.31	23.86	31.66	26.14	35.89	30.66	24.24	29.06	25.08	30.51	33.30	29.51	25.98	35.80

Bold = above the normal range
Italics = below the normal range

Large Table 5
Precipitation During the Growing Season
2010-2016
Poly Met Mining, Inc.
Hoyt Lakes, Minnesota

Growing Season ¹	Year						
	2010	2011	2012	2013	2014	2015	2016
Days Below Normal Range of Precipitation (percent of total days)	5 (3%)	30 (20%)	29 (19%)	7 (5%)	4 (3%)	2 (1%)	2 (1%)
Days Within Normal Range of Precipitation (percent of total days)	102 (68%)	116 (77%)	35 (23%)	108 (72%)	90 (60%)	84 (56%)	61 (40%)
Days Above Normal Range of Precipitation (percent of total days)	44 (29%)	5 (3%)	87 (58%)	36 (24%)	57 (38%)	65 (43%)	88 (58%)

¹Growing season range is from May 9 through October 6; 151 days.

Large Table 6
Wetland Hydrology Criteria Summary During the Growing Season
Mine Site
2006-2009
Poly Met Mining, Inc.
Hoyt Lakes, Minnesota

Well ID	Eggers and Reed Wetland Type	Entire Growing Season ¹									
		2006		2007		2008			2009		
		Longest period - Water Level within 12 inches of Soil Surface (days) ²	Percent of Well Ref1 ³	Longest period - Water Level within 12 inches of Soil Surface (days) ²	Percent of Well Ref1 ³	Longest period - Water Level within 12 inches of Soil Surface (days)	Percent of Well Ref1	Percent of Well Ref2	Longest period - Water Level within 12 inches of Soil Surface (days)	Percent of Well Ref1	Percent of Well Ref2
1	Coniferous bog	151	---	85	---	84	61%	---	111	85%	---
2	Coniferous bog	---	---	---	---	84	61%	---	64	49%	---
4	Coniferous bog	151	---	141	---	151	109%	---	131	100%	---
4A	Coniferous bog	---	---	---	---	138	100%	---	151	115%	---
6	Alder thicket	---	---	---	---	74	---	82%	128	---	85%
7	Alder thicket	42	---	116	---	151	---	168%	151	---	100%
8	Coniferous bog	---	---	---	---	68	49%	---	64	49%	---
9	Alder thicket	---	---	---	---	101	---	112%	151	---	100%
10	Coniferous bog	---	---	---	---	83	60%	---	126	96%	---
11	Coniferous bog	---	---	---	---	72	52%	---	48	37%	---
12	Coniferous bog	68	---	35	---	87	63%	---	131	100%	---
13	Coniferous bog	---	---	---	---	64	46%	---	60	46%	---
14	Coniferous bog	---	---	---	---	41	30%	---	39	30%	---
15	Coniferous bog	---	---	---	---	79	57%	---	137	105%	---
16	Coniferous bog	---	---	---	---	86	62%	---	151	115%	---
18 ⁴	Coniferous bog	---	---	---	---	77	56%	---	119	91%	---
19 ⁴	Coniferous bog	---	---	---	---	80	58%	---	139	106%	---
21	Coniferous bog	---	---	---	---	85	62%	---	130	99%	---
22	Coniferous bog	---	---	---	---	78	57%	---	127	97%	---
Ref1	Coniferous bog	---	---	---	---	138	---	---	131	---	---
Ref2	Alder thicket	---	---	---	---	90	---	---	151	---	---

¹ To calculate the percentage of the reference wetland hydroperiod, the comparable type of reference wetland(s) was selected. If there was no comparable type, all reference wetlands were selected.

²Only electronic recording wells 1, 4, 7, and 12 were installed in 2006 and 2007.

³Reference wells were first installed in 2008.

⁴Wells 18 and 19 recorded data in 2008 and 2009 only.

Large Table 7
Wetland Hydrology Criteria Summary During the Growing Season
Mine Site and Transportation and Utility Corridors
2010-2016
Poly Met Mining, Inc.
Hoyt Lakes, Minnesota

Well ID	Eggers and Reed Wetland Type	Entire Growing Season ¹																							
		2010			2011			2012			2013			2014				2015				2016			
		Longest period - Water Level within 12 inches of Soil Surface (days)	Percent of Well Ref1	Percent of Well Ref2	Longest period - Water Level within 12 inches of Soil Surface (days)	Percent of Well Ref1	Percent of Well Ref2	Longest period - Water Level within 12 inches of Soil Surface (days)	Percent of Well Ref1	Percent of Well Ref2	Longest period - Water Level within 12 inches of Soil Surface (days)	Percent of Well Ref1	Percent of Well Ref2	Longest period - Water Level within 12 inches of Soil Surface (days) ²	Percent of Well Ref1	Percent of Well Ref2	Percent of Well Ref3	Longest period - Water Level within 12 inches of Soil Surface (days) ²	Percent of Well Ref1	Percent of Well Ref2	Percent of Well Ref3	Longest period - Water Level within 12 inches of Soil Surface (days) ²	Percent of Well Ref1 ³	Percent of Well Ref2	Percent of Well Ref3
1	Coniferous bog	78	52%	---	108	72%	---	118	83%	---	137	123%	---	138	105%	---	---	79	103%	---	---	151	---	---	---
2	Coniferous bog	61	41%	---	116	78%	---	114	80%	---	137	123%	---	138	105%	---	---	60	78%	---	---	151	---	---	---
4	Coniferous bog	149	100%	---	150	101%	---	73	51%	---	138	124%	---	139	106%	---	---	151	196%	---	---	151	---	---	---
4A	Coniferous bog	149	100%	---	150	101%	---	151	106%	---	138	124%	---	139	106%	---	---	151	196%	---	---	151	---	---	---
6	Alder thicket	97	---	65%	108	---	72%	119	---	81%	138	---	100%	139	---	100%	---	81	---	54%	---	151	---	100%	---
7	Alder thicket	149	---	100%	150	---	100%	151	---	103%	138	---	100%	139	---	100%	---	151	---	100%	---	151	---	100%	---
8	Coniferous bog	61	41%	---	75	50%	---	107	75%	---	86	77%	---	74	56%	---	---	72	94%	---	---	109	---	---	---
9	Alder thicket	148	---	99%	148	---	99%	151	---	103%	138	---	100%	139	---	100%	---	101	---	67%	---	151	---	100%	---
10	Coniferous bog	105	70%	---	104	70%	---	111	78%	---	94	85%	---	80	61%	---	---	76	99%	---	---	151	---	---	---
11	Coniferous bog	34	23%	---	37	25%	---	93	65%	---	56	50%	---	53	40%	---	---	38	49%	---	---	134	---	---	---
12	Coniferous bog	109	73%	---	115	77%	---	113	79%	---	94	85%	---	85	65%	---	---	54	70%	---	---	151	---	---	---
13	Coniferous bog	22	15%	---	43	29%	---	103	72%	---	55	50%	---	52	40%	---	---	31	40%	---	---	82	---	---	---
14	Coniferous bog	34	23%	---	37	25%	---	89	62%	---	53	48%	---	56	43%	---	---	79	103%	---	---	85	---	---	---
15	Coniferous bog	148	99%	---	118	79%	---	125	87%	---	137	123%	---	138	105%	---	---	88	114%	---	---	151	---	---	---
16	Coniferous bog	112	75%	---	121	81%	---	131	92%	---	137	123%	---	139	106%	---	---	88	114%	---	---	151	---	---	---
18	Coniferous bog	---	---	---			---			---			---			---	---			---	---		---	---	---
19	Coniferous bog	---	---	---			---			---			---			---	---			---	---		---	---	---
21	Coniferous bog	148	99%	---	148	99%	---	151	106%	---	138	124%	---	139	106%	---	---	133	173%	---	---	151	---	---	---
22	Coniferous bog	76	51%	---	107	72%	---	112	78%	---	109	98%	---	84	64%	---	---	79	103%	---	---	151	---	---	---
23	Alder thicket	149	---	100%	122	---	81%	151	---	103%	138	---	100%	139	---	100%	---	151	---	100%	---	151	---	100%	---
24	Alder thicket	76	---	51%	114	---	76%	118	---	80%	137	---	99%	98	---	71%	---	79	---	52%	---	151	---	100%	---
25	Coniferous swamp	---	---	---	---	---	---	---	---	---	---	---	---	35	---	---	81%	69	---	---	84%	151	---	---	100%
26	Alder thicket	---	---	---	---	---	---	---	---	---	---	---	---	97	---	70%	---	147	---	97%	---	151	---	100%	---
27	Coniferous swamp	---	---	---	---	---	---	---	---	---	---	---	---	98	---	---	228%	48	---	---	59%	151	---	---	100%
28	Alder thicket	---	---	---	---	---	---	---	---	---	---	---	---	32	---	23%	---	52	---	34%	---	106	---	70%	---
29	Coniferous bog	---	---	---	---	---	---	---	---	---	---	---	---	38	29%	---	---	31	40%	---	---	84	---	---	---
30	Coniferous swamp	---	---	---	---	---	---	---	---	---	---	---	---	45	---	---	105%	73	---	---	89%	151	---	---	100%
31	Hardwood swamp	---	---	---	---	---	---	---	---	---	---	---	---	58	44%	42%	135%	73	95%	48%	89%	151	---	100%	100%
32	Coniferous bog	---	---	---	---	---	---	---	---	---	---	---	---	96	73%	---	---	77	100%	---	---	151	---	---	---
33	Alder thicket	---	---	---	---	---	---	---	---	---	---	---	---	97	---	70%	---	83	---	55%	---	151	---	100%	---
34	Coniferous swamp	---	---	---	---	---	---	---	---	---	---	---	---	37	---	---	86%	46	---	---	56%	82	---	---	54%
35	Alder thicket	---	---	---	---	---	---	---	---	---	---	---	---	38	---	27%	---	69	---	46%	---	151	---	100%	---
36	Alder thicket	---	---	---	---	---	---	---	---	---	---	---	---	18	---	13%	---	51	---	34%	---	77	---	51%	---
37	Alder thicket	---	---	---	---	---	---	---	---	---	---	---	---	54	---	39%	---	77	---	51%	---	151	---	100%	---
38	Coniferous bog	---	---	---	---	---	---	---	---	---	---	---	---	97	74%	---	---	81	105%	---	---	151	---	---	---
39	Shallow marsh	---	---	---	---	---	---	---	---	---	---	---	---	97	74%	70%	226%	48	62%	32%	59%	151	---	100%	100%
40	Coniferous swamp	---	---	---	---	---	---	---	---	---	---	---	---	30	---	---	70%	65	---	---	79%	84	---	---	56%
41	Shallow marsh	---	---	---	---	---	---	---	---	---	---	---	---	96	73%	69%	223%	146	190%	97%	178%	151	---	100%	100%
42	Shrub-carr	---	---	---	---	---	---	---	---	---	---	---	---	97	74%	70%	226%	146	190%	97%	178%	109	---	72%	72%
43	Coniferous bog	---	---	---	---	---	---	---	---	---	---	---	---	96	73%	---	---	51	66%	---	---	151	---	---	---
44	Coniferous swamp	---	---	---	---	---	---	---	---	---	---	---	---	0	---	---	0%	0	---	---	0%	0	---	---	0%
45	Open bog	---	---	---	---	---	---	---	---	---	---	---	---	38	29%	27%	88%	52	68%	34%	63%	71	---	47%	47%
46	Coniferous swamp	---	---	---	---	---	---	---	---	---	---	---	---	0	---	---	0%	0	---	---	0%	0	---	---	0%
47	Alder thicket	---	---	---	---	---	---	---	---	---	---	---	---	38	---	27%	---	70	---	46%	---	151	---	100%	---
48	Alder thicket	---	---	---	---	---	---	---	---	---	---	---	---	36	---	26%	---	69	---	46%	---	151	---	100%	---
Ref1	Coniferous bog	149	---	---	149	---	---	143	---	---	111	---	---	131	---	---	---	77	---	---	---	---	---	---	---
Ref2	Alder thicket	149	---	---	150	---	---	147	---	---	138	---	---	139	---	---	---	151	---	---	---	151	---	---	---
Ref3	Coniferous swamp	---	---	---	---	---	---	---	---	---	---	---	---	43	---	---	---	82	---	---	---	151	---	---	---

¹ To calculate the percentage of the reference wetland hydroperiod, the comparable type of reference wetland(s) was selected. If there was no comparable type, all reference wetlands were

² Bold numbers show wells that do not meet wetland hydrology criteria.

³ The Well Ref1 logger malfunctioned in 2016, and data was not useable.

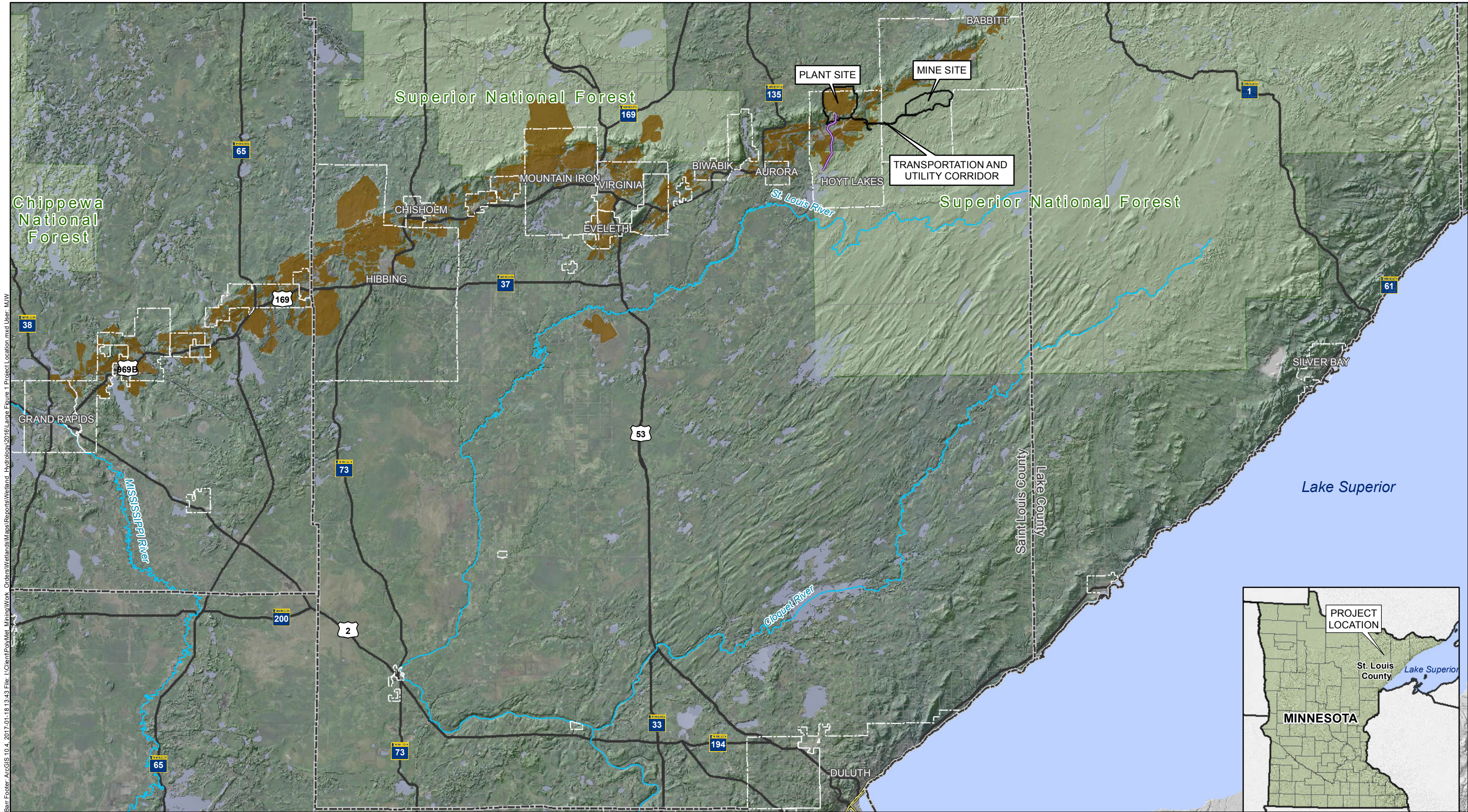
Large Table 8
Wetland Hydrology Criteria Summary During the Growing Season
Plant Site
2010-2016
Poly Met Mining, Inc.
Hoyt Lakes, Minnesota

Well ID	Eggers and Reed Wetland Type	Entire Growing Season ¹																
		2010		2011		2012		2013		2014			2015			2016		
		Longest period - Water Level within 12 inches of Soil Surface (days) ²	Percent of Well Ref TB8	Longest period - Water Level within 12 inches of Soil Surface (days) ²	Percent of Well Ref TB8	Longest period - Water Level within 12 inches of Soil Surface (days) ²	Percent of Well Ref TB8	Longest period - Water Level within 12 inches of Soil Surface (days) ²	Percent of Well Ref TB8	Longest period - Water Level within 12 inches of Soil Surface (days)	Percent of Well Ref TB8	Percent of Well Ref TB1	Longest period - Water Level within 12 inches of Soil Surface (days)	Percent of Well Ref TB8	Percent of Well Ref TB1	Longest period - Water Level within 12 inches of Soil Surface (days)	Percent of Well Ref TB8	Percent of Well Ref TB1
TB1	Sedge Meadow	34	23%	60	58%	50	38%	86	101%	140	177%	147%	151	236%	103%	79	52%	52%
TB2	Coniferous bog	151	100%	117	113%	118	90%	136	160%	129	163%	---	151	236%	---	148	98%	---
TB3	Shallow marsh	151	100%	147	141%	151	115%	136	160%	140	177%	147%	151	236%	103%	151	100%	100%
TB4	Shallow marsh	42	28%	147	141%	151	115%	139	164%	141	178%	148%	151	236%	103%	151	100%	100%
TB5	Hardwood swamp	151	100%	147	141%	151	115%	139	164%	140	177%	147%	151	236%	103%	151	100%	100%
TB6	Coniferous swamp	151	---	147	---	151	---	136	---	140	---	147%	146	---	100%	151	---	100%
TB7	Alder thicket	151	100%	147	141%	151	115%	136	160%	140	177%	147%	151	236%	103%	151	100%	100%
TB9	Shallow marsh	---	---	---	---	---	---	---	---	79	100%	83%	93	145%	64%	151	100%	100%
TB10	Hardwood swamp	---	---	---	---	---	---	---	---	74	94%	78%	146	228%	100%	151	100%	100%
TB11	Shallow marsh	---	---	---	---	---	---	---	---	38	48%	40%	146	228%	100%	56	37%	37%
TB12	Coniferous swamp	---	---	---	---	---	---	---	---	98	---	103%	146	---	100%	151	---	100%
TB13	Shallow marsh/ Shrub- carr	---	---	---	---	---	---	---	---	95	120%	100%	146	228%	100%	151	100%	100%
TB14	Shallow marsh	---	---	---	---	---	---	---	---	47	59%	49%	146	228%	100%	151	100%	100%
Ref TB8	Coniferous bog	151	---	104	---	131	---	85	---	79	---	---	64	---	---	151	---	---
Ref TB1	Coniferous Swamp	---	---	---	---	---	---	---	---	95	---	---	146	---	---	151	---	---








¹ To calculate the percentage of the reference wetland hydroperiod, the comparable type of reference wetland(s) was selected. If there was no comparable type, all

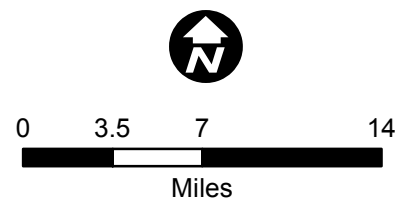
² Wells TB9 to TB14 and Ref TB1 were installed in 2014.

Large Figures



Barr Footer: ArcGIS 10.4, 2017-01-18 13:43 File: I:\Client\PayMet_Mining\Work Orders\Wetlands\Map\Reports\Wetland_Hydrology\2016\Large Figure 1 Project Location.mxd User: MJW

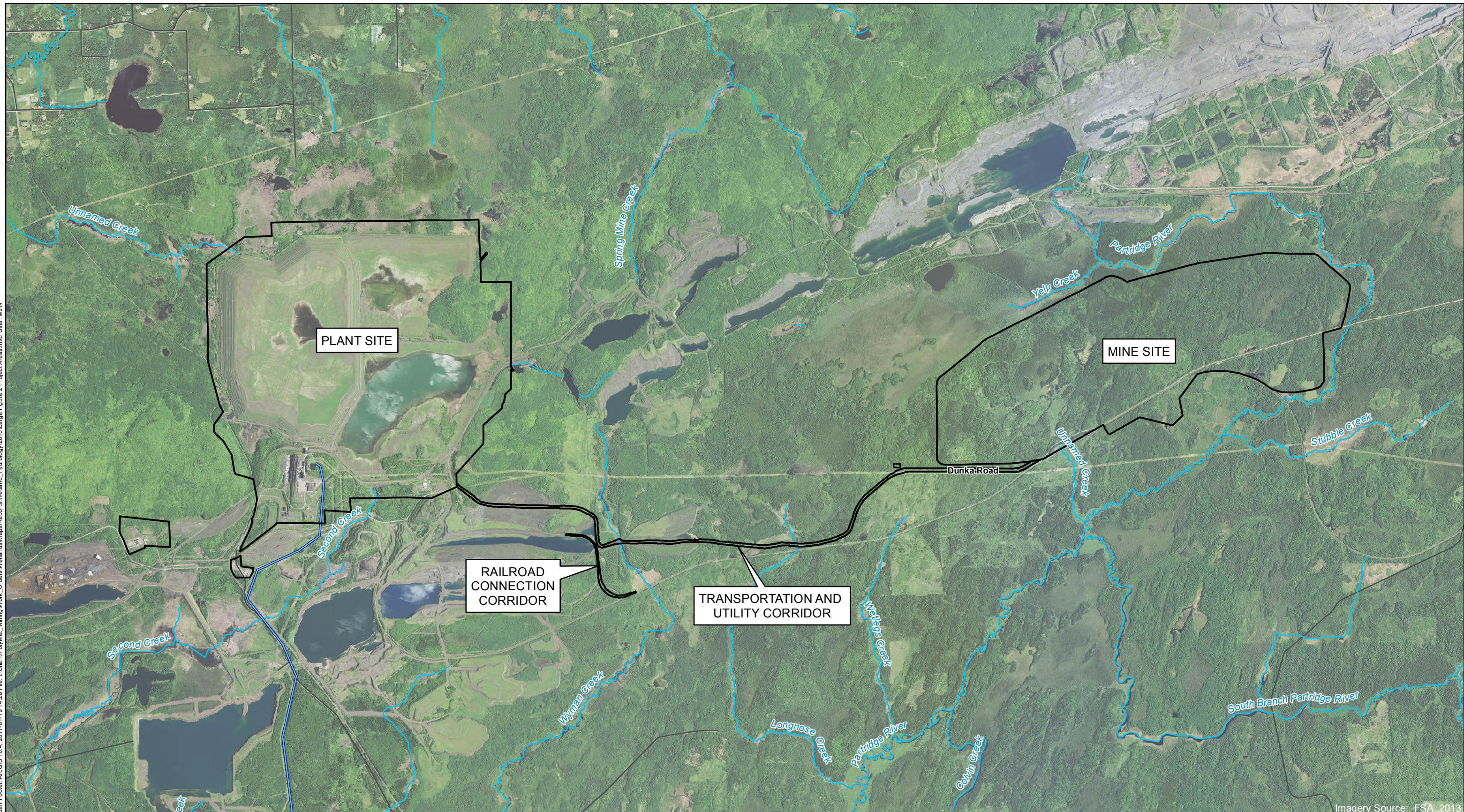
-  EIS Project Areas
-  Mesabi Iron Range
-  National Forest Boundary
-  County Boundaries
-  City Boundaries
-  Major River
-  Lakes





PROJECT LOCATION
NorthMet Project
Poly Met Mining, Inc.

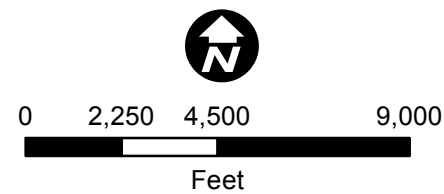
Large Figure 1
Wetland Hydrology Report

Barr Footer: ArcGIS 10.4, 2017-01-19 14:28 File: I:\Client\PolyMet_Mining\Work_Orders\Wetlands\Mapa\Reports\Wetland_Hydrology\2016\Large Figure 2 Project Areas.mxd User: MJW



Imagery Source: FSA, 2013

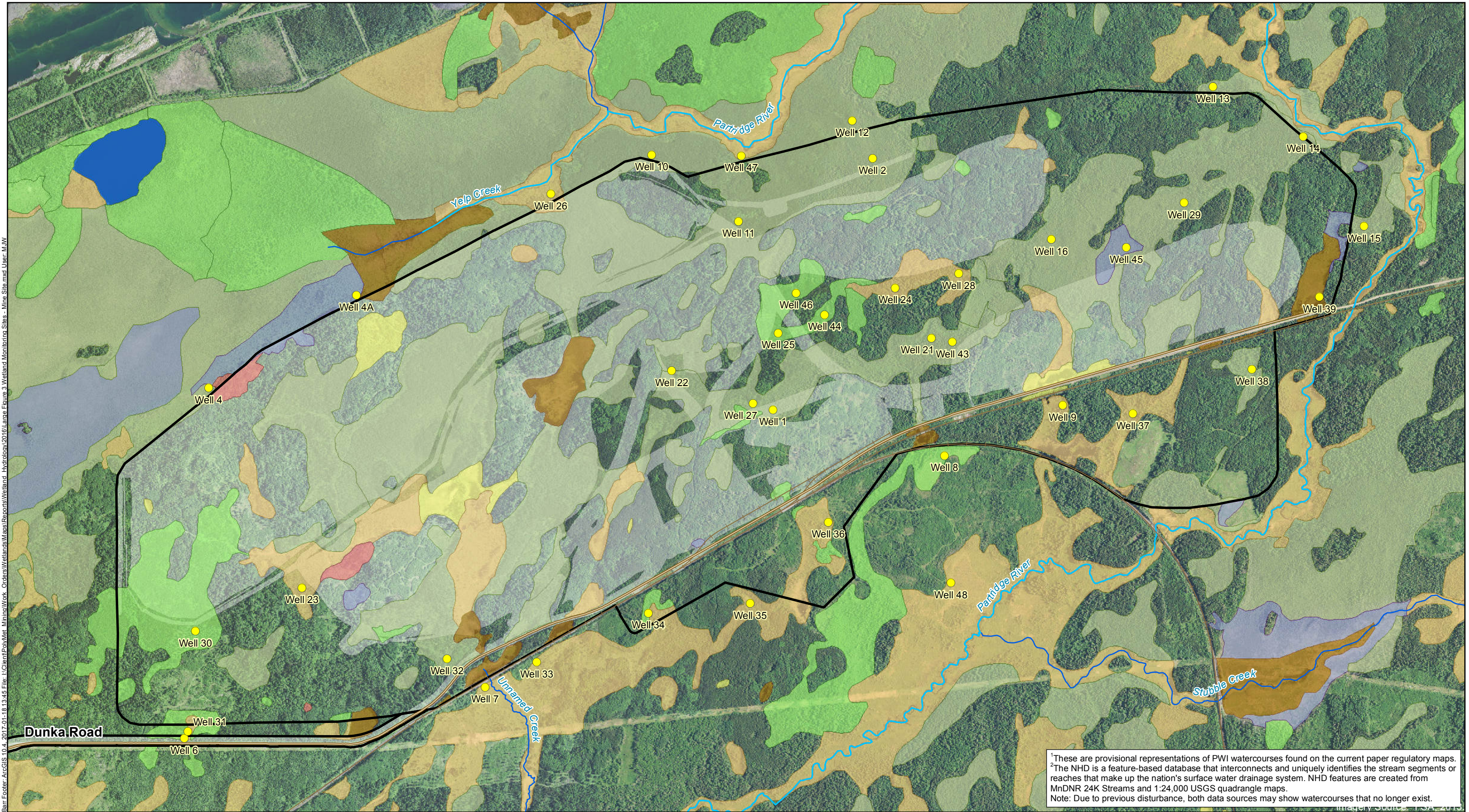
-  Project Areas
-  Rivers & Streams



PROJECT AREAS
NorthMet Project
Poly Met Mining, Inc.

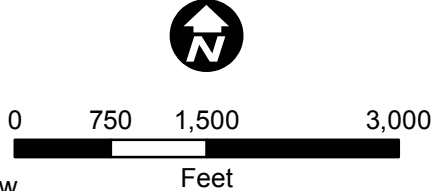
Large Figure 2
Wetland Hydrology Report

Bar Footer: ArcGIS 10.4 2017-01-18 13:45 File: I:\Client\PolMet Mining\Work Orders\Wetlands\Map\Reports\Wetland Hydrology\2016\Large Figure 3 Wetland Monitoring Sites - Mine Site.mxd User: M.J.W.



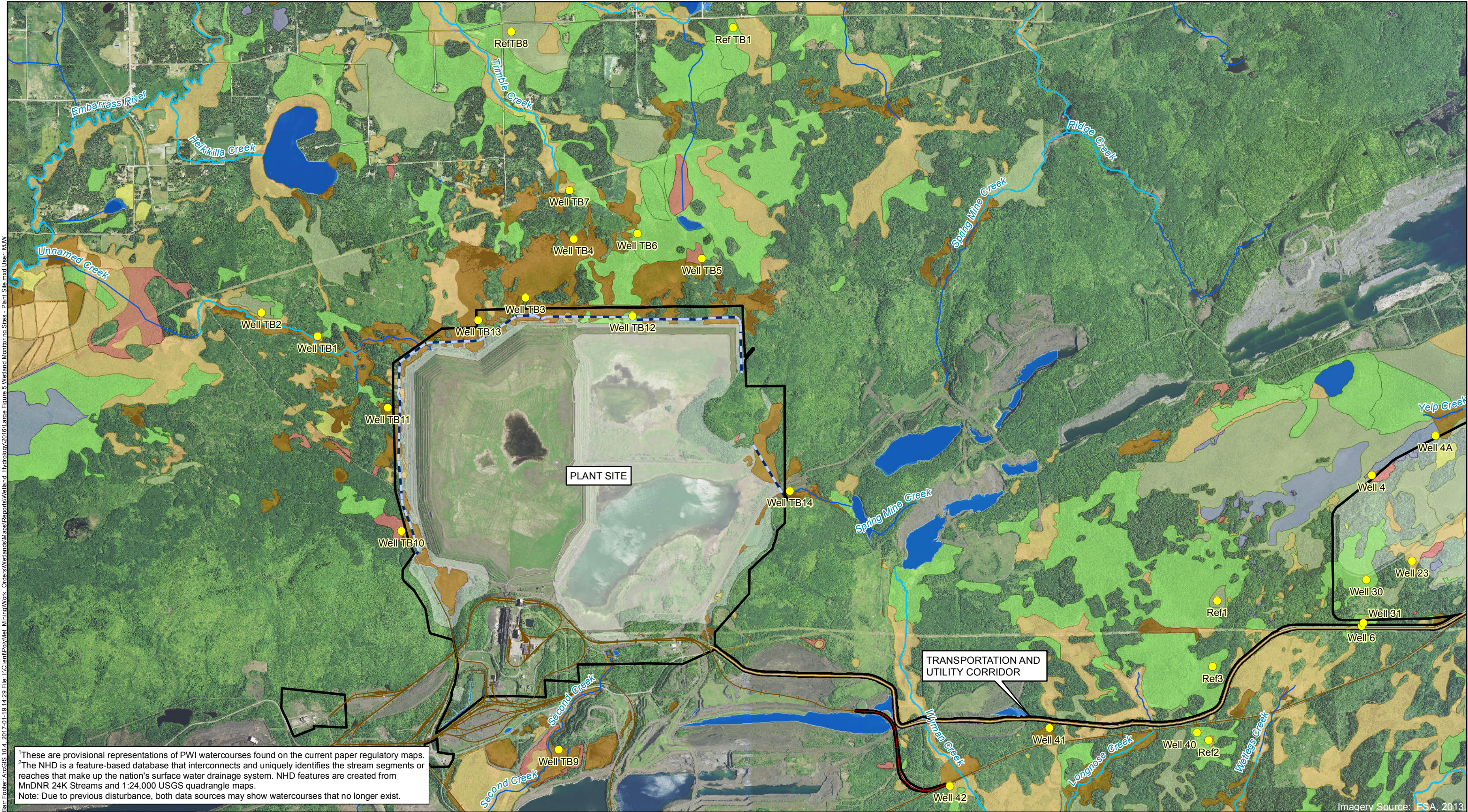
¹These are provisional representations of PWI watercourses found on the current paper regulatory maps.
²The NHD is a feature-based database that interconnects and uniquely identifies the stream segments or reaches that make up the nation's surface water drainage system. NHD features are created from MnDNR 24K Streams and 1:24,000 USGS quadrangle maps.
Note: Due to previous disturbance, both data sources may show watercourses that no longer exist.

- | | | | |
|--|--|--|---|
| <ul style="list-style-type: none">Wetland Hydrology Monitoring LocationsDunka RoadRailroadsPublic Waters Inventory (PWI) Watercourses¹ | <ul style="list-style-type: none">National Hydrography Dataset (NHD) Rivers & Streams²Project AreasAreas Disturbed by Proposed Project Features | Eggers & Reed Wetland Types <ul style="list-style-type: none">Shrub Swamps (Alder thickets & Shrub-carrs)Coniferous bogConiferous swampDeep marsh; Shallow marsh | <ul style="list-style-type: none">Hardwood swampOpen water (Shallow, open water & lakes)Open bogSedge meadow; Wet meadow |
|--|--|--|---|



**WETLAND MONITORING SITES -
MINE SITE AREA**
NorthMet Project
Poly Met Mining, Inc.

Large Figure 3
Wetland Hydrology Report



Barr Footer: ArcGIS 10.4, 2017-01-19 14:29 File: I:\Client\PolyMet Mining\Work Orders\Wetlands\Map\Reports\Wetland Hydrology\2016\Large Figure 4 Wetland Monitoring Sites - Plant Site.mxd User: MWW

¹These are provisional representations of PWI watercourses found on the current paper regulatory maps.
²The NHD is a feature-based database that interconnects and uniquely identifies the stream segments or reaches that make up the nation's surface water drainage system. NHD features are created from MnDNR 24K Streams and 1:24,000 USGS quadrangle maps.
Note: Due to previous disturbance, both data sources may show watercourses that no longer exist.

Wetland Hydrology Monitoring Locations

Dunka Road

Existing Private Railroad

Proposed Railroad Track

FTB Containment System

Public Waters Inventory (PWI) Watercourses¹

National Hydrography Dataset (NHD) Rivers & Streams²

Project

Areas Disturbed by Proposed Project Features

Eggers & Reed Wetland Types

Shrub Swamps (Alder thickets & Shrub-carrs)

Coniferous bog

Coniferous swamp

Deep marsh; Shallow marsh

Hardwood swamp

Open water (Shallow, open water & lakes)

Open bog

Sedge meadow; Wet meadow

0

1,750

3,500

7,000

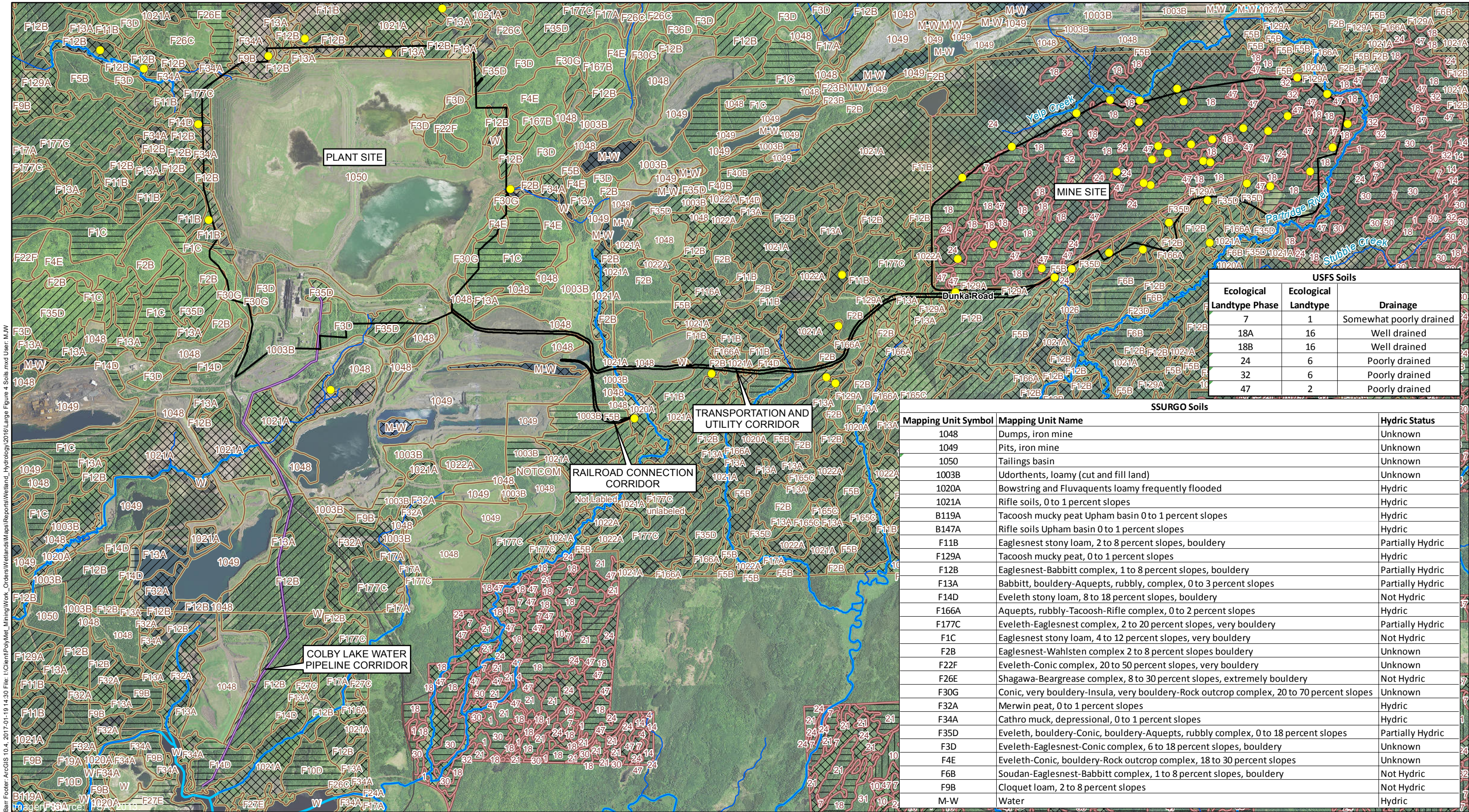
Feet

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**WETLAND MONITORING SITES -
PLANT SITE AND TRANSPORTATION
AND UTILITY CORRIDORS AREAS**
NorthMet Project
Poly Met Mining, Inc.

Large Figure 4
Wetland Hydrology Report



USFS Soils		
Ecological Landtype Phase	Ecological Landtype	Drainage
7	1	Somewhat poorly drained
18A	16	Well drained
18B	16	Well drained
24	6	Poorly drained
32	6	Poorly drained
47	2	Poorly drained

SSURGO Soils		
Mapping Unit Symbol	Mapping Unit Name	Hydric Status
1048	Dumps, iron mine	Unknown
1049	Pits, iron mine	Unknown
1050	Tailings basin	Unknown
1003B	Udorthents, loamy (cut and fill land)	Unknown
1020A	Bowstring and Fluvaquents loamy frequently flooded	Hydric
1021A	Rifle soils, 0 to 1 percent slopes	Hydric
B119A	Tacoosh mucky peat Upham basin 0 to 1 percent slopes	Hydric
B147A	Rifle soils Upham basin 0 to 1 percent slopes	Hydric
F11B	Eaglesnest stony loam, 2 to 8 percent slopes, bouldery	Partially Hydric
F129A	Tacoosh mucky peat, 0 to 1 percent slopes	Hydric
F12B	Eaglesnest-Babbitt complex, 1 to 8 percent slopes, bouldery	Partially Hydric
F13A	Babbitt, bouldery-Aquepts, rubbly, complex, 0 to 3 percent slopes	Partially Hydric
F14D	Eveleth stony loam, 8 to 18 percent slopes, bouldery	Not Hydric
F166A	Aquepts, rubbly-Tacoosh-Rifle complex, 0 to 2 percent slopes	Hydric
F177C	Eveleth-Eaglesnest complex, 2 to 20 percent slopes, very bouldery	Partially Hydric
F1C	Eaglesnest stony loam, 4 to 12 percent slopes, very bouldery	Not Hydric
F2B	Eaglesnest-Wahlsten complex 2 to 8 percent slopes bouldery	Unknown
F22F	Eveleth-Conic complex, 20 to 50 percent slopes, very bouldery	Unknown
F26E	Shagawa-Beargrease complex, 8 to 30 percent slopes, extremely bouldery	Not Hydric
F30G	Conic, very bouldery-Insula, very bouldery-Rock outcrop complex, 20 to 70 percent slopes	Unknown
F32A	Merwin peat, 0 to 1 percent slopes	Hydric
F34A	Cathro muck, depressional, 0 to 1 percent slopes	Hydric
F35D	Eveleth, bouldery-Conic, bouldery-Aquepts, rubbly complex, 0 to 18 percent slopes	Partially Hydric
F3D	Eveleth-Eaglesnest-Conic complex, 6 to 18 percent slopes, bouldery	Unknown
F4E	Eveleth-Conic, bouldery-Rock outcrop complex, 18 to 30 percent slopes	Unknown
F6B	Soudan-Eaglesnest-Babbitt complex, 1 to 8 percent slopes, bouldery	Not Hydric
F9B	Cloquet loam, 2 to 8 percent slopes	Not Hydric
M-W	Water	Hydric

- Wetland Hydrology Monitoring Locations

Hydric Rating/Drainage Class

All Hydric/Poorly drained

Partially Hydric/Somewhat poorly drained

Not Hydric/Well drained

Unknown Hydric

SSURGO Soils - Embarrass Subset (Mapping Unit Symbol)

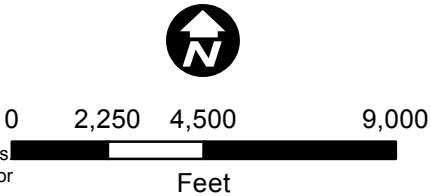
Ecological Landtype Phase - USFS

EIS Project Areas

- Public Waters Inventory (PWI) Watercourses¹

National Hydrography Dataset (NHD) Rivers & Streams²

¹These are provisional representations of PWI watercourses found on the current paper regulatory maps.
²The NHD is a feature-based database that interconnects and uniquely identifies the stream segments or reaches that make up the nation's surface water drainage system. NHD features are created from MnDNR 24K Streams and 1:24,000 USGS quadrangle maps.
Note: Due to previous disturbance, both data sources may show watercourses that no longer exist.



SOILS IN THE
PROJECT AREAS
NorthMet Project
Poly Met Mining, Inc.

Large Figure 5
Wetland Hydrology Report

Appendices

Appendix A

Wetland Hydrology Monitoring Data – Mine Site

Well ID: 1

NorthMet Project Area: Mine Site

Wetland Number: 48

Wetland Type: Coniferous Bog (Type 8)

UTM Coordinates (NAD 83 Zone 15)

Easting: 577788

Northing: 5274017

Growing Season: May 9-October 6 (151 days)

Water Level Fluctuation During the Growing

Season for All Years: 30.6 inches

Well Type(s): Ecotone and Manual

Date Recording Well Installed: 11/9/2005

Installed By: Barr

Water Level Recorded Every: 4 hours

Date Manual Well Installed: 6/28/2005

Installed By: Barr/NTS

Manual Water Levels Read: Monthly

Monitored by: NTS

Notes: Recording and manual wells were relocated on 5/22/2008 by Barr/NTS. UTM coordinates are for recording well.

Table 1-1. Monitoring Period Each Year¹. See the hydrographs in Figure 1-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Start Date	11/11	4/27	4/27	5/22	5/27	5/11	5/10	4/19	5/22	5/21	4/29	4/27
End Date	11/23	11/22	11/26	11/25	10/28	10/27	10/25	10/31	10/29	10/29	10/27	10/25
Total Days	13	210	214	188	155	170	169	196	161	162	182	182
Grow. Seas. Days	0	151	148	138	133	149	150	151	138	139	151	151

¹ Manual (M) well only at this location. No wells at the location (---). Day ranges and Growing Season (Grow. Seas.) Days in this table represent full calendar days.

Table 1-2. Precipitation During Each Growing Season and Water Year¹. See the yearly hydrographs in Figure 1-2.

Year		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Growing Season	May	A	N	A	N	B	B	A	A	N	A	A	B
	June	A	B	N	A	B	N	N	A	A	A	N	A
	July	B	A	B	B	B	A	B	A	A	N	B	B
	Aug	B	B	B	B	N	A	N	B	B	N	N	A
	Sept	B	B	A	A	B	N	B	B	B	B	N	A
Water Year		A	B	A	A	B	N	B	A	A	N	B	A

¹ The growing season includes precipitation during May through September and the water year includes precipitation from October 1 of the previous year through September 30 of the current year. Each time period, the precipitation is represented as: within the normal range of precipitation (N), below the normal range of precipitation (B), or above the normal range of precipitation (A).

Table 1-3. Hydroperiod(s) for Each Year During the Growing Season¹. Total number of days water level is ≥ 12 " below ground level for 14 or more consecutive days during the growing season. The yearly hydrographs are shown in Figure 1-2.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# of Periods ≥ 14 Consecutive Days	---	1	2	2	1	3	1	1	1	1	2	1
Total Days	---	151	115	109	111	129	108	118	137	138	127	151
% Grow. Seas.	---	100%	78%	79%	83%	87%	72%	78%	99%	99%	84%	100%

¹ Hydroperiods were not determined for locations with only a Manual (M) well. No wells at the location (---). The total days counted for the hydroperiod may not match the total days monitored within a growing season (Grow. Seas.) because the hydroperiod date count does not include partial days.

Table 1-4. Water Level Fluctuations During the Growing Season (inches)¹. Yearly fluctuations are shown in Figure 1-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum (in.)	---	-9.7	-20.4	-19.2	-16.4	-17.2	-17.7	-17.3	-8.0	-11.0	-17.9	-4.1
Maximum (in.)	---	10.2	4.5	2.6	-2.0	0.0	0.6	7.0	4.5	3.0	4.7	4.0
Fluctuation (in.)	---	19.9	24.9	21.8	14.4	17.2	18.3	24.3	12.5	14.0	22.5	8.1

¹ Fluctuations in water level were not determined for locations with only a Manual (M) well. No wells at the location (---). Some water level depths were deeper than the bottom of the well casing (<) resulting in greater fluctuations than indicated in the data (>).

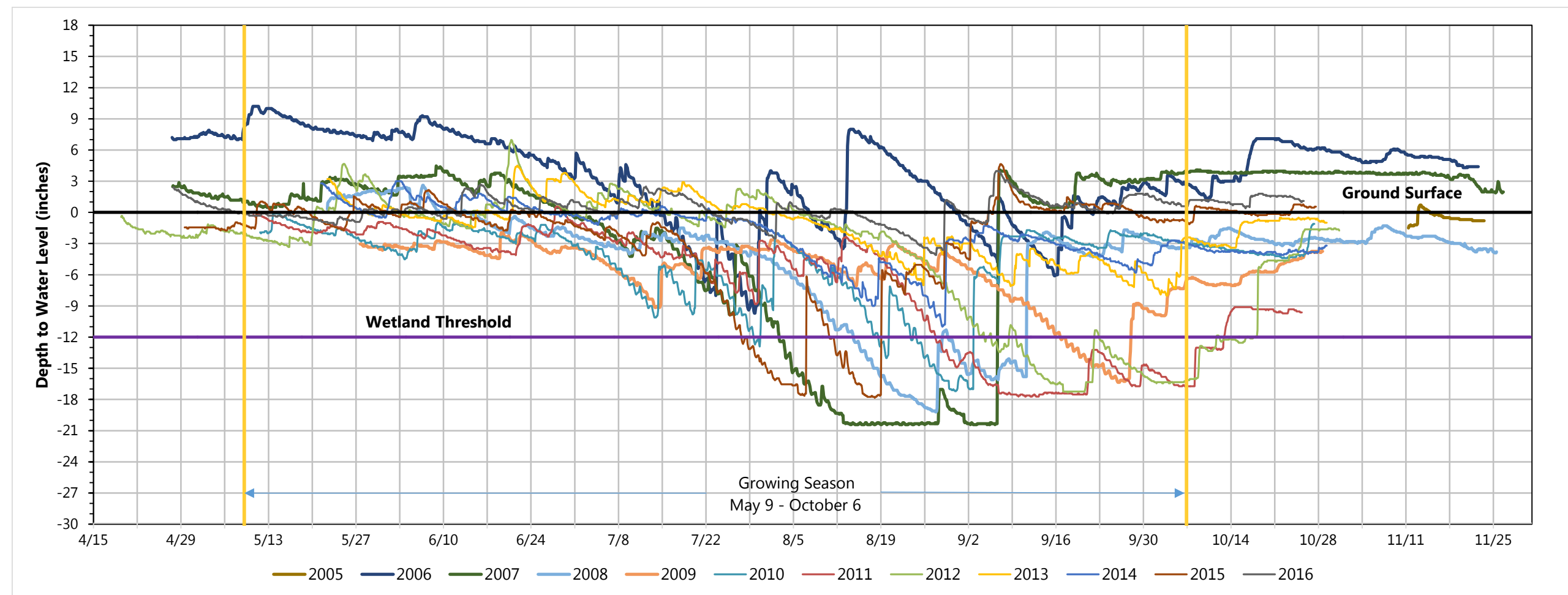


Figure 1-1
 WETLAND MONITORING WELL 1
 2005-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

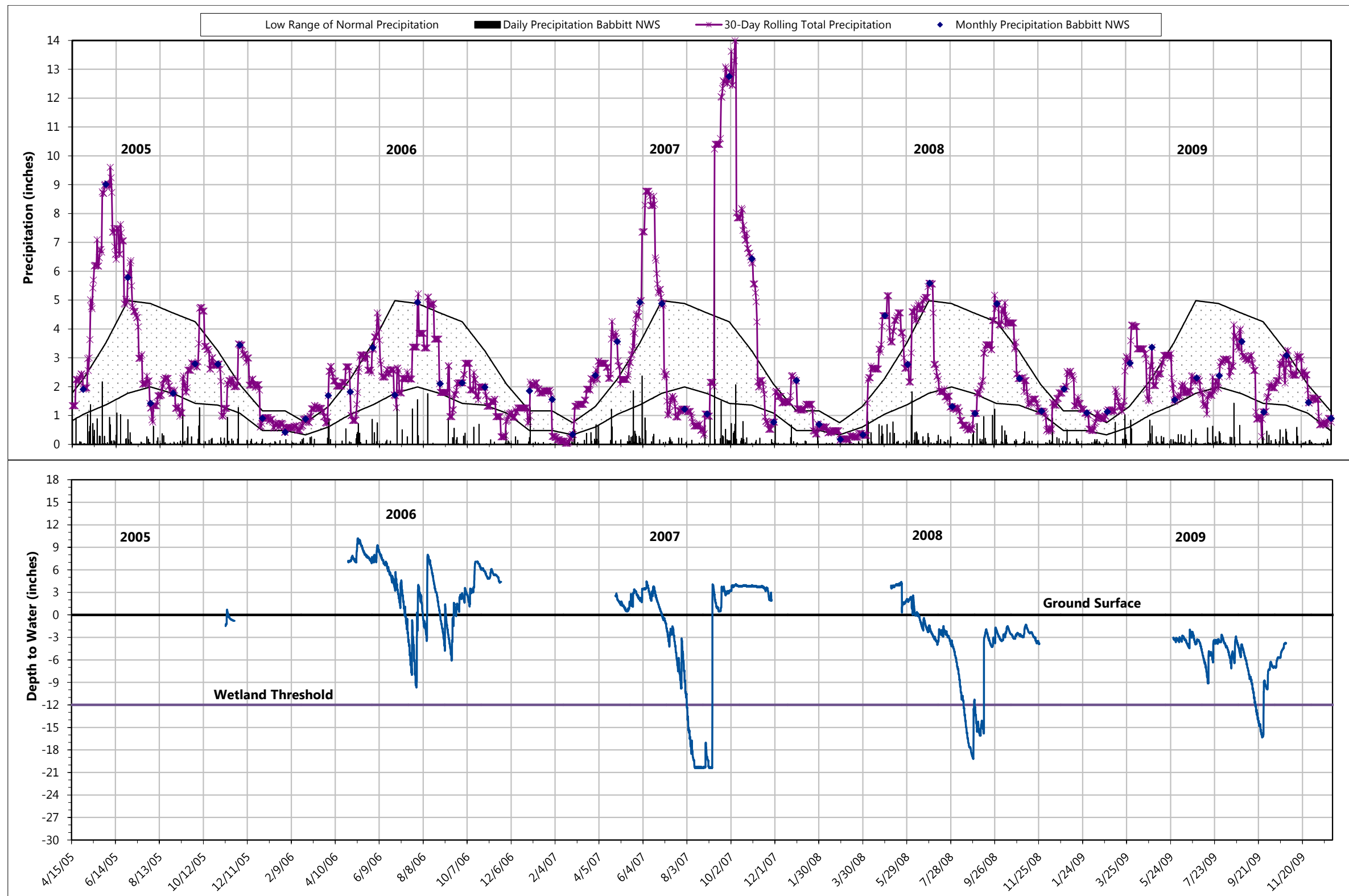


Figure 1-2a
 WETLAND MONITORING WELL 1
 2005-2009 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

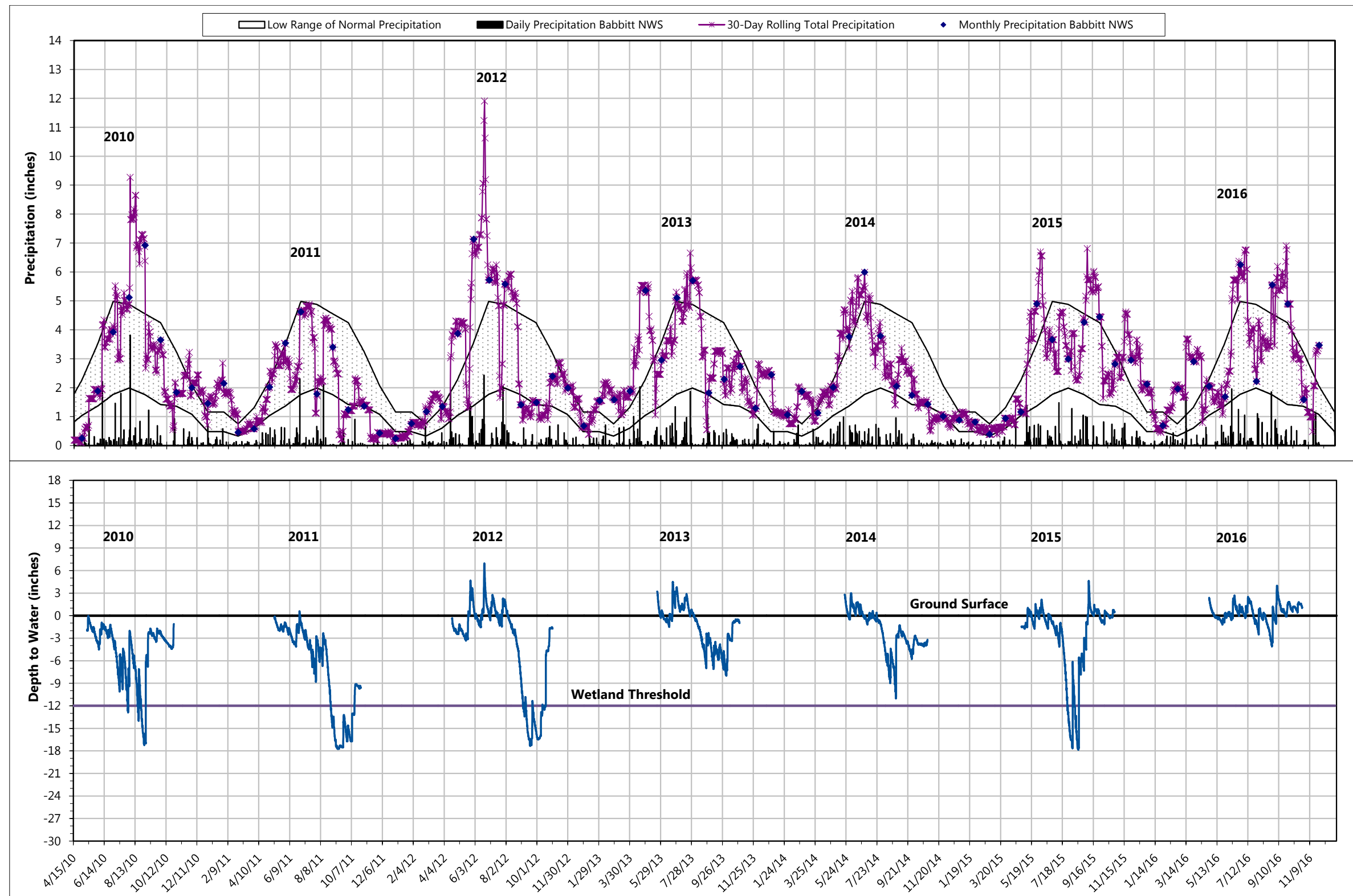


Figure 1-2b
 WETLAND MONITORING WELL 1
 2010-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

NorthMet Project Hydrology Monitoring – Well 1



May 2008



October 2009



June 2010



May 2011



June 2012



June 2013

NorthMet Project Hydrology Monitoring – Well 1



June 2014



May 2015



June 2016

Well ID: 2

NorthMet Project Area: Mine Site

Wetland Number: 100

Wetland Type: Coniferous Bog (Type 8)

UTM Coordinates (NAD 83 Zone 15)

Easting: 578291

Northing: 5275286

Well Type(s): Ecotone and Manual

Date Recording Well Installed: 5/22/2008

Installed By: Barr/NTS

Water Level Recorded Every: 4 hours

Date Manual Well Installed: 6/30/2005

Installed By: Barr

Manual Water Levels Read: Monthly

Growing Season: May 9-October 6 (151 days)

Monitored by: NTS

Water Level Fluctuation for All Years: 18.1 inches

Notes: UTM coordinates are for recording well.

Table 2-1. Monitoring Period Each Year¹. See the hydrographs in Figure 2-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Start Date	M	M	M	5/22	5/27	5/12	5/11	4/19	5/22	5/21	5/27	4/27
End Date	M	M	M	11/25	10/28	10/28	10/25	10/31	10/29	10/29	10/28	10/26
Total Days	M	M	M	188	155	170	168	196	161	162	155	183
Grow. Seas. Days	M	M	M	138	133	148	149	151	138	139	133	151

¹ Manual (M) well only at this location. No wells at the location (---). Day ranges and Growing Season (Grow. Seas.) Days in this table represent full calendar days.

Table 2-2. Precipitation During Each Growing Season and Water Year¹. See the yearly hydrographs in Figure 2-2.

Year		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Growing Season	May	A	N	A	N	B	B	A	A	N	A	A	B
	June	A	B	N	A	B	N	N	A	A	A	N	A
	July	B	A	B	B	B	A	B	A	A	N	B	B
	Aug	B	B	B	B	N	A	N	B	B	N	N	A
	Sept	B	B	A	A	B	N	B	B	B	B	N	A
Water Year		A	B	A	A	B	N	B	A	A	N	B	A

¹ The growing season includes precipitation during May through September and the water year includes precipitation from October 1 of the previous year through September 30 of the current year. Each time period, the precipitation is represented as: within the normal range of precipitation (N), below the normal range of precipitation (B), or above the normal range of precipitation (A).

Table 2-3. Hydroperiod(s) for Each Year During the Growing Season¹. Total number of days water level is ≥ 12 " below ground level for 14 or more consecutive days during the growing season. The yearly hydrographs are shown in Figure 2-2.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# of Periods ≥ 14 Consecutive Days	M	M	M	2	2	3	1	1	1	1	2	1
Total Days	M	M	M	123	110	144	116	114	137	138	108	151
% Grow. Seas.	M	M	M	89%	83%	97%	78%	75%	99%	99%	81%	100%

¹ Hydroperiods were not determined for locations with only a Manual (M) well. No wells at the location (---). The total days counted for the hydroperiod may not match the total days monitored within a growing season (Grow. Seas.) because the hydroperiod date count does not include partial days.

Table 2-4. Water Level Fluctuations During the Growing Season (inches)¹. Yearly fluctuations are shown in Figure 2-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum (in.)	M	M	M	-15.1	-13.9	-12.3	-15.4	-16.1	-10.8	-9.8	-15.1	-6.3
Maximum (in.)	M	M	M	-1.2	-4.3	-3.5	-2.4	0.8	-0.8	-0.4	1.1	2.0
Fluctuation (in.)	M	M	M	13.9	9.6	8.8	13.0	16.9	10.0	9.4	16.2	8.3

¹ Fluctuations in water level were not determined for locations with only a Manual (M) well. No wells at the location (---). Some water level depths were deeper than the bottom of the well casing (<) resulting in greater fluctuations than indicated in the data (>).

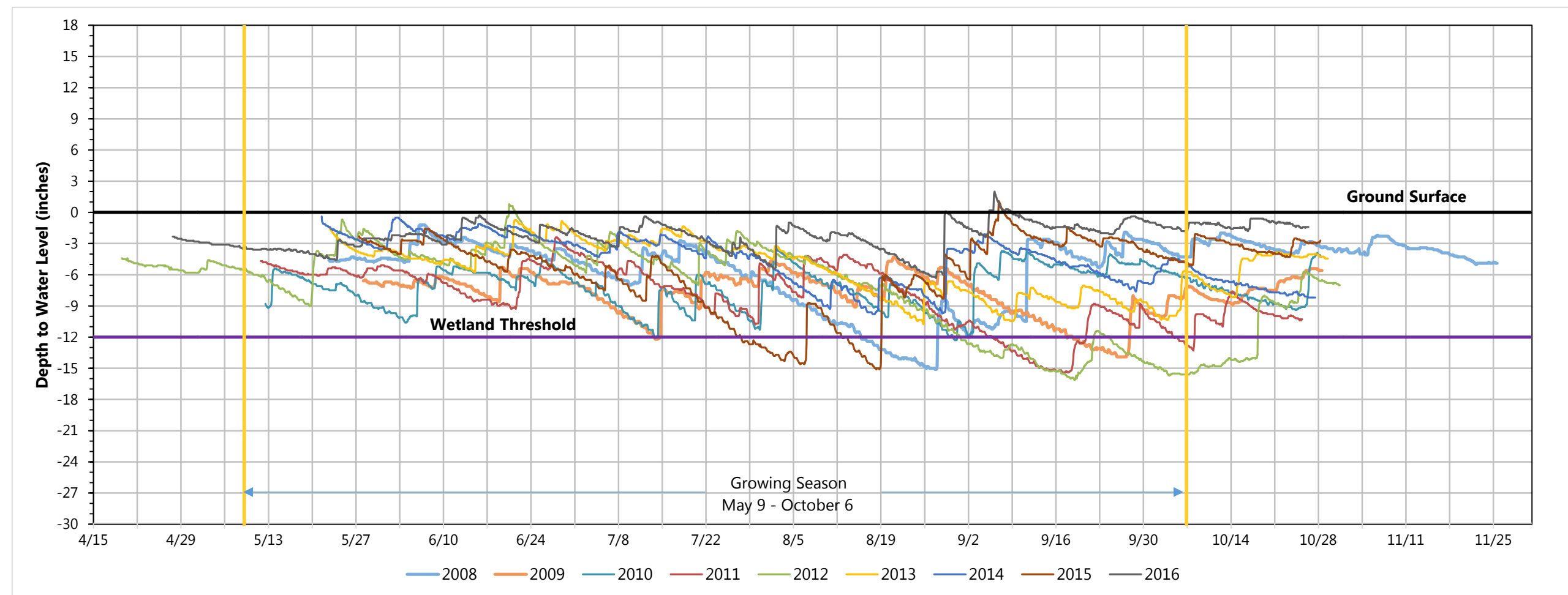
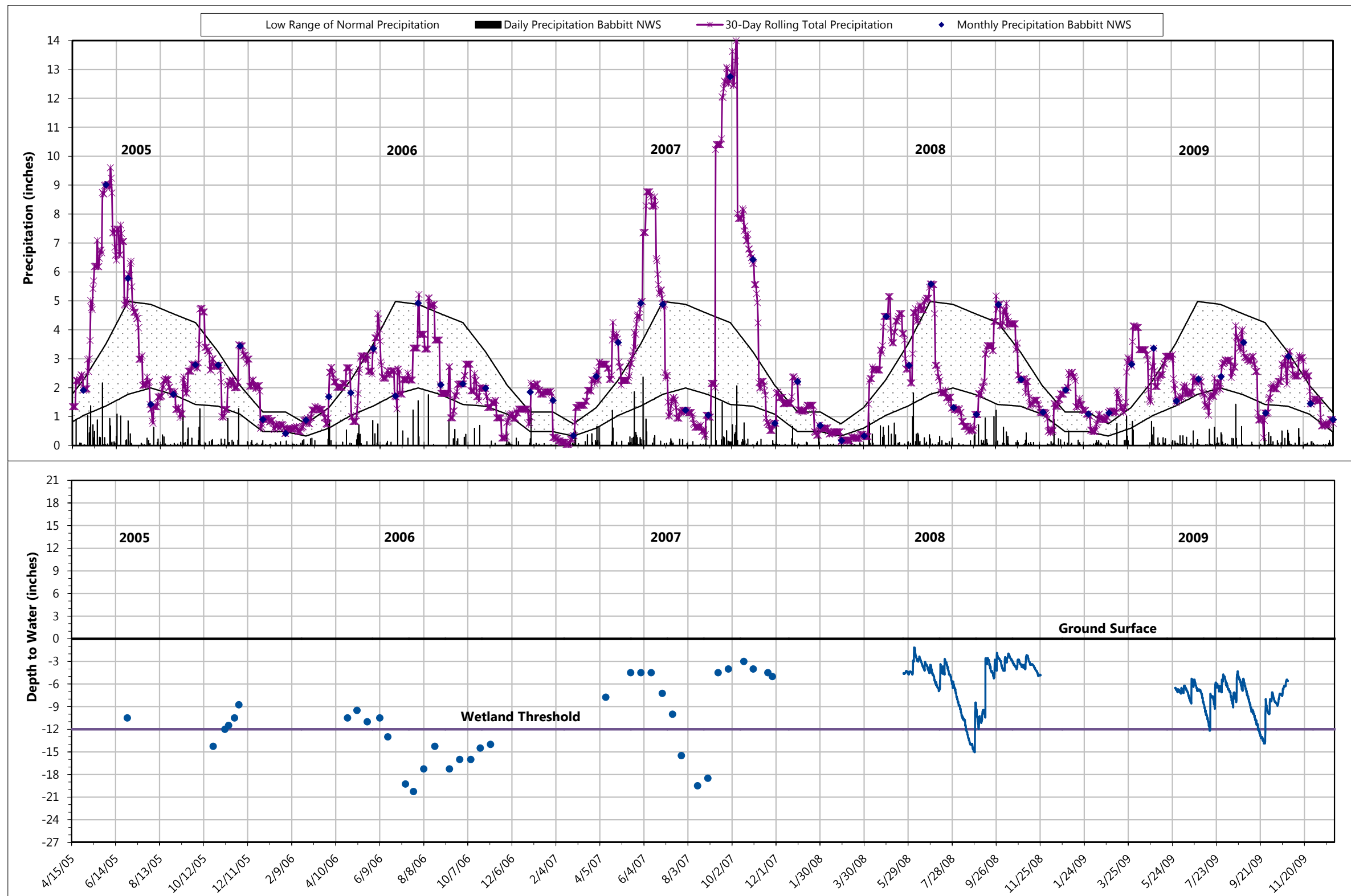


Figure 2-1
 WETLAND MONITORING WELL 2
 2008-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota



Points represent manual well measurements.
 Lines represent electronic well measurements.

Figure 2-2a
 WETLAND MONITORING WELL 2
 2005-2009 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

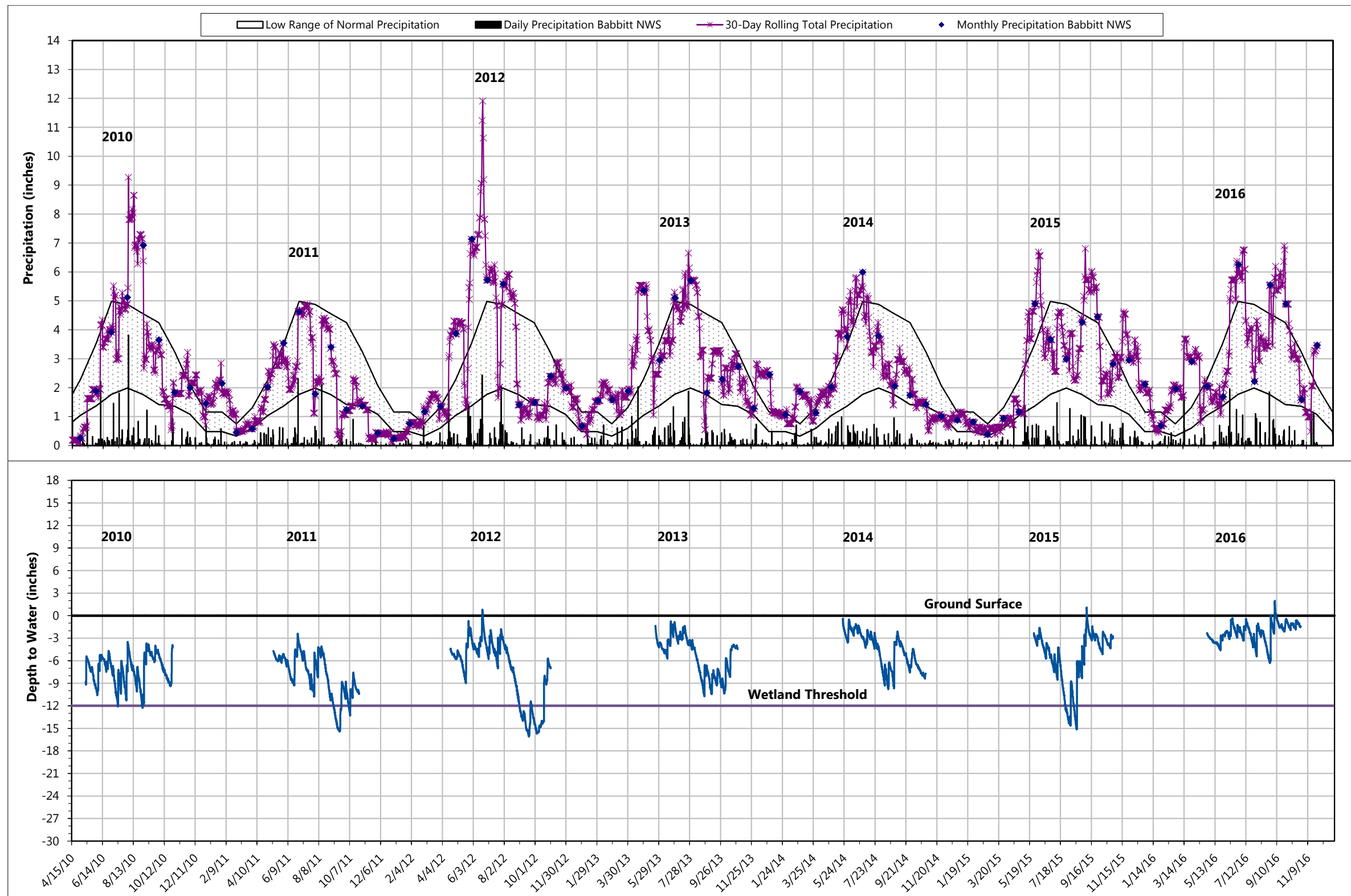


Figure 2-2b
 WETLAND MONITORING WELL 2
 2010-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

NorthMet Project Hydrology Monitoring – Well 2



May 2008



June 2009



June 2010



May 2011



June 2012



June 2013

NorthMet Project Hydrology Monitoring – Well 2



June 2014



May 2015



June 2016

Well ID: 3

NorthMet Project Area: Mine Site

Wetland Number: 103

Wetland Type: Coniferous Bog (Type 8)

UTM Coordinates (NAD 83 Zone 15)

Easting: 576018

Northing: 5274075

Growing Season: May 9-October 6 (151 days)

Water Level Fluctuation for All Years: NA

Well Type(s): Manual

Date Recording Well Installed: NA

Installed By: NA

Water Level Recorded Every: NA

Date Manual Well Installed: 6/29/2005

Installed By: Barr

Manual Water Levels Read: Monthly

Monitored by: NTS

Notes: No recording well was installed. Only manual readings were collected for this well. Well was removed from study on 11/27/2007.

Table 3-1. Monitoring Period Each Year¹. See the hydrographs in Figure 3-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Start Date	M	M	M	---	---	---	---	---	---	---	---	---
End Date	M	M	M	---	---	---	---	---	---	---	---	---
Total Days	M	M	M	---	---	---	---	---	---	---	---	---
Grow. Seas. Days	M	M	M	---	---	---	---	---	---	---	---	---

¹ Manual (M) well only at this location. No wells at the location (---). Day ranges and Growing Season (Grow. Seas.) Days in this table represent full calendar days.

Table 3-2. Precipitation During Each Growing Season and Water Year¹. See the yearly hydrographs in Figure 3-2.

Year		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Growing Season	May	A	N	A	N	B	B	A	A	N	A	A	B
	June	A	B	N	A	B	N	N	A	A	A	N	A
	July	B	A	B	B	B	A	B	A	A	N	B	B
	Aug	B	B	B	B	N	A	N	B	B	N	N	A
	Sept	B	B	A	A	B	N	B	B	B	B	N	A
Water Year		A	B	A	A	B	N	B	A	A	N	B	A

¹ The growing season includes precipitation during May through September and the water year includes precipitation from October 1 of the previous year through September 30 of the current year. Each time period, the precipitation is represented as: within the normal range of precipitation (N), below the normal range of precipitation (B), or above the normal range of precipitation (A).

Table 3-3. Hydroperiod(s) for Each Year During the Growing Season¹. Total number of days water level is ≥ 12 " below ground level for 14 or more consecutive days during the growing season. The yearly hydrographs are shown in Figure 3-2.

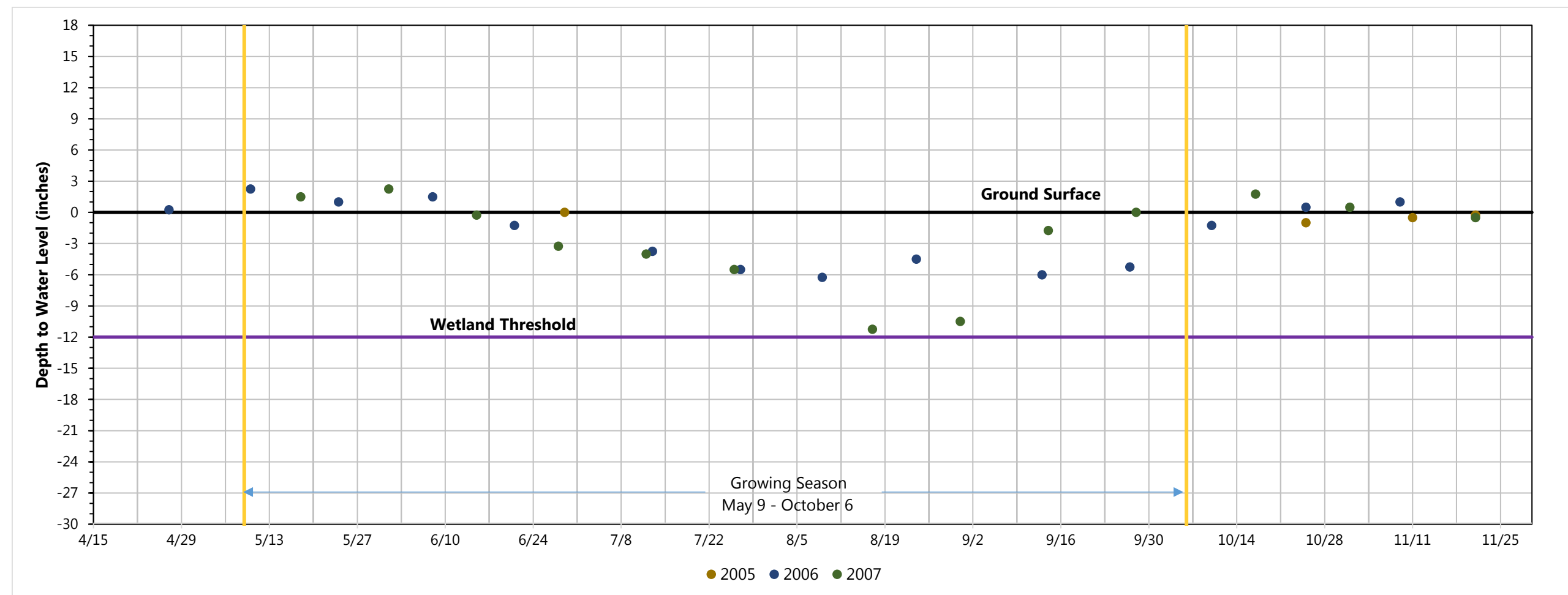
Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# of Periods ≥ 14 Consecutive Days	M	M	M	---	---	---	---	---	---	---	---	---
Total Days	M	M	M	---	---	---	---	---	---	---	---	---
% Grow. Seas.	M	M	M	---	---	---	---	---	---	---	---	---

¹ Hydroperiods were not determined for locations with only a Manual (M) well. No wells at the location (---). The total days counted for the hydroperiod may not match the total days monitored within a growing season (Grow. Seas.) because the hydroperiod date count does not include partial days.

Table 3-4. Water Level Fluctuations During the Growing Season (inches)¹. Yearly fluctuations are shown in Figure 3-1.

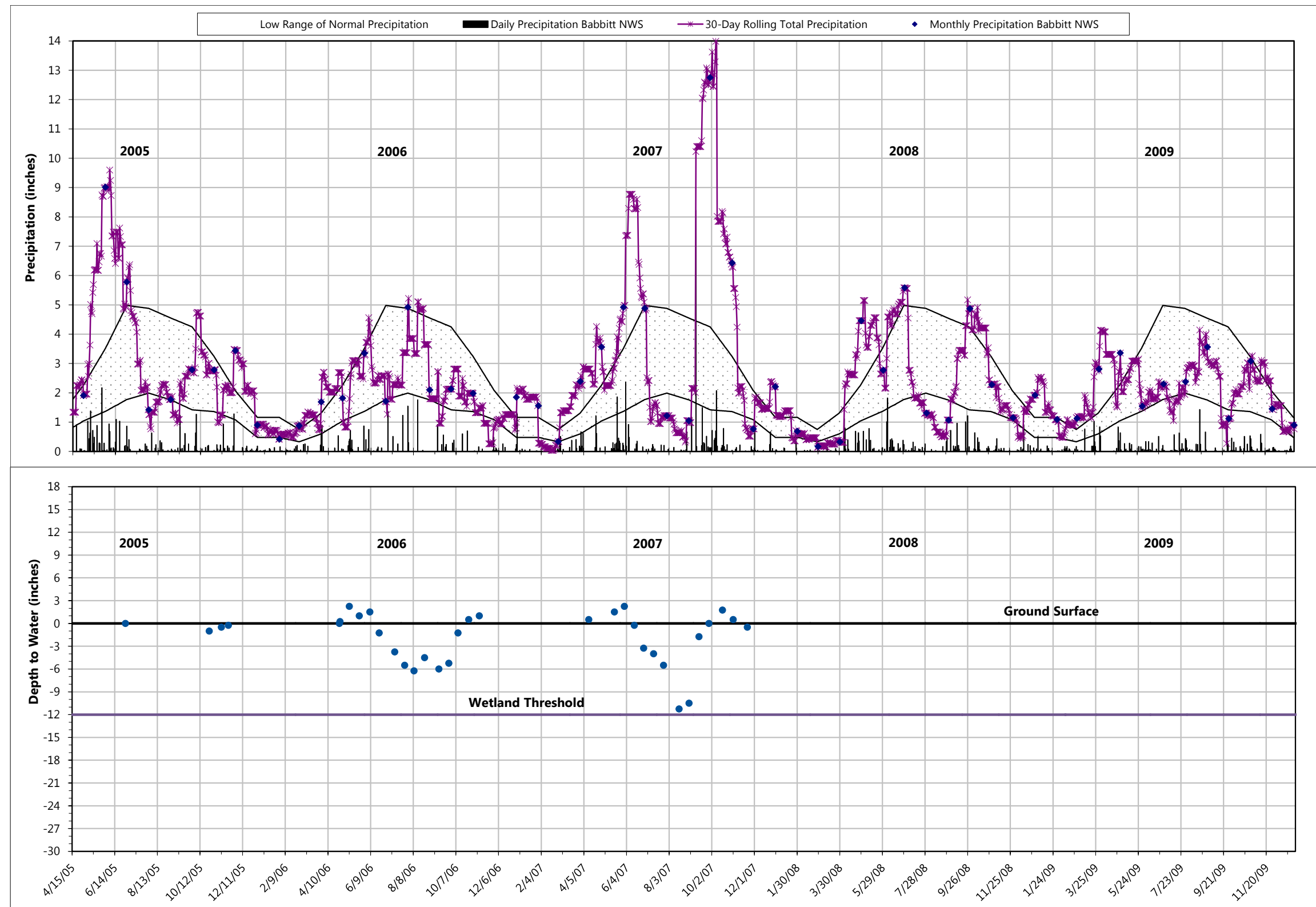
Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum (in.)	M	M	M	---	---	---	---	---	---	---	---	---
Maximum (in.)	M	M	M	---	---	---	---	---	---	---	---	---
Fluctuation (in.)	M	M	M	---	---	---	---	---	---	---	---	---

¹ Fluctuations in water level were not determined for locations with only a Manual (M) well. No wells at the location (---). Some water level depths were deeper than the bottom of the well casing (<) resulting in greater fluctuations than indicated in the data (>).



Points represent manual readings.

Figure 3M-1
 WETLAND MONITORING WELL 3M
 2005-2007 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota



Points represent manual well measurements.

Figure 3-2
 WETLAND MONITORING WELL 3
 2005-2007 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

NorthMet Project Hydrology Monitoring – Well 3

No photographs are available for Well 3

Well ID: 4

NorthMet Project Area: Mine Site

Wetland Number: 887

Wetland Type: Coniferous Bog (Type 8)

UTM Coordinates (NAD 83 Zone 15)

Easting: 574920

Northing: 5274138

Well Type(s): Ecotone

Date Recording Well Installed: 11/9/2005

Installed By: NTS

Water Level Recorded Every: 4 hours

Date Manual Well Installed: 6/28/2005

Installed By: Barr

Manual Water Levels Read: Monthly

Growing Season: May 9-October 6 (151 days)

Monitored by: NTS

Water Level Fluctuation for All Years: 13.7 inches

Notes: UTM coordinates are for recording well.

Table 4-1. Monitoring Period Each Year. See the hydrographs in Figure 4-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Start Date	11/11	4/27	5/18	5/8	5/28	5/10	5/9	7/25	5/21	5/20	4/28	4/26
End Date	11/23	11/22	11/26	11/24	10/28	10/26	10/24	10/30	10/28	10/28	10/27	10/25
Total Days	13	210	193	201	154	170	169	98	161	162	183	183
Grow. Seas. Days	0	151	142	152	132	150	151	74	139	140	151	151

¹ Manual (M) well only at this location. No wells at the location (---). Day ranges and Growing Season (Grow. Seas.) Days in this table represent full calendar days.

Table 4-2. Precipitation During Each Growing Season and Water Year¹. See the yearly hydrographs in Figure 4-2.

Year		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Growing Season	May	A	N	A	N	B	B	A	A	N	A	A	B
	June	A	B	N	A	B	N	N	A	A	A	N	A
	July	B	A	B	B	B	A	B	A	A	N	B	B
	Aug	B	B	B	B	N	A	N	B	B	N	N	A
	Sept	B	B	A	A	B	N	B	B	B	B	N	A
Water Year		A	B	A	A	B	N	B	A	A	N	B	A

¹ The growing season includes precipitation during May through September and the water year includes precipitation from October 1 of the previous year through September 30 of the current year. Each time period, the precipitation is represented as: within the normal range of precipitation (N), below the normal range of precipitation (B), or above the normal range of precipitation (A).

Table 4-3. Hydroperiod(s) for Each Year During the Growing Season¹. Total number of days water level is ≥ 12 " below ground level for 14 or more consecutive days during the growing season. The yearly hydrographs are shown in Figure 4-2.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# of Periods ≥ 14 Consecutive Days	---	1	1	1	1	1	1	1	1	1	1	1
Total Days	---	151	141	151	131	149	150	71	138	139	151	151
% Grow. Seas.		100%	99%	99%	99%	99%	99%	96%	99%	99%	100%	100%

¹ Hydroperiods were not determined for locations with only a Manual (M) well. No wells at the location (---). The total days counted for the hydroperiod may not match the total days monitored within a growing season (Grow. Seas.) because the hydroperiod date count does not include partial days.

Table 4-4. Water Level Fluctuations During the Growing Season (inches)¹. Yearly fluctuations are shown in Figure 4-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum (in.)	---	-3.8	-7.3	-8.1	-4.1	-4.4	-5.9	-4.0	-1.6	-2.2	-4.1	-0.5
Maximum (in.)	---	4.2	5.1	2.2	0.7	0.6	2.2	1.5	5.6	4.1	3.7	5.1
Fluctuation (in.)	---	8.0	12.4	10.3	4.8	5.0	8.1	5.5	7.2	6.3	7.8	5.6

¹ Fluctuations in water level were not determined for locations with only a Manual (M) well. No wells at the location (---). Some water level depths were deeper than the bottom of the well casing (<) resulting in greater fluctuations than indicated in the data (>).

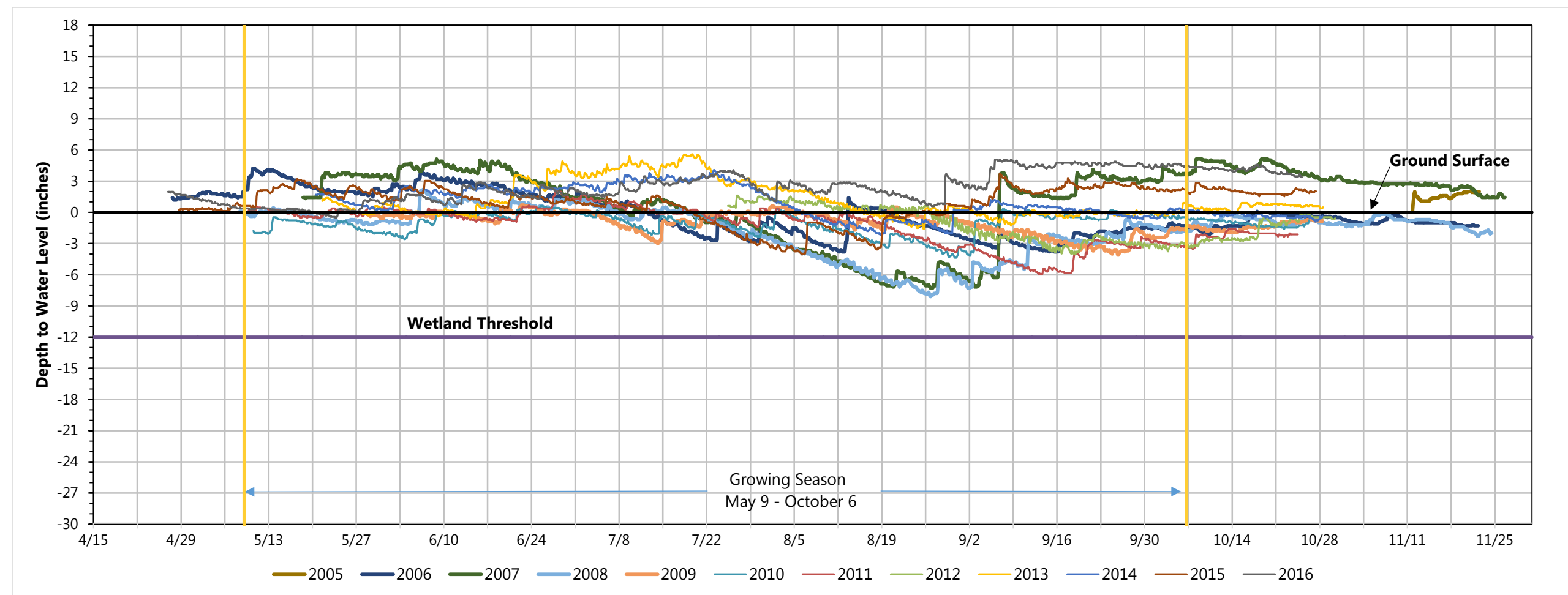


Figure 4-1
 WETLAND MONITORING WELL 4
 2005-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

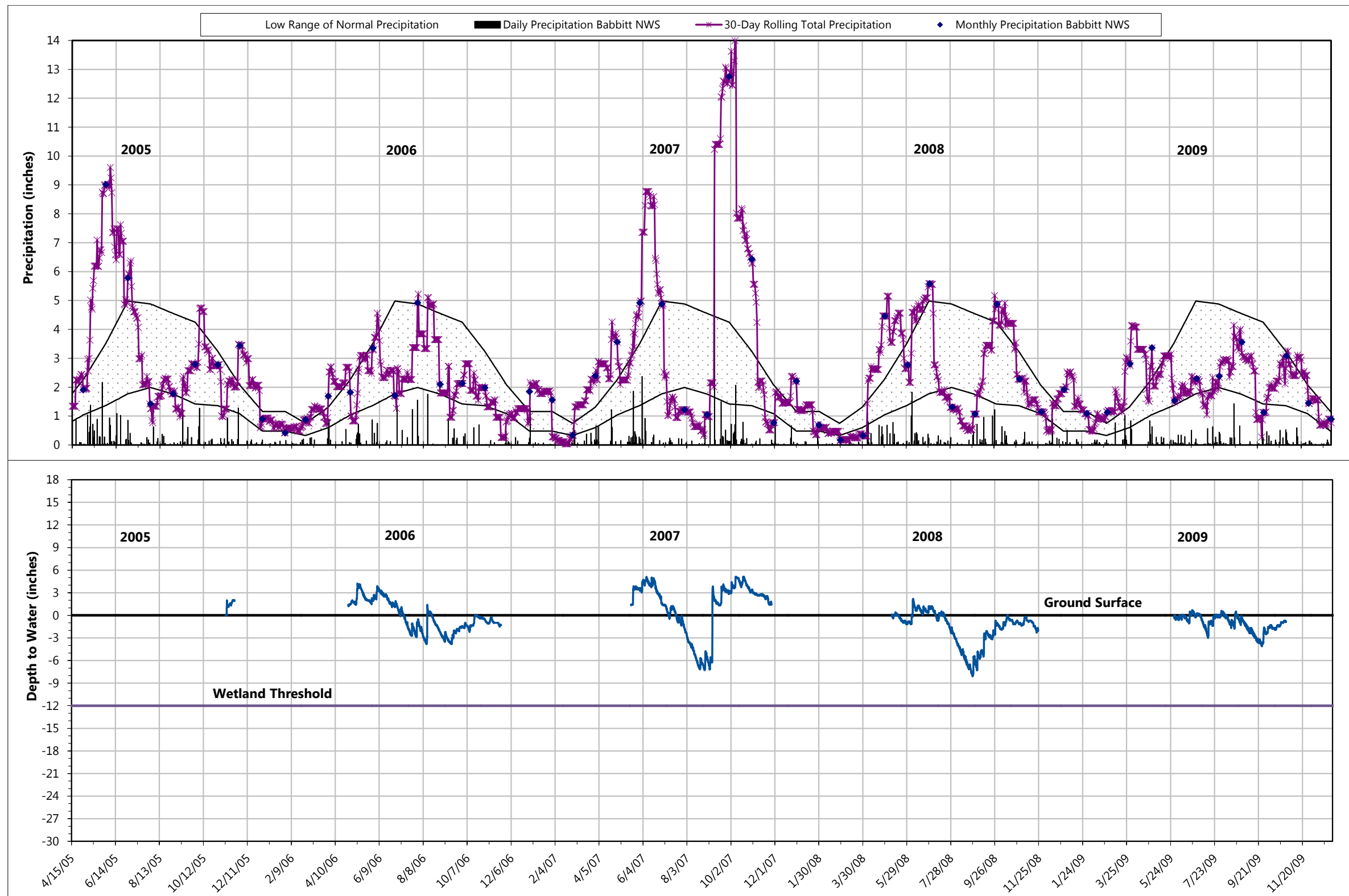


Figure 4-2a
 WETLAND MONITORING WELL 4
 2005-2009 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

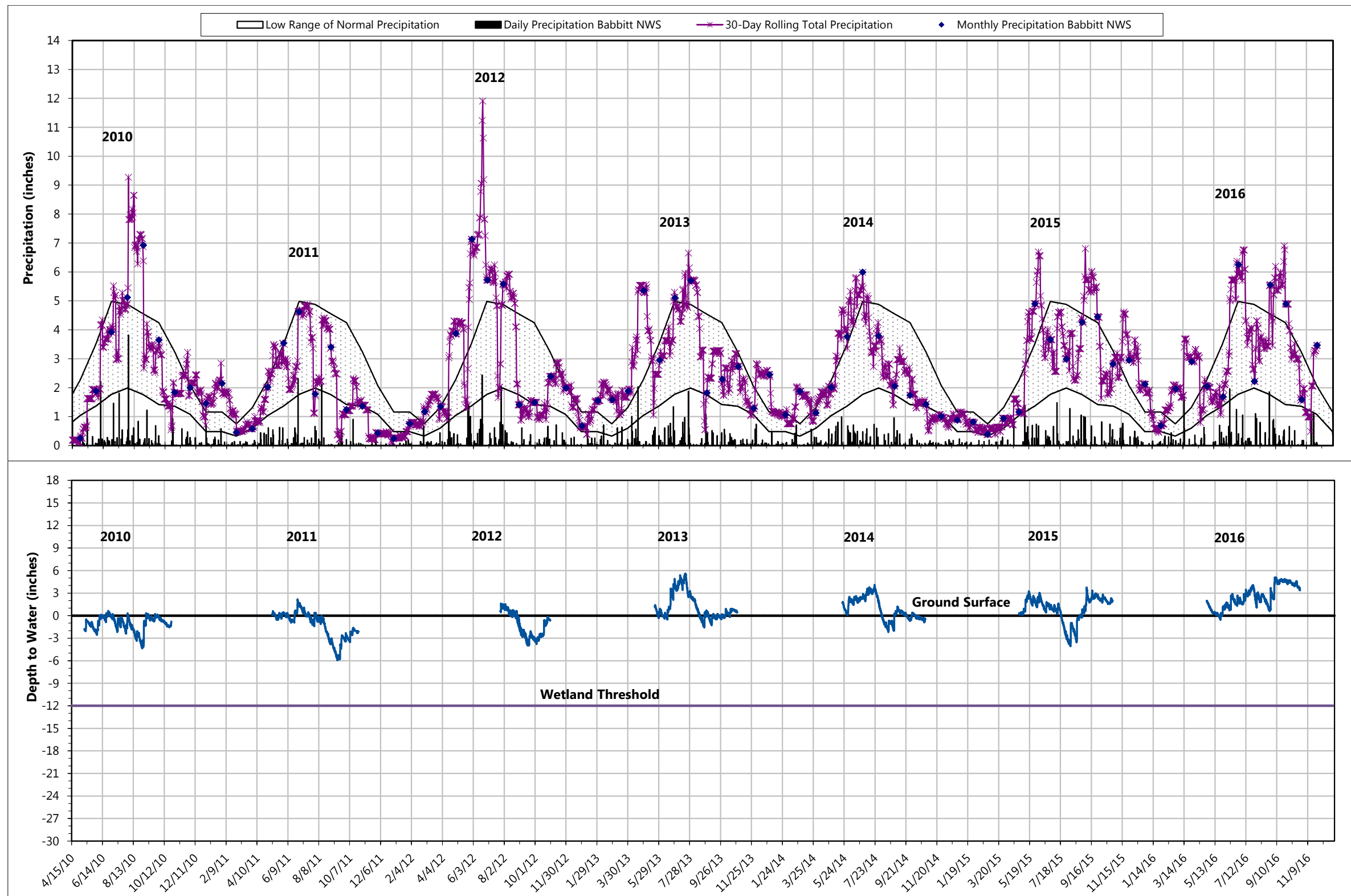


Figure 4-2b
 WETLAND MONITORING WELL 4
 2010-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

NorthMet Project Hydrology Monitoring – Well 4



June 2005

June 2006 – No photo available



June 2007 – No photo available

May 2008



June 2009



June 2010

NorthMet Project Hydrology Monitoring – Well 4



June 2011



June 2012



June 2013



June 2014



June 2015



June 2016

Well ID: 4A

NorthMet Project Area: Mine Site

Wetland Number: 889

Wetland Type: Coniferous Bog (Type 8)

UTM Coordinates (NAD 83 Zone 15)

Easting: 575669

Northing: 5274600

Well Type(s): Ecotone and Manual

Date Recording Well Installed: 5/21/2008

Installed By: Barr/NTS

Water Level Recorded Every: 4 hours

Date Manual Well Installed: 6/29/2005

Installed By: Barr

Manual Water Levels Read: Monthly

Growing Season: May 9-October 6 (151 days)

Monitored by: NTS

Water Level Fluctuation for All Years: 18.7 inches

Notes: UTM coordinates are for recording well.

Table 4A-1. Monitoring Period Each Year¹. See the hydrographs in Figure 4A-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Start Date	M	M	M	5/21	4/28	5/10	5/9	4/18	5/21	5/20	4/28	4/26
End Date	M	M	M	11/24	10/28	10/26	10/24	10/30	10/28	10/28	10/27	10/25
Total Days	M	M	M	188	184	170	169	196	161	162	183	183
Grow. Seas. Days	M	M	M	139	151	150	151	151	139	140	151	151

¹ Manual (M) well only at this location. No wells at the location (---). Day ranges and Growing Season (Grow. Seas.) Days in this table represent full calendar days.

Table 4A-2. Precipitation During Each Growing Season and Water Year¹. See the yearly hydrographs in Figure 4A-2.

Year		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Growing Season	May	A	N	A	N	B	B	A	A	N	A	A	B
	June	A	B	N	A	B	N	N	A	A	A	N	A
	July	B	A	B	B	B	A	B	A	A	N	B	B
	Aug	B	B	B	B	N	A	N	B	B	N	N	A
	Sept	B	B	A	A	B	N	B	B	B	B	N	A
Water Year		A	B	A	A	B	N	B	A	A	N	B	A

¹ The growing season includes precipitation during May through September and the water year includes precipitation from October 1 of the previous year through September 30 of the current year. Each time period, the precipitation is represented as: within the normal range of precipitation (N), below the normal range of precipitation (B), or above the normal range of precipitation (A).

Table 4A-3. Hydroperiod(s) for Each Year During the Growing Season¹. Total number of days water level is ≥ 12 " below ground level for 14 or more consecutive days during the growing season. The yearly hydrographs are shown in Figure 4A-2.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# of Periods ≥ 14 Consecutive Days	M	M	M	1	1	1	1	1	1	1	1	1
Total Days	M	M	M	138	151	149	150	151	138	139	151	151
% Grow. Seas.	M	M	M	99%	100%	99%	99%	100%	99%	99%	100%	100%

¹ Hydroperiods were not determined for locations with only a Manual (M) well. No wells at the location (---). The total days counted for the hydroperiod may not match the total days monitored within a growing season (Grow. Seas.) because the hydroperiod date count does not include partial days.

Table 4A-4. Water Level Fluctuations During the Growing Season (inches)¹. Yearly fluctuations are shown in Figure 4A-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum (in.)	M	M	M	-11.0	-1.4	-2.2	-7.0	-2.6	0.0	-1.6	-2.8	-0.1
Maximum (in.)	M	M	M	1.2	3.1	3.3	4.5	7.1	7.0	6.7	6.8	7.7
Fluctuation (in.)	M	M	M	12.2	4.5	5.5	11.5	9.7	7.0	8.3	9.6	7.8

¹ Fluctuations in water level were not determined for locations with only a Manual (M) well. No wells at the location (---). Some water level depths were deeper than the bottom of the well casing (<) resulting in greater fluctuations than indicated in the data (>).

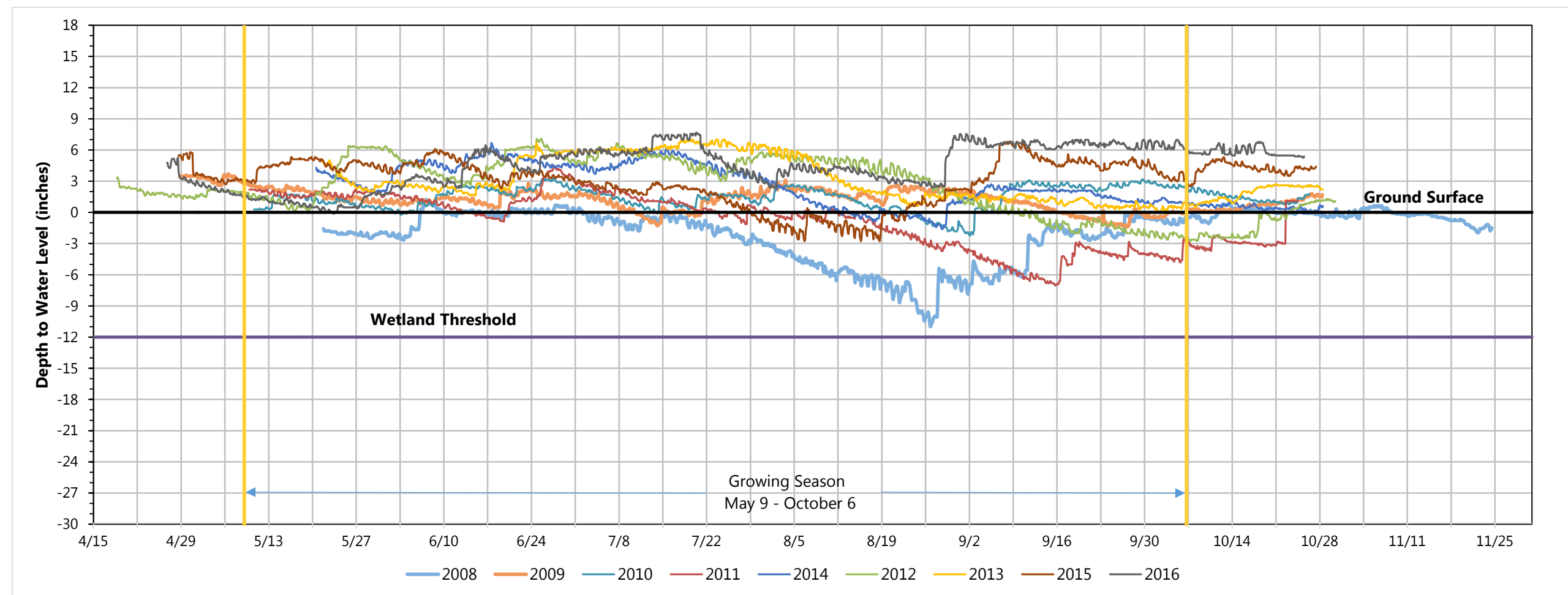
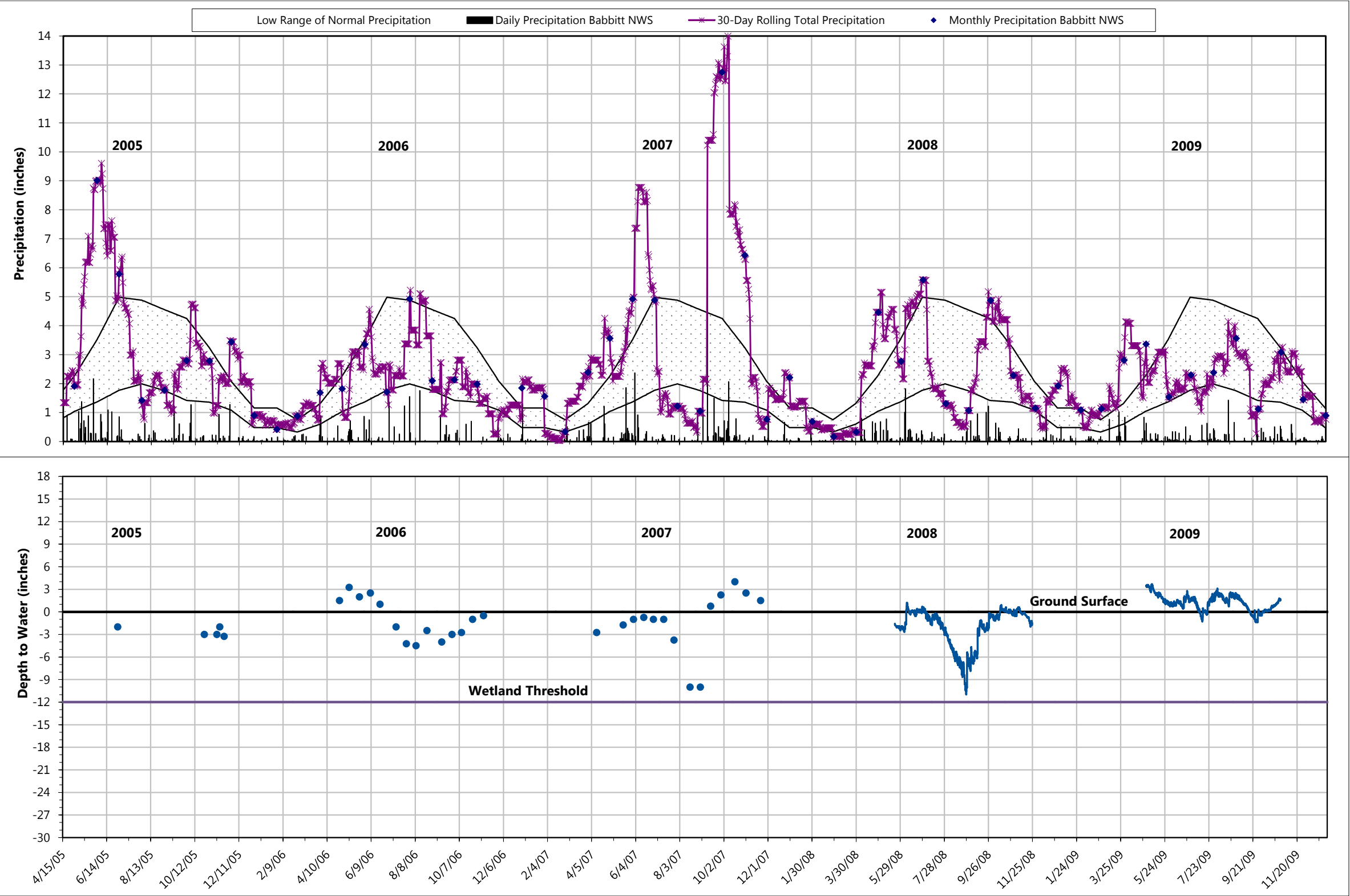


Figure 4A-1
WETLAND MONITORING WELL 4A
2008-2016 WETLAND HYDROLOGY MONITORING DATA
NorthMet Project
Poly Met Mining, Inc.
Hoyt Lakes, Minnesota



Points represent manual well measurements.
Lines represent electronic well measurements.

Figure 4A-2a
WETLAND MONITORING WELL 4A
2005-2009 WETLAND HYDROLOGY MONITORING DATA
NorthMet Project
Poly Met Mining, Inc.
Hoyt Lakes, Minnesota

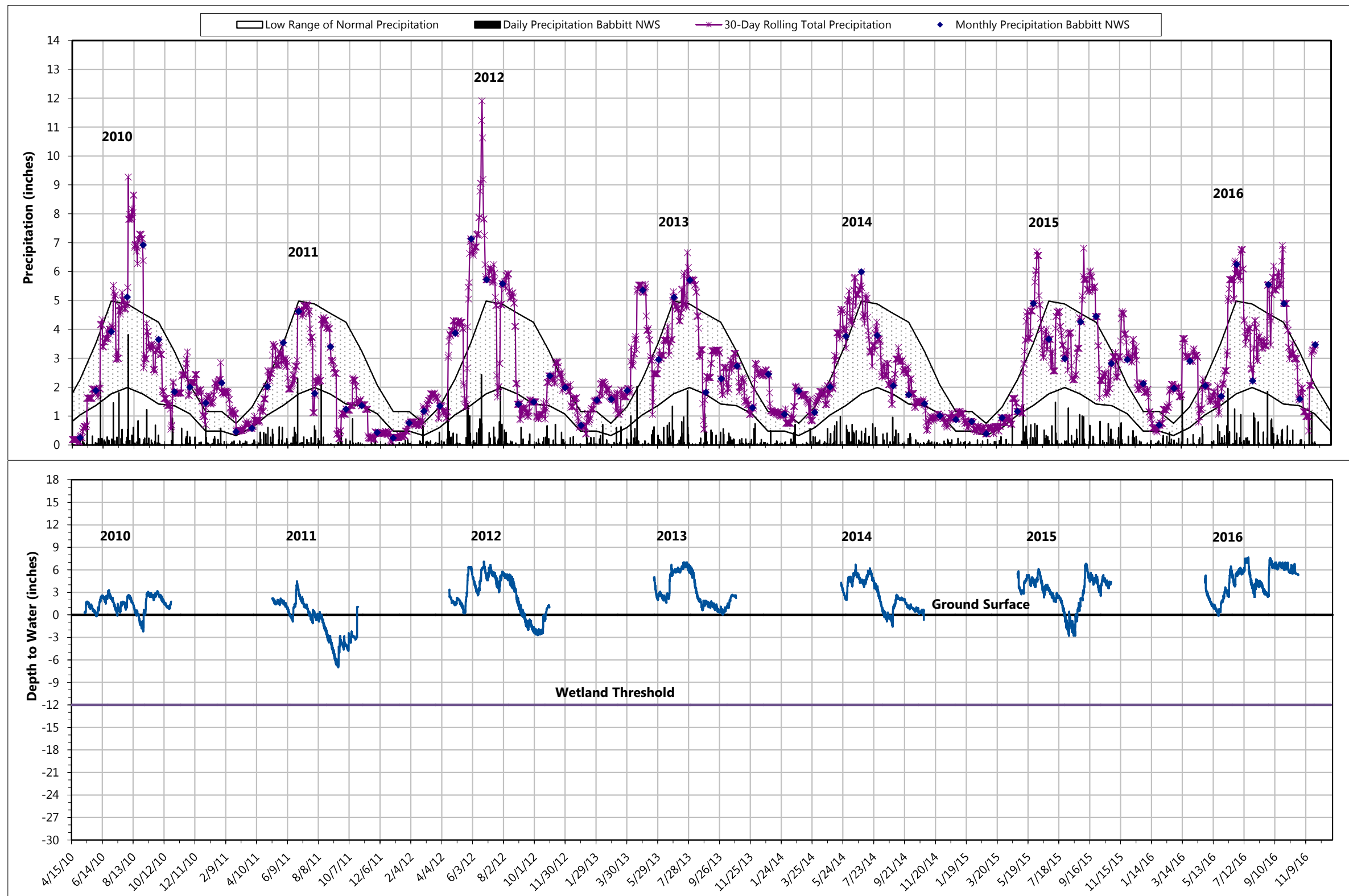


Figure 4A-2b
 WETLAND MONITORING WELL 4A
 2010-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

NorthMet Project Hydrology Monitoring – Well 4A



May 2008



June 2009



June 2010



May 2011



June 2012



June 2013

NorthMet Project Hydrology Monitoring – Well 4A



June 2014



June 2015



June 2016

Well ID: 5

NorthMet Project Area: Mine Site

Wetland Number: 887

Wetland Type: Coniferous Bog (Type 8)

UTM Coordinates (NAD 83 Zone 15)

Easting: 576018

Northing: 5274129

Growing Season: May 9-October 6 (151 days)

Water Level Fluctuation for All Years: NA

Well Type(s): Manual

Date Recording Well Installed: NA

Installed By: NA

Water Level Recorded Every: NA

Date Manual Well Installed: 6/28/2005

Installed By: Barr

Manual Water Levels Read: Monthly

Monitored by: NTS

Notes: No recording well was installed. Only manual readings were collected for this well.

Table 5-1. Monitoring Period Each Year¹. See the hydrographs in Figure 5-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Start Date	M	M	M	M	M	M	M	M	M	M	M	M
End Date	M	M	M	M	M	M	M	M	M	M	M	M
Total Days	M	M	M	M	M	M	M	M	M	M	M	M
Grow. Seas. Days	M	M	M	M	M	M	M	M	M	M	M	M

¹ Manual (M) well only at this location. No wells at the location (---). Day ranges and Growing Season (Grow. Seas.) Days in this table represent full calendar days.

Table 5-2. Precipitation During Each Growing Season and Water Year¹. See the yearly hydrographs in Figure 5-2.

Year		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Growing Season	May	A	N	A	N	B	B	A	A	N	A	A	B
	June	A	B	N	A	B	N	N	A	A	A	N	A
	July	B	A	B	B	B	A	B	A	A	N	B	B
	Aug	B	B	B	B	N	A	N	B	B	N	N	A
	Sept	B	B	A	A	B	N	B	B	B	B	N	A
Water Year		A	B	A	A	B	N	B	A	A	N	B	A

¹ The growing season includes precipitation during May through September and the water year includes precipitation from October 1 of the previous year through September 30 of the current year. Each time period, the precipitation is represented as: within the normal range of precipitation (N), below the normal range of precipitation (B), or above the normal range of precipitation (A).

Table 5-3. Hydroperiod(s) for Each Year During the Growing Season¹. Total number of days water level is ≥ 12 " below ground level for 14 or more consecutive days during the growing season. The yearly hydrographs are shown in Figure 5-2.

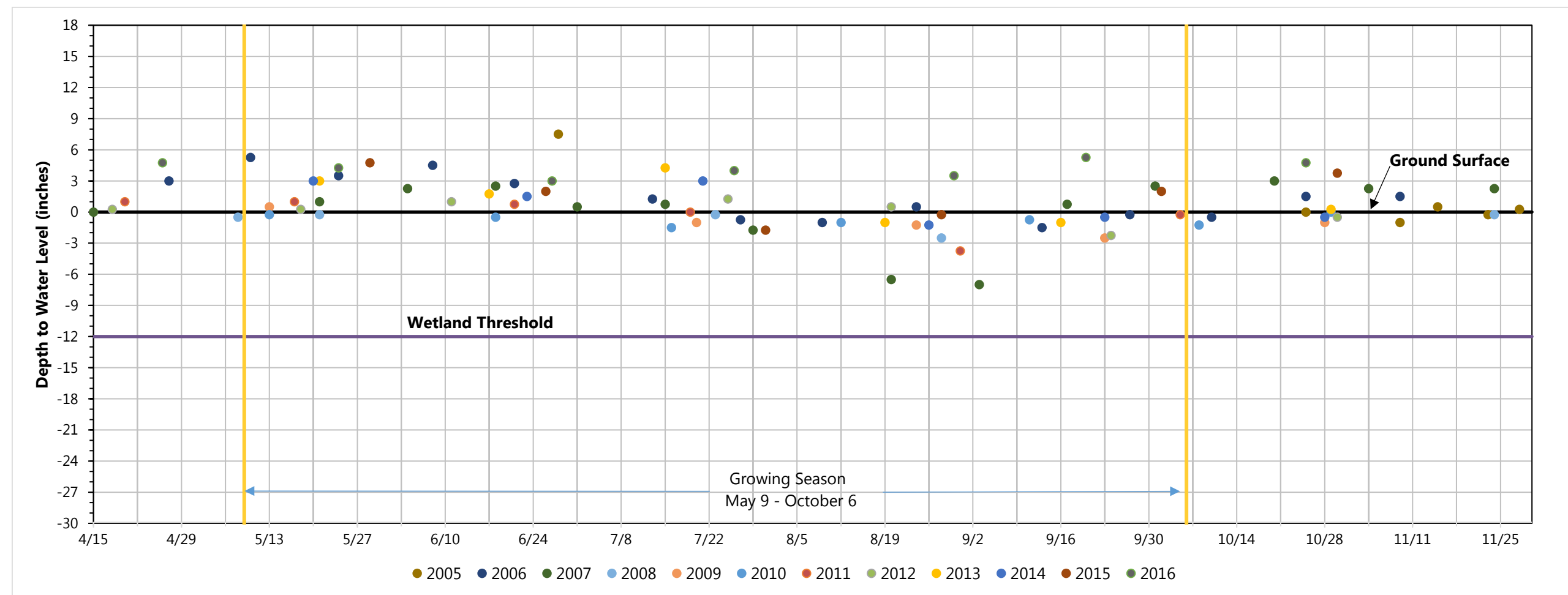
Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# of Periods ≥ 14 Consecutive Days	M	M	M	M	M	M	M	M	M	M	M	M
Total Days	M	M	M	M	M	M	M	M	M	M	M	M
% Grow. Seas.	M	M	M	M	M	M	M	M	M	M	M	M

¹ Hydroperiods were not determined for locations with only a Manual (M) well. No wells at the location (---). The total days counted for the hydroperiod may not match the total days monitored within a growing season (Grow. Seas.) because the hydroperiod date count does not include partial days.

Table 5-4. Water Level Fluctuations During the Growing Season (inches)¹. Yearly fluctuations are shown in Figure 5-1.

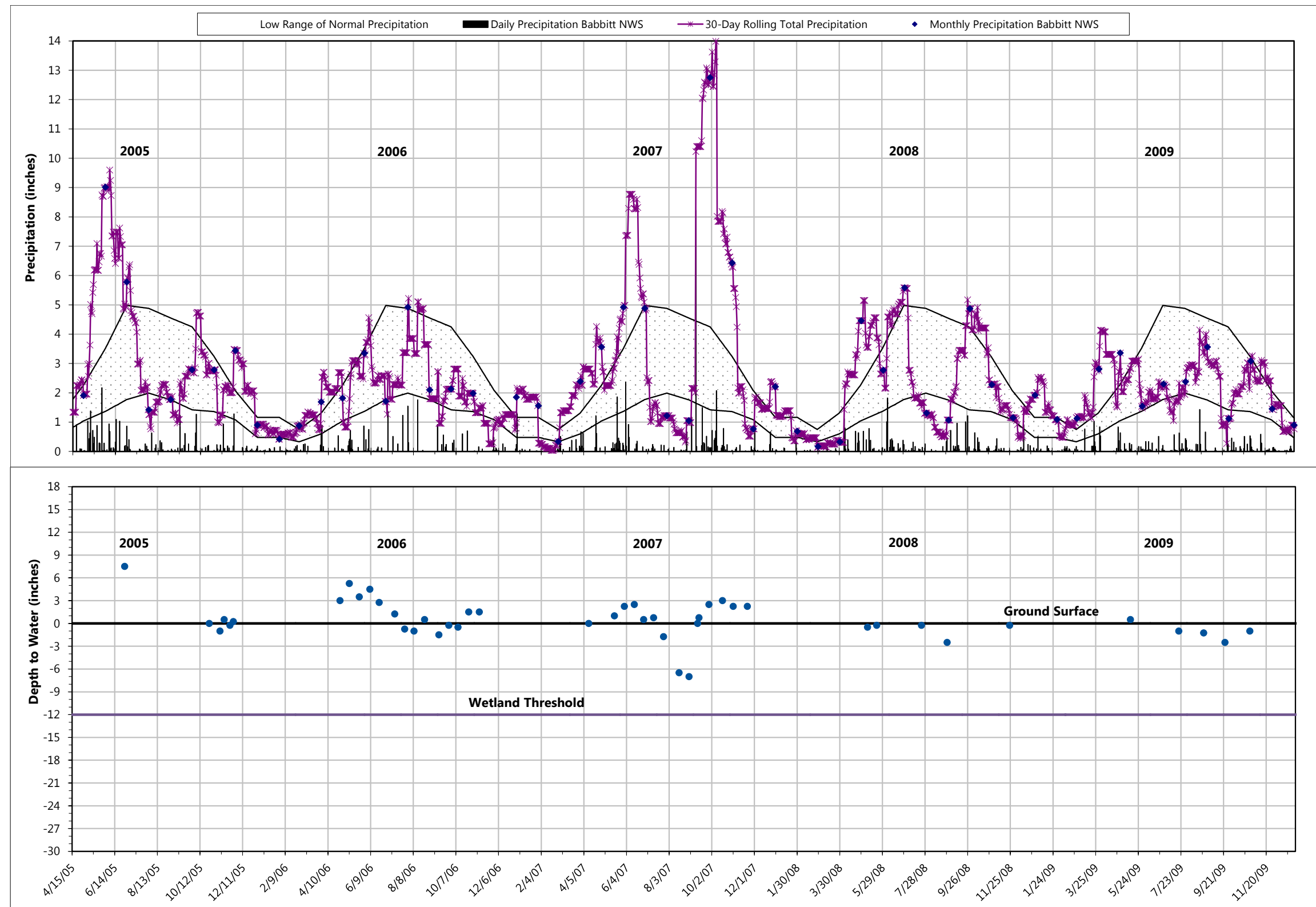
Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum (in.)	M	M	M	M	M	M	M	M	M	M	M	M
Maximum (in.)	M	M	M	M	M	M	M	M	M	M	M	M
Fluctuation (in.)	M	M	M	M	M	M	M	M	M	M	M	M

¹ Fluctuations in water level were not determined for locations with only a Manual (M) well. No wells at the location (---). Some water level depths were deeper than the bottom of the well casing (<) resulting in greater fluctuations than indicated in the data (>).



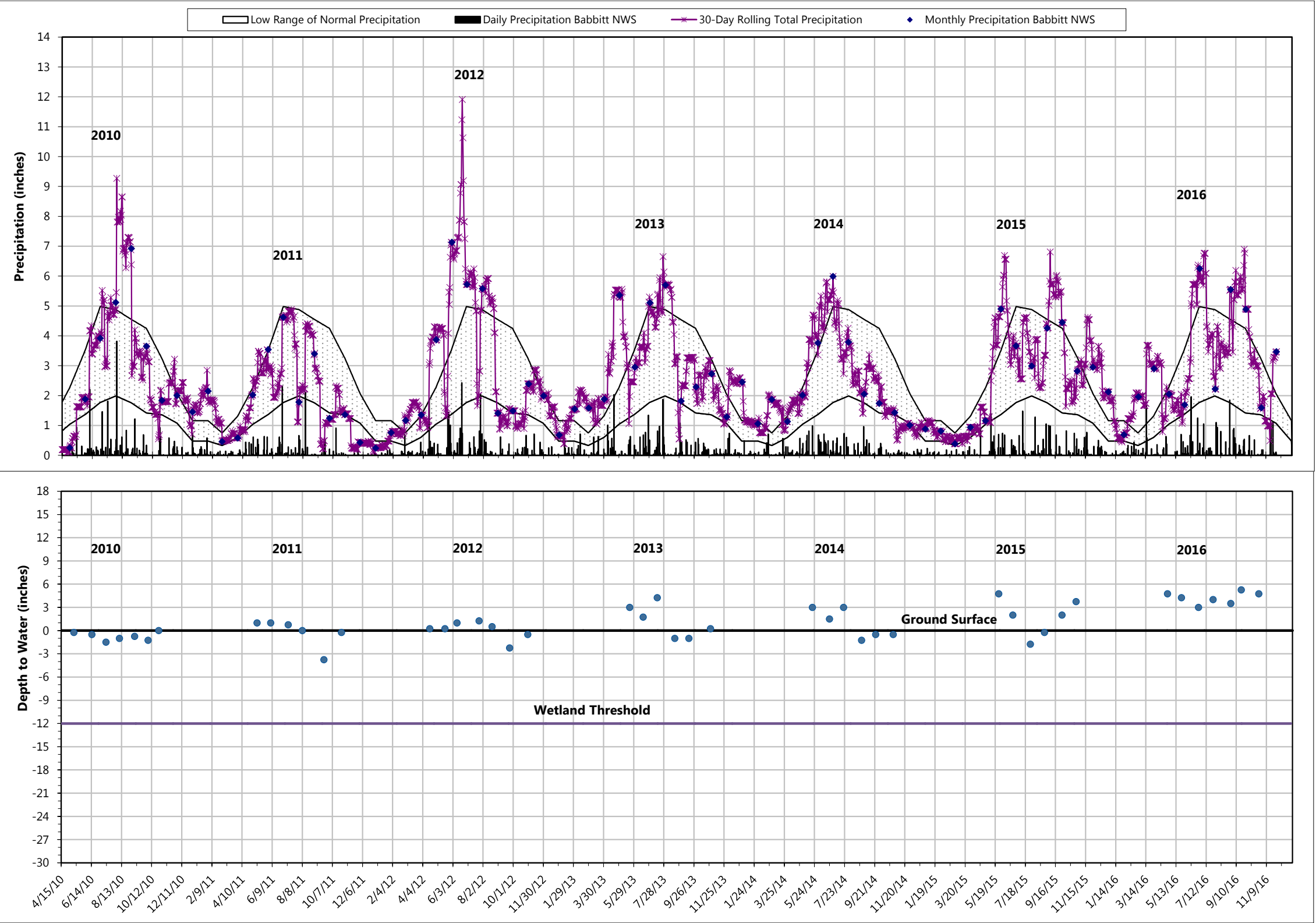
Points represent manual readings.

Figure 5M-1
WETLAND MONITORING WELL 5M
2008-2016 WETLAND HYDROLOGY MONITORING DATA
NorthMet Project
Poly Met Mining, Inc.
Hoyt Lakes, Minnesota



Points represent manual well measurements.

Figure 5-2
 WETLAND MONITORING WELL 5
 2005-2009 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota



Points represent manual readings.

Figure 5-2b
WETLAND MONITORING WELL 5
2010-2016 WETLAND HYDROLOGY MONITORING DATA
NorthMet Project
Poly Met Mining, Inc.
Hoyt Lakes, Minnesota

NorthMet Project Hydrology Monitoring – Well 5M



June 2005

June 2006 – No photo available



June 2007 – No photo available

May 2008



June 2009



May 2010

NorthMet Project Hydrology Monitoring – Well 5M



June 2011



June 2012



June 2013



June 2014



June 2015



June 2016

Well ID: 6

NorthMet Project Area: Mine Site

Wetland Number: 54

Wetland Type: Alder Thicket (Type 6)

UTM Coordinates (NAD 83 Zone 15)

Easting: 574794

Northing: 5272347

Well Type(s): Ecotone and Manual

Date Recording Well Installed: 5/23/2008

Installed By: NTS

Water Level Recorded Every: 4 hours

Date Manual Well Installed: 6/29/2005

Installed By: Barr

Manual Water Levels Read: Monthly

Growing Season: May 9-October 6 (151 days)

Monitored by: NTS

Water Level Fluctuation for All Years: 40.0 inches

Notes: UTM coordinates are for recording well.

Table 6-1. Monitoring Period Each Year¹. See the hydrographs in Figure 6-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Start Date	M	M	M	5/22	4/28	5/10	5/9	4/19	5/21	5/20	4/28	4/27
End Date	M	M	M	11/23	10/28	10/26	10/24	10/30	10/28	10/28	10/27	10/25
Total Days	M	M	M	186	184	170	169	195	161	162	183	182
Grow. Seas. Days	M	M	M	138	151	150	151	151	139	140	151	151

¹ Manual (M) well only at this location. No wells at the location (---). Day ranges and Growing Season (Grow. Seas.) Days in this table represent full calendar days.

Table 6-2. Precipitation During Each Growing Season and Water Year¹. See the yearly hydrographs in Figure 6-2.

Year		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Growing Season	May	A	N	A	N	B	B	A	A	N	A	A	B
	June	A	B	N	A	B	N	N	A	A	A	N	A
	July	B	A	B	B	B	A	B	A	A	N	B	B
	Aug	B	B	B	B	N	A	N	B	B	N	N	A
	Sept	B	B	A	A	B	N	B	B	B	B	N	A
Water Year		A	B	A	A	B	N	B	A	A	N	B	A

¹ The growing season includes precipitation during May through September and the water year includes precipitation from October 1 of the previous year through September 30 of the current year. Each time period, the precipitation is represented as: within the normal range of precipitation (N), below the normal range of precipitation (B), or above the normal range of precipitation (A).

Table 6-3. Hydroperiod(s) for Each Year During the Growing Season¹. Total number of days water level is ≥ 12 " below ground level for 14 or more consecutive days during the growing season. The yearly hydrographs are shown in Figure 6-2.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# of Periods ≥ 14 Consecutive Days	M	M	M	2	1	2	1	1	1	1	2	1
Total Days	M	M	M	101	128	131	108	119	138	139	129	151
% Grow. Seas.	M	M	M	73%	85%	87%	72%	79%	99%	99%	85%	100%

¹ Hydroperiods were not determined for locations with only a Manual (M) well. No wells at the location (---). The total days counted for the hydroperiod may not match the total days monitored within a growing season (Grow. Seas.) because the hydroperiod date count does not include partial days.

Table 6-4. Water Level Fluctuations During the Growing Season (inches)¹. Yearly fluctuations are shown in Figure 6-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum (in.)	M	M	M	-32.2	-20.6	-24.6	-27.7	-22.1	-6.1	-11.8	-19.5	-4.6
Maximum (in.)	M	M	M	2.2	2.6	3.3	4.3	5.0	7.8	5.9	5.1	4.1
Fluctuation (in.)	M	M	M	34.4	23.1	27.9	32.0	27.1	13.8	17.7	24.6	8.7

¹ Fluctuations in water level were not determined for locations with only a Manual (M) well. No wells at the location (---). Some water level depths were deeper than the bottom of the well casing (<) resulting in greater fluctuations than indicated in the data (>).

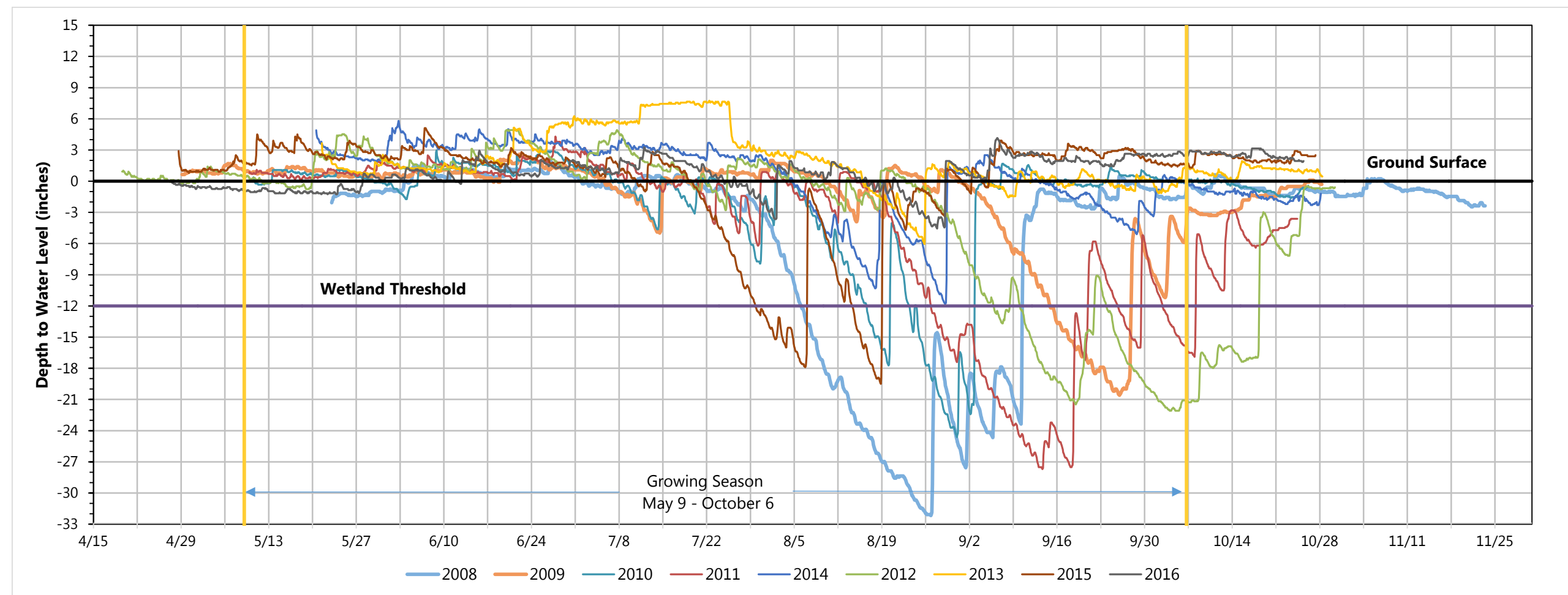
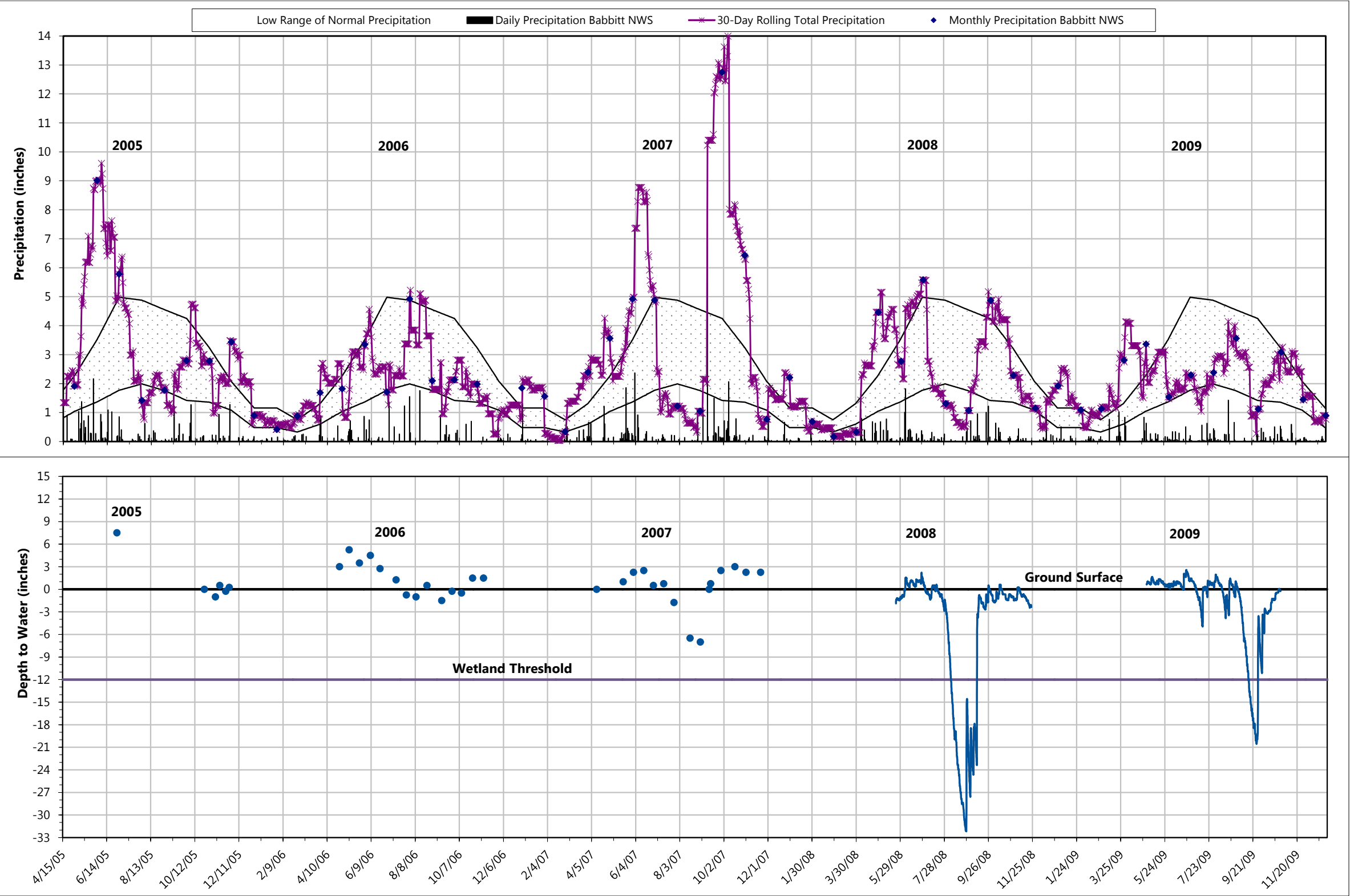


Figure 6-1
 WETLAND MONITORING WELL 6
 2008-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota



Points represent manual well measurements.
Lines represent electronic well measurements.

Figure 6-2a
WETLAND MONITORING WELL 6
2005-2009 WETLAND HYDROLOGY MONITORING DATA
NorthMet Project
Poly Met Mining, Inc.
Hoyt Lakes, Minnesota

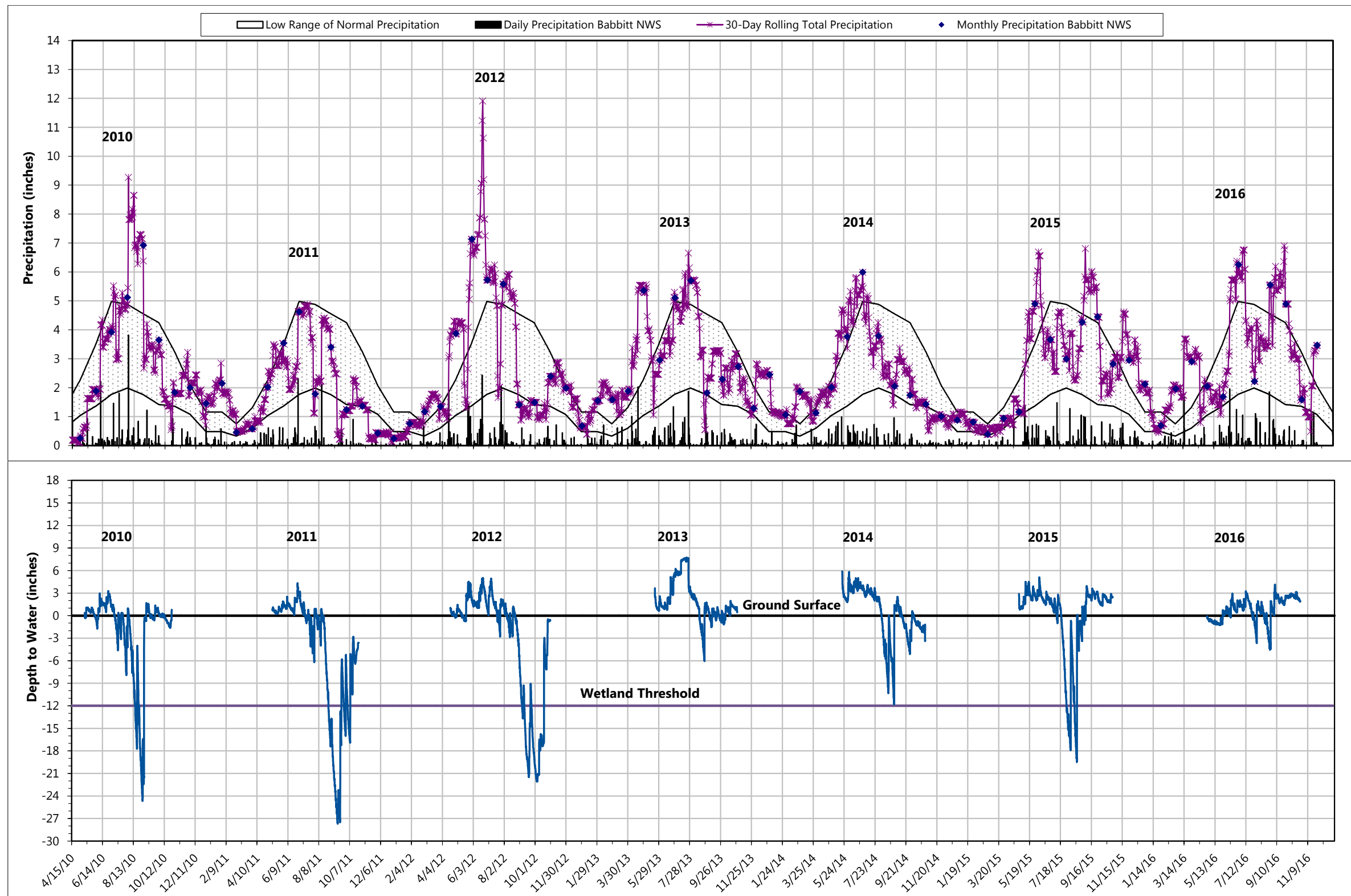


Figure 6-2b
 WETLAND MONITORING WELL 6
 2010-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

NorthMet Project Hydrology Monitoring – Well 6



June 2009



June 2010



June 2011



June 2012



June 2013

June 2008 – No photo available

NorthMet Project Hydrology Monitoring – Well 6



June 2014



May 2015



June 2016

Well ID: 7

NorthMet Project Area: Mine Site

Wetland Number: 53

Wetland Type: Alder Thicket (Type 6)

UTM Coordinates (NAD 83 Zone 15)

Easting: 576312

Northing: 5272607

Well Type(s): Ecotone and Manual

Date Recording Well Installed: 11/9/2005

Installed By: NTS

Water Level Recorded Every: 4 hours

Date Manual Well Installed: 6/29/2005

Installed By: Barr

Manual Water Levels Read: Monthly

Growing Season: May 9-October 6 (151 days)

Monitored by: NTS

Water Level Fluctuation for All Years: 21.0 inches

Notes: UTM coordinates are for recording well.

Table 7-1. Monitoring Period Each Year¹. See the hydrographs in Figure 7-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Start Date	11/11	4/26	4/26	5/8	4/28	5/10	5/9	4/18	5/21	5/20	4/28	4/26
End Date	11/23	11/21	11/26	11/24	10/28	10/26	10/24	10/30	10/28	10/28	10/27	10/25
Total Days	13	210	215	201	184	170	169	196	161	162	183	183
Grow. Seas. Days	0	151	151	152	151	150	151	151	139	140	151	151

¹ Manual (M) well only at this location. No wells at the location (---). Day ranges and Growing Season (Grow. Seas.) Days in this table represent full calendar days.

Table 7-2. Precipitation During Each Growing Season and Water Year¹. See the yearly hydrographs in Figure 7-2.

Year		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Growing Season	May	A	N	A	N	B	B	A	A	N	A	A	B
	June	A	B	N	A	B	N	N	A	A	A	N	A
	July	B	A	B	B	B	A	B	A	A	N	B	B
	Aug	B	B	B	B	N	A	N	B	B	N	N	A
	Sept	B	B	A	A	B	N	B	B	B	B	N	A
Water Year		A	B	A	A	B	N	B	A	A	N	B	A

¹ The growing season includes precipitation during May through September and the water year includes precipitation from October 1 of the previous year through September 30 of the current year. Each time period, the precipitation is represented as: within the normal range of precipitation (N), below the normal range of precipitation (B), or above the normal range of precipitation (A).

Table 7-3. Hydroperiod(s) for Each Year During the Growing Season¹. Total number of days water level is ≥ 12 " below ground level for 14 or more consecutive days during the growing season. The yearly hydrographs are shown in Figure 7-2.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# of Periods ≥ 14 Consecutive Days	---	2	2	1	1	1	1	1	1	1	1	1
Total Days	---	146	138	151	151	149	150	151	138	139	151	151
% Grow. Seas.	---	97%	91%	99%	100%	99%	99%	100%	99%	99%	100%	100%

¹ Hydroperiods were not determined for locations with only a Manual (M) well. No wells at the location (---). The total days counted for the hydroperiod may not match the total days monitored within a growing season (Grow. Seas.) because the hydroperiod date count does not include partial days.

Table 7-4. Water Level Fluctuations During the Growing Season (inches)¹. Yearly fluctuations are shown in Figure 7-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum (in.)	---	-12.6	-15.9	-11.1	-4.8	-2.5	-1.8	-10.0	-6.3	-4.2	-10.5	-2.1
Maximum (in.)	---	2.5	2.8	2.4	2.0	3.1	4.0	5.1	3.9	2.0	3.7	4.2
Fluctuation (in.)	---	15.1	18.7	13.5	6.8	5.6	5.8	15.1	10.1	6.2	14.2	6.3

¹ Fluctuations in water level were not determined for locations with only a Manual (M) well. No wells at the location (---). Some water level depths were deeper than the bottom of the well casing (<) resulting in greater fluctuations than indicated in the data (>).

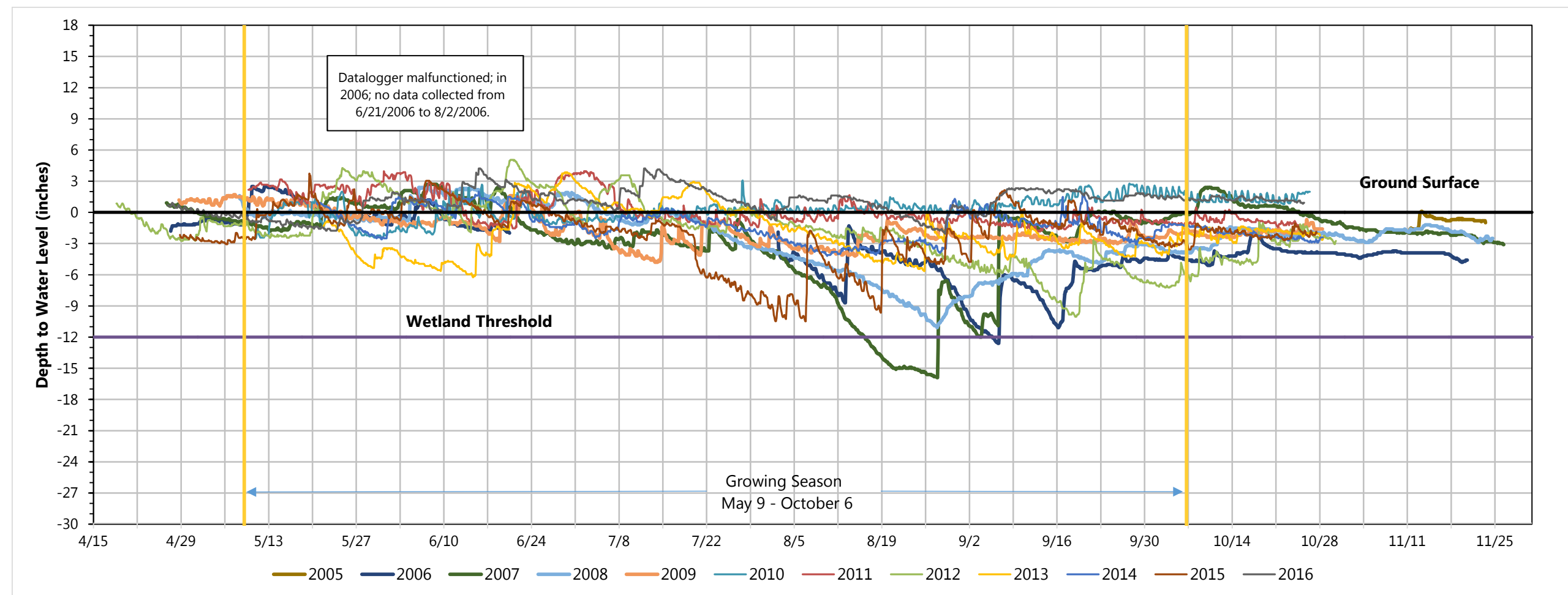


Figure 7-1
 WETLAND MONITORING WELL 7
 2005-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

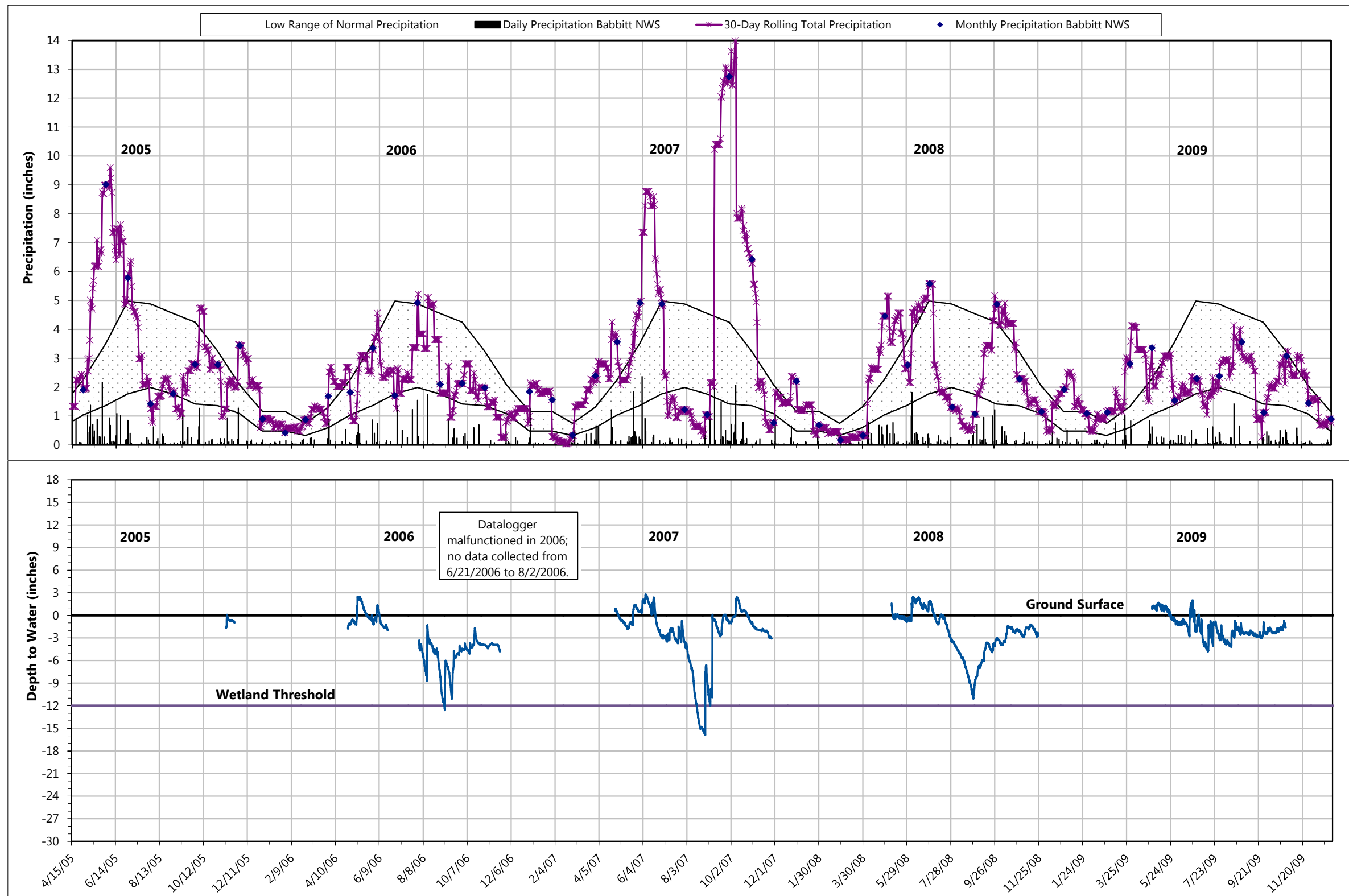


Figure 7-2a
 WETLAND MONITORING WELL 7
 2005-2009 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

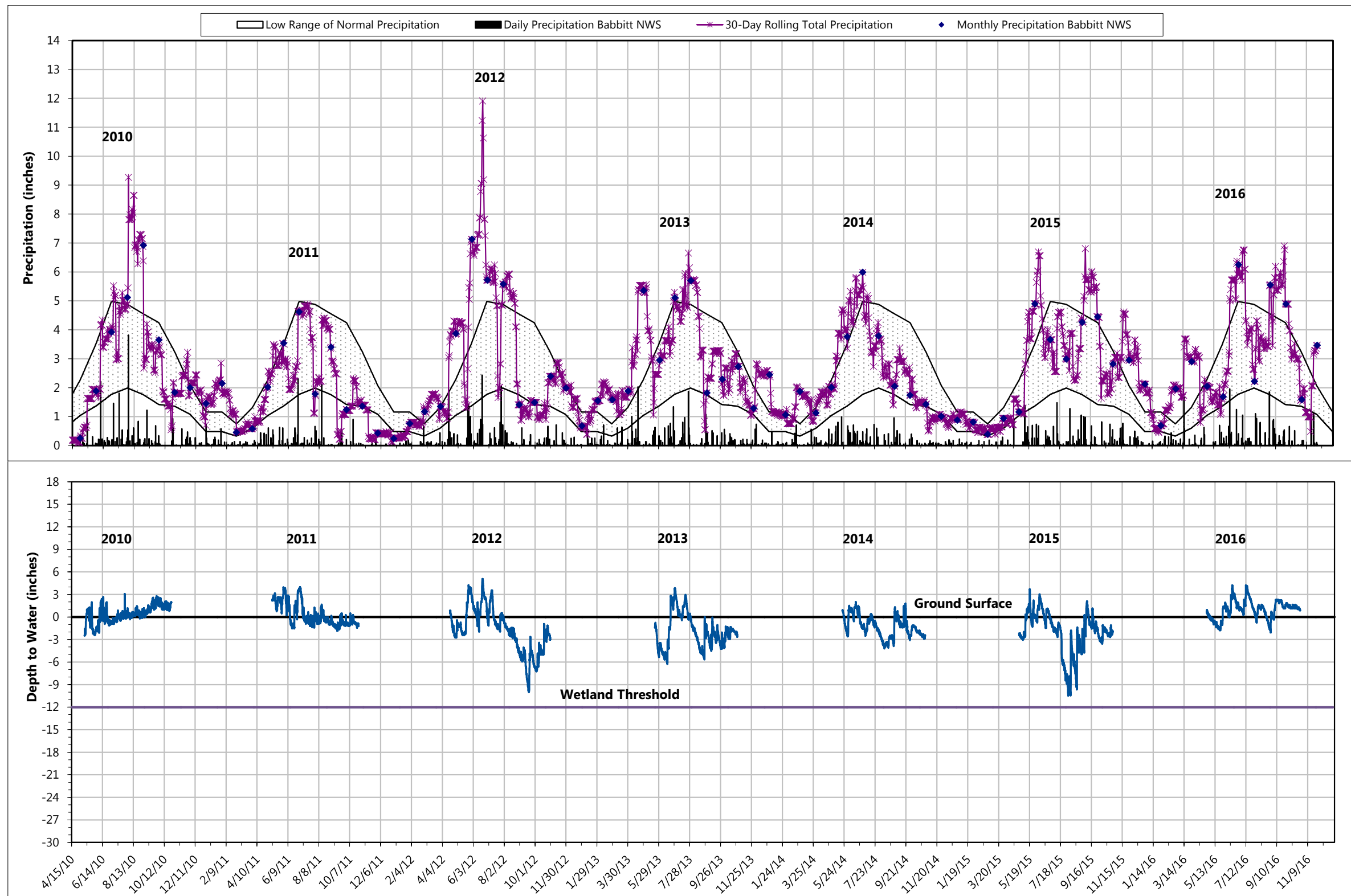


Figure 7-2b
 WETLAND MONITORING WELL 7
 2010-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

NorthMet Project Hydrology Monitoring – Well 7



June 2005

June 2006 – No photo available

June 2007 – No photo available

June 2008 – No photo available



June 2009



May 2010

NorthMet Project Hydrology Monitoring – Well 7



May 2011



June 2012



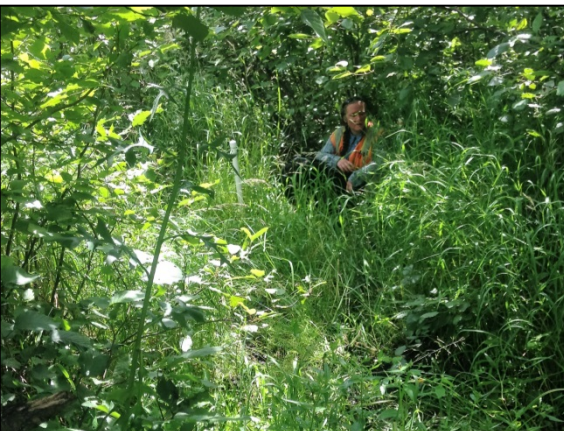
June 2013



June 2014



June 2015



June 2016

Well ID: 8

NorthMet Project Area: Mine Site

Wetland Number: 106

Wetland Type: Coniferous Bog (Type 8)

UTM Coordinates (NAD 83 Zone 15)

Easting: 578657

Northing: 5273785

Well Type(s): Ecotone and Manual

Date Recording Well Installed: 5/23/2008

Installed By: NTS

Water Level Recorded Every: 4 hours

Date Manual Well Installed: 6/30/2005

Installed By: Barr

Manual Water Levels Read: Monthly

Growing Season: May 9-October 6 (151 days)

Monitored by: NTS

Water Level Fluctuation for All Years: 36.7 inches

Notes: UTM coordinates are for recording well.

Table 8-1. Monitoring Period Each Year¹. See the hydrographs in Figure 8-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Start Date	M	M	M	5/23	4/28	5/12	5/11	4/18	5/22	5/20	4/28	4/26
End Date	M	M	M	11/25	10/28	10/26	10/24	10/30	10/28	10/28	10/27	10/25
Total Days	M	M	M	187	184	168	167	196	160	162	183	183
Grow. Seas. Days	M	M	M	137	151	148	149	151	138	140	151	151

¹ Manual (M) well only at this location. No wells at the location (---). Day ranges and Growing Season (Grow. Seas.) Days in this table represent full calendar days.

Table 8-2. Precipitation During Each Growing Season and Water Year¹. See the yearly hydrographs in Figure 8-2.

Table 3-2: Precipitation During Each Growing Season and Water Year. See the yearly hydrographs in Figure 3-2.													
Year		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Growing Season	May	A	N	A	N	B	B	A	A	N	A	A	B
	June	A	B	N	A	B	N	N	A	A	A	N	A
	July	B	A	B	B	B	A	B	A	A	N	B	B
	Aug	B	B	B	B	N	A	N	B	B	N	N	A
	Sept	B	B	A	A	B	N	B	B	B	B	N	A
Water Year		A	B	A	A	B	N	B	A	A	N	B	A

¹ The growing season includes precipitation during May through September and the water year includes precipitation from October 1 of the previous year through September 30 of the current year. Each time period, the precipitation is represented as: within the normal range of precipitation (N), below the normal range of precipitation (B), or above the normal range of precipitation (A).

Table 8-3. Hydroperiod(s) for Each Year During the Growing Season¹. Total number of days water level is ≥ 12 " below ground level for 14 or more consecutive days during the growing season. The yearly hydrographs are shown in Figure 8-2.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# of Periods ≥ 14 Consecutive Days	M	M	M	2	3	3	2	1	1	2	2	2
Total Days	M	M	M	94	116	112	96	107	86	96	106	147
% Grow. Seas.	M	M	M	69%	77%	76%	64%	71%	62%	69%	70%	97%

¹ Hydroperiods were not determined for locations with only a Manual (M) well. No wells at the location (---). The total days counted for the hydroperiod may not match the total days monitored within a growing season (Grow. Seas.) because the hydroperiod date count does not include partial days.

Table 8-4. Water Level Fluctuations During the Growing Season (inches)¹. Yearly fluctuations are shown in Figure 8-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum (in.)	M	M	M	-28.6	-20.7	-17.8	-28.7	-23.7	-17.9	-21.2	-26.1	-13.4
Maximum (in.)	M	M	M	1.8	3.9	3.6	5.7	8.0	7.7	5.9	6.4	6.9
Fluctuation (in.)	M	M	M	30.4	24.6	21.4	34.4	31.7	25.5	27.1	32.5	20.3

¹ Fluctuations in water level were not determined for locations with only a Manual (M) well. No wells at the location (---). Some water level depths were deeper than the bottom of the well casing (<) resulting in greater fluctuations than indicated in the data (>).

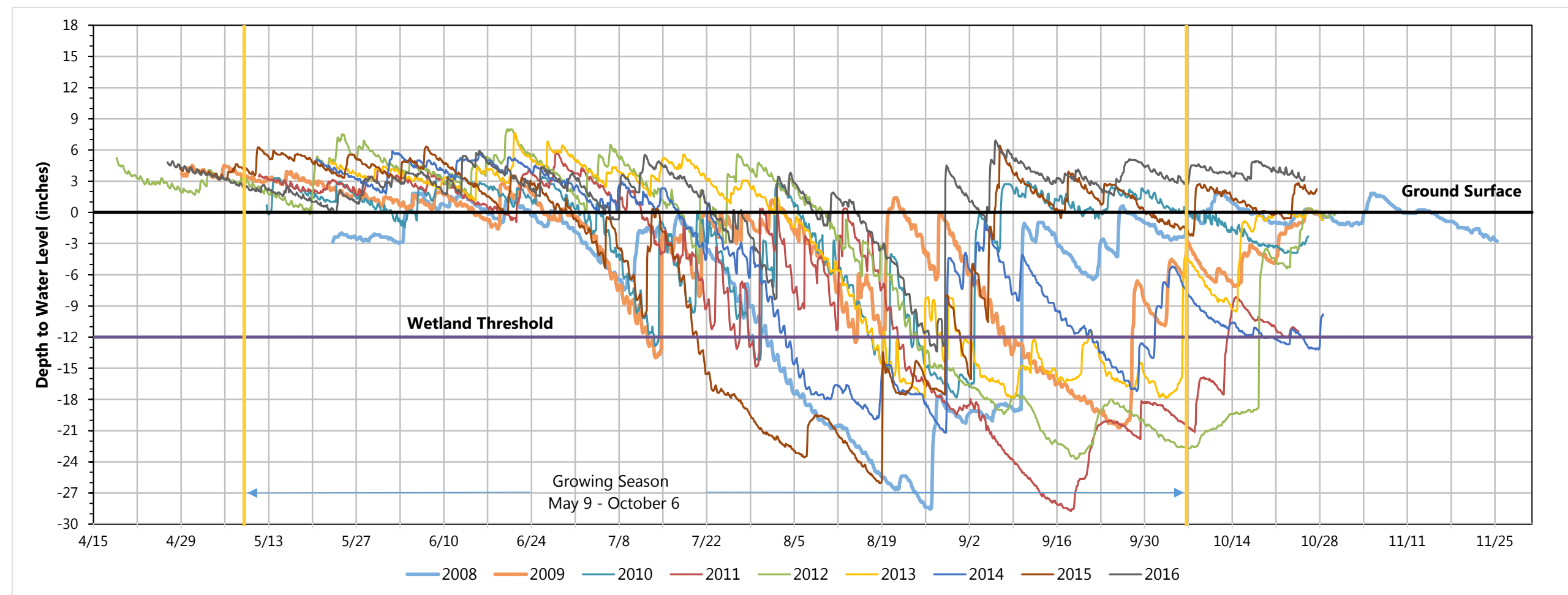
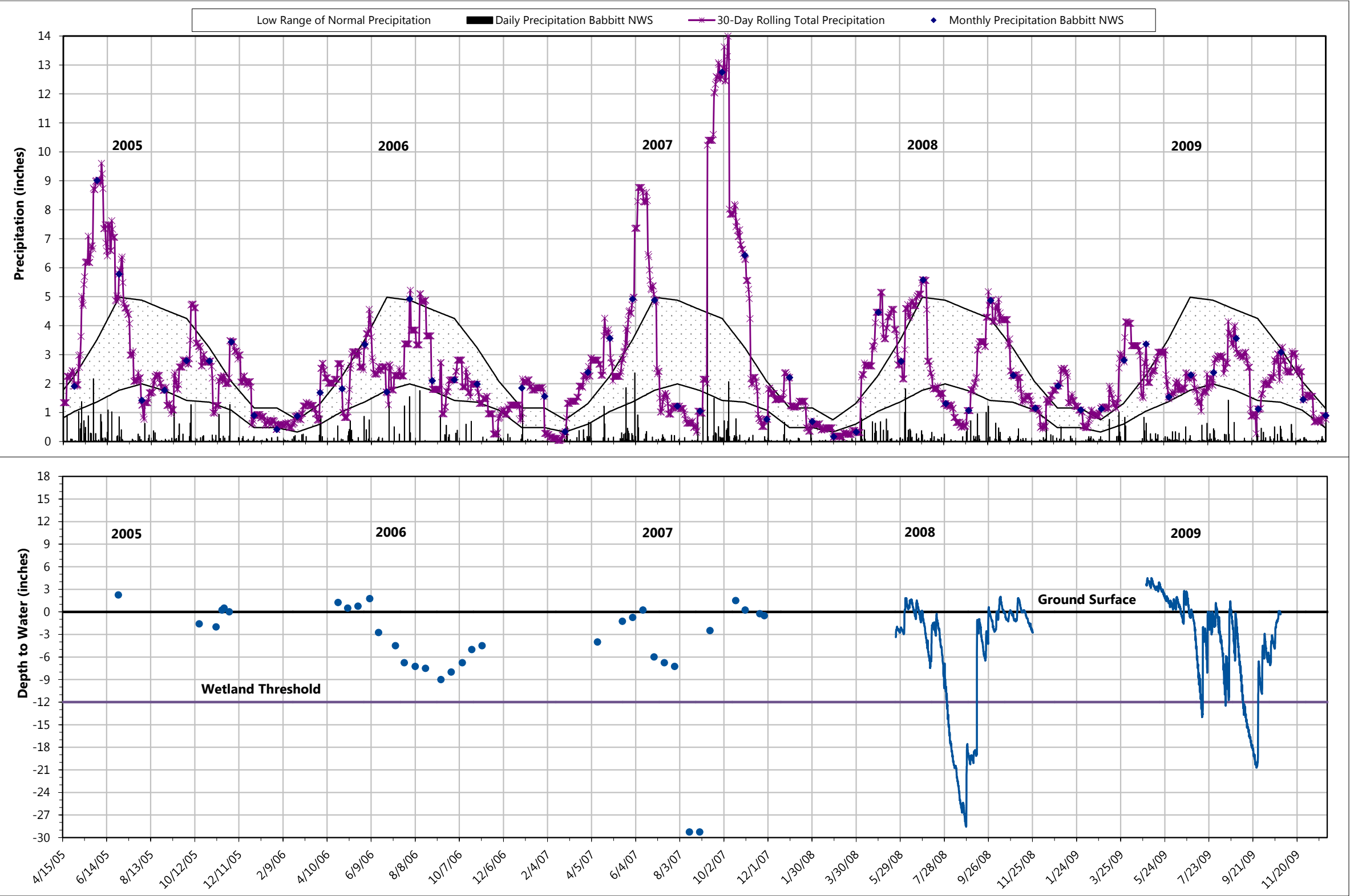


Figure 8-1
 WETLAND MONITORING WELL 8
 2008-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota



Points represent manual well measurements.
Lines represent electronic well measurements.

Figure 8-2a
WETLAND MONITORING WELL 8
2005-2009 WETLAND HYDROLOGY MONITORING DATA
NorthMet Project
Poly Met Mining, Inc.
Hoyt Lakes, Minnesota

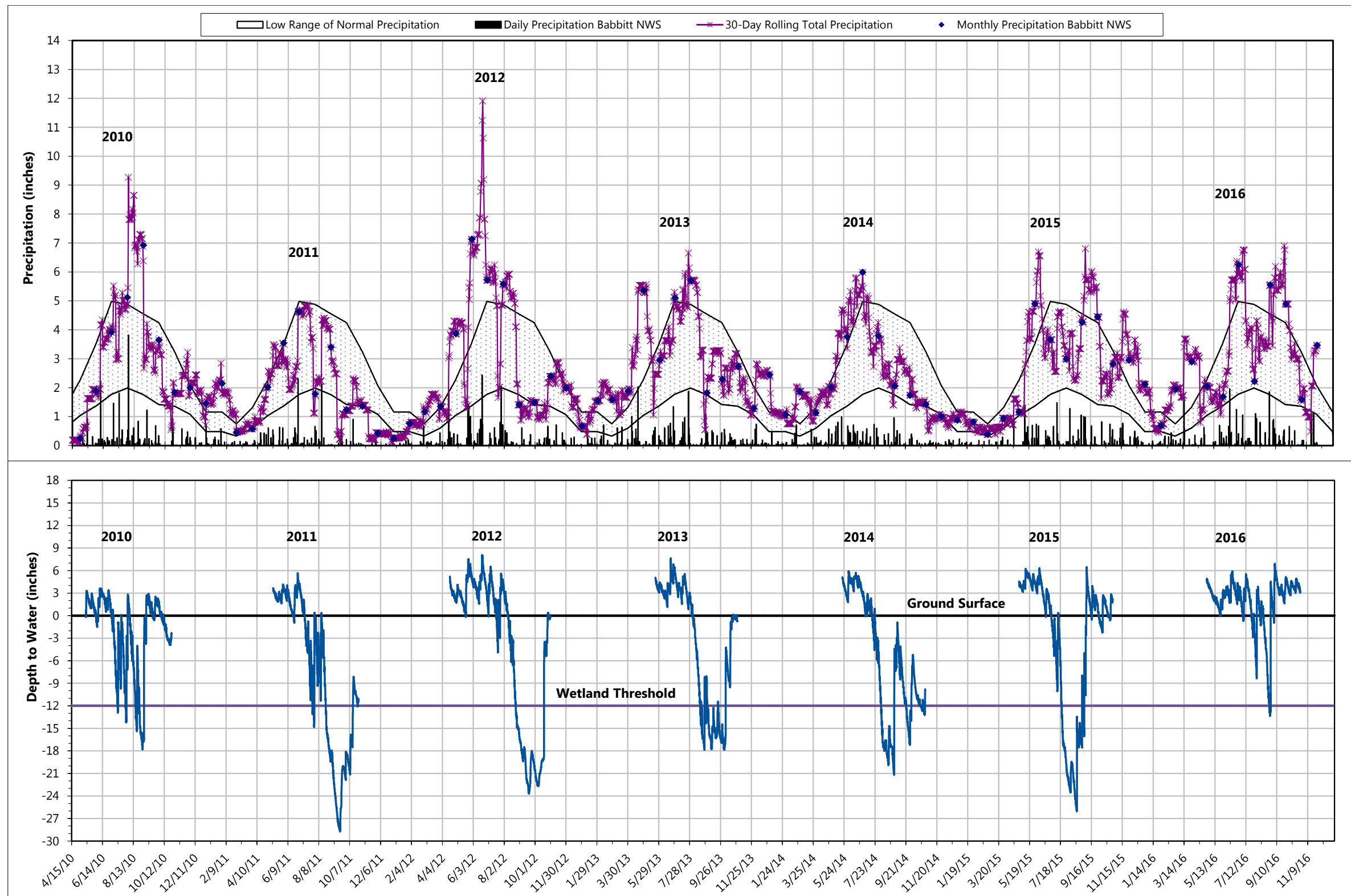


Figure 8-2b
 WETLAND MONITORING WELL 8
 2010-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

NorthMet Project Hydrology Monitoring – Well 8



June 2009



June 2010



July 2011



June 2012



June 2013

NorthMet Project Hydrology Monitoring – Well 8



June 2014



June 2015



June 2016

Well ID: 9

NorthMet Project Area: Mine Site

Wetland Number: 58

Wetland Type: Alder Thicket (Type 6)

UTM Coordinates (NAD 83 Zone 15)

Easting: 579257

Northing: 5274041

Well Type(s): Ecotone and Manual

Date Recording Well Installed: 6/27/2008

Installed By: Barr/NTS

Water Level Recorded Every: 4 hours

Date Manual Well Installed: 6/30/2005

Installed By: Barr

Manual Water Levels Read: Monthly

Growing Season: May 9-October 6 (151 days)

Monitored by: NTS

Water Level Fluctuation for All Years: 20.1 inches

Notes: UTM coordinates are for recording well.

Table 9-1. Monitoring Period Each Year¹. See the hydrographs in Figure 9-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Start Date	M	M	M	6/27	4/29	5/11	5/11	4/18	5/21	5/20	4/28	4/26
End Date	M	M	M	11/26	10/29	10/26	10/24	10/30	10/27	10/28	10/27	10/25
Total Days	M	M	M	153	184	169	167	196	160	162	183	183
Grow. Seas. Days	M	M	M	102	151	149	149	151	139	140	151	151

¹ Manual (M) well only at this location. No wells at the location (---). Day ranges and Growing Season (Grow. Seas.) Days in this table represent full calendar days.

Table 9-2. Precipitation During Each Growing Season and Water Year¹. See the yearly hydrographs in Figure 9-2.

Year		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Growing Season	May	A	N	A	N	B	B	A	A	N	A	A	B
	June	A	B	N	A	B	N	N	A	A	A	N	A
	July	B	A	B	B	B	A	B	A	A	N	B	B
	Aug	B	B	B	B	N	A	N	B	B	N	N	A
	Sept	B	B	A	A	B	N	B	B	B	B	N	A
Water Year		A	B	A	A	B	N	B	A	A	N	B	A

¹ The growing season includes precipitation during May through September and the water year includes precipitation from October 1 of the previous year through September 30 of the current year. Each time period, the precipitation is represented as: within the normal range of precipitation (N), below the normal range of precipitation (B), or above the normal range of precipitation (A).

Table 9-3. Hydroperiod(s) for Each Year During the Growing Season¹. Total number of days water level is ≥ 12 " below ground level for 14 or more consecutive days during the growing season. The yearly hydrographs are shown in Figure 9-2.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# of Periods ≥ 14 Consecutive Days	M	M	M	1	1	1	1	1	1	1	2	1
Total Days	M	M	M	101	151	148	148	151	138	139	150	151
% Grow. Seas.	M	M	M	99%	100%	99%	99%	100%	99%	99%	99%	100%

¹ Hydroperiods were not determined for locations with only a Manual (M) well. No wells at the location (---). The total days counted for the hydroperiod may not match the total days monitored within a growing season (Grow. Seas.) because the hydroperiod date count does not include partial days.

Table 9-4. Water Level Fluctuations During the Growing Season (inches)¹. Yearly fluctuations are shown in Figure 9-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum (in.)	M	M	M	-2.9	-0.9	-0.5	-0.7	-0.4	2.4	-2.8	-12.2	-1.6
Maximum (in.)	M	M	M	1.3	1.1	3.1	4.1	7.6	7.7	7.9	5.7	6.3
Fluctuation (in.)	M	M	M	4.1	2.0	3.6	4.8	8.0	5.3	10.7	17.8	7.9

¹ Fluctuations in water level were not determined for locations with only a Manual (M) well. No wells at the location (---). Some water level depths were deeper than the bottom of the well casing (<) resulting in greater fluctuations than indicated in the data (>).

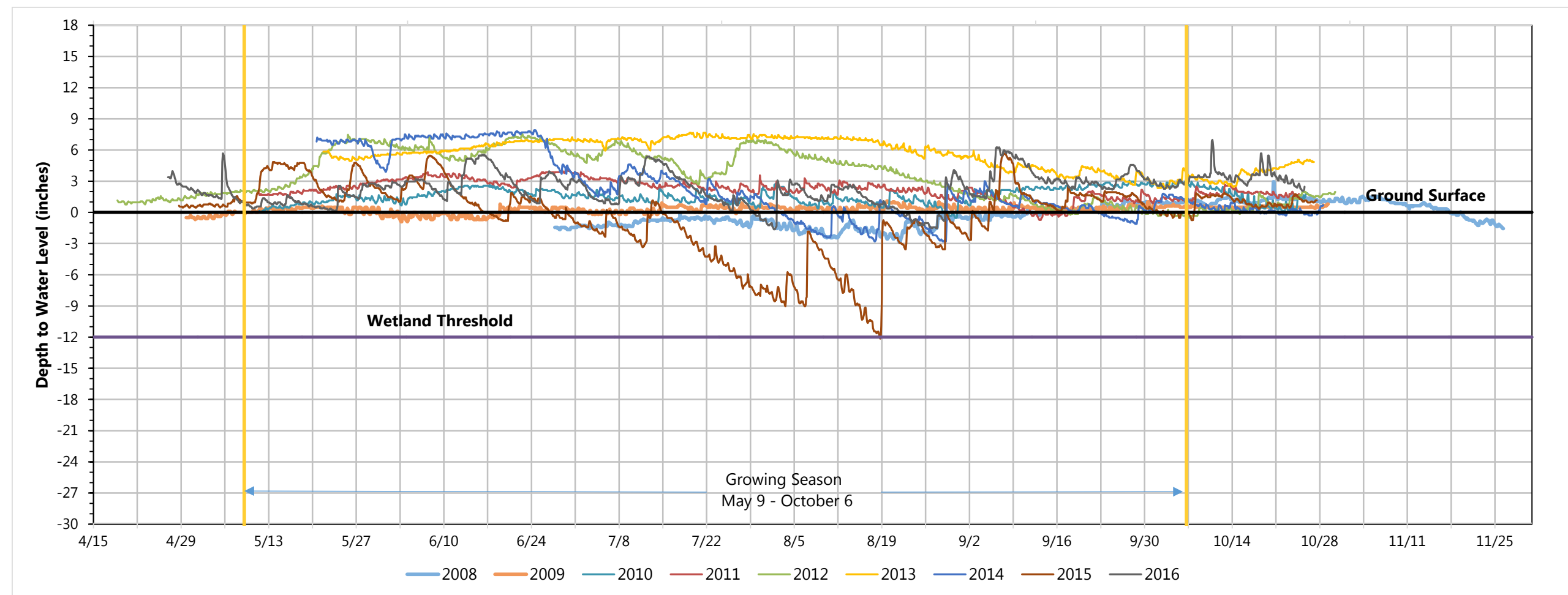
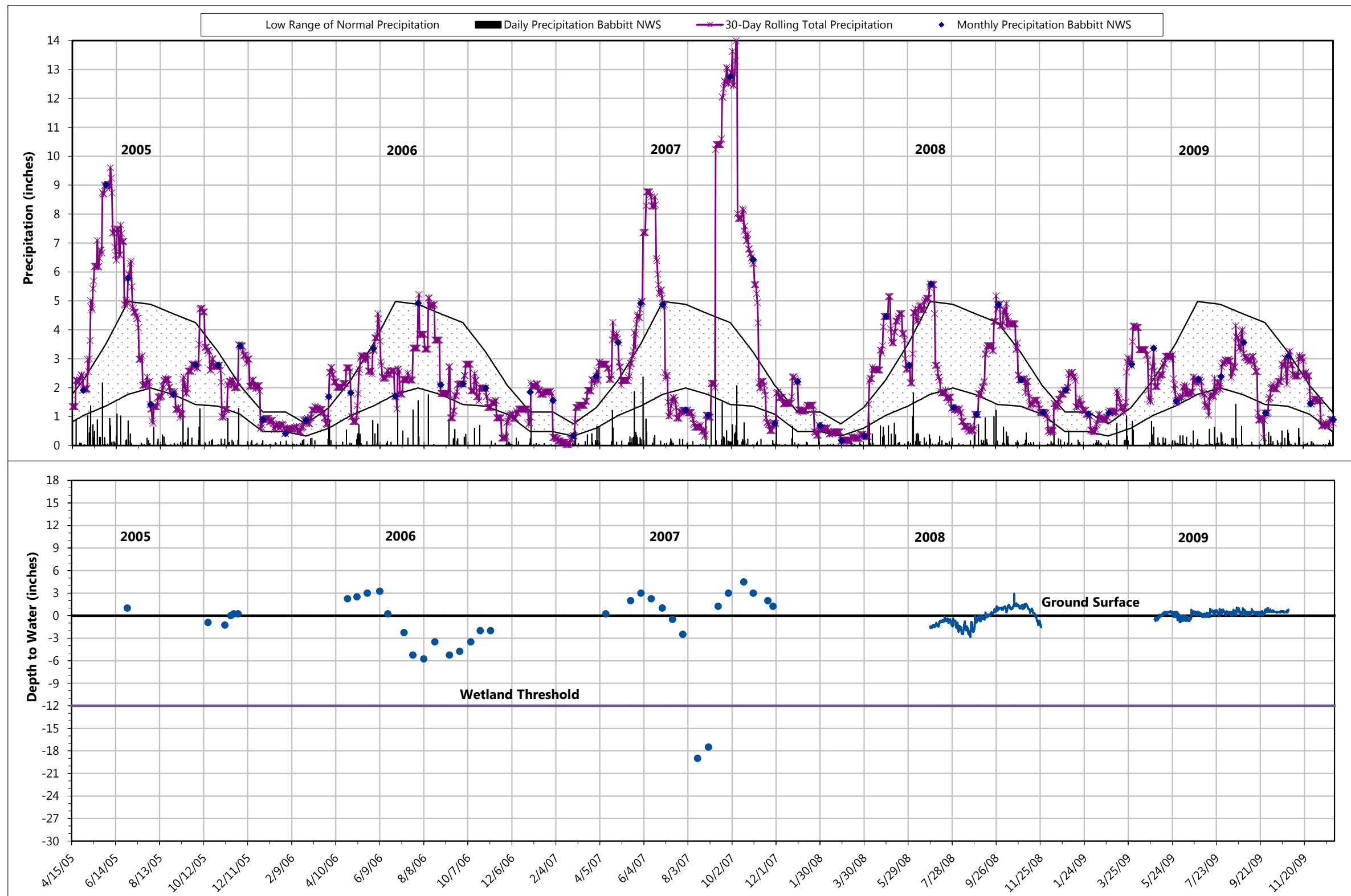


Figure 9-1
 WETLAND MONITORING WELL 9
 2008-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota



Points represent manual well measurements.
Lines represent electronic well measurements.

Figure 9-2a
WETLAND MONITORING WELL 9
2005-2009 WETLAND HYDROLOGY MONITORING DATA
NorthMet Project
Poly Met Mining, Inc.
Hoyt Lakes, Minnesota

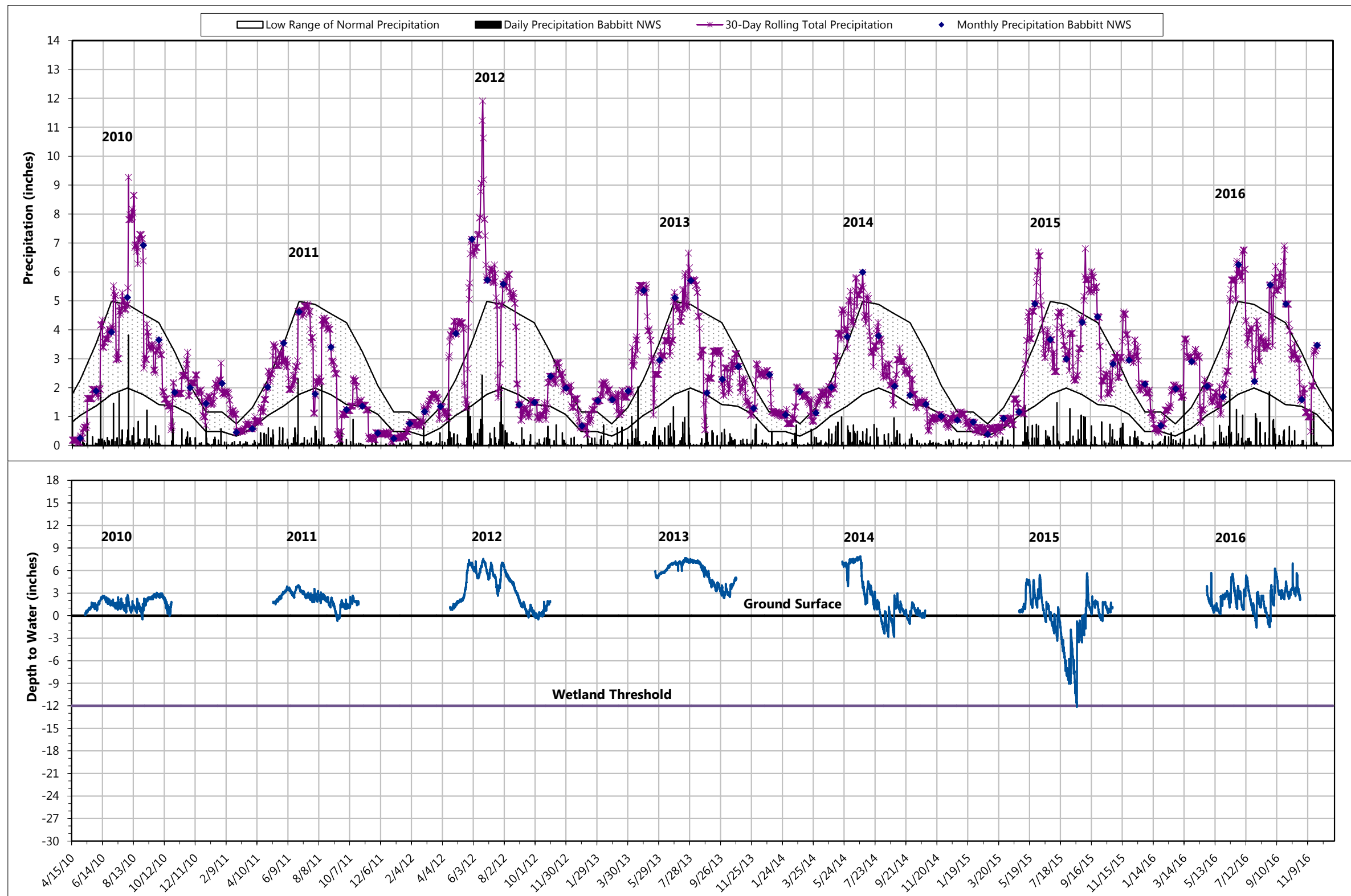


Figure 9-2b
 WETLAND MONITORING WELL 9
 2010-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

NorthMet Project Hydrology Monitoring – Well 9



June 2009

June 2008 – No photo available



May 2010



June 2011



June 2012



June 2013

NorthMet Project Hydrology Monitoring – Well 9



June 2014



May 2015



June 2016

Well ID: 10

NorthMet Project Area: Mine Site

Wetland Number: 888

Wetland Type: Coniferous Bog (Type 8)

UTM Coordinates (NAD 83 Zone 15)

Easting: 577165

Northing: 5275315

Well Type(s): Ecotone and Manual

Date Recording Well Installed: 5/22/2008

Installed By: Barr/NTS

Water Level Recorded Every: 4 hours

Date Manual Well Installed: 10/25/2005

Installed By: Barr/NTS

Manual Water Levels Read: Monthly

Growing Season: May 9-October 6 (151 days)

Monitored by: NTS

Water Level Fluctuation for All Years: 20.3 inches

Notes: UTM coordinates are for recording well.

Table 10-1. Monitoring Period Each Year¹. See the hydrographs in Figure 10-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Start Date	M	M	M	5/22	4/29	5/12	5/11	4/19	5/22	5/21	5/13	4/27
End Date	M	M	M	11/25	10/28	10/27	10/25	10/31	10/29	10/29	10/28	10/26
Total Days	M	M	M	188	183	169	168	196	161	162	169	183
Grow. Seas. Days	M	M	M	138	151	148	149	151	138	139	147	151

¹ Manual (M) well only at this location. No wells at the location (---). Day ranges and Growing Season (Grow. Seas.) Days in this table represent full calendar days.

Table 10-2. Precipitation During Each Growing Season and Water Year¹. See the yearly hydrographs in Figure 10-2.

Year		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Growing Season	May	A	N	A	N	B	B	A	A	N	A	A	B
	June	A	B	N	A	B	N	N	A	A	A	N	A
	July	B	A	B	B	B	A	B	A	A	N	B	B
	Aug	B	B	B	B	N	A	N	B	B	N	N	A
	Sept	B	B	A	A	B	N	B	B	B	B	N	A
Water Year		A	B	A	A	B	N	B	A	A	N	B	A

¹ The growing season includes precipitation during May through September and the water year includes precipitation from October 1 of the previous year through September 30 of the current year. Each time period, the precipitation is represented as: within the normal range of precipitation (N), below the normal range of precipitation (B), or above the normal range of precipitation (A).

Table 10-3. Hydroperiod(s) for Each Year During the Growing Season¹. Total number of days water level is ≥ 12 " below ground level for 14 or more consecutive days during the growing season. The yearly hydrographs are shown in Figure 10-2.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# of Periods ≥ 14 Consecutive Days	M	M	M	2	1	2	1	1	1	2	2	1
Total Days	M	M	M	108	126	139	104	111	94	106	124	151
% Grow. Seas.	M	M	M	78%	83%	94%	70%	74%	68%	76%	84%	100%

¹ Hydroperiods were not determined for locations with only a Manual (M) well. No wells at the location (---). The total days counted for the hydroperiod may not match the total days monitored within a growing season (Grow. Seas.) because the hydroperiod date count does not include partial days.

Table 10-4. Water Level Fluctuations During the Growing Season (inches)¹. Yearly fluctuations are shown in Figure 10-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum (in.)	M	M	M	-17.8	-16.0	-14.4	-20.9	-20.3	-15.4	-14.0	-16.0	-8.8
Maximum (in.)	M	M	M	-1.9	-4.1	-3.7	-3.4	-0.6	-2.9	-3.1	-1.3	-0.8
Fluctuation (in.)	M	M	M	15.9	11.9	10.7	17.5	19.7	12.5	10.9	14.7	8.0

¹ Fluctuations in water level were not determined for locations with only a Manual (M) well. No wells at the location (---). Some water level depths were deeper than the bottom of the well casing (<) resulting in greater fluctuations than indicated in the data (>).

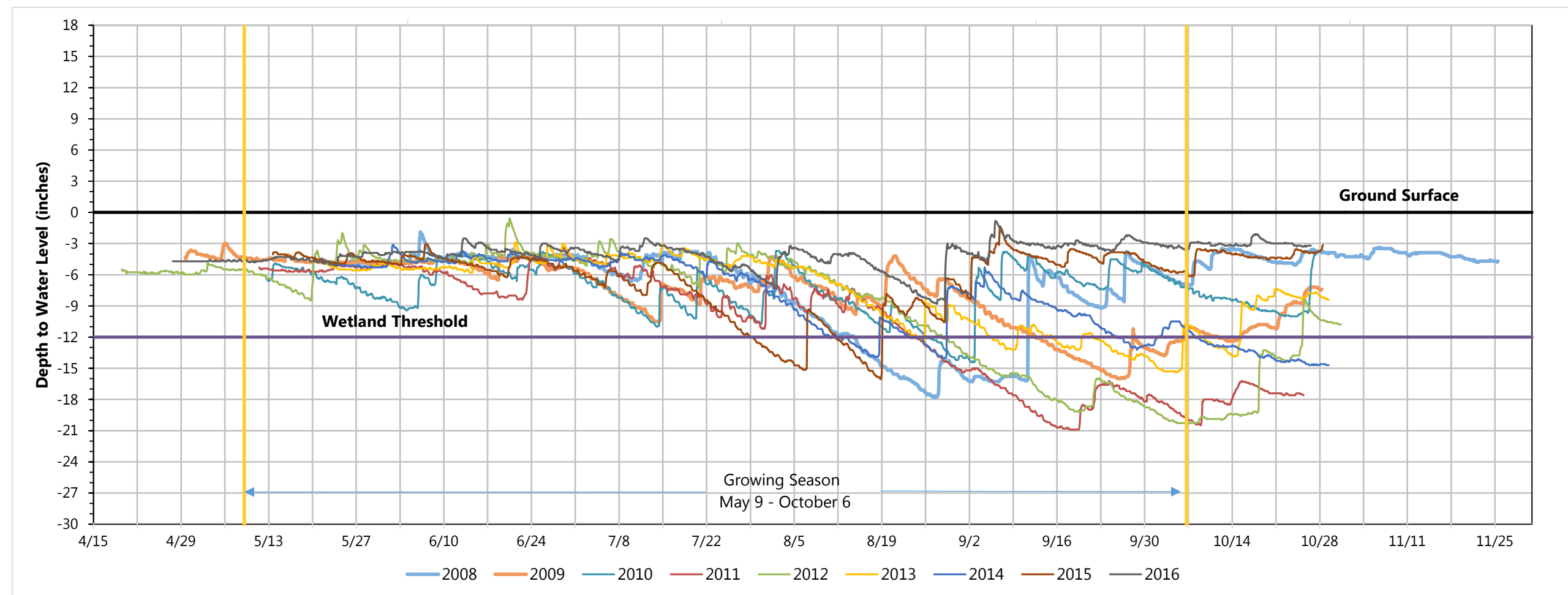
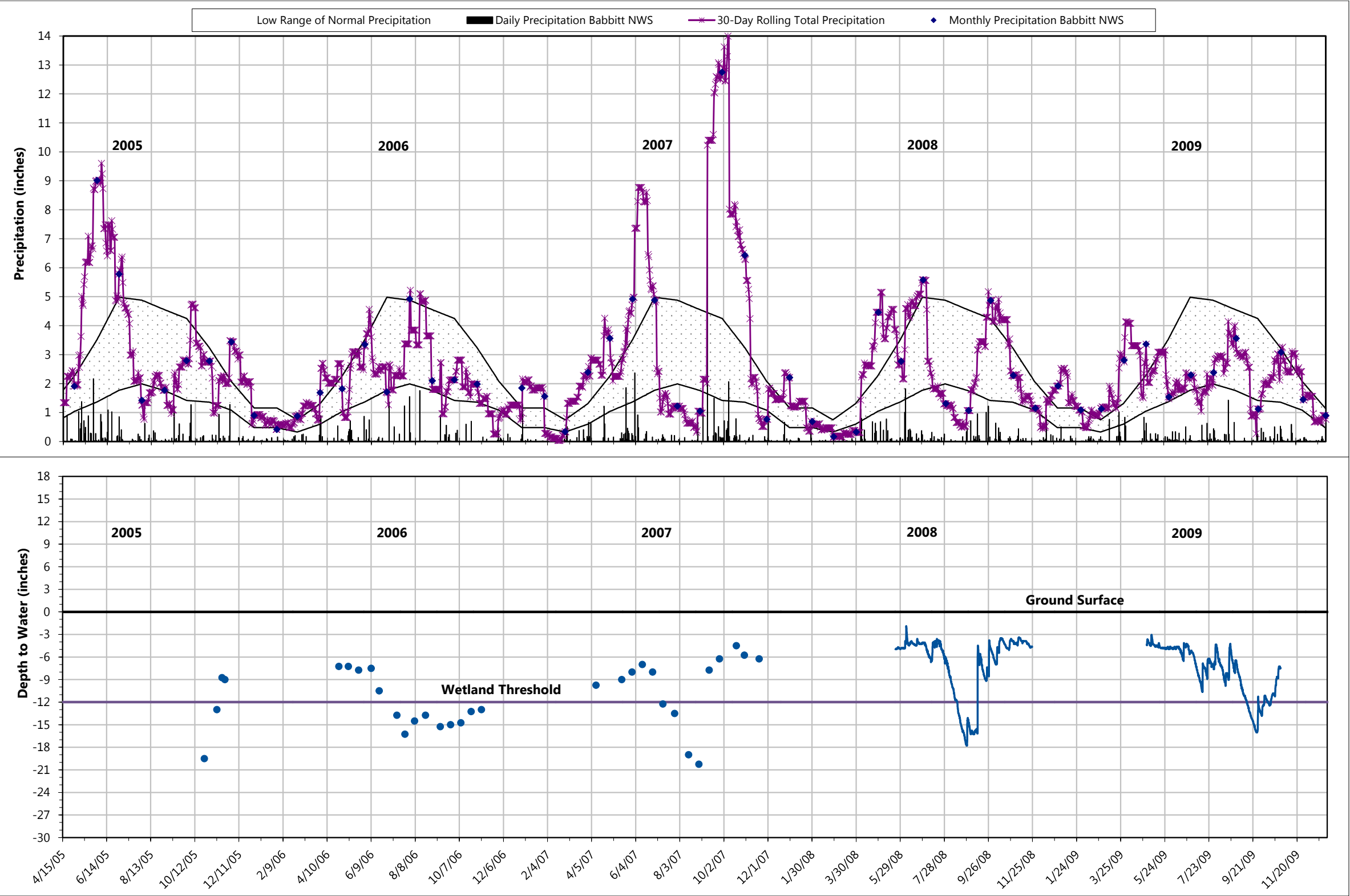


Figure 10-1
 WETLAND MONITORING WELL 10
 2008-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota



Points represent manual well measurements.
Lines represent electronic well measurements.

Figure 10-2a
WETLAND MONITORING WELL 10
2005-2009 WETLAND HYDROLOGY MONITORING DATA
NorthMet Project
Poly Met Mining, Inc.
Hoyt Lakes, Minnesota

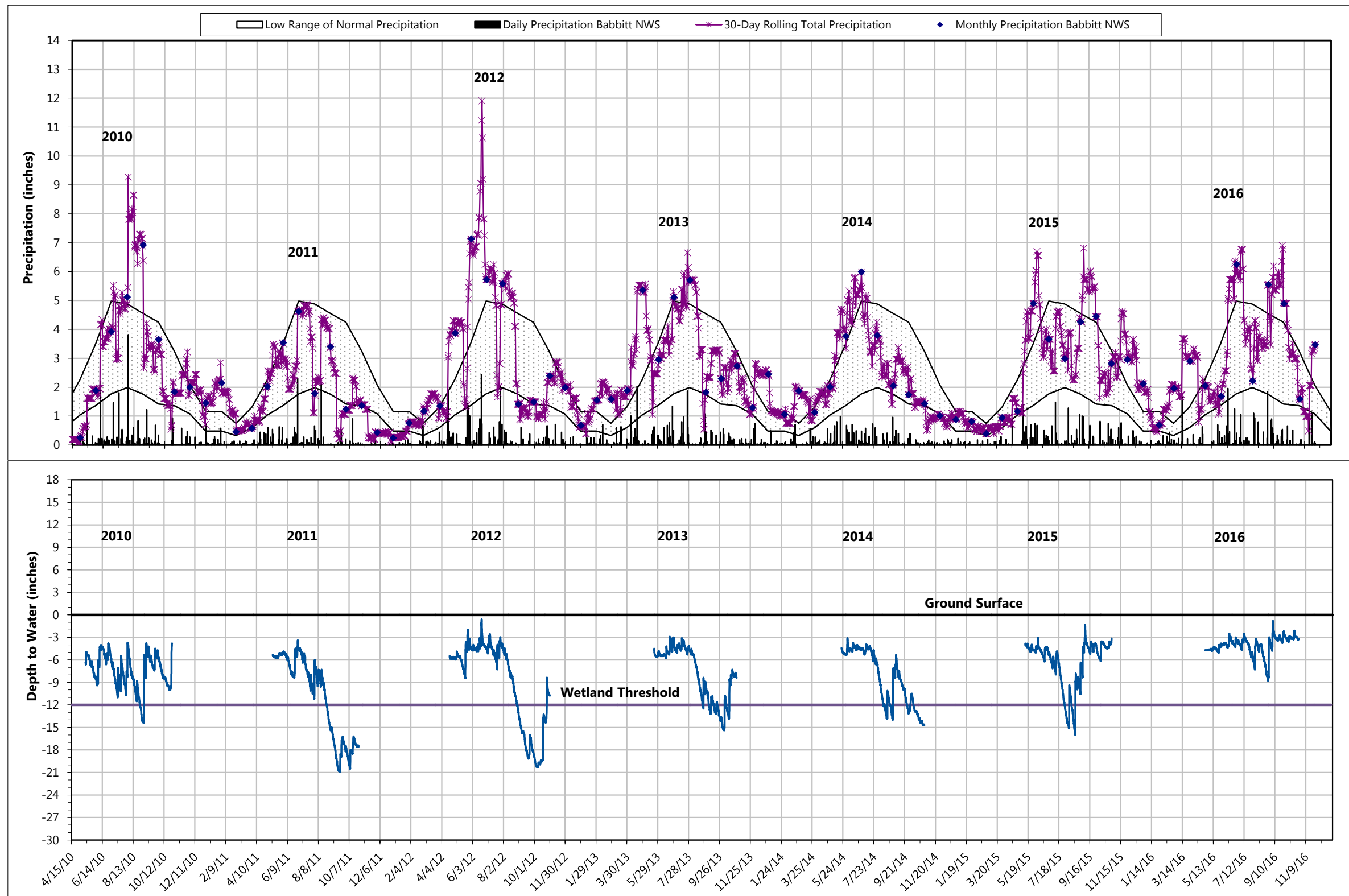


Figure 10-2b
 WETLAND MONITORING WELL 10
 2010-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

NorthMet Project Hydrology Monitoring – Well 10



May 2008



June 2009



May 2010



June 2011



June 2012



June 2013

NorthMet Project Hydrology Monitoring – Well 10



June 2014



May 2015



June 2016

Well ID: 11

NorthMet Project Area: Mine Site

Wetland Number: 100

Wetland Type: Coniferous Bog (Type 8)

UTM Coordinates (NAD 83 Zone 15)

Easting: 577624

Northing: 5274981

Well Type(s): Ecotone and Manual

Date Recording Well Installed: 5/22/2008

Installed By: Barr/NTS

Water Level Recorded Every: 4 hours

Date Manual Well Installed: 10/25/2005

Installed By: Barr/NTS

Manual Water Levels Read: Monthly

Growing Season: May 9-October 6 (151 days)

Monitored by: NTS

Water Level Fluctuation for All Years: 25.5 inches

Notes: UTM coordinates are for recording well.

Table 11-1. Monitoring Period Each Year¹. See the hydrographs in Figure 11-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Start Date	M	M	M	5/22	6/24	6/16	5/10	5/16	6/18	6/11	7/9	5/25
End Date	M	M	M	11/25	10/28	10/27	10/25	10/31	10/29	10/29	10/28	10/26
Total Days	M	M	M	188	127	134	169	169	134	141	112	155
Grow. Seas. Days	M	M	M	138	105	113	150	144	111	118	90	135

¹ Manual (M) well only at this location. No wells at the location (---). Day ranges and Growing Season (Grow. Seas.) Days in this table represent full calendar days.

Table 11-2. Precipitation During Each Growing Season and Water Year¹. See the yearly hydrographs in Figure 11-2.

Year		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Growing Season	May	A	N	A	N	B	B	A	A	N	A	A	B
	June	A	B	N	A	B	N	N	A	A	A	N	A
	July	B	A	B	B	B	A	B	A	A	N	B	B
	Aug	B	B	B	B	N	A	N	B	B	N	N	A
	Sept	B	B	A	A	B	N	B	B	B	B	N	A
Water Year		A	B	A	A	B	N	B	A	A	N	B	A

¹ The growing season includes precipitation during May through September and the water year includes precipitation from October 1 of the previous year through September 30 of the current year. Each time period, the precipitation is represented as: within the normal range of precipitation (N), below the normal range of precipitation (B), or above the normal range of precipitation (A).

Table 11-3. Hydroperiod(s) for Each Year During the Growing Season¹. Total number of days water level is ≥ 12 " below ground level for 14 or more consecutive days during the growing season. The yearly hydrographs are shown in Figure 11-2.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# of Periods ≥ 14 Consecutive Days	M	M	M	2	1	2	2	1	1	2	2	1
Total Days	M	M	M	97	48	54	64	93	56	80	52	134
% Grow. Seas.	M	M	M	70%	46%	48%	43%	65%	50%	68%	58%	99%

¹ Hydroperiods were not determined for locations with only a Manual (M) well. No wells at the location (---). The total days counted for the hydroperiod may not match the total days monitored within a growing season (Grow. Seas.) because the hydroperiod date count does not include partial days.

Table 11-4. Water Level Fluctuations During the Growing Season (inches)¹. Yearly fluctuations are shown in Figure 11-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum (in.)	M	M	M	-22.2	-19.0	-18.8	-24.5	-25.9	-19.5	-16.8	-19.1	-9.8
Maximum (in.)	M	M	M	-4.2	-7.1	-7.7	-6.6	-1.7	-5.5	-6.8	-0.4	-1.0
Fluctuation (in.)	M	M	M	18.0	11.9	11.1	17.9	24.2	14.0	10.0	18.7	8.8

¹ Fluctuations in water level were not determined for locations with only a Manual (M) well. No wells at the location (---). Some water level depths were deeper than the bottom of the well casing (<) resulting in greater fluctuations than indicated in the data (>).

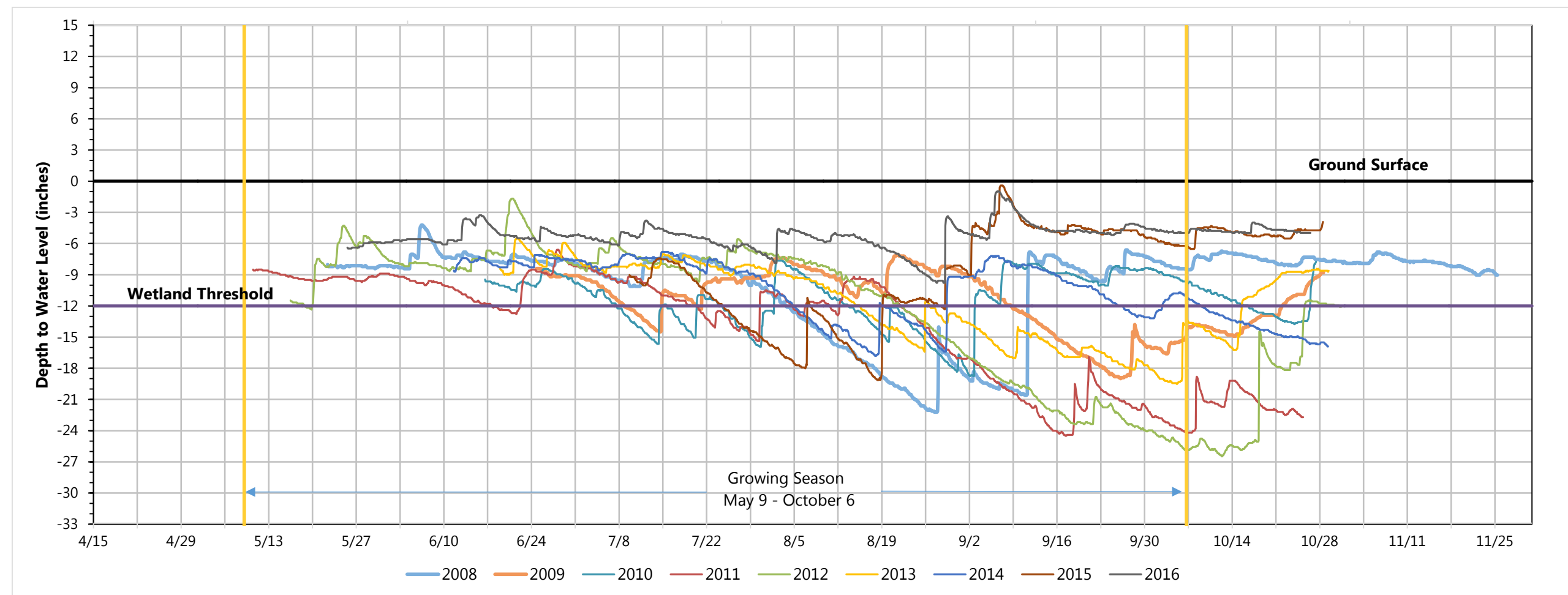
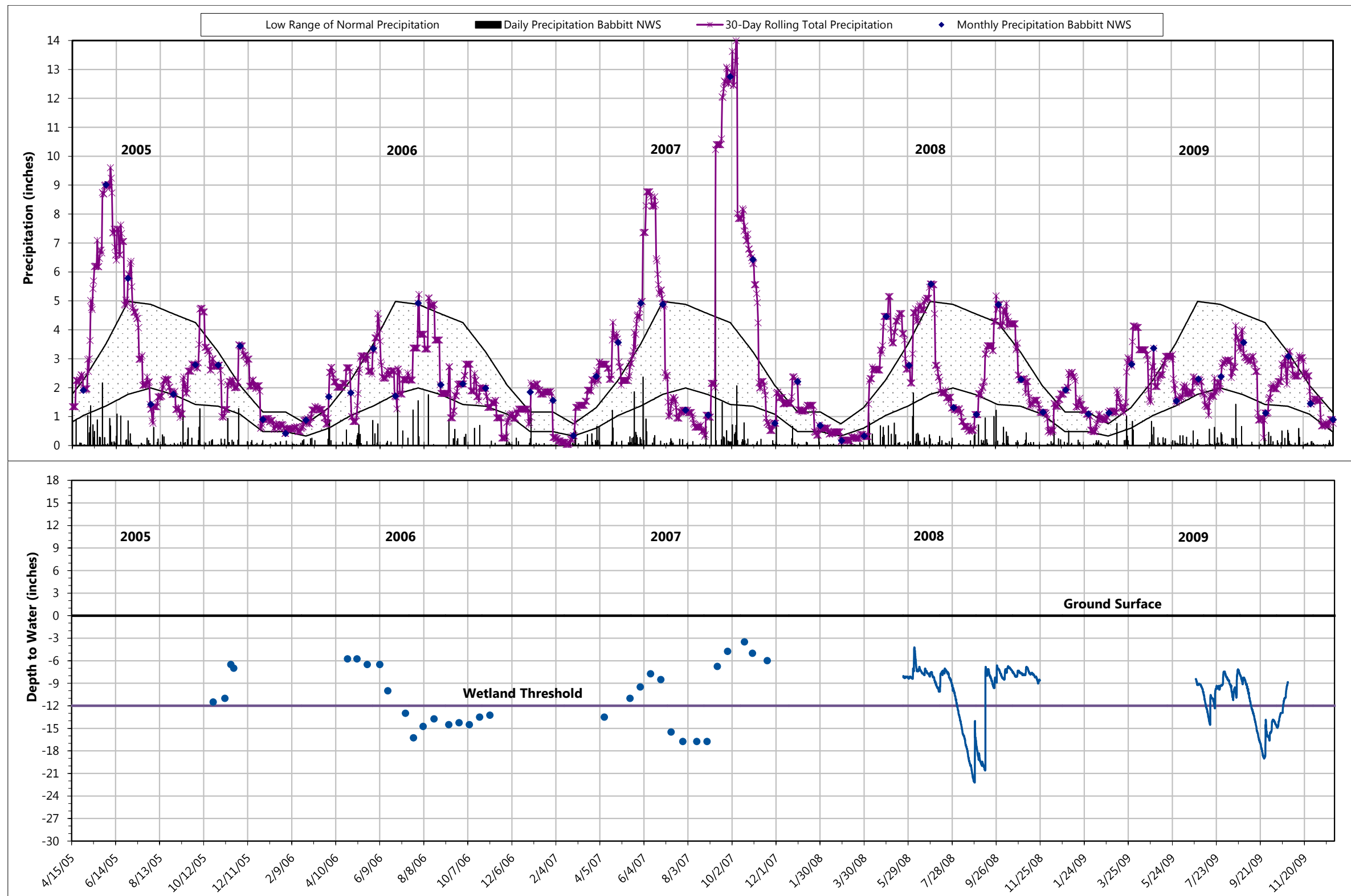


Figure 11-1
WETLAND MONITORING WELL 11
2008-2016 WETLAND HYDROLOGY MONITORING DATA
NorthMet Project
Poly Met Mining, Inc.
Hoyt Lakes, Minnesota



Points represent manual well measurements.

Lines represent electronic well measurements.

Figure 11-2a
 WETLAND MONITORING WELL 11
 2005-2009 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

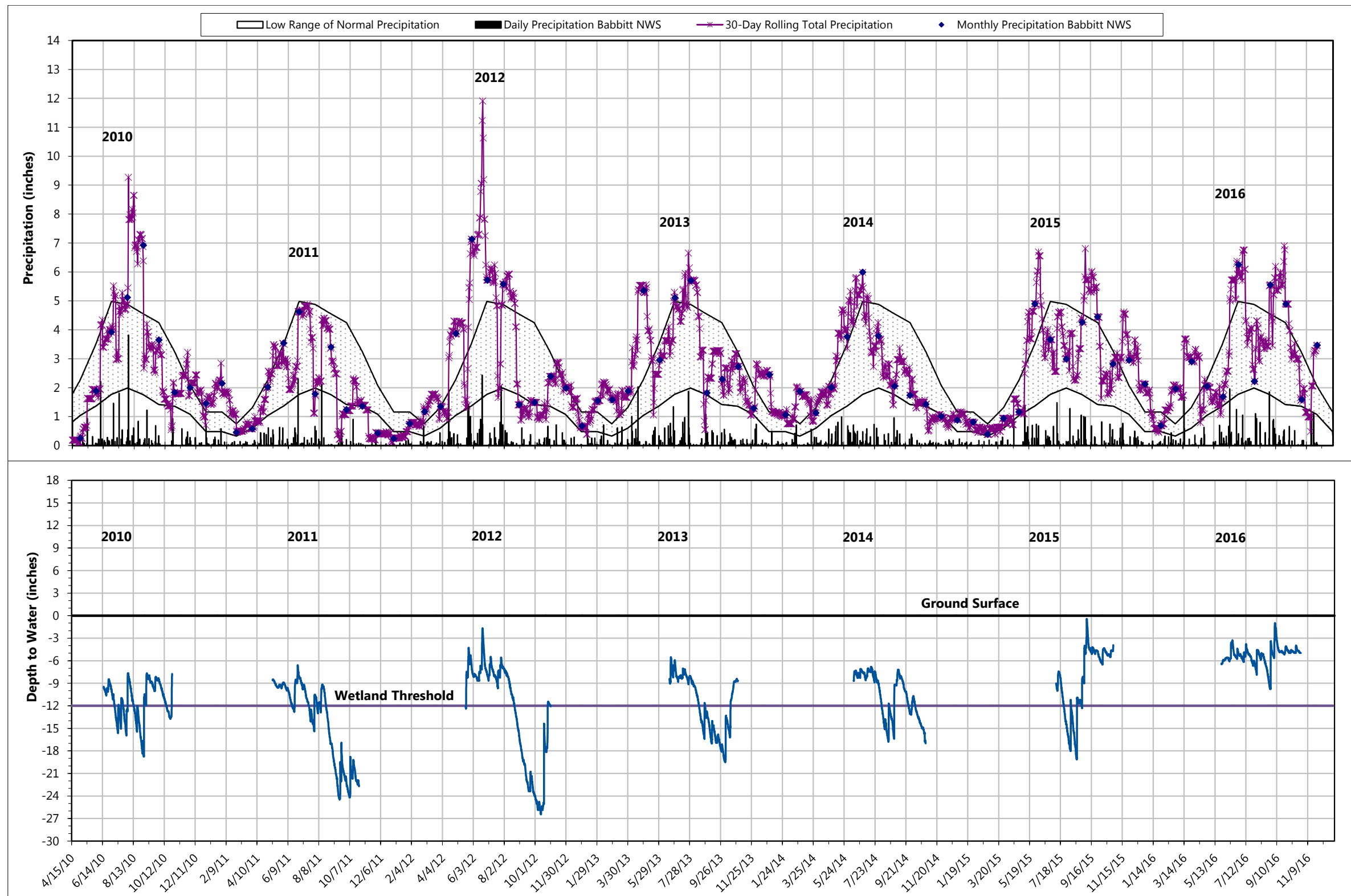


Figure 11-2b
 WETLAND MONITORING WELL 11
 2010-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

NorthMet Project Hydrology Monitoring – Well 11



June 2008 – No photo available

June 2009



May 2010



June 2011



June 2012



June 2013

NorthMet Project Hydrology Monitoring – Well 11



June 2014



June 2015



June 2016

Well ID: 12

NorthMet Project Area: Mine Site

Wetland Number: 888

Wetland Type: Coniferous Bog (Type 8)

UTM Coordinates (NAD 83 Zone 15)

Easting: 578180

Northing: 5275483

Well Type(s): Ecotone and Manual

Date Recording Well Installed: 11/9/2005

Installed By: NTS

Water Level Recorded Every: 4 hours

Date Manual Well Installed: 6/30/2005

Installed By: Barr

Manual Water Levels Read: Monthly

Growing Season: May 9-October 6 (151 days)

Monitored by: NTS

Water Level Fluctuation for All Years: 20.1 inches

Notes: UTM coordinates are for recording well.

Table 12-1. Monitoring Period Each Year¹. See the hydrographs in Figure 12-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Start Date	11/11	4/26	4/31	5/7	4/29	5/12	5/11	4/19	5/22	5/21	5/27	4/27
End Date	11/23	11/21	11/26	11/25	10/28	10/28	10/25	10/31	10/29	10/29	10/28	10/26
Total Days	13	210	180	203	183	170	168	196	161	162	155	183
Grow. Seas. Days	0	151	129	153	151	148	149	151	138	139	133	151

¹ Manual (M) well only at this location. No wells at the location (---). Day ranges and Growing Season (Grow. Seas.) Days in this table represent full calendar days.

Table 12-2. Precipitation During Each Growing Season and Water Year¹. See the yearly hydrographs in Figure 12-2.

Year		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Growing Season	May	A	N	A	N	B	B	A	A	N	A	A	B
	June	A	B	N	A	B	N	N	A	A	A	N	A
	July	B	A	B	B	B	A	B	A	A	N	B	B
	Aug	B	B	B	B	N	A	N	B	B	N	N	A
	Sept	B	B	A	A	B	N	B	B	B	B	N	A
Water Year		A	B	A	A	B	N	B	A	A	N	B	A

¹ The growing season includes precipitation during May through September and the water year includes precipitation from October 1 of the previous year through September 30 of the current year. Each time period, the precipitation is represented as: within the normal range of precipitation (N), below the normal range of precipitation (B), or above the normal range of precipitation (A).

Table 12-3. Hydroperiod(s) for Each Year During the Growing Season¹. Total number of days water level is ≥ 12 " below ground level for 14 or more consecutive days during the growing season. The yearly hydrographs are shown in Figure 12-2.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# of Periods ≥ 14 Consecutive Days	---	3	2	2	1	2	1	1	2	2	2	1
Total Days	---	134	65	112	131	143	115	113	113	123	102	151
% Grow. Seas.	---	89%	50	73%	87%	97%	77%	75%	82%	88%	77%	100%

¹ Hydroperiods were not determined for locations with only a Manual (M) well. No wells at the location (---). The total days counted for the hydroperiod may not match the total days monitored within a growing season (Grow. Seas.) because the hydroperiod date count does not include partial days.

Table 12-4. Water Level Fluctuations During the Growing Season (inches)¹. Yearly fluctuations are shown in Figure 12-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum (in.)	---	-13.7	-20.0	-19.4	-14.9	-12.6	-17.7	<-18.0	-12.8	-13.7	-16.9	-9.0
Maximum (in.)	---	-3.7	-2.2	-3.2	-3.1	-3.2	-2.9	-0.2	-2.1	-3.1	-0.6	0.1
Fluctuation (in.)	---	10.0	17.8	16.2	11.8	9.4	14.8	>17.8	10.7	10.6	16.3	9.1

¹ Fluctuations in water level were not determined for locations with only a Manual (M) well. No wells at the location (---). Some water level depths were deeper than the bottom of the well casing (<) resulting in greater fluctuations than indicated in the data (>).

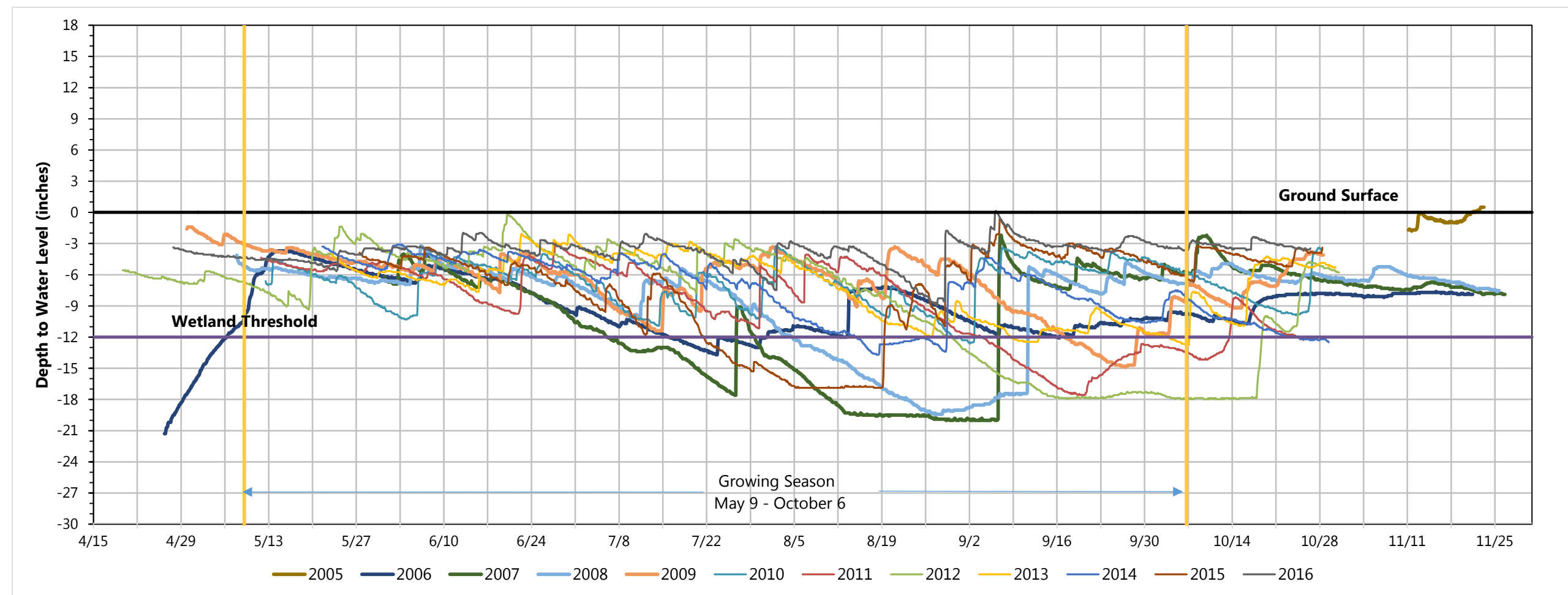


Figure 12-1
 WETLAND MONITORING WELL 12
 2005-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

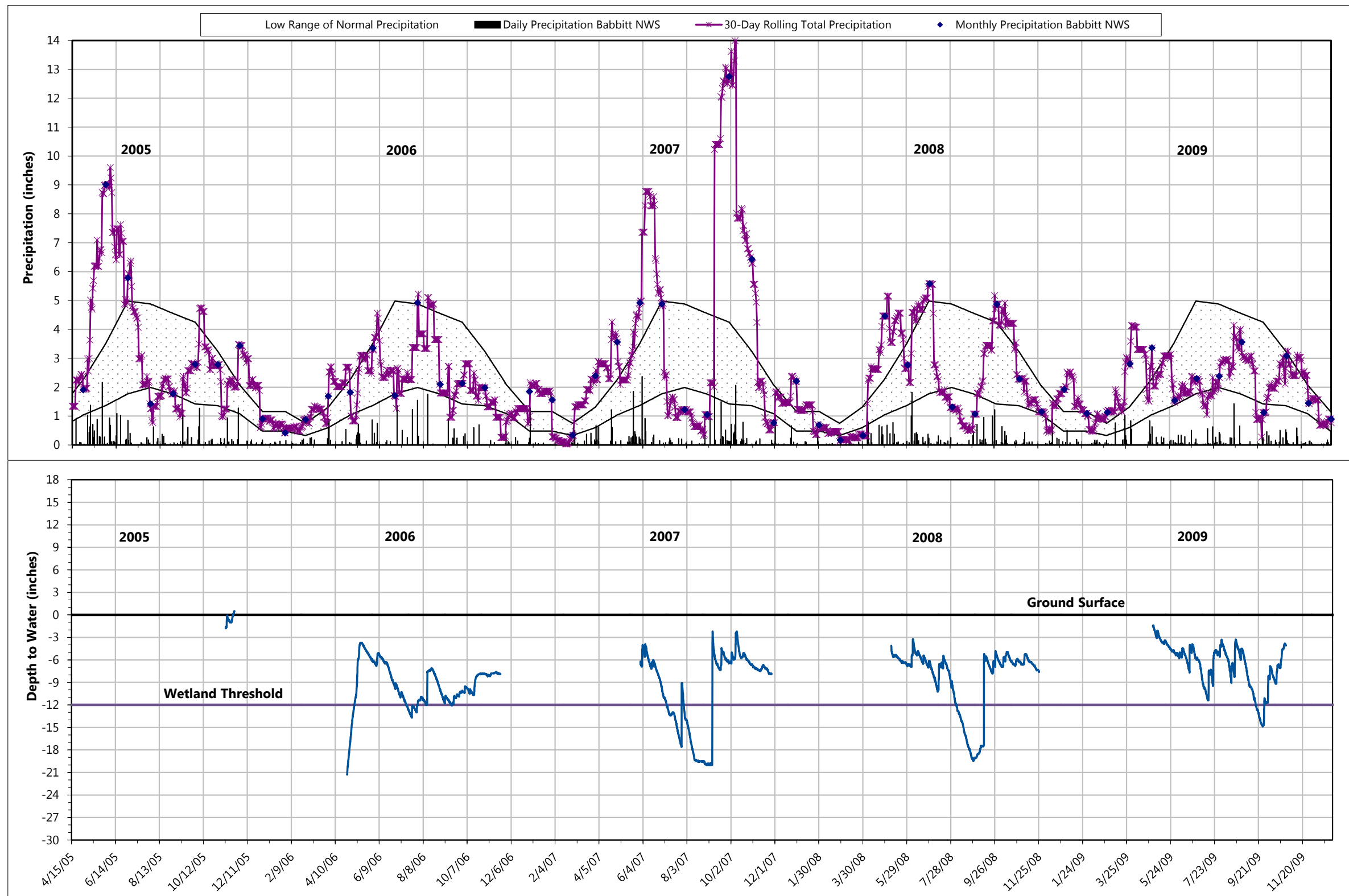


Figure 12-2a
 WETLAND MONITORING WELL 12
 2005-2009 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

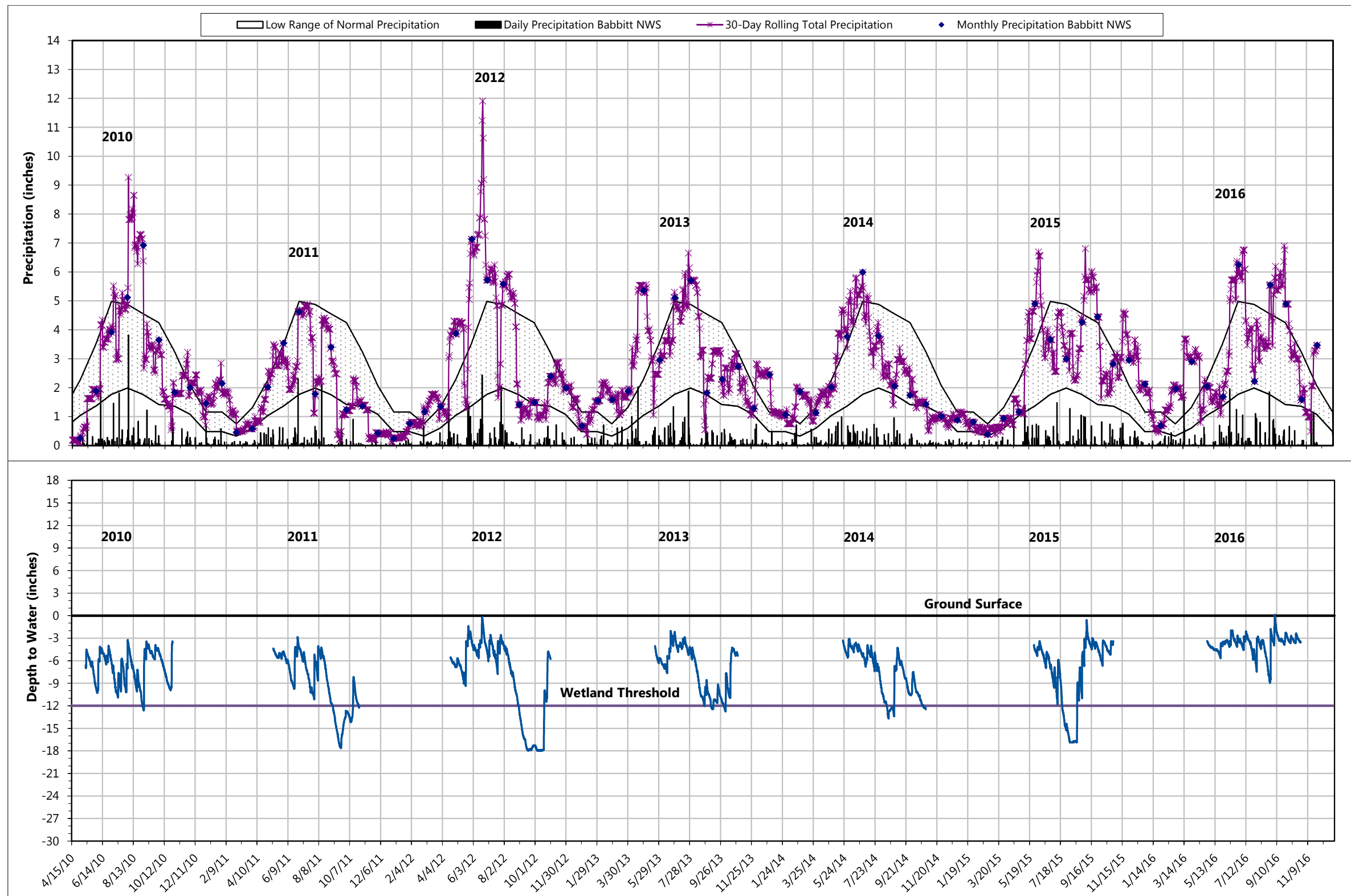


Figure 12-2b
 WETLAND MONITORING WELL 12
 2010-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

NorthMet Project Hydrology Monitoring – Well 12



June 2005

June 2006 – No photo available

June 2007 – No photo available

June 2008 – No photo available



June 2009



June 2010

NorthMet Project Hydrology Monitoring – Well 12



June 2011



June 2012



June 2013



June 2014



June 2015



June 2016

Well ID: 13

NorthMet Project Area: Mine Site

Wetland Number: 84

Wetland Type: Coniferous Bog (Type 8)

UTM Coordinates (NAD 83 Zone 15)

Easting: 580022

Northing: 5275659

Well Type(s): Ecotone and Manual

Date Recording Well Installed: 5/23/2008

Installed By: NTS

Water Level Recorded Every: 4 hours

Date Manual Well Installed: 6/29/2005

Installed By: Barr

Manual Water Levels Read: Monthly

Growing Season: May 9-October 6 (151 days)

Monitored by: NTS

Water Level Fluctuation for All Years: 26.0 inches

Notes: UTM coordinates are for recording well.

Table 13-1. Monitoring Period Each Year¹. See the hydrographs in Figure 13-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Start Date	M	M	M	5/23	4/29	6/16	6/7	4/18	6/18	6/11	6/10	4/27
End Date	M	M	M	11/26	11/29	10/27	10/25	10/31	10/29	10/29	10/28	10/26
Total Days	M	M	M	188	215	134	141	197	134	141	141	183
Grow. Seas. Days	M	M	M	137	151	113	122	151	111	118	119	151

¹ Manual (M) well only at this location. No wells at the location (---). Day ranges and Growing Season (Grow. Seas.) Days in this table represent full calendar days.

Table 13-2. Precipitation During Each Growing Season and Water Year¹. See the yearly hydrographs in Figure 13-2.

Year		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Growing Season	May	A	N	A	N	B	B	A	A	N	A	A	B
	June	A	B	N	A	B	N	N	A	A	A	N	A
	July	B	A	B	B	B	A	B	A	A	N	B	B
	Aug	B	B	B	B	N	A	N	B	B	N	N	A
	Sept	B	B	A	A	B	N	B	B	B	B	N	A
Water Year		A	B	A	A	B	N	B	A	A	N	B	A

¹ The growing season includes precipitation during May through September and the water year includes precipitation from October 1 of the previous year through September 30 of the current year. Each time period, the precipitation is represented as: within the normal range of precipitation (N), below the normal range of precipitation (B), or above the normal range of precipitation (A).

Table 13-3. Hydroperiod(s) for Each Year During the Growing Season¹. Total number of days water level is ≥ 12 " below ground level for 14 or more consecutive days during the growing season. The yearly hydrographs are shown in Figure 13-2.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# of Periods ≥ 14 Consecutive Days	M	M	M	2	3	4	2	1	1	2	2	3
Total Days	M	M	M	89	111	87	66	103	55	90	54	141
% Grow. Seas.	M	M	M	65%	74%	77%	54%	68%	50%	76%	45%	93%

¹ Hydroperiods were not determined for locations with only a Manual (M) well. No wells at the location (---). The total days counted for the hydroperiod may not match the total days monitored within a growing season (Grow. Seas.) because the hydroperiod date count does not include partial days.

Table 13-4. Water Level Fluctuations During the Growing Season (inches)¹. Yearly fluctuations are shown in Figure 13-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum (in.)	M	M	M	-24.4	-20.7	-17.2	-24.4	-24.1	-21.0	-18.2	-24.6	-14.8
Maximum (in.)	M	M	M	-2.3	-4.0	-2.4	-2.2	1.4	-0.5	-3.4	-1.9	0.4
Fluctuation (in.)	M	M	M	22.1	16.7	14.8	22.2	25.5	20.5	14.8	22.7	15.1

¹ Fluctuations in water level were not determined for locations with only a Manual (M) well. No wells at the location (---). Some water level depths were deeper than the bottom of the well casing (<) resulting in greater fluctuations than indicated in the data (>).

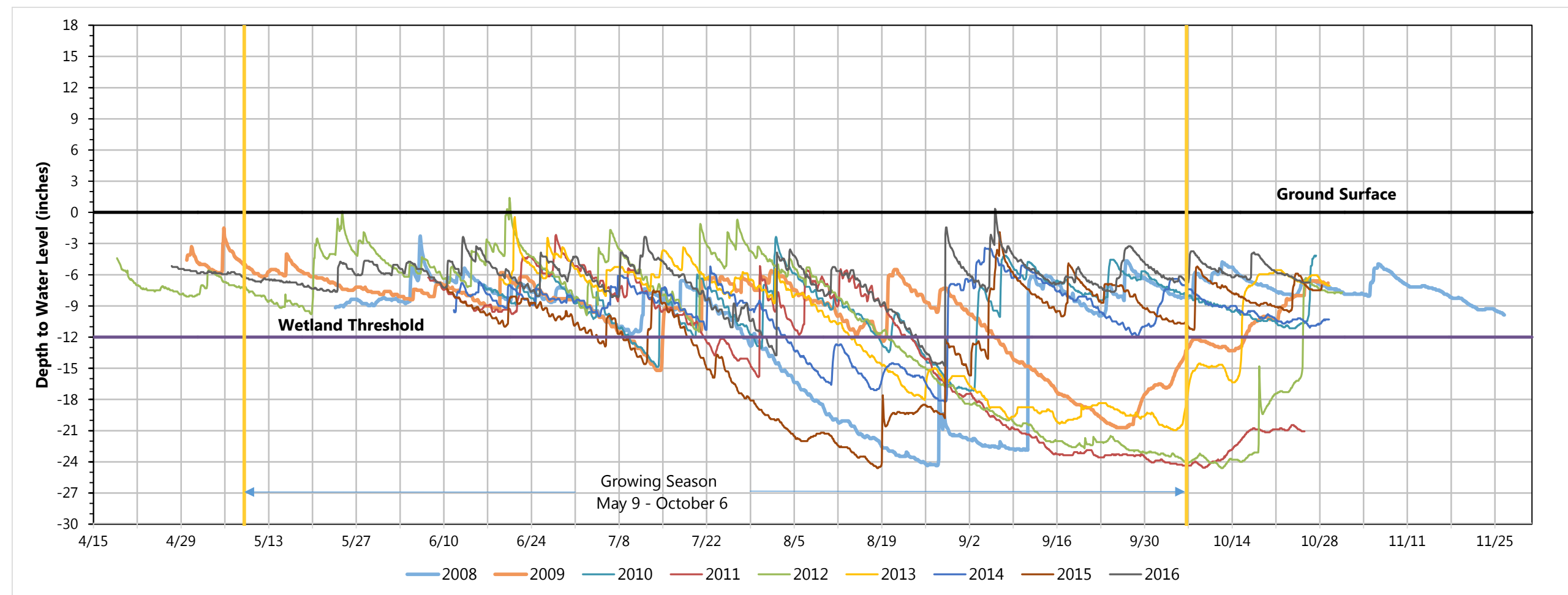
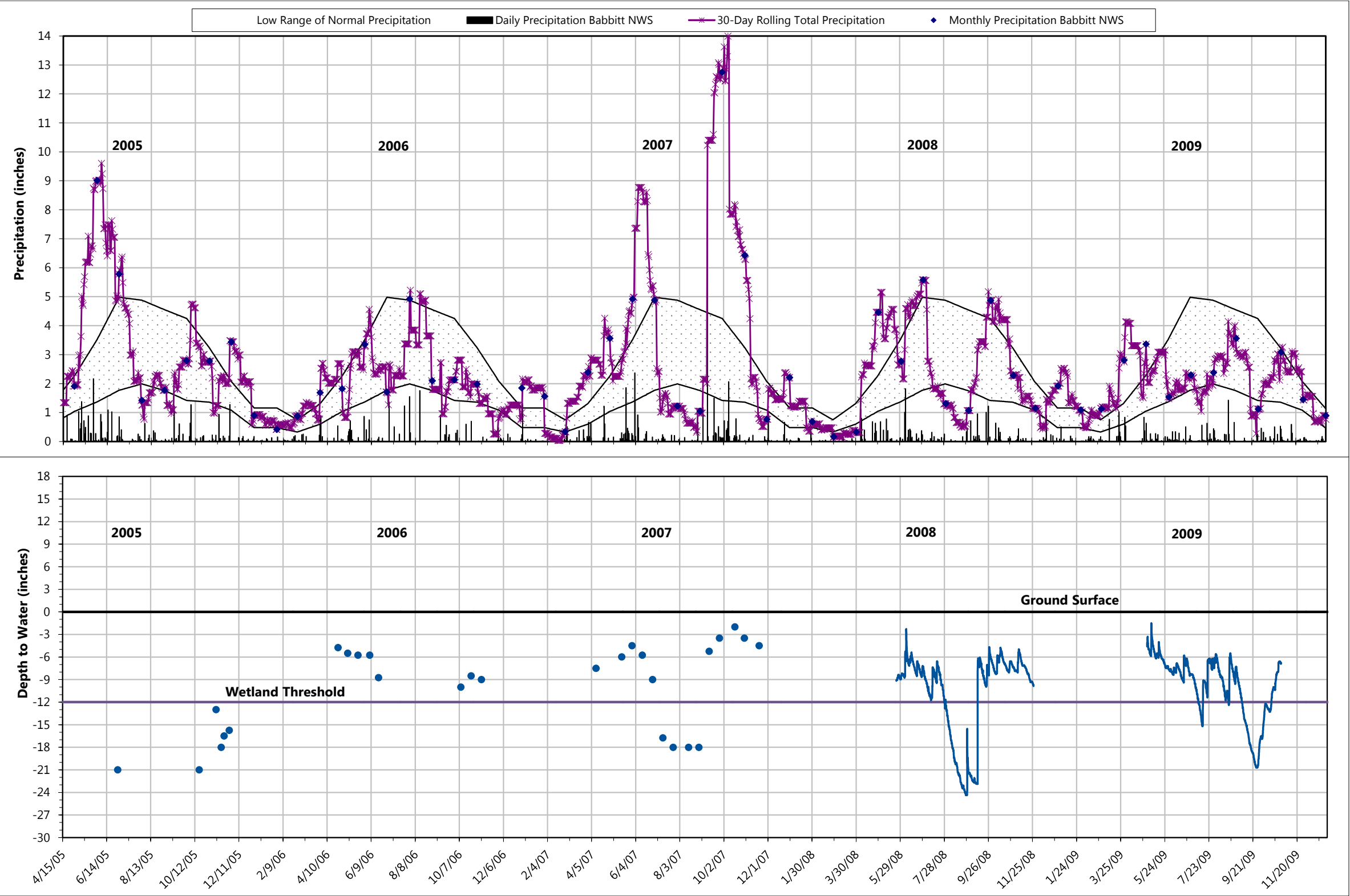


Figure 13-1
 WETLAND MONITORING WELL 13
 2008-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota



Points represent manual well measurements.
Lines represent electronic well measurements.

Figure 13-2a
WETLAND MONITORING WELL 13
2005-2009 WETLAND HYDROLOGY MONITORING DATA
NorthMet Project
Poly Met Mining, Inc.
Hoyt Lakes, Minnesota

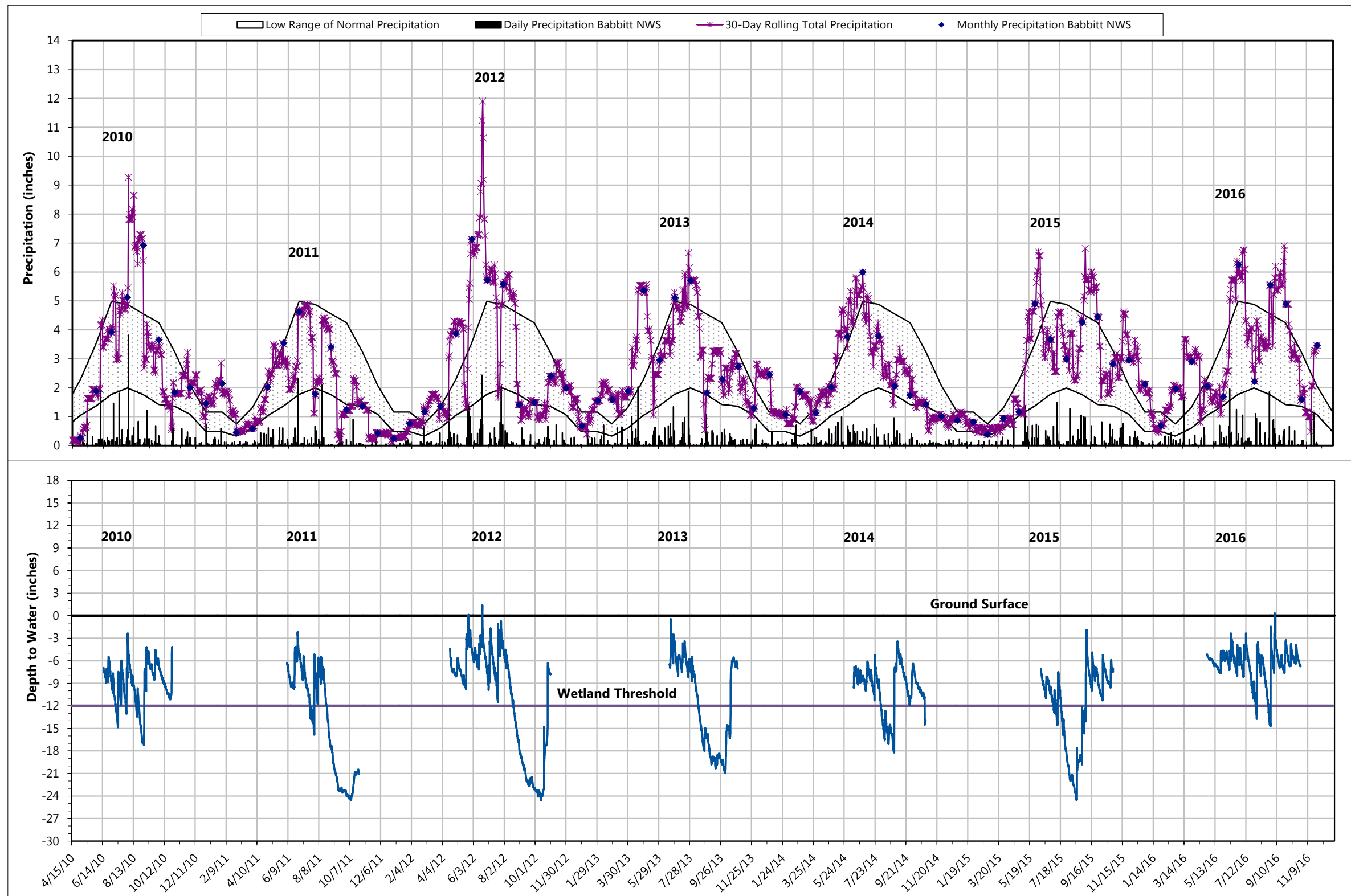


Figure 13-2b
 WETLAND MONITORING WELL 13
 2010-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

NorthMet Project Hydrology Monitoring – Well 13



June 2009



July 2010



June 2011



June 2012



June 2013

NorthMet Project Hydrology Monitoring – Well 13



June 2014



May 2015



June 2016

Well ID: 14

NorthMet Project Area: Mine Site

Wetland Number: 90

Wetland Type: Coniferous Bog (Type 8)

UTM Coordinates (NAD 83 Zone 15)

Easting: 580480

Northing: 5275406

Well Type(s): Ecotone and Manual

Date Recording Well Installed: 5/23/2008

Installed By: NTS

Water Level Recorded Every: 4 hours

Date Manual Well Installed: 6/29/2005

Installed By: Barr

Manual Water Levels Read: Monthly

Growing Season: May 9-October 6 (151 days)

Monitored by: NTS

Water Level Fluctuation for All Years: 21.8 inches

Notes: UTM coordinates are for recording well.

Table 14-1. Monitoring Period Each Year¹. See the hydrographs in Figure 14-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Start Date	M	M	M	5/23	4/29	5/11	5/11	4/18	5/22	5/21	5/13	4/27
End Date	M	M	M	11/26	10/29	10/27	10/25	10/31	10/29	10/29	10/27	10/26
Total Days	M	M	M	188	184	170	168	197	161	162	168	183
Grow. Seas. Days	M	M	M	137	151	149	149	151	138	139	147	151

¹ Manual (M) well only at this location. No wells at the location (---). Day ranges and Growing Season (Grow. Seas.) Days in this table represent full calendar days.

Table 14-2. Precipitation During Each Growing Season and Water Year¹. See the yearly hydrographs in Figure 14-2.

Year		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Growing Season	May	A	N	A	N	B	B	A	A	N	A	A	B
	June	A	B	N	A	B	N	N	A	A	A	N	A
	July	B	A	B	B	B	A	B	A	A	N	B	B
	Aug	B	B	B	B	N	A	N	B	B	N	N	A
	Sept	B	B	A	A	B	N	B	B	B	B	N	A
Water Year		A	B	A	A	B	N	B	A	A	N	B	A

¹ The growing season includes precipitation during May through September and the water year includes precipitation from October 1 of the previous year through September 30 of the current year. Each time period, the precipitation is represented as: within the normal range of precipitation (N), below the normal range of precipitation (B), or above the normal range of precipitation (A).

Table 14-3. Hydroperiod(s) for Each Year During the Growing Season¹. Total number of days water level is ≥ 12 " below ground level for 14 or more consecutive days during the growing season. The yearly hydrographs are shown in Figure 14-2.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# of Periods ≥ 14 Consecutive Days	M	M	M	1	2	3	2	1	2	1	2	3
Total Days	M	M	M	41	60	76	63	89	76	56	140	144
% Grow. Seas.	M	M	M	30%	40%	51%	42%	59%	55%	40%	95%	95%

¹ Hydroperiods were not determined for locations with only a Manual (M) well. No wells at the location (---). The total days counted for the hydroperiod may not match the total days monitored within a growing season (Grow. Seas.) because the hydroperiod date count does not include partial days.

Table 14-4. Water Level Fluctuations During the Growing Season (inches)¹. Yearly fluctuations are shown in Figure 14-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum (in.)	M	M	M	-23.1	-20.4	-16.3	-23.0	-22.1	-20.2	-18.6	-13.1	-13.3
Maximum (in.)	M	M	M	-4.7	-6.9	-4.7	-5.4	-1.3	-4.4	-6.6	-3.7	-3.3
Fluctuation (in.)	M	M	M	18.4	13.5	11.6	17.6	20.8	15.8	12.0	9.4	10.0

¹ Fluctuations in water level were not determined for locations with only a Manual (M) well. No wells at the location (---). Some water level depths were deeper than the bottom of the well casing (<) resulting in greater fluctuations than indicated in the data (>).

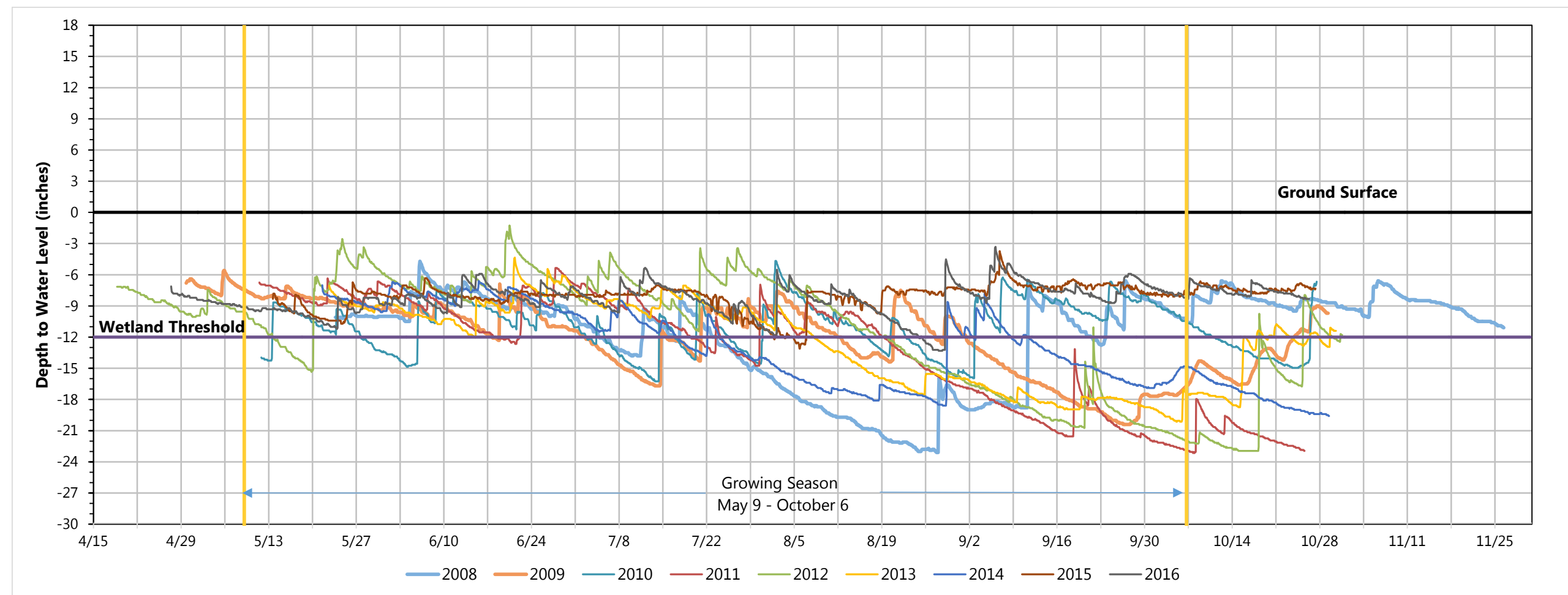
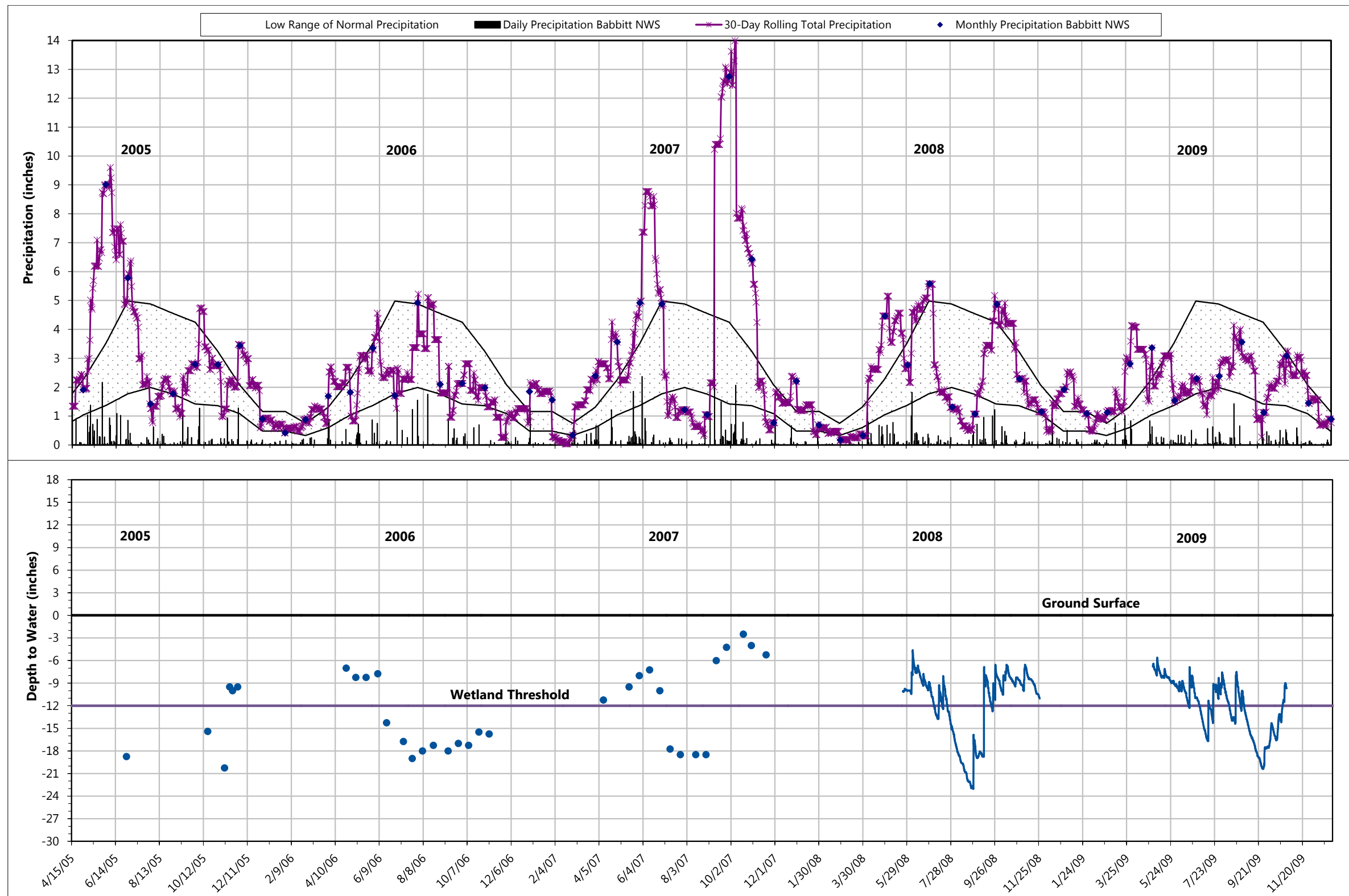


Figure 14-1
 WETLAND MONITORING WELL 14
 2008-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota



Points represent manual well measurements.
 Lines represent electronic well measurements.

Figure 14-2a
 WETLAND MONITORING WELL 14
 2005-2009 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

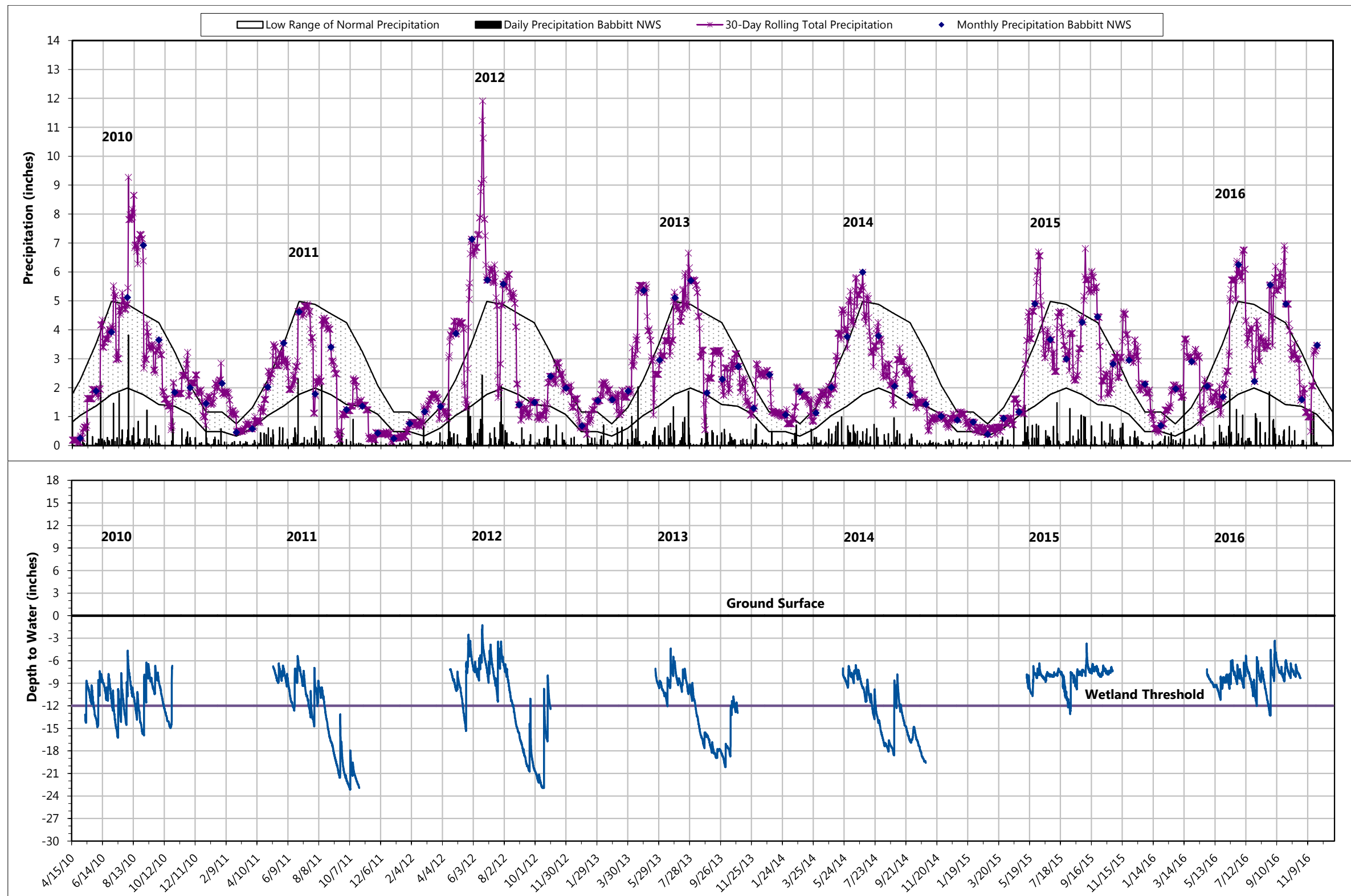


Figure 14-2b
 WETLAND MONITORING WELL 14
 2010-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

NorthMet Project Hydrology Monitoring – Well 14



June 2009



June 2008 – No photo available



May 2011



June 2012



June 2013

NorthMet Project Hydrology Monitoring – Well 14



June 2014



June 2015



June 2016

Well ID: 15

NorthMet Project Area: Mine Site

Wetland Number: 693

Wetland Type: Coniferous Bog (Type 8)

UTM Coordinates (NAD 83 Zone 15)

Easting: 580790

Northing: 5274950

Well Type(s): Ecotone and Manual

Date Recording Well Installed: 5/23/2008

Installed By: NTS

Water Level Recorded Every: 4 hours

Date Manual Well Installed: 6/29/2005

Installed By: Barr

Manual Water Levels Read: Monthly

Growing Season: May 9-October 6 (151 days)

Monitored by: NTS

Water Level Fluctuation for All Years: 26.9 inches

Notes: UTM coordinates are for recording well.

Table 15-1. Monitoring Period Each Year¹. See the hydrographs in Figure 15-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Start Date	M	M	M	5/23	4/29	5/11	5/11	4/18	5/22	5/21	4/29	4/27
End Date	M	M	M	11/26	10/29	10/27	10/25	10/31	10/29	10/29	10/28	10/26
Total Days	M	M	M	188	184	170	168	197	161	162	183	183
Grow. Seas. Days	M	M	M	137	151	149	149	151	138	139	151	151

¹ Manual (M) well only at this location. No wells at the location (---). Day ranges and Growing Season (Grow. Seas.) Days in this table represent full calendar days.

Table 15-2. Precipitation During Each Growing Season and Water Year¹. See the yearly hydrographs in Figure 15-2.

Year		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Growing Season	May	A	N	A	N	B	B	A	A	N	A	A	B
	June	A	B	N	A	B	N	N	A	A	A	N	A
	July	B	A	B	B	B	A	B	A	A	N	B	B
	Aug	B	B	B	B	N	A	N	B	B	N	N	A
	Sept	B	B	A	A	B	N	B	B	B	B	N	A
Water Year		A	B	A	A	B	N	B	A	A	N	B	A

¹ The growing season includes precipitation during May through September and the water year includes precipitation from October 1 of the previous year through September 30 of the current year. Each time period, the precipitation is represented as: within the normal range of precipitation (N), below the normal range of precipitation (B), or above the normal range of precipitation (A).

Table 15-3. Hydroperiod(s) for Each Year During the Growing Season¹. Total number of days water level is ≥ 12 " below ground level for 14 or more consecutive days during the growing season. The yearly hydrographs are shown in Figure 15-2.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# of Periods ≥ 14 Consecutive Days	M	M	M	2	1	1	1	1	1	1	2	1
Total Days	M	M	M	118	137	148	118	125	137	138	136	151
% Grow. Seas.	M	M	M	86%	91%	99%	79%	83%	99%	99%	90%	100%

¹ Hydroperiods were not determined for locations with only a Manual (M) well. No wells at the location (---). The total days counted for the hydroperiod may not match the total days monitored within a growing season (Grow. Seas.) because the hydroperiod date count does not include partial days.

Table 15-4. Water Level Fluctuations During the Growing Season (inches)¹. Yearly fluctuations are shown in Figure 15-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum (in.)	M	M	M	-22.1	-13.6	-9.3	-20.4	-17.3	-7.1	-9.0	-18.8	-2.2
Maximum (in.)	M	M	M	0.8	-0.7	0.1	1.3	4.8	3.9	1.5	2.6	4.0
Fluctuation (in.)	M	M	M	22.9	12.9	9.4	21.6	22.1	10.9	10.5	21.4	6.2

¹ Fluctuations in water level were not determined for locations with only a Manual (M) well. No wells at the location (---). Some water level depths were deeper than the bottom of the well casing (<) resulting in greater fluctuations than indicated in the data (>).

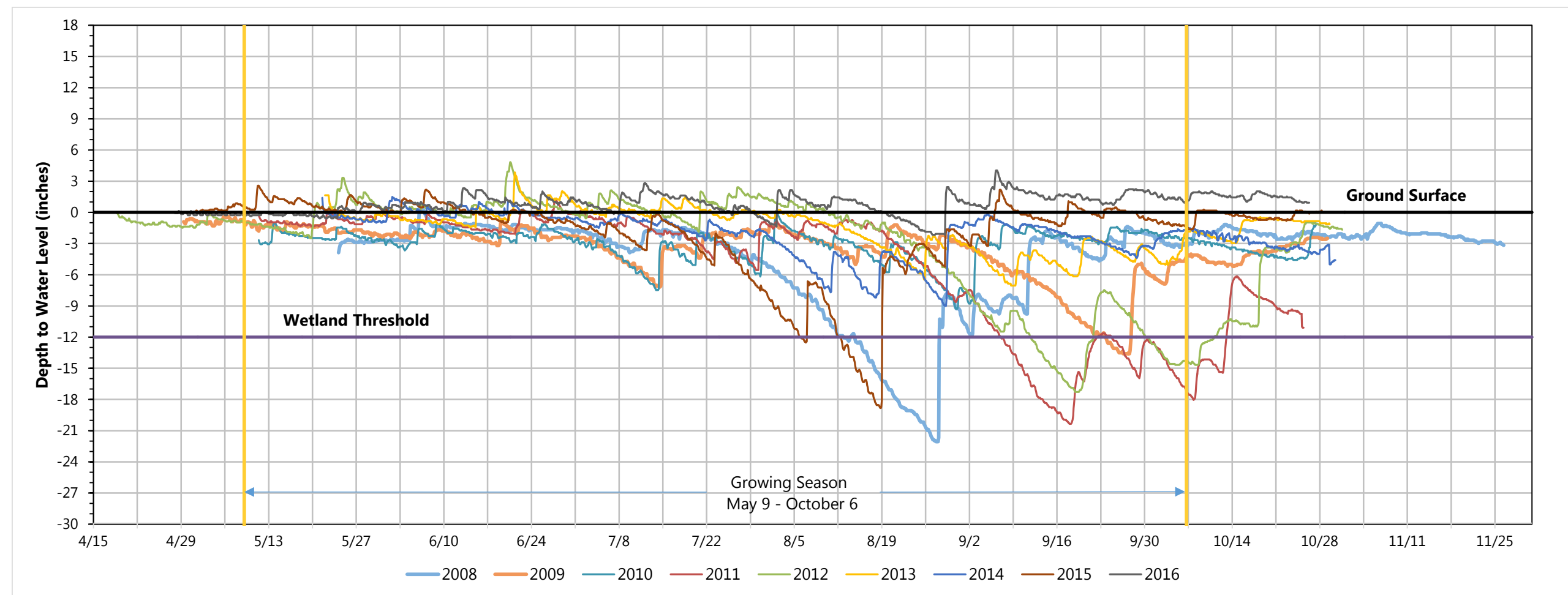
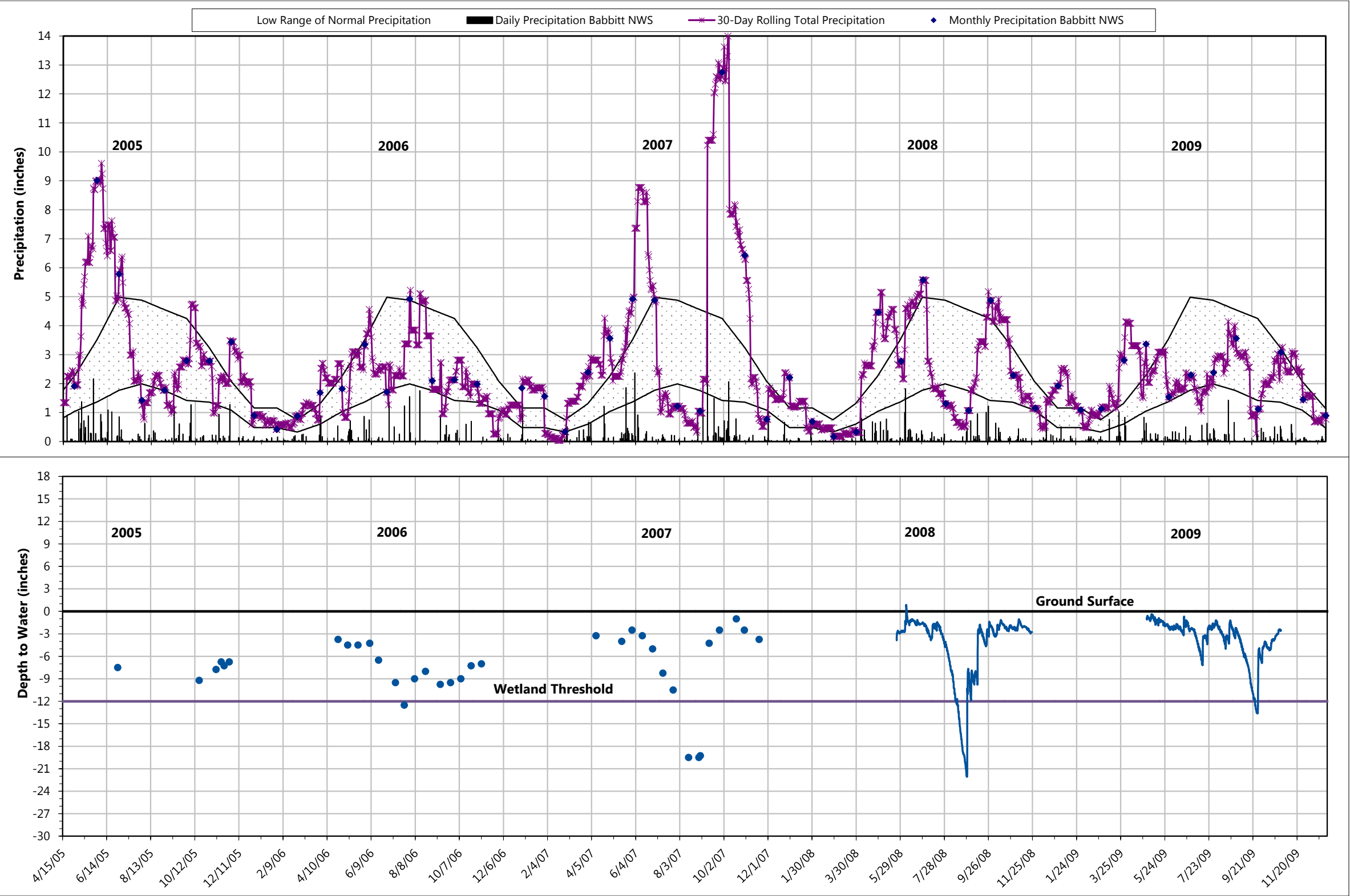


Figure 15-1
WETLAND MONITORING WELL 15
2008-2016 WETLAND HYDROLOGY MONITORING DATA
NorthMet Project
Poly Met Mining, Inc.
Hoyt Lakes, Minnesota



Points represent manual well measurements.
Lines represent electronic well measurements.

Figure 15-2a
WETLAND MONITORING WELL 15
2005-2009 WETLAND HYDROLOGY MONITORING DATA
NorthMet Project
Poly Met Mining, Inc.
Hoyt Lakes, Minnesota

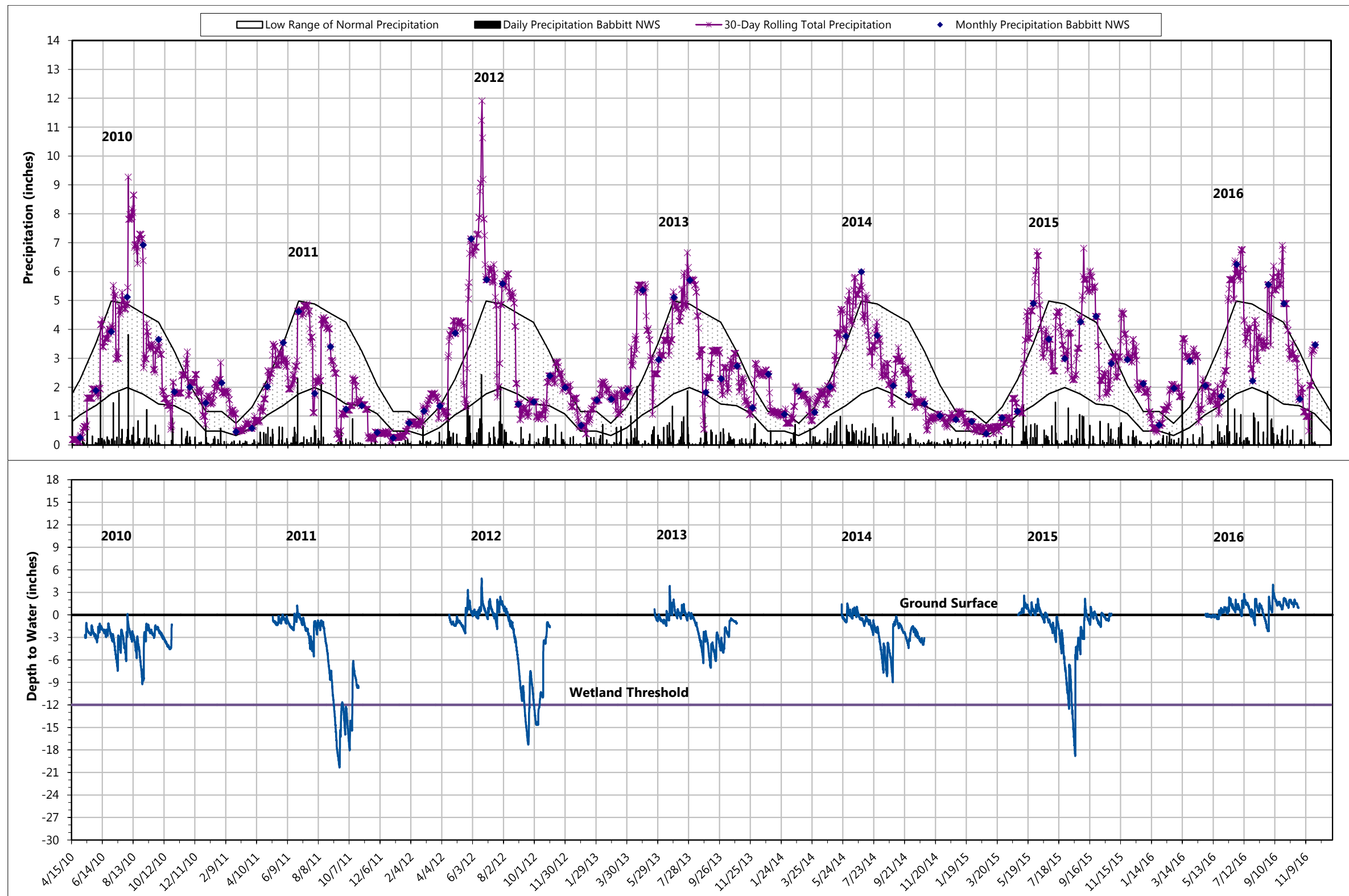


Figure 15-2b
 WETLAND MONITORING WELL 15
 2010-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

NorthMet Project Hydrology Monitoring – Well 15



June 2009



May 2010



May 2011



June 2012



June 2013

NorthMet Project Hydrology Monitoring – Well 15



June 2014



June 2015



June 2016

Well ID: 16

NorthMet Project Area: Mine Site

Wetland Number: 90

Wetland Type: Coniferous Bog (Type 8)

UTM Coordinates (NAD 83 Zone 15)

Easting: 579199

Northing: 5274883

Well Type(s): Ecotone and Manual

Date Recording Well Installed: 5/22/2008

Installed By: Barr/NTS

Water Level Recorded Every: 4 hours

Date Manual Well Installed: 6/30/2005

Installed By: Barr

Manual Water Levels Read: Monthly

Growing Season: May 9-October 6 (151 days)

Monitored by: NTS

Water Level Fluctuation for All Years: 19.4 inches

Notes: UTM coordinates are for recording well.

Table 16-1. Monitoring Period Each Year¹. See the hydrographs in Figure 16-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Start Date	M	M	M	5/22	4/29	6/16	5/11	4/19	5/22	5/20	4/28	4/27
End Date	M	M	M	11/25	10/28	10/28	10/24	10/31	10/29	10/28	10/27	10/26
Total Days	M	M	M	188	183	135	167	196	161	162	183	183
Grow. Seas. Days	M	M	M	138	151	113	149	151	138	140	151	151

¹ Manual (M) well only at this location. No wells at the location (---). Day ranges and Growing Season (Grow. Seas.) Days in this table represent full calendar days.

Table 16-2. Precipitation During Each Growing Season and Water Year¹. See the yearly hydrographs in Figure 16-2.

Year		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Growing Season	May	A	N	A	N	B	B	A	A	N	A	A	B
	June	A	B	N	A	B	N	N	A	A	A	N	A
	July	B	A	B	B	B	A	B	A	A	N	B	B
	Aug	B	B	B	B	N	A	N	B	B	N	N	A
	Sept	B	B	A	A	B	N	B	B	B	B	N	A
Water Year		A	B	A	A	B	N	B	A	A	N	B	A

¹ The growing season includes precipitation during May through September and the water year includes precipitation from October 1 of the previous year through September 30 of the current year. Each time period, the precipitation is represented as: within the normal range of precipitation (N), below the normal range of precipitation (B), or above the normal range of precipitation (A).

Table 16-3. Hydroperiod(s) for Each Year During the Growing Season¹. Total number of days water level is ≥ 12 " below ground level for 14 or more consecutive days during the growing season. The yearly hydrographs are shown in Figure 16-2.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# of Periods ≥ 14 Consecutive Days	M	M	M	2	1	1	2	2	1	1	2	1
Total Days	M	M	M	125	151	112	139	148	137	139	136	151
% Grow. Seas.	M	M	M	91%	100%	99%	93%	98%	99%	99%	90%	100%

¹ Hydroperiods were not determined for locations with only a Manual (M) well. No wells at the location (---). The total days counted for the hydroperiod may not match the total days monitored within a growing season (Grow. Seas.) because the hydroperiod date count does not include partial days.

Table 16-4. Water Level Fluctuations During the Growing Season (inches)¹. Yearly fluctuations are shown in Figure 16-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum (in.)	M	M	M	-15.6	-11.6	-11.4	-14.1	-12.3	-6.6	-8.0	-14.9	-2.8
Maximum (in.)	M	M	M	0.3	-0.9	-3.3	0.0	3.4	3.4	1.9	1.8	3.8
Fluctuation (in.)	M	M	M	15.9	10.7	8.1	14.1	15.7	10.0	9.9	16.7	6.6

¹ Fluctuations in water level were not determined for locations with only a Manual (M) well. No wells at the location (---). Some water level depths were deeper than the bottom of the well casing (<) resulting in greater fluctuations than indicated in the data (>).

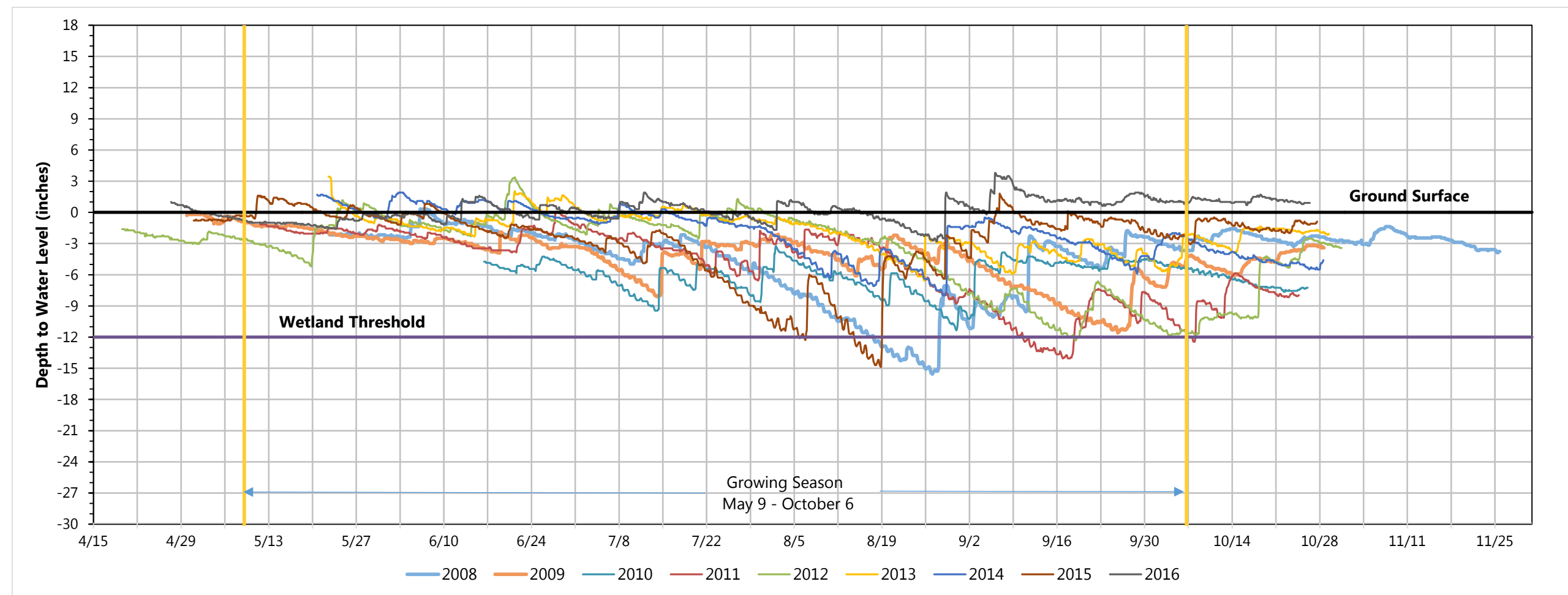
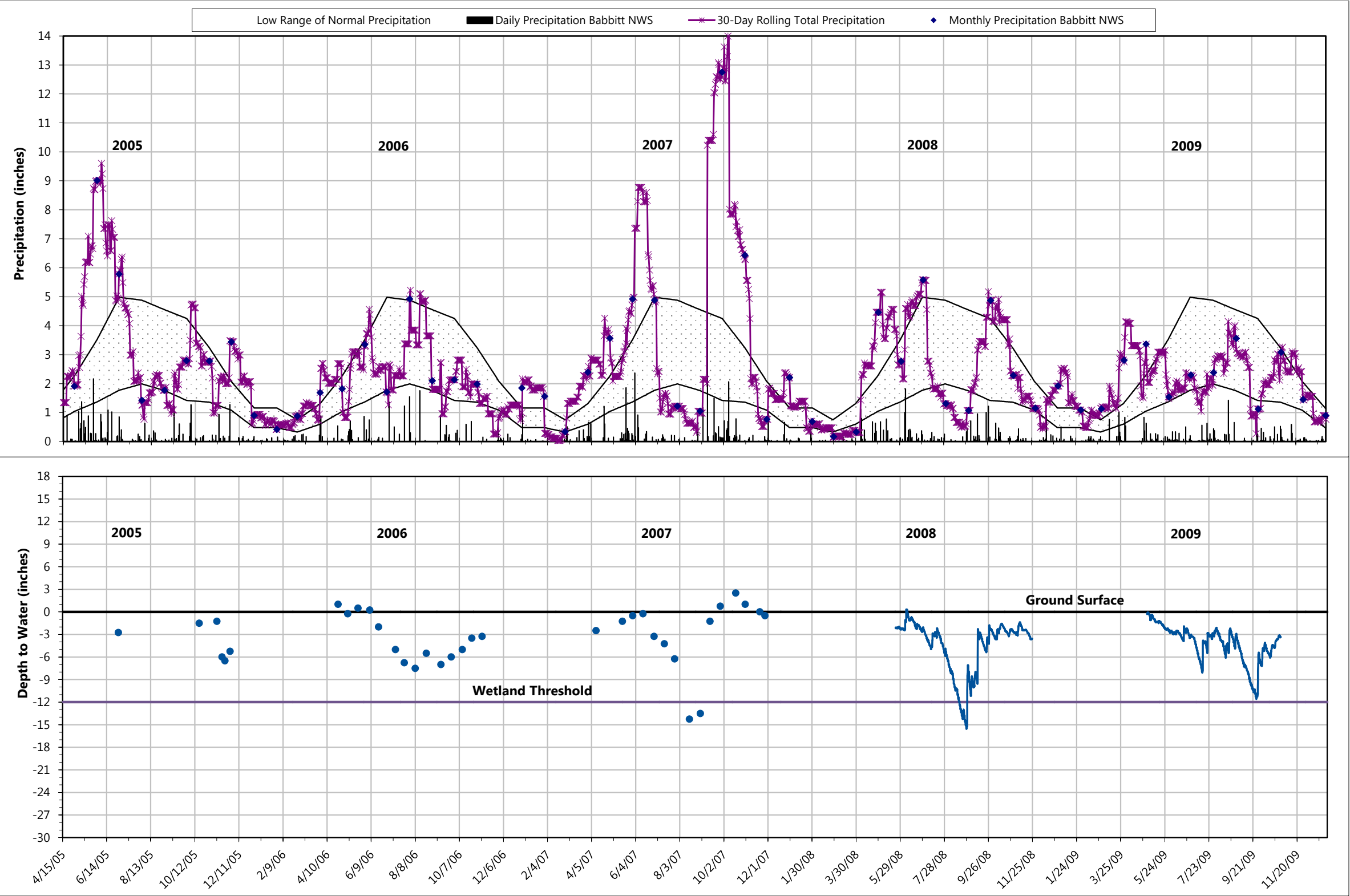


Figure 16-1
 WETLAND MONITORING WELL 16
 2008-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota



Points represent manual well measurements.
Lines represent electronic well measurements.

Figure 16-2a
WETLAND MONITORING WELL 16
2005-2009 WETLAND HYDROLOGY MONITORING DATA
NorthMet Project
Poly Met Mining, Inc.
Hoyt Lakes, Minnesota

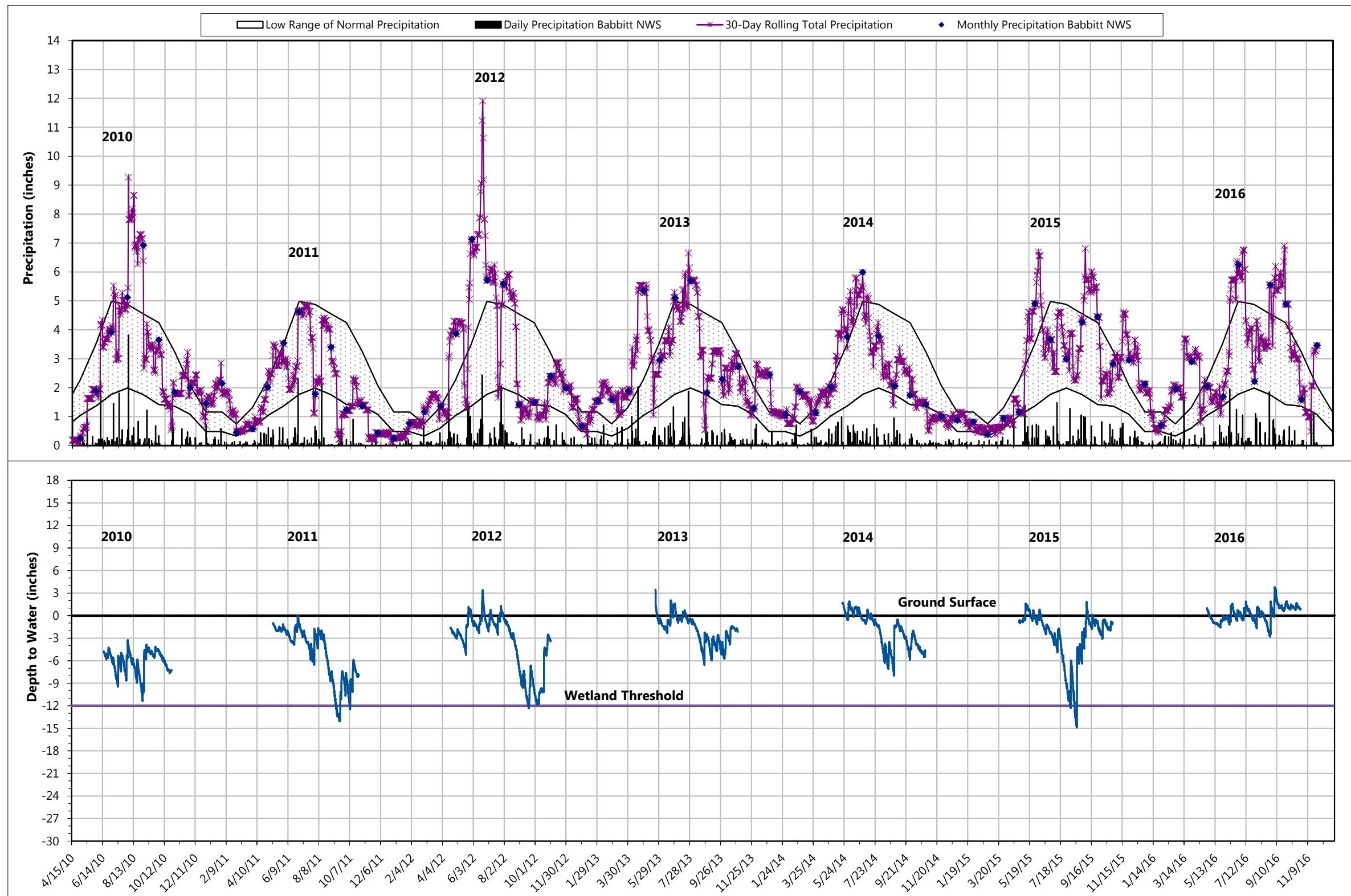


Figure 16-2b
 WETLAND MONITORING WELL 16
 2010-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

NorthMet Project Hydrology Monitoring – Well 16



May 2008



June 2009



May 2010



May 2011



June 2012



June 2013

NorthMet Project Hydrology Monitoring – Well 16



June 2014



May 2015



June 2016

Well ID: 17

NorthMet Project Area: Mine Site

Wetland Number: 103

Wetland Type: Coniferous Bog (Type 8)

UTM Coordinates (NAD 83 Zone 15)

Easting: 575812

Northing: 5273791

Growing Season: May 9-October 6 (151 days)

Water Level Fluctuation for All Years: NA

Well Type(s): Manual

Date Recording Well Installed: NA

Installed By: NA

Water Level Recorded Every: NA

Date Manual Well Installed: 6/29/2005

Installed By: Barr

Manual Water Levels Read: Monthly

Monitored by: NTS

Notes: No recording well was installed. Only manual readings were collected for this well. Well was removed from study on 11/27/2007.

Table 17-1. Monitoring Period Each Year¹. See the hydrographs in Figure 17-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Start Date	M	M	M	---	---	---	---	---	---	---	---	---
End Date	M	M	M	---	---	---	---	---	---	---	---	---
Total Days	M	M	M	---	---	---	---	---	---	---	---	---
Grow. Seas. Days	M	M	M	---	---	---	---	---	---	---	---	---

¹ Manual (M) well only at this location. No wells at the location (---). Day ranges and Growing Season (Grow. Seas.) Days in this table represent full calendar days.

Table 17-2. Precipitation During Each Growing Season and Water Year¹. See the yearly hydrographs in Figure 17-2.

Year		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Growing Season	May	A	N	A	N	B	B	A	A	N	A	A	B
	June	A	B	N	A	B	N	N	A	A	A	N	A
	July	B	A	B	B	B	A	B	A	A	N	B	B
	Aug	B	B	B	B	N	A	N	B	B	N	N	A
	Sept	B	B	A	A	B	N	B	B	B	B	N	A
Water Year		A	B	A	A	B	N	B	A	A	N	B	A

¹ The growing season includes precipitation during May through September and the water year includes precipitation from October 1 of the previous year through September 30 of the current year. Each time period, the precipitation is represented as: within the normal range of precipitation (N), below the normal range of precipitation (B), or above the normal range of precipitation (A).

Table 17-3. Hydroperiod(s) for Each Year During the Growing Season¹. Total number of days water level is ≥ 12 " below ground level for 14 or more consecutive days during the growing season. The yearly hydrographs are shown in Figure 17-2.

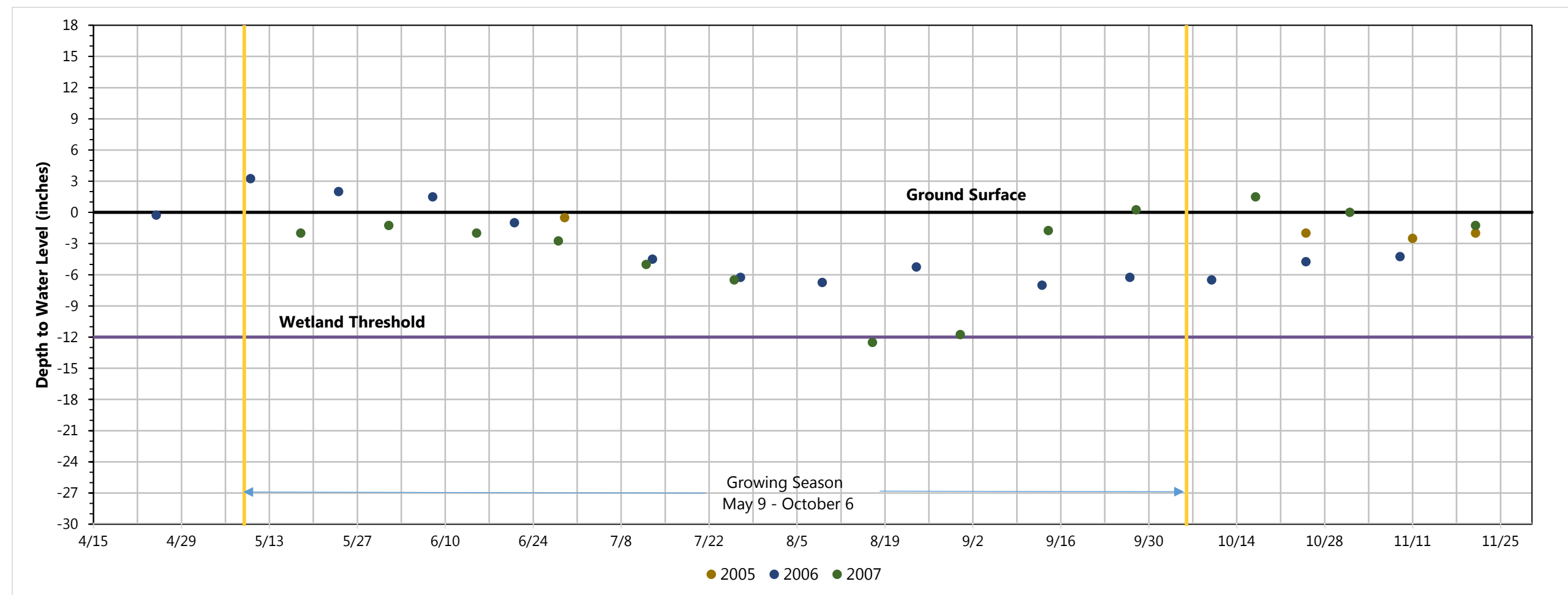
Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# of Periods ≥ 14 Consecutive Days	M	M	M	---	---	---	---	---	---	---	---	---
Total Days	M	M	M	---	---	---	---	---	---	---	---	---
% Grow. Seas.	M	M	M	---	---	---	---	---	---	---	---	---

¹ Hydroperiods were not determined for locations with only a Manual (M) well. No wells at the location (---). The total days counted for the hydroperiod may not match the total days monitored within a growing season (Grow. Seas.) because the hydroperiod date count does not include partial days.

Table 17-4. Water Level Fluctuations During the Growing Season (inches)¹. Yearly fluctuations are shown in Figure 17-1.

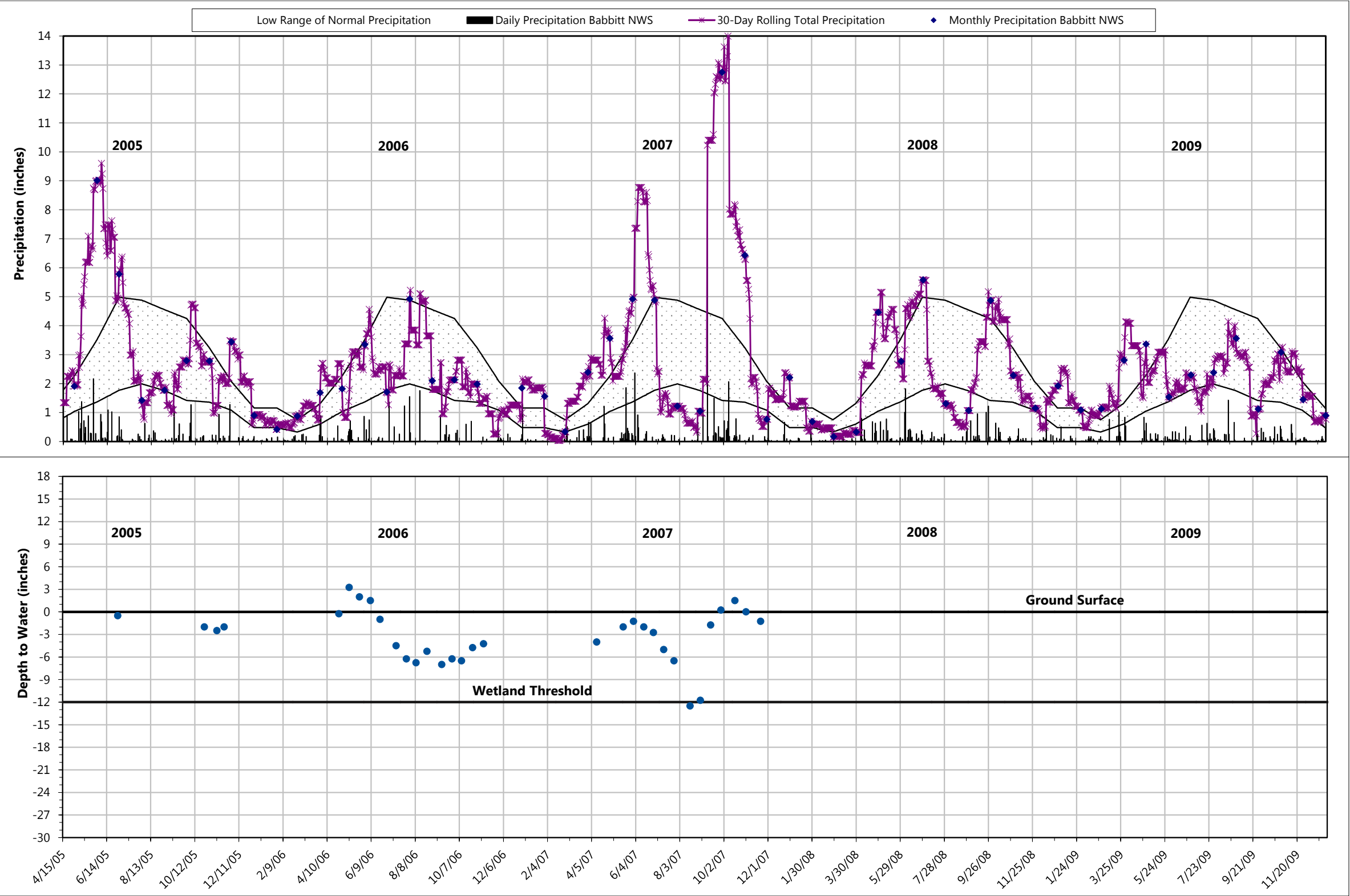
Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum (in.)	M	M	M	---	---	---	---	---	---	---	---	---
Maximum (in.)	M	M	M	---	---	---	---	---	---	---	---	---
Fluctuation (in.)	M	M	M	---	---	---	---	---	---	---	---	---

¹ Fluctuations in water level were not determined for locations with only a Manual (M) well. No wells at the location (---). Some water level depths were deeper than the bottom of the well casing (<) resulting in greater fluctuations than indicated in the data (>).



Points represent manual readings.

Figure 17-1
 WETLAND MONITORING WELL 17
 2005-2007 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota



Points represent manual well measurements.

Figure 17-2
WETLAND MONITORING WELL 17
2005-2007 WETLAND HYDROLOGY MONITORING DATA
NorthMet Project
Poly Met Mining, Inc.
Hoyt Lakes, Minnesota

NorthMet Project Hydrology Monitoring – Well 17

No photographs are available for Well 17

Well ID: 18
NorthMet Project Area: Mine Site
Wetland Number: 100
Wetland Type: Coniferous Bog (Type 8)

UTM Coordinates (NAD 83 Zone 15)
Easting: 577107
Northing: 5274695

Growing Season: May 9-October 6 (151 days)

Water Level Fluctuation for All Years: 16.1 inches

Well Type(s): Ecotone and Manual

Date Recording Well Installed: 5/22/2008
Installed By: Barr/NTS
Water Level Recorded Every: 4 hours

Date Manual Well Installed: 10/25/2005
Installed By: Barr/NTS
Manual Water Levels Read: Monthly

Monitored by: NTS

Notes: Recording and manual wells removed from study on 10/29/2009. UTM coordinates were for recording well.

Table 18-1. Monitoring Period Each Year¹. See the hydrographs in Figure 18-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Start Date	M	M	M	5/22	4/29	---	---	---	---	---	---	---
End Date	M	M	M	11/25	10/28	---	---	---	---	---	---	---
Total Days	M	M	M	188	183	---	---	---	---	---	---	---
Grow. Seas. Days	M	M	M	138	151	---	---	---	---	---	---	---

¹ Manual (M) well only at this location. No wells at the location (---). Day ranges and Growing Season (Grow. Seas.) Days in this table represent full calendar days.

Table 18-2. Precipitation During Each Growing Season and Water Year¹. See the yearly hydrographs in Figure 18-2.

Year		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Growing Season	May	A	N	A	N	B	B	A	A	N	A	A	B
	June	A	B	N	A	B	N	N	A	A	A	N	A
	July	B	A	B	B	B	A	B	A	A	N	B	B
	Aug	B	B	B	B	N	A	N	B	B	N	N	A
	Sept	B	B	A	A	B	N	B	B	B	B	N	A
Water Year		A	B	A	A	B	N	B	A	A	N	B	A

¹ The growing season includes precipitation during May through September and the water year includes precipitation from October 1 of the previous year through September 30 of the current year. Each time period, the precipitation is represented as: within the normal range of precipitation (N), below the normal range of precipitation (B), or above the normal range of precipitation (A).

Table 18-3. Hydroperiod(s) for Each Year During the Growing Season¹. Total number of days water level is ≥ 12 " below ground level for 14 or more consecutive days during the growing season. The yearly hydrographs are shown in Figure 18-2.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# of Periods ≥ 14 Consecutive Days	M	M	M	2	1	---	---	---	---	---	---	---
Total Days	M	M	M	102	119	---	---	---	---	---	---	---
% Grow. Seas.	M	M	M	74%	79%	---	---	---	---	---	---	---

¹ Hydroperiods were not determined for locations with only a Manual (M) well. No wells at the location (---). The total days counted for the hydroperiod may not match the total days monitored within a growing season (Grow. Seas.) because the hydroperiod date count does not include partial days.

Table 18-4. Water Level Fluctuations During the Growing Season (inches)¹. Yearly fluctuations are shown in Figure 18-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum (in.)	M	M	M	-16.8	-16.0	---	---	---	---	---	---	---
Maximum (in.)	M	M	M	-0.7	-3.1	---	---	---	---	---	---	---
Fluctuation (in.)	M	M	M	16.1	12.9	---	---	---	---	---	---	---

¹ Fluctuations in water level were not determined for locations with only a Manual (M) well. No wells at the location (---). Some water level depths were deeper than the bottom of the well casing (<) resulting in greater fluctuations than indicated in the data (>).

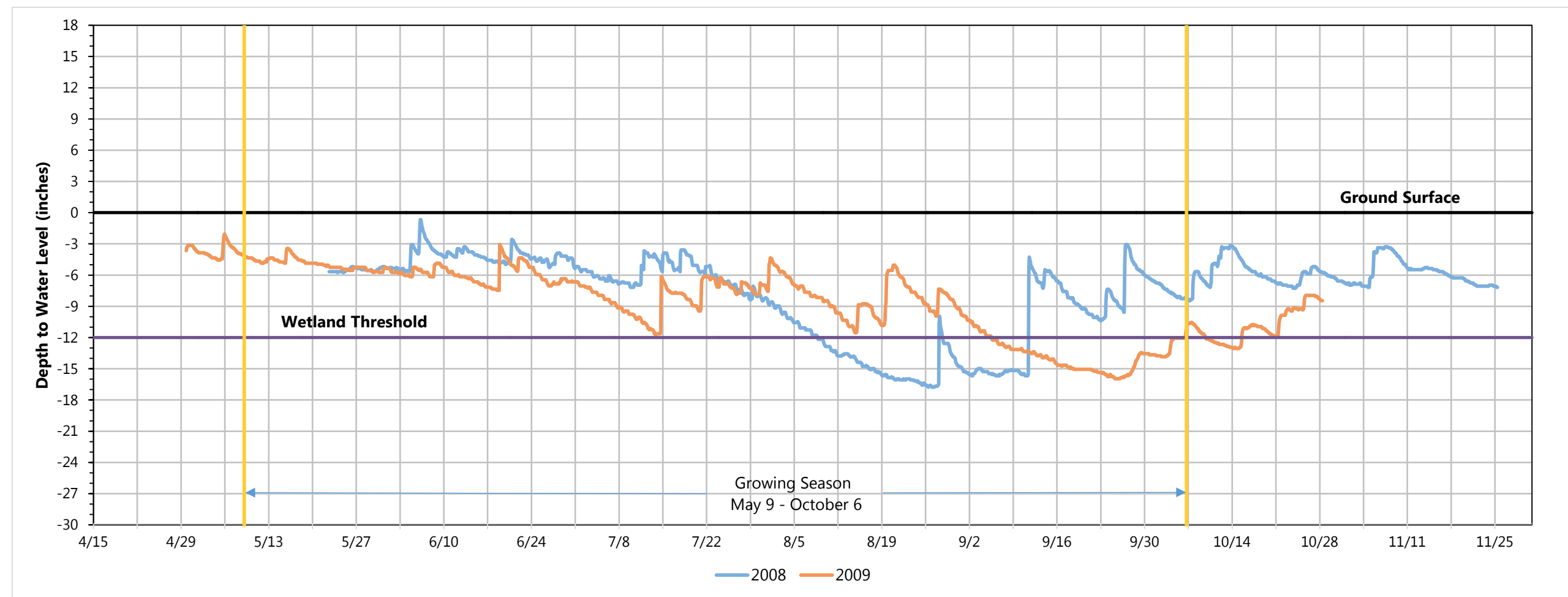
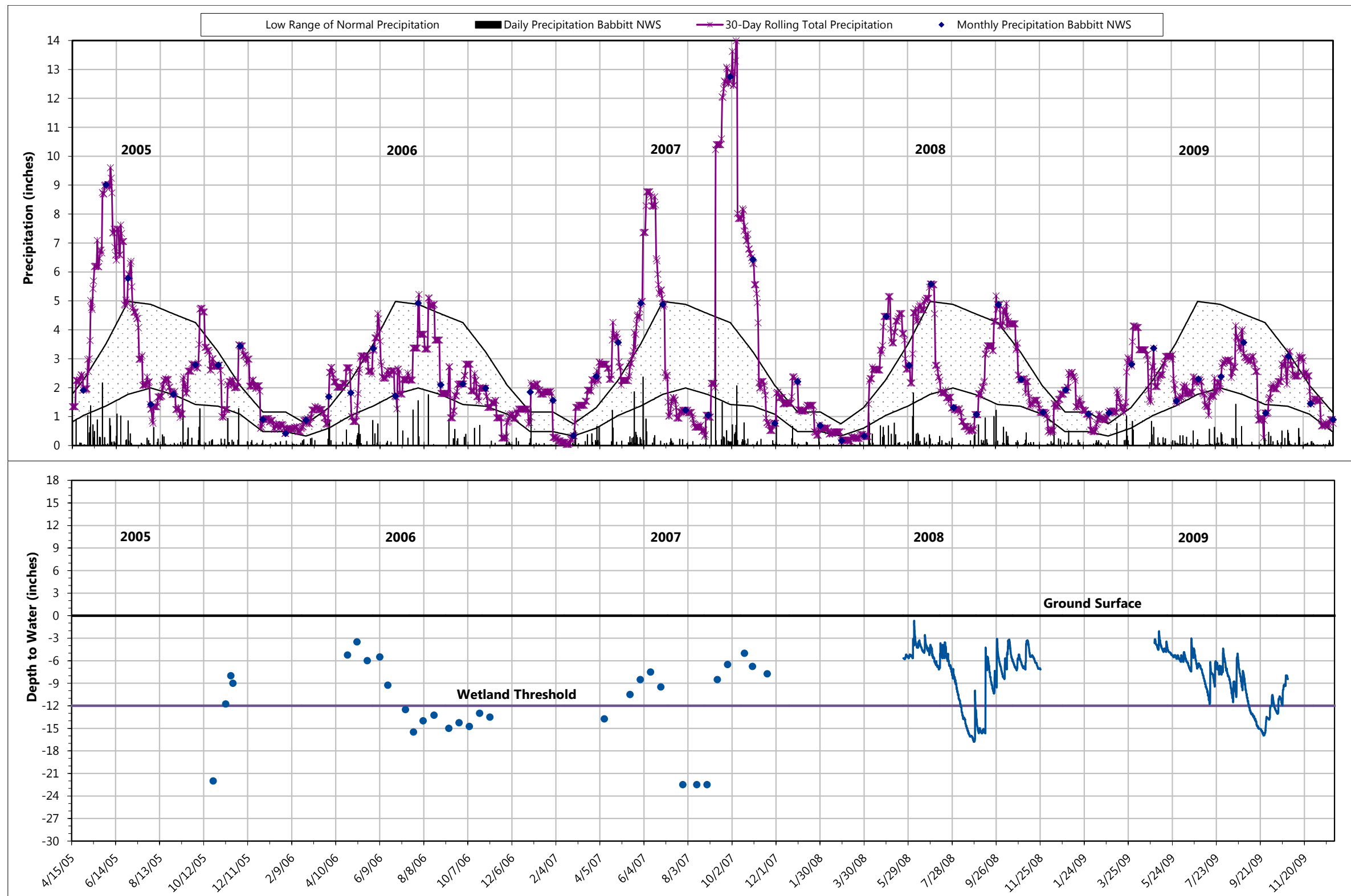


Figure 18-1
WETLAND MONITORING WELL 18
2008-2009 WETLAND HYDROLOGY MONITORING DATA
NorthMet Project
Poly Met Mining, Inc.
Hoyt Lakes, Minnesota



Points represent manual well measurements.
Lines represent electronic well measurements.

Figure 18-2
WETLAND MONITORING WELL 18
2005-2009 WETLAND HYDROLOGY MONITORING DATA
NorthMet Project
Poly Met Mining, Inc.
Hoyt Lakes, Minnesota

NorthMet Project Hydrology Monitoring – Well 18

June 2005 – No photo available

June 2006 – No photo available

June 2007 – No photo available

June 2008 – No photo available



June 2009

Well ID: 19

NorthMet Project Area: Mine Site

Wetland Number: 107

Wetland Type: Coniferous Bog (Type 8)

UTM Coordinates (NAD 83 Zone 15)

Easting: 575721

Northing: 5272927

Well Type(s): Ecotone and Manual

Date Recording Well Installed: 5/21/2008

Installed By: Barr/NTS

Water Level Recorded Every: 4 hours

Date Manual Well Installed: 6/28/2005

Installed By: Barr

Manual Water Levels Read: Monthly

Growing Season: May 9-October 6 (151 days)

Monitored by: NTS

Water Level Fluctuation for All Years: 27.9 inches

Notes: Well removed from study on 10/29/2009. UTM coordinates were for recording well

Table 19-1. Monitoring Period Each Year¹. See the hydrographs in Figure 19-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Start Date	M	M	M	5/21	4/28	---	---	---	---	---	---	---
End Date	M	M	M	11/24	10/28	---	---	---	---	---	---	---
Total Days	M	M	M	188	184	---	---	---	---	---	---	---
Grow. Seas. Days	M	M	M	139	151	---	---	---	---	---	---	---

¹ Manual (M) well only at this location. No wells at the location (---). Day ranges and Growing Season (Grow. Seas.) Days in this table represent full calendar days.

Table 19-2. Precipitation During Each Growing Season and Water Year¹. See the yearly hydrographs in Figure 19-2.

Year		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Growing Season	May	A	N	A	N	B	B	A	A	N	A	A	B
	June	A	B	N	A	B	N	N	A	A	A	N	A
	July	B	A	B	B	B	A	B	A	A	N	B	B
	Aug	B	B	B	B	N	A	N	B	B	N	N	A
	Sept	B	B	A	A	B	N	B	B	B	B	N	A
Water Year		A	B	A	A	B	N	B	A	A	N	B	A

¹ The growing season includes precipitation during May through September and the water year includes precipitation from October 1 of the previous year through September 30 of the current year. Each time period, the precipitation is represented as: within the normal range of precipitation (N), below the normal range of precipitation (B), or above the normal range of precipitation (A).

Table 19-3. Hydroperiod(s) for Each Year During the Growing Season¹. Total number of days water level is ≥ 12 " below ground level for 14 or more consecutive days during the growing season. The yearly hydrographs are shown in Figure 19-2.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# of Periods ≥ 14 Consecutive Days	M	M	M	2	1	---	---	---	---	---	---	---
Total Days	M	M	M	105	139	---	---	---	---	---	---	---
% Grow. Seas.	M	M	M	76%	92%	---	---	---	---	---	---	---

¹ Hydroperiods were not determined for locations with only a Manual (M) well. No wells at the location (---). The total days counted for the hydroperiod may not match the total days monitored within a growing season (Grow. Seas.) because the hydroperiod date count does not include partial days.

Table 19-4. Water Level Fluctuations During the Growing Season (inches)¹. Yearly fluctuations are shown in Figure 19-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum (in.)	M	M	M	-25.5	-12.4	---	---	---	---	---	---	---
Maximum (in.)	M	M	M	1.9	2.4	---	---	---	---	---	---	---
Fluctuation (in.)	M	M	M	27.3	14.8	---	---	---	---	---	---	---

¹ Fluctuations in water level were not determined for locations with only a Manual (M) well. No wells at the location (---). Some water level depths were deeper than the bottom of the well casing (<) resulting in greater fluctuations than indicated in the data (>).

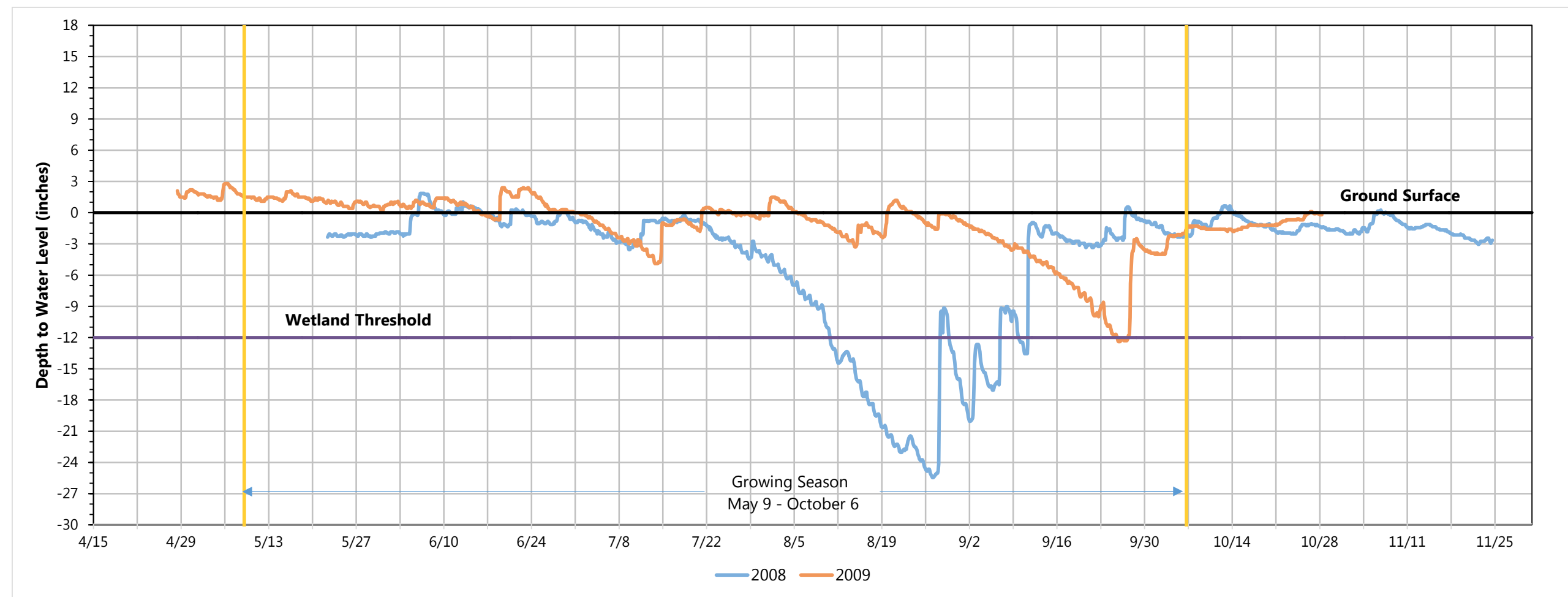
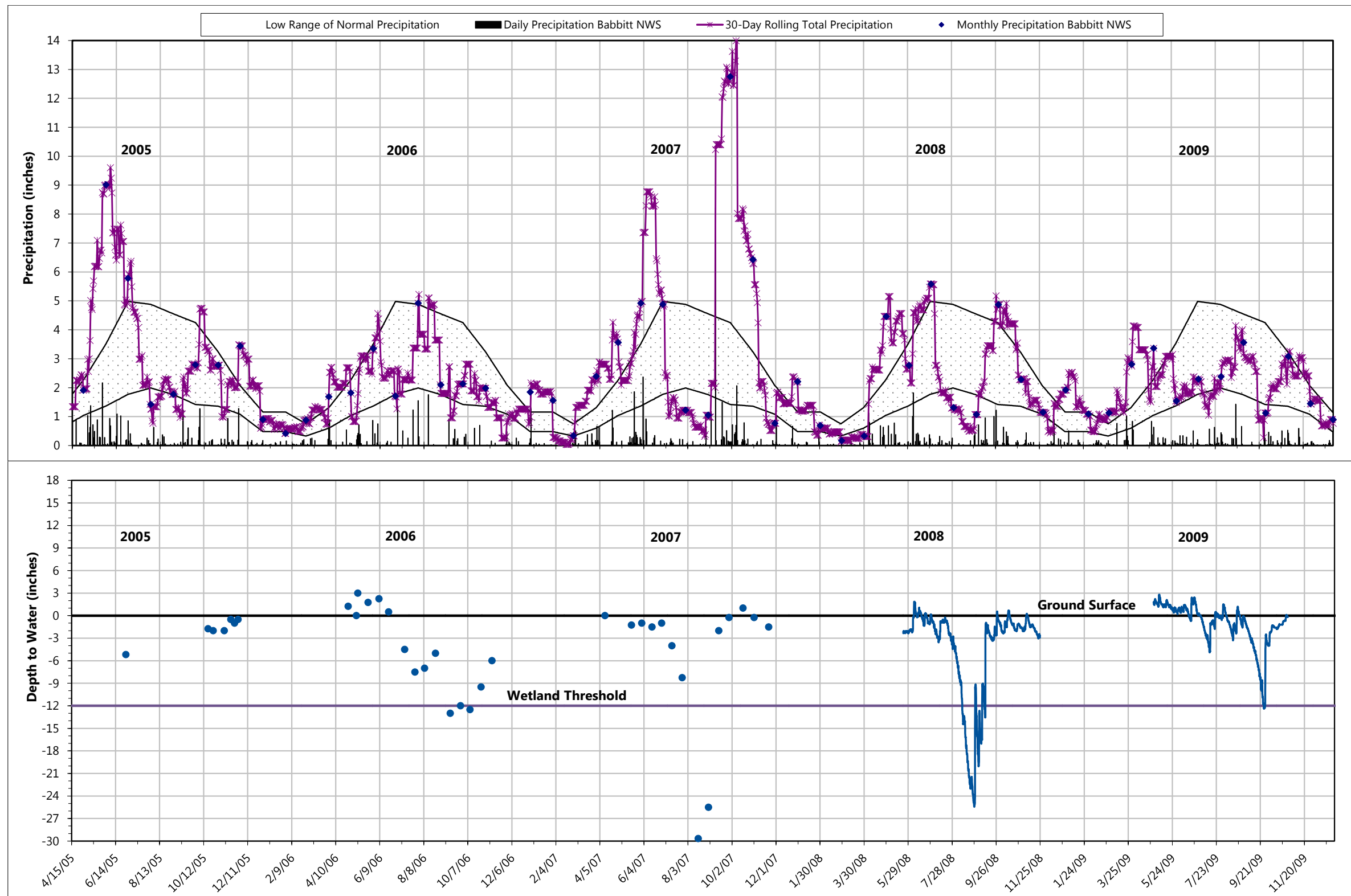


Figure 19-1
WETLAND MONITORING WELL 19
2008-2009 WETLAND HYDROLOGY MONITORING DATA
NorthMet Project
Poly Met Mining, Inc.
Hoyt Lakes, Minnesota



Points represent manual well measurements.
Lines represent electronic well measurements.

Figure 19-2
WETLAND MONITORING WELL 19
2005-2009 WETLAND HYDROLOGY MONITORING DATA
NorthMet Project
Poly Met Mining, Inc.
Hoyt Lakes, Minnesota

NorthMet Project Hydrology Monitoring – Well 19



June 2005

June 2006 – No photo available



June 2007 – No photo available

May 2008



June 2009

Well ID: 21

NorthMet Project Area: Mine Site

Wetland Number: 48

Wetland Type: Coniferous Bog (Type 8)

UTM Coordinates (NAD 83 Zone 15)

Easting: 578593

Northing: 5274381

Well Type(s): Ecotone and Manual

Date Recording Well Installed: 5/22/2008

Installed By: Barr/NTS

Water Level Recorded Every: 4 hours

Date Manual Well Installed: 5/22/2008

Installed By: Barr/NTS

Manual Water Levels Read: Monthly

Growing Season: May 9-October 6 (151 days)

Monitored by: NTS

Water Level Fluctuation for All Years: 18.5 inches

Notes: UTM coordinates are for recording well.

Table 21-1. Monitoring Period Each Year¹. See the hydrographs in Figure 21-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Start Date	---	---	---	5/22	5/29	5/11	5/11	4/19	5/21	5/20	5/26	4/27
End Date	---	---	---	11/26	10/29	10/28	10/24	10/30	10/28	10/28	10/27	10/25
Total Days	---	---	---	189	154	171	167	195	161	162	155	182
Grow. Seas. Days	---	---	---	138	131	149	149	151	139	140	134	151

¹ Manual (M) well only at this location. No wells at the location (---). Day ranges and Growing Season (Grow. Seas.) Days in this table represent full calendar days.

Table 21-2. Precipitation During Each Growing Season and Water Year¹. See the yearly hydrographs in Figure 21-2.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Growing Season	May	A	N	A	N	B	B	A	A	N	A	B
	June	A	B	N	A	B	N	N	A	A	N	A
	July	B	A	B	B	B	A	B	A	A	N	B
	Aug	B	B	B	B	N	A	N	B	B	N	N
	Sept	B	B	A	A	B	N	B	B	B	N	A
Water Year	A	B	A	A	B	N	B	A	A	N	B	A

¹ The growing season includes precipitation during May through September and the water year includes precipitation from October 1 of the previous year through September 30 of the current year. Each time period, the precipitation is represented as: within the normal range of precipitation (N), below the normal range of precipitation (B), or above the normal range of precipitation (A).

Table 21-3. Hydroperiod(s) for Each Year During the Growing Season¹. Total number of days water level is ≥ 12 " below ground level for 14 or more consecutive days during the growing season. The yearly hydrographs are shown in Figure 21-2.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# of Periods ≥ 14 Consecutive Days	---	---	---	2	1	1	1	1	1	1	1	1
Total Days	---	---	---	124	130	148	148	151	138	139	133	151
% Grow. Seas.	---	---	---	90%	99%	99%	99%	100%	99%	99%	99%	100%

¹ Hydroperiods were not determined for locations with only a Manual (M) well. No wells at the location (---). The total days counted for the hydroperiod may not match the total days monitored within a growing season (Grow. Seas.) because the hydroperiod date count does not include partial days.

Table 21-4. Water Level Fluctuations During the Growing Season (inches)¹. Yearly fluctuations are shown in Figure 21-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum (in.)	---	---	---	-14.6	-10.8	-8.2	-11.2	-10.9	-6.0	-5.9	-10.8	-2.3
Maximum (in.)	---	---	---	-0.8	-1.7	0.9	0.3	2.8	2.1	1.3	2.7	3.9
Fluctuation (in.)	---	---	---	13.8	9.1	9.1	11.5	13.7	8.0	7.2	13.5	6.2

¹ Fluctuations in water level were not determined for locations with only a Manual (M) well. No wells at the location (---). Some water level depths were deeper than the bottom of the well casing (<) resulting in greater fluctuations than indicated in the data (>).

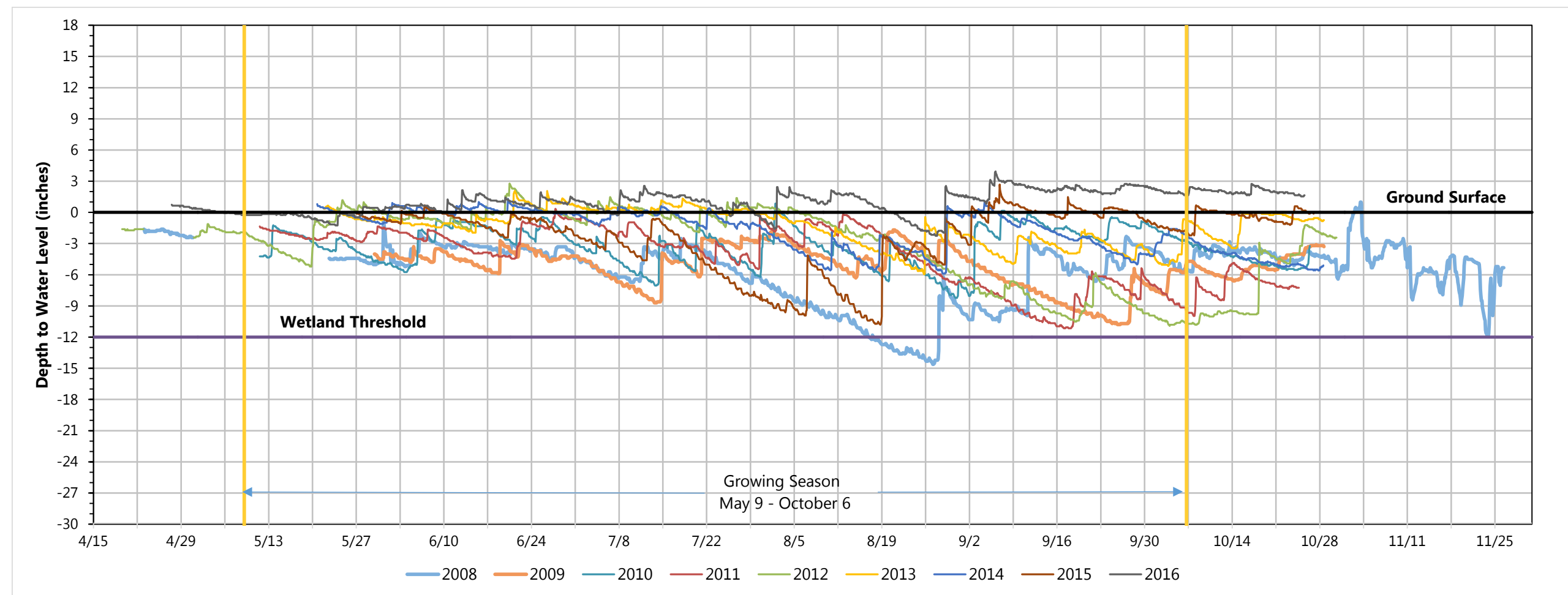


Figure 21-1
WETLAND MONITORING WELL 21
2008-2016 WETLAND HYDROLOGY MONITORING DATA
NorthMet Project
Poly Met Mining, Inc.
Hoyt Lakes, Minnesota

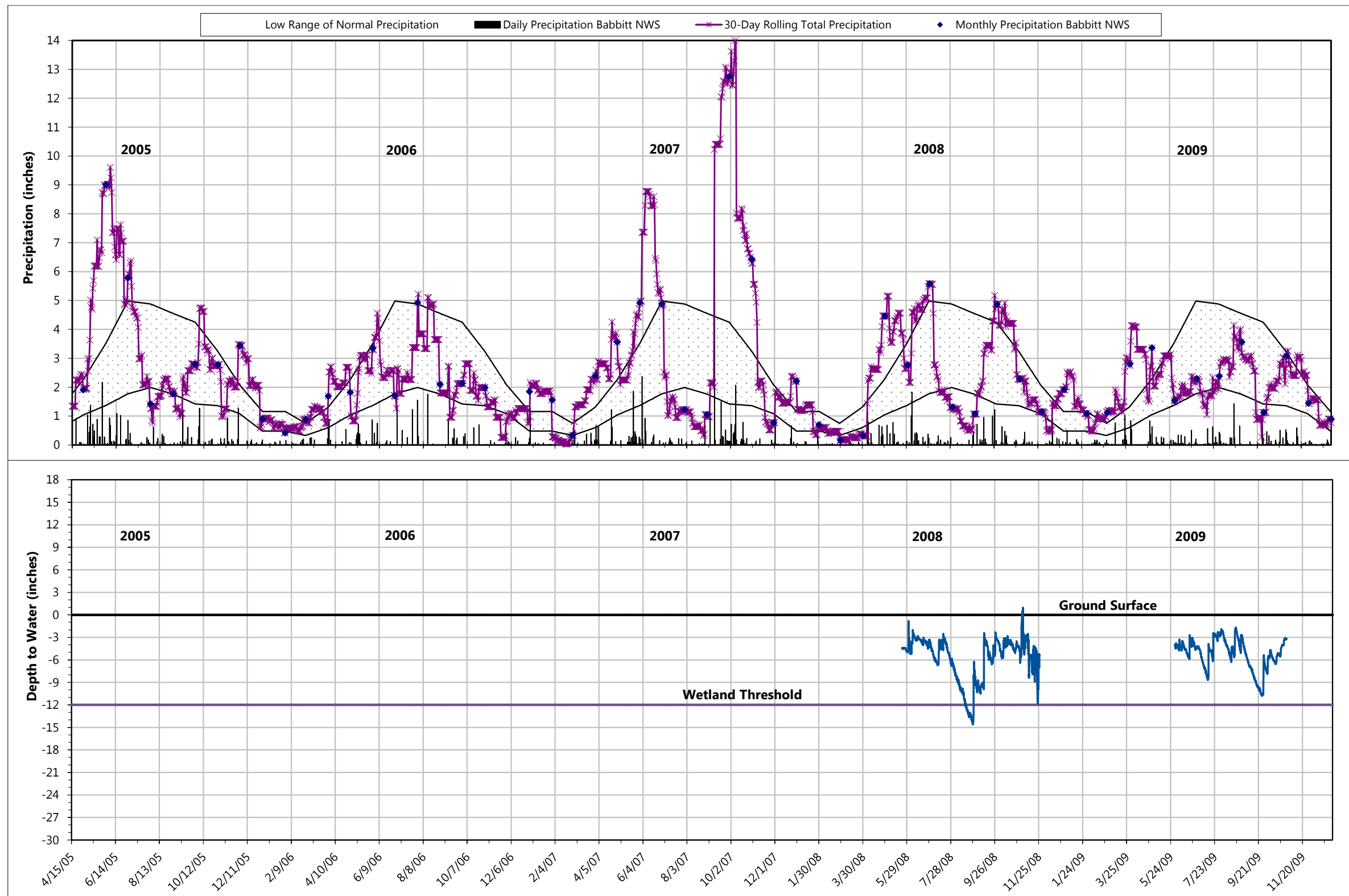


Figure 21-2a
 WETLAND MONITORING WELL 21
 2008-2009 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

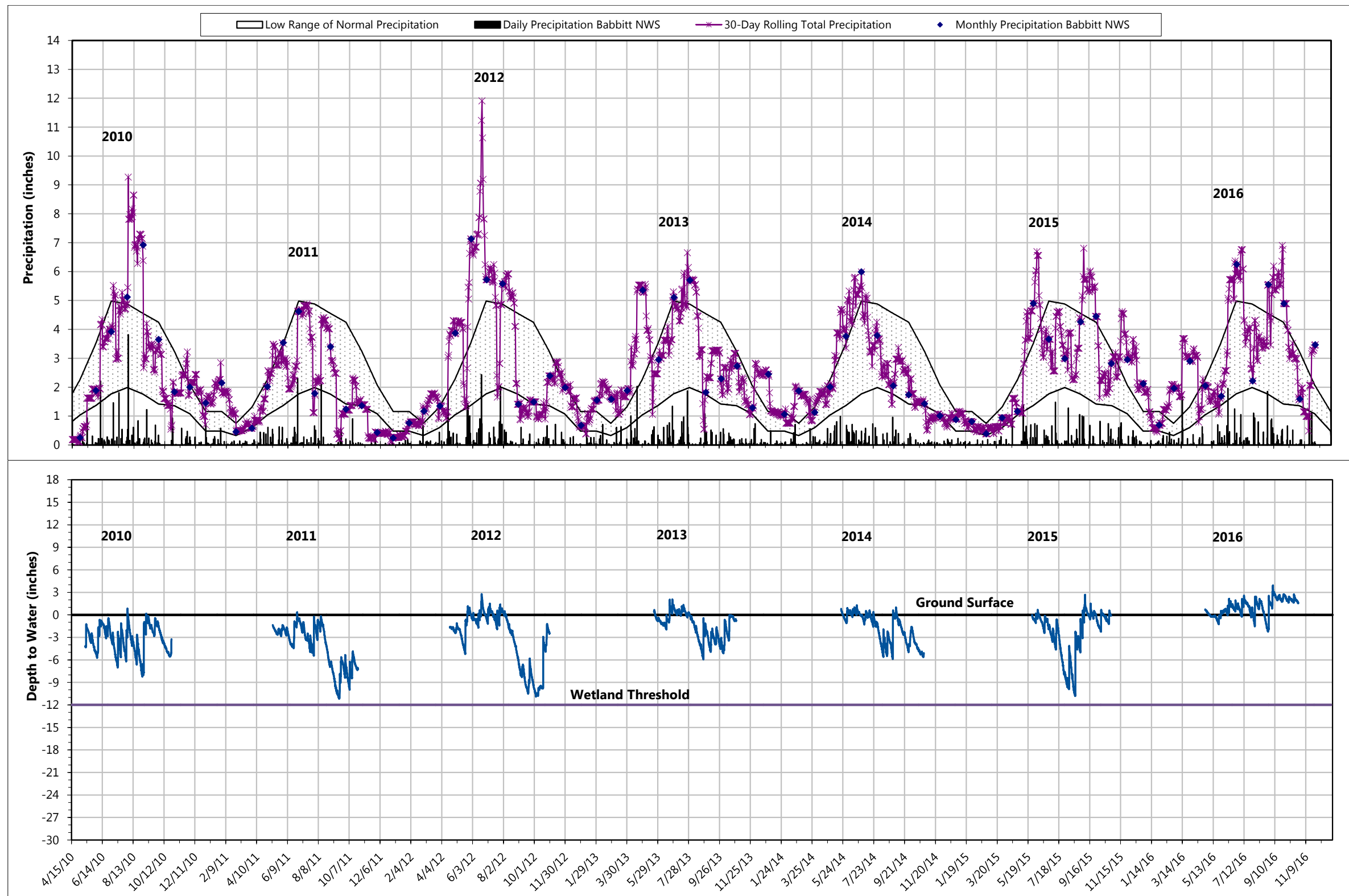


Figure 21-2b
WETLAND MONITORING WELL 21
2010-2016 WETLAND HYDROLOGY MONITORING DATA
NorthMet Project
Poly Met Mining, Inc.
Hoyt Lakes, Minnesota

NorthMet Project Hydrology Monitoring – Well 21



May 2008



June 2009



June 2010



June 2011



June 2012



June 2013

NorthMet Project Hydrology Monitoring – Well 21



June 2014



May 2015



June 2016

Well ID: 22

NorthMet Project Area: Mine Site

Wetland Number: 48

Wetland Type: Coniferous Bog (Type 8)

UTM Coordinates (NAD 83 Zone 15)

Easting: 577268

Northing: 5274214

Well Type(s): Ecotone and Manual

Date Recording Well Installed: 5/22/2008

Installed By: Barr/NTS

Water Level Recorded Every: 4 hours

Date Manual Well Installed: 5/22/2008

Installed By: Barr/NTS

Manual Water Levels Read: Monthly

Growing Season: May 9-October 6 (151 days)

Monitored by: NTS

Water Level Fluctuation for All Years: 33.0 inches

Notes: UTM coordinates are for recording well.

Table 22-1. Monitoring Period Each Year¹. See the hydrographs in Figure 22-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Start Date	---	---	---	5/22	4/29	5/12	5/10	4/19	5/22	5/21	4/29	4/27
End Date	---	---	---	11/25	10/28	10/27	10/25	10/31	10/29	10/29	10/28	10/26
Total Days	---	---	---	188	183	169	169	196	161	162	183	183
Grow. Seas. Days	---	---	---	138	151	148	150	151	138	139	151	151

¹ Manual (M) well only at this location. No wells at the location (---). Day ranges and Growing Season (Grow. Seas.) Days in this table represent full calendar days.

Table 22-2. Precipitation During Each Growing Season and Water Year¹. See the yearly hydrographs in Figure 22-2.

Year		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Growing Season	May	A	N	A	N	B	B	A	A	N	A	A	B
	June	A	B	N	A	B	N	N	A	A	A	N	A
	July	B	A	B	B	B	A	B	A	A	N	B	B
	Aug	B	B	B	B	N	A	N	B	B	N	N	A
	Sept	B	B	A	A	B	N	B	B	B	B	N	A
Water Year		A	B	A	A	B	N	B	A	A	N	B	A

¹ The growing season includes precipitation during May through September and the water year includes precipitation from October 1 of the previous year through September 30 of the current year. Each time period, the precipitation is represented as: within the normal range of precipitation (N), below the normal range of precipitation (B), or above the normal range of precipitation (A).

Table 22-3. Hydroperiod(s) for Each Year During the Growing Season¹. Total number of days water level is ≥ 12 " below ground level for 14 or more consecutive days during the growing season. The yearly hydrographs are shown in Figure 22-2.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# of Periods ≥ 14 Consecutive Days	---	---	---	2	1	3	1	1	1	2	2	1
Total Days	---	---	---	103	127	127	107	112	109	110	128	151
% Grow. Seas.	---	---	---	75%	84%	86%	71%	74%	79%	79%	85%	100%

¹ Hydroperiods were not determined for locations with only a Manual (M) well. No wells at the location (---). The total days counted for the hydroperiod may not match the total days monitored within a growing season (Grow. Seas.) because the hydroperiod date count does not include partial days.

Table 22-4. Water Level Fluctuations During the Growing Season (inches)¹. Yearly fluctuations are shown in Figure 22-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum (in.)	---	---	---	-24.7	-21.3	-20.3	-28.3	-28.4	-18.3	-16.9	-18.9	-6.2
Maximum (in.)	---	---	---	2.0	-0.9	-1.2	0.4	3.3	3.9	1.5	4.6	4.5
Fluctuation (in.)	---	---	---	26.7	20.4	19.1	28.7	31.7	22.2	18.4	23.4	10.7

¹ Fluctuations in water level were not determined for locations with only a Manual (M) well. No wells at the location (---). Some water level depths were deeper than the bottom of the well casing (<) resulting in greater fluctuations than indicated in the data (>).

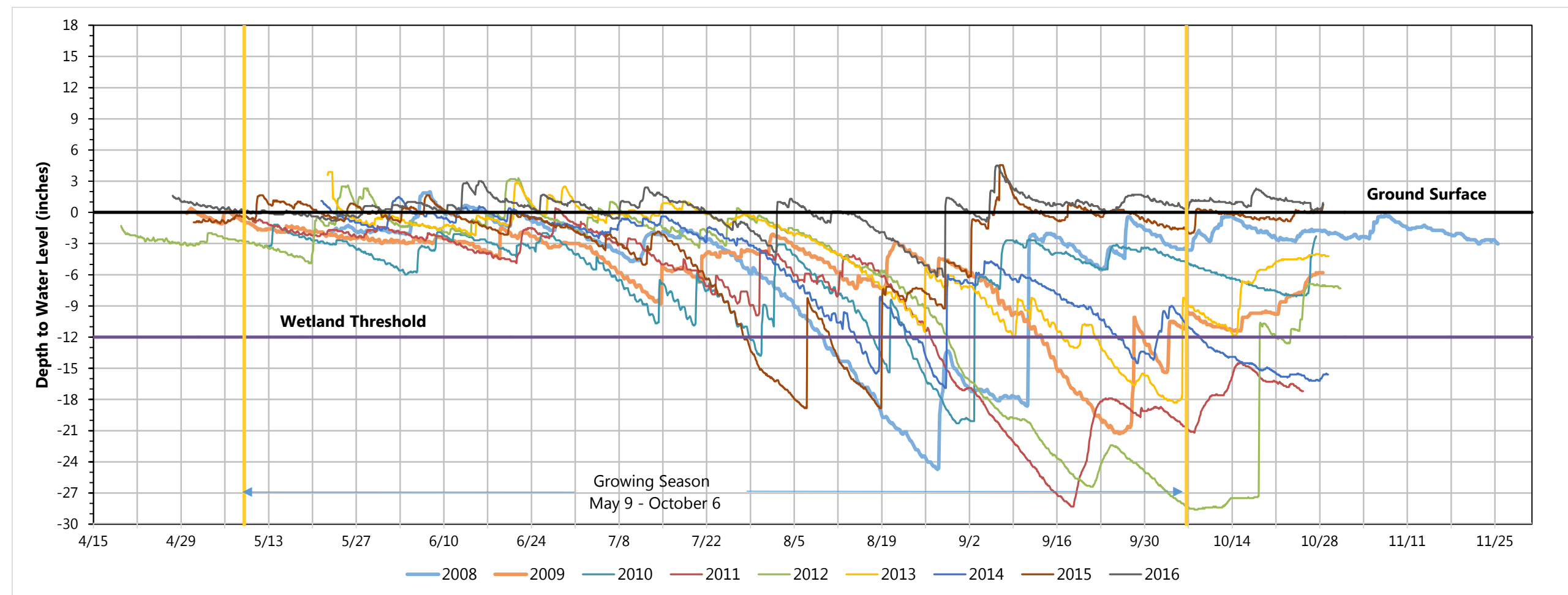


Figure 22-1
 WETLAND MONITORING WELL 22
 2008-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

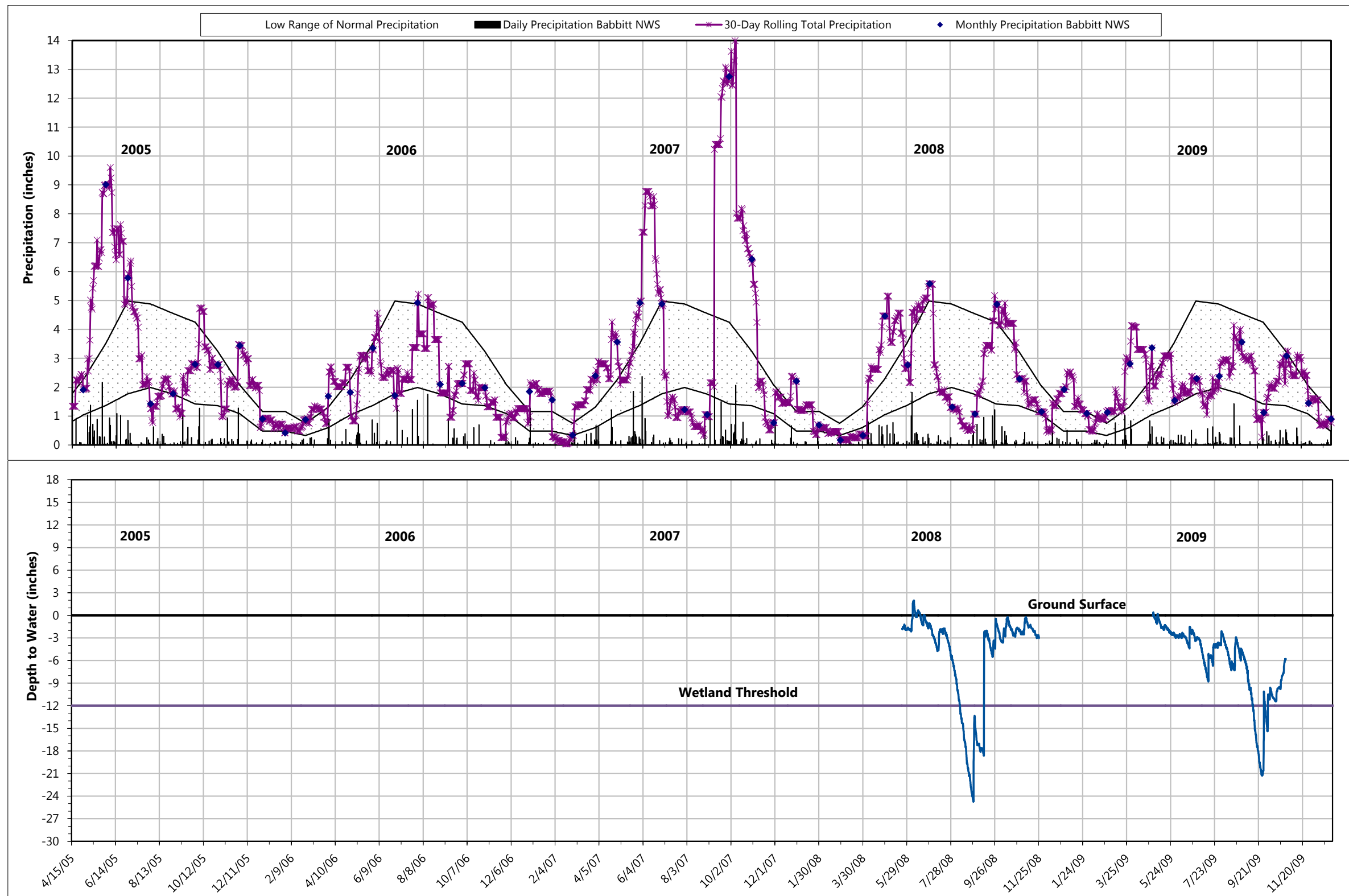


Figure 22-2a
WETLAND MONITORING WELL 22
2008-2009 WETLAND HYDROLOGY MONITORING DATA
NorthMet Project
Poly Met Mining, Inc.
Hoyt Lakes, Minnesota

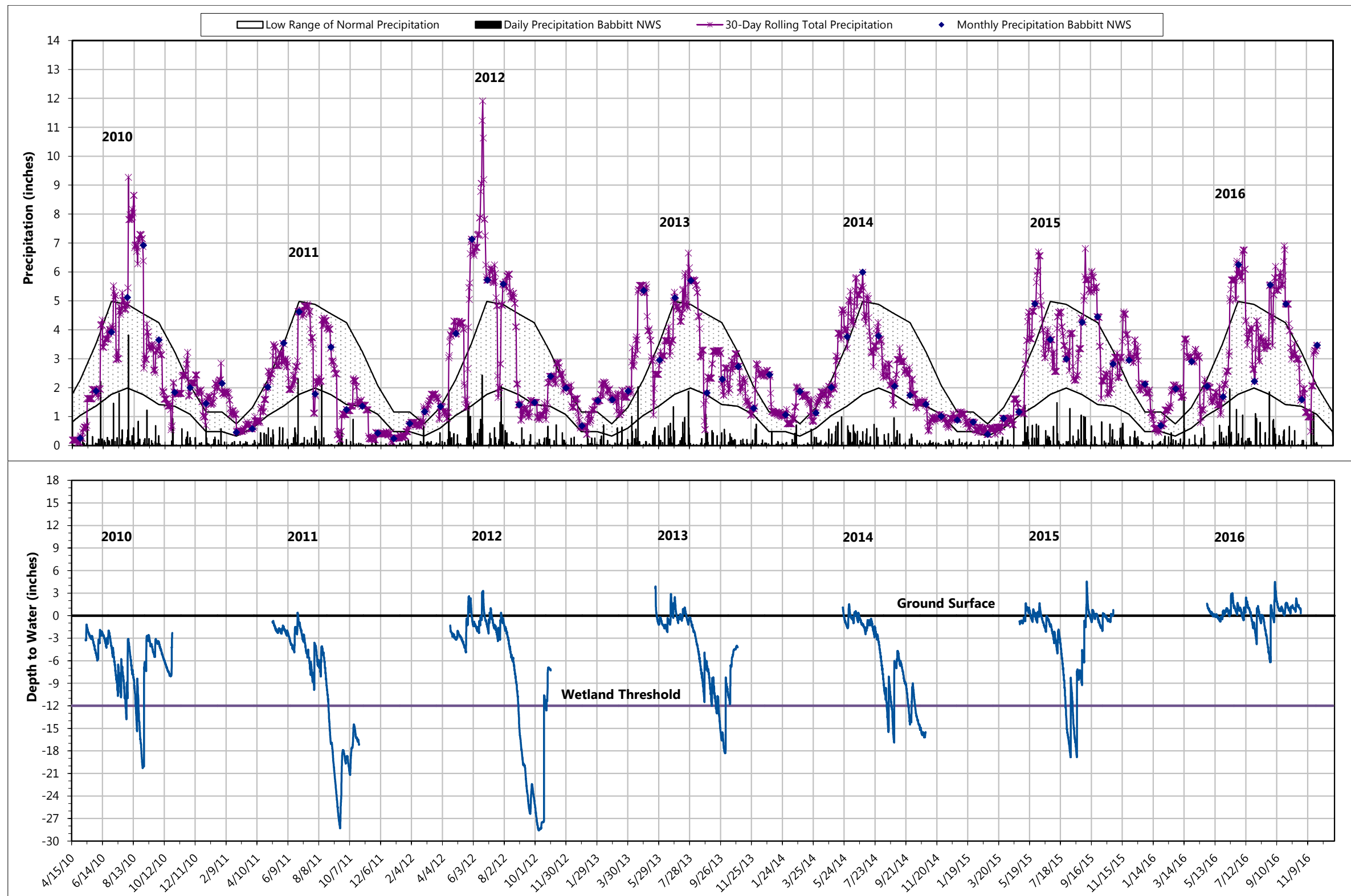


Figure 22-2b
 WETLAND MONITORING WELL 22
 2010-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

NorthMet Project Hydrology Monitoring – Well 22



May 2008



June 2009



June 2010



May 2011



June 2012



June 2013

NorthMet Project Hydrology Monitoring – Well 22



June 2014



May 2015



June 2016

Well ID: 23

NorthMet Project Area: Mine Site

Wetland Number: 45

Wetland Type: Alder Thicket (Type 6)

UTM Coordinates (NAD 83 Zone 15)

Easting: 575391

Northing: 5273113

Well Type(s): Ecotone and Manual

Date Recording Well Installed: 5/10/2010

Installed By: NTS

Water Level Recorded Every: 4 hours

Date Manual Well Installed: 5/10/2010

Installed By: NTS

Manual Water Levels Read: Monthly

Growing Season: May 9-October 6 (151 days)

Monitored by: NTS

Water Level Fluctuation for All Years: 17.9 inches

Notes: UTM coordinates are for recording well.

Table 23-1. Monitoring Period Each Year¹. See the hydrographs in Figure 23-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Start Date	---	---	---	---	---	5/10	6/6	4/18	5/21	5/20	4/28	4/26
End Date	---	---	---	---	---	10/26	10/24	10/30	10/28	10/28	10/28	10/25
Total Days	---	---	---	---	---	170	141	196	161	162	184	183
Grow. Seas. Days	---	---	---	---	---	150	123	151	139	140	151	151

¹ Manual (M) well only at this location. No wells at the location (---). Day ranges and Growing Season (Grow. Seas.) Days in this table represent full calendar days.

Table 23-2. Precipitation During Each Growing Season and Water Year¹. See the yearly hydrographs in Figure 23-2.

Year		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Growing Season	May	A	N	A	N	B	B	A	A	N	A	A	B
	June	A	B	N	A	B	N	N	A	A	A	N	A
	July	B	A	B	B	B	A	B	A	A	N	B	B
	Aug	B	B	B	B	N	A	N	B	B	N	N	A
	Sept	B	B	A	A	B	N	B	B	B	B	N	A
Water Year		A	B	A	A	B	N	B	A	A	N	B	A

¹ The growing season includes precipitation during May through September and the water year includes precipitation from October 1 of the previous year through September 30 of the current year. Each time period, the precipitation is represented as: within the normal range of precipitation (N), below the normal range of precipitation (B), or above the normal range of precipitation (A).

Table 23-3. Hydroperiod(s) for Each Year During the Growing Season¹. Total number of days water level is ≥ 12 " below ground level for 14 or more consecutive days during the growing season. The yearly hydrographs are shown in Figure 23-2.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# of Periods ≥ 14 Consecutive Days	---	---	---	---	---	1	1	1	1	1	1	1
Total Days	---	---	---	---	---	149	122	151	138	139	151	151
% Grow. Seas.	---	---	---	---	---	99%	99%	100%	99%	99%	100%	100%

² Hydroperiods were not determined for locations with only a Manual (M) well. No wells at the location (---). The total days counted for the hydroperiod may not match the total days monitored within a growing season (Grow. Seas.) because the hydroperiod date count does not include partial days.

Table 23-4. Water Level Fluctuations During the Growing Season (inches)¹. Yearly fluctuations are shown in Figure 23-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum (in.)	---	---	---	---	---	-8.6	-9.8	-8.9	-0.6	-1.0	-4.8	2.2
Maximum (in.)	---	---	---	---	---	1.6	4.2	5.8	7.1	6.8	6.5	8.1
Fluctuation (in.)	---	---	---	---	---	10.1	14.0	14.7	7.6	7.8	11.3	5.9

¹ Fluctuations in water level were not determined for locations with only a Manual (M) well. No wells at the location (---). Some water level depths were deeper than the bottom of the well casing (<) resulting in greater fluctuations than indicated in the data (>).

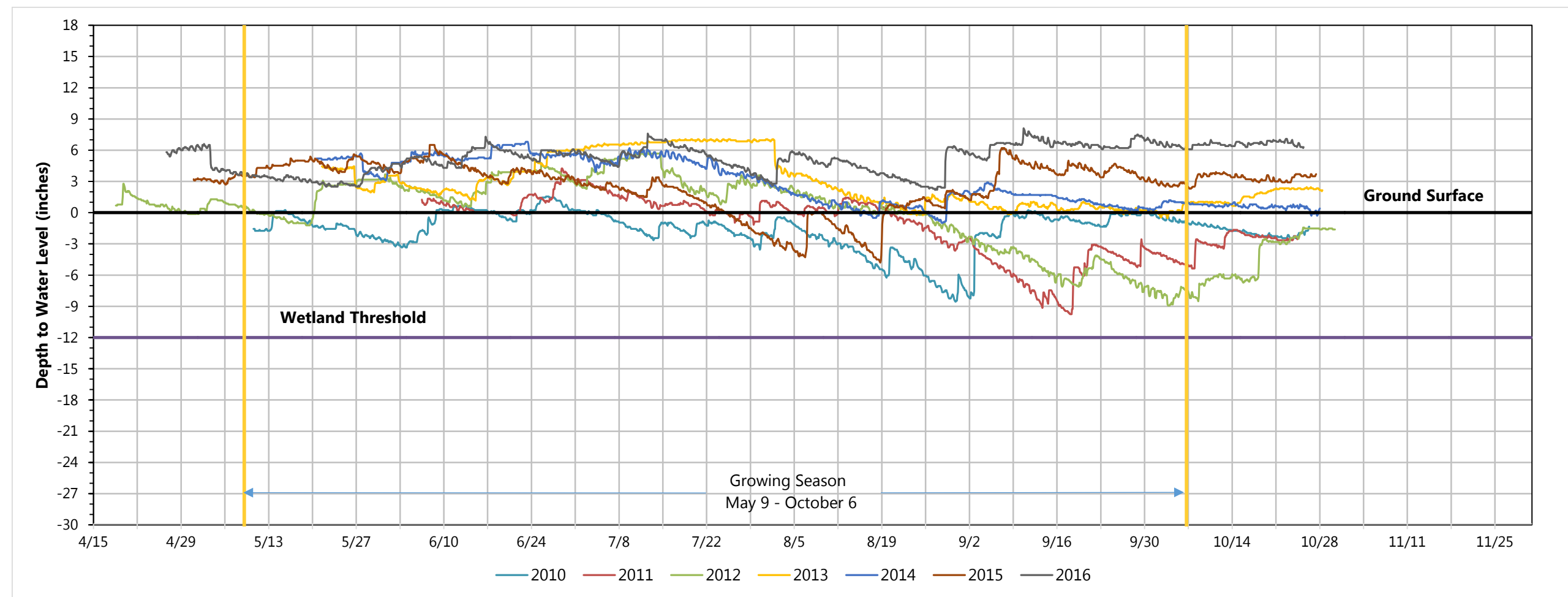


Figure 23-1
WETLAND MONITORING WELL 23
2010-2016 WETLAND HYDROLOGY MONITORING DATA
NorthMet Project
Poly Met Mining, Inc.
Hoyt Lakes, Minnesota

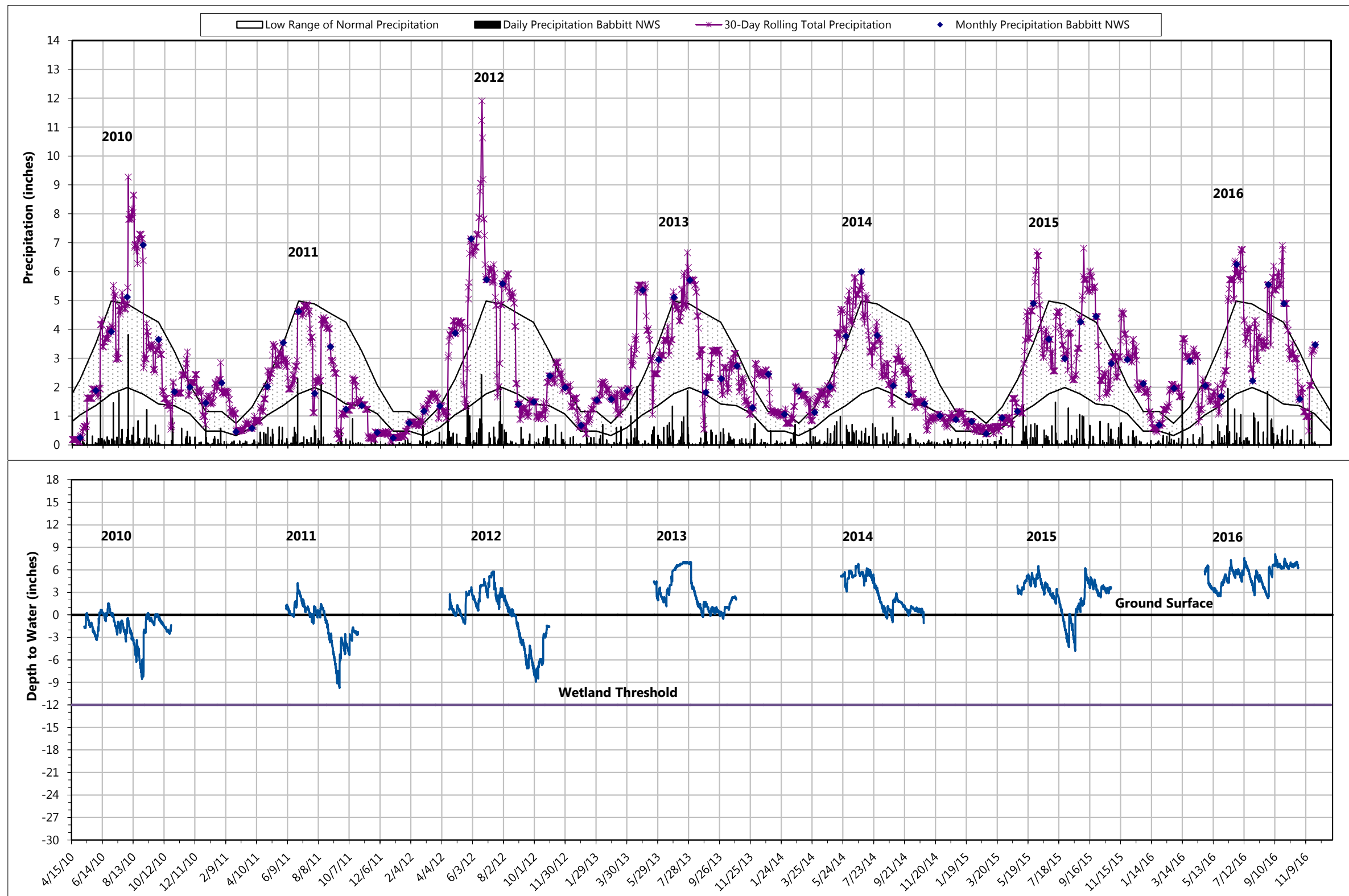


Figure 23-2
 WETLAND MONITORING WELL 23
 2010-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

NorthMet Project Hydrology Monitoring – Well 23



June 2010



June 2011



June 2012



June 2013



June 2014



May 2015

NorthMet Project Hydrology Monitoring – Well 23



June 2016

Well ID: 24

NorthMet Project Area: Mine Site

Wetland Number: 33A

Wetland Type: Alder Thicket (Type 6)

UTM Coordinates (NAD 83 Zone 15)

Easting: 577406

Northing: 5274637

Well Type(s): Ecotone and Manual

Date Recording Well Installed: 5/12/2010

Installed By: NTS

Water Level Recorded Every: 4 hours

Date Manual Well Installed: 5/12/2010

Installed By: NTS

Manual Water Levels Read: Monthly

Growing Season: May 9-October 6 (151 days)

Monitored by: NTS

Water Level Fluctuation for All Years: 26.0 inches

Notes: UTM coordinates are for recording well.

Table 24-1. Monitoring Period Each Year¹. See the hydrographs in Figure 24-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Start Date	---	---	---	---	---	5/12	5/11	4/19	5/22	5/21	4/29	4/27
End Date	---	---	---	---	---	10/28	10/25	10/31	10/29	10/29	10/28	10/26
Total Days	---	---	---	---	---	170	168	196	161	162	183	183
Grow. Seas. Days	---	---	---	---	---	148	149	151	138	139	151	151

¹ Manual (M) well only at this location. No wells at the location (---). Day ranges and Growing Season (Grow. Seas.) Days in this table represent full calendar days.

Table 24-2. Precipitation During Each Growing Season and Water Year¹. See the yearly hydrographs in Figure 24-2.

Year		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Growing Season	May	A	N	A	N	B	B	A	A	N	A	A	B
	June	A	B	N	A	B	N	N	A	A	A	N	A
	July	B	A	B	B	B	A	B	A	A	N	B	B
	Aug	B	B	B	B	N	A	N	B	B	N	N	A
	Sept	B	B	A	A	B	N	B	B	B	B	N	A
Water Year		A	B	A	A	B	N	B	A	A	N	B	A

¹ The growing season includes precipitation during May through September and the water year includes precipitation from October 1 of the previous year through September 30 of the current year. Each time period, the precipitation is represented as: within the normal range of precipitation (N), below the normal range of precipitation (B), or above the normal range of precipitation (A).

Table 24-3. Hydroperiod(s) for Each Year During the Growing Season¹. Total number of days water level is ≥ 12 " below ground level for 14 or more consecutive days during the growing season. The yearly hydrographs are shown in Figure 23-2.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# of Periods ≥ 14 Consecutive Days	---	---	---	---	---	3	1	1	1	2	2	1
Total Days	---	---	---	---	---	128	114	118	137	136	127	151
% Grow. Seas.	---	---	---	---	---	86%	77%	78%	99%	98%	84%	100%

¹ Hydroperiods were not determined for locations with only a Manual (M) well. No wells at the location (---). The total days counted for the hydroperiod may not match the total days monitored within a growing season (Grow. Seas.) because the hydroperiod date count does not include partial days.

Table 24-4. Water Level Fluctuations During the Growing Season (inches)¹. Yearly fluctuations are shown in Figure 23-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum (in.)	---	---	---	---	---	-17.5	-19.7	-17.8	-10.5	-12.3	-20.2	-4.7
Maximum (in.)	---	---	---	---	---	-1.5	1.4	5.8	3.5	2.5	3.0	3.5
Fluctuation (in.)	---	---	---	---	---	16.0	21.1	23.6	13.9	14.8	23.2	8.2

¹ Fluctuations in water level were not determined for locations with only a Manual (M) well. No wells at the location (---). Some water level depths were deeper than the bottom of the well casing (<) resulting in greater fluctuations than indicated in the data (>).

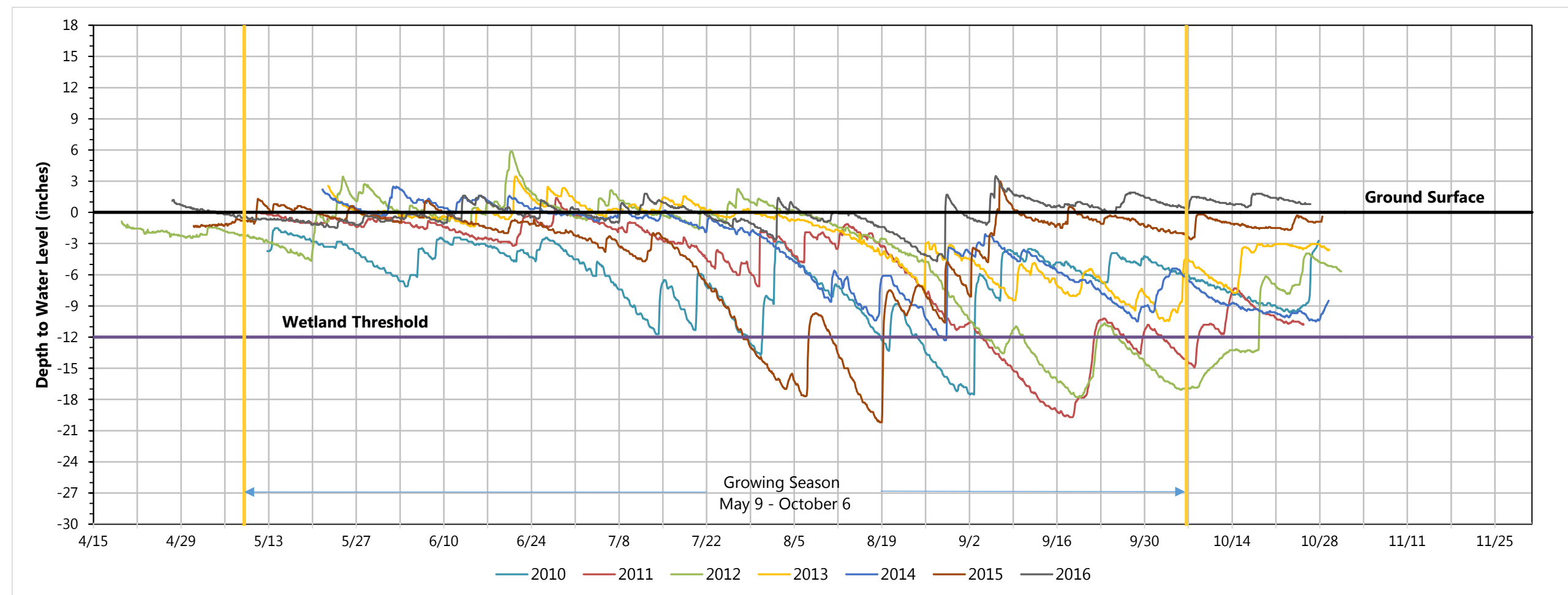


Figure 24-1
 WETLAND MONITORING WELL 24
 2010-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

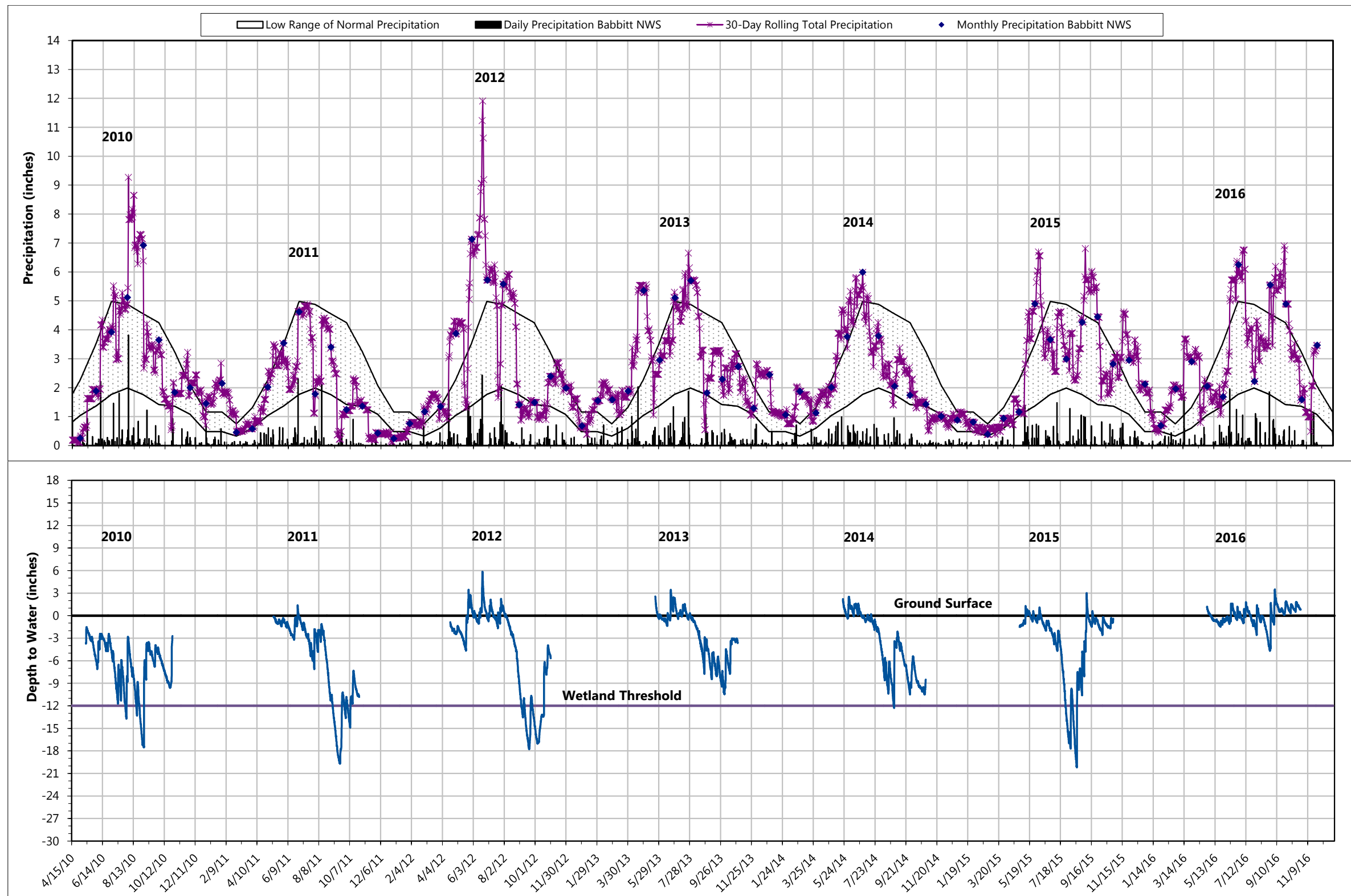


Figure 24-2
 WETLAND MONITORING WELL 24
 2010-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

NorthMet Project Hydrology Monitoring – Well 24



May 2010



June 2011



June 2012



June 2013



June 2014



May 2015

NorthMet Project Hydrology Monitoring – Well 24



June 2016

Well ID: 25

NorthMet Project Area: Mine Site

Wetland Number: 68

Wetland Type: Coniferous Swamp (Type 7)

UTM Coordinates (NAD 83 Zone 15)

Easting: 577811

Northing: 5274407

Well Type(s): In-Situ Troll

Date Recording Well Installed: 6/30/2014

Installed By: Barr

Water Level Recorded Every: 2 hours

Date Manual Well Installed: NA

Installed By: NA

Manual Water Levels Read: See notes

Growing Season: May 9-October 6 (151 days)

Monitored by: Barr

Water Level Fluctuation for All Years: 37.7 inches

Notes: A manual reading is completed twice per monitoring period - prior to initial installation of logger and when logger is removed at end of period.

Table 25-1. Monitoring Period Each Year¹. See the hydrographs in Figure 25-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Start Date	---	---	---	---	---	---	---	---	---	6/30	5/12	5/3
End Date	---	---	---	---	---	---	---	---	---	10/28	10/27	10/11
Total Days	---	---	---	---	---	---	---	---	---	120	169	162
Grow. Seas. Days	---	---	---	---	---	---	---	---	---	98	148	151

¹ Manual (M) well only at this location. No wells at the location (---). Day ranges and Growing Season (Grow. Seas.) Days in this table represent full calendar days.

Table 25-2. Precipitation During Each Growing Season and Water Year¹. See the yearly hydrographs in Figure 25-2.

Year		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Growing Season	May	A	N	A	N	B	B	A	A	N	A	A	B
	June	A	B	N	A	B	N	N	A	A	A	N	A
	July	B	A	B	B	B	A	B	A	A	N	B	B
	Aug	B	B	B	B	N	A	N	B	B	N	N	A
	Sept	B	B	A	A	B	N	B	B	B	B	N	A
Water Year		A	B	A	A	B	N	B	A	A	N	B	A

¹ The growing season includes precipitation during May through September and the water year includes precipitation from October 1 of the previous year through September 30 of the current year. Each time period, the precipitation is represented as: within the normal range of precipitation (N), below the normal range of precipitation (B), or above the normal range of precipitation (A).

Table 25-3. Hydroperiod(s) for Each Year During the Growing Season¹. Total number of days water level is ≥ 12 " below ground level for 14 or more consecutive days during the growing season. The yearly hydrographs are shown in Figure 25-2.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# of Periods ≥ 14 Consecutive Days	---	---	---	---	---	---	---	---	---	2	2	1
Total Days	---	---	---	---	---	---	---	---	---	51	107	151
% Grow. Seas.	---	---	---	---	---	---	---	---	---	52%	72%	100%

¹ Hydroperiods were not determined for locations with only a Manual (M) well. No wells at the location (---). The total days counted for the hydroperiod may not match the total days monitored within a growing season (Grow. Seas.) because the hydroperiod date count does not include partial days.

Table 25-4. Water Level Fluctuations During the Growing Season (inches)¹. Yearly fluctuations are shown in Figure 25-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum (in.)	---	---	---	---	---	---	---	---	---	<-13.1	-33.5	-11.0
Maximum (in.)	---	---	---	---	---	---	---	---	---	-0.9	3.5	4.2
Fluctuation (in.)	---	---	---	---	---	---	---	---	---	>12.2	37.1	15.3

¹ Fluctuations in water level were not determined for locations with only a Manual (M) well. No wells at the location (---). Some water level depths were deeper than the bottom of the well casing (<) resulting in greater fluctuations than indicated in the data (>).

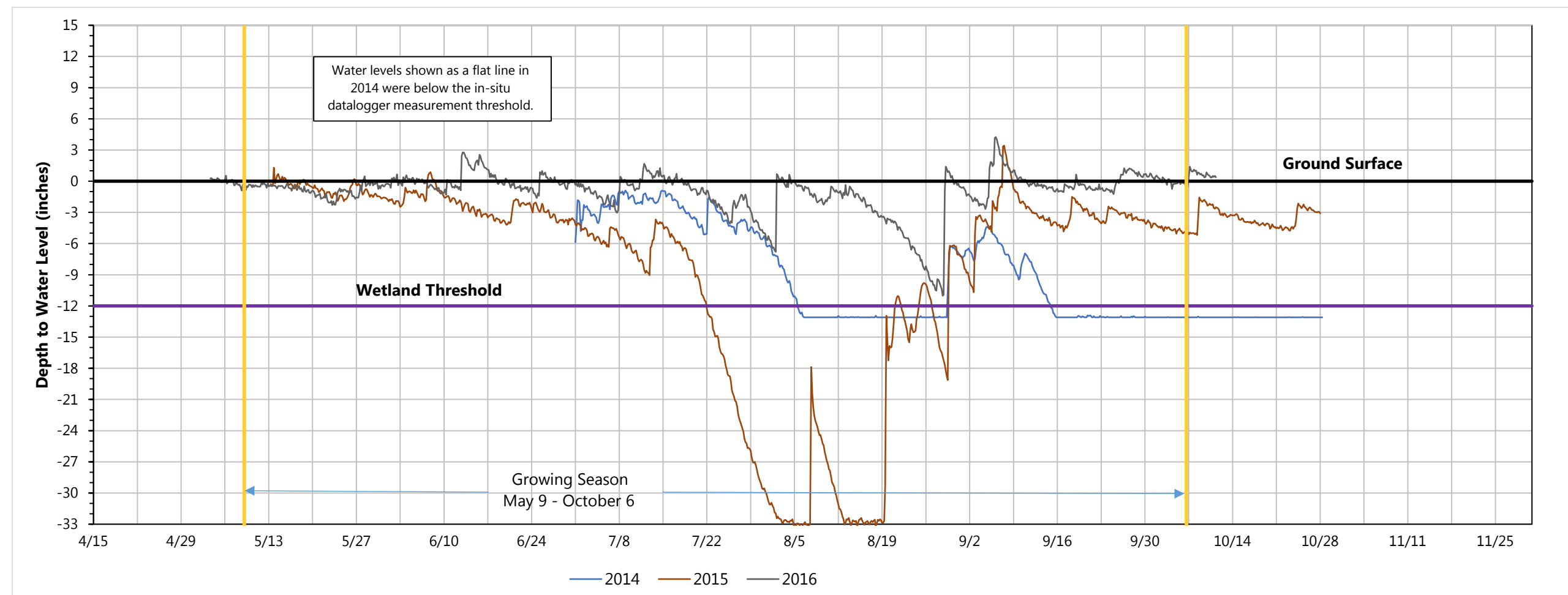


Figure 25-1
 WETLAND MONITORING WELL 25
 2014-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

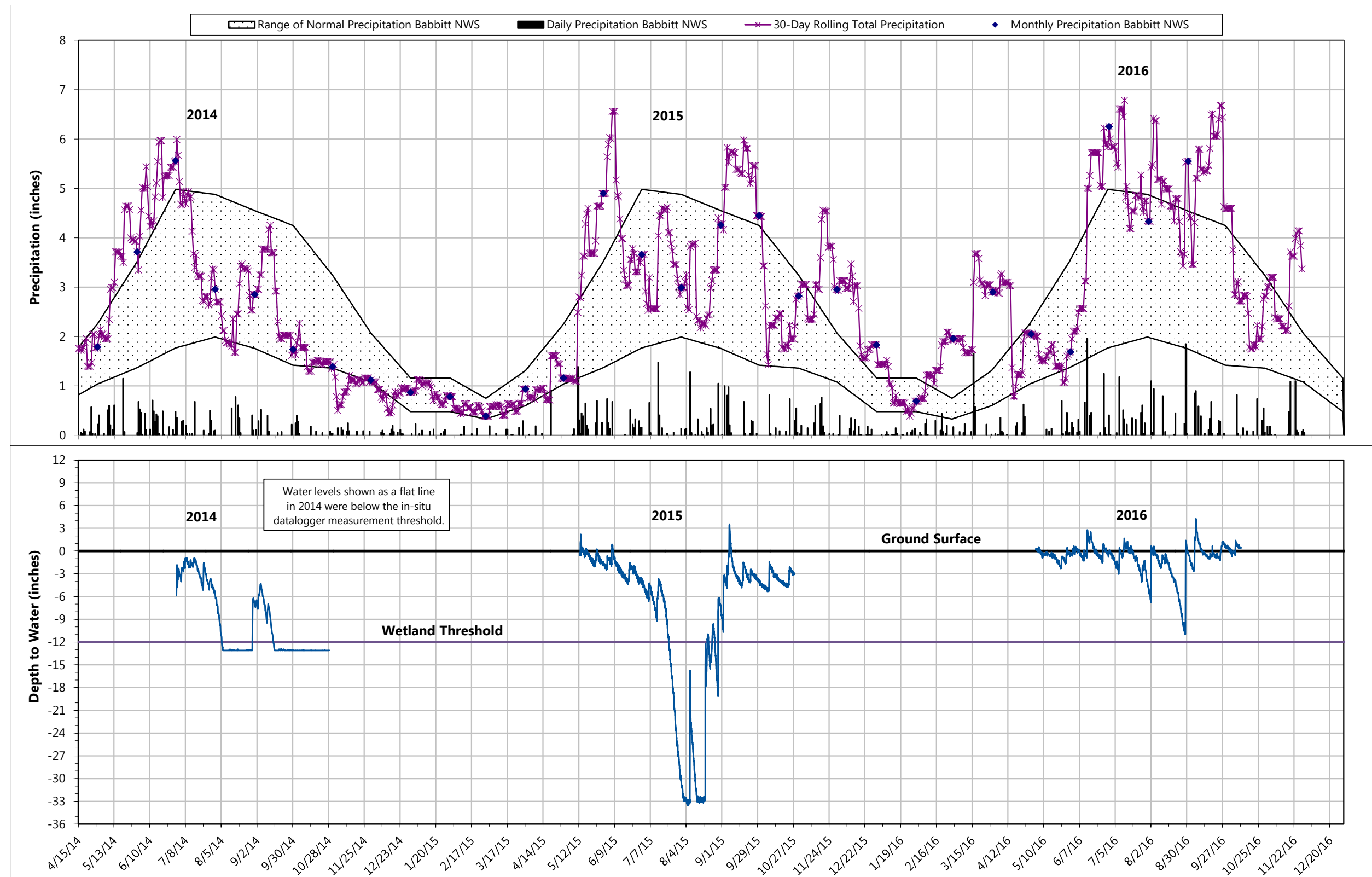


Figure 25-2
 WETLAND MONITORING WELL 25
 2014-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

NorthMet Project Hydrology Monitoring – Well 25



June 2014



May 2015



May 2016

Well ID: 26

NorthMet Project Area: Mine Site

Wetland Number: 315

Wetland Type: Alder Thicket (Type 6)

UTM Coordinates (NAD 83 Zone 15)

Easting: 576657

Northing: 5275115

Growing Season: May 9-October 6 (151 days)

Water Level Fluctuation for All Years: 10.8 inches

Well Type(s): In-Situ Troll

Date Recording Well Installed: 7/1/2014

Installed By: Barr

Water Level Recorded Every: 2 hours

Date Manual Well Installed: NA

Installed By: NA

Manual Water Levels Read: See notes

Monitored by: Barr

Notes: A manual reading is completed twice per monitoring period - prior to initial installation of logger and when logger is removed at end of period.

Table 26-1. Monitoring Period Each Year¹. See the hydrographs in Figure 26-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Start Date	---	---	---	---	---	---	---	---	---	7/1	5/12	5/3
End Date	---	---	---	---	---	---	---	---	---	10/28	10/27	10/11
Total Days	---	---	---	---	---	---	---	---	---	120	169	162
Grow. Seas. Days	---	---	---	---	---	---	---	---	---	98	148	151

¹ Manual (M) well only at this location. No wells at the location (---). Day ranges and Growing Season (Grow. Seas.) Days in this table represent full calendar days.

Table 26-2. Precipitation During Each Growing Season and Water Year¹. See the yearly hydrographs in Figure 26-2.

Year		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Growing Season	May	A	N	A	N	B	B	A	A	N	A	A	B
	June	A	B	N	A	B	N	N	A	A	A	N	A
	July	B	A	B	B	B	A	B	A	A	N	B	B
	Aug	B	B	B	B	N	A	N	B	B	N	N	A
	Sept	B	B	A	A	B	N	B	B	B	B	N	A
Water Year		A	B	A	A	B	N	B	A	A	N	B	A

¹ The growing season includes precipitation during May through September and the water year includes precipitation from October 1 of the previous year through September 30 of the current year. Each time period, the precipitation is represented as: within the normal range of precipitation (N), below the normal range of precipitation (B), or above the normal range of precipitation (A).

Table 26-3. Hydroperiod(s) for Each Year During the Growing Season¹. Total number of days water level is ≥ 12 " below ground level for 14 or more consecutive days during the growing season. The yearly hydrographs are shown in Figure 26-2.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# of Periods ≥ 14 Consecutive Days	---	---	---	---	---	---	---	---	---	1	1	1
Total Days	---	---	---	---	---	---	---	---	---	97	147	151
% Grow. Seas.	---	---	---	---	---	---	---	---	---	99%	99%	100%

¹ Hydroperiods were not determined for locations with only a Manual (M) well. No wells at the location (---). The total days counted for the hydroperiod may not match the total days monitored within a growing season (Grow. Seas.) because the hydroperiod date count does not include partial days.

Table 26-4. Water Level Fluctuations During the Growing Season (inches)¹. Yearly fluctuations are shown in Figure 26-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum (in.)	---	---	---	---	---	---	---	---	---	-1.4	-3.9	0.8
Maximum (in.)	---	---	---	---	---	---	---	---	---	2.2	5.2	6.9
Fluctuation (in.)	---	---	---	---	---	---	---	---	---	3.6	9.1	6.1

¹ Fluctuations in water level were not determined for locations with only a Manual (M) well. No wells at the location (---). Some water level depths were deeper than the bottom of the well casing (<) resulting in greater fluctuations than indicated in the data (>).

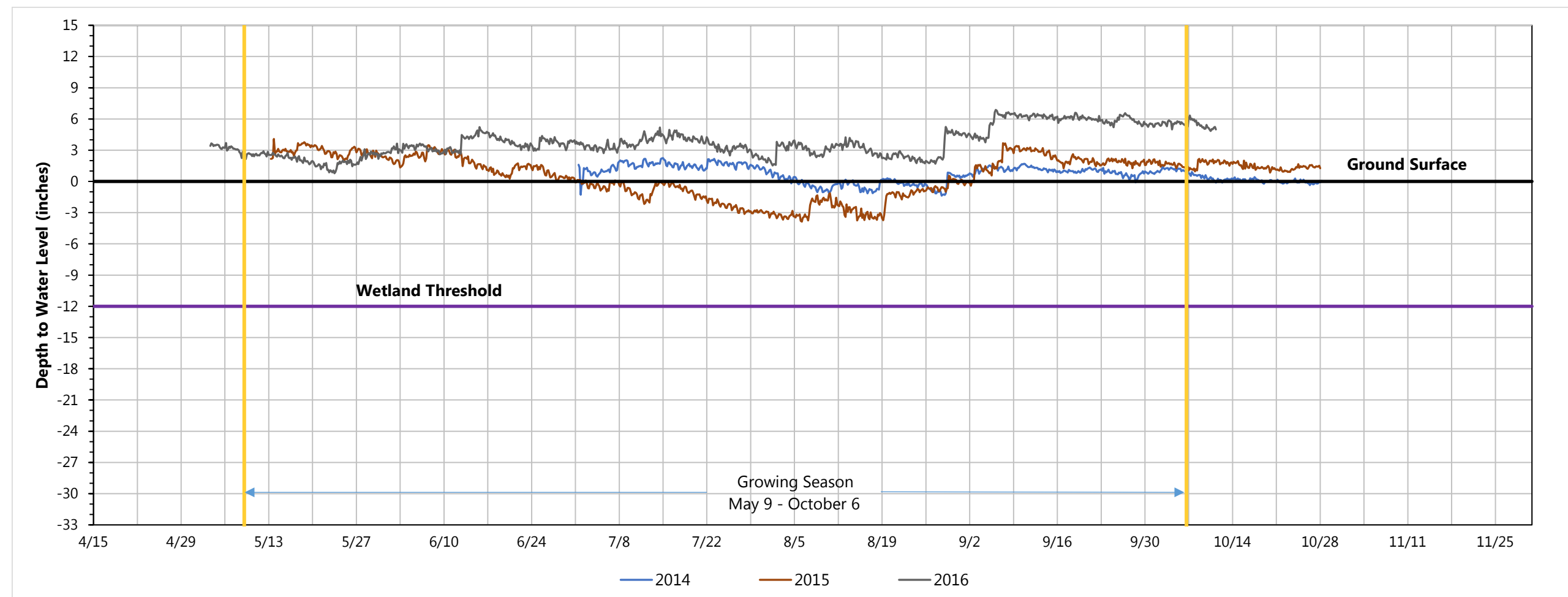


Figure 26-1
 WETLAND MONITORING WELL 26
 2014-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

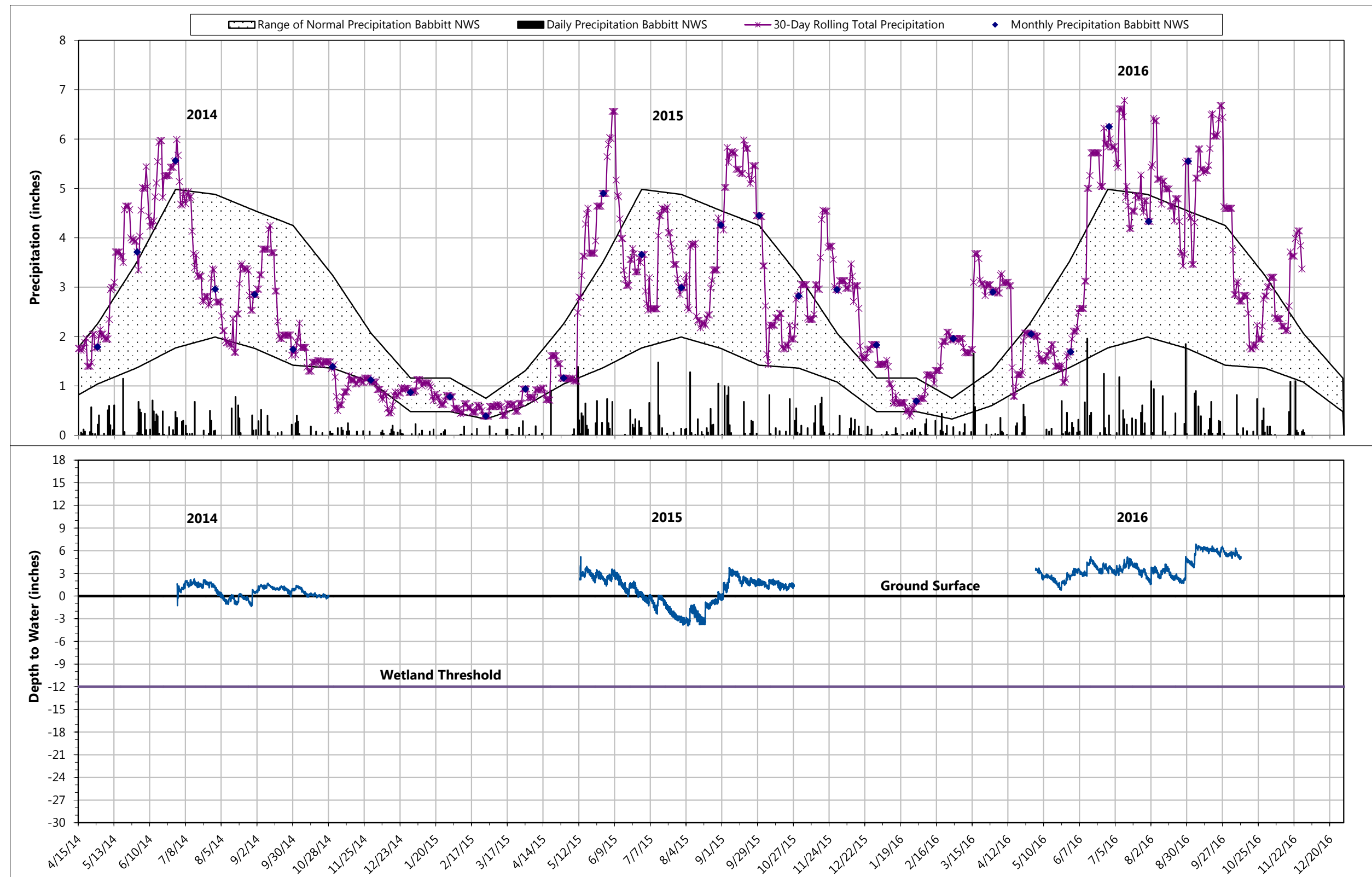


Figure 26-2
 WETLAND MONITORING WELL 26
 2014-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

NorthMet Project Hydrology Monitoring – Well 26



June 2014



May 2015



May 2016

Well ID: 27

NorthMet Project Area: Mine Site

Wetland Number: 48A

Wetland Type: Coniferous Swamp (Type 7)

UTM Coordinates (NAD 83 Zone 15)

Easting: 577684

Northing: 5274049

Well Type(s): In-Situ Troll

Date Recording Well Installed: 6/30/2014

Installed By: Barr

Water Level Recorded Every: 2 hours

Date Manual Well Installed: NA

Installed By: NA

Manual Water Levels Read: See notes

Growing Season: May 9-October 6 (151 days)

Monitored by: Barr

Water Level Fluctuation for All Years: 25.1 inches

Notes: A manual reading is completed twice per monitoring period - prior to initial installation of logger and when logger is removed at end of period.

Table 27-1. Monitoring Period Each Year¹. See the hydrographs in Figure 27-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Start Date	---	---	---	---	---	---	---	---	---	6/30	5/12	5/3
End Date	---	---	---	---	---	---	---	---	---	10/28	10/27	10/11
Total Days	---	---	---	---	---	---	---	---	---	121	169	162
Grow. Seas. Days	---	---	---	---	---	---	---	---	---	99	148	151

¹ Manual (M) well only at this location. No wells at the location (---). Day ranges and Growing Season (Grow. Seas.) Days in this table represent full calendar days.

Table 27-2. Precipitation During Each Growing Season and Water Year¹. See the yearly hydrographs in Figure 27-2.

Year		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Growing Season	May	A	N	A	N	B	B	A	A	N	A	A	B
	June	A	B	N	A	B	N	N	A	A	A	N	A
	July	B	A	B	B	B	A	B	A	A	N	B	B
	Aug	B	B	B	B	N	A	N	B	B	N	N	A
	Sept	B	B	A	A	B	N	B	B	B	B	N	A
Water Year		A	B	A	A	B	N	B	A	A	N	B	A

¹ The growing season includes precipitation during May through September and the water year includes precipitation from October 1 of the previous year through September 30 of the current year. Each time period, the precipitation is represented as: within the normal range of precipitation (N), below the normal range of precipitation (B), or above the normal range of precipitation (A).

Table 27-3. Hydroperiod(s) for Each Year During the Growing Season¹. Total number of days water level is ≥ 12 " below ground level for 14 or more consecutive days during the growing season. The yearly hydrographs are shown in Figure 27-2.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# of Periods ≥ 14 Consecutive Days	---	---	---	---	---	---	---	---	---	1	2	1
Total Days	---	---	---	---	---	---	---	---	---	98	94	151
% Grow. Seas.	---	---	---	---	---	---	---	---	---	99%	64%	100%

¹ Hydroperiods were not determined for locations with only a Manual (M) well. No wells at the location (---). The total days counted for the hydroperiod may not match the total days monitored within a growing season (Grow. Seas.) because the hydroperiod date count does not include partial days.

Table 27-4. Water Level Fluctuations During the Growing Season (inches)¹. Yearly fluctuations are shown in Figure 27-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum (in.)	---	---	---	---	---	---	---	---	---	-10.0	-20.6	-5.1
Maximum (in.)	---	---	---	---	---	---	---	---	---	0.9	0.4	4.5
Fluctuation (in.)	---	---	---	---	---	---	---	---	---	10.8	21.1	9.6

¹ Fluctuations in water level were not determined for locations with only a Manual (M) well. No wells at the location (---). Some water level depths were deeper than the bottom of the well casing (<) resulting in greater fluctuations than indicated in the data (>).

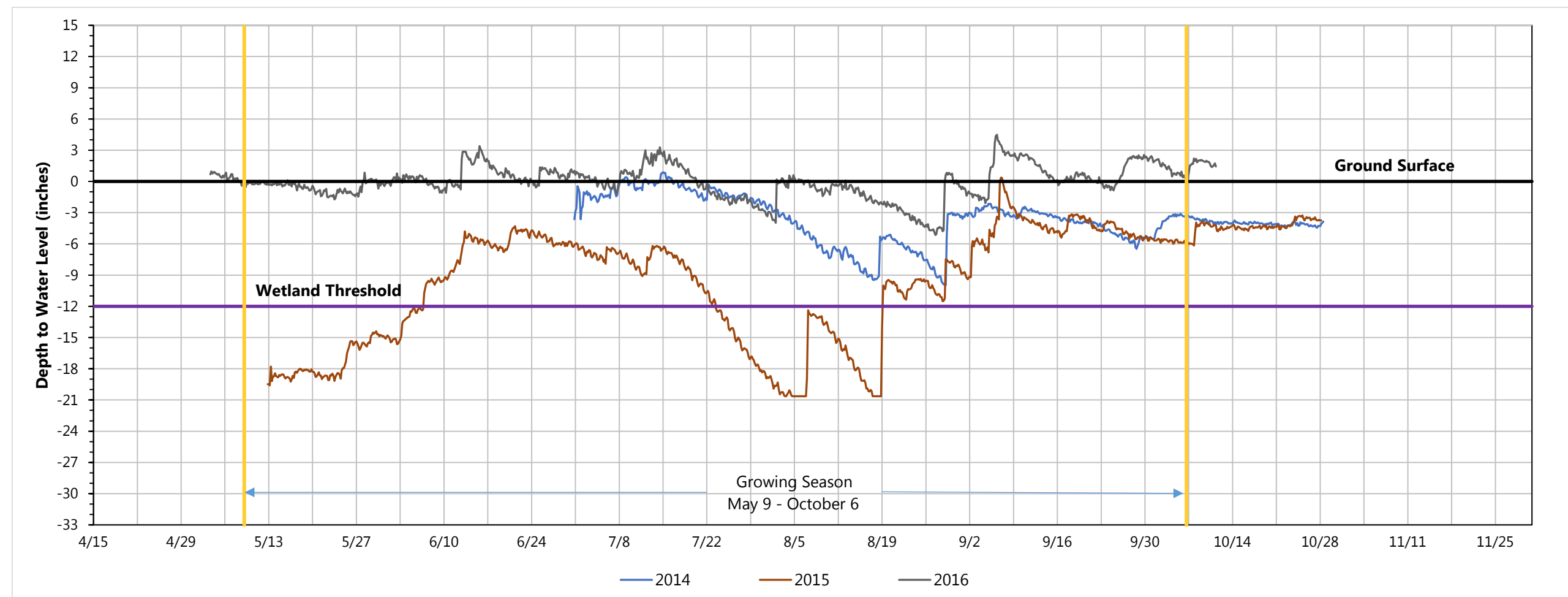


Figure 27-1
 WETLAND MONITORING WELL 27
 2014-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

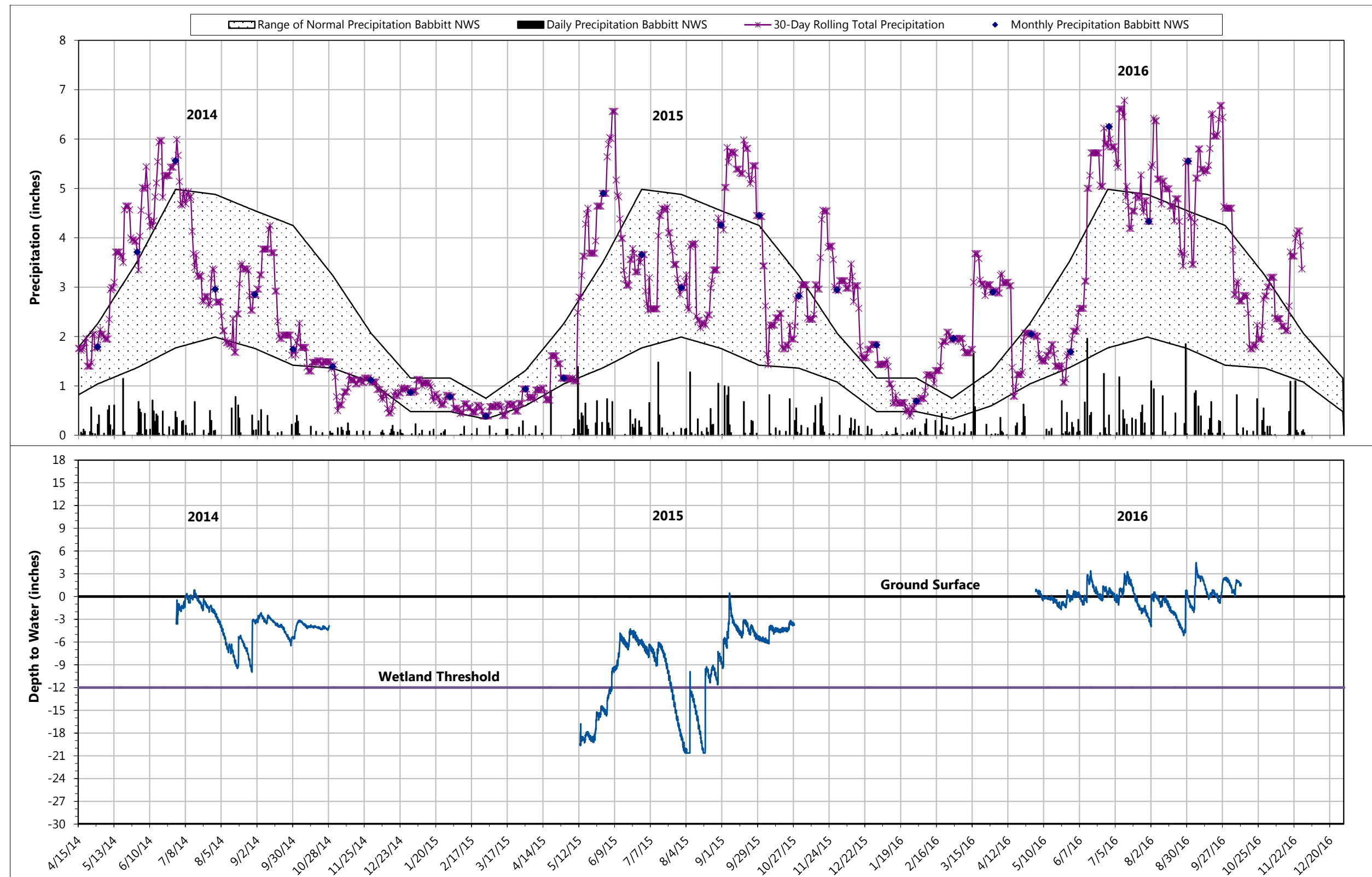


Figure 27-2
 WETLAND MONITORING WELL 27
 2014-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

Well ID: 28

NorthMet Project Area: Mine Site

Wetland Number: 33A

Wetland Type: Alder Thicket (Type 6)

UTM Coordinates (NAD 83 Zone 15)

Easting: 578729

Northing: 5274709

Well Type(s): In-Situ Troll

Date Recording Well Installed: 7/2/2014

Installed By: Barr

Water Level Recorded Every: 2 hours

Date Manual Well Installed: NA

Installed By: NA

Manual Water Levels Read: See notes

Growing Season: May 9-October 6 (151 days)

Monitored by: Barr

Water Level Fluctuation for All Years: >26.5 inches

Notes: A manual reading is completed twice per monitoring period - prior to initial installation of logger and when logger is removed at end of period.

Table 28-1. Monitoring Period Each Year¹. See the hydrographs in Figure 28-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Start Date	---	---	---	---	---	---	---	---	---	7/2	5/12	5/3
End Date	---	---	---	---	---	---	---	---	---	10/28	10/28	10/11
Total Days	---	---	---	---	---	---	---	---	---	119	170	162
Grow. Seas. Days	---	---	---	---	---	---	---	---	---	97	149	153

¹ Manual (M) well only at this location. No wells at the location (---). Day ranges and Growing Season (Grow. Seas.) Days in this table represent full calendar days.

Table 28-2. Precipitation During Each Growing Season and Water Year¹. See the yearly hydrographs in Figure 28-2.

Year		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Growing Season	May	A	N	A	N	B	B	A	A	N	A	A	B
	June	A	B	N	A	B	N	N	A	A	A	N	A
	July	B	A	B	B	B	A	B	A	A	N	B	B
	Aug	B	B	B	B	N	A	N	B	B	N	N	A
	Sept	B	B	A	A	B	N	B	B	B	B	N	A
Water Year		A	B	A	A	B	N	B	A	A	N	B	A

¹ The growing season includes precipitation during May through September and the water year includes precipitation from October 1 of the previous year through September 30 of the current year. Each time period, the precipitation is represented as: within the normal range of precipitation (N), below the normal range of precipitation (B), or above the normal range of precipitation (A).

Table 28-3. Hydroperiod(s) for Each Year During the Growing Season¹. Total number of days water level is ≥ 12 " below ground level for 14 or more consecutive days during the growing season. The yearly hydrographs are shown in Figure 28-2.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# of Periods ≥ 14 Consecutive Days	---	---	---	---	---	---	---	---	---	2	2	2
Total Days	---	---	---	---	---	---	---	---	---	49	86	144
% Grow. Seas.	---	---	---	---	---	---	---	---	---	51%	58%	94%

¹ Hydroperiods were not determined for locations with only a Manual (M) well. No wells at the location (---). The total days counted for the hydroperiod may not match the total days monitored within a growing season (Grow. Seas.) because the hydroperiod date count does not include partial days.

Table 28-4. Water Level Fluctuations During the Growing Season (inches)¹. Yearly fluctuations are shown in Figure 28-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum (in.)	---	---	---	---	---	---	---	---	---	<-19.8	<-26.6	-13.8
Maximum (in.)	---	---	---	---	---	---	---	---	---	-4.1	-0.1	-0.9
Fluctuation (in.)	---	---	---	---	---	---	---	---	---	>15.7	>26.6	12.9

¹ Fluctuations in water level were not determined for locations with only a Manual (M) well. No wells at the location (---). Some water level depths were deeper than the bottom of the well casing (<) resulting in greater fluctuations than indicated in the data (>).

NorthMet Project Hydrology Monitoring – Well 27



July 2014



May 2015



May 2016

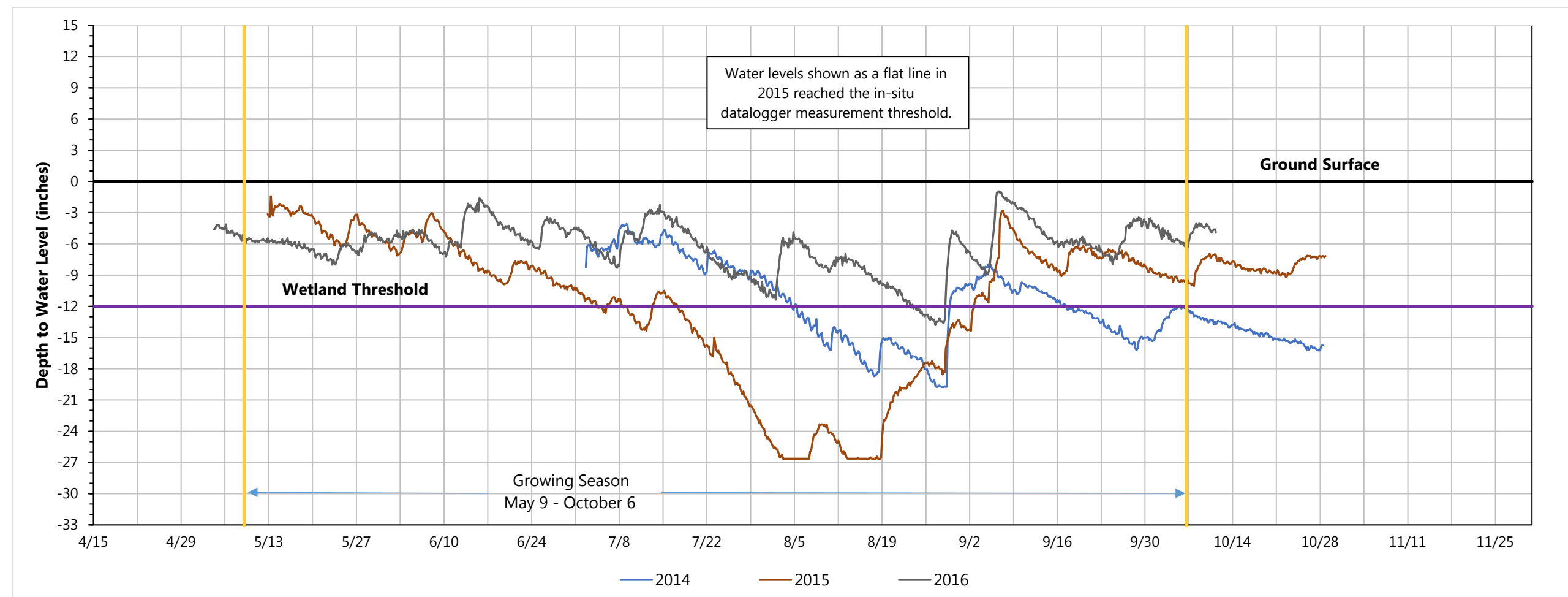


Figure 28-1
 WETLAND MONITORING WELL 28
 2014-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

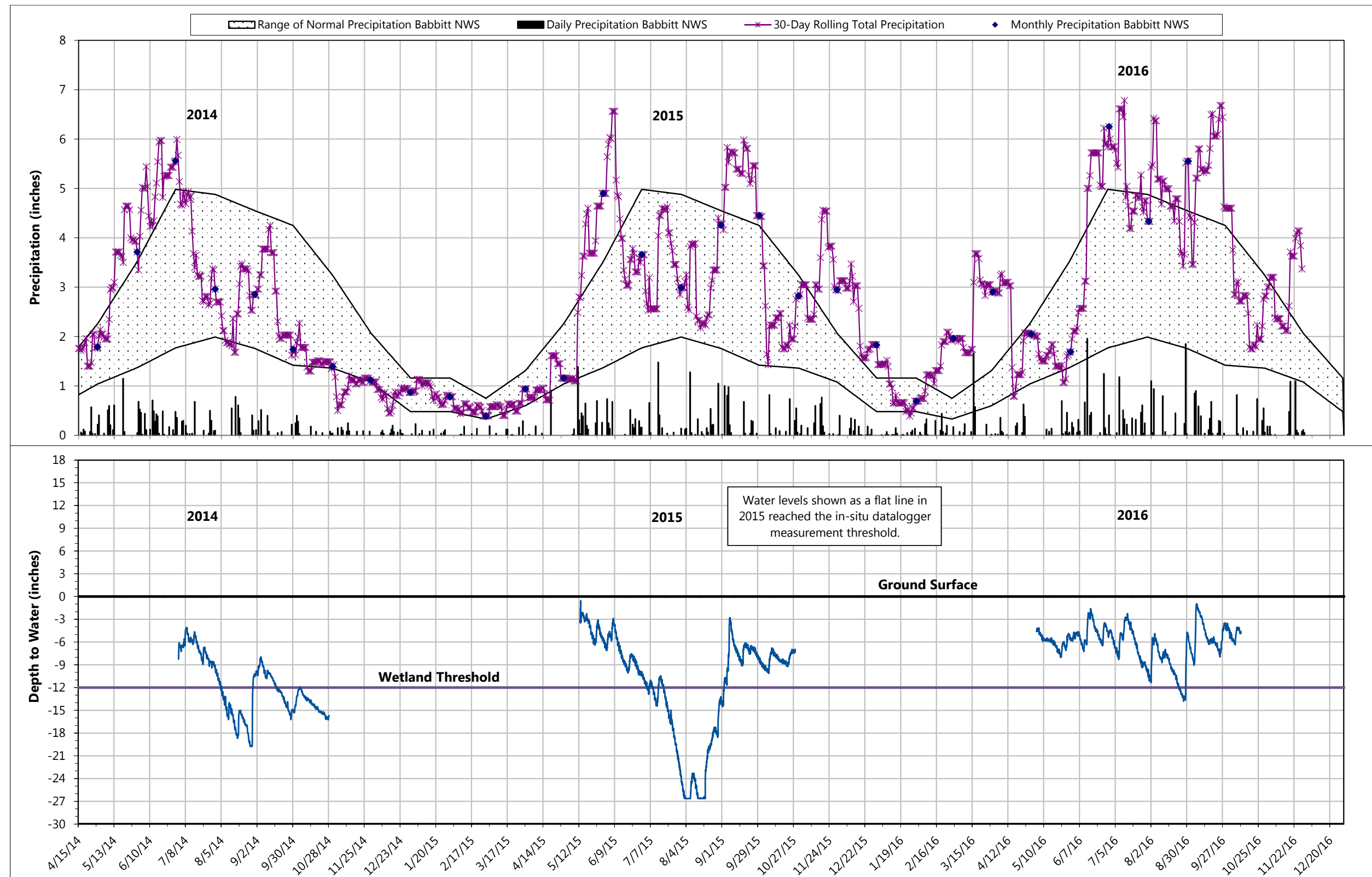


Figure 28-2
 WETLAND MONITORING WELL 28
 2014-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

NorthMet Project Hydrology Monitoring – Well 28



July 2014



May 2015



May 2016

Well ID: 29

NorthMet Project Area: Mine Site

Wetland Number: 90

Wetland Type: Coniferous Bog (Type 8)

UTM Coordinates (NAD 83 Zone 15)

Easting: 579575

Northing: 5275069

Well Type(s): In-Situ Troll

Date Recording Well Installed: 7/2/2014

Installed By: Barr

Water Level Recorded Every: 2 hours

Date Manual Well Installed: NA

Installed By: NA

Manual Water Levels Read: See notes

Growing Season: May 9-October 6 (151 days)

Monitored by: Barr

Water Level Fluctuation for All Years: 19.7 inches

Notes: A manual reading is completed twice per monitoring period - prior to initial installation of logger and when logger is removed at end of period.

Table 29-1. Monitoring Period Each Year¹. See the hydrographs in Figure 29-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Start Date	---	---	---	---	---	---	---	---	---	7/2	6/18	5/7
End Date	---	---	---	---	---	---	---	---	---	10/29	10/27	10/11
Total Days	---	---	---	---	---	---	---	---	---	120	132	158
Grow. Seas. Days	---	---	---	---	---	---	---	---	---	97	111	151

¹ Manual (M) well only at this location. No wells at the location (---). Day ranges and Growing Season (Grow. Seas.) Days in this table represent full calendar days.

Table 29-2. Precipitation During Each Growing Season and Water Year¹. See the yearly hydrographs in Figure 29-2.

Year		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Growing Season	May	A	N	A	N	B	B	A	A	N	A	A	B
	June	A	B	N	A	B	N	N	A	A	A	N	A
	July	B	A	B	B	B	A	B	A	A	N	B	B
	Aug	B	B	B	B	N	A	N	B	B	N	N	A
	Sept	B	B	A	A	B	N	B	B	B	B	N	A
Water Year		A	B	A	A	B	N	B	A	A	N	B	A

¹ The growing season includes precipitation during May through September and the water year includes precipitation from October 1 of the previous year through September 30 of the current year. Each time period, the precipitation is represented as: within the normal range of precipitation (N), below the normal range of precipitation (B), or above the normal range of precipitation (A).

Table 29-3. Hydroperiod(s) for Each Year During the Growing Season¹. Total number of days water level is ≥ 12 " below ground level for 14 or more consecutive days during the growing season. The yearly hydrographs are shown in Figure 29-2.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# of Periods ≥ 14 Consecutive Days	---	---	---	---	---	---	---	---	---	2	1	3
Total Days	---	---	---	---	---	---	---	---	---	69	31	146
% Grow. Seas.	---	---	---	---	---	---	---	---	---	71%	28%	97%

¹ Hydroperiods were not determined for locations with only a Manual (M) well. No wells at the location (---). The total days counted for the hydroperiod may not match the total days monitored within a growing season (Grow. Seas.) because the hydroperiod date count does not include partial days.

Table 29-4. Water Level Fluctuations During the Growing Season (inches)¹. Yearly fluctuations are shown in Figure 29-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum (in.)	---	---	---	---	---	---	---	---	---	-17.4	-25.7	-12.7
Maximum (in.)	---	---	---	---	---	---	---	---	---	-6.7	-8.1	-6.0
Fluctuation (in.)	---	---	---	---	---	---	---	---	---	10.7	17.6	6.7

¹ Fluctuations in water level were not determined for locations with only a Manual (M) well. No wells at the location (---). Some water level depths were deeper than the bottom of the well casing (<) resulting in greater fluctuations than indicated in the data (>).

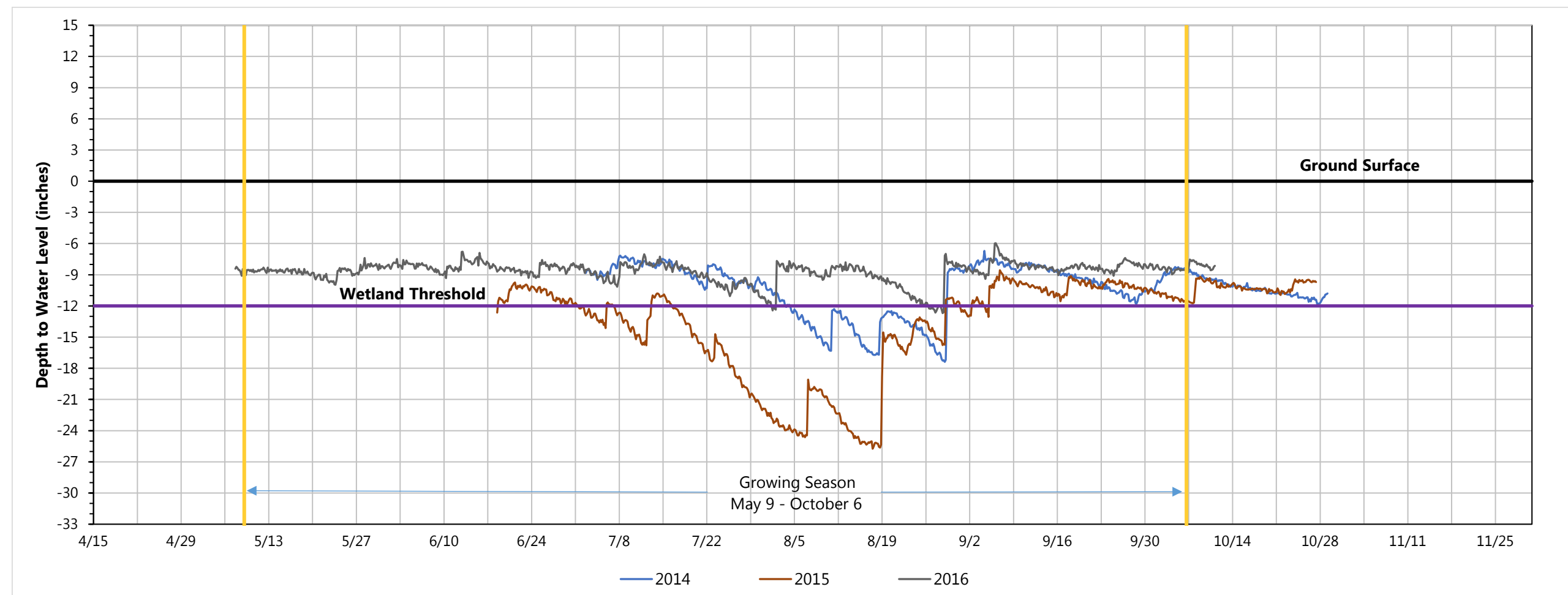


Figure 29-1
 WETLAND MONITORING WELL 29
 2014-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

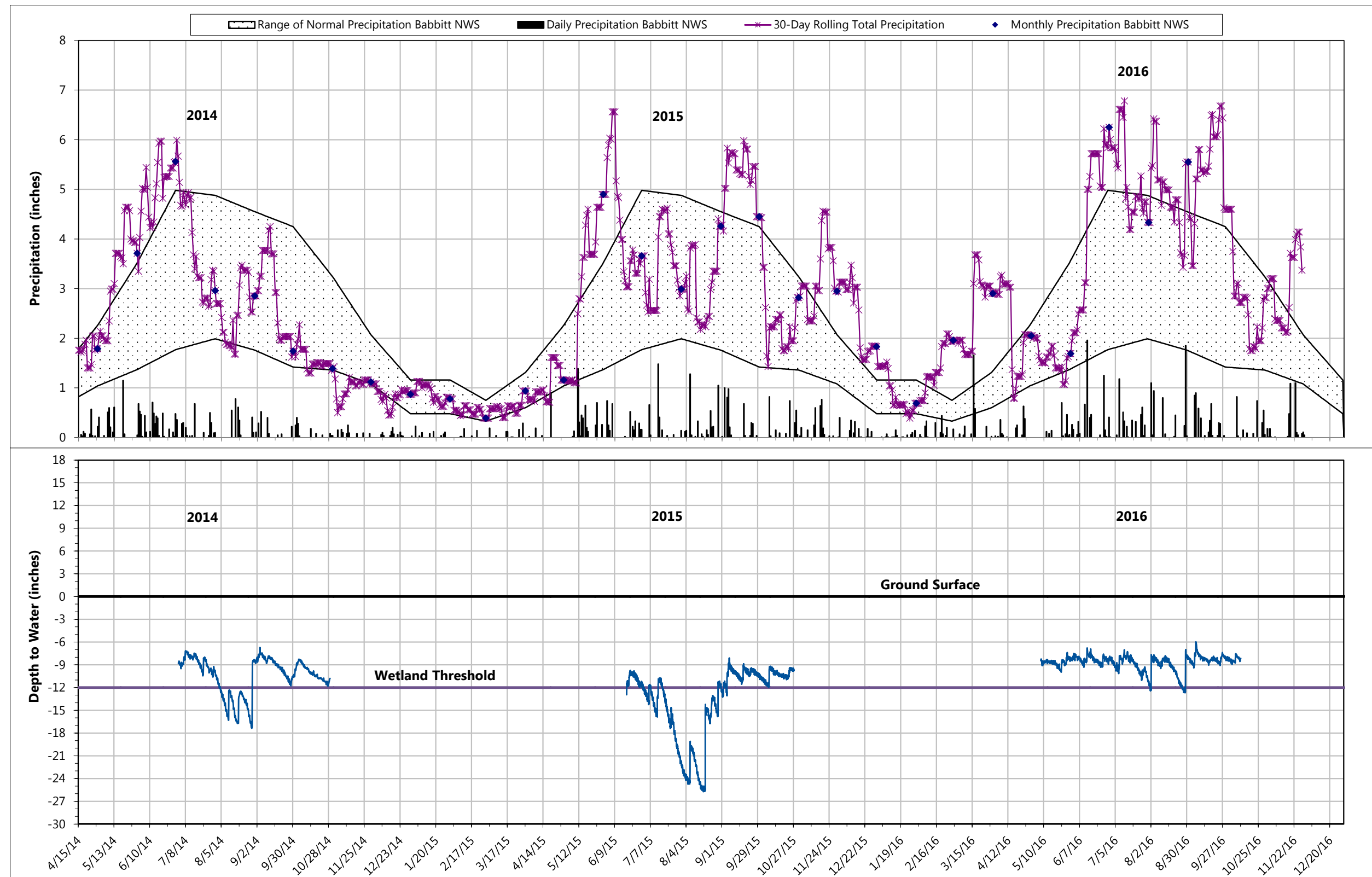


Figure 29-2
 WETLAND MONITORING WELL 29
 2014-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

NorthMet Project Hydrology Monitoring – Well 29



July 2014



May 2015



May 2016

Well ID: 30

NorthMet Project Area: Mine Site

Wetland Number: 57

Wetland Type: Coniferous Swamp (Type 7)

UTM Coordinates (NAD 83 Zone 15)

Easting: 574850

Northing: 5272893

Growing Season: May 9-October 6 (151 days)

Water Level Fluctuation for All Years: 29.0 inches

Well Type(s): In-Situ Troll

Date Recording Well Installed: 6/30/2014

Installed By: Barr

Water Level Recorded Every: 2 hours

Date Manual Well Installed: NA

Installed By: NA

Manual Water Levels Read: See notes

Monitored by: Barr

Notes: A manual reading is completed twice per monitoring period - prior to initial installation of logger and when logger is removed at end of period.

Table 30-1. Monitoring Period Each Year¹. See the hydrographs in Figure 30-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Start Date	---	---	---	---	---	---	---	---	---	6/30	5/12	5/4
End Date	---	---	---	---	---	---	---	---	---	10/28	10/28	10/11
Total Days	---	---	---	---	---	---	---	---	---	121	170	161
Grow. Seas. Days	---	---	---	---	---	---	---	---	---	99	148	151

¹ Manual (M) well only at this location. No wells at the location (---). Day ranges and Growing Season (Grow. Seas.) Days in this table represent full calendar days.

Table 30-2. Precipitation During Each Growing Season and Water Year¹. See the yearly hydrographs in Figure 30-2.

Year		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Growing Season	May	A	N	A	N	B	B	A	A	N	A	A	B
	June	A	B	N	A	B	N	N	A	A	A	N	A
	July	B	A	B	B	B	A	B	A	A	N	B	B
	Aug	B	B	B	B	N	A	N	B	B	N	N	A
	Sept	B	B	A	A	B	N	B	B	B	B	N	A
Water Year		A	B	A	A	B	N	B	A	A	N	B	A

¹ The growing season includes precipitation during May through September and the water year includes precipitation from October 1 of the previous year through September 30 of the current year. Each time period, the precipitation is represented as: within the normal range of precipitation (N), below the normal range of precipitation (B), or above the normal range of precipitation (A).

Table 30-3. Hydroperiod(s) for Each Year During the Growing Season¹. Total number of days water level is ≥ 12 " below ground level for 14 or more consecutive days during the growing season. The yearly hydrographs are shown in Figure 30-2.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# of Periods ≥ 14 Consecutive Days	---	---	---	---	---	---	---	---	---	2	2	1
Total Days	---	---	---	---	---	---	---	---	---	72	121	151
% Grow. Seas.	---	---	---	---	---	---	---	---	---	73%	82%	100%

¹ Hydroperiods were not determined for locations with only a Manual (M) well. No wells at the location (---). The total days counted for the hydroperiod may not match the total days monitored within a growing season (Grow. Seas.) because the hydroperiod date count does not include partial days.

Table 30-4. Water Level Fluctuations During the Growing Season (inches)¹. Yearly fluctuations are shown in Figure 30-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum (in.)	---	---	---	---	---	---	---	---	---	-15.4	-22.7	-1.1
Maximum (in.)	---	---	---	---	---	---	---	---	---	-2.2	2.4	6.3
Fluctuation (in.)	---	---	---	---	---	---	---	---	---	13.1	25.1	7.3

¹ Fluctuations in water level were not determined for locations with only a Manual (M) well. No wells at the location (---). Some water level depths were deeper than the bottom of the well casing (<) resulting in greater fluctuations than indicated in the data (>).

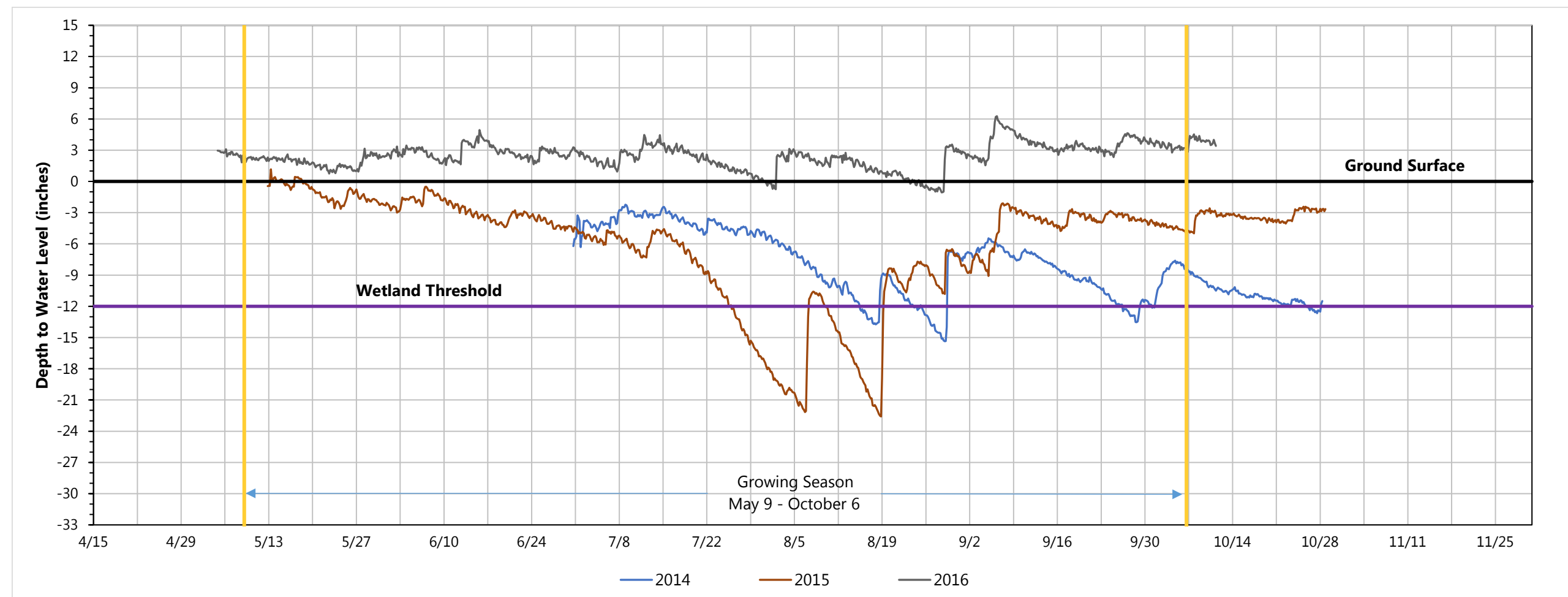


Figure 30-1
 WETLAND MONITORING WELL 30
 2014-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

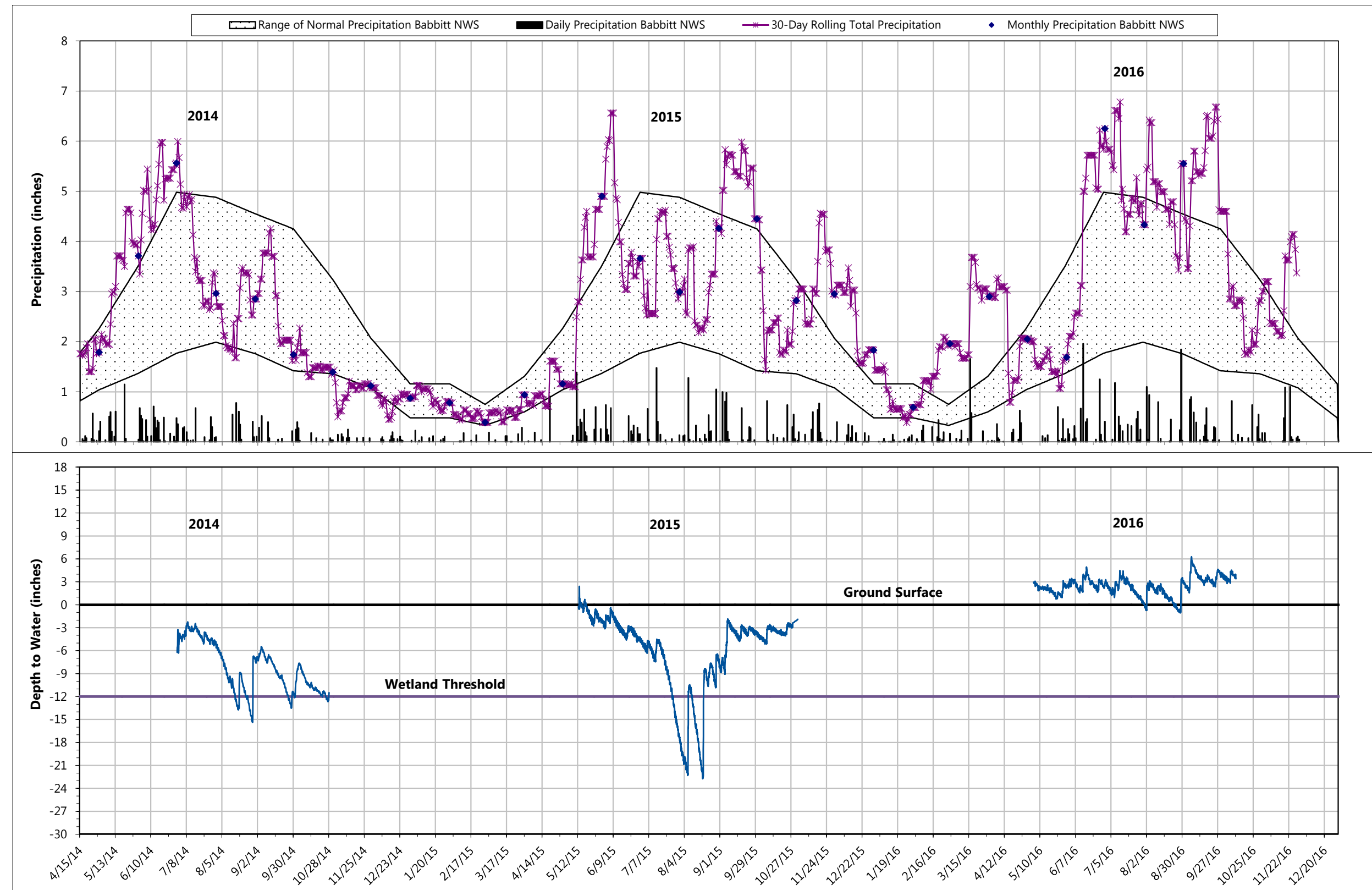


Figure 30-2
 WETLAND MONITORING WELL 30
 2014-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

NorthMet Project Hydrology Monitoring – Well 30



October 2014



May 2015



May 2016

Well ID: 31

NorthMet Project Area: Mine Site

Wetland Number: 54E

Wetland Type: Coniferous Swamp (Type 7)

UTM Coordinates (NAD 83 Zone 15)

Easting: 574813

Northing: 5272382

Well Type(s): In-Situ Troll

Date Recording Well Installed: 6/30/2014

Installed By: Barr

Water Level Recorded Every: 2 hours

Date Manual Well Installed: NA

Installed By: NA

Manual Water Levels Read: See notes

Growing Season: May 9-October 6 (151 days)

Monitored by: Barr

Water Level Fluctuation for All Years: 22.9 inches

Notes: A manual reading is completed twice per monitoring period - prior to initial installation of logger and when logger is removed at end of period.

Table 31-1. Monitoring Period Each Year¹. See the hydrographs in Figure 31-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Start Date	---	---	---	---	---	---	---	---	---	6/30	5/12	5/3
End Date	---	---	---	---	---	---	---	---	---	10/28	10/27	10/11
Total Days	---	---	---	---	---	---	---	---	---	121	169	162
Grow. Seas. Days	---	---	---	---	---	---	---	---	---	99	148	151

¹ Manual (M) well only at this location. No wells at the location (---). Day ranges and Growing Season (Grow. Seas.) Days in this table represent full calendar days.

Table 31-2. Precipitation During Each Growing Season and Water Year¹. See the yearly hydrographs in Figure 31-2.

Year		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Growing Season	May	A	N	A	N	B	B	A	A	N	A	A	B
	June	A	B	N	A	B	N	N	A	A	A	N	A
	July	B	A	B	B	B	A	B	A	A	N	B	B
	Aug	B	B	B	B	N	A	N	B	B	N	N	A
	Sept	B	B	A	A	B	N	B	B	B	B	N	A
Water Year		A	B	A	A	B	N	B	A	A	N	B	A

¹ The growing season includes precipitation during May through September and the water year includes precipitation from October 1 of the previous year through September 30 of the current year. Each time period, the precipitation is represented as: within the normal range of precipitation (N), below the normal range of precipitation (B), or above the normal range of precipitation (A).

Table 31-3. Hydroperiod(s) for Each Year During the Growing Season¹. Total number of days water level is ≥ 12 " below ground level for 14 or more consecutive days during the growing season. The yearly hydrographs are shown in Figure 31-2.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# of Periods ≥ 14 Consecutive Days	---	---	---	---	---	---	---	---	---	2	2	1
Total Days	---	---	---	---	---	---	---	---	---	97	121	151
% Grow. Seas.	---	---	---	---	---	---	---	---	---	98%	82%	100%

¹ Hydroperiods were not determined for locations with only a Manual (M) well. No wells at the location (---). The total days counted for the hydroperiod may not match the total days monitored within a growing season (Grow. Seas.) because the hydroperiod date count does not include partial days.

Table 31-4. Water Level Fluctuations During the Growing Season (inches)¹. Yearly fluctuations are shown in Figure 31-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum (in.)	---	---	---	---	---	---	---	---	---	-12.0	-21.4	-5.5
Maximum (in.)	---	---	---	---	---	---	---	---	---	-2.0	-2.5	1.5
Fluctuation (in.)	---	---	---	---	---	---	---	---	---	10.0	18.9	7.0

¹ Fluctuations in water level were not determined for locations with only a Manual (M) well. No wells at the location (---). Some water level depths were deeper than the bottom of the well casing (<) resulting in greater fluctuations than indicated in the data (>).

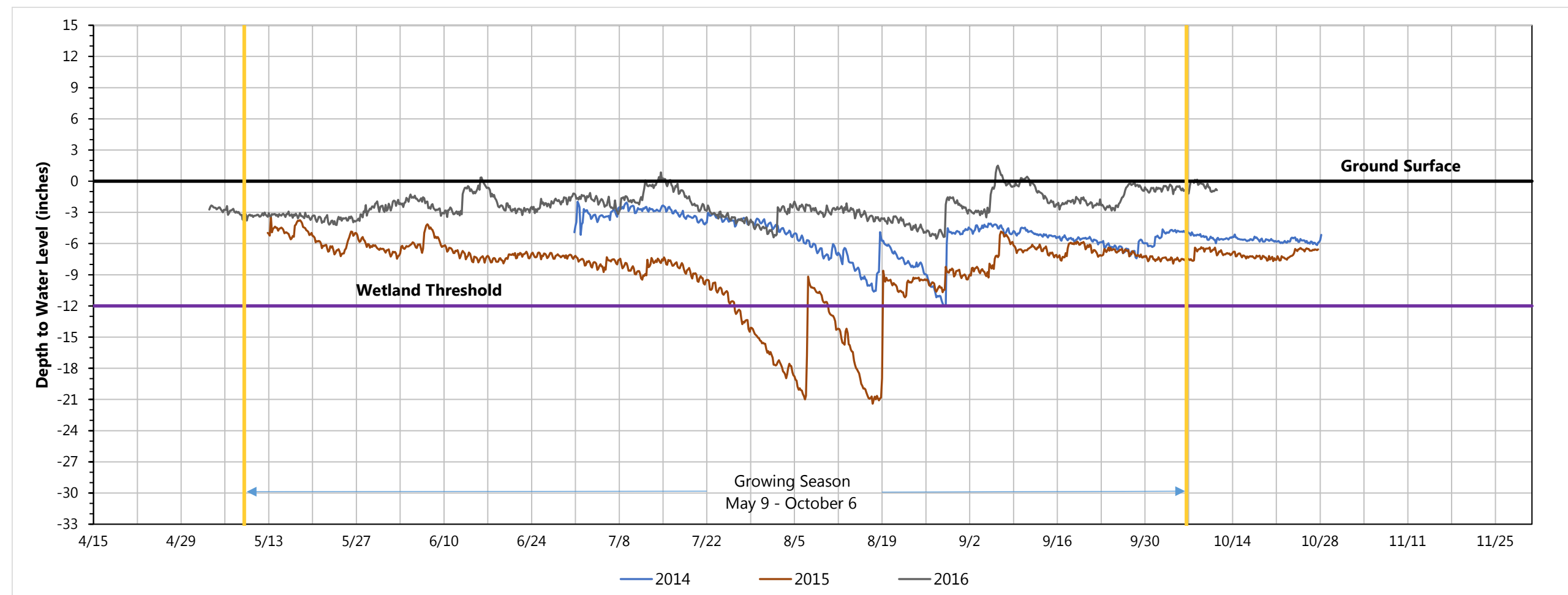


Figure 31-1
WETLAND MONITORING WELL 31
2014-2016 WETLAND HYDROLOGY MONITORING DATA
NorthMet Project
Poly Met Mining, Inc.
Hoyt Lakes, Minnesota

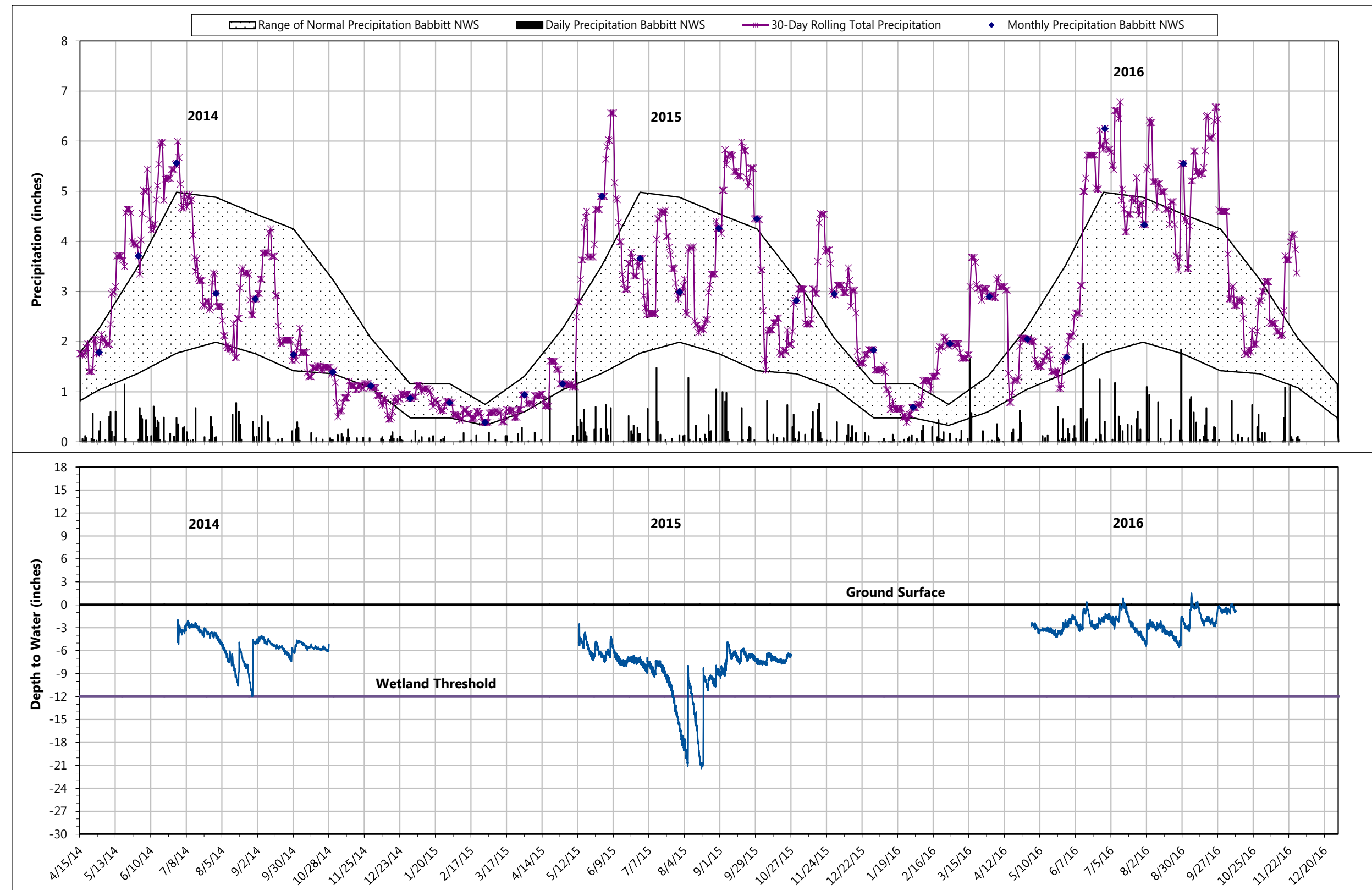


Figure 31-2
 WETLAND MONITORING WELL 31
 2014-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

NorthMet Project Hydrology Monitoring – Well 31



July 2014



May 2015



May 2016

Well ID: 32

NorthMet Project Area: Mine Site

Wetland Number: 107

Wetland Type: Coniferous Bog (Type 8)

UTM Coordinates (NAD 83 Zone 15)

Easting: 576129

Northing: 5272751

Well Type(s): In-Situ Troll

Date Recording Well Installed: 7/2/2014

Installed By: Barr

Water Level Recorded Every: 2 hours

Date Manual Well Installed: NA

Installed By: NA

Manual Water Levels Read: See notes

Growing Season: May 9-October 6 (151 days)

Monitored by: Barr

Water Level Fluctuation for All Years: 28.0 inches

Notes: A manual reading is completed twice per monitoring period - prior to initial installation of logger and when logger is removed at end of period.

Table 32-1. Monitoring Period Each Year¹. See the hydrographs in Figure 32-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Start Date	---	---	---	---	---	---	---	---	---	7/2	5/13	5/4
End Date	---	---	---	---	---	---	---	---	---	10/29	10/28	10/11
Total Days	---	---	---	---	---	---	---	---	---	120	169	161
Grow. Seas. Days	---	---	---	---	---	---	---	---	---	97	147	151

¹ Manual (M) well only at this location. No wells at the location (---). Day ranges and Growing Season (Grow. Seas.) Days in this table represent full calendar days.

Table 32-2. Precipitation During Each Growing Season and Water Year¹. See the yearly hydrographs in Figure 32-2.

Year		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Growing Season	May	A	N	A	N	B	B	A	A	N	A	A	B
	June	A	B	N	A	B	N	N	A	A	A	N	A
	July	B	A	B	B	B	A	B	A	A	N	B	B
	Aug	B	B	B	B	N	A	N	B	B	N	N	A
	Sept	B	B	A	A	B	N	B	B	B	B	N	A
Water Year		A	B	A	A	B	N	B	A	A	N	B	A

¹ The growing season includes precipitation during May through September and the water year includes precipitation from October 1 of the previous year through September 30 of the current year. Each time period, the precipitation is represented as: within the normal range of precipitation (N), below the normal range of precipitation (B), or above the normal range of precipitation (A).

Table 32-3. Hydroperiod(s) for Each Year During the Growing Season¹. Total number of days water level is ≥ 12 " below ground level for 14 or more consecutive days during the growing season. The yearly hydrographs are shown in Figure 32-2.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# of Periods ≥ 14 Consecutive Days	---	---	---	---	---	---	---	---	---	1	2	1
Total Days	---	---	---	---	---	---	---	---	---	96	125	151
% Grow. Seas.	---	---	---	---	---	---	---	---	---	99%	85%	100%

¹ Hydroperiods were not determined for locations with only a Manual (M) well. No wells at the location (---). The total days counted for the hydroperiod may not match the total days monitored within a growing season (Grow. Seas.) because the hydroperiod date count does not include partial days.

Table 32-4. Water Level Fluctuations During the Growing Season (inches)¹. Yearly fluctuations are shown in Figure 32-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum (in.)	---	---	---	---	---	---	---	---	---	-11.6	-20.9	-1.7
Maximum (in.)	---	---	---	---	---	---	---	---	---	0.6	6.1	7.1
Fluctuation (in.)	---	---	---	---	---	---	---	---	---	12.2	27.1	8.8

¹ Fluctuations in water level were not determined for locations with only a Manual (M) well. No wells at the location (---). Some water level depths were deeper than the bottom of the well casing (<) resulting in greater fluctuations than indicated in the data (>).

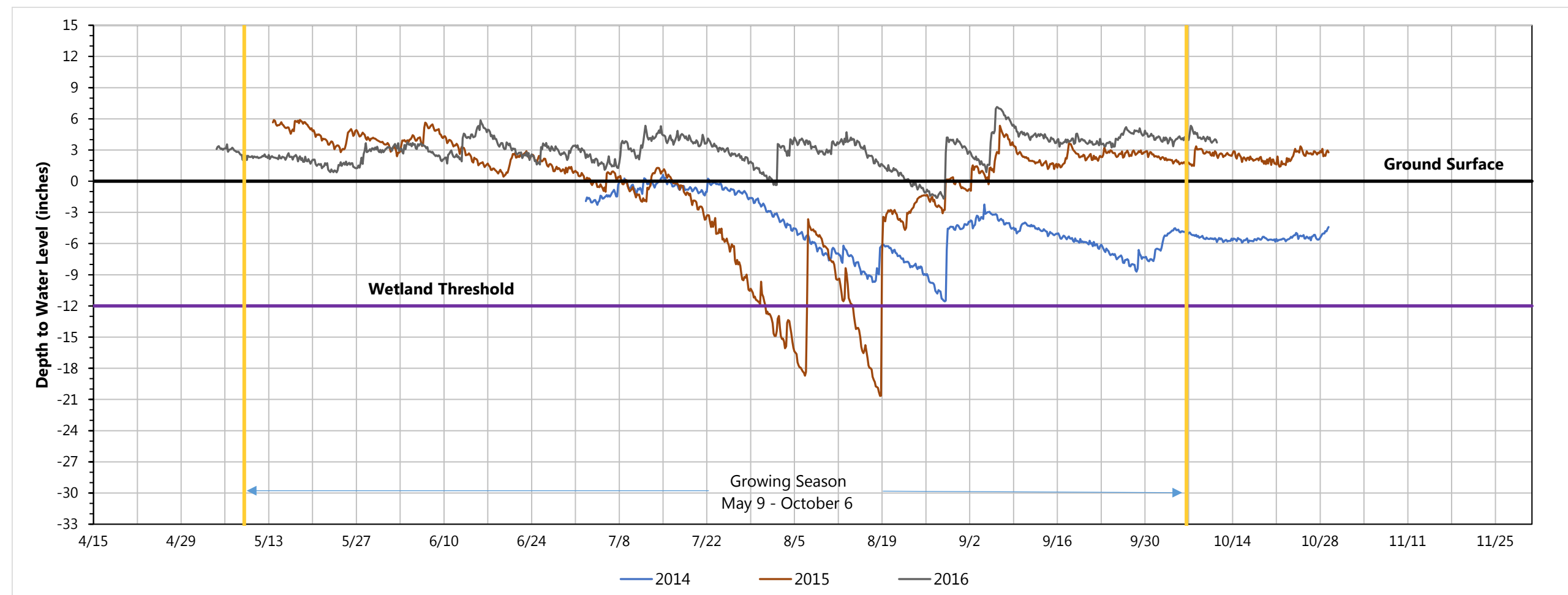


Figure 32-1
 WETLAND MONITORING WELL 32
 2014-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

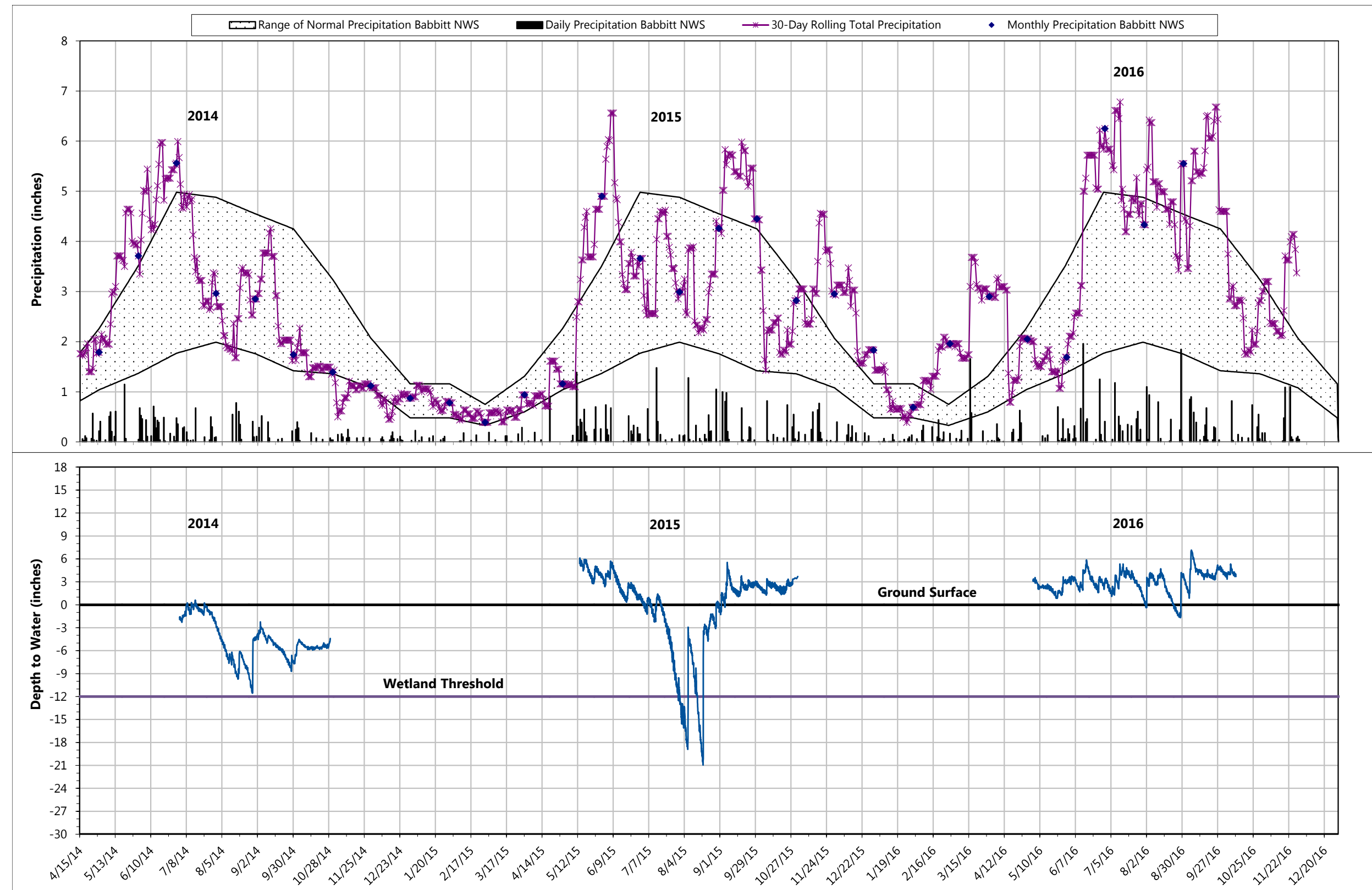


Figure 32-2
 WETLAND MONITORING WELL 32
 2014-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

NorthMet Project Hydrology Monitoring – Well 32



July 2014



May 2015



May 2016

Well ID: 33

NorthMet Project Area: Mine Site

Wetland Number: 53D

Wetland Type: Alder Thicket (Type 6)

UTM Coordinates (NAD 83 Zone 15)

Easting: 576584

Northing: 5272734

Well Type(s): In-Situ Troll

Date Recording Well Installed: 7/1/2014

Installed By: Barr

Water Level Recorded Every: 2 hours

Date Manual Well Installed: NA

Installed By: NA

Manual Water Levels Read: See notes

Growing Season: May 9-October 6 (151 days)

Monitored by: Barr

Water Level Fluctuation for All Years: 24.2 inches

Notes: A manual reading is completed twice per monitoring period - prior to initial installation of logger and when logger is removed at end of period.

Table 33-1. Monitoring Period Each Year¹. See the hydrographs in Figure 33-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Start Date	---	---	---	---	---	---	---	---	---	7/2	5/13	5/4
End Date	---	---	---	---	---	---	---	---	---	10/29	10/28	10/11
Total Days	---	---	---	---	---	---	---	---	---	120	169	161
Grow. Seas. Days	---	---	---	---	---	---	---	---	---	97	147	151

¹ Manual (M) well only at this location. No wells at the location (---). Day ranges and Growing Season (Grow. Seas.) Days in this table represent full calendar days.

Table 33-2. Precipitation During Each Growing Season and Water Year¹. See the yearly hydrographs in Figure 33-2.

Year		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Growing Season	May	A	N	A	N	B	B	A	A	N	A	A	B
	June	A	B	N	A	B	N	N	A	A	A	N	A
	July	B	A	B	B	B	A	B	A	A	N	B	B
	Aug	B	B	B	B	N	A	N	B	B	N	N	A
	Sept	B	B	A	A	B	N	B	B	B	B	N	A
Water Year		A	B	A	A	B	N	B	A	A	N	B	A

¹ The growing season includes precipitation during May through September and the water year includes precipitation from October 1 of the previous year through September 30 of the current year. Each time period, the precipitation is represented as: within the normal range of precipitation (N), below the normal range of precipitation (B), or above the normal range of precipitation (A).

Table 33-3. Hydroperiod(s) for Each Year During the Growing Season¹. Total number of days water level is ≥ 12 " below ground level for 14 or more consecutive days during the growing season. The yearly hydrographs are shown in Figure 33-2.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# of Periods ≥ 14 Consecutive Days	---	---	---	---	---	---	---	---	---	1	2	1
Total Days	---	---	---	---	---	---	---	---	---	97	131	151
% Grow. Seas.	---	---	---	---	---	---	---	---	---	100%	89%	100%

¹ Hydroperiods were not determined for locations with only a Manual (M) well. No wells at the location (---). The total days counted for the hydroperiod may not match the total days monitored within a growing season (Grow. Seas.) because the hydroperiod date count does not include partial days.

Table 33-4. Water Level Fluctuations During the Growing Season (inches)¹. Yearly fluctuations are shown in Figure 33-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum (in.)	---	---	---	---	---	---	---	---	---	-9.7	-15.4	-2.7
Maximum (in.)	---	---	---	---	---	---	---	---	---	3.0	8.1	8.8
Fluctuation (in.)	---	---	---	---	---	---	---	---	---	12.7	23.5	11.5

¹ Fluctuations in water level were not determined for locations with only a Manual (M) well. No wells at the location (---). Some water level depths were deeper than the bottom of the well casing (<) resulting in greater fluctuations than indicated in the data (>).

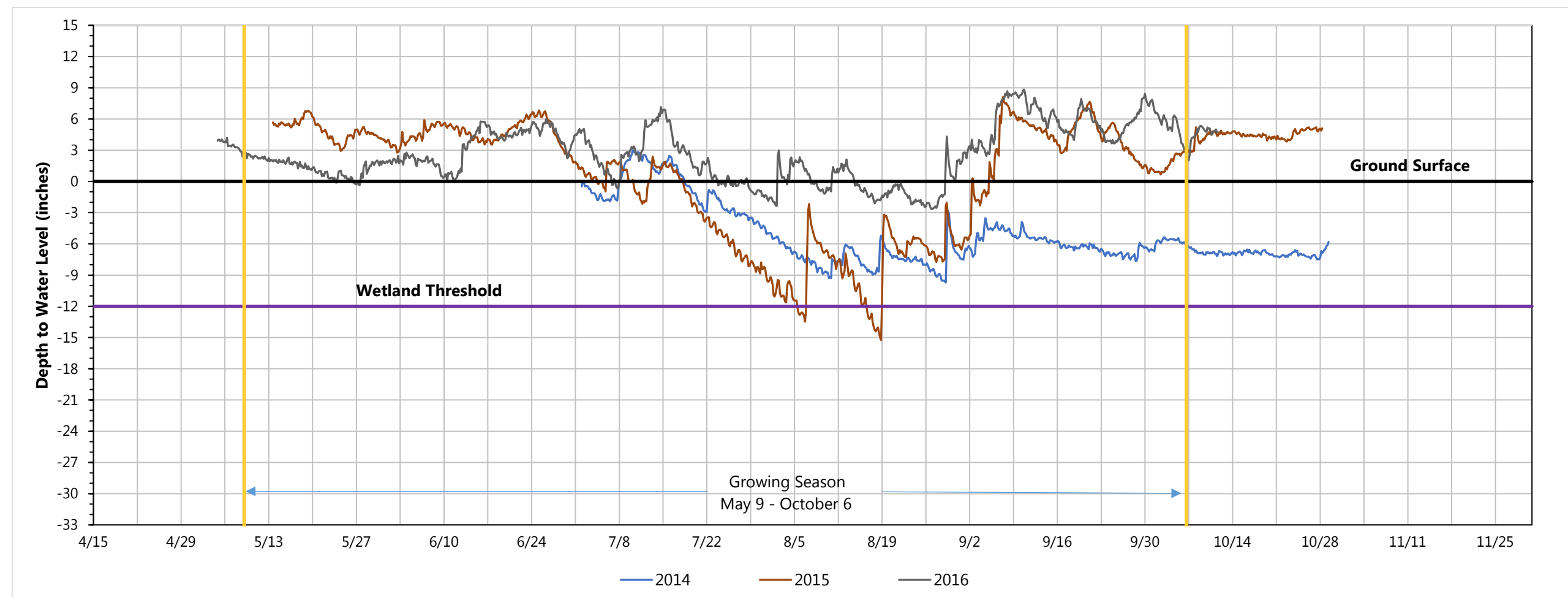


Figure 33-1
WETLAND MONITORING WELL 33
2014-2016 WETLAND HYDROLOGY MONITORING DATA
NorthMet Project
Poly Met Mining, Inc.
Hoyt Lakes, Minnesota

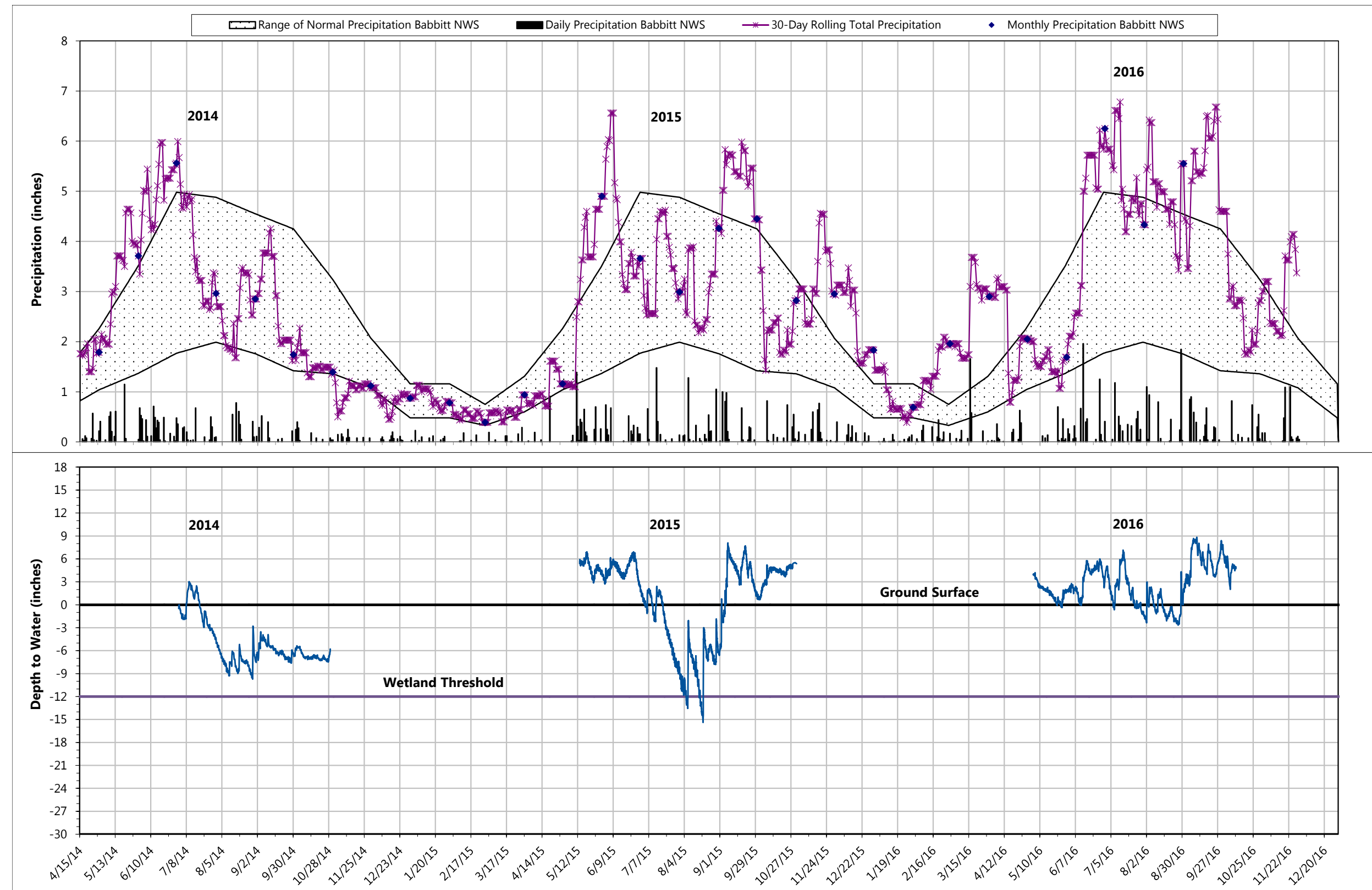


Figure 33-2
 WETLAND MONITORING WELL 33
 2014-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

NorthMet Project Hydrology Monitoring – Well 33



July 2014



May 2015



May 2016

Well ID: 34

NorthMet Project Area: Mine Site

Wetland Number: 53C

Wetland Type: Coniferous Swamp (Type 7)

UTM Coordinates (NAD 83 Zone 15)

Easting: 577152

Northing: 5272984

Well Type(s): In-Situ Troll

Date Recording Well Installed: 7/1/2014

Installed By: Barr

Water Level Recorded Every: 2 hours

Date Manual Well Installed: NA

Installed By: NA

Manual Water Levels Read: See notes

Growing Season: May 9-October 6 (151 days)

Monitored by: Barr

Water Level Fluctuation for All Years: 16.2 inches

Notes: A manual reading is completed twice per monitoring period - prior to initial installation of logger and when logger is removed at end of period.

Table 34-1. Monitoring Period Each Year¹. See the hydrographs in Figure 34-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Start Date	---	---	---	---	---	---	---	---	---	7/1	5/12	5/4
End Date	---	---	---	---	---	---	---	---	---	10/29	10/28	10/11
Total Days	---	---	---	---	---	---	---	---	---	121	170	161
Grow. Seas. Days	---	---	---	---	---	---	---	---	---	98	148	151

¹ Manual (M) well only at this location. No wells at the location (---). Day ranges and Growing Season (Grow. Seas.) Days in this table represent full calendar days.

Table 34-2. Precipitation During Each Growing Season and Water Year¹. See the yearly hydrographs in Figure 34-2.

Year		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Growing Season	May	A	N	A	N	B	B	A	A	N	A	A	B
	June	A	B	N	A	B	N	N	A	A	A	N	A
	July	B	A	B	B	B	A	B	A	A	N	B	B
	Aug	B	B	B	B	N	A	N	B	B	N	N	A
	Sept	B	B	A	A	B	N	B	B	B	B	N	A
Water Year		A	B	A	A	B	N	B	A	A	N	B	A

¹ The growing season includes precipitation during May through September and the water year includes precipitation from October 1 of the previous year through September 30 of the current year. Each time period, the precipitation is represented as: within the normal range of precipitation (N), below the normal range of precipitation (B), or above the normal range of precipitation (A).

Table 34-3. Hydroperiod(s) for Each Year During the Growing Season¹. Total number of days water level is ≥ 12 " below ground level for 14 or more consecutive days during the growing season. The yearly hydrographs are shown in Figure 34-2.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# of Periods ≥ 14 Consecutive Days	---	---	---	---	---	---	---	---	---	2	2	3
Total Days	---	---	---	---	---	---	---	---	---	65	63	139
% Grow. Seas.	---	---	---	---	---	---	---	---	---	66%	43%	92%

¹ Hydroperiods were not determined for locations with only a Manual (M) well. No wells at the location (---). The total days counted for the hydroperiod may not match the total days monitored within a growing season (Grow. Seas.) because the hydroperiod date count does not include partial days.

Table 34-4. Water Level Fluctuations During the Growing Season (inches)¹. Yearly fluctuations are shown in Figure 34-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum (in.)	---	---	---	---	---	---	---	---	---	-13.5	<-18.2	-16.8
Maximum (in.)	---	---	---	---	---	---	---	---	---	-4.2	-2.5	-2.0
Fluctuation (in.)	---	---	---	---	---	---	---	---	---	9.3	>15.7	14.8

¹ Fluctuations in water level were not determined for locations with only a Manual (M) well. No wells at the location (---). Some water level depths were deeper than the bottom of the well casing (<) resulting in greater fluctuations than indicated in the data (>).

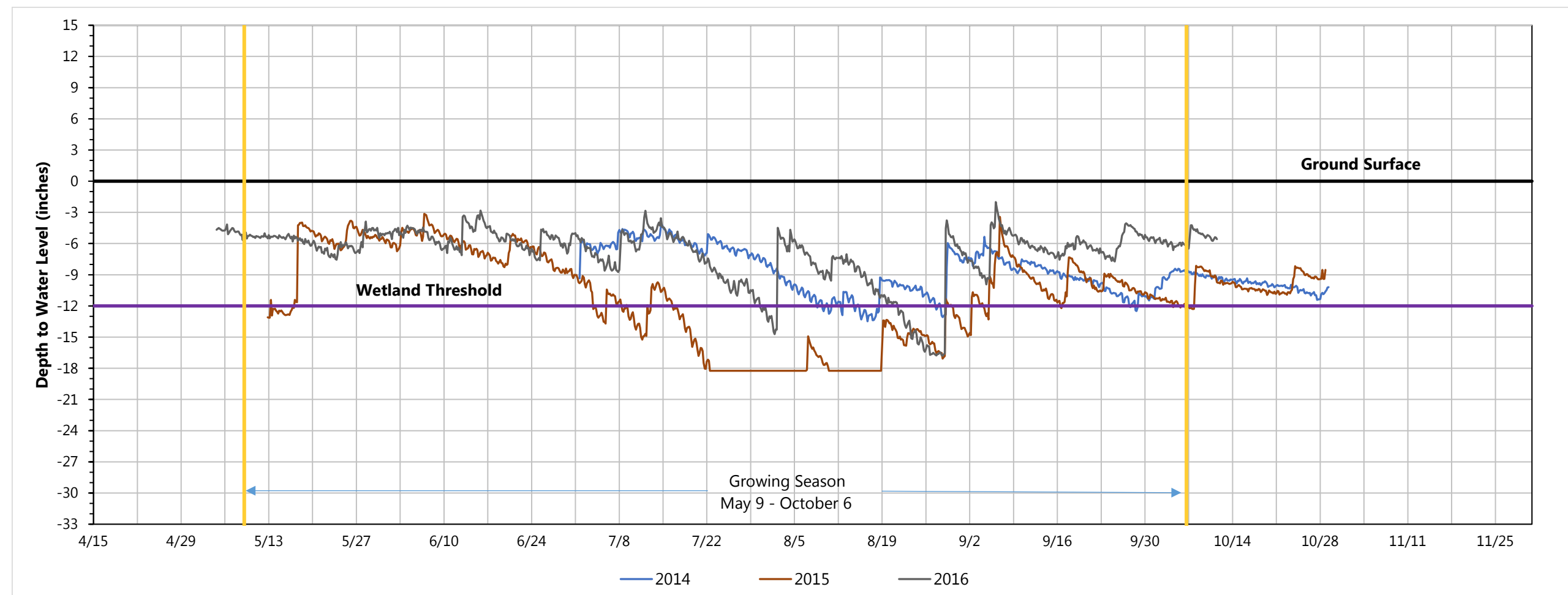


Figure 34-1
WETLAND MONITORING WELL 34
2014-2016 WETLAND HYDROLOGY MONITORING DATA
NorthMet Project
Poly Met Mining, Inc.
Hoyt Lakes, Minnesota

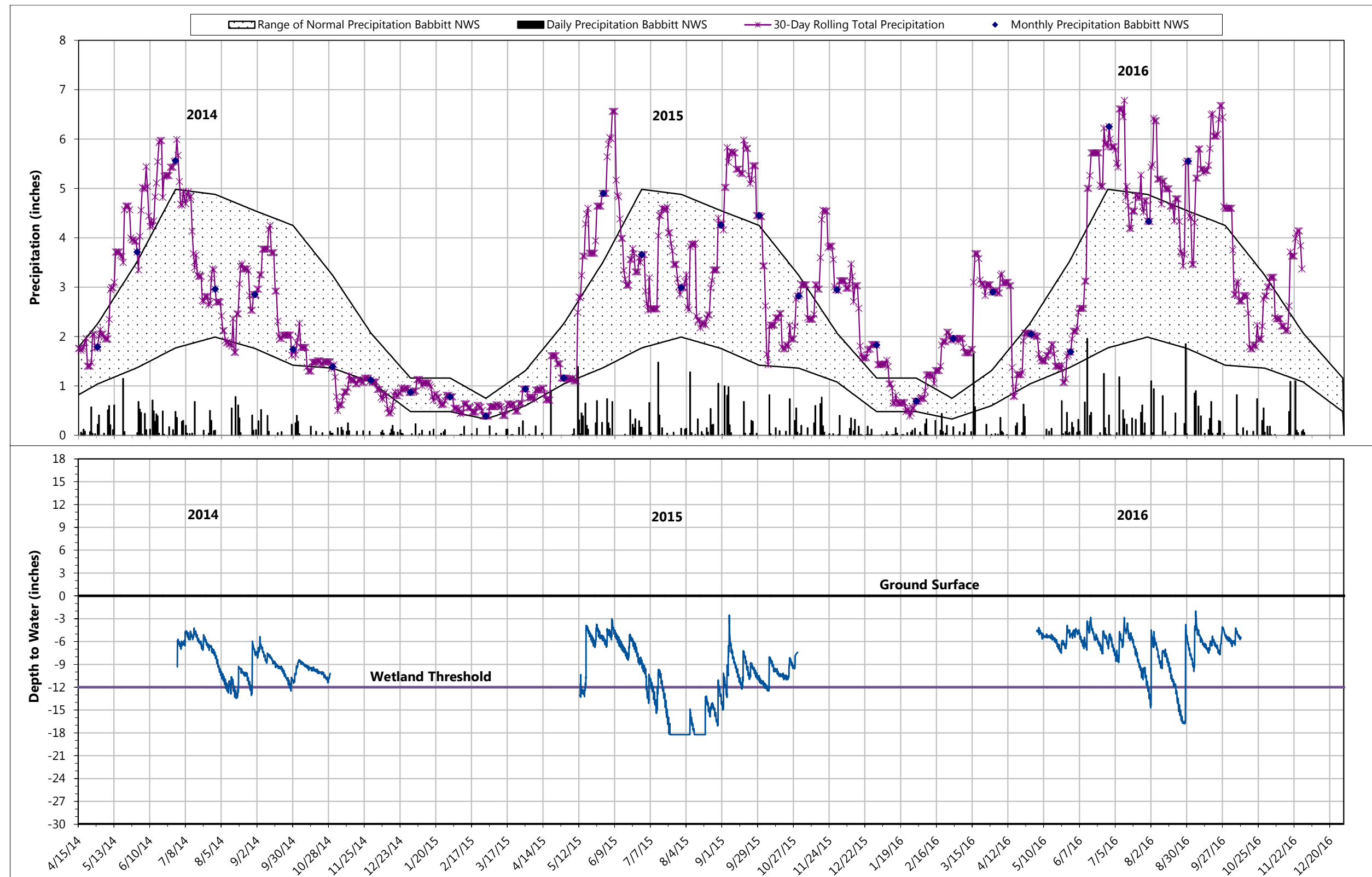


Figure 34-2
 WETLAND MONITORING WELL 34
 2014-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

NorthMet Project Hydrology Monitoring – Well 34



July 2014



May 2015



May 2016

Well ID: 35

NorthMet Project Area: Mine Site

Wetland Number: 53D

Wetland Type: Alder Thicket (Type 6)

UTM Coordinates (NAD 83 Zone 15)

Easting: 577670

Northing: 5273033

Well Type(s): In-Situ Troll

Date Recording Well Installed: 7/2/2014

Installed By: Barr

Water Level Recorded Every: 2 hours

Date Manual Well Installed: NA

Installed By: NA

Manual Water Levels Read: See notes

Growing Season: May 9-October 6 (151 days)

Monitored by: Barr

Water Level Fluctuation for All Years: 37.9 inches

Notes: A manual reading is completed twice per monitoring period - prior to initial installation of logger and when logger is removed at end of period.

Table 35-1. Monitoring Period Each Year¹. See the hydrographs in Figure 35-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Start Date	---	---	---	---	---	---	---	---	---	7/2	5/12	5/4
End Date	---	---	---	---	---	---	---	---	---	10/29	10/28	10/11
Total Days	---	---	---	---	---	---	---	---	---	120	170	161
Grow. Seas. Days	---	---	---	---	---	---	---	---	---	97	148	151

¹ Manual (M) well only at this location. No wells at the location (---). Day ranges and Growing Season (Grow. Seas.) Days in this table represent full calendar days.

Table 35-2. Precipitation During Each Growing Season and Water Year¹. See the yearly hydrographs in Figure 35-2.

Year		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Growing Season	May	A	N	A	N	B	B	A	A	N	A	A	B
	June	A	B	N	A	B	N	N	A	A	A	N	A
	July	B	A	B	B	B	A	B	A	A	N	B	B
	Aug	B	B	B	B	N	A	N	B	B	N	N	A
	Sept	B	B	A	A	B	N	B	B	B	B	N	A
Water Year		A	B	A	A	B	N	B	A	A	N	B	A

¹ The growing season includes precipitation during May through September and the water year includes precipitation from October 1 of the previous year through September 30 of the current year. Each time period, the precipitation is represented as: within the normal range of precipitation (N), below the normal range of precipitation (B), or above the normal range of precipitation (A).

Table 35-3. Hydroperiod(s) for Each Year During the Growing Season¹. Total number of days water level is ≥ 12 " below ground level for 14 or more consecutive days during the growing season. The yearly hydrographs are shown in Figure 35-2.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# of Periods ≥ 14 Consecutive Days	---	---	---	---	---	---	---	---	---	2	2	1
Total Days	---	---	---	---	---	---	---	---	---	70	117	151
% Grow. Seas.	---	---	---	---	---	---	---	---	---	72%	79%	100%

¹ Hydroperiods were not determined for locations with only a Manual (M) well. No wells at the location (---). The total days counted for the hydroperiod may not match the total days monitored within a growing season (Grow. Seas.) because the hydroperiod date count does not include partial days.

Table 35-4. Water Level Fluctuations During the Growing Season (inches)¹. Yearly fluctuations are shown in Figure 35-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum (in.)	---	---	---	---	---	---	---	---	---	-26.1	-26.3	0.4
Maximum (in.)	---	---	---	---	---	---	---	---	---	2.2	11.6	9.8
Fluctuation (in.)	---	---	---	---	---	---	---	---	---	28.3	37.9	9.4

¹ Fluctuations in water level were not determined for locations with only a Manual (M) well. No wells at the location (---). Some water level depths were deeper than the bottom of the well casing (<) resulting in greater fluctuations than indicated in the data (>).

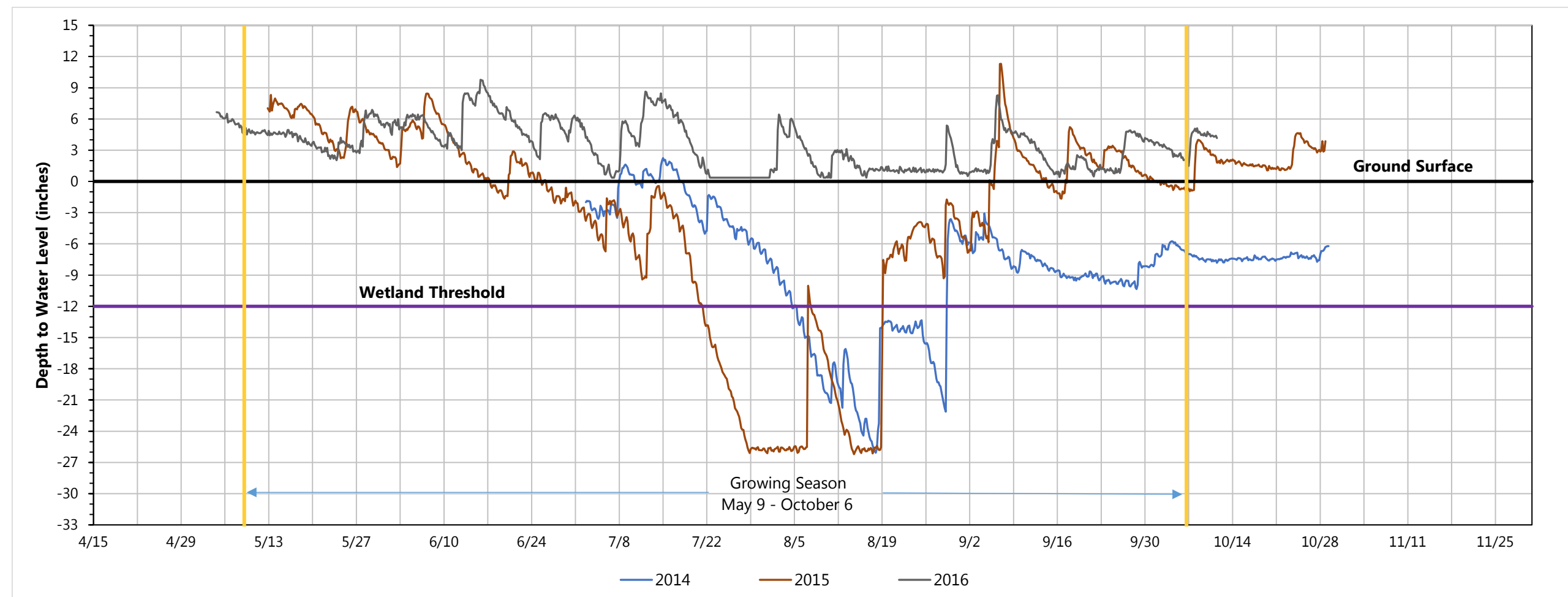


Figure 35-1
 WETLAND MONITORING WELL 35
 2014-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

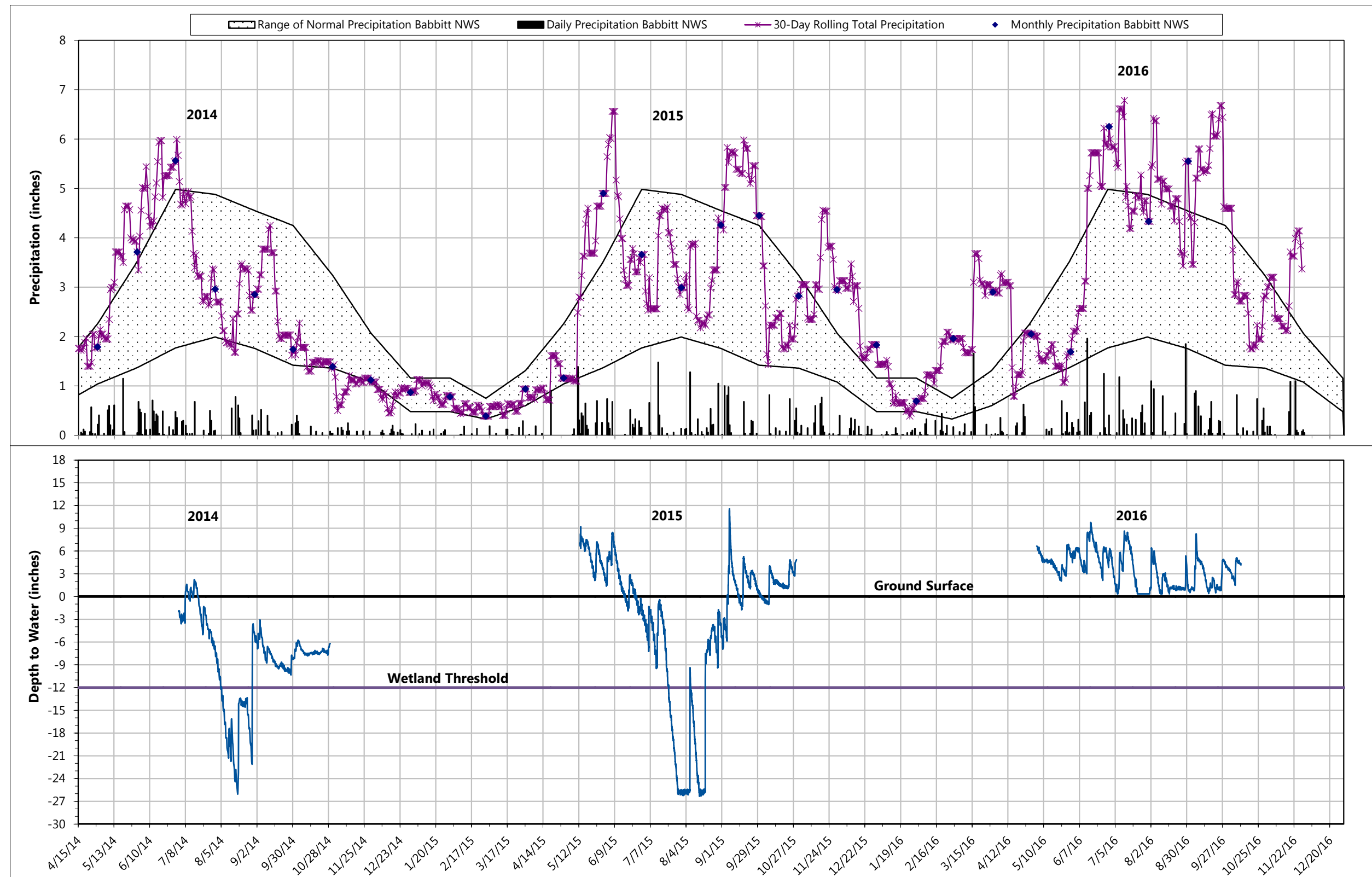


Figure 35-2
 WETLAND MONITORING WELL 35
 2014-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

NorthMet Project Hydrology Monitoring – Well 35



July 2014



May 2015



May 2016

Well ID: 36

NorthMet Project Area: Mine Site

Wetland Number: 53

Wetland Type: Alder Thicket (Type 6)

UTM Coordinates (NAD 83 Zone 15)

Easting: 578066

Northing: 5273446

Growing Season: May 9-October 6 (151 days)

Water Level Fluctuation for All Years: 26.8 inches

Well Type(s): In-Situ Troll

Date Recording Well Installed: 7/2/2014

Installed By: Barr

Water Level Recorded Every: 2 hours

Date Manual Well Installed: NA

Installed By: NA

Manual Water Levels Read: See notes

Monitored by: Barr

Notes: A manual reading is completed twice per monitoring period - prior to initial installation of logger and when logger is removed at end of period.

Table 36-1. Monitoring Period Each Year¹. See the hydrographs in Figure 36-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Start Date	---	---	---	---	---	---	---	---	---	7/2	5/12	5/4
End Date	---	---	---	---	---	---	---	---	---	10/28	10/27	10/11
Total Days	---	---	---	---	---	---	---	---	---	119	169	161
Grow. Seas. Days	---	---	---	---	---	---	---	---	---	97	148	151

¹ Manual (M) well only at this location. No wells at the location (---). Day ranges and Growing Season (Grow. Seas.) Days in this table represent full calendar days.

Table 36-2. Precipitation During Each Growing Season and Water Year¹. See the yearly hydrographs in Figure 36-2.

Year		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Growing Season	May	A	N	A	N	B	B	A	A	N	A	A	B
	June	A	B	N	A	B	N	N	A	A	A	N	A
	July	B	A	B	B	B	A	B	A	A	N	B	B
	Aug	B	B	B	B	N	A	N	B	B	N	N	A
	Sept	B	B	A	A	B	N	B	B	B	B	N	A
Water Year		A	B	A	A	B	N	B	A	A	N	B	A

¹ The growing season includes precipitation during May through September and the water year includes precipitation from October 1 of the previous year through September 30 of the current year. Each time period, the precipitation is represented as: within the normal range of precipitation (N), below the normal range of precipitation (B), or above the normal range of precipitation (A).

Table 36-3. Hydroperiod(s) for Each Year During the Growing Season¹. Total number of days water level is ≥ 12 " below ground level for 14 or more consecutive days during the growing season. The yearly hydrographs are shown in Figure 36-2.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# of Periods ≥ 14 Consecutive Days	---	---	---	---	---	---	---	---	---	1	2	2
Total Days	---	---	---	---	---	---	---	---	---	18	82	116
% Grow. Seas.	---	---	---	---	---	---	---	---	---	19%	55%	77%

¹ Hydroperiods were not determined for locations with only a Manual (M) well. No wells at the location (---). The total days counted for the hydroperiod may not match the total days monitored within a growing season (Grow. Seas.) because the hydroperiod date count does not include partial days.

Table 36-4. Water Level Fluctuations During the Growing Season (inches)¹. Yearly fluctuations are shown in Figure 36-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum (in.)	---	---	---	---	---	---	---	---	---	-25.2	-24.4	-23.9
Maximum (in.)	---	---	---	---	---	---	---	---	---	-2.4	1.6	1.1
Fluctuation (in.)	---	---	---	---	---	---	---	---	---	22.8	26.0	25.0

¹ Fluctuations in water level were not determined for locations with only a Manual (M) well. No wells at the location (---). Some water level depths were deeper than the bottom of the well casing (<) resulting in greater fluctuations than indicated in the data (>).

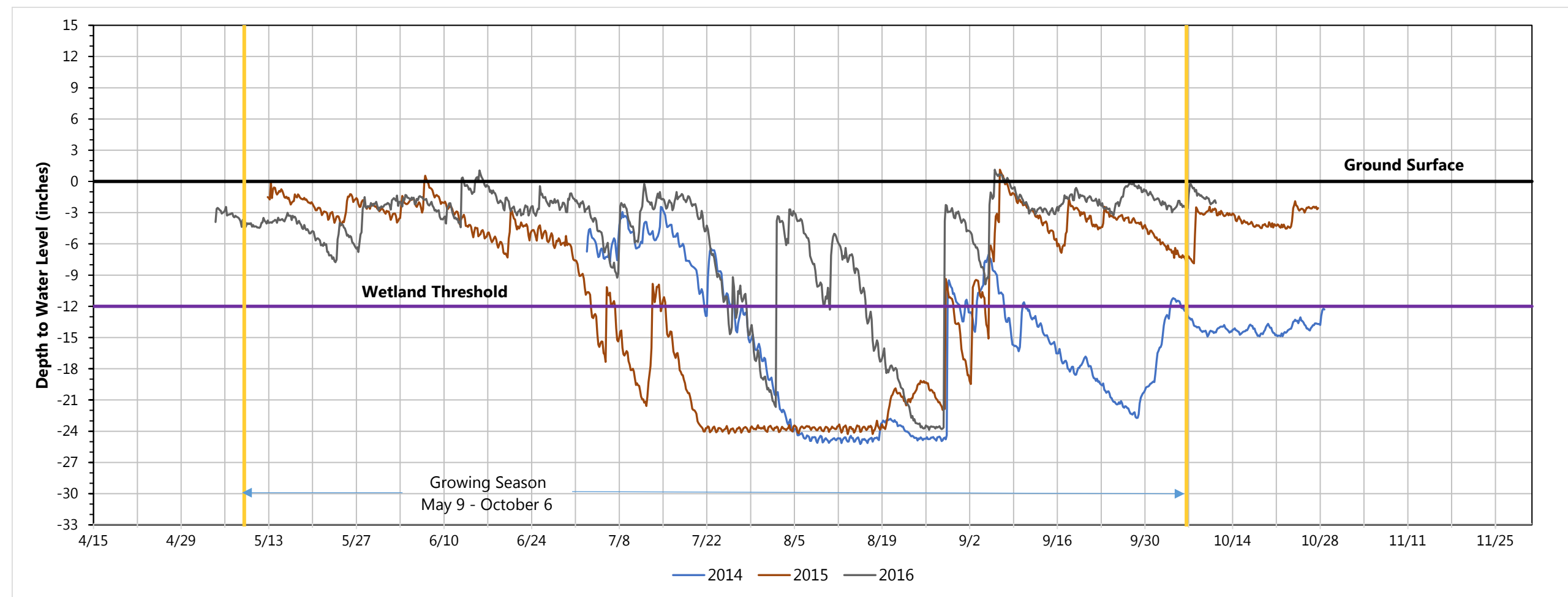


Figure 36-1
 WETLAND MONITORING WELL 36
 2014-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

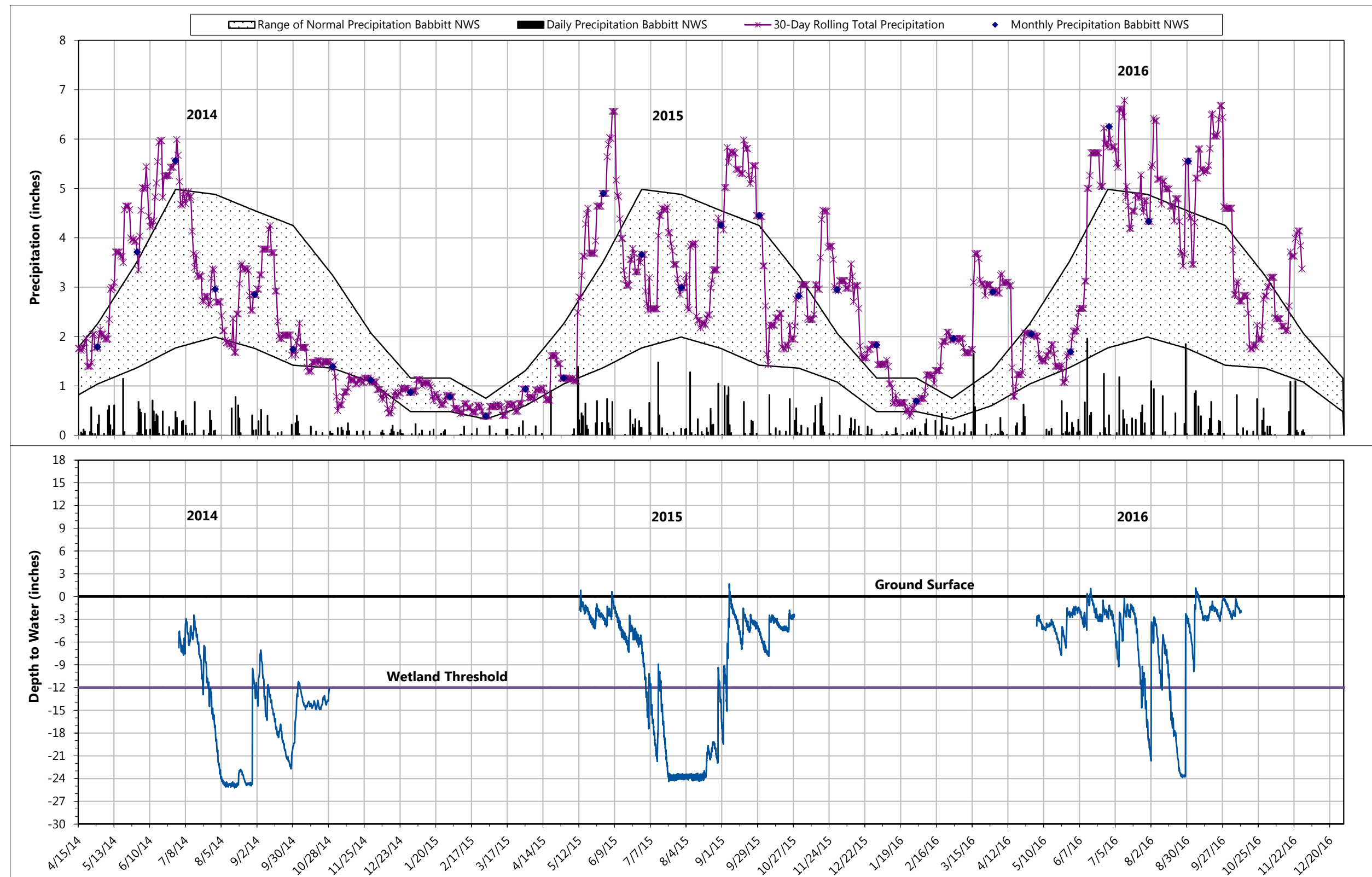


Figure 36-2
 WETLAND MONITORING WELL 36
 2014-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

NorthMet Project Hydrology Monitoring – Well 36



July 2014



May 2015



May 2016

Well ID: 37

NorthMet Project Area: Mine Site

Wetland Number: 58

Wetland Type: Alder Thicket (Type 6)

UTM Coordinates (NAD 83 Zone 15)

Easting: 579614

Northing: 5273998

Well Type(s): In-Situ Troll

Date Recording Well Installed: 7/2/2014

Installed By: Barr

Water Level Recorded Every: 2 hours

Date Manual Well Installed: NA

Installed By: NA

Manual Water Levels Read: See notes

Growing Season: May 9-October 6 (151 days)

Monitored by: Barr

Water Level Fluctuation for All Years: 27.3 inches

Notes: A manual reading is completed twice per monitoring period - prior to initial installation of logger and when logger is removed at end of period.

Table 37-1. Monitoring Period Each Year¹. See the hydrographs in Figure 37-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Start Date	---	---	---	---	---	---	---	---	---	7/2	5/12	5/3
End Date	---	---	---	---	---	---	---	---	---	10/28	10/28	10/11
Total Days	---	---	---	---	---	---	---	---	---	119	170	162
Grow. Seas. Days	---	---	---	---	---	---	---	---	---	97	148	151

¹ Manual (M) well only at this location. No wells at the location (---). Day ranges and Growing Season (Grow. Seas.) Days in this table represent full calendar days.

Table 37-2. Precipitation During Each Growing Season and Water Year¹. See the yearly hydrographs in Figure 37-2.

Year		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Growing Season	May	A	N	A	N	B	B	A	A	N	A	A	B
	June	A	B	N	A	B	N	N	A	A	A	N	A
	July	B	A	B	B	B	A	B	A	A	N	B	B
	Aug	B	B	B	B	N	A	N	B	B	N	N	A
	Sept	B	B	A	A	B	N	B	B	B	B	N	A
Water Year		A	B	A	A	B	N	B	A	A	N	B	A

¹ The growing season includes precipitation during May through September and the water year includes precipitation from October 1 of the previous year through September 30 of the current year. Each time period, the precipitation is represented as: within the normal range of precipitation (N), below the normal range of precipitation (B), or above the normal range of precipitation (A).

Table 37-3. Hydroperiod(s) for Each Year During the Growing Season¹. Total number of days water level is ≥ 12 " below ground level for 14 or more consecutive days during the growing season. The yearly hydrographs are shown in Figure 37-2.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# of Periods ≥ 14 Consecutive Days	---	---	---	---	---	---	---	---	---	2	2	1
Total Days	---	---	---	---	---	---	---	---	---	92	125	151
% Grow. Seas.	---	---	---	---	---	---	---	---	---	95%	84%	100%

¹ Hydroperiods were not determined for locations with only a Manual (M) well. No wells at the location (---). The total days counted for the hydroperiod may not match the total days monitored within a growing season (Grow. Seas.) because the hydroperiod date count does not include partial days.

Table 37-4. Water Level Fluctuations During the Growing Season (inches)¹. Yearly fluctuations are shown in Figure 37-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum (in.)	---	---	---	---	---	---	---	---	---	-13.9	-23.7	-5.2
Maximum (in.)	---	---	---	---	---	---	---	---	---	-0.4	3.6	2.7
Fluctuation (in.)	---	---	---	---	---	---	---	---	---	13.6	27.3	7.9

¹ Fluctuations in water level were not determined for locations with only a Manual (M) well. No wells at the location (---). Some water level depths were deeper than the bottom of the well casing (<) resulting in greater fluctuations than indicated in the data (>).

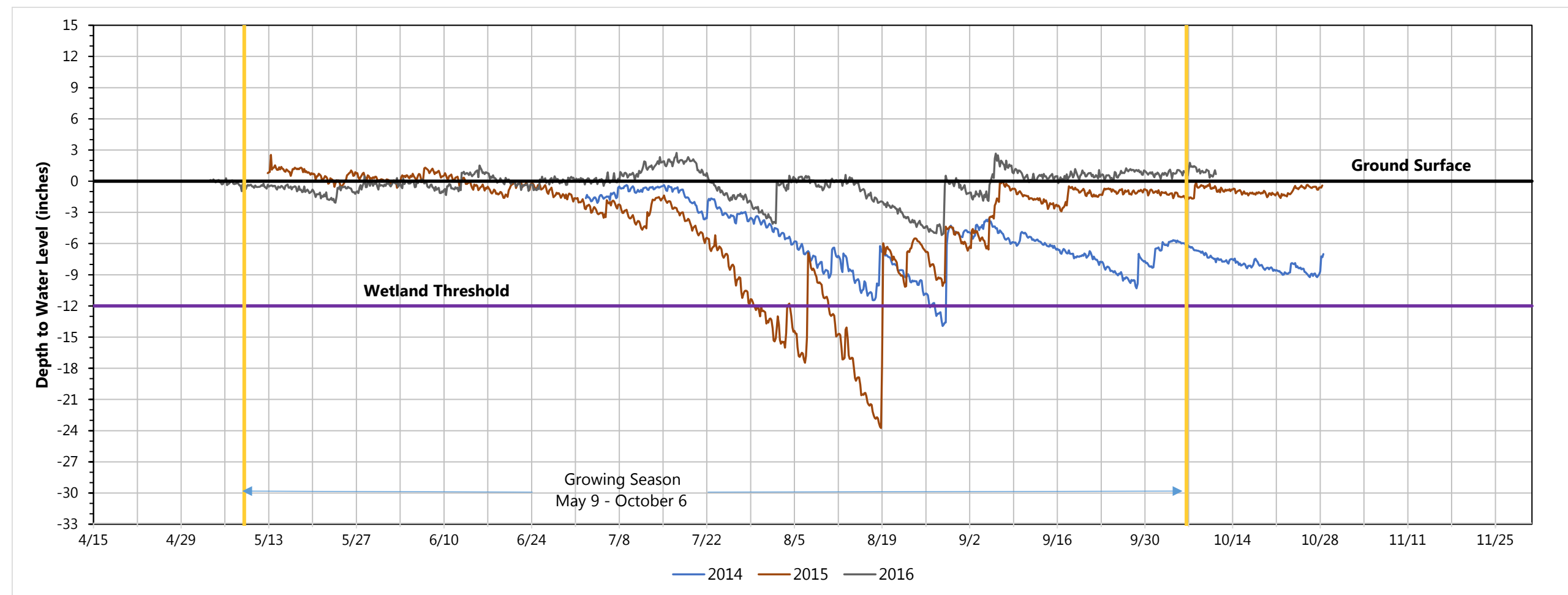


Figure 37-1
 WETLAND MONITORING WELL 37
 2014-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

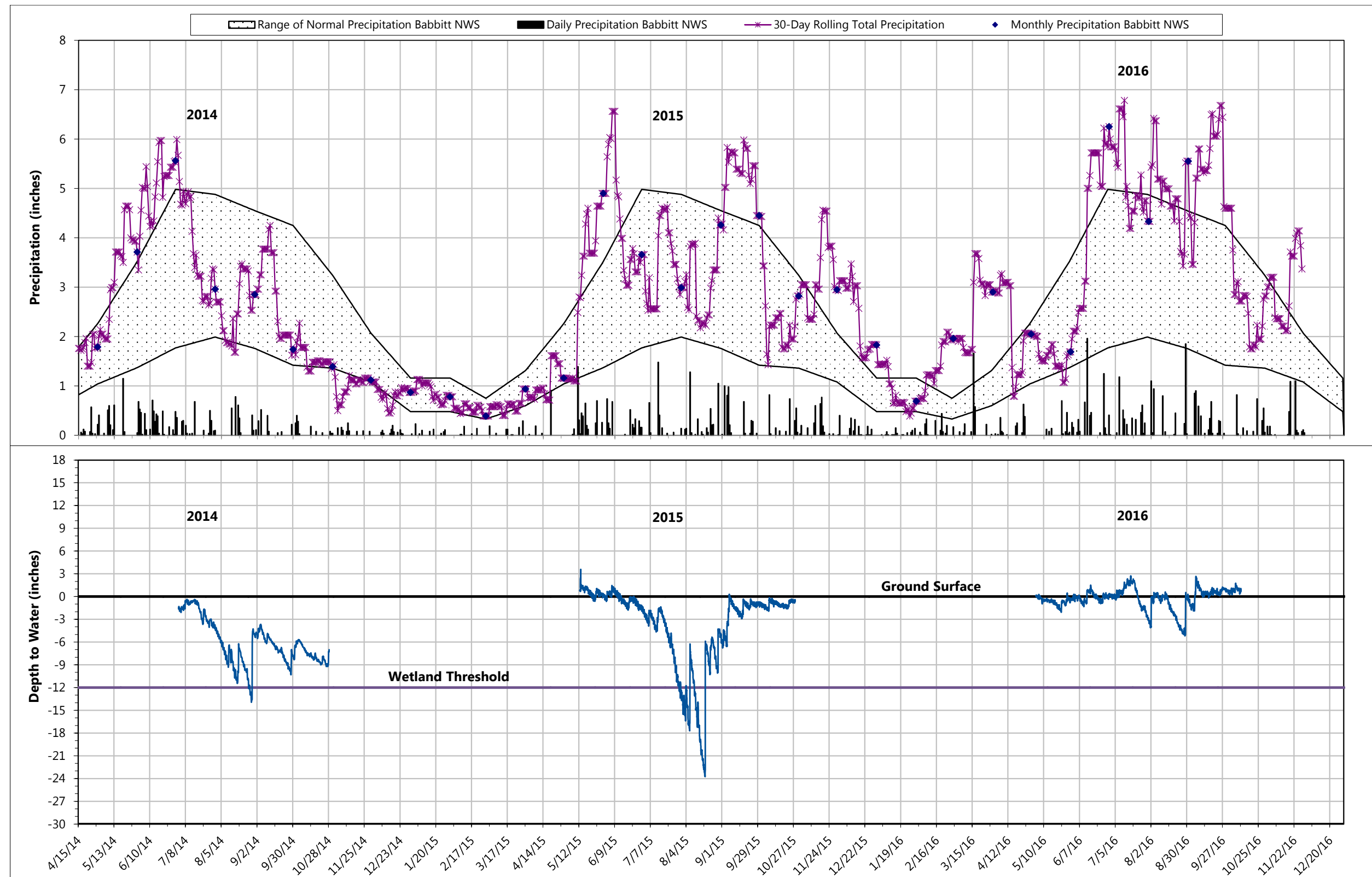


Figure 37-2
 WETLAND MONITORING WELL 37
 2014-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

NorthMet Project Hydrology Monitoring – Well 37



July 2014



May 2015



May 2016

Well ID: 38

NorthMet Project Area: Mine Site

Wetland Number: 11

Wetland Type: Coniferous Bog (Type 8)

UTM Coordinates (NAD 83 Zone 15)

Easting: 580220

Northing: 5274224

Well Type(s): In-Situ Troll

Date Recording Well Installed: 7/1/2014

Installed By: Barr

Water Level Recorded Every: 2 hours

Date Manual Well Installed: NA

Installed By: NA

Manual Water Levels Read: See notes

Growing Season: May 9-October 6 (151 days)

Monitored by: Barr

Water Level Fluctuation for All Years: 32.5 inches

Notes: A manual reading is completed twice per monitoring period - prior to initial installation of logger and when logger is removed at end of period.

Table 38-1. Monitoring Period Each Year¹. See the hydrographs in Figure 38-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Start Date	---	---	---	---	---	---	---	---	---	7/1	5/12	5/4
End Date	---	---	---	---	---	---	---	---	---	10/28	10/28	10/11
Total Days	---	---	---	---	---	---	---	---	---	120	170	161
Grow. Seas. Days	---	---	---	---	---	---	---	---	---	98	148	151

¹ Manual (M) well only at this location. No wells at the location (---). Day ranges and Growing Season (Grow. Seas.) Days in this table represent full calendar days.

Table 38-2. Precipitation During Each Growing Season and Water Year¹. See the yearly hydrographs in Figure 38-2.

Year		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Growing Season	May	A	N	A	N	B	B	A	A	N	A	A	B
	June	A	B	N	A	B	N	N	A	A	A	N	A
	July	B	A	B	B	B	A	B	A	A	N	B	B
	Aug	B	B	B	B	N	A	N	B	B	N	N	A
	Sept	B	B	A	A	B	N	B	B	B	B	N	A
Water Year		A	B	A	A	B	N	B	A	A	N	B	A

¹ The growing season includes precipitation during May through September and the water year includes precipitation from October 1 of the previous year through September 30 of the current year. Each time period, the precipitation is represented as: within the normal range of precipitation (N), below the normal range of precipitation (B), or above the normal range of precipitation (A).

Table 38-3. Hydroperiod(s) for Each Year During the Growing Season¹. Total number of days water level is ≥ 12 " below ground level for 14 or more consecutive days during the growing season. The yearly hydrographs are shown in Figure 38-2.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# of Periods ≥ 14 Consecutive Days	---	---	---	---	---	---	---	---	---	1	2	1
Total Days	---	---	---	---	---	---	---	---	---	97	129	151
% Grow. Seas.	---	---	---	---	---	---	---	---	---	99%	87%	100%

¹ Hydroperiods were not determined for locations with only a Manual (M) well. No wells at the location (---). The total days counted for the hydroperiod may not match the total days monitored within a growing season (Grow. Seas.) because the hydroperiod date count does not include partial days.

Table 38-4. Water Level Fluctuations During the Growing Season (inches)¹. Yearly fluctuations are shown in Figure 38-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum (in.)	---	---	---	---	---	---	---	---	---	-10.6	-23.1	0.9
Maximum (in.)	---	---	---	---	---	---	---	---	---	3.4	9.4	9.3
Fluctuation (in.)	---	---	---	---	---	---	---	---	---	14.1	32.4	8.4

¹ Fluctuations in water level were not determined for locations with only a Manual (M) well. No wells at the location (---). Some water level depths were deeper than the bottom of the well casing (<) resulting in greater fluctuations than indicated in the data (>).

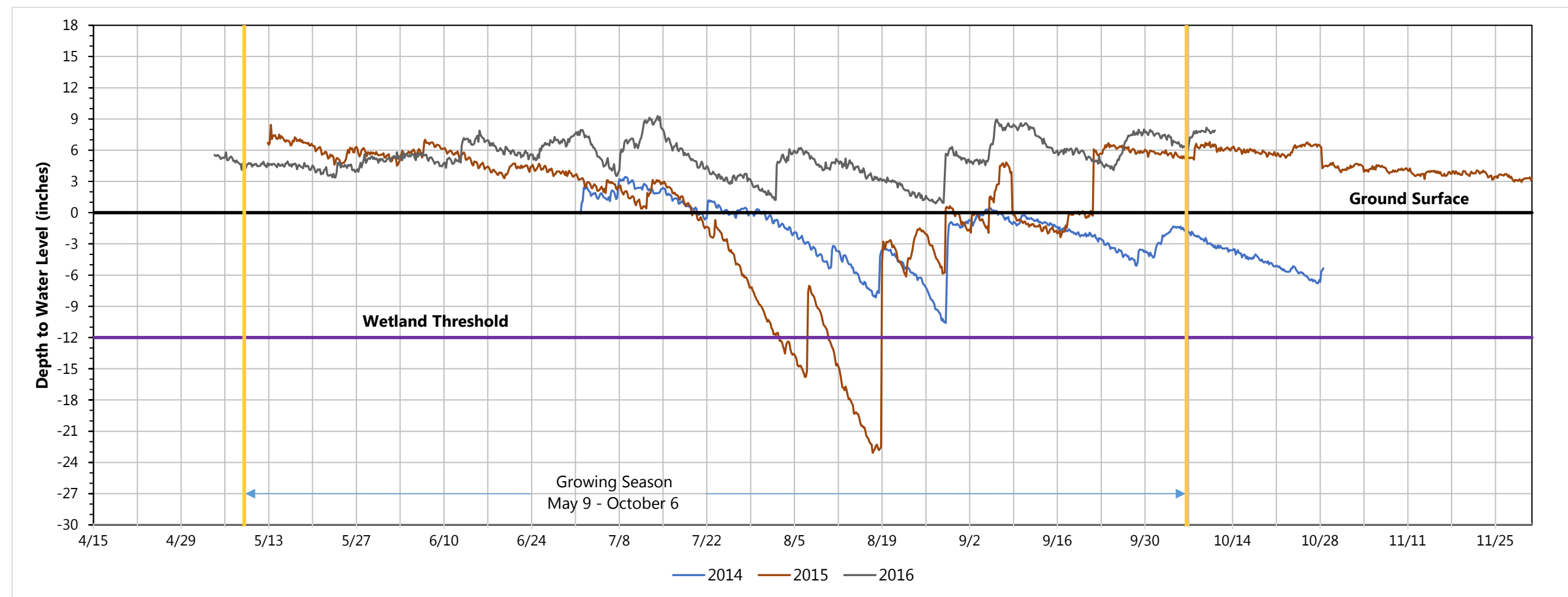


Figure 38-1
 WETLAND MONITORING WELL 38
 2014-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

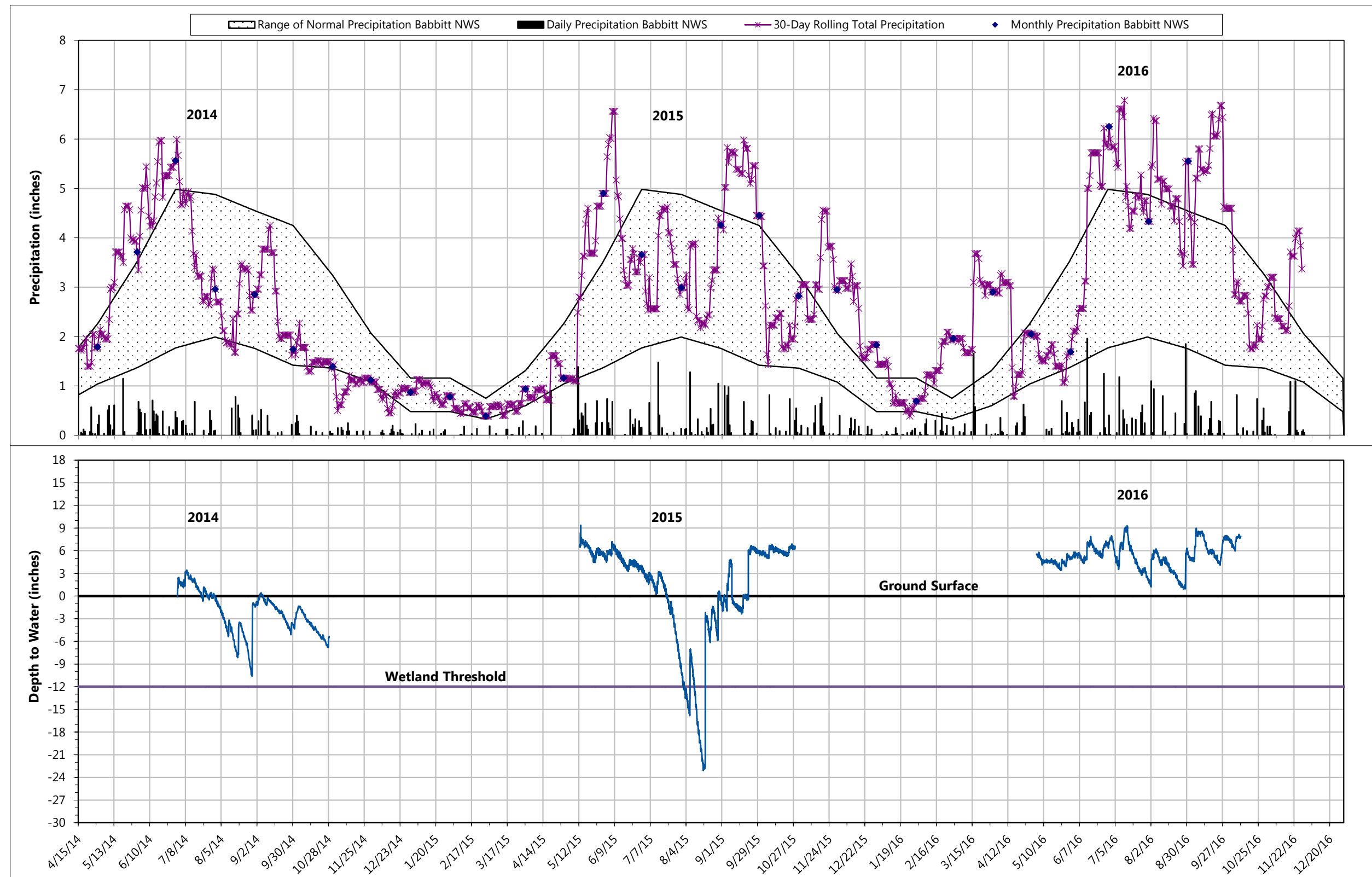


Figure 38-2
 WETLAND MONITORING WELL 38
 2014-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

NorthMet Project Hydrology Monitoring – Well 38



July 2014



May 2015



May 2016

Well ID: 39

NorthMet Project Area: Mine Site

Wetland Number: 29

Wetland Type: Shallow Marsh (Type 3)

UTM Coordinates (NAD 83 Zone 15)

Easting: 580563

Northing: 5274591

Well Type(s): In-Situ Troll

Date Recording Well Installed: 7/1/2014

Installed By: Barr

Water Level Recorded Every: 2 hours

Date Manual Well Installed: NA

Installed By: NA

Manual Water Levels Read: See notes

Growing Season: May 9-October 6 (151 days)

Monitored by: Barr

Water Level Fluctuation for All Years: 13.4 inches

Notes: A manual reading is completed twice per monitoring period - prior to initial installation of logger and when logger is removed at end of period.

Table 39-1. Monitoring Period Each Year¹. See the hydrographs in Figure 39-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Start Date	---	---	---	---	---	---	---	---	---	7/1	5/12	5/3
End Date	---	---	---	---	---	---	---	---	---	10/28	6/30	10/11
Total Days	---	---	---	---	---	---	---	---	---	120	50	162
Grow. Seas. Days	---	---	---	---	---	---	---	---	---	98	50	151

¹ Manual (M) well only at this location. No wells at the location (---). Day ranges and Growing Season (Grow. Seas.) Days in this table represent full calendar days. In 2015, casing was broken off and logger was on the ground; data was not useable after 6/30.

Table 39-2. Precipitation During Each Growing Season and Water Year¹. See the yearly hydrographs in Figure 39-2.

Year		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Growing Season	May	A	N	A	N	B	B	A	A	N	A	A	B
	June	A	B	N	A	B	N	N	A	A	A	N	A
	July	B	A	B	B	B	A	B	A	A	N	B	B
	Aug	B	B	B	B	N	A	N	B	B	N	N	A
	Sept	B	B	A	A	B	N	B	B	B	B	N	A
Water Year		A	B	A	A	B	N	B	A	A	N	B	A

¹ The growing season includes precipitation during May through September and the water year includes precipitation from October 1 of the previous year through September 30 of the current year. Each time period, the precipitation is represented as: within the normal range of precipitation (N), below the normal range of precipitation (B), or above the normal range of precipitation (A).

Table 39-3. Hydroperiod(s) for Each Year During the Growing Season¹. Total number of days water level is $\geq 12"$ below ground level for 14 or more consecutive days during the growing season. The yearly hydrographs are shown in Figure 39-2.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# of Periods ≥ 14 Consecutive Days	---	---	---	---	---	---	---	---	---	1	1	1
Total Days	---	---	---	---	---	---	---	---	---	97	48	151
% Grow. Seas.	---	---	---	---	---	---	---	---	---	99%	96%	100%

¹ Hydroperiods were not determined for locations with only a Manual (M) well. No wells at the location (---). The total days counted for the hydroperiod may not match the total days monitored within a growing season (Grow. Seas.) because the hydroperiod date count does not include partial days.

Table 39-4. Water Level Fluctuations During the Growing Season (inches)¹. Yearly fluctuations are shown in Figure 39-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum (in.)	---	---	---	---	---	---	---	---	---	-8.8	-0.4	-2.0
Maximum (in.)	---	---	---	---	---	---	---	---	---	0.9	3.1	4.6
Fluctuation (in.)	---	---	---	---	---	---	---	---	---	9.7	3.5	6.6

¹ Fluctuations in water level were not determined for locations with only a Manual (M) well. No wells at the location (---). Some water level depths were deeper than the bottom of the well casing (<) resulting in greater fluctuations than indicated in the data (>).

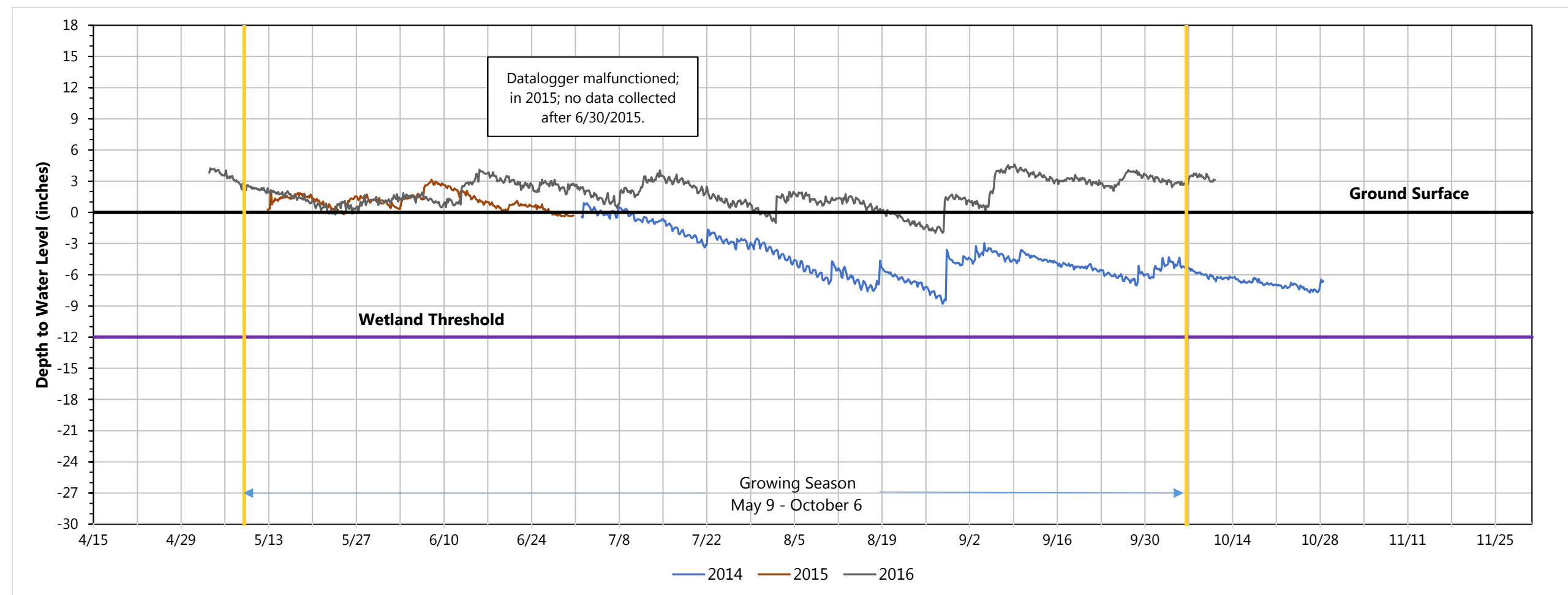


Figure 39-1
 WETLAND MONITORING WELL 39
 2014-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

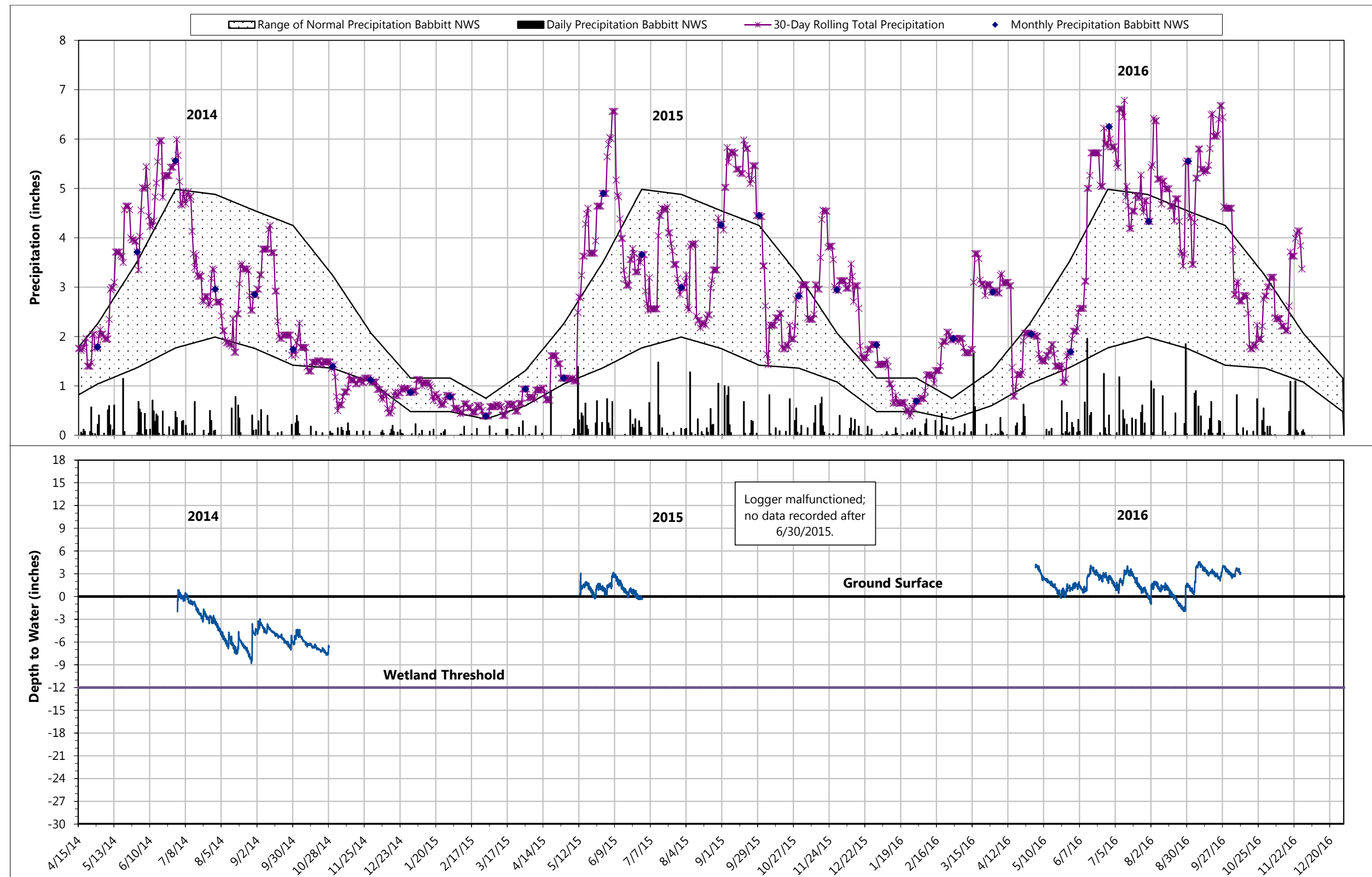


Figure 39-2
 WETLAND MONITORING WELL 39
 2014-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

NorthMet Project Hydrology Monitoring – Well 39



July 2014



May 2015



May 2016

Well ID: 43

NorthMet Project Area: Mine Site

Wetland Number: 48

Wetland Type: Coniferous Bog (Type 8)

UTM Coordinates (NAD 83 Zone 15)

Easting: 578697

Northing: 5274362

Growing Season: May 9-October 6 (151 days)

Water Level Fluctuation for All Years: 16.2 inches

Well Type(s): In-Situ Troll

Date Recording Well Installed: 7/2/2014

Installed By: Barr

Water Level Recorded Every: 2 hours

Date Manual Well Installed: NA

Installed By: NA

Manual Water Levels Read: See notes

Monitored by: Barr

Notes: A manual reading is completed twice per monitoring period - prior to initial installation of logger and when logger is removed at end of period.

Table 43-1. Monitoring Period Each Year¹. See the hydrographs in Figure 43-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Start Date	---	---	---	---	---	---	---	---	---	7/2	5/12	5/3
End Date	---	---	---	---	---	---	---	---	---	10/28	10/28	10/11
Total Days	---	---	---	---	---	---	---	---	---	119	170	162
Grow. Seas. Days	---	---	---	---	---	---	---	---	---	97	148	151

¹ Manual (M) well only at this location. No wells at the location (---). Day ranges and Growing Season (Grow. Seas.) Days in this table represent full calendar days.

Table 43-2. Precipitation During Each Growing Season and Water Year¹. See the yearly hydrographs in Figure 43-2.

Year		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Growing Season	May	A	N	A	N	B	B	A	A	N	A	A	B
	June	A	B	N	A	B	N	N	A	A	A	N	A
	July	B	A	B	B	B	A	B	A	A	N	B	B
	Aug	B	B	B	B	N	A	N	B	B	N	N	A
	Sept	B	B	A	A	B	N	B	B	B	B	N	A
Water Year		A	B	A	A	B	N	B	A	A	N	B	A

¹ The growing season includes precipitation during May through September and the water year includes precipitation from October 1 of the previous year through September 30 of the current year. Each time period, the precipitation is represented as: within the normal range of precipitation (N), below the normal range of precipitation (B), or above the normal range of precipitation (A).

Table 43-3. Hydroperiod(s) for Each Year During the Growing Season¹. Total number of days water level is ≥ 12 " below ground level for 14 or more consecutive days during the growing season. The yearly hydrographs are shown in Figure 43-2.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# of Periods ≥ 14 Consecutive Days	---	---	---	---	---	---	---	---	---	1	2	1
Total Days	---	---	---	---	---	---	---	---	---	96	86	151
% Grow. Seas.	---	---	---	---	---	---	---	---	---	99%	58%	100%

¹ Hydroperiods were not determined for locations with only a Manual (M) well. No wells at the location (---). The total days counted for the hydroperiod may not match the total days monitored within a growing season (Grow. Seas.) because the hydroperiod date count does not include partial days.

Table 43-4. Water Level Fluctuations During the Growing Season (inches)¹. Yearly fluctuations are shown in Figure 43-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum (in.)	---	---	---	---	---	---	---	---	---	-11.7	-20.2	-11.6
Maximum (in.)	---	---	---	---	---	---	---	---	---	-4.0	-4.4	-4.9
Fluctuation (in.)	---	---	---	---	---	---	---	---	---	7.6	15.8	6.7

¹ Fluctuations in water level were not determined for locations with only a Manual (M) well. No wells at the location (---). Some water level depths were deeper than the bottom of the well casing (<) resulting in greater fluctuations than indicated in the data (>).

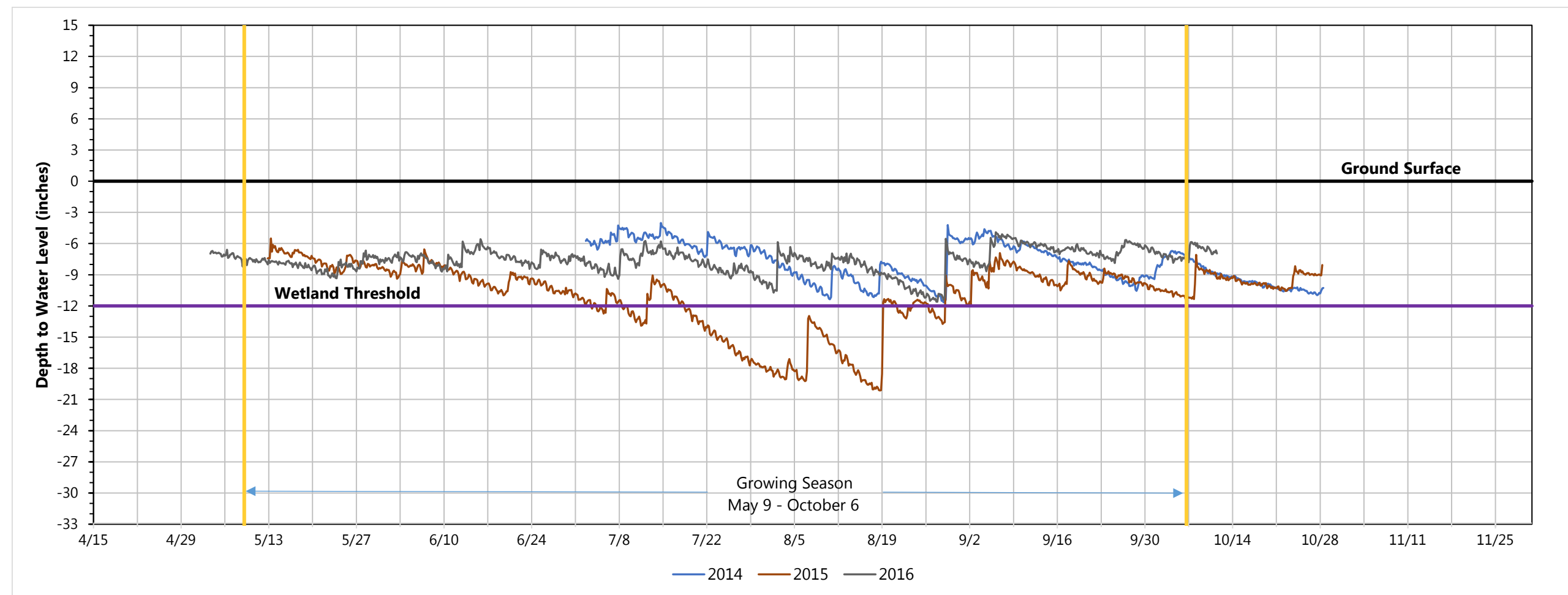


Figure 43-1
 WETLAND MONITORING WELL 43
 2014-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

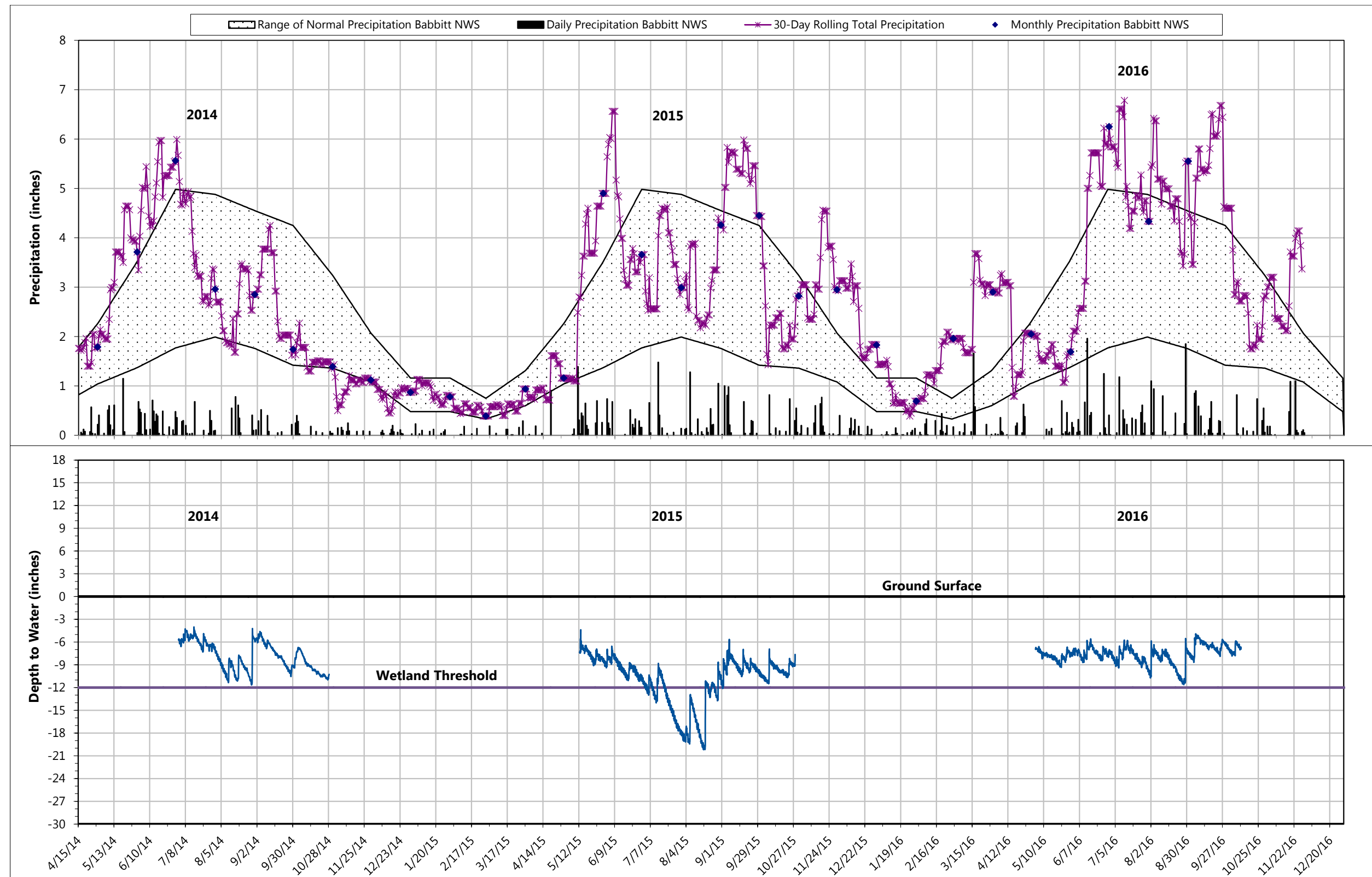


Figure 43-2
 WETLAND MONITORING WELL 43
 2014-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

NorthMet Project Hydrology Monitoring – Well 43



July 2014



May 2015



May 2016

Well ID: 44

NorthMet Project Area: Mine Site

Wetland Number: 68

Wetland Type: Coniferous Swamp (Type 7)

UTM Coordinates (NAD 83 Zone 15)

Easting: 578048

Northing: 5274500

Well Type(s): In-Situ Troll

Date Recording Well Installed: 7/1/2014

Installed By: Barr

Water Level Recorded Every: 2 hours

Date Manual Well Installed: NA

Installed By: NA

Manual Water Levels Read: See notes

Growing Season: May 9-October 6 (151 days)

Monitored by: Barr

Water Level Fluctuation for All Years: >18.2 inches

Notes: A manual reading is completed twice per monitoring period - prior to initial installation of logger and when logger is removed at end of period.

Table 44-1. Monitoring Period Each Year¹. See the hydrographs in Figure 44-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Start Date	---	---	---	---	---	---	---	---	---	7/1	5/12	5/3
End Date	---	---	---	---	---	---	---	---	---	10/28	10/27	10/11
Total Days	---	---	---	---	---	---	---	---	---	120	169	162
Grow. Seas. Days	---	---	---	---	---	---	---	---	---	98	148	151

¹ Manual (M) well only at this location. No wells at the location (---). Day ranges and Growing Season (Grow. Seas.) Days in this table represent full calendar days.

Table 44-2. Precipitation During Each Growing Season and Water Year¹. See the yearly hydrographs in Figure 44-2.

Year		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Growing Season	May	A	N	A	N	B	B	A	A	N	A	A	B
	June	A	B	N	A	B	N	N	A	A	A	N	A
	July	B	A	B	B	B	A	B	A	A	N	B	B
	Aug	B	B	B	B	N	A	N	B	B	N	N	A
	Sept	B	B	A	A	B	N	B	B	B	B	N	A
Water Year		A	B	A	A	B	N	B	A	A	N	B	A

¹ The growing season includes precipitation during May through September and the water year includes precipitation from October 1 of the previous year through September 30 of the current year. Each time period, the precipitation is represented as: within the normal range of precipitation (N), below the normal range of precipitation (B), or above the normal range of precipitation (A).

Table 44-3. Hydroperiod(s) for Each Year During the Growing Season¹. Total number of days water level is ≥ 12 " below ground level for 14 or more consecutive days during the growing season. The yearly hydrographs are shown in Figure 44-2.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# of Periods ≥ 14 Consecutive Days	---	---	---	---	---	---	---	---	---	0	0	0
Total Days	---	---	---	---	---	---	---	---	---	0	0	0
% Grow. Seas.	---	---	---	---	---	---	---	---	---	0%	0%	0%

¹ Hydroperiods were not determined for locations with only a Manual (M) well. No wells at the location (---). The total days counted for the hydroperiod may not match the total days monitored within a growing season (Grow. Seas.) because the hydroperiod date count does not include partial days.

Table 44-4. Water Level Fluctuations During the Growing Season (inches)¹. Yearly fluctuations are shown in Figure 44-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum (in.)	---	---	---	---	---	---	---	---	---	<-20.5	<-26.4	-24.7
Maximum (in.)	---	---	---	---	---	---	---	---	---	-14.2	-9.0	-8.2
Fluctuation (in.)	---	---	---	---	---	---	---	---	---	>6.3	>17.5	16.5

¹ Fluctuations in water level were not determined for locations with only a Manual (M) well. No wells at the location (---). Some water level depths were deeper than the bottom of the well casing (<) resulting in greater fluctuations than indicated in the data (>).

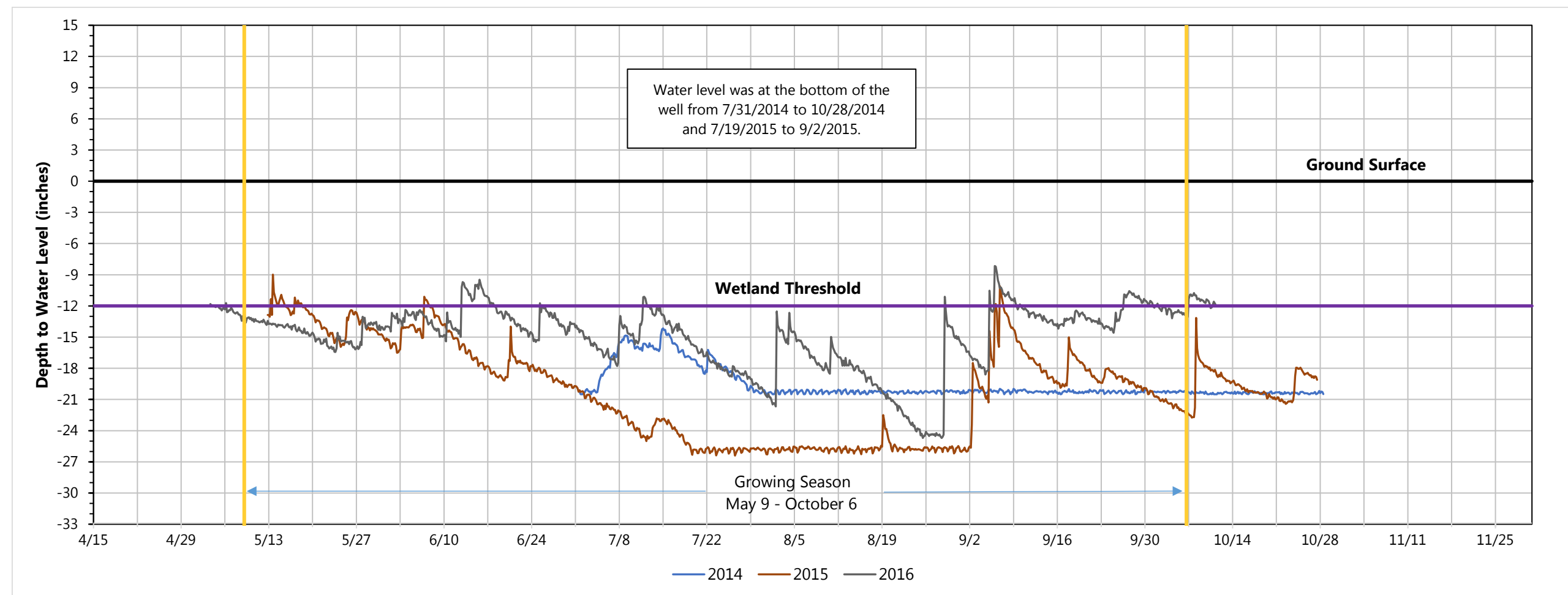


Figure 44-1
 WETLAND MONITORING WELL 44
 2014-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

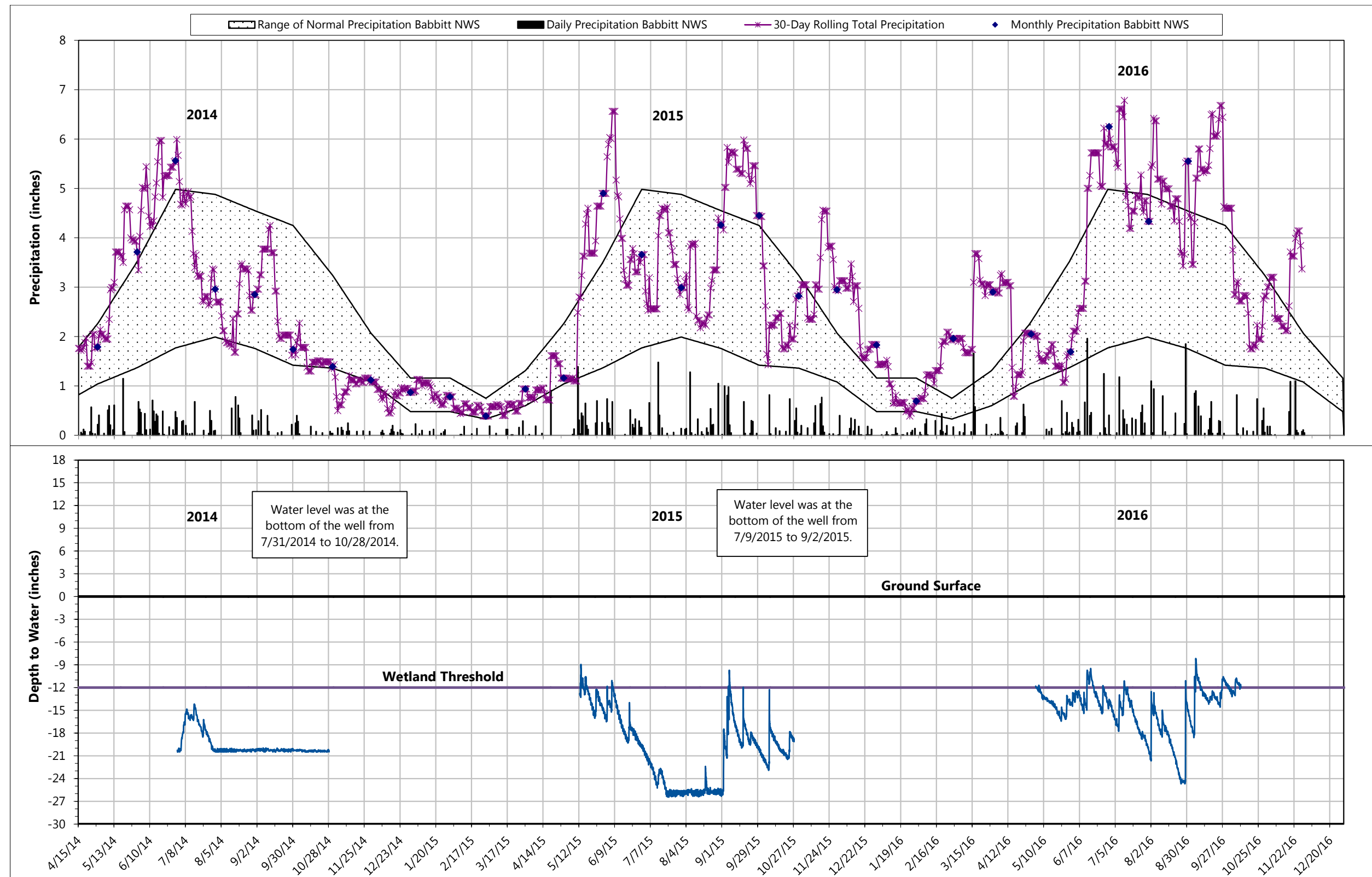


Figure 44-2
 WETLAND MONITORING WELL 44
 2014-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

NorthMet Project Hydrology Monitoring – Well 44



July 2014



May 2015



May 2016

Well ID: 45

NorthMet Project Area: Mine Site

Wetland Number: 90A

Wetland Type: Open Bog (Type 8)

UTM Coordinates (NAD 83 Zone 15)

Easting: 579580

Northing: 5274842

Growing Season: May 9-October 6 (151 days)

Water Level Fluctuation for All Years: 15.7 inches

Well Type(s): In-Situ Troll

Date Recording Well Installed: 7/2/2014

Installed By: Barr

Water Level Recorded Every: 2 hours

Date Manual Well Installed: NA

Installed By: NA

Manual Water Levels Read: See notes

Monitored by: Barr

Notes: A manual reading is completed twice per monitoring period - prior to initial installation of logger and when logger is removed at end of period.

Table 45-1. Monitoring Period Each Year¹. See the hydrographs in Figure 45-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Start Date	---	---	---	---	---	---	---	---	---	7/2	5/19	5/21
End Date	---	---	---	---	---	---	---	---	---	10/29	10/27	10/11
Total Days	---	---	---	---	---	---	---	---	---	120	162	144
Grow. Seas. Days	---	---	---	---	---	---	---	---	---	97	141	139

¹ Manual (M) well only at this location. No wells at the location (---). Day ranges and Growing Season (Grow. Seas.) Days in this table represent full calendar days.

Table 45-2. Precipitation During Each Growing Season and Water Year¹. See the yearly hydrographs in Figure 45-2.

Year		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Growing Season	May	A	N	A	N	B	B	A	A	N	A	A	B
	June	A	B	N	A	B	N	N	A	A	A	N	A
	July	B	A	B	B	B	A	B	A	A	N	B	B
	Aug	B	B	B	B	N	A	N	B	B	N	N	A
	Sept	B	B	A	A	B	N	B	B	B	B	N	A
Water Year		A	B	A	A	B	N	B	A	A	N	B	A

¹ The growing season includes precipitation during May through September and the water year includes precipitation from October 1 of the previous year through September 30 of the current year. Each time period, the precipitation is represented as: within the normal range of precipitation (N), below the normal range of precipitation (B), or above the normal range of precipitation (A).

Table 45-3. Hydroperiod(s) for Each Year During the Growing Season¹. Total number of days water level is ≥ 12 " below ground level for 14 or more consecutive days during the growing season. The yearly hydrographs are shown in Figure 45-2.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# of Periods ≥ 14 Consecutive Days	---	---	---	---	---	---	---	---	---	2	2	3
Total Days	---	---	---	---	---	---	---	---	---	76	90	136
% Grow. Seas.	---	---	---	---	---	---	---	---	---	78%	64%	98%

¹ Hydroperiods were not determined for locations with only a Manual (M) well. No wells at the location (---). The total days counted for the hydroperiod may not match the total days monitored within a growing season (Grow. Seas.) because the hydroperiod date count does not include partial days.

Table 45-4. Water Level Fluctuations During the Growing Season (inches)¹. Yearly fluctuations are shown in Figure 45-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum (in.)	---	---	---	---	---	---	---	---	---	-13.7	-20.1	-12.1
Maximum (in.)	---	---	---	---	---	---	---	---	---	-4.8	-4.4	-5.4
Fluctuation (in.)	---	---	---	---	---	---	---	---	---	8.9	15.7	6.8

¹ Fluctuations in water level were not determined for locations with only a Manual (M) well. No wells at the location (---). Some water level depths were deeper than the bottom of the well casing (<) resulting in greater fluctuations than indicated in the data (>).

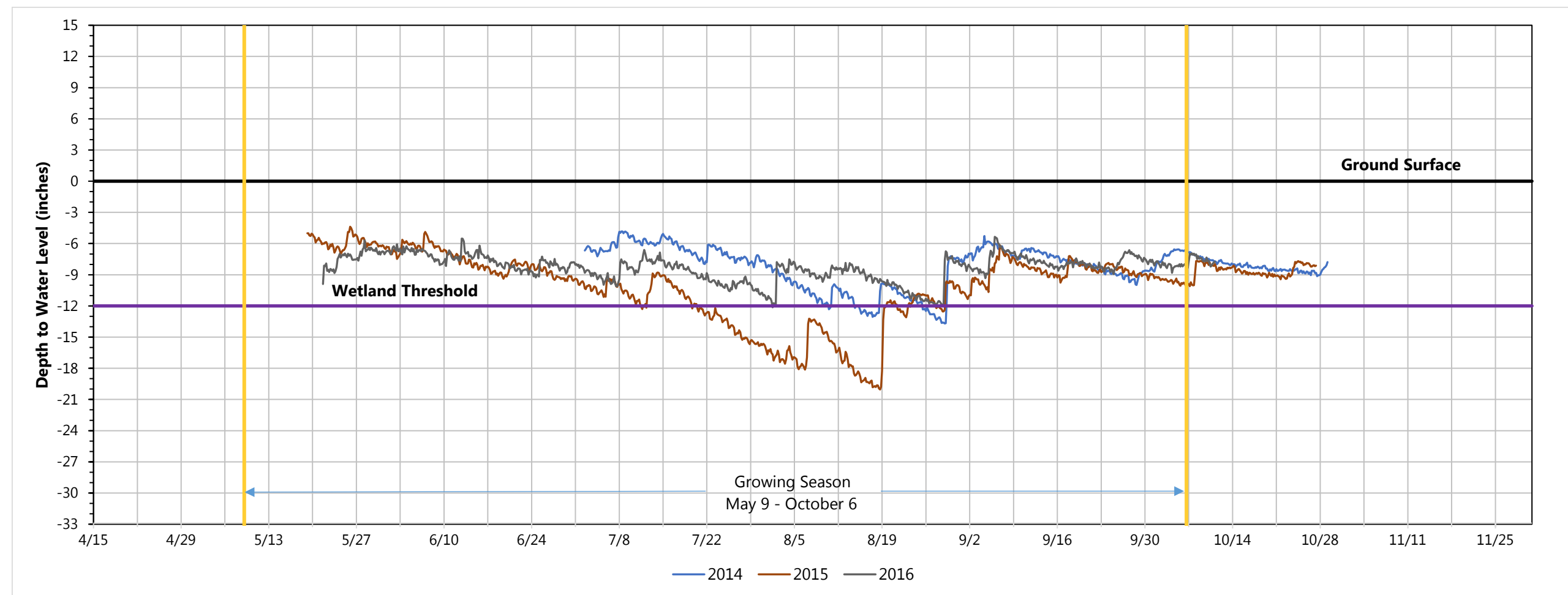


Figure 45-1
WETLAND MONITORING WELL 45
2014-2016 WETLAND HYDROLOGY MONITORING DATA
NorthMet Project
Poly Met Mining, Inc.
Hoyt Lakes, Minnesota

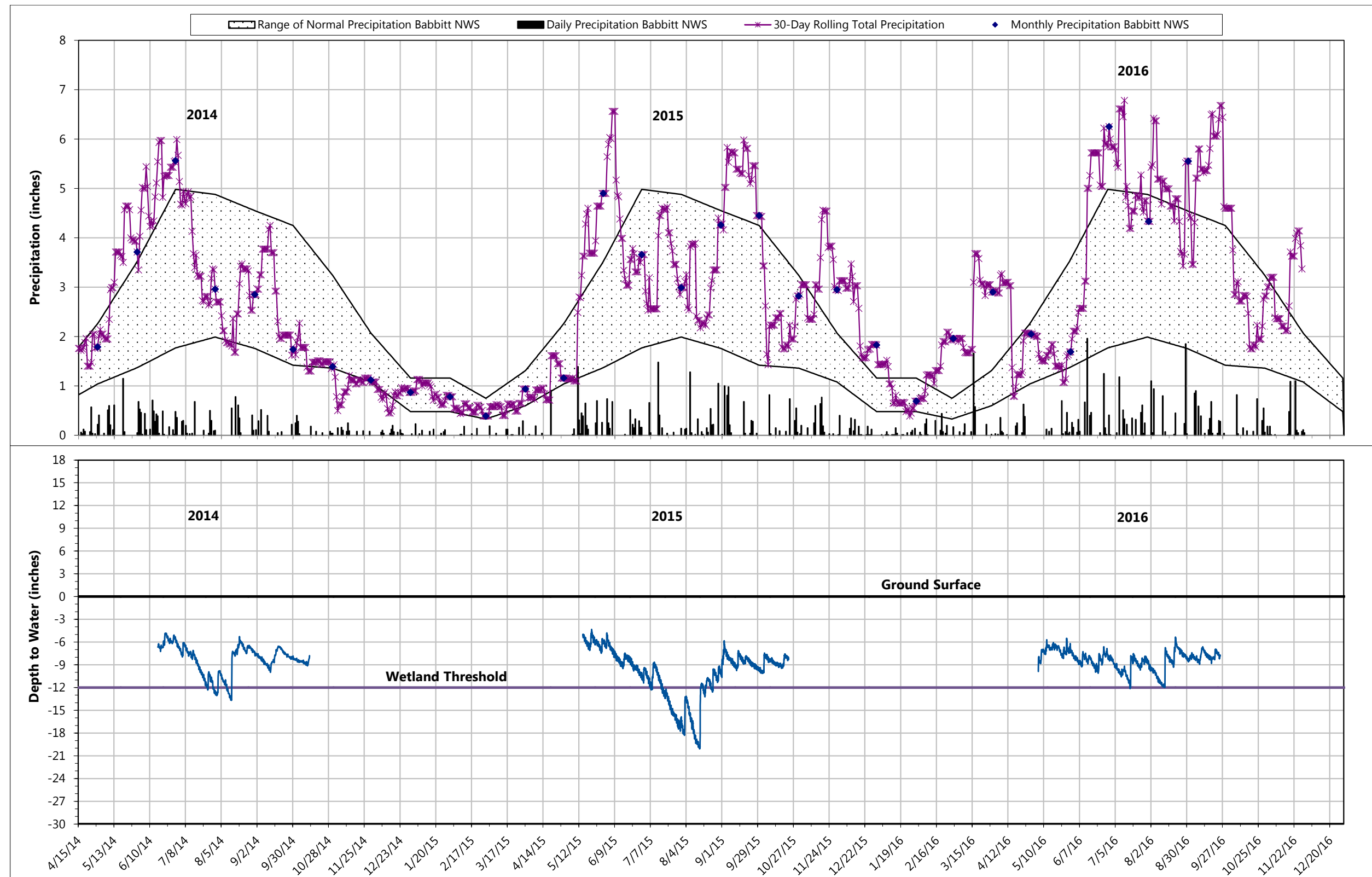
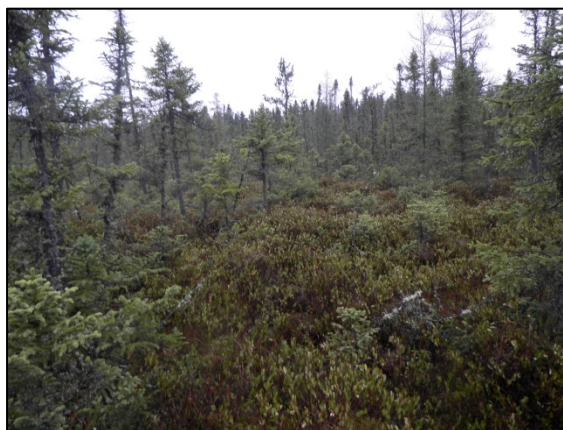


Figure 45-2
WETLAND MONITORING WELL 45
2014-2016 WETLAND HYDROLOGY MONITORING DATA
NorthMet Project
Poly Met Mining, Inc.
Hoyt Lakes, Minnesota

NorthMet Project Hydrology Monitoring – Well 45



July 2014



May 2015



May 2016

Well ID: 46

NorthMet Project Area: Mine Site

Wetland Number: 68

Wetland Type: Coniferous Swamp (Type 7)

UTM Coordinates (NAD 83 Zone 15)

Easting: 577902

Northing: 5274611

Well Type(s): In-Situ Troll

Date Recording Well Installed: 7/1/2014

Installed By: Barr

Water Level Recorded Every: 2 hours

Date Manual Well Installed: NA

Installed By: NA

Manual Water Levels Read: See notes

Growing Season: May 9-October 6 (151 days)

Monitored by: Barr

Water Level Fluctuation for All Years: >10.7 inches

Notes: A manual reading is completed twice per monitoring period - prior to initial installation of logger and when logger is removed at end of period.

Table 46-1. Monitoring Period Each Year¹. See the hydrographs in Figure 46-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Start Date	---	---	---	---	---	---	---	---	---	7/1	5/12	5/3
End Date	---	---	---	---	---	---	---	---	---	10/28	10/27	10/11
Total Days	---	---	---	---	---	---	---	---	---	120	169	162
Grow. Seas. Days	---	---	---	---	---	---	---	---	---	98	148	151

¹ Manual (M) well only at this location. No wells at the location (---). Day ranges and Growing Season (Grow. Seas.) Days in this table represent full calendar days.

Table 46-2. Precipitation During Each Growing Season and Water Year¹. See the yearly hydrographs in Figure 46-2.

Year		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Growing Season	May	A	N	A	N	B	B	A	A	N	A	A	B
	June	A	B	N	A	B	N	N	A	A	A	N	A
	July	B	A	B	B	B	A	B	A	A	N	B	B
	Aug	B	B	B	B	N	A	N	B	B	N	N	A
	Sept	B	B	A	A	B	N	B	B	B	B	N	A
Water Year		A	B	A	A	B	N	B	A	A	N	B	A

¹ The growing season includes precipitation during May through September and the water year includes precipitation from October 1 of the previous year through September 30 of the current year. Each time period, the precipitation is represented as: within the normal range of precipitation (N), below the normal range of precipitation (B), or above the normal range of precipitation (A).

Table 46-3. Hydroperiod(s) for Each Year During the Growing Season¹. Total number of days water level is ≥ 12 " below ground level for 14 or more consecutive days during the growing season. The yearly hydrographs are shown in Figure 46-2.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# of Periods ≥ 14 Consecutive Days	---	---	---	---	---	---	---	---	---	0	0	0
Total Days	---	---	---	---	---	---	---	---	---	0	0	0
% Grow. Seas.	---	---	---	---	---	---	---	---	---	0%	0%	0%

¹ Hydroperiods were not determined for locations with only a Manual (M) well. No wells at the location (---). The total days counted for the hydroperiod may not match the total days monitored within a growing season (Grow. Seas.) because the hydroperiod date count does not include partial days.

Table 46-4. Water Level Fluctuations During the Growing Season (inches)¹. Yearly fluctuations are shown in Figure 46-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum (in.)	---	---	---	---	---	---	---	---	---	<-22.2	<-29.6	-28.2
Maximum (in.)	---	---	---	---	---	---	---	---	---	-20.1	-18.9	-19.0
Fluctuation (in.)	---	---	---	---	---	---	---	---	---	>2.1	>10.7	9.3

¹ Fluctuations in water level were not determined for locations with only a Manual (M) well. No wells at the location (---). Some water level depths were deeper than the bottom of the well casing (<) resulting in greater fluctuations than indicated in the data (>).

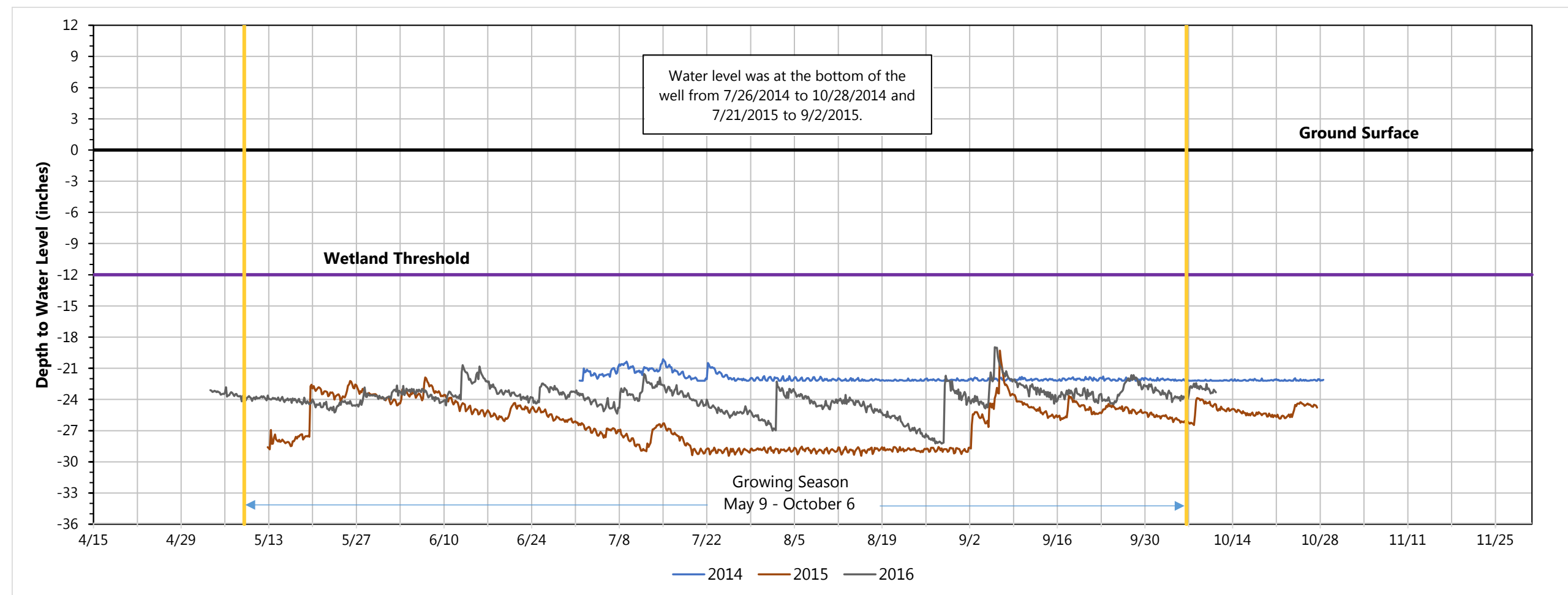


Figure 46-1
 WETLAND MONITORING WELL 46
 2014-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

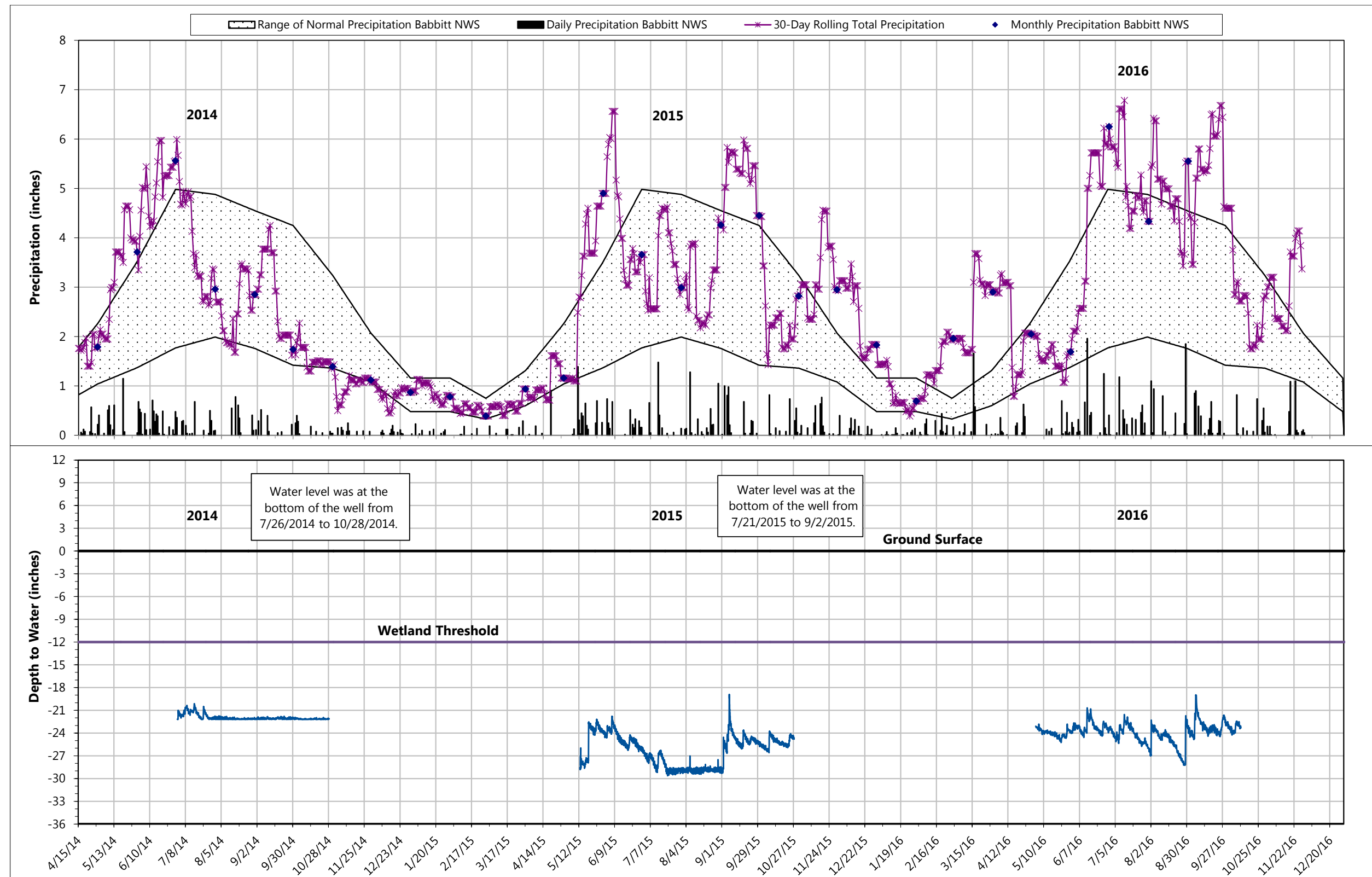


Figure 46-2
 WETLAND MONITORING WELL 46
 2014-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

NorthMet Project Hydrology Monitoring – Well 46



July 2014



May 2015



May 2016

Well ID: 47

NorthMet Project Area: Mine Site

Wetland Number: 315

Wetland Type: Alder Thicket (Type 6)

UTM Coordinates (NAD 83 Zone 15)

Easting: 577624

Northing: 5275308

Well Type(s): In-Situ Troll

Date Recording Well Installed: 7/1/2014

Installed By: Barr

Water Level Recorded Every: 2 hours

Date Manual Well Installed: NA

Installed By: NA

Manual Water Levels Read: See notes

Growing Season: May 9-October 6 (151 days)

Monitored by: Barr

Water Level Fluctuation for All Years: 26.2 inches

Notes: A manual reading is completed twice per monitoring period - prior to initial installation of logger and when logger is removed at end of period.

Table 47-1. Monitoring Period Each Year¹. See the hydrographs in Figure 47-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Start Date	---	---	---	---	---	---	---	---	---	7/1	5/12	5/3
End Date	---	---	---	---	---	---	---	---	---	10/28	10/27	10/11
Total Days	---	---	---	---	---	---	---	---	---	120	169	162
Grow. Seas. Days	---	---	---	---	---	---	---	---	---	98	148	151

¹ Manual (M) well only at this location. No wells at the location (---). Day ranges and Growing Season (Grow. Seas.) Days in this table represent full calendar days.

Table 47-2. Precipitation During Each Growing Season and Water Year¹. See the yearly hydrographs in Figure 47-2.

Year		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Growing Season	May	A	N	A	N	B	B	A	A	N	A	A	B
	June	A	B	N	A	B	N	N	A	A	A	N	A
	July	B	A	B	B	B	A	B	A	A	N	B	B
	Aug	B	B	B	B	N	A	N	B	B	N	N	A
	Sept	B	B	A	A	B	N	B	B	B	B	N	A
Water Year		A	B	A	A	B	N	B	A	A	N	B	A

¹ The growing season includes precipitation during May through September and the water year includes precipitation from October 1 of the previous year through September 30 of the current year. Each time period, the precipitation is represented as: within the normal range of precipitation (N), below the normal range of precipitation (B), or above the normal range of precipitation (A).

Table 47-3. Hydroperiod(s) for Each Year During the Growing Season¹. Total number of days water level is ≥ 12 " below ground level for 14 or more consecutive days during the growing season. The yearly hydrographs are shown in Figure 47-2.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# of Periods ≥ 14 Consecutive Days	---	---	---	---	---	---	---	---	---	2	2	1
Total Days	---	---	---	---	---	---	---	---	---	73	118	151
% Grow. Seas.	---	---	---	---	---	---	---	---	---	74%	80%	100%

¹ Hydroperiods were not determined for locations with only a Manual (M) well. No wells at the location (---). The total days counted for the hydroperiod may not match the total days monitored within a growing season (Grow. Seas.) because the hydroperiod date count does not include partial days.

Table 47-4. Water Level Fluctuations During the Growing Season (inches)¹. Yearly fluctuations are shown in Figure 47-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum (in.)	---	---	---	---	---	---	---	---	---	-15.7	-18.2	-6.7
Maximum (in.)	---	---	---	---	---	---	---	---	---	-3.6	-1.9	8.0
Fluctuation (in.)	---	---	---	---	---	---	---	---	---	12.1	16.2	14.7

¹ Fluctuations in water level were not determined for locations with only a Manual (M) well. No wells at the location (---). Some water level depths were deeper than the bottom of the well casing (<) resulting in greater fluctuations than indicated in the data (>).

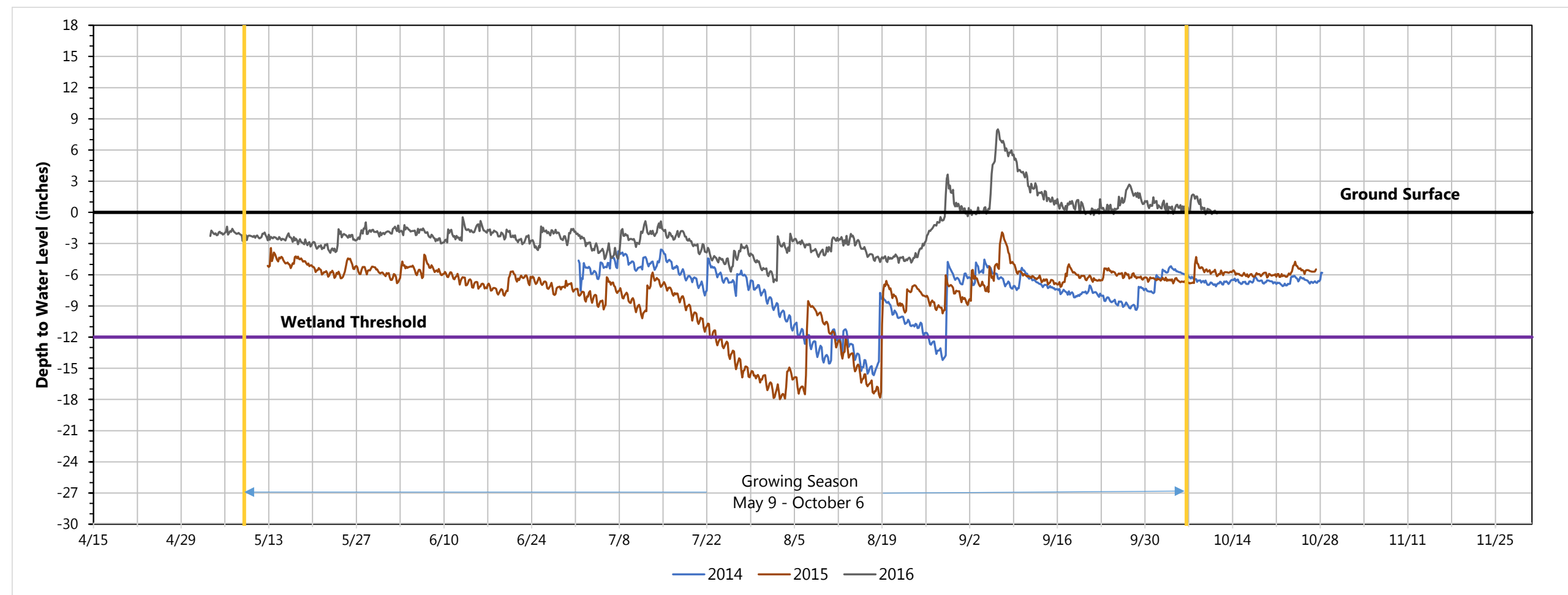


Figure 47-1
 WETLAND MONITORING WELL 47
 2014-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

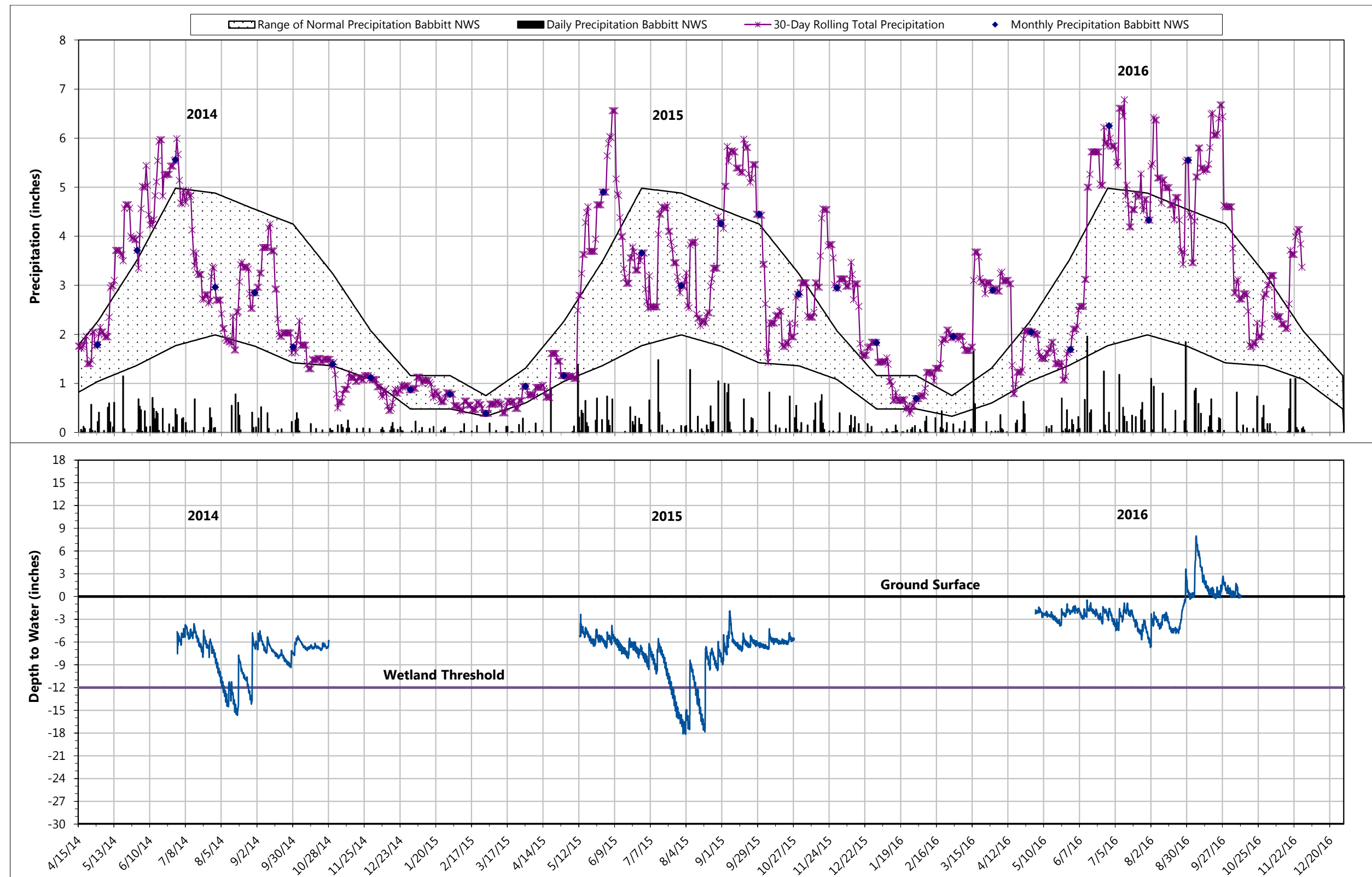


Figure 47-2
 WETLAND MONITORING WELL 47
 2014-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

NorthMet Project Hydrology Monitoring – Well 47



July 2014



May 2015



May 2016

Well ID: 48

NorthMet Project Area: Mine Site

Wetland Number: 53D

Wetland Type: Alder Thicket (Type 6)

UTM Coordinates (NAD 83 Zone 15)

Easting: 578689

Northing: 5273138

Well Type(s): In-Situ Troll

Date Recording Well Installed: 7/2/2014

Installed By: Barr

Water Level Recorded Every: 2 hours

Date Manual Well Installed: NA

Installed By: NA

Manual Water Levels Read: See notes

Growing Season: May 9-October 6 (151 days)

Monitored by: Barr

Water Level Fluctuation for All Years: 33.0 inches

Notes: A manual reading is completed twice per monitoring period - prior to initial installation of logger and when logger is removed at end of period.

Table 48-1. Monitoring Period Each Year¹. See the hydrographs in Figure 48-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Start Date	---	---	---	---	---	---	---	---	---	7/2	5/12	5/4
End Date	---	---	---	---	---	---	---	---	---	10/29	10/27	10/11
Total Days	---	---	---	---	---	---	---	---	---	120	169	161
Grow. Seas. Days	---	---	---	---	---	---	---	---	---	97	148	151

¹ Manual (M) well only at this location. No wells at the location (---). Day ranges and Growing Season (Grow. Seas.) Days in this table represent full calendar days.

Table 48-2. Precipitation During Each Growing Season and Water Year¹. See the yearly hydrographs in Figure 48-2.

Year		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Growing Season	May	A	N	A	N	B	B	A	A	N	A	A	B
	June	A	B	N	A	B	N	N	A	A	A	N	A
	July	B	A	B	B	B	A	B	A	A	N	B	B
	Aug	B	B	B	B	N	A	N	B	B	N	N	A
	Sept	B	B	A	A	B	N	B	B	B	B	N	A
Water Year		A	B	A	A	B	N	B	A	A	N	B	A

¹ The growing season includes precipitation during May through September and the water year includes precipitation from October 1 of the previous year through September 30 of the current year. Each time period, the precipitation is represented as: within the normal range of precipitation (N), below the normal range of precipitation (B), or above the normal range of precipitation (A).

Table 48-3. Hydroperiod(s) for Each Year During the Growing Season¹. Total number of days water level is ≥ 12 " below ground level for 14 or more consecutive days during the growing season. The yearly hydrographs are shown in Figure 48-2.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# of Periods ≥ 14 Consecutive Days	---	---	---	---	---	---	---	---	---	2	2	1
Total Days	---	---	---	---	---	---	---	---	---	65	100	151
% Grow. Seas.	---	---	---	---	---	---	---	---	---	67%	68%	100%

¹ Hydroperiods were not determined for locations with only a Manual (M) well. No wells at the location (---). The total days counted for the hydroperiod may not match the total days monitored within a growing season (Grow. Seas.) because the hydroperiod date count does not include partial days.

Table 48-4. Water Level Fluctuations During the Growing Season (inches)¹. Yearly fluctuations are shown in Figure 48-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum (in.)	---	---	---	---	---	---	---	---	---	-19.9	-31.1	-11.0
Maximum (in.)	---	---	---	---	---	---	---	---	---	-2.5	1.9	1.0
Fluctuation (in.)	---	---	---	---	---	---	---	---	---	17.4	33.0	11.9

¹ Fluctuations in water level were not determined for locations with only a Manual (M) well. No wells at the location (---). Some water level depths were deeper than the bottom of the well casing (<) resulting in greater fluctuations than indicated in the data (>).

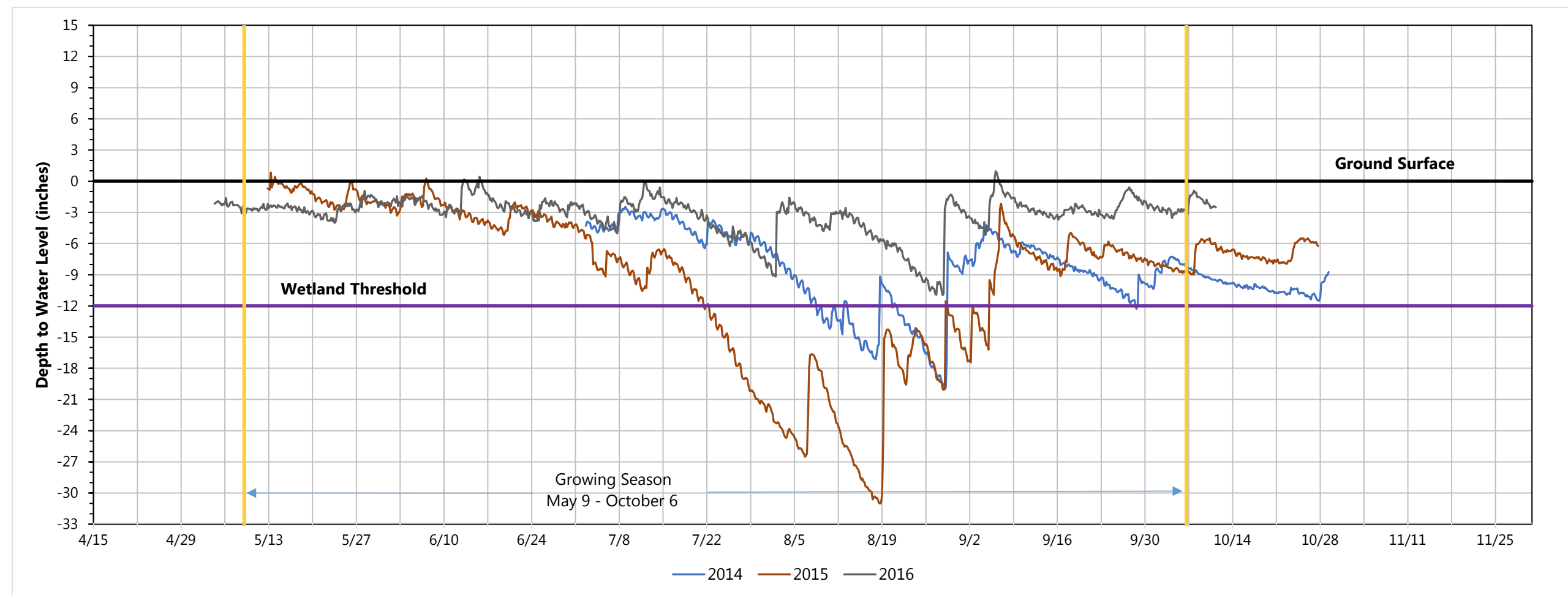


Figure 48-1
 WETLAND MONITORING WELL 48
 2014-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

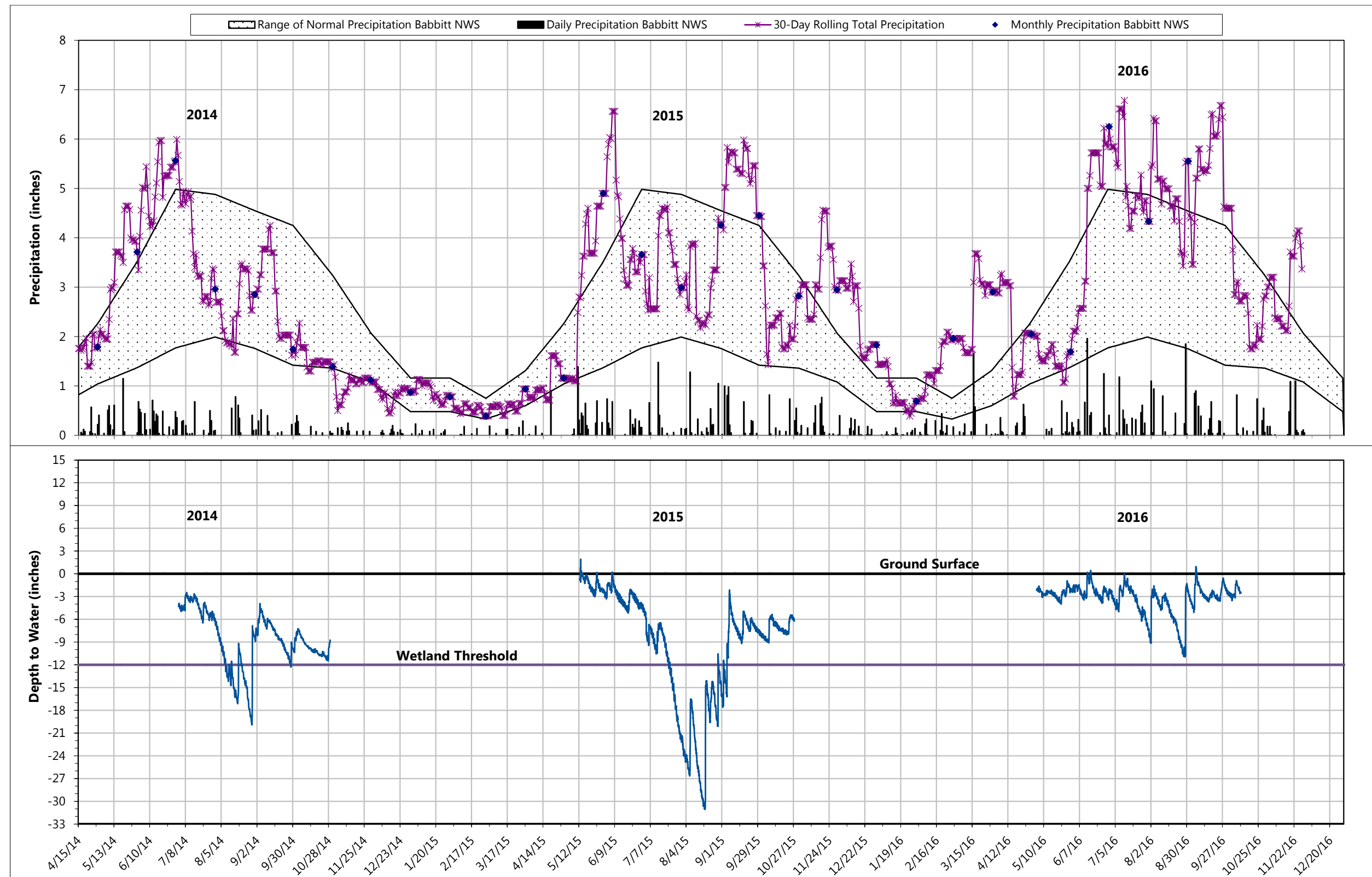


Figure 48-2
 WETLAND MONITORING WELL 48
 2014-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

NorthMet Project Hydrology Monitoring – Well 48



July 2014



May 2015



May 2016

Appendix B

Wetland Hydrology Monitoring Data – Transportation and Utility Corridors

Well ID: 40

NorthMet Project Area: Transportation and
Utility Corridors

Wetland Number: 571

Wetland Type: Coniferous Swamp (Type 7)

UTM Coordinates (NAD 83 Zone 15)

Easting: 572845

Northing: 5271086

Well Type(s): In-Situ Troll

Date Recording Well Installed: 7/1/2014

Installed By: Barr

Water Level Recorded Every: 2 hours

Date Manual Well Installed: NA

Installed By: NA

Manual Water Levels Read: See notes

Growing Season: May 9-October 6 (151 days)

Monitored by: Barr

Water Level Fluctuation for All Years: 29.0 inches

Notes: A manual reading is completed twice per monitoring period - prior to initial installation of logger and when logger is removed at end of period.

Table 40-1. Monitoring Period Each Year¹. See the hydrographs in Figure 40-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Start Date	---	---	---	---	---	---	---	---	---	7/1	5/14	5/4
End Date	---	---	---	---	---	---	---	---	---	10/29	10/28	10/11
Total Days	---	---	---	---	---	---	---	---	---	121	168	161
Grow. Seas. Days	---	---	---	---	---	---	---	---	---	98	146	151

¹ Manual (M) well only at this location. No wells at the location (---). Day ranges and Growing Season (Grow. Seas.) Days in this table represent full calendar days.

Table 40-2. Precipitation During Each Growing Season and Water Year¹. See the yearly hydrographs in Figure 40-2.

Table 40-2: Precipitation During Each Growing Season and Water Year : See the yearly hydrographs in Figure 40-2.													
Year		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Growing Season	May	A	N	A	N	B	B	A	A	N	A	A	B
	June	A	B	N	A	B	N	N	A	A	A	N	A
	July	B	A	B	B	B	A	B	A	A	N	B	B
	Aug	B	B	B	B	N	A	N	B	B	N	N	A
	Sept	B	B	A	A	B	N	B	B	B	B	N	A
Water Year		A	B	A	A	B	N	B	A	A	N	B	A

¹ The growing season includes precipitation during May through September and the water year includes precipitation from October 1 of the previous year through September 30 of the current year. Each time period, the precipitation is represented as: within the normal range of precipitation (N), below the normal range of precipitation (B), or above the normal range of precipitation (A).

Table 40-2. Hydroperiod(s) for Each Year During the Growing Season¹. Total number of days water level is ≥ 12 " below ground level for 14 or more consecutive days during the growing season. The yearly hydrographs are shown in Figure 40-2.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# of Periods ≥ 14 Consecutive Days	---	---	---	---	---	---	---	---	---	1	2	3
Total Days	---	---	---	---	---	---	---	---	---	30	103	143
% Grow. Seas.	---	---	---	---	---	---	---	---	---	31%	71%	95%

¹ Hydroperiods were not determined for locations with only a Manual (M) well. No wells at the location (---). The total days counted for the hydroperiod may not match the total days monitored within a growing season (Grow. Seas.) because the hydroperiod date count does not include partial days.

Table 40-4. Water Level Fluctuations During the Growing Season (inches)¹. Yearly fluctuations are shown in Figure 40-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum (in.)	---	---	---	---	---	---	---	---	---	-25.7	-27.3	-15.1
Maximum (in.)	---	---	---	---	---	---	---	---	---	-4.5	-0.8	1.7
Fluctuation (in.)	---	---	---	---	---	---	---	---	---	21.2	26.5	16.8

¹ Fluctuations in water level were not determined for locations with only a Manual (M) well. No wells at the location (---). Some water level depths were deeper than the bottom of the well casing (<) resulting in greater fluctuations than indicated in the data (>).

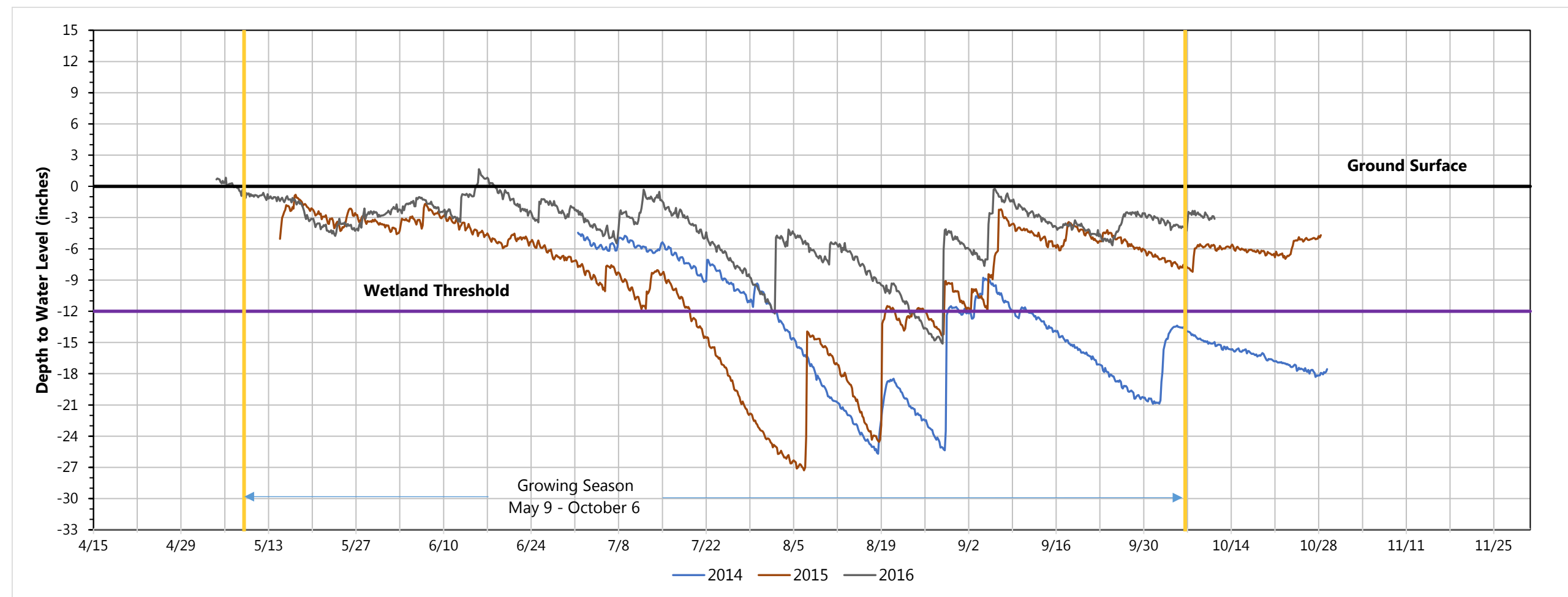


Figure 40-1
WETLAND MONITORING WELL 40
2014-2016 WETLAND HYDROLOGY MONITORING DATA
NorthMet Project
Poly Met Mining, Inc.
Hoyt Lakes, Minnesota

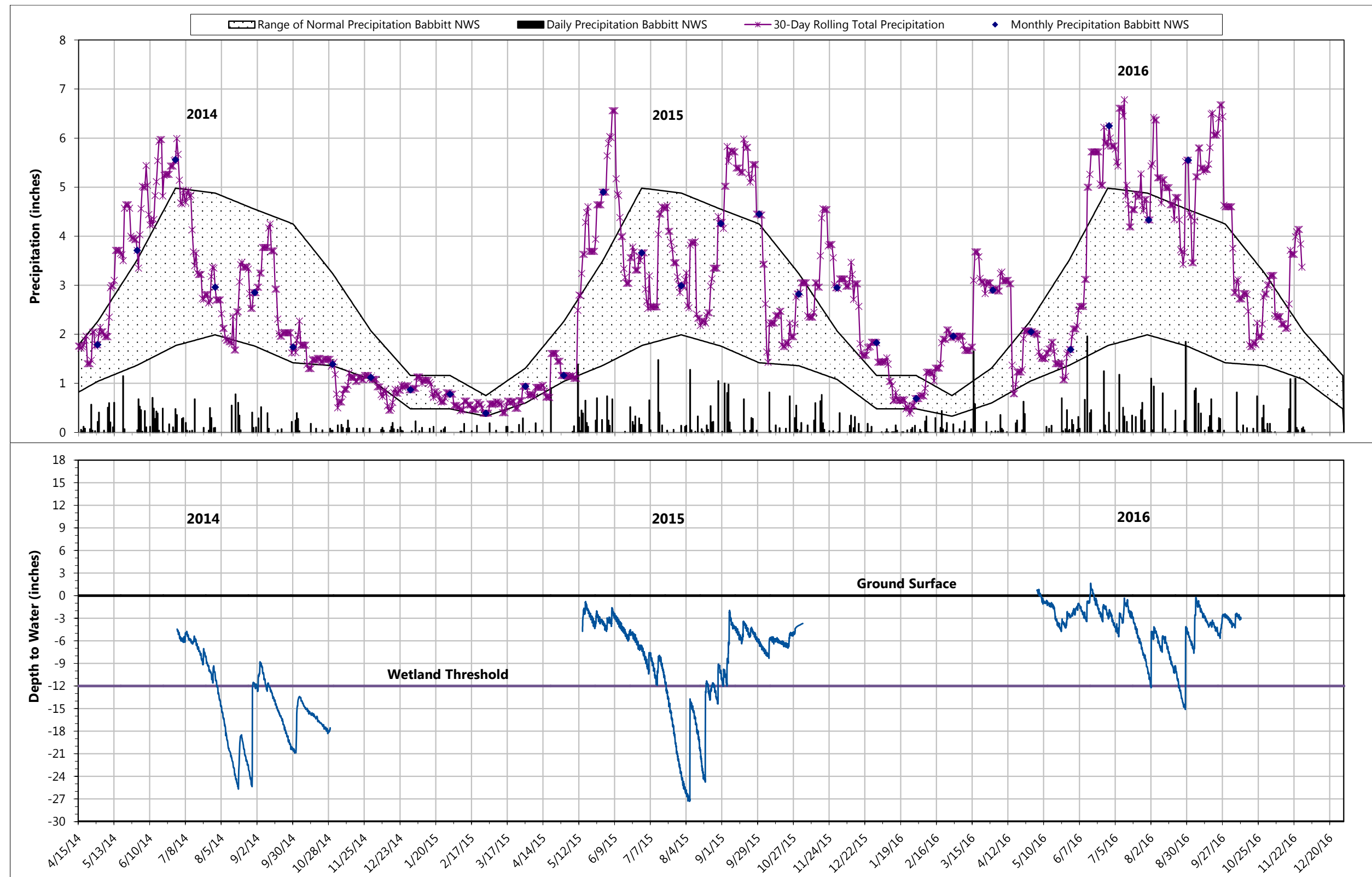


Figure 40-2
 WETLAND MONITORING WELL 40
 2014-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

NorthMet Project Hydrology Monitoring – Well 40



July 2014



May 2015



May 2016

Well ID: 41

NorthMet Project Area: Transportation and
Utility Corridors

Wetland Number: R-7A

Wetland Type: Shallow Marsh (Type 3)

UTM Coordinates (NAD 83 Zone 15)

Easting: 571093

Northing: 5271142

Well Type(s): In-Situ Troll

Date Recording Well Installed: 7/2/2014

Installed By: Barr

Water Level Recorded Every: 2 hours

Date Manual Well Installed: NA

Installed By: NA

Manual Water Levels Read: See notes

Growing Season: May 9-October 6 (151 days)

Monitored by: Barr

Water Level Fluctuation for All Years: 11.8 inches

Notes: A manual reading is completed twice per monitoring period - prior to initial installation of logger and when logger is removed at end of period.

Table 41-1. Monitoring Period Each Year¹. See the hydrographs in Figure 41-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Start Date	---	---	---	---	---	---	---	---	---	7/2	5/13	5/4
End Date	---	---	---	---	---	---	---	---	---	10/29	10/28	10/11
Total Days	---	---	---	---	---	---	---	---	---	120	169	161
Grow. Seas. Days	---	---	---	---	---	---	---	---	---	97	147	151

¹ Manual (M) well only at this location. No wells at the location (---). Day ranges and Growing Season (Grow. Seas.) Days in this table represent full calendar days.

Table 41-2. Precipitation During Each Growing Season and Water Year¹. See the yearly hydrographs in Figure 41-2.

Year		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Growing Season	May	A	N	A	N	B	B	A	A	N	A	A	B
	June	A	B	N	A	B	N	N	A	A	A	N	A
	July	B	A	B	B	B	A	B	A	A	N	B	B
	Aug	B	B	B	B	N	A	N	B	B	N	N	A
	Sept	B	B	A	A	B	N	B	B	B	B	N	A
Water Year		A	B	A	A	B	N	B	A	A	N	B	A

¹ The growing season includes precipitation during May through September and the water year includes precipitation from October 1 of the previous year through September 30 of the current year. Each time period, the precipitation is represented as: within the normal range of precipitation (N), below the normal range of precipitation (B), or above the normal range of precipitation (A).

Table 41-3. Hydroperiod(s) for Each Year During the Growing Season¹. Total number of days water level is ≥ 12 " below ground level for 14 or more consecutive days during the growing season. The yearly hydrographs are shown in Figure 41-2.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# of Periods ≥ 14 Consecutive Days	---	---	---	---	---	---	---	---	---	1	1	1
Total Days	---	---	---	---	---	---	---	---	---	96	146	151
% Grow. Seas.	---	---	---	---	---	---	---	---	---	99%	99%	100%

¹ Hydroperiods were not determined for locations with only a Manual (M) well. No wells at the location (---). The total days counted for the hydroperiod may not match the total days monitored within a growing season (Grow. Seas.) because the hydroperiod date count does not include partial days.

Table 41-4. Water Level Fluctuations During the Growing Season (inches)¹. Yearly fluctuations are shown in Figure 41-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum (in.)	---	---	---	---	---	---	---	---	---	-7.2	-8.5	-3.3
Maximum (in.)	---	---	---	---	---	---	---	---	---	-0.6	3.3	2.2
Fluctuation (in.)	---	---	---	---	---	---	---	---	---	6.6	11.8	5.5

¹ Fluctuations in water level were not determined for locations with only a Manual (M) well. No wells at the location (---). Some water level depths were deeper than the bottom of the well casing (<) resulting in greater fluctuations than indicated in the data (>).

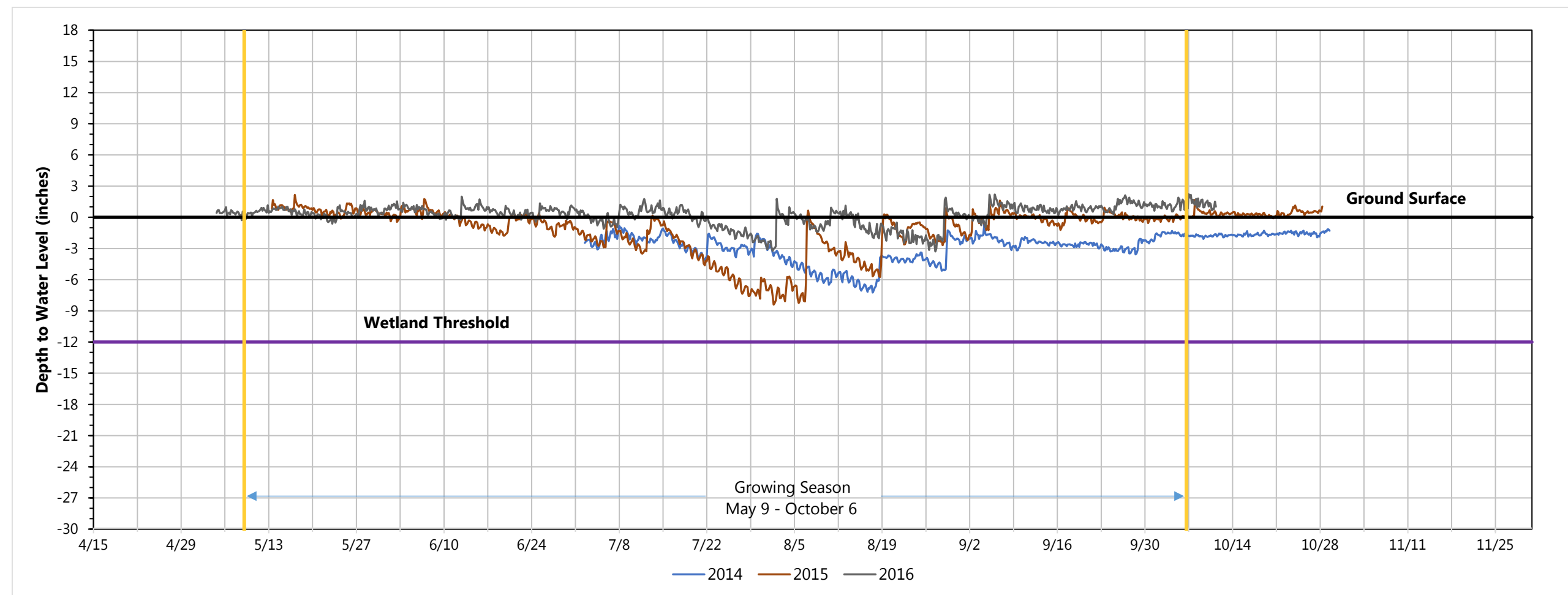


Figure 41-1
 WETLAND MONITORING WELL 41
 2014-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

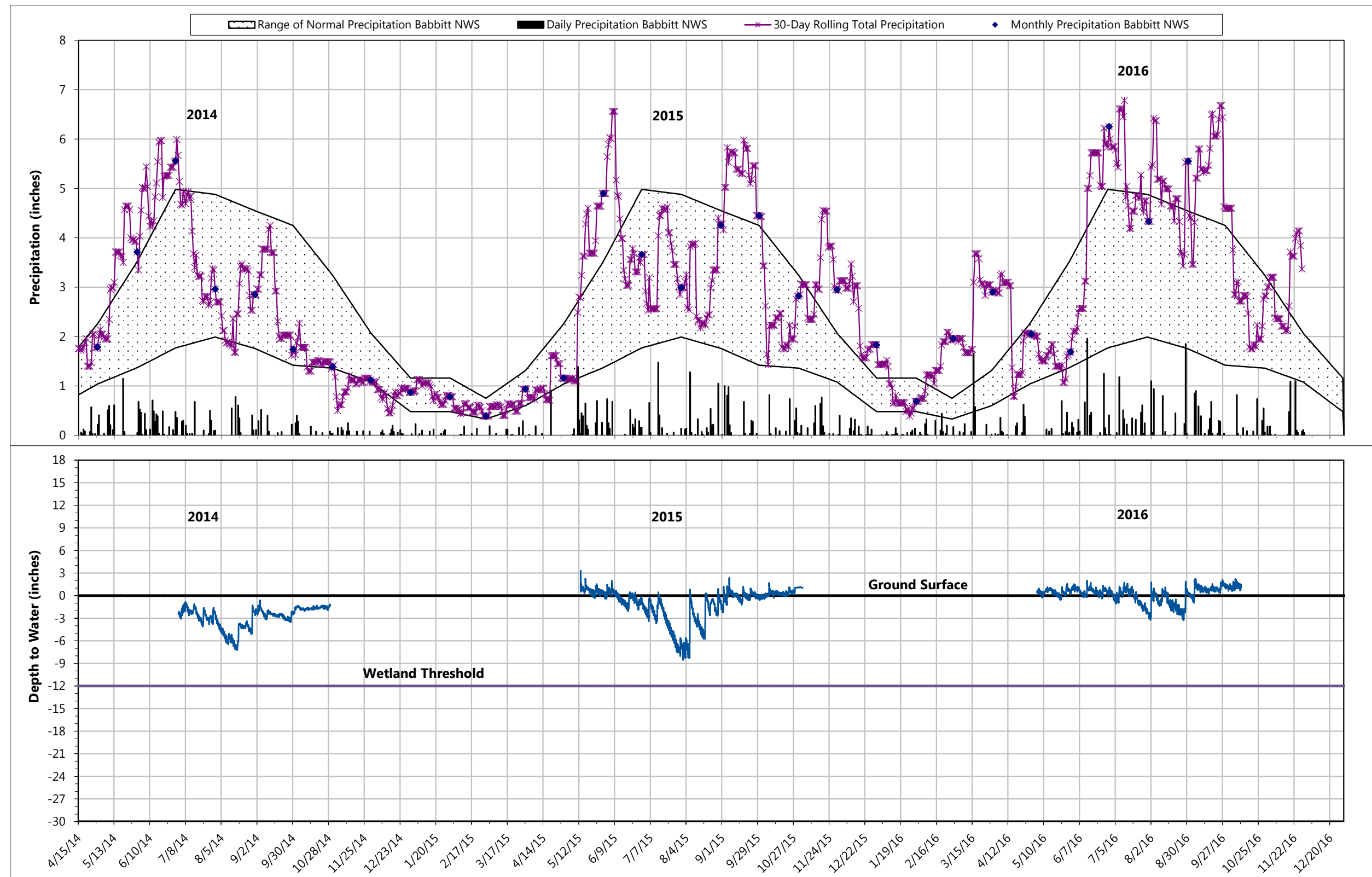


Figure 41-2
 WETLAND MONITORING WELL 41
 2014-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

NorthMet Project Hydrology Monitoring – Well 41



July 2014



May 2015



May 2016

Well ID: 42

NorthMet Project Area: Transportation and
Utility Corridors

Wetland Number: 1041

Wetland Type: Shrub-carr (Type 6)

UTM Coordinates (NAD 83 Zone 15)

Easting: 569918

Northing: 5270458

Well Type(s): In-Situ Troll

Date Recording Well Installed: 7/1/2014

Installed By: Barr

Water Level Recorded Every: 2 hours

Date Manual Well Installed: NA

Installed By: NA

Manual Water Levels Read: See notes

Growing Season: May 9-October 6 (151 days)

Monitored by: Barr

Water Level Fluctuation for All Years: 21.9 inches

Notes: A manual reading is completed twice per monitoring period - prior to initial installation of logger and when logger is removed at end of period.

Table 42-1. Monitoring Period Each Year¹. See the hydrographs in Figure 42-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Start Date	---	---	---	---	---	---	---	---	---	7/1	5/13	5/4
End Date	---	---	---	---	---	---	---	---	---	10/29	10/28	10/11
Total Days	---	---	---	---	---	---	---	---	---	121	169	161
Grow. Seas. Days	---	---	---	---	---	---	---	---	---	98	147	151

¹ Manual (M) well only at this location. No wells at the location (---). Day ranges and Growing Season (Grow. Seas.) Days in this table represent full calendar days.

Table 42-2. Precipitation During Each Growing Season and Water Year¹. See the yearly hydrographs in Figure 42-2.

Year		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Growing Season	May	A	N	A	N	B	B	A	A	N	A	A	B
	June	A	B	N	A	B	N	N	A	A	A	N	A
	July	B	A	B	B	B	A	B	A	A	N	B	B
	Aug	B	B	B	B	N	A	N	B	B	N	N	A
	Sept	B	B	A	A	B	N	B	B	B	B	N	A
Water Year		A	B	A	A	B	N	B	A	A	N	B	A

¹ The growing season includes precipitation during May through September and the water year includes precipitation from October 1 of the previous year through September 30 of the current year. Each time period, the precipitation is represented as: within the normal range of precipitation (N), below the normal range of precipitation (B), or above the normal range of precipitation (A).

Table 42-3. Hydroperiod(s) for Each Year During the Growing Season¹. Total number of days water level is ≥ 12 " below ground level for 14 or more consecutive days during the growing season. The yearly hydrographs are shown in Figure 42-2.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# of Periods ≥ 14 Consecutive Days	---	---	---	---	---	---	---	---	---	1	1	2
Total Days	---	---	---	---	---	---	---	---	---	97	146	149
% Grow. Seas.	---	---	---	---	---	---	---	---	---	99%	99%	99%

¹ Hydroperiods were not determined for locations with only a Manual (M) well. No wells at the location (---). The total days counted for the hydroperiod may not match the total days monitored within a growing season (Grow. Seas.) because the hydroperiod date count does not include partial days.

Table 42-4. Water Level Fluctuations During the Growing Season (inches)¹. Yearly fluctuations are shown in Figure 42-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum (in.)	---	---	---	---	---	---	---	---	---	-3.2	-2.8	-12.3
Maximum (in.)	---	---	---	---	---	---	---	---	---	3.5	9.6	5.2
Fluctuation (in.)	---	---	---	---	---	---	---	---	---	6.7	12.4	17.5

¹ Fluctuations in water level were not determined for locations with only a Manual (M) well. No wells at the location (---). Some water level depths were deeper than the bottom of the well casing (<) resulting in greater fluctuations than indicated in the data (>).

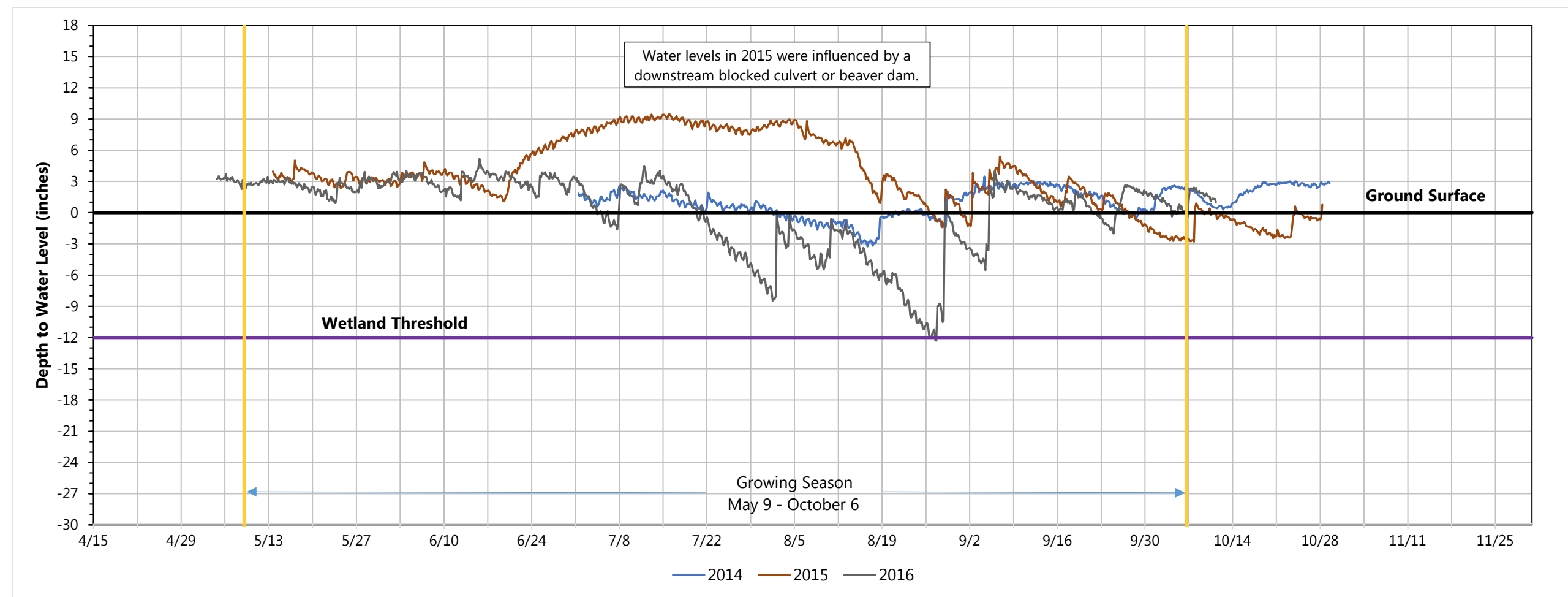


Figure 42-1
 WETLAND MONITORING WELL 42
 2014-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

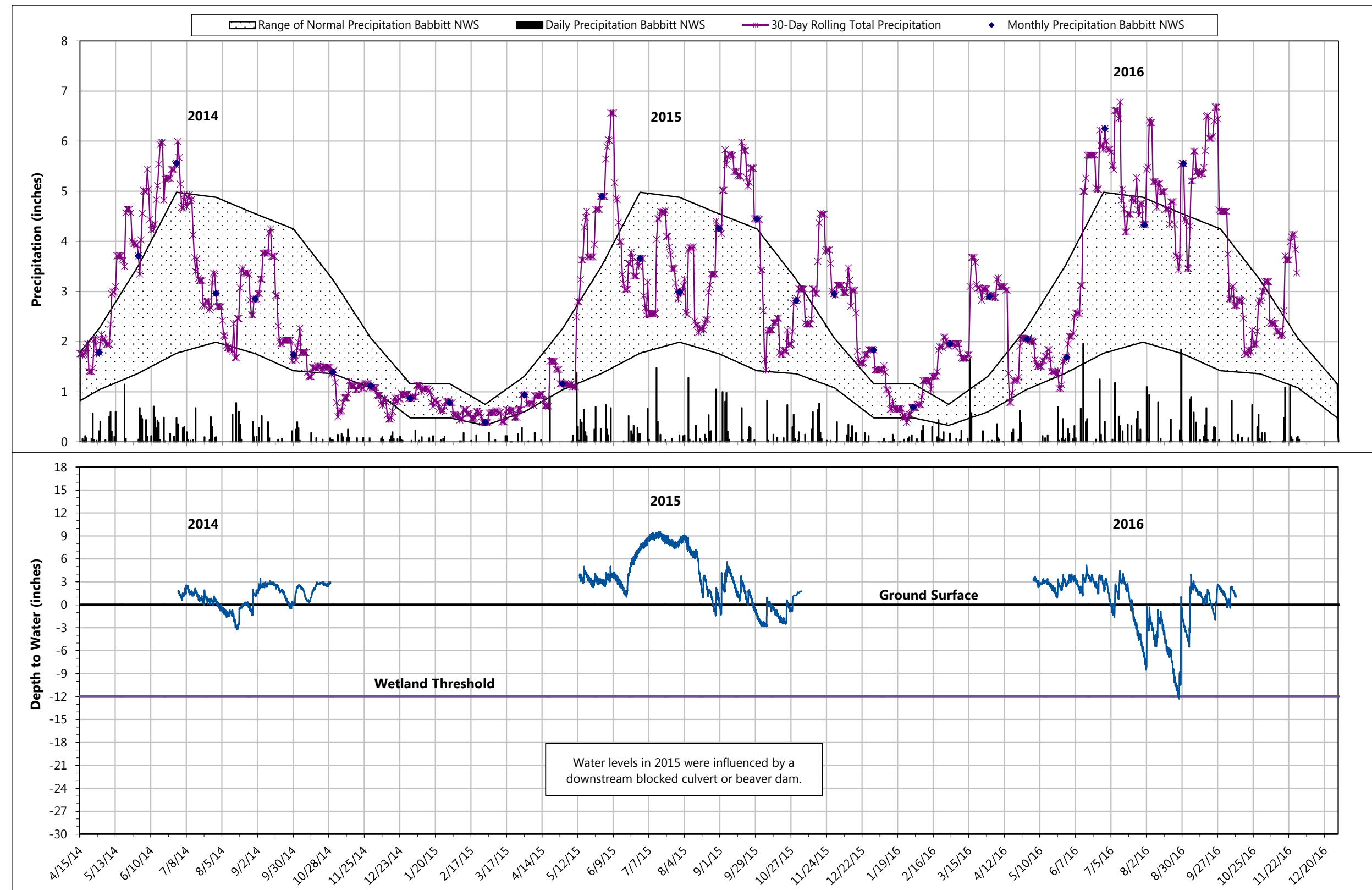


Figure 42-2
 WETLAND MONITORING WELL 42
 2014-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

NorthMet Project Hydrology Monitoring – Well 42



July 2014



May 2015



May 2016

Appendix C

Wetland Hydrology Monitoring Data – Plant Site

Well ID: TB1

NorthMet Project Area: Plant Site

Wetland Number: 923

Wetland Type: Sedge Meadow (Type 2)

UTM Coordinates (NAD 83 Zone 15)

Easting: 562438

Northing: 5275792

Growing Season: May 9-October 6 (151 days)

Water Level Fluctuation for All Years: 45.6 inches

Well Type(s): Ecotone and Manual

Date Recording Well Installed: 4/26/2010

Installed By: Barr/NTS

Water Level Recorded Every: 4 hours

Date Manual Well Installed: 4/26/2010

Installed By: Barr/NTS

Manual Water Levels Read: Monthly

Monitored by: NTS

Notes: UTM coordinates are for recording well. The logger malfunctioned after installation in 2010 and no data was collected until it was replaced on 8/10/2014.

Table TB1-1. Monitoring Period Each Year¹. See the hydrographs in Figure TB1-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Start Date	---	---	---	---	---	8/10	5/12	6/1	5/23	5/19	4/27	7/1
End Date	---	---	---	---	---	10/25	10/26	10/29	10/30	10/27	10/26	9/19
Total Days	---	---	---	---	---	77	168	151	161	162	183	81
Grow. Seas. Days	---	---	---	---	---	58	148	128	137	141	151	81

¹ Manual (M) well only at this location. No wells at the location (---). Day ranges and Growing Season (Grow. Seas.) Days in this table represent full calendar days.

Table TB1-2. Precipitation During Each Growing Season and Water Year¹. See the yearly hydrographs in Figure TB1-2.

Year		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Growing Season	May	A	N	A	N	B	B	A	A	N	A	A	B
	June	A	B	N	A	B	N	N	A	A	A	N	A
	July	B	A	B	B	B	A	B	A	A	N	B	B
	Aug	B	B	B	B	N	A	N	B	B	N	N	A
	Sept	B	B	A	A	B	N	B	B	B	B	N	A
Water Year		A	B	A	A	B	N	B	A	A	N	B	A

¹ The growing season includes precipitation during May through September and the water year includes precipitation from October 1 of the previous year through September 30 of the current year. Each time period, the precipitation is represented as: within the normal range of precipitation (N), below the normal range of precipitation (B), or above the normal range of precipitation (A).

Table TB1-3. Hydroperiod(s) for Each Year During the Growing Season¹. Total number of days water level is $\geq 12"$ below ground level for 14 or more consecutive days during the growing season. The yearly hydrographs are shown in Figure TB1-2.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# of Periods ≥ 14 Consecutive Days	---	---	---	---	---	1	1	2	2	1	1	1
Total Days	---	---	---	---	---	34	60	76	102	140	151	79
% Grow. Seas.	---	---	---	---	---	59%	41%	59%	74%	99%	100%	98%

¹ Hydroperiods were not determined for locations with only a Manual (M) well. No wells at the location (---). The total days counted for the hydroperiod may not match the total days monitored within a growing season (Grow. Seas.) because the hydroperiod date count does not include partial days.

Table TB1-4. Water Level Fluctuations During the Growing Season (inches)¹. Yearly fluctuations are shown in Figure TB1-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum (in.)	---	---	---	---	---	-19.7	-28.0	-25.4	-15.6	-5.3	8.2	7.1
Maximum (in.)	---	---	---	---	---	-1.1	0.4	5.8	0.9	10.1	17.6	14.4
Fluctuation (in.)	---	---	---	---	---	18.6	28.4	31.2	16.5	15.4	9.4	7.3

¹ Fluctuations in water level were not determined for locations with only a Manual (M) well. No wells at the location (---). Some water level depths were deeper than the bottom of the well casing (<) resulting in greater fluctuations than indicated in the data (>).

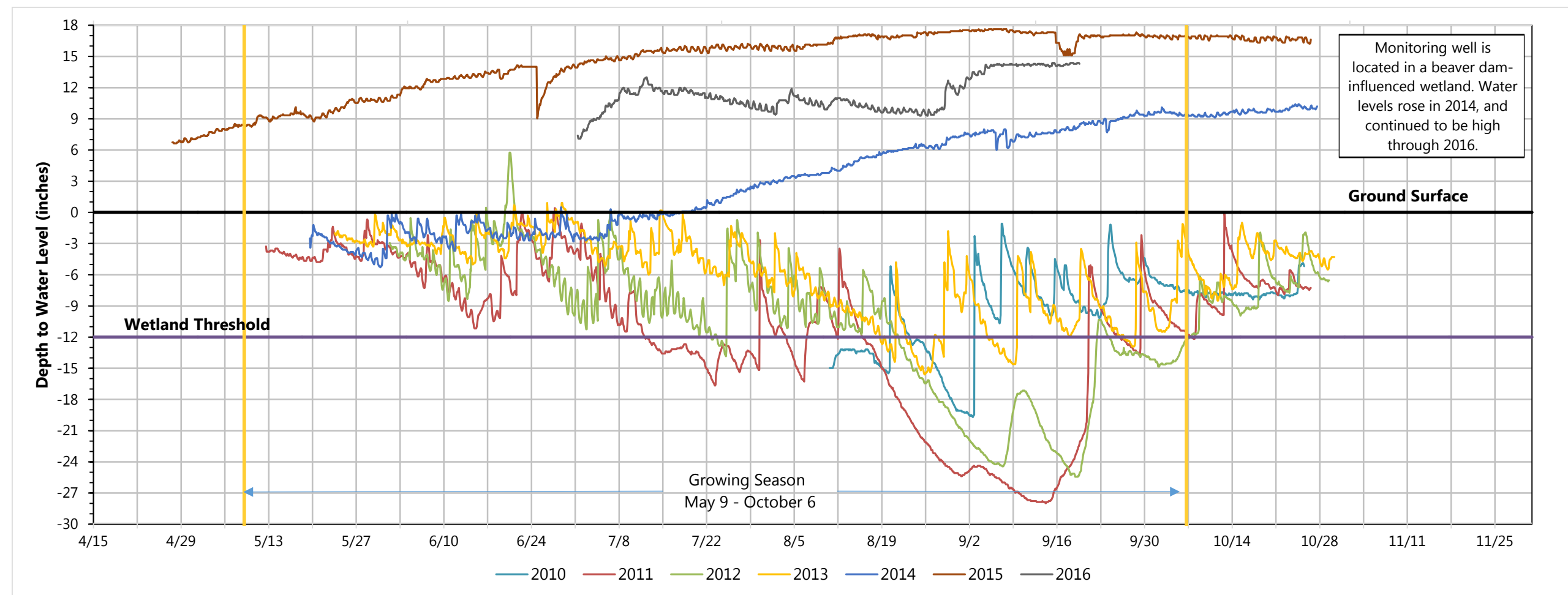


Figure TB1-1
 WETLAND MONITORING WELL TB1
 2010-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

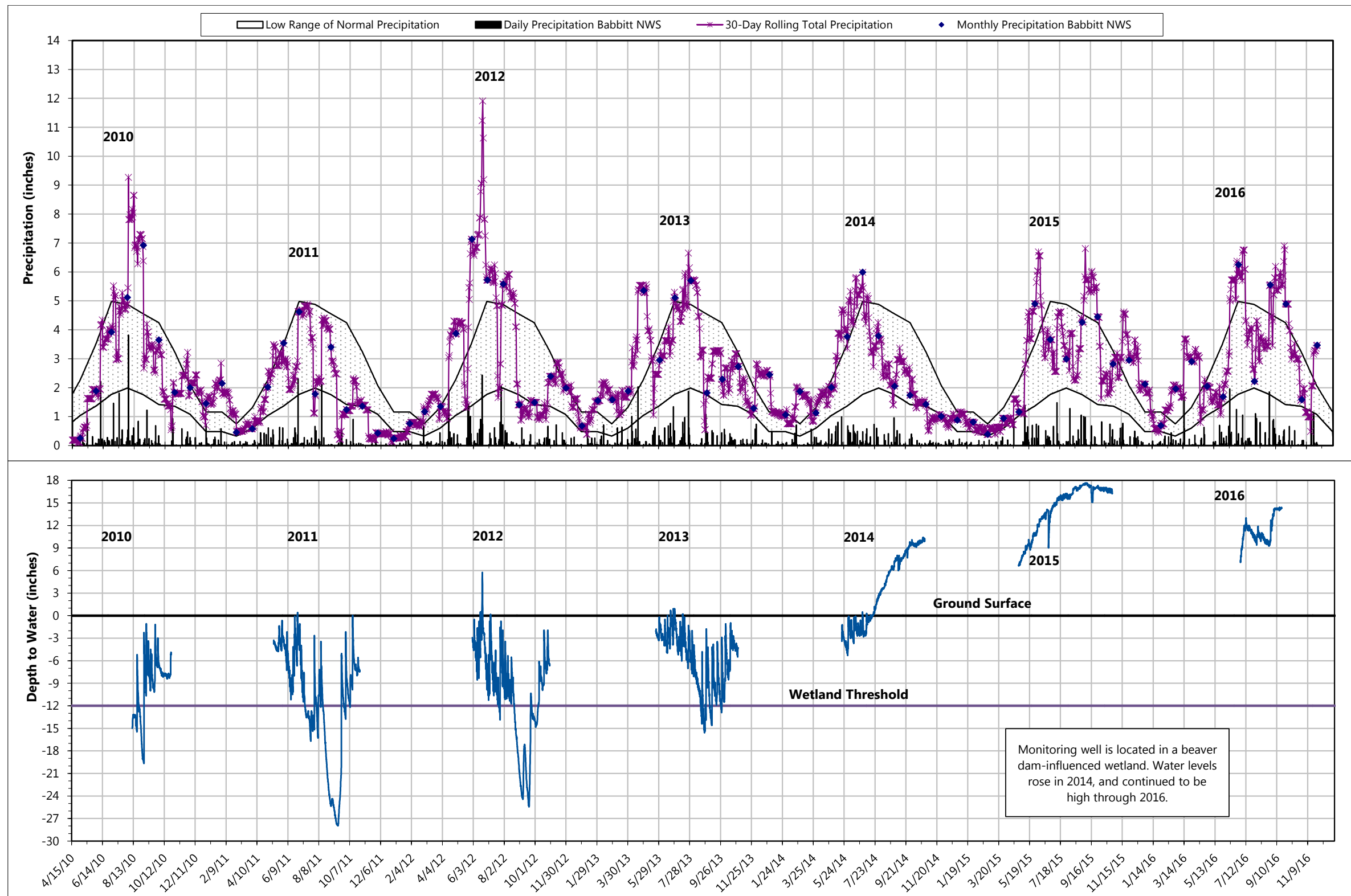


Figure TB1-2
 WETLAND MONITORING WELL TB1
 2010-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

NorthMet Project Hydrology Monitoring – Well TB1



May 2010



July 2011



June 2012



June 2013



June 2014



May 2015

NorthMet Project Hydrology Monitoring – Well TB1



June 2016

Well ID: TB2

NorthMet Project Area: Plant Site

Wetland Number: 917

Wetland Type: Coniferous Bog (Type 8)

UTM Coordinates (NAD 83 Zone 15)

Easting: 561772

Northing: 5276073

Growing Season: May 9-October 6 (151 days)

Water Level Fluctuation for All Years: 22.5 inches

Well Type(s): Ecotone and Manual

Date Recording Well Installed: 4/26/2010

Installed By: Barr/NTS

Water Level Recorded Every: 4 hours

Date Manual Well Installed: 4/26/2010

Installed By: Barr/NTS

Manual Water Levels Read: Monthly

Monitored by: NTS

Notes: UTM coordinates are for recording well. The logger malfunctioned after installation in 2010 and no data was collected until it was replaced on 8/10/2014.

Table TB2-1. Monitoring Period Each Year¹. See the hydrographs in Figure TB2-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Start Date	---	---	---	---	---	4/26	5/12	4/17	5/23	5/19	4/27	4/25
End Date	---	---	---	---	---	10/25	10/26	10/29	10/30	10/27	10/26	10/3
Total Days	---	---	---	---	---	183	168	196	161	162	183	162
Grow. Seas. Days	---	---	---	---	---	151	148	151	137	141	151	148

¹ Manual (M) well only at this location. No wells at the location (---). Day ranges and Growing Season (Grow. Seas.) Days in this table represent full calendar days.

Table TB2-2. Precipitation During Each Growing Season and Water Year¹. See the yearly hydrographs in Figure TB2-2.

Table 1B2-2: Precipitation During Each Growing Season and Water Year. See the yearly hydrographs in Figure 1B2-2.													
Year		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Growing Season	May	A	N	A	N	B	B	A	A	N	A	A	B
	June	A	B	N	A	B	N	N	A	A	A	N	A
	July	B	A	B	B	B	A	B	A	A	N	B	B
	Aug	B	B	B	B	N	A	N	B	B	N	N	A
	Sept	B	B	A	A	B	N	B	B	B	B	N	A
Water Year		A	B	A	A	B	N	B	A	A	N	B	A

¹ The growing season includes precipitation during May through September and the water year includes precipitation from October 1 of the previous year through September 30 of the current year. Each time period, the precipitation is represented as: within the normal range of precipitation (N), below the normal range of precipitation (B), or above the normal range of precipitation (A).

Table TB2-3. Hydroperiod(s) for Each Year During the Growing Season¹. Total number of days water level is $\geq 12"$ below ground level for 14 or more consecutive days during the growing season. The yearly hydrographs are shown in Figure TB2-2.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# of Periods ≥ 14 Consecutive Days	---	---	---	---	---	1	2	1	1	1	1	1
Total Days	---	---	---	---	---	151	135	118	136	129	151	1483
% Grow. Seas.	---	---	---	---	---	100%	91%	78%	99%	91%	100%	100%

¹ Hydroperiods were not determined for locations with only a Manual (M) well. No wells at the location (---). The total days counted for the hydroperiod may not match the total days monitored within a growing season (Grow. Seas.) because the hydroperiod date count does not include partial days.

Table TB2-4. Water Level Fluctuations During the Growing Season (inches)¹. Yearly fluctuations are shown in Figure TB2-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum (in.)	---	---	---	---	---	-3.6	-14.8	-14.9	-8.2	-15.7	-8.9	-4.2
Maximum (in.)	---	---	---	---	---	0.6	1.9	2.3	0.6	1.4	2.5	6.8
Fluctuation (in.)	---	---	---	---	---	4.2	16.7	17.2	8.8	17.1	11.4	10.9

¹ Fluctuations in water level were not determined for locations with only a Manual (M) well. No wells at the location (---). Some water level depths were deeper than the bottom of the well casing (<) resulting in greater fluctuations than indicated in the data (>).

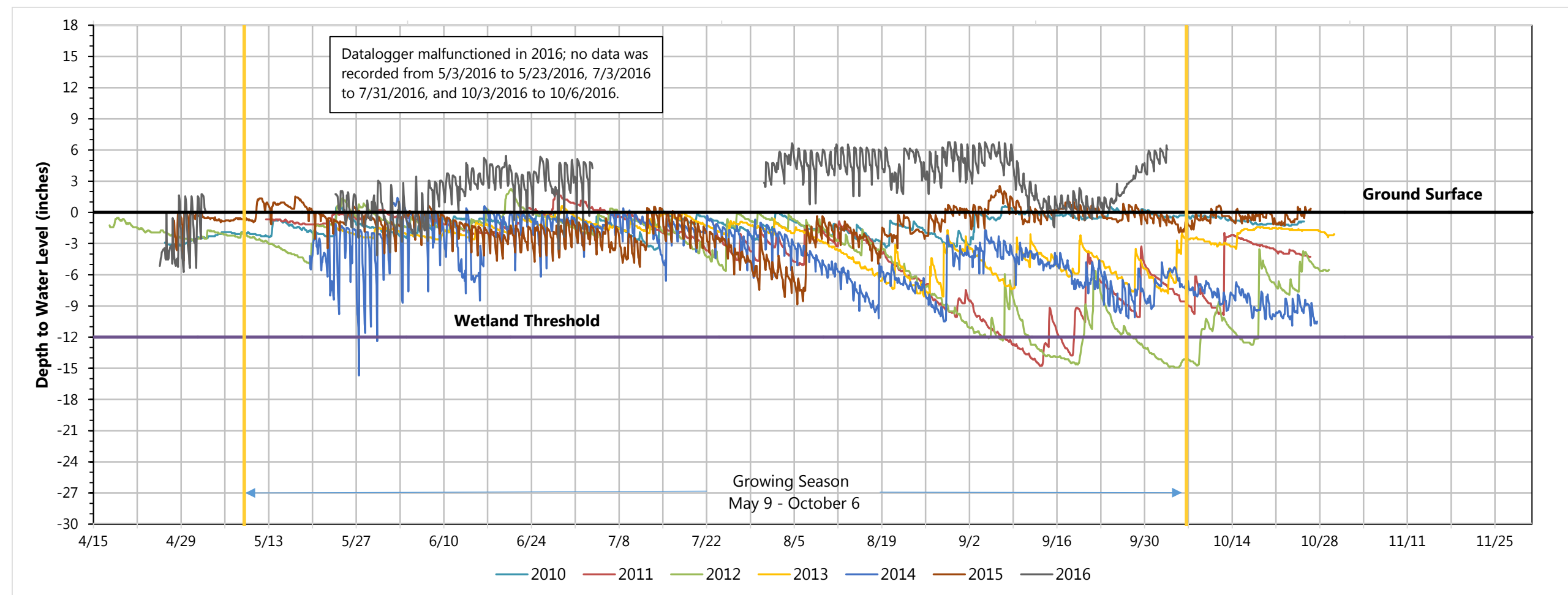


Figure TB2-1
 WETLAND MONITORING WELL TB2
 2010-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

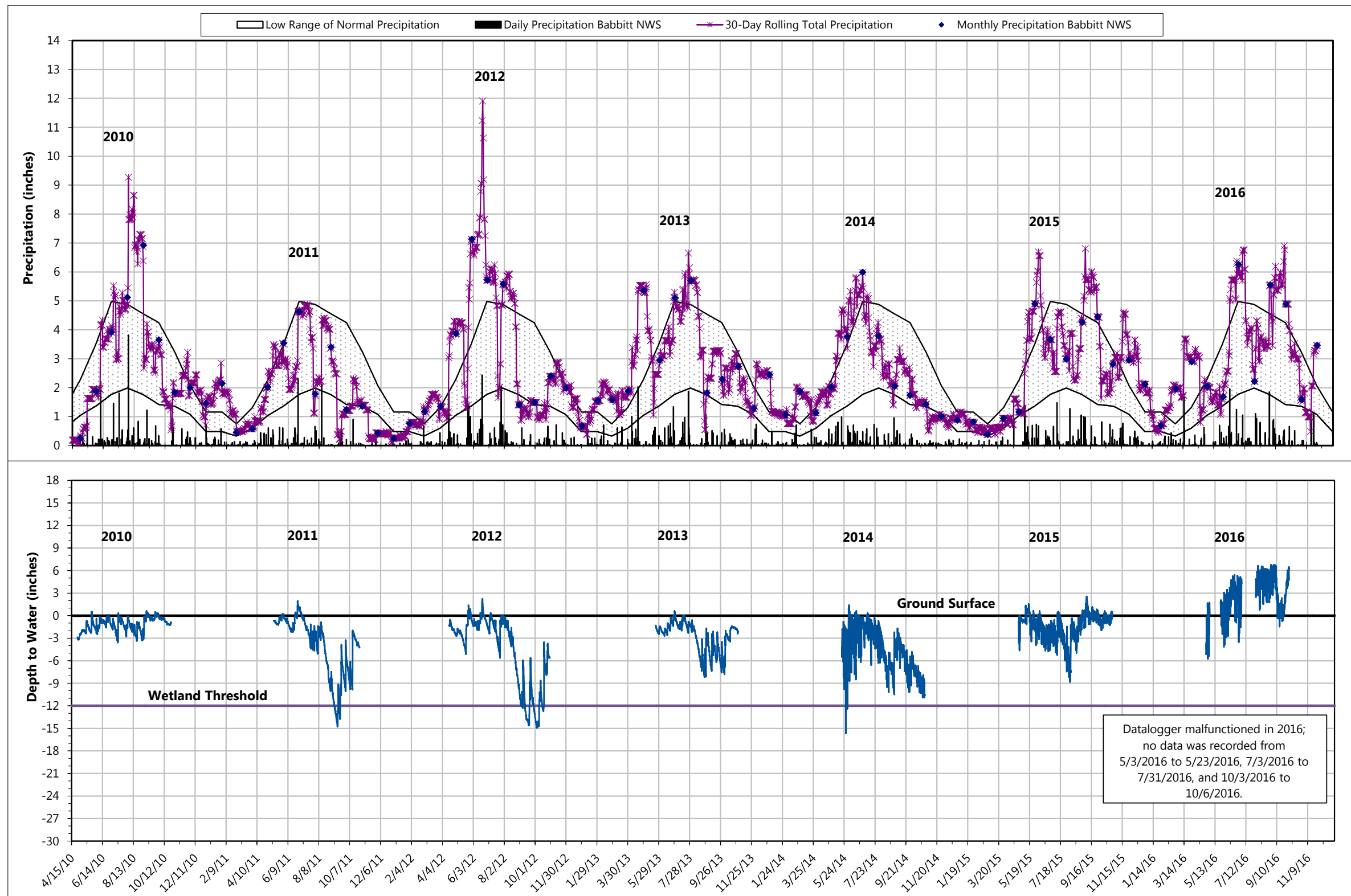


Figure TB2-2
 WETLAND MONITORING WELL TB2
 2010-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

NorthMet Project Hydrology Monitoring – Well TB2



May 2010



July 2011



June 2012



June 2013



June 2014



May 2015

NorthMet Project Hydrology Monitoring – Well TB2



June 2016

Well ID: TB3

NorthMet Project Area: Plant Site

Wetland Number: 260

Wetland Type: Shallow Marsh (Type 3)

UTM Coordinates (NAD 83 Zone 15)

Easting: 564896

Northing: 5276248

Well Type(s): Ecotone and Manual

Date Recording Well Installed: 4/26/2010

Installed By: Barr/NTS

Water Level Recorded Every: 4 hours

Date Manual Well Installed: 4/26/2010

Installed By: Barr/NTS

Manual Water Levels Read: Monthly

Growing Season: May 9-October 6 (151 days)

Monitored by: NTS

Water Level Fluctuation for All Years: 9.1 inches

Notes: UTM coordinates are for recording well.

Table TB3-1. Monitoring Period Each Year¹. See the hydrographs in Figure TB3-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Start Date	---	---	---	---	---	4/26	5/12	4/17	5/23	5/19	4/28	4/25
End Date	---	---	---	---	---	10/25	10/26	10/29	10/30	10/27	10/26	10/17
Total Days	---	---	---	---	---	183	168	196	161	162	182	171
Grow. Seas. Days	---	---	---	---	---	151	148	151	137	141	151	151

¹ Manual (M) well only at this location. No wells at the location (---). Day ranges and Growing Season (Grow. Seas.) Days in this table represent full calendar days.

Table TB3-2. Precipitation During Each Growing Season and Water Year¹. See the yearly hydrographs in Figure TB3-2.

Year		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Growing Season	May	A	N	A	N	B	B	A	A	N	A	A	B
	June	A	B	N	A	B	N	N	A	A	A	N	A
	July	B	A	B	B	B	A	B	A	A	N	B	B
	Aug	B	B	B	B	N	A	N	B	B	N	N	A
	Sept	B	B	A	A	B	N	B	B	B	B	N	A
Water Year		A	B	A	A	B	N	B	A	A	N	B	A

¹ The growing season includes precipitation during May through September and the water year includes precipitation from October 1 of the previous year through September 30 of the current year. Each time period, the precipitation is represented as: within the normal range of precipitation (N), below the normal range of precipitation (B), or above the normal range of precipitation (A).

Table TB3-3. Hydroperiod(s) for Each Year During the Growing Season¹. Total number of days water level is ≥ 12 " below ground level for 14 or more consecutive days during the growing season. The yearly hydrographs are shown in Figure TB3-2.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# of Periods ≥ 14 Consecutive Days	---	---	---	---	---	1	1	1	1	1	1	1
Total Days	---	---	---	---	---	151	147	151	136	140	151	151
% Grow. Seas.	---	---	---	---	---	100%	99%	100%	99%	99%	100%	100%

¹ Hydroperiods were not determined for locations with only a Manual (M) well. No wells at the location (---). The total days counted for the hydroperiod may not match the total days monitored within a growing season (Grow. Seas.) because the hydroperiod date count does not include partial days.

Table TB3-4. Water Level Fluctuations During the Growing Season (inches)¹. Yearly fluctuations are shown in Figure TB3-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum (in.)	---	---	---	---	---	2.9	4.6	6.3	7.1	7.2	6.8	8.2
Maximum (in.)	---	---	---	---	---	5.7	7.5	9.5	10.5	9.2	9.3	12.0
Fluctuation (in.)	---	---	---	---	---	2.8	2.9	3.2	3.4	2.0	2.5	3.8

¹ Fluctuations in water level were not determined for locations with only a Manual (M) well. No wells at the location (---). Some water level depths were deeper than the bottom of the well casing (<) resulting in greater fluctuations than indicated in the data (>).

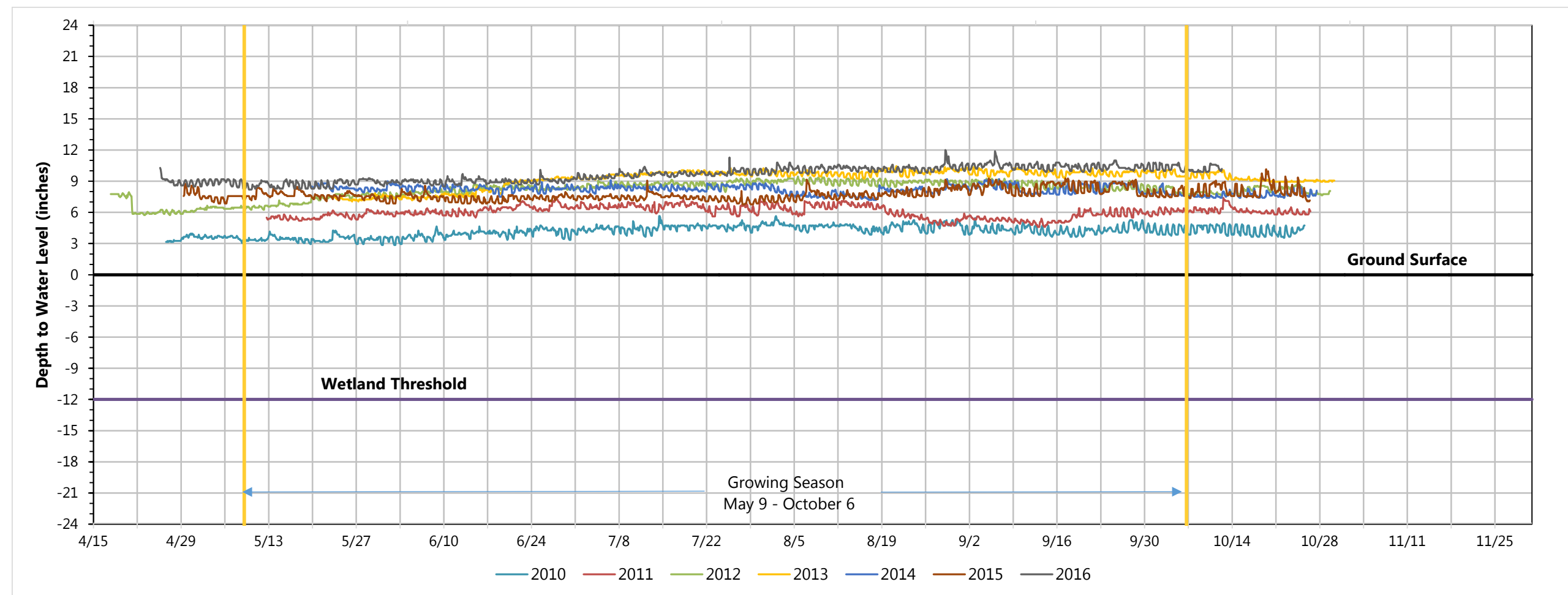


Figure TB3-1
 WETLAND MONITORING WELL TB3
 2010-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

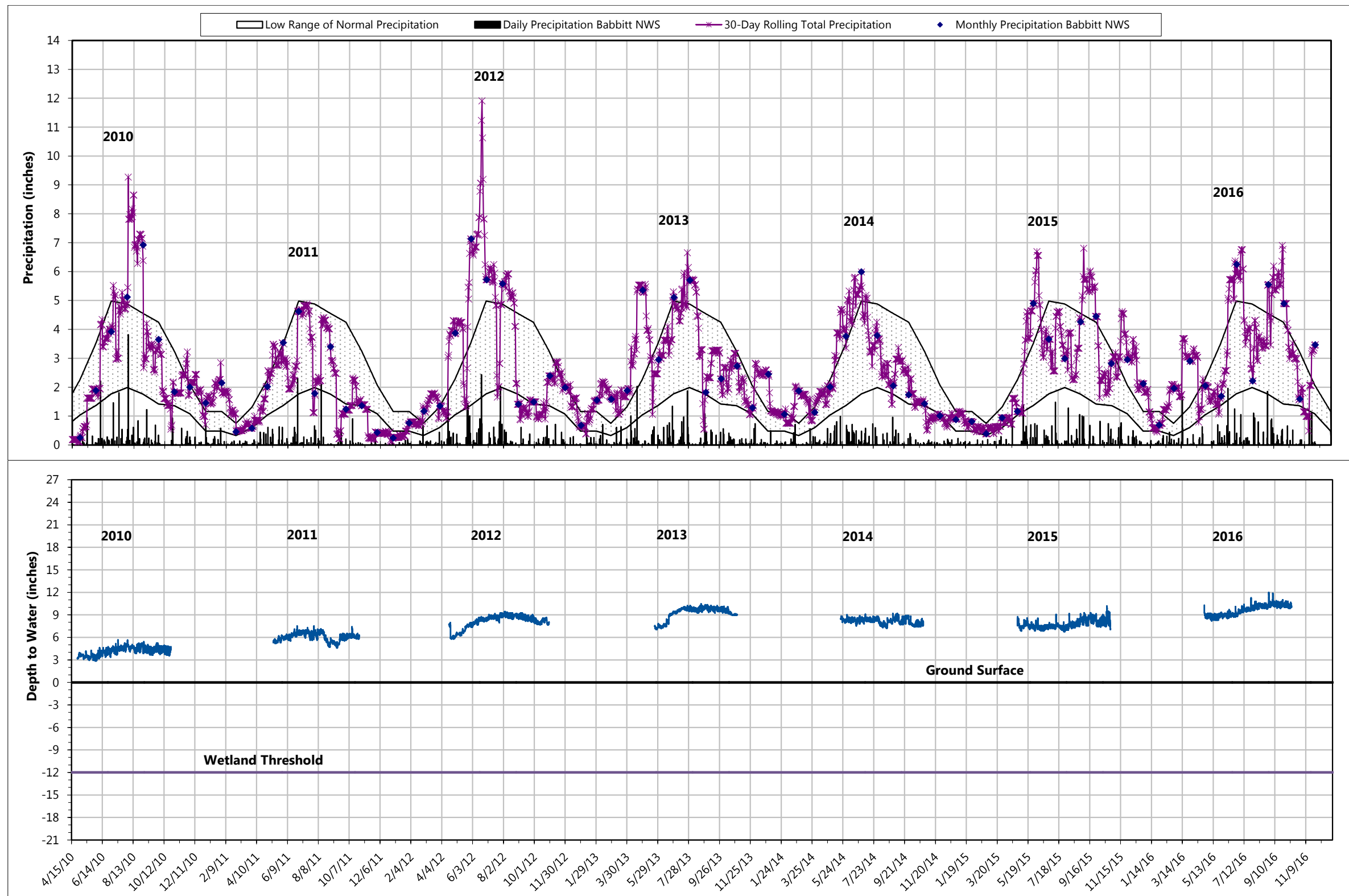


Figure TB3-2
 WETLAND MONITORING WELL TB3
 2010-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

NorthMet Project Hydrology Monitoring – Well TB3



May 2010



August 2011



June 2012



June 2013



June 2014



June 2015

NorthMet Project Hydrology Monitoring – Well TB3



June 2016

Well ID: TB4

NorthMet Project Area: Plant Site

Wetland Number: 260

Wetland Type: Shallow Marsh (Type 3)

UTM Coordinates (NAD 83 Zone 15)

Easting: 565471

Northing: 5276420

Well Type(s): Ecotone and Manual

Date Recording Well Installed: 4/27/2010

Installed By: Barr/NTS

Water Level Recorded Every: 4 hours

Date Manual Well Installed: 4/27/2010

Installed By: Barr/NTS

Manual Water Levels Read: Monthly

Growing Season: May 9-October 6 (151 days)

Monitored by: NTS

Water Level Fluctuation for All Years: 13.7 inches

Notes: UTM coordinates are for recording well.

Table TB4-1. Monitoring Period Each Year¹ See the hydrographs in Figure TB4-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Start Date	---	---	---	---	---	8/25	5/12	4/17	5/20	5/19	4/27	4/25
End Date	---	---	---	---	---	10/25	10/26	10/29	10/30	10/27	10/26	10/27
Total Days	---	---	---	---	---	62	168	196	164	162	183	186
Grow. Seas. Days	---	---	---	---	---	43	148	151	140	141	151	151

¹ Manual (M) well only at this location. No wells at the location (---). Day ranges and Growing Season (Grow. Seas.) Days in this table represent full calendar days.

Table TB4-2. Precipitation During Each Growing Season and Water Year¹ See the yearly hydrographs in Figure TB41-2.

Year		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Growing Season	May	A	N	A	N	B	B	A	A	N	A	A	B
	June	A	B	N	A	B	N	N	A	A	A	N	A
	July	B	A	B	B	B	A	B	A	A	N	B	B
	Aug	B	B	B	B	N	A	N	B	B	N	N	A
	Sept	B	B	A	A	B	N	B	B	B	B	N	A
Water Year		A	B	A	A	B	N	B	A	A	N	B	A

¹ The growing season includes precipitation during May through September and the water year includes precipitation from October 1 of the previous year through September 30 of the current year. Each time period, the precipitation is represented as: within the normal range of precipitation (N), below the normal range of precipitation (B), or above the normal range of precipitation (A).

Table TB4-3. Hydroperiod(s) for Each Year During the Growing Season¹ Total number of days water level is ≥ 12 " below ground level for 14 or more consecutive days during the growing season. The yearly hydrographs are shown in Figure TB4-2.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# of Periods ≥ 14 Consecutive Days	---	---	---	---	---	1	1	1	1	1	1	1
Total Days	---	---	---	---	---	42	147	151	139	1441	151	151
% Grow. Seas.	---	---	---	---	---	98%	99%	100%	99%	100%	100%	100%

¹ Hydroperiods were not determined for locations with only a Manual (M) well. No wells at the location (---). The total days counted for the hydroperiod may not match the total days monitored within a growing season (Grow. Seas.) because the hydroperiod date count does not include partial days.

Table TB4-4. Water Level Fluctuations During the Growing Season (inches)¹ Yearly fluctuations are shown in Figure TB4-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum (in.)	---	---	---	---	---	10.1	3.9	2.4	8.1	9.8	9.0	10.3
Maximum (in.)	---	---	---	---	---	14.1	13.6	14.3	14.0	16.1	15.8	15.4
Fluctuation (in.)	---	---	---	---	---	4.0	9.7	11.9	5.9	6.3	6.8	5.1

¹ Fluctuations in water level were not determined for locations with only a Manual (M) well. No wells at the location (---). Some water level depths were deeper than the bottom of the well casing (<) resulting in greater fluctuations than indicated in the data (>).

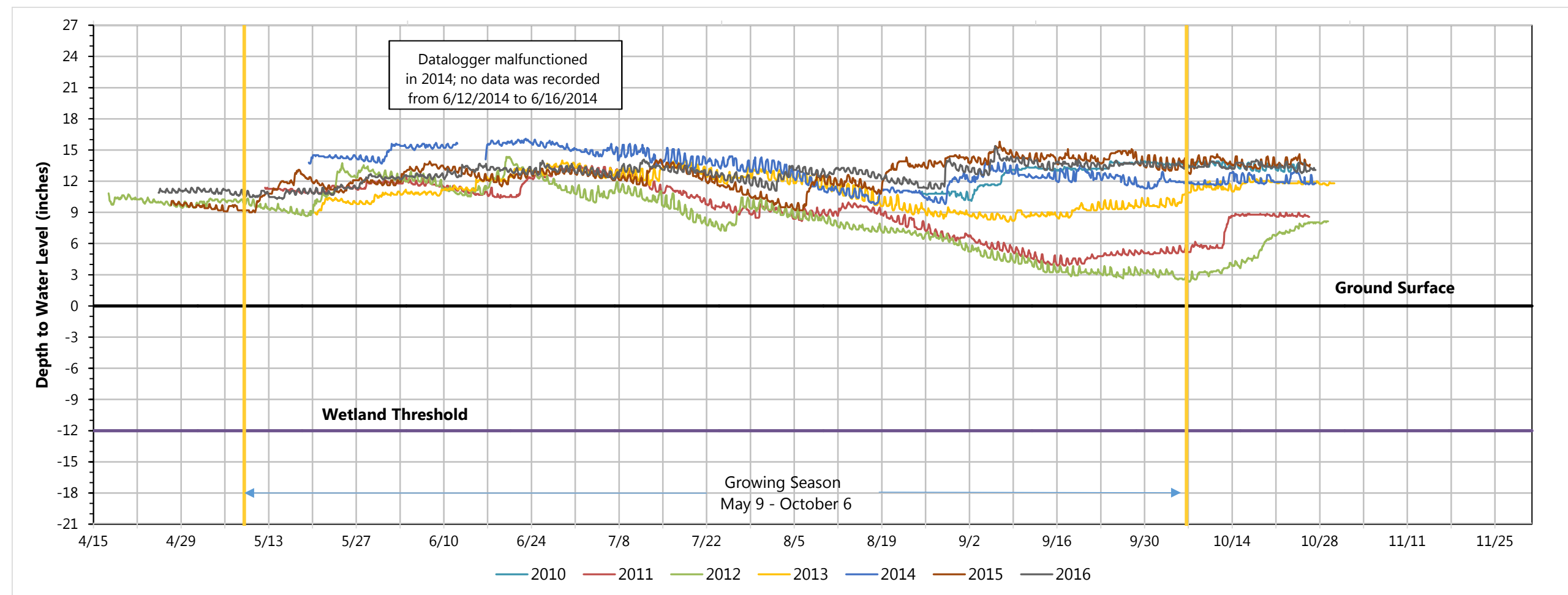


Figure TB4-1
 WETLAND MONITORING WELL TB4
 2010-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

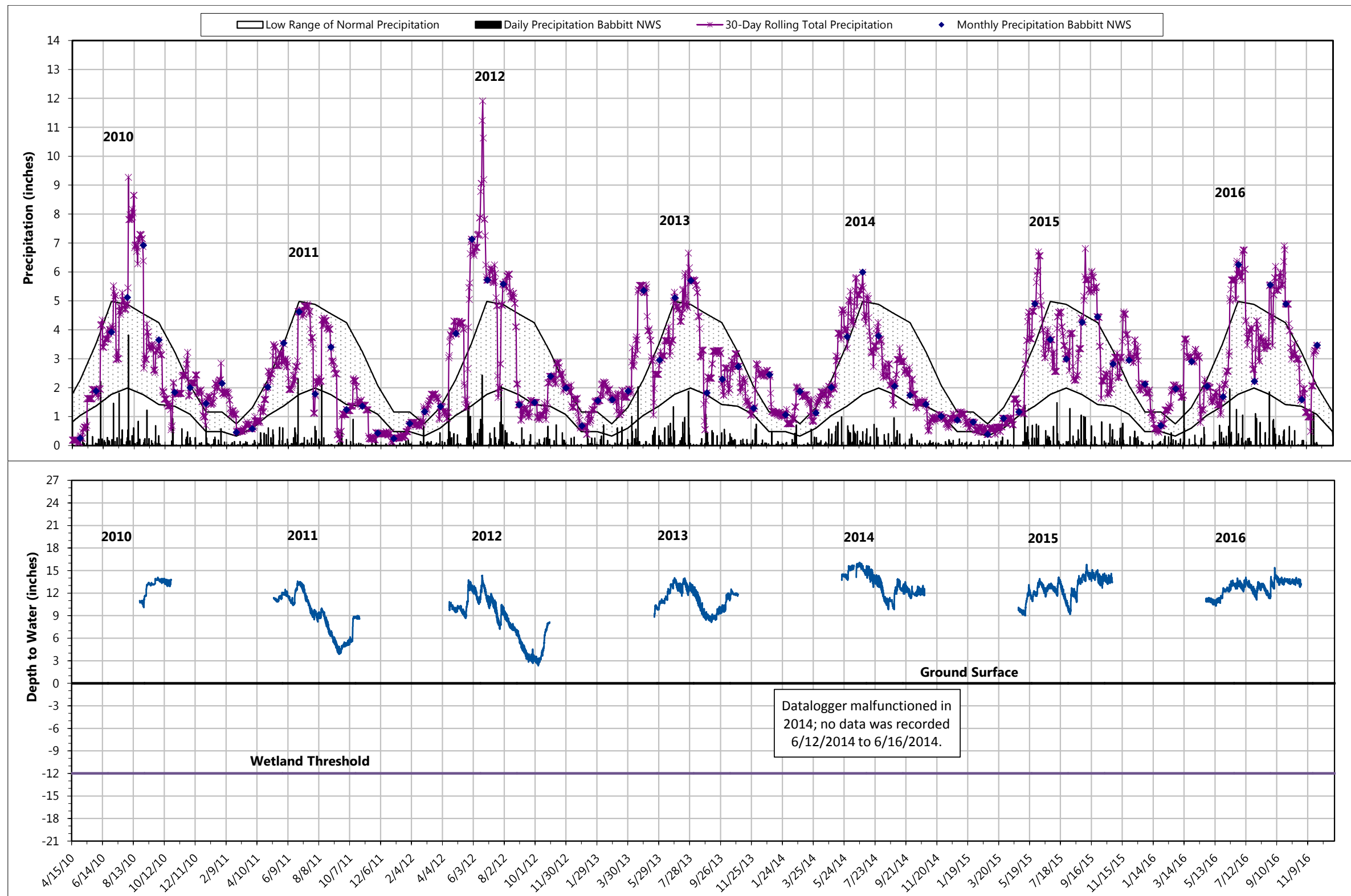


Figure TB4-2
 WETLAND MONITORING WELL TB4
 2010-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

NorthMet Project Hydrology Monitoring – Well TB4



May 2010



June 2011



June 2012



June 2013



June 2014



May 2015

NorthMet Project Hydrology Monitoring – Well TB4



June 2016

Well ID: TB5

NorthMet Project Area: Plant Site

Wetland Number: 868

Wetland Type: Hardwood Swamp (Type 7)

UTM Coordinates (NAD 83 Zone 15)

Easting: 566986

Northing: 5276708

Well Type(s): Ecotone and Manual

Date Recording Well Installed: 4/26/2010

Installed By: Barr/NTS

Water Level Recorded Every: 4 hours

Date Manual Well Installed: 4/26/2010

Installed By: Barr/NTS

Manual Water Levels Read: Monthly

Growing Season: May 9-October 6 (151 days)

Monitored by: NTS

Water Level Fluctuation for All Years: 24.6 inches

Notes: UTM coordinates are for recording well.

Table TB5-1. Monitoring Period Each Year¹. See the hydrographs in Figure TB5-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Start Date	---	---	---	---	---	4/26	5/12	4/17	5/20	5/19	4/27	4/25
End Date	---	---	---	---	---	10/25	10/26	10/29	10/30	10/27	10/26	10/27
Total Days	---	---	---	---	---	183	168	196	164	162	183	186
Grow. Seas. Days	---	---	---	---	---	151	148	151	140	141	151	151

¹ Manual (M) well only at this location. No wells at the location (---). Day ranges and Growing Season (Grow. Seas.) Days in this table represent full calendar days.

Table TB5-2. Precipitation During Each Growing Season and Water Year¹. See the yearly hydrographs in Figure TB5-2.

Year		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Growing Season	May	A	N	A	N	B	B	A	A	N	A	A	B
	June	A	B	N	A	B	N	N	A	A	A	N	A
	July	B	A	B	B	B	A	B	A	A	N	B	B
	Aug	B	B	B	B	N	A	N	B	B	N	N	A
	Sept	B	B	A	A	B	N	B	B	B	B	N	A
Water Year		A	B	A	A	B	N	B	A	A	N	B	A

¹ The growing season includes precipitation during May through September and the water year includes precipitation from October 1 of the previous year through September 30 of the current year. Each time period, the precipitation is represented as: within the normal range of precipitation (N), below the normal range of precipitation (B), or above the normal range of precipitation (A).

Table TB5-3. Hydroperiod(s) for Each Year During the Growing Season¹. Total number of days water level is $\geq 12"$ below ground level for 14 or more consecutive days during the growing season. The yearly hydrographs are shown in Figure TB5-2.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# of Periods ≥ 14 Consecutive Days	---	---	---	---	---	1	1	1	1	1	1	1
Total Days	---	---	---	---	---	151	147	151	139	140	151	151
% Grow. Seas.	---	---	---	---	---	100%	99%	100%	99%	99%	100%	100%

¹ Hydroperiods were not determined for locations with only a Manual (M) well. No wells at the location (---). The total days counted for the hydroperiod may not match the total days monitored within a growing season (Grow. Seas.) because the hydroperiod date count does not include partial days.

Table TB5-4. Water Level Fluctuations During the Growing Season (inches)¹. Yearly fluctuations are shown in Figure TB5-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum (in.)	---	---	---	---	---	1.3	-0.6	0.3	3.7	3.0	6.6	17.1
Maximum (in.)	---	---	---	---	---	6.1	6.2	9.9	9.0	9.4	13.7	24.0
Fluctuation (in.)	---	---	---	---	---	4.8	6.8	9.6	5.3	6.4	7.1	6.9

¹ Fluctuations in water level were not determined for locations with only a Manual (M) well. No wells at the location (---). Some water level depths were deeper than the bottom of the well casing (<) resulting in greater fluctuations than indicated in the data (>).

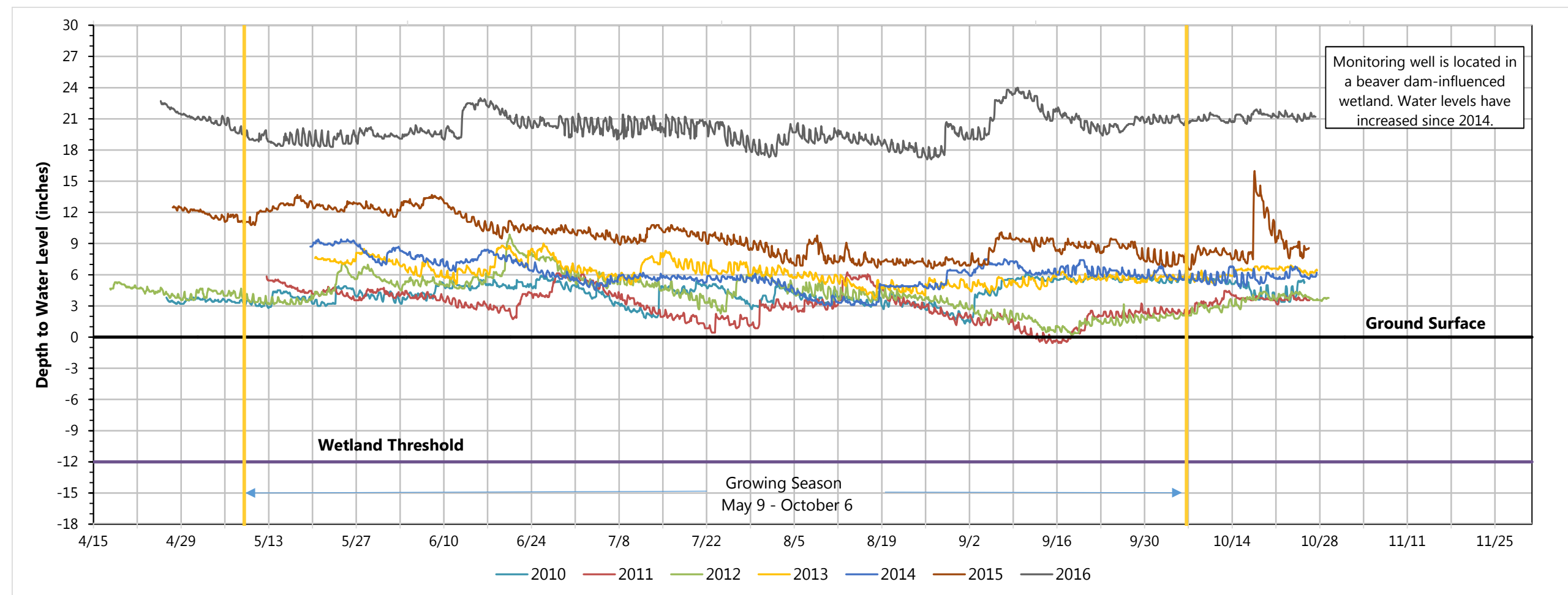


Figure TB5-1
WETLAND MONITORING WELL TB5
2010-2016 WETLAND HYDROLOGY MONITORING DATA
NorthMet Project
Poly Met Mining, Inc.
Hoyt Lakes, Minnesota

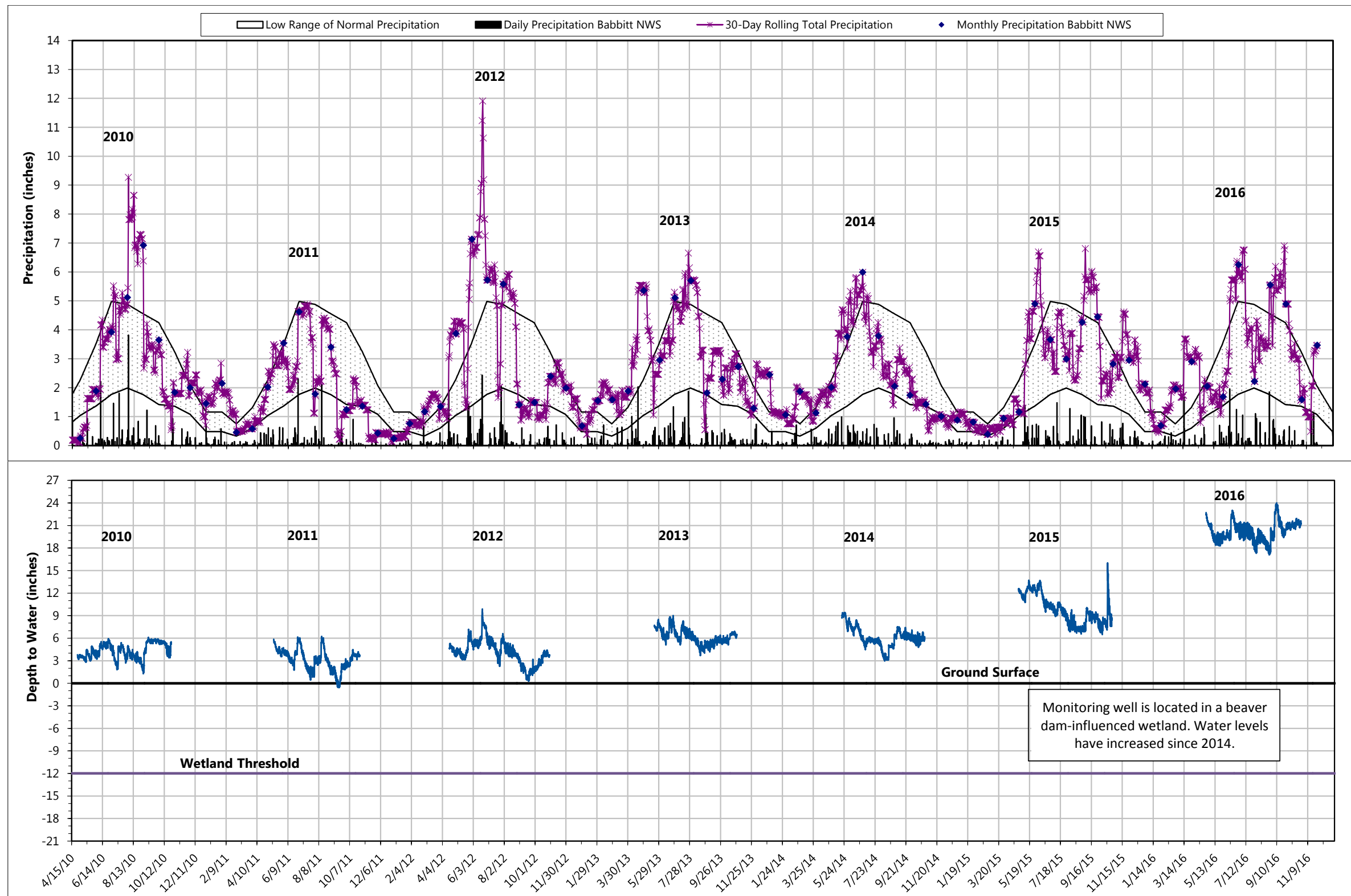


Figure TB5-2
 WETLAND MONITORING WELL TB5
 2010-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

NorthMet Project Hydrology Monitoring – Well TB5



May 2010



June 2011



June 2012



June 2013



June 2014



May 2015

NorthMet Project Hydrology Monitoring – Well TB5



June 2016

Well ID: TB6

NorthMet Project Area: Plant Site

Wetland Number: 1151

Wetland Type: Coniferous Swamp (Type 7)

UTM Coordinates (NAD 83 Zone 15)

Easting: 566225

Northing: 5277005

Well Type(s): Ecotone and Manual

Date Recording Well Installed: 4/27/2010

Installed By: Barr/NTS

Water Level Recorded Every: 4 hours

Date Manual Well Installed: 4/27/2010

Installed By: Barr/NTS

Manual Water Levels Read: Monthly

Growing Season: May 9-October 6 (151 days)

Monitored by: NTS

Water Level Fluctuation for All Years: 10.6 inches

Notes: UTM coordinates are for recording well.

Table TB6-1. Monitoring Period Each Year¹. See the hydrographs in Figure TB6-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Start Date	---	---	---	---	---	4/27	5/12	4/17	5/23	5/19	5/13	4/25
End Date	---	---	---	---	---	10/25	10/26	10/29	10/30	10/27	10/26	10/27
Total Days	---	---	---	---	---	182	167	195	160	161	166	185
Grow. Seas. Days	---	---	---	---	---	151	148	151	137	141	147	151

¹ Manual (M) well only at this location. No wells at the location (---). Day ranges and Growing Season (Grow. Seas.) Days in this table represent full calendar days.

Table TB6-2. Precipitation During Each Growing Season and Water Year¹. See the yearly hydrographs in Figure TB6-2.

Year		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Growing Season	May	A	N	A	N	B	B	A	A	N	A	A	B
	June	A	B	N	A	B	N	N	A	A	A	N	A
	July	B	A	B	B	B	A	B	A	A	N	B	B
	Aug	B	B	B	B	N	A	N	B	B	N	N	A
	Sept	B	B	A	A	B	N	B	B	B	B	N	A
Water Year		A	B	A	A	B	N	B	A	A	N	B	A

¹ The growing season includes precipitation during May through September and the water year includes precipitation from October 1 of the previous year through September 30 of the current year. Each time period, the precipitation is represented as: within the normal range of precipitation (N), below the normal range of precipitation (B), or above the normal range of precipitation (A).

Table TB6-3. Hydroperiod(s) for Each Year During the Growing Season¹. Total number of days water level is ≥ 12 " below ground level for 14 or more consecutive days during the growing season. The yearly hydrographs are shown in Figure TB6-2.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# of Periods ≥ 14 Consecutive Days	---	---	---	---	---	1	1	1	1	1	1	1
Total Days	---	---	---	---	---	151	147	151	136	140	146	151
% Grow. Seas.	---	---	---	---	---	100%	99%	100%	99%	99%	99%	100%

¹ Hydroperiods were not determined for locations with only a Manual (M) well. No wells at the location (---). The total days counted for the hydroperiod may not match the total days monitored within a growing season (Grow. Seas.) because the hydroperiod date count does not include partial days.

Table TB6-4. Water Level Fluctuations During the Growing Season (inches)¹. Yearly fluctuations are shown in Figure TB6-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum (in.)	---	---	---	---	---	2.3	2.3	1.5	2.0	2.3	-1.0	3.4
Maximum (in.)	---	---	---	---	---	5.1	6.3	7.6	7.3	5.8	8.9	9.6
Fluctuation (in.)	---	---	---	---	---	2.8	4.0	6.1	5.3	3.5	9.9	6.2

¹ Fluctuations in water level were not determined for locations with only a Manual (M) well. No wells at the location (---). Some water level depths were deeper than the bottom of the well casing (<) resulting in greater fluctuations than indicated in the data (>).

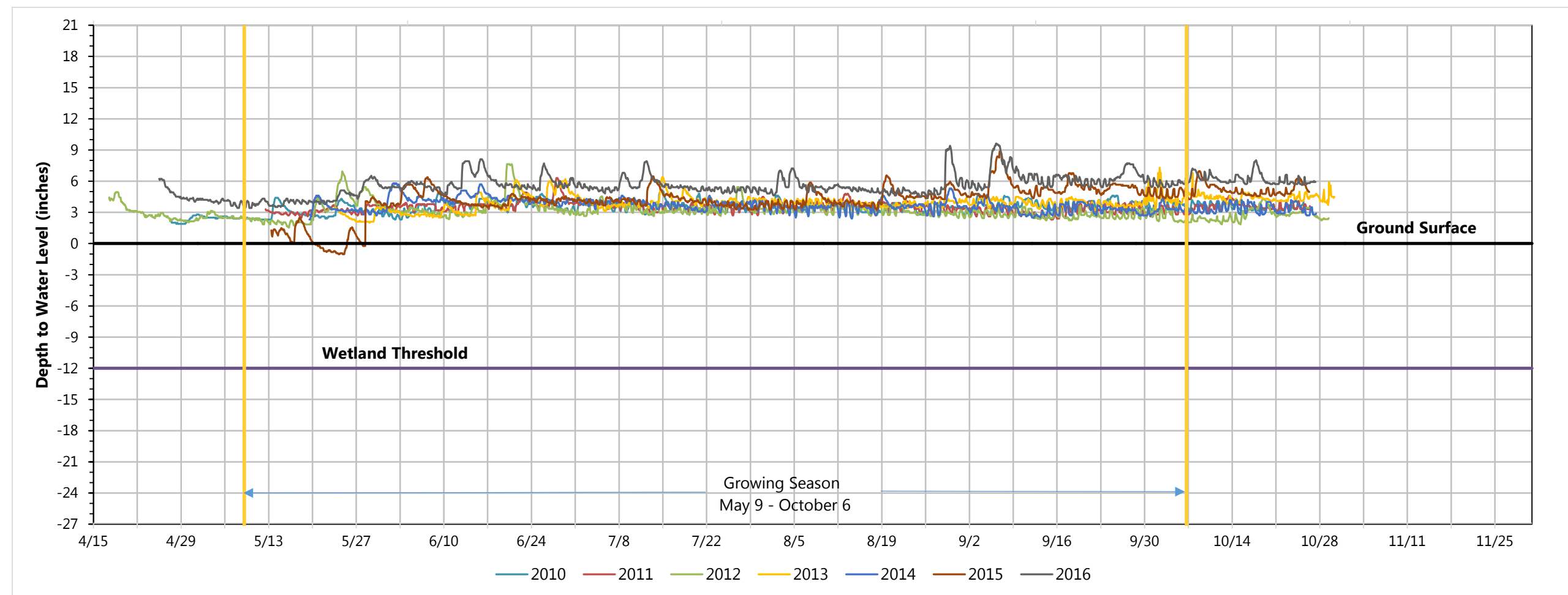


Figure TB6-1
 WETLAND MONITORING WELL TB6
 2010-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

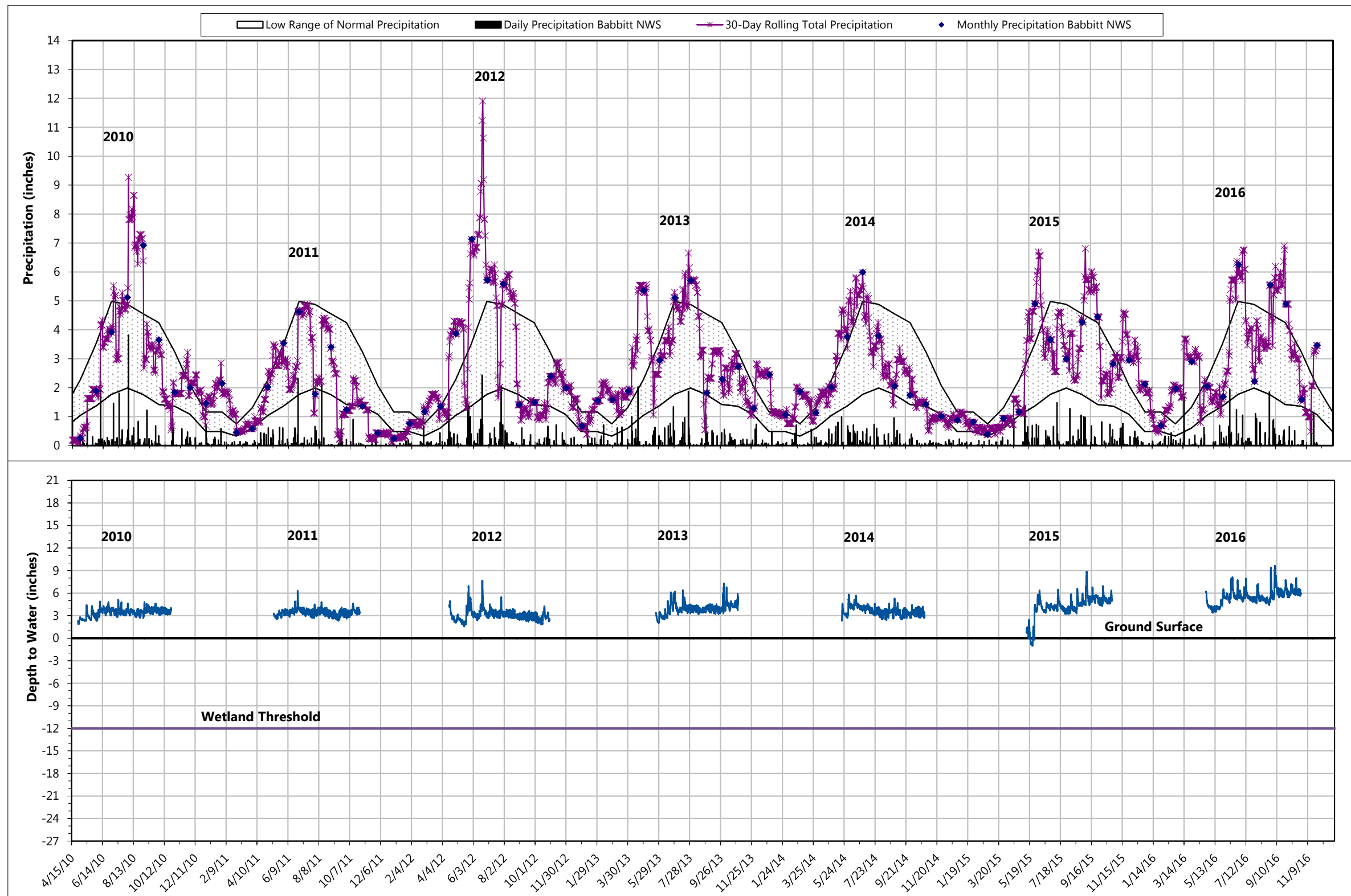


Figure TB6-2
 WETLAND MONITORING WELL TB6
 2010-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

NorthMet Project Hydrology Monitoring – Well TB6



July 2010



June 2011



June 2012



June 2013



June 2014



June 2015

NorthMet Project Hydrology Monitoring – Well TB6



June 2016

Well ID: TB7

NorthMet Project Area: Plant Site

Wetland Number: 915

Wetland Type: Alder Thicket (Type 6)

UTM Coordinates (NAD 83 Zone 15)

Easting: 565419

Northing: 5277519

Growing Season: May 9-October 6 (151 days)

Water Level Fluctuation for All Years: 12.7 inches

Well Type(s): Ecotone and Manual

Date Recording Well Installed: 4/27/2010

Installed By: Barr/NTS

Water Level Recorded Every: 4 hours

Date Manual Well Installed: 4/27/2010

Installed By: Barr/NTS

Manual Water Levels Read: Monthly

Monitored by: NTS

Notes: UTM coordinates are for recording well.

Table TB7-1. Monitoring Period Each Year¹. See the hydrographs in Figure TB7-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Start Date	---	---	---	---	---	4/27	5/12	4/17	5/23	5/19	4/27	4/25
End Date	---	---	---	---	---	10/25	10/26	10/29	10/30	10/27	10/26	10/27
Total Days	---	---	---	---	---	182	168	196	161	162	183	186
Grow. Seas. Days	---	---	---	---	---	151	148	151	137	141	151	151

¹ Manual (M) well only at this location. No wells at the location (---). Day ranges and Growing Season (Grow. Seas.) Days in this table represent full calendar days.

Table TB7-2. Precipitation During Each Growing Season and Water Year¹. See the yearly hydrographs in Figure TB7-2.

Year		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Growing Season	May	A	N	A	N	B	B	A	A	N	A	A	B
	June	A	B	N	A	B	N	N	A	A	A	N	A
	July	B	A	B	B	B	A	B	A	A	N	B	B
	Aug	B	B	B	B	N	A	N	B	B	N	N	A
	Sept	B	B	A	A	B	N	B	B	B	B	N	A
Water Year		A	B	A	A	B	N	B	A	A	N	B	A

¹ The growing season includes precipitation during May through September and the water year includes precipitation from October 1 of the previous year through September 30 of the current year. Each time period, the precipitation is represented as: within the normal range of precipitation (N), below the normal range of precipitation (B), or above the normal range of precipitation (A).

Table TB7-3. Hydroperiod(s) for Each Year During the Growing Season¹. Total number of days water level is $\geq 12"$ below ground level for 14 or more consecutive days during the growing season. The yearly hydrographs are shown in Figure TB7-2.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# of Periods ≥ 14 Consecutive Days	---	---	---	---	---	1	1	1	1	1	1	1
Total Days	---	---	---	---	---	151	147	151	136	140	151	151
% Grow. Seas.	---	---	---	---	---	100%	99%	100%	99%	99%	100%	100%

¹ Hydroperiods were not determined for locations with only a Manual (M) well. No wells at the location (---). The total days counted for the hydroperiod may not match the total days monitored within a growing season (Grow. Seas.) because the hydroperiod date count does not include partial days.

Table TB7-4. Water Level Fluctuations During the Growing Season (inches)¹. Yearly fluctuations are shown in Figure TB7-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum (in.)	---	---	---	---	---	-1.3	1.9	2.6	3.0	1.6	-0.8	2.3
Maximum (in.)	---	---	---	---	---	4.6	7.2	11.4	7.6	7.0	6.8	8.4
Fluctuation (in.)	---	---	---	---	---	5.8	5.3	8.8	4.6	5.4	7.6	6.1

¹ Fluctuations in water level were not determined for locations with only a Manual (M) well. No wells at the location (---). Some water level depths were deeper than the bottom of the well casing (<) resulting in greater fluctuations than indicated in the data (>).

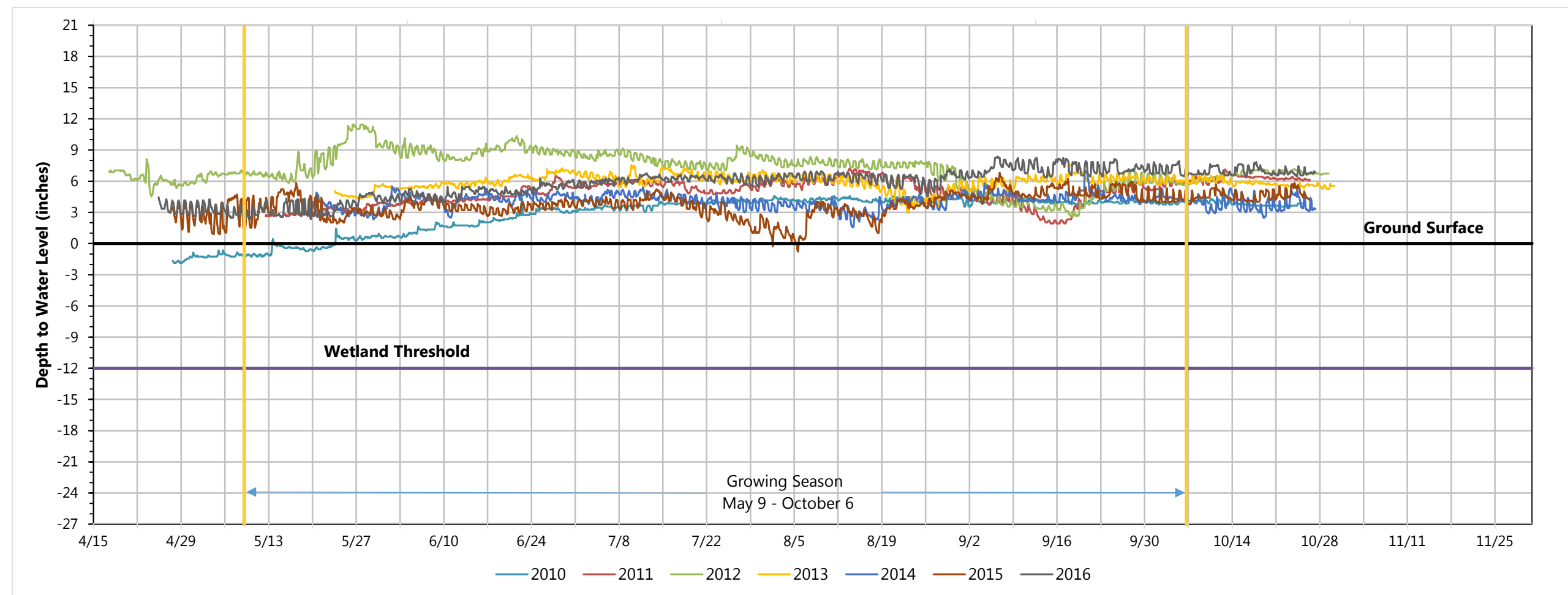


Figure TB7-1
 WETLAND MONITORING WELL TB7
 2010-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

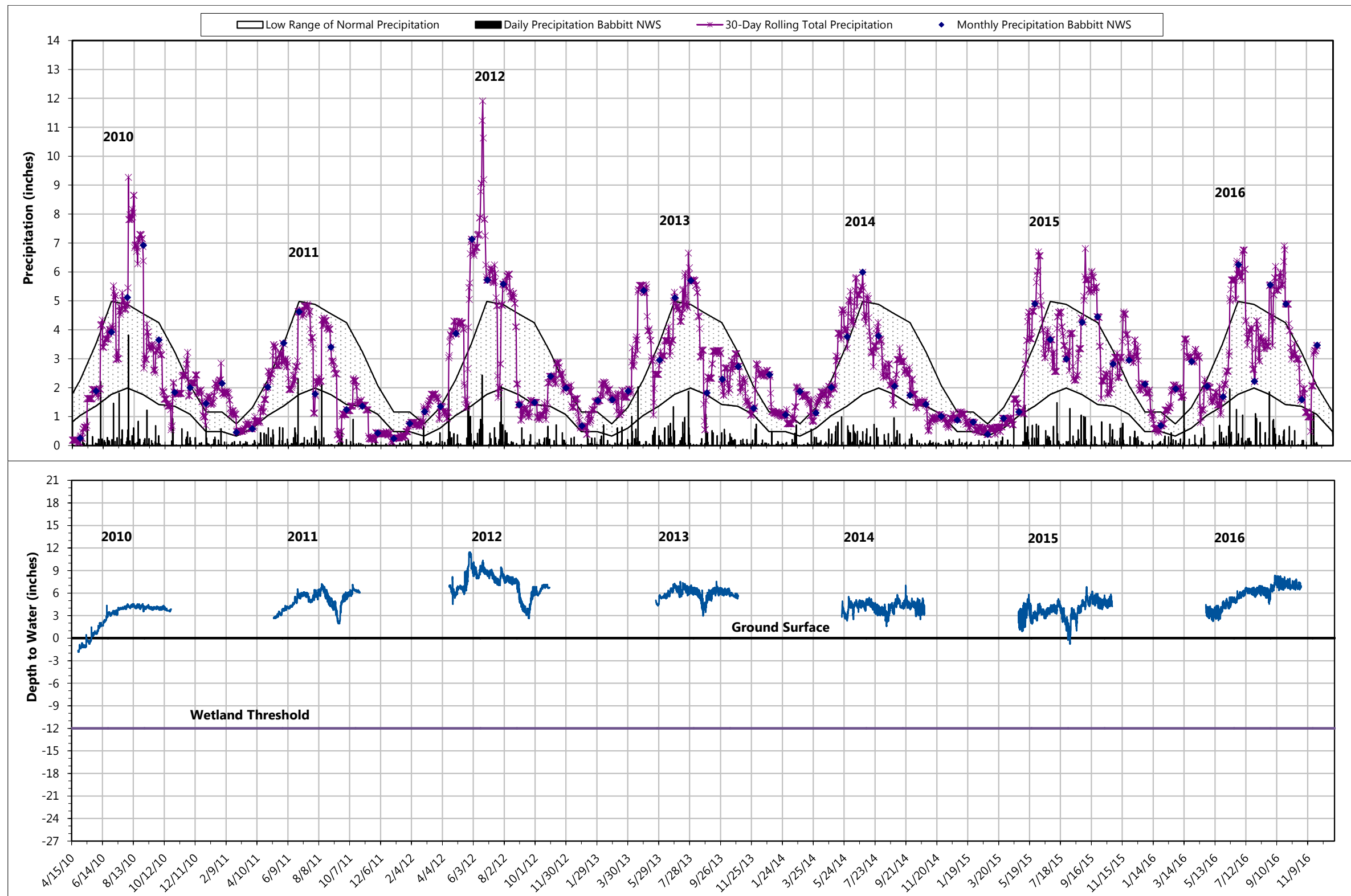


Figure TB7-2
 WETLAND MONITORING WELL TB7
 2010-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

NorthMet Project Hydrology Monitoring – Well TB7



July 2010



June 2011



June 2012



June 2013



June 2014



June 2015

NorthMet Project Hydrology Monitoring – Well TB7



June 2016

Well ID: TB9

NorthMet Project Area: Plant Site

Wetland Number: 1162

Wetland Type: Shallow Marsh (Type 3)

UTM Coordinates (NAD 83 Zone 15)

Easting: 565286

Northing: 5270895

Well Type(s): In-Situ Troll

Date Recording Well Installed: 6/30/2014

Installed By: Barr

Water Level Recorded Every: 2 hours

Date Manual Well Installed: NA

Installed By: NA

Manual Water Levels Read: See notes

Growing Season: May 9-October 6 (151 days)

Monitored by: Barr

Water Level Fluctuation for All Years: 27.8 inches

Notes: A manual reading is completed twice per monitoring period - prior to initial installation of logger and when logger is removed at end of period.

Table TB9-1. Monitoring Period Each Year¹. See the hydrographs in Figure TB9-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Start Date	---	---	---	---	---	---	---	---	---	6/30	5/13	5/5
End Date	---	---	---	---	---	---	---	---	---	10/29	10/28	10/13
Total Days	---	---	---	---	---	---	---	---	---	122	169	162
Grow. Seas. Days	---	---	---	---	---	---	---	---	---	99	147	151

¹ Manual (M) well only at this location. No wells at the location (---). Day ranges and Growing Season (Grow. Seas.) Days in this table represent full calendar days.

Table TB9-2. Precipitation During Each Growing Season and Water Year¹. See the yearly hydrographs in Figure TB9-2.

Year		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Growing Season	May	A	N	A	N	B	B	A	A	N	A	A	B
	June	A	B	N	A	B	N	N	A	A	A	N	A
	July	B	A	B	B	B	A	B	A	A	N	B	B
	Aug	B	B	B	B	N	A	N	B	B	N	N	A
	Sept	B	B	A	A	B	N	B	B	B	B	N	A
Water Year		A	B	A	A	B	N	B	A	A	N	B	A

¹ The growing season includes precipitation during May through September and the water year includes precipitation from October 1 of the previous year through September 30 of the current year. Each time period, the precipitation is represented as: within the normal range of precipitation (N), below the normal range of precipitation (B), or above the normal range of precipitation (A).

Table TB9-3. Hydroperiod(s) for Each Year During the Growing Season¹. Total number of days water level is ≥ 12 " below ground level for 14 or more consecutive days during the growing season. The yearly hydrographs are shown in Figure TB9-2.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# of Periods ≥ 14 Consecutive Days	---	---	---	---	---	---	---	---	---	1	2	1
Total Days	---	---	---	---	---	---	---	---	---	79	142	151
% Grow. Seas.	---	---	---	---	---	---	---	---	---	80%	97%	100%

¹ Hydroperiods were not determined for locations with only a Manual (M) well. No wells at the location (---). The total days counted for the hydroperiod may not match the total days monitored within a growing season (Grow. Seas.) because the hydroperiod date count does not include partial days.

Table TB9-4. Water Level Fluctuations During the Growing Season (inches)¹. Yearly fluctuations are shown in Figure TB9-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum (in.)	---	---	---	---	---	---	---	---	---	-14.4	-13.9	4.2
Maximum (in.)	---	---	---	---	---	---	---	---	---	6.1	4.7	13.4
Fluctuation (in.)	---	---	---	---	---	---	---	---	---	20.5	18.6	9.3

¹ Fluctuations in water level were not determined for locations with only a Manual (M) well. No wells at the location (---). Some water level depths were deeper than the bottom of the well casing (<) resulting in greater fluctuations than indicated in the data (>).

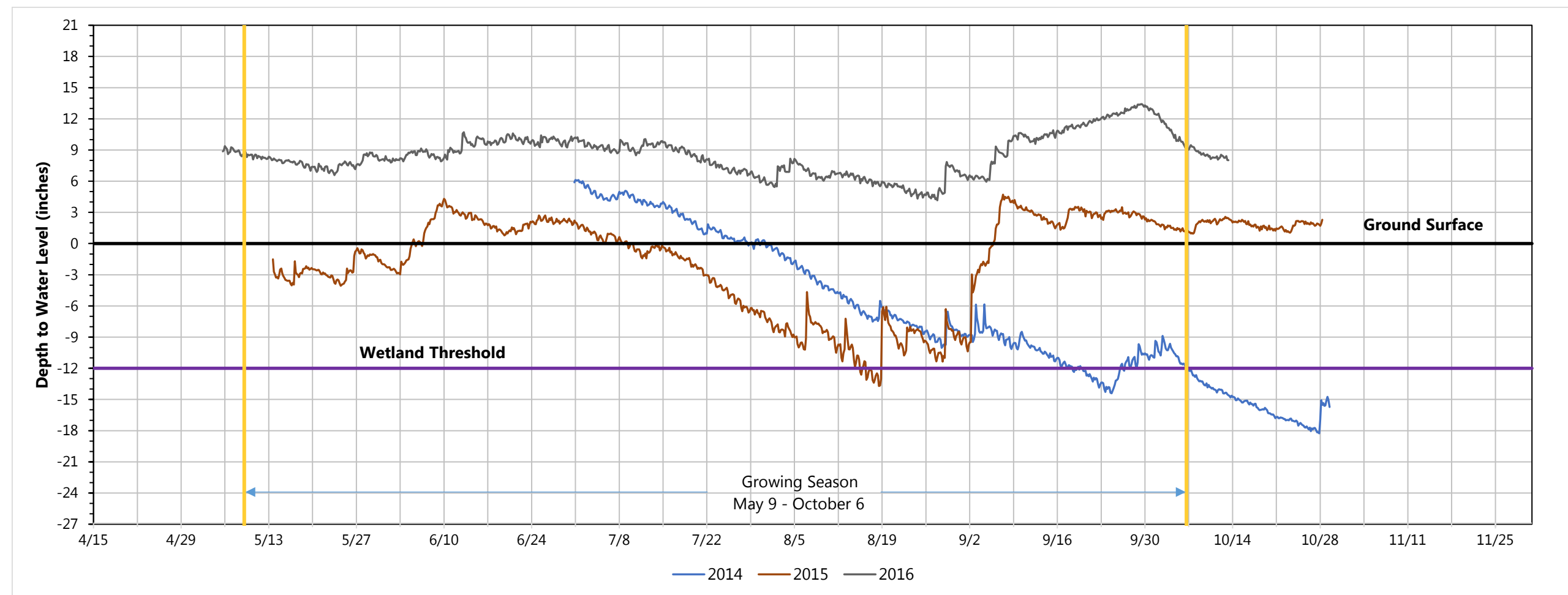


Figure TB9-1
 WETLAND MONITORING WELL TB9
 2014-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

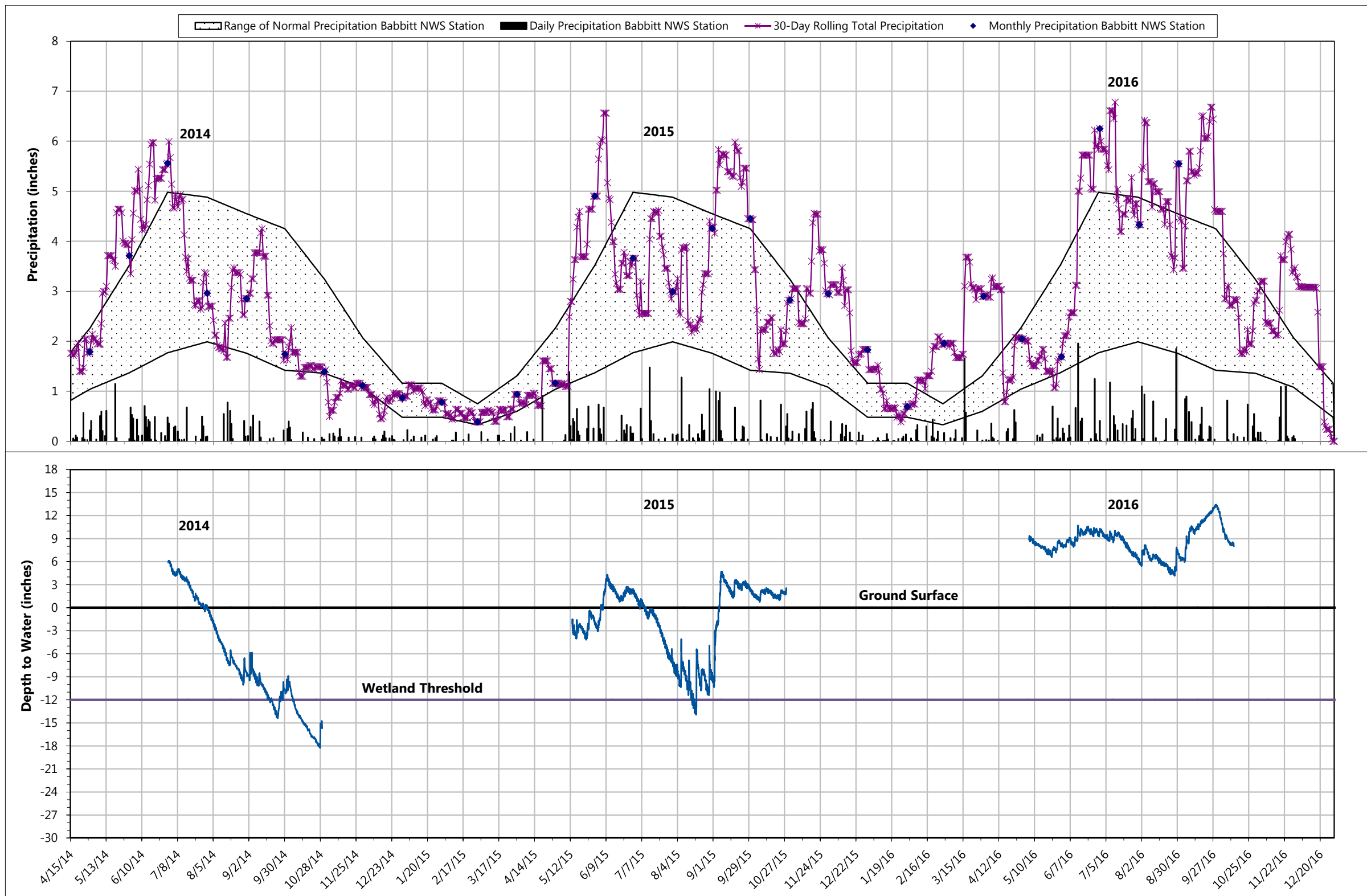


Figure TB9-2
 WETLAND MONITORING WELL TB9
 2014-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

NorthMet Project Hydrology Monitoring – Well TB9



July 2014



May 2015



May 2016

Well ID: TB10

NorthMet Project Area: Plant Site

Wetland Number: 1176

Wetland Type: Hardwood Swamp (Type 7)

UTM Coordinates (NAD 83 Zone 15)

Easting: 563425

Northing: 5273484

Well Type(s): In-Situ Troll

Date Recording Well Installed: 6/30/2014

Installed By: Barr

Water Level Recorded Every: 2 hours

Date Manual Well Installed: NA

Installed By: NA

Manual Water Levels Read: See notes

Growing Season: May 9-October 6 (151 days)

Monitored by: Barr

Water Level Fluctuation for All Years: 26.1 inches

Notes: A manual reading is completed twice per monitoring period - prior to initial installation of logger and when logger is removed at end of period.

Table TB10-1. Monitoring Period Each Year¹ See the hydrographs in Figure TB10-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Start Date	---	---	---	---	---	---	---	---	---	6/30	5/13	5/5
End Date	---	---	---	---	---	---	---	---	---	10/29	10/28	10/13
Total Days	---	---	---	---	---	---	---	---	---	122	169	162
Grow. Seas. Days	---	---	---	---	---	---	---	---	---	99	147	151

¹ Manual (M) well only at this location. No wells at the location (---). Day ranges and Growing Season (Grow. Seas.) Days in this table represent full calendar days.

Table TB10-2. Precipitation During Each Growing Season and Water Year¹ See the yearly hydrographs in Figure TB10-2.

Year		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Growing Season	May	A	N	A	N	B	B	A	A	N	A	A	B
	June	A	B	N	A	B	N	N	A	A	A	N	A
	July	B	A	B	B	B	A	B	A	A	N	B	B
	Aug	B	B	B	B	N	A	N	B	B	N	N	A
	Sept	B	B	A	A	B	N	B	B	B	B	N	A
Water Year		A	B	A	A	B	N	B	A	A	N	B	A

¹ The growing season includes precipitation during May through September and the water year includes precipitation from October 1 of the previous year through September 30 of the current year. Each time period, the precipitation is represented as: within the normal range of precipitation (N), below the normal range of precipitation (B), or above the normal range of precipitation (A).

Table TB10-3. Hydroperiod(s) for Each Year During the Growing Season¹ Total number of days water level is $\geq 12''$ below ground level for 14 or more consecutive days during the growing season. The yearly hydrographs are shown in Figure TB10-2.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# of Periods ≥ 14 Consecutive Days	---	---	---	---	---	---	---	---	---	1	1	1
Total Days	---	---	---	---	---	---	---	---	---	74	146	151
% Grow. Seas.	---	---	---	---	---	---	---	---	---	75%	99%	100%

¹ Hydroperiods were not determined for locations with only a Manual (M) well. No wells at the location (---). The total days counted for the hydroperiod may not match the total days monitored within a growing season (Grow. Seas.) because the hydroperiod date count does not include partial days.

Table TB10-4. Water Level Fluctuations During the Growing Season (inches)¹ Yearly fluctuations are shown in Figure TB10-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum (in.)	---	---	---	---	---	---	---	---	---	-16.1	-9.9	-5.0
Maximum (in.)	---	---	---	---	---	---	---	---	---	4.4	10.0	6.2
Fluctuation (in.)	---	---	---	---	---	---	---	---	---	20.5	19.9	11.2

¹ Fluctuations in water level were not determined for locations with only a Manual (M) well. No wells at the location (---). Some water level depths were deeper than the bottom of the well casing (<) resulting in greater fluctuations than indicated in the data (>).

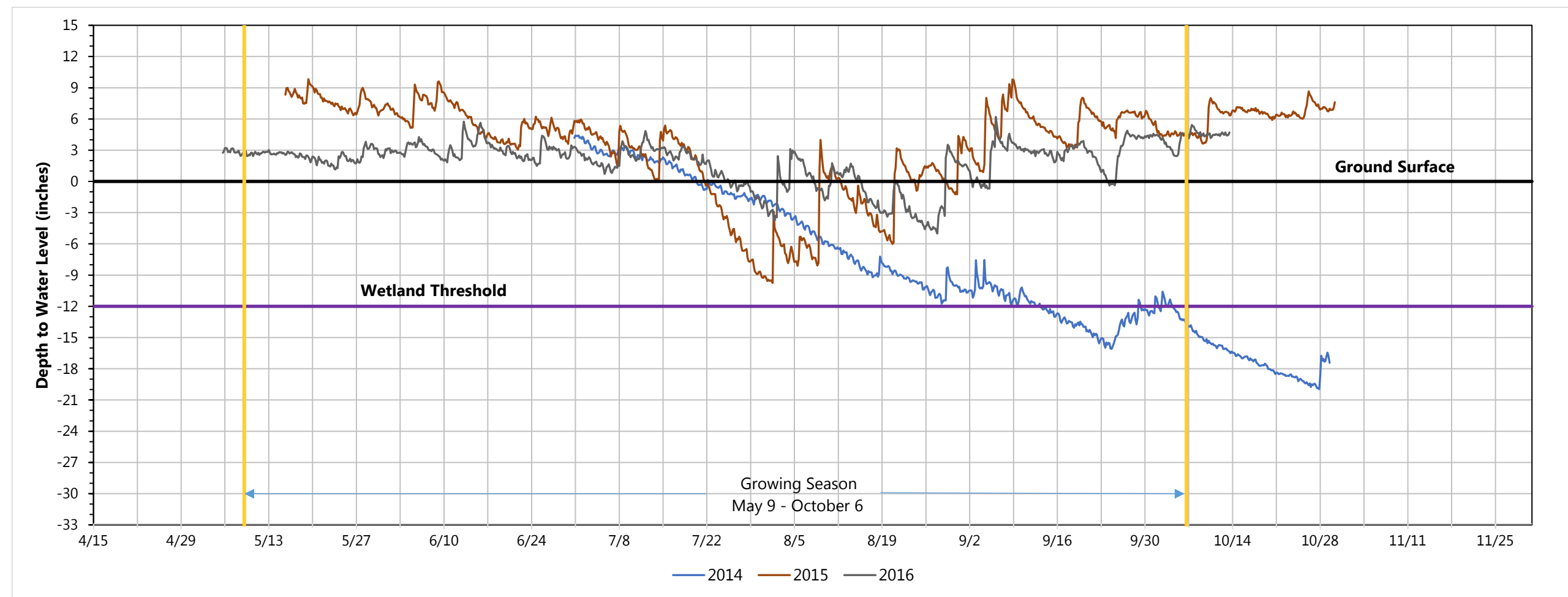


Figure TB10-1
 WETLAND MONITORING WELL TB10
 2014-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

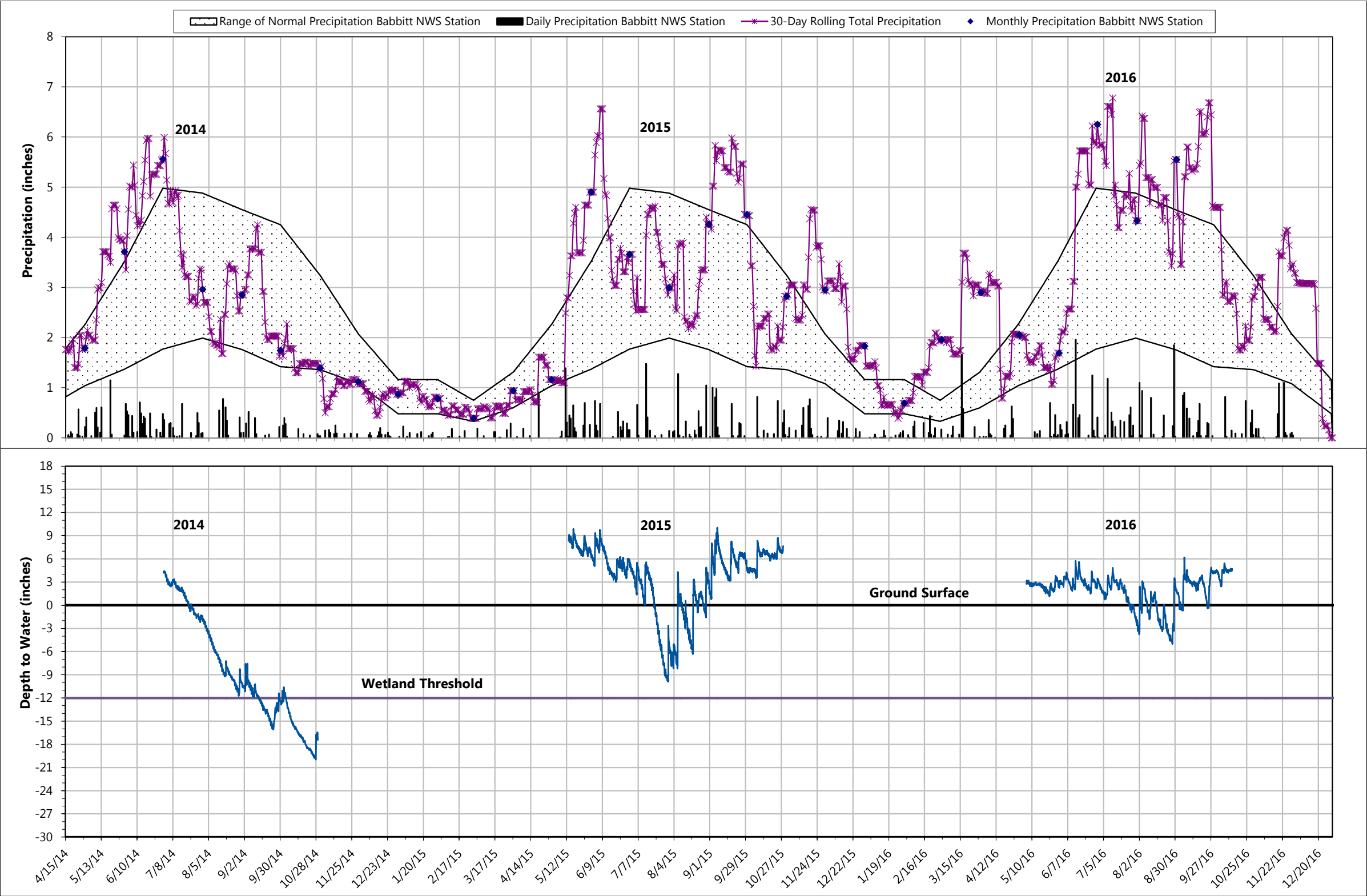


Figure TB10-2
WETLAND MONITORING WELL TB10
2014-2016 WETLAND HYDROLOGY MONITORING DATA
NorthMet Project
Poly Met Mining, Inc.
Hoyt Lakes, Minnesota

NorthMet Project Hydrology Monitoring – Well TB10



July 2014



May 2015



May 2016

Well ID: TB11

NorthMet Project Area: Plant Site

Wetland Number: 282A

Wetland Type: Shallow Marsh (Type 3)

UTM Coordinates (NAD 83 Zone 15)

Easting: 563268

Northing: 5274944

Well Type(s): In-Situ Troll

Date Recording Well Installed: 7/3/2014

Installed By: Barr

Water Level Recorded Every: 2 hours

Date Manual Well Installed: NA

Installed By: NA

Manual Water Levels Read: See notes

Growing Season: May 9-October 6 (151 days)

Monitored by: Barr

Water Level Fluctuation for All Years: 21.6 inches

Notes: A manual reading is completed twice per monitoring period - prior to initial installation of logger and when logger is removed at end of period.

Table TB11-1. Monitoring Period Each Year¹ See the hydrographs in Figure TB11-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Start Date	---	---	---	---	---	---	---	---	---	7/3	5/13	5/5
End Date	---	---	---	---	---	---	---	---	---	10/29	10/28	10/13
Total Days	---	---	---	---	---	---	---	---	---	119	169	162
Grow. Seas. Days	---	---	---	---	---	---	---	---	---	96	147	151

¹ Manual (M) well only at this location. No wells at the location (---). Day ranges and Growing Season (Grow. Seas.) Days in this table represent full calendar days.

Table TB11-2. Precipitation During Each Growing Season and Water Year¹ See the yearly hydrographs in Figure TB11-2.

Year		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Growing Season	May	A	N	A	N	B	B	A	A	N	A	A	B
	June	A	B	N	A	B	N	N	A	A	A	N	A
	July	B	A	B	B	B	A	B	A	A	N	B	B
	Aug	B	B	B	B	N	A	N	B	B	N	N	A
	Sept	B	B	A	A	B	N	B	B	B	B	N	A
Water Year		A	B	A	A	B	N	B	A	A	N	B	A

¹ The growing season includes precipitation during May through September and the water year includes precipitation from October 1 of the previous year through September 30 of the current year. Each time period, the precipitation is represented as: within the normal range of precipitation (N), below the normal range of precipitation (B), or above the normal range of precipitation (A).

Table TB11-3. Hydroperiod(s) for Each Year During the Growing Season¹ Total number of days water level is $\geq 12''$ below ground level for 14 or more consecutive days during the growing season. The yearly hydrographs are shown in Figure TB11-2.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# of Periods ≥ 14 Consecutive Days	---	---	---	---	---	---	---	---	---	2	1	1
Total Days	---	---	---	---	---	---	---	---	---	71	146	56
% Grow. Seas.	---	---	---	---	---	---	---	---	---	74%	99%	37%

¹ Hydroperiods were not determined for locations with only a Manual (M) well. No wells at the location (---). The total days counted for the hydroperiod may not match the total days monitored within a growing season (Grow. Seas.) because the hydroperiod date count does not include partial days.

Table TB11-4. Water Level Fluctuations During the Growing Season (inches)¹ Yearly fluctuations are shown in Figure TB11-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum (in.)	---	---	---	---	---	---	---	---	---	-14.4	-11.9	-21.3
Maximum (in.)	---	---	---	---	---	---	---	---	---	-2.7	0.3	-1.6
Fluctuation (in.)	---	---	---	---	---	---	---	---	---	11.7	12.2	19.6

¹ Fluctuations in water level were not determined for locations with only a Manual (M) well. No wells at the location (---). Some water level depths were deeper than the bottom of the well casing (<) resulting in greater fluctuations than indicated in the data (>).

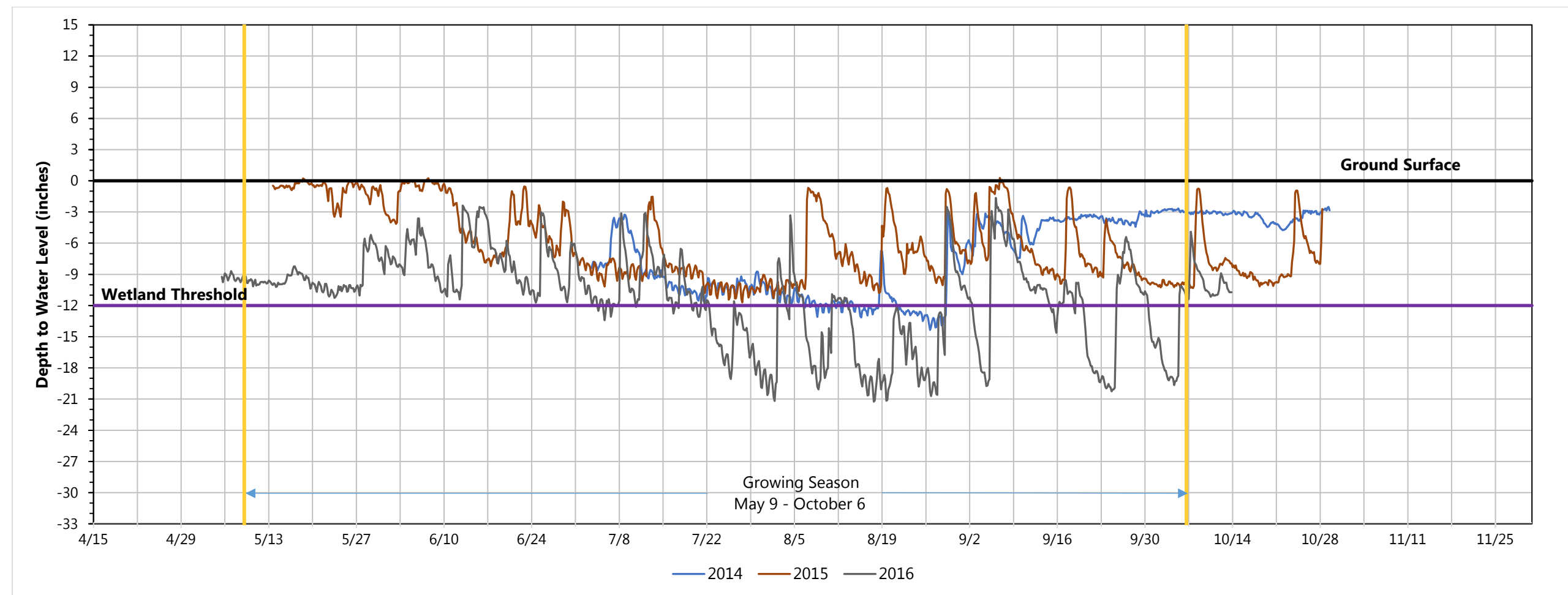


Figure TB11-1
 WETLAND MONITORING WELL TB11
 2014-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

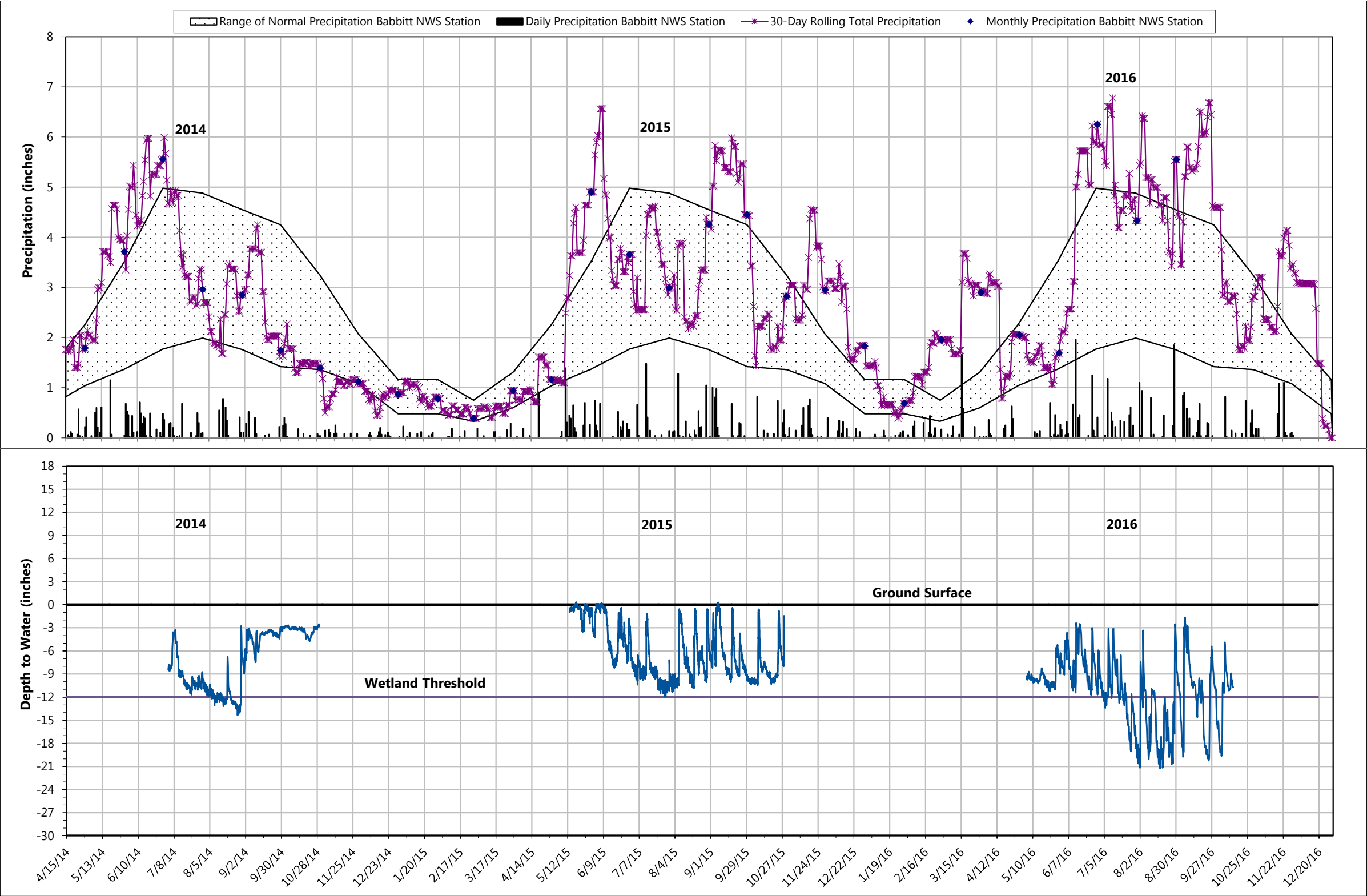


Figure TB11-2
WETLAND MONITORING WELL TB11
2014-2016 WETLAND HYDROLOGY MONITORING DATA
NorthMet Project
Poly Met Mining, Inc.
Hoyt Lakes, Minnesota

NorthMet Project Hydrology Monitoring – Well TB11



July 2014



May 2015



May 2016

Well ID: TB12

NorthMet Project Area: Plant Site

Wetland Number: 968

Wetland Type: Coniferous Swamp (Type 7)

UTM Coordinates (NAD 83 Zone 15)

Easting: 566166

Northing: 5276029

Well Type(s): In-Situ Troll

Date Recording Well Installed: 6/30/2014

Installed By: Barr

Water Level Recorded Every: 2 hours

Date Manual Well Installed: NA

Installed By: NA

Manual Water Levels Read: See notes

Growing Season: May 9-October 6 (151 days)

Monitored by: Barr

Water Level Fluctuation for All Years: 4.5 inches

Notes: A manual reading is completed twice per monitoring period - prior to initial installation of logger and when logger is removed at end of period.

Table TB12-1. Monitoring Period Each Year¹ See the hydrographs in Figure TB12-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Start Date	---	---	---	---	---	---	---	---	---	6/30	5/13	5/4
End Date	---	---	---	---	---	---	---	---	---	10/29	10/28	10/13
Total Days	---	---	---	---	---	---	---	---	---	122	169	163
Grow. Seas. Days	---	---	---	---	---	---	---	---	---	99	147	151

¹ Manual (M) well only at this location. No wells at the location (---). Day ranges and Growing Season (Grow. Seas.) Days in this table represent full calendar days.

Table TB12-2. Precipitation During Each Growing Season and Water Year¹ See the yearly hydrographs in Figure TB12-2.

Year		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Growing Season	May	A	N	A	N	B	B	A	A	N	A	A	B
	June	A	B	N	A	B	N	N	A	A	A	N	A
	July	B	A	B	B	B	A	B	A	A	N	B	B
	Aug	B	B	B	B	N	A	N	B	B	N	N	A
	Sept	B	B	A	A	B	N	B	B	B	B	N	A
Water Year		A	B	A	A	B	N	B	A	A	N	B	A

¹ The growing season includes precipitation during May through September and the water year includes precipitation from October 1 of the previous year through September 30 of the current year. Each time period, the precipitation is represented as: within the normal range of precipitation (N), below the normal range of precipitation (B), or above the normal range of precipitation (A).

Table TB12-3. Hydroperiod(s) for Each Year During the Growing Season¹ Total number of days water level is $\geq 12''$ below ground level for 14 or more consecutive days during the growing season. The yearly hydrographs are shown in Figure TB12-2.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# of Periods ≥ 14 Consecutive Days	---	---	---	---	---	---	---	---	---	1	1	1
Total Days	---	---	---	---	---	---	---	---	---	98	146	151
% Grow. Seas.	---	---	---	---	---	---	---	---	---	99%	99%	100%

¹ Hydroperiods were not determined for locations with only a Manual (M) well. No wells at the location (---). The total days counted for the hydroperiod may not match the total days monitored within a growing season (Grow. Seas.) because the hydroperiod date count does not include partial days.

Table TB12-4. Water Level Fluctuations During the Growing Season (inches)¹ Yearly fluctuations are shown in Figure TB12-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum (in.)	---	---	---	---	---	---	---	---	---	5.3	6.7	6.6
Maximum (in.)	---	---	---	---	---	---	---	---	---	7.1	9.7	9.8
Fluctuation (in.)	---	---	---	---	---	---	---	---	---	1.8	3.0	3.2

¹ Fluctuations in water level were not determined for locations with only a Manual (M) well. No wells at the location (---). Some water level depths were deeper than the bottom of the well casing (<) resulting in greater fluctuations than indicated in the data (>).

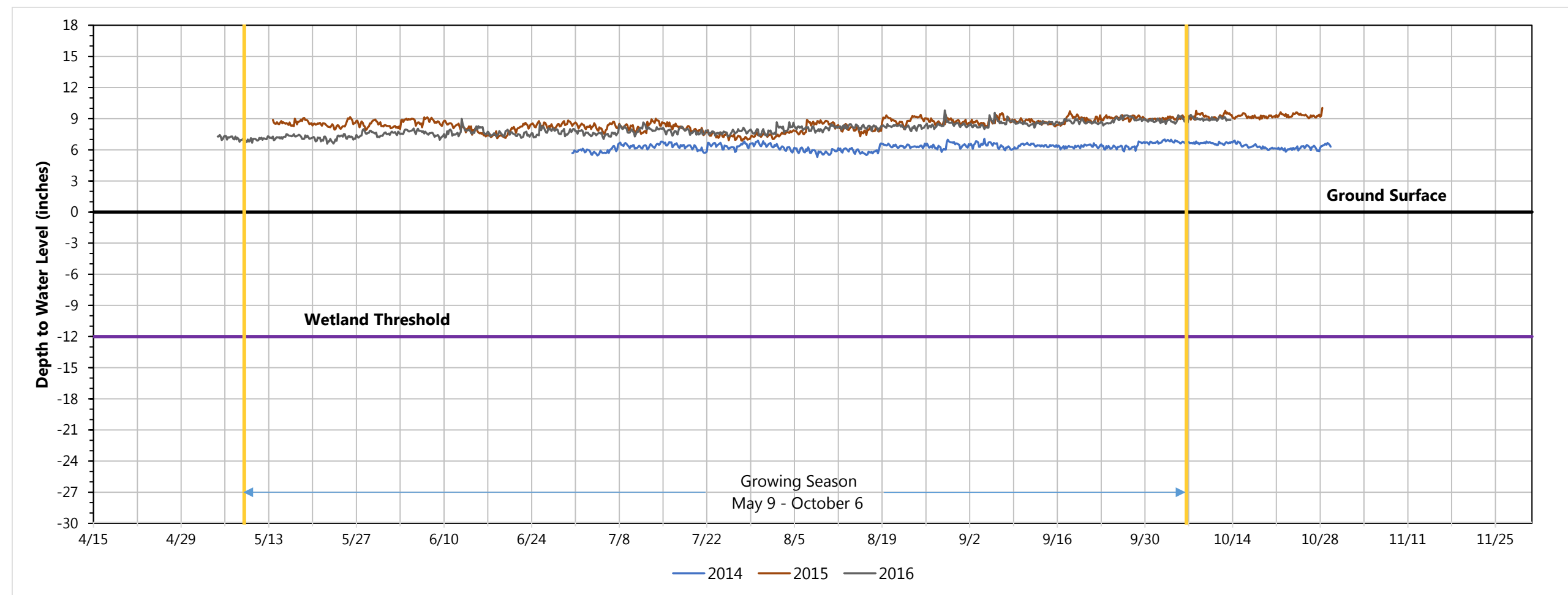


Figure TB12-1
 WETLAND MONITORING WELL TB12
 2014-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

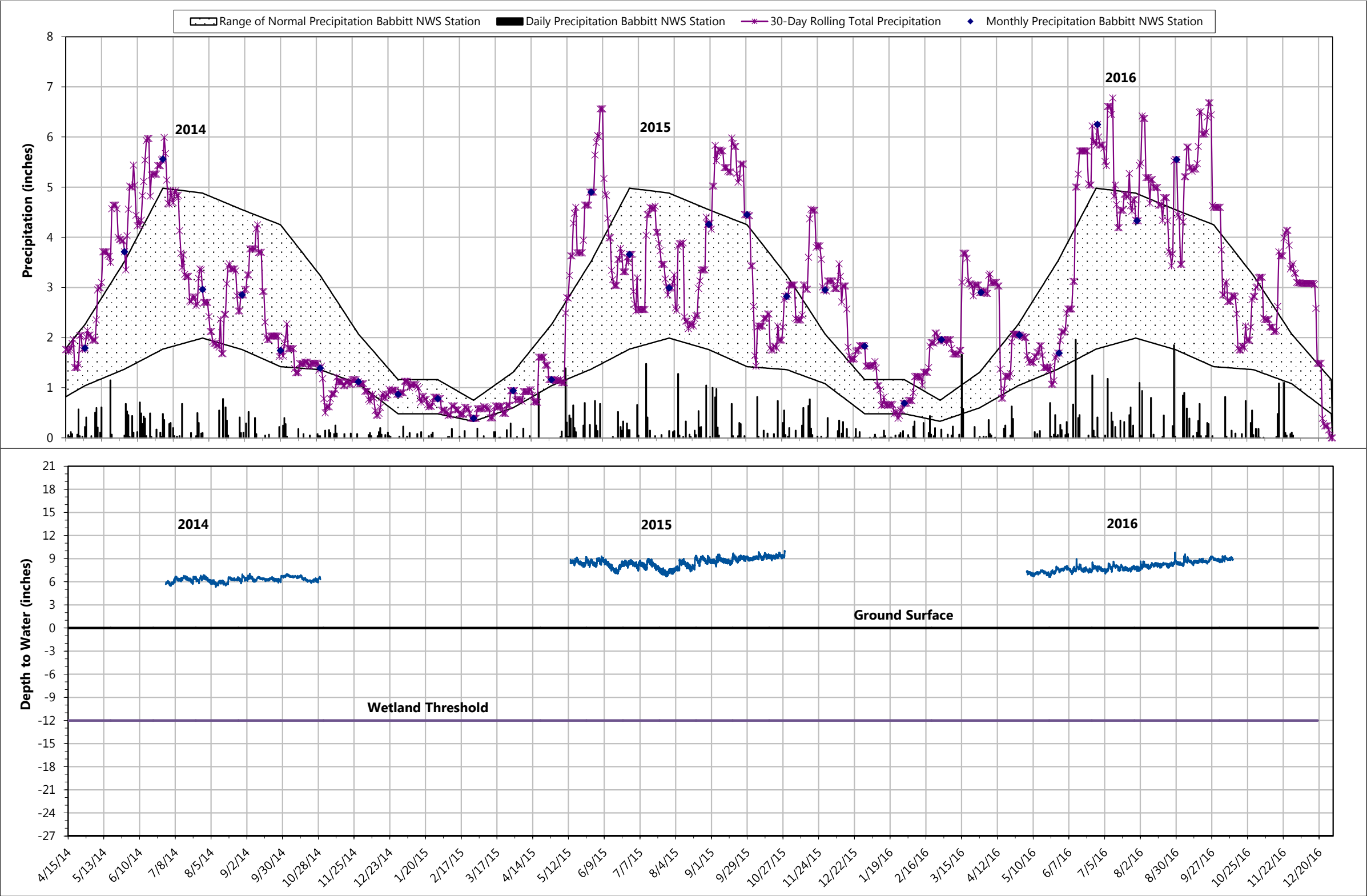


Figure TB12-2
WETLAND MONITORING WELL TB12
2014-2016 WETLAND HYDROLOGY MONITORING DATA
NorthMet Project
Poly Met Mining, Inc.
Hoyt Lakes, Minnesota

NorthMet Project Hydrology Monitoring – Well TB12



July 2014



May 2015



May 2016

Well ID: TB13

NorthMet Project Area: Plant Site

Wetland Number: 584

Wetland Type: Shallow Marsh (Type 3)

UTM Coordinates (NAD 83 Zone 15)

Easting: 564338

Northing: 5275981

Well Type(s): In-Situ Troll

Date Recording Well Installed: 7/3/2014

Installed By: Barr

Water Level Recorded Every: 2 hours

Date Manual Well Installed: NA

Installed By: NA

Manual Water Levels Read: See notes

Growing Season: May 9-October 6 (151 days)

Monitored by: Barr

Water Level Fluctuation for All Years: 5.5 inches

Notes: A manual reading is completed twice per monitoring period - prior to initial installation of logger and when logger is removed at end of period.

Table TB13-1. Monitoring Period Each Year¹. See the hydrographs in Figure TB13-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Start Date	---	---	---	---	---	---	---	---	---	7/3	5/13	5/5
End Date	---	---	---	---	---	---	---	---	---	11/6	10/28	10/13
Total Days	---	---	---	---	---	---	---	---	---	127	169	162
Grow. Seas. Days	---	---	---	---	---	---	---	---	---	96	147	151

¹ Manual (M) well only at this location. No wells at the location (---). Day ranges and Growing Season (Grow. Seas.) Days in this table represent full calendar days.

Table TB13-2. Precipitation During Each Growing Season and Water Year¹. See the yearly hydrographs in Figure TB13-2.

Year		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Growing Season	May	A	N	A	N	B	B	A	A	N	A	A	B
	June	A	B	N	A	B	N	N	A	A	A	N	A
	July	B	A	B	B	B	A	B	A	A	N	B	B
	Aug	B	B	B	B	N	A	N	B	B	N	N	A
	Sept	B	B	A	A	B	N	B	B	B	B	N	A
Water Year		A	B	A	A	B	N	B	A	A	N	B	A

¹ The growing season includes precipitation during May through September and the water year includes precipitation from October 1 of the previous year through September 30 of the current year. Each time period, the precipitation is represented as: within the normal range of precipitation (N), below the normal range of precipitation (B), or above the normal range of precipitation (A).

Table TB13-3. Hydroperiod(s) for Each Year During the Growing Season¹. Total number of days water level is $\geq 12''$ below ground level for 14 or more consecutive days during the growing season. The yearly hydrographs are shown in Figure TB13-2.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# of Periods ≥ 14 Consecutive Days	---	---	---	---	---	---	---	---	---	1	1	1
Total Days	---	---	---	---	---	---	---	---	---	95	146	151
% Grow. Seas.	---	---	---	---	---	---	---	---	---	99%	99%	100%

¹ Hydroperiods were not determined for locations with only a Manual (M) well. No wells at the location (---). The total days counted for the hydroperiod may not match the total days monitored within a growing season (Grow. Seas.) because the hydroperiod date count does not include partial days.

Table TB13-4. Water Level Fluctuations During the Growing Season (inches)¹. Yearly fluctuations are shown in Figure TB13-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum (in.)	---	---	---	---	---	---	---	---	---	2.8	0.0	0.4
Maximum (in.)	---	---	---	---	---	---	---	---	---	5.5	4.0	3.0
Fluctuation (in.)	---	---	---	---	---	---	---	---	---	2.7	4.0	2.7

¹ Fluctuations in water level were not determined for locations with only a Manual (M) well. No wells at the location (---). Some water level depths were deeper than the bottom of the well casing (<) resulting in greater fluctuations than indicated in the data (>).

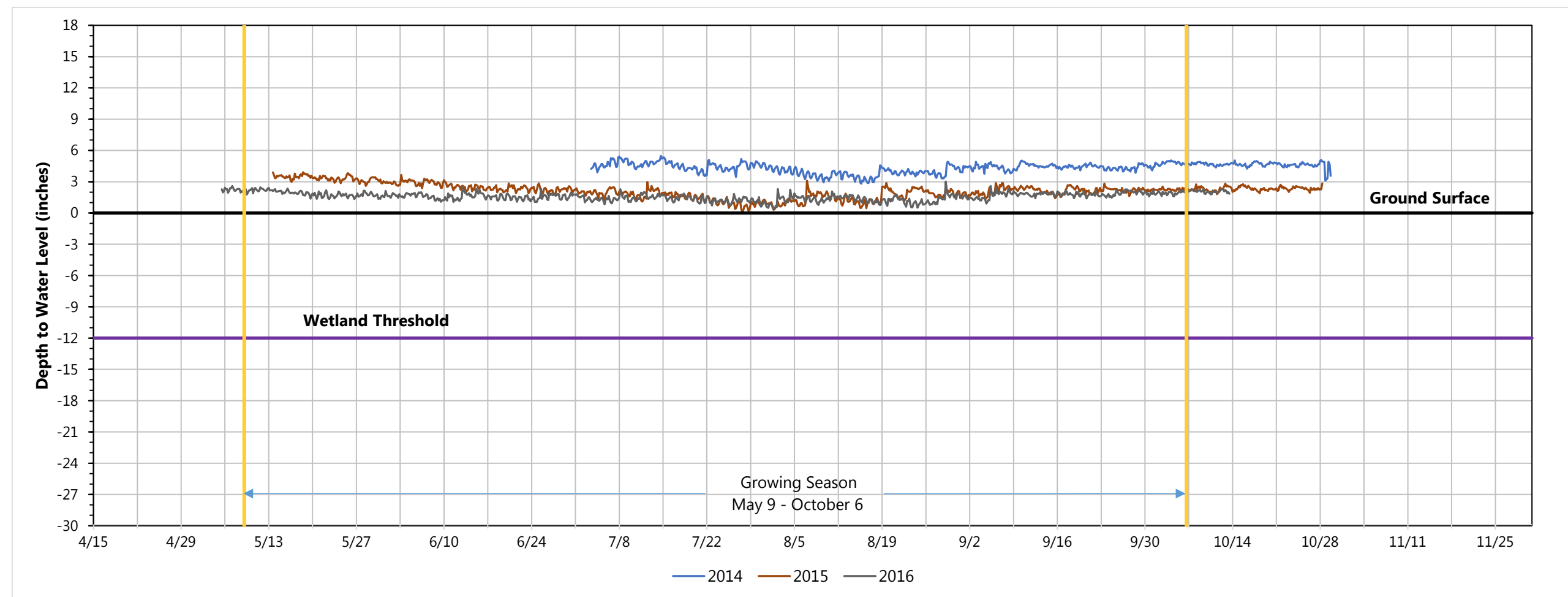


Figure TB13-1
WETLAND MONITORING WELL TB13
2014-2016 WETLAND HYDROLOGY MONITORING DATA
NorthMet Project
Poly Met Mining, Inc.
Hoyt Lakes, Minnesota

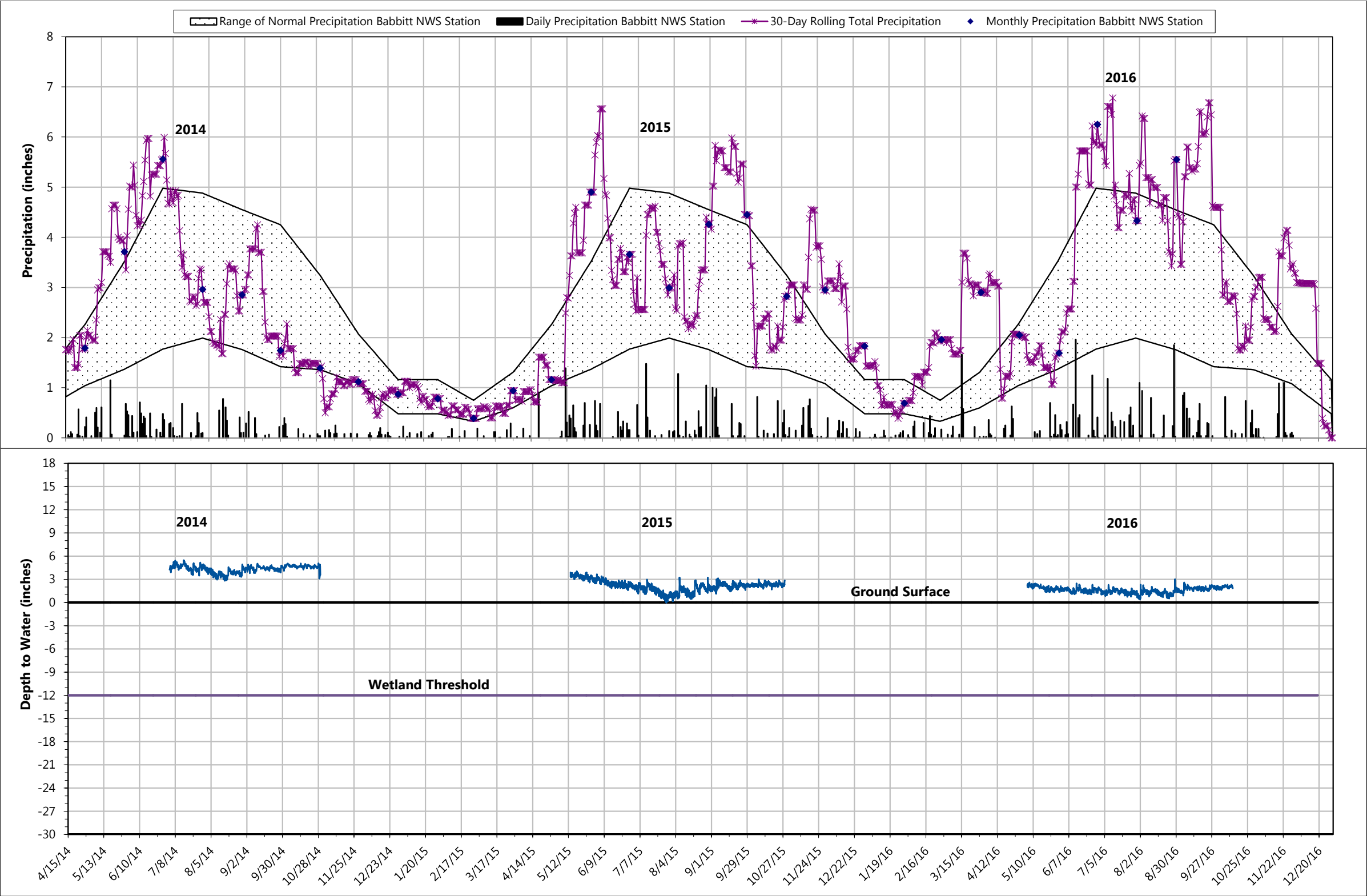


Figure TB13-2
WETLAND MONITORING WELL TB13
2014-2016 WETLAND HYDROLOGY MONITORING DATA
NorthMet Project
Poly Met Mining, Inc.
Hoyt Lakes, Minnesota

NorthMet Project Hydrology Monitoring – Well TB13



July 2014



May 2015



May 2016

Well ID: TB14

NorthMet Project Area: Plant Site

Wetland Number: T13A

Wetland Type: Shallow Marsh (Type 3)

UTM Coordinates (NAD 83 Zone 15)

Easting: 568028

Northing: 5273955

Well Type(s): In-Situ Troll

Date Recording Well Installed: 7/3/2014

Installed By: Barr

Water Level Recorded Every: 2 hours

Date Manual Well Installed: NA

Installed By: NA

Manual Water Levels Read: See notes

Growing Season: May 9-October 6 (151 days)

Monitored by: Barr

Water Level Fluctuation for All Years: 42.7 inches

Notes: A manual reading is completed twice per monitoring period - prior to initial installation of logger and when logger is removed at end of period.

Table TB14-1. Monitoring Period Each Year¹. See the hydrographs in Figure TB14-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Start Date	---	---	---	---	---	---	---	---	---	7/3	5/13	5/4
End Date	---	---	---	---	---	---	---	---	---	10/29	10/28	10/13
Total Days	---	---	---	---	---	---	---	---	---	119	169	163
Grow. Seas. Days	---	---	---	---	---	---	---	---	---	96	147	151

¹ Manual (M) well only at this location. No wells at the location (---). Day ranges and Growing Season (Grow. Seas.) Days in this table represent full calendar days. In 2014, the monitoring period ended on 10/29 but the well was dry after 8/20.

Table TB14-2. Precipitation During Each Growing Season and Water Year¹. See the yearly hydrographs in Figure TB14-2.

Year		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Growing Season	May	A	N	A	N	B	B	A	A	N	A	A	B
	June	A	B	N	A	B	N	N	A	A	A	N	A
	July	B	A	B	B	B	A	B	A	A	N	B	B
	Aug	B	B	B	B	N	A	N	B	B	N	N	A
	Sept	B	B	A	A	B	N	B	B	B	B	N	A
Water Year		A	B	A	A	B	N	B	A	A	N	B	A

¹ The growing season includes precipitation during May through September and the water year includes precipitation from October 1 of the previous year through September 30 of the current year. Each time period, the precipitation is represented as: within the normal range of precipitation (N), below the normal range of precipitation (B), or above the normal range of precipitation (A).

Table TB14-3. Hydroperiod(s) for Each Year During the Growing Season¹. Total number of days water level is $\geq 12"$ below ground level for 14 or more consecutive days during the growing season. The yearly hydrographs are shown in Figure TB14-2.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# of Periods ≥ 14 Consecutive Days	---	---	---	---	---	---	---	---	---	1	1	1
Total Days	---	---	---	---	---	---	---	---	---	47	146	151
% Grow. Seas.	---	---	---	---	---	---	---	---	---	49%	99%	100%

¹ Hydroperiods were not determined for locations with only a Manual (M) well. No wells at the location (---). The total days counted for the hydroperiod may not match the total days monitored within a growing season (Grow. Seas.) because the hydroperiod date count does not include partial days.

Table TB14-4. Water Level Fluctuations During the Growing Season (inches)¹. Yearly fluctuations are shown in Figure TB14-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum (in.)	---	---	---	---	---	---	---	---	---	-7.8	-8.8	-3.0
Maximum (in.)	---	---	---	---	---	---	---	---	---	22.9	20.5	33.9
Fluctuation (in.)	---	---	---	---	---	---	---	---	---	30.7	29.3	36.9

¹ Fluctuations in water level were not determined for locations with only a Manual (M) well. No wells at the location (---). Some water level depths were deeper than the bottom of the well casing (<) resulting in greater fluctuations than indicated in the data (>).

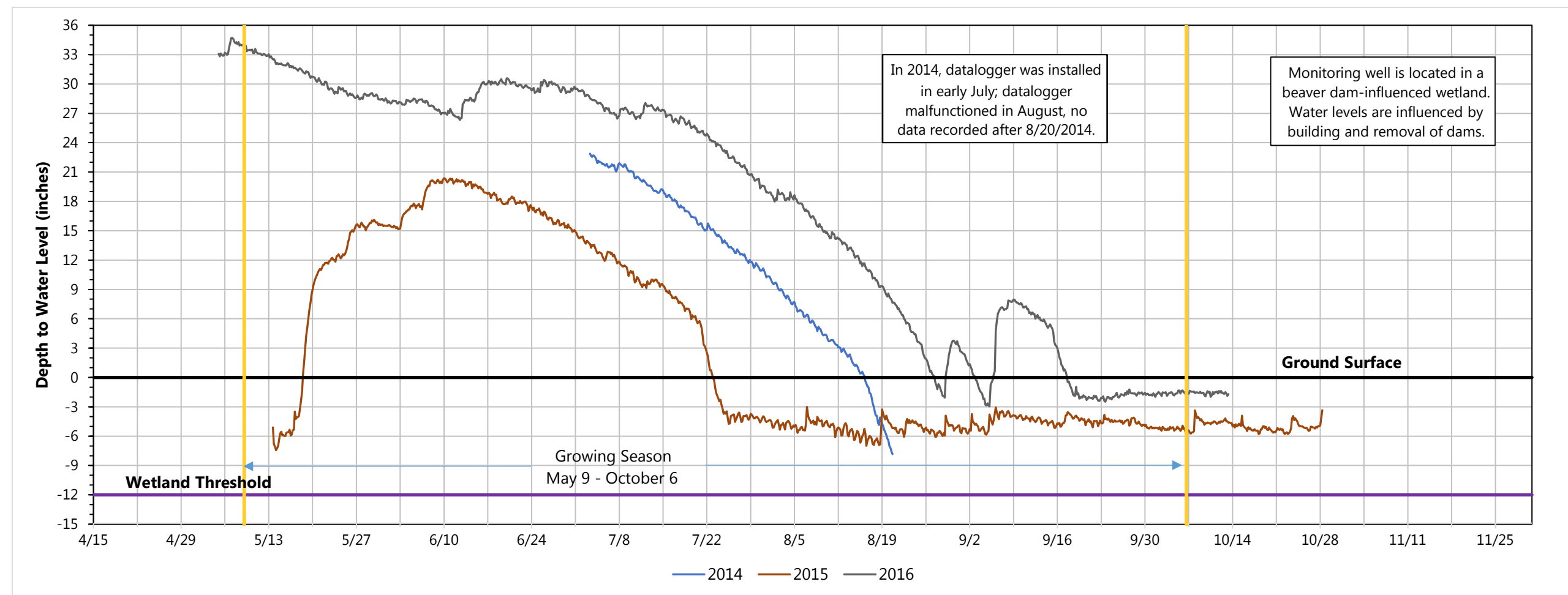


Figure TB14-1
 WETLAND MONITORING WELL TB14
 2014-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

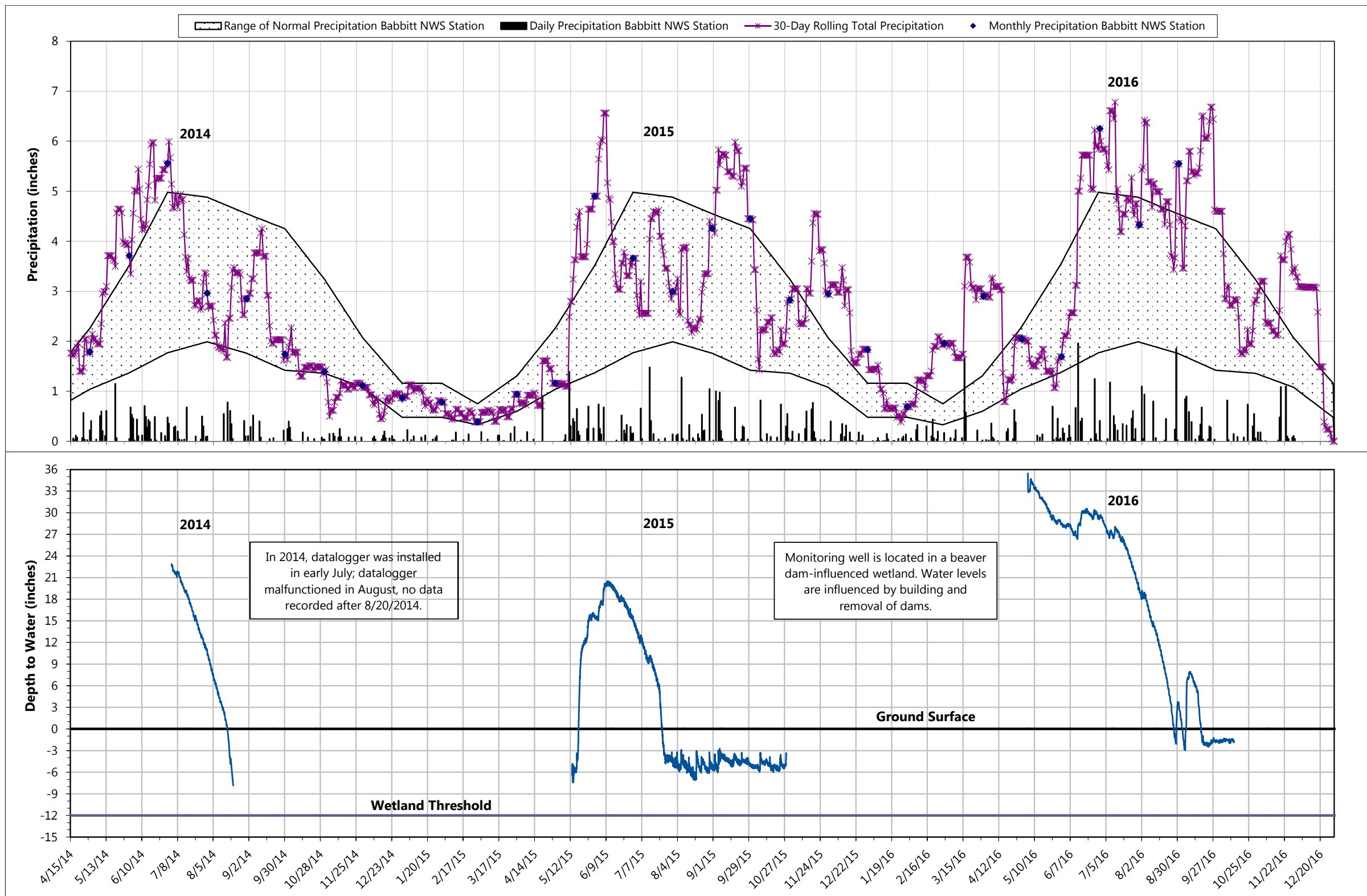


Figure TB14-2
 WETLAND MONITORING WELL TB14
 2014-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

NorthMet Project Hydrology Monitoring – Well TB14



July 2014



May 2015



May 2016

Appendix D

Wetland Hydrology Monitoring Data – Reference Wetlands

Well ID: Ref1

NorthMet Project Area: Mine Site

Wetland Number: 900

Wetland Type: Coniferous Bog (Type 8)

UTM Coordinates (NAD 83 Zone 15)

Easting: 573085

Northing: 5272646

Well Type(s): Ecotone and Manual

Date Recording Well Installed: 5/21/2008

Installed By: Barr/NTS

Water Level Recorded Every: 4 hours

Date Manual Well Installed: 5/21/2008

Installed By: Barr/NTS

Manual Water Levels Read: Monthly

Growing Season: May 9-October 6 (151 days)

Monitored by: NTS

Water Level Fluctuation for All Years: 20.1 inches

Notes: UTM coordinates are for recording well.

Table Ref1-1. Monitoring Period Each Year¹. See the hydrographs in Figure Ref1-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Start Date	---	---	---	5/21	5/28	5/10	5/10	5/16	6/17	5/28	5/13	5/17
End Date	---	---	---	11/24	10/28	10/26	10/24	10/30	10/28	10/28	10/27	10/25
Total Days	---	---	---	188	154	170	168	168	134	154	168	162
Grow. Seas. Days	---	---	---	139	132	150	150	144	112	132	147	143

¹ Manual (M) well only at this location. No wells at the location (---). Day ranges and Growing Season (Grow. Seas.) Days in this table represent full calendar days.

Table Ref1-2. Precipitation During Each Growing Season and Water Year¹. See the yearly hydrographs in Figure Ref1-2.

Year		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Growing Season	May	A	N	A	N	B	B	A	A	N	A	A	B
	June	A	B	N	A	B	N	N	A	A	A	N	A
	July	B	A	B	B	B	A	B	A	A	N	B	B
	Aug	B	B	B	B	N	A	N	B	B	N	N	A
	Sept	B	B	A	A	B	N	B	B	B	B	N	A
Water Year		A	B	A	A	B	N	B	A	A	N	B	A

¹ The growing season includes precipitation during May through September and the water year includes precipitation from October 1 of the previous year through September 30 of the current year. Each time period, the precipitation is represented as: within the normal range of precipitation (N), below the normal range of precipitation (B), or above the normal range of precipitation (A).

Table Ref1-3. Hydroperiod(s) for Each Year During the Growing Season¹. Total number of days water level is $\geq 12"$ below ground level for 14 or more consecutive days during the growing season. The yearly hydrographs are shown in Figure Ref1-2.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# of Periods ≥ 14 Consecutive Days	---	---	---	1	1	1	1	1	1	1	2	NA
Total Days	---	---	---	138	131	149	149	143	111	131	115	NA
% Grow. Seas.	---	---	---	99%	99%	99%	99%	99%	99%	99%	78%	NA

¹ Hydroperiods were not determined for locations with only a Manual (M) well. No wells at the location (---). The total days counted for the hydroperiod may not match the total days monitored within a growing season (Grow. Seas.) because the hydroperiod date count does not include partial days. The data from the logger was corrupt and unusable in 2016 (NA).

Table Ref1-4. Water Level Fluctuations During the Growing Season (inches)¹. Yearly fluctuations are shown in Figure Ref1-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum (in.)	---	---	---	-11.2	-4.5	-5.9	-7.3	-4.2	-3.9	-5.1	-16.0	NA
Maximum (in.)	---	---	---	1.2	1.1	1.1	0.4	4.1	1.8	-0.1	0.1	NA
Fluctuation (in.)	---	---	---	12.3	5.6	7.0	7.7	8.3	5.7	5.0	16.0	NA

¹ Fluctuations in water level were not determined for locations with only a Manual (M) well. No wells at the location (---). Some water level depths were deeper than the bottom of the well casing (<) resulting in greater fluctuations than indicated in the data (>). The data from the logger was corrupt and unusable in 2016 (NA).

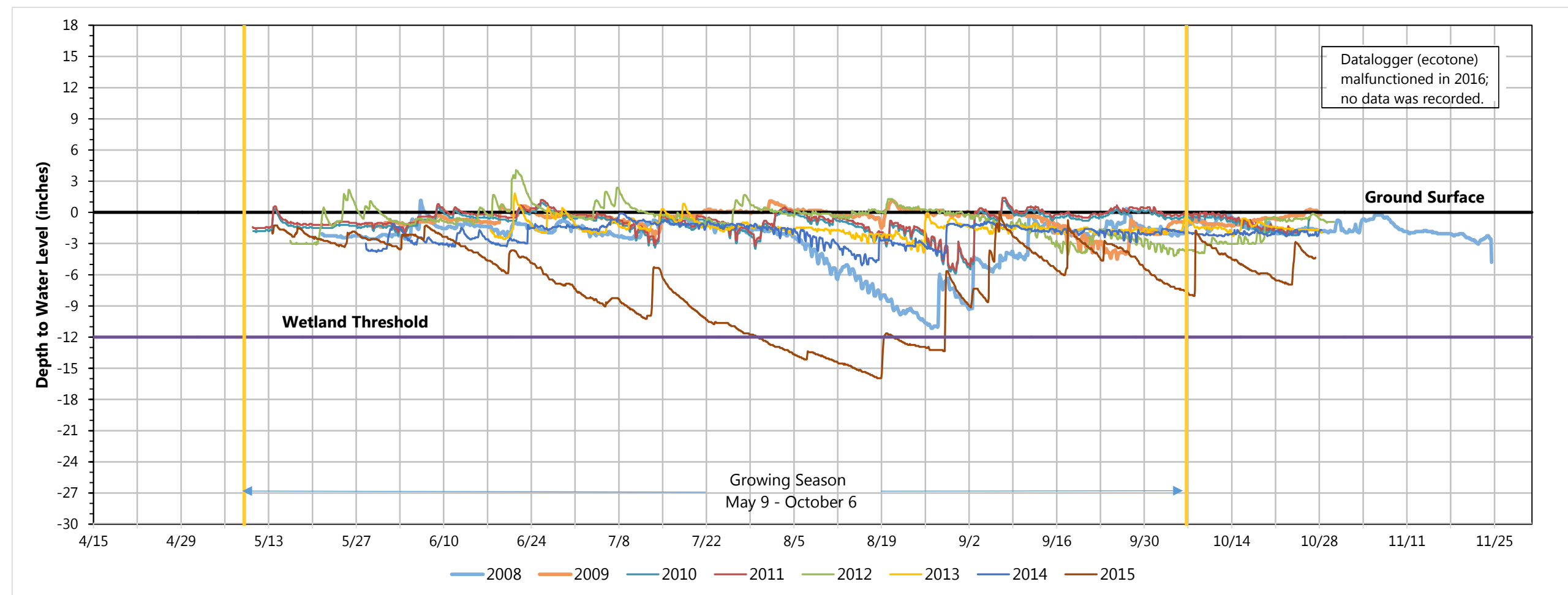


Figure Ref1-1
WETLAND MONITORING WELL Ref1
2008-2016 WETLAND HYDROLOGY MONITORING DATA
NorthMet Project
Poly Met Mining, Inc.
Hoyt Lakes, Minnesota

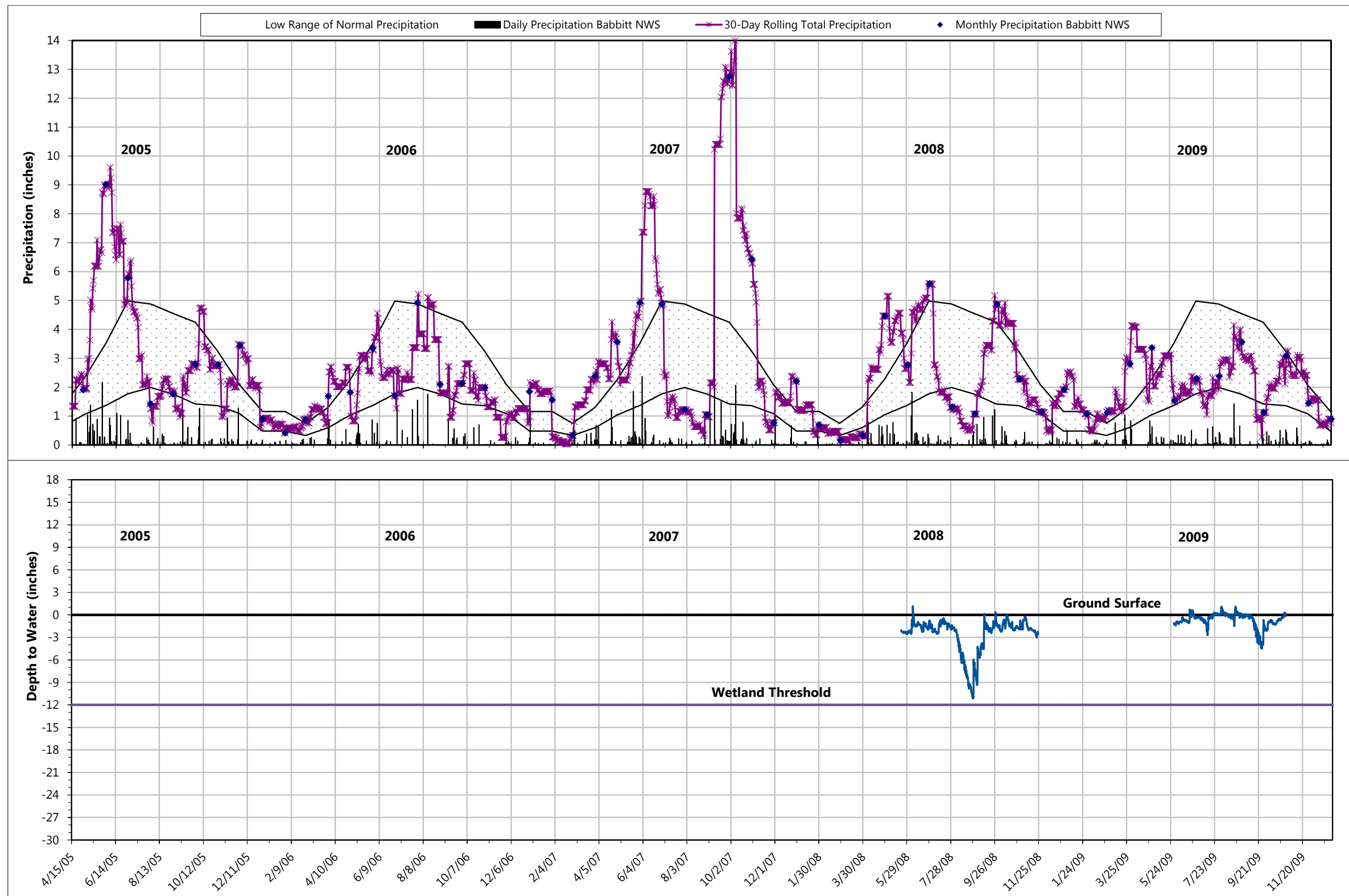


Figure Ref1-2a
WETLAND MONITORING WELL Ref1
2008-2009 WETLAND HYDROLOGY MONITORING DATA
NorthMet Project
Poly Met Mining, Inc.
Hoyt Lakes, Minnesota

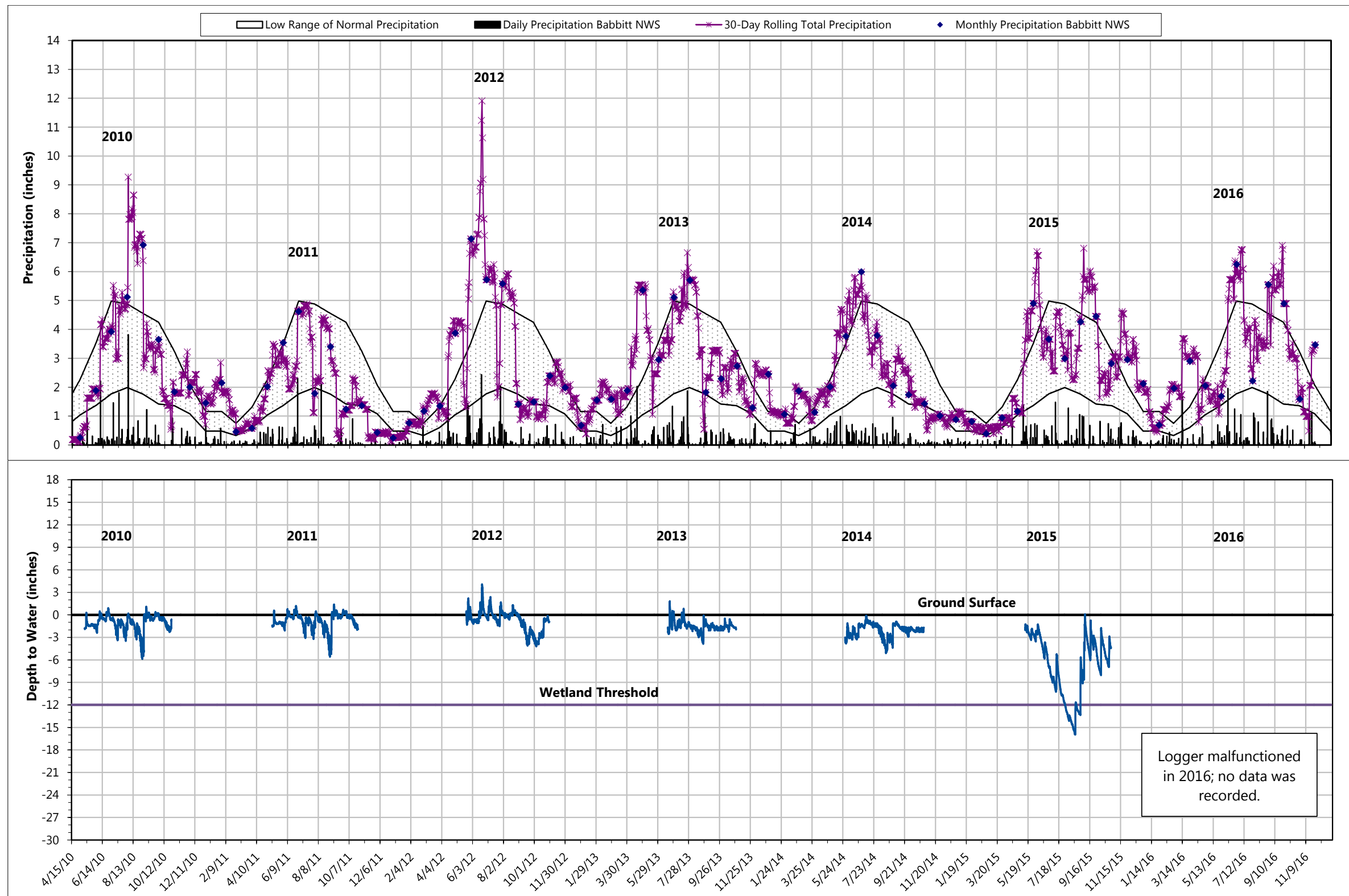


Figure Ref1-2b
 WETLAND MONITORING WELL Ref1
 2010-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

NorthMet Project Hydrology Monitoring – Well Ref1



June 2008



June 2009



June 2010



June 2011



June 2012



June 2013

NorthMet Project Hydrology Monitoring – Well Ref1



June 2014



May 2015



June 2016

Well ID: Ref2

NorthMet Project Area: Mine Site

Wetland Number: 315

Wetland Type: Alder Thicket (Type 6)

UTM Coordinates (NAD 83 Zone 15)

Easting: 572979

Northing: 5270994

Well Type(s): Ecotone and Manual

Date Recording Well Installed: 5/21/2008

Installed By: Barr/NTS

Water Level Recorded Every: 4 hours

Date Manual Well Installed: 5/21/2008

Installed By: Barr/NTS

Manual Water Levels Read: Monthly

Growing Season: May 9-October 6 (151 days)

Monitored by: NTS

Water Level Fluctuation for All Years: 26.2 inches

Notes: UTM coordinates are for recording well.

Table Ref2-1. Monitoring Period Each Year¹. See the hydrographs in Figure Ref2-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Start Date	---	---	---	5/21	4/30	5/10	5/9	4/18	5/21	5/20	4/28	4/26
End Date	---	---	---	11/24	10/28	10/27	10/24	10/30	10/25	10/28	10/27	10/25
Total Days	---	---	---	188	182	171	169	196	158	162	183	183
Grow. Seas. Days	---	---	---	139	151	150	151	151	139	140	151	151

¹ Manual (M) well only at this location. No wells at the location (---). Day ranges and Growing Season (Grow. Seas.) Days in this table represent full calendar days.

Table Ref2-2. Precipitation During Each Growing Season and Water Year¹. See the yearly hydrographs in Figure Ref2-2.

Year		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Growing Season	May	A	N	A	N	B	B	A	A	N	A	A	B
	June	A	B	N	A	B	N	N	A	A	A	N	A
	July	B	A	B	B	B	A	B	A	A	N	B	B
	Aug	B	B	B	B	N	A	N	B	B	N	N	A
	Sept	B	B	A	A	B	N	B	B	B	B	N	A
Water Year		A	B	A	A	B	N	B	A	A	N	B	A

¹ The growing season includes precipitation during May through September and the water year includes precipitation from October 1 of the previous year through September 30 of the current year. Each time period, the precipitation is represented as: within the normal range of precipitation (N), below the normal range of precipitation (B), or above the normal range of precipitation (A).

Table Ref2-3. Hydroperiod(s) for Each Year During the Growing Season¹. Total number of days water level is $\geq 12"$ below ground level for 14 or more consecutive days during the growing season. The yearly hydrographs are shown in Figure Ref2-2.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# of Periods ≥ 14 Consecutive Days	---	---	---	2	1	1	1	1	1	1	1	1
Total Days	---	---	---	124	151	149	150	147	138	139	151	151
% Grow. Seas.	---	---	---	89%	100%	99%	99%	97%	99%	99%	100%	100%

¹ Hydroperiods were not determined for locations with only a Manual (M) well. No wells at the location (---). The total days counted for the hydroperiod may not match the total days monitored within a growing season (Grow. Seas.) because the hydroperiod date count does not include partial days.

Table Ref2-4. Water Level Fluctuations During the Growing Season (inches)¹. Yearly fluctuations are shown in Figure Ref2-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum (in.)	---	---	---	-17.1	-4.9	-11.0	-8.8	-12.4	0.2	-5.3	-6.3	1.3
Maximum (in.)	---	---	---	7.7	3.7	3.7	5.5	9.1	8.6	6.4	7.0	8.3
Fluctuation (in.)	---	---	---	24.8	8.6	14.7	14.3	21.5	8.4	11.7	13.3	7.0

¹ Fluctuations in water level were not determined for locations with only a Manual (M) well. No wells at the location (---). Some water level depths were deeper than the bottom of the well casing (<) resulting in greater fluctuations than indicated in the data (>).

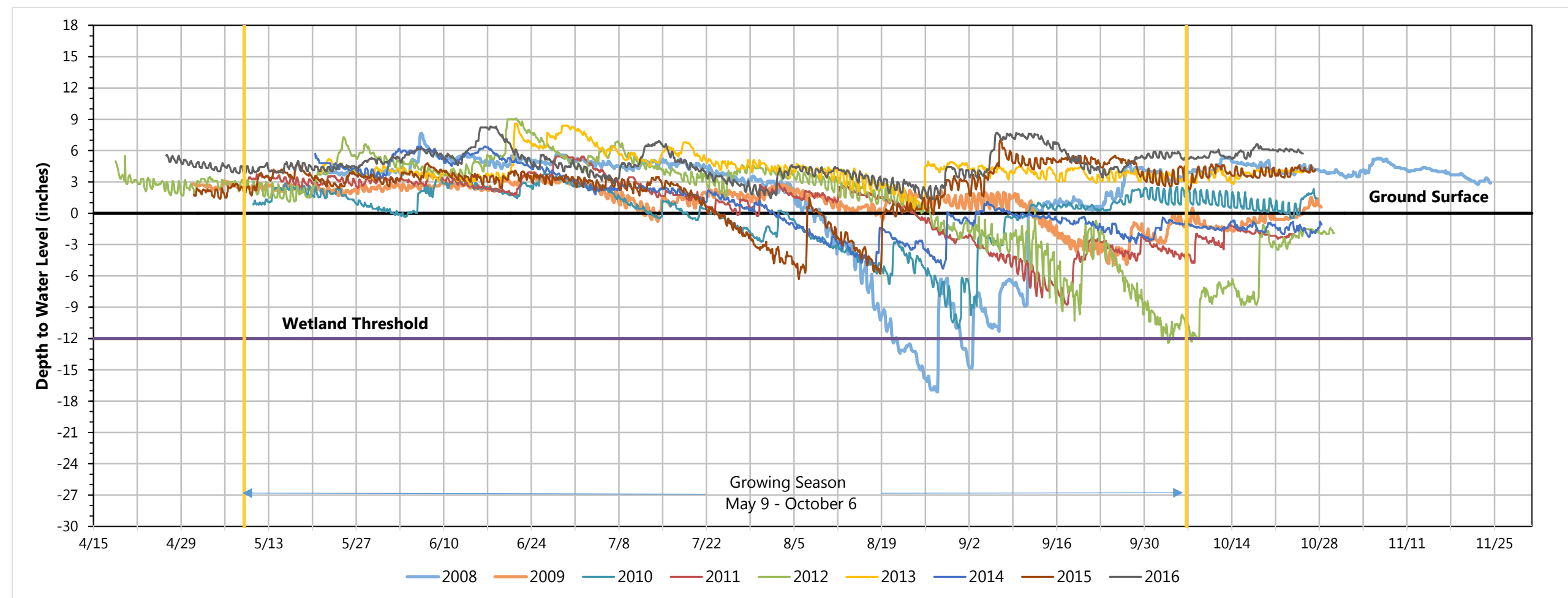


Figure Ref2-1
WETLAND MONITORING WELL Ref2
2008-2016 WETLAND HYDROLOGY MONITORING DATA
NorthMet Project
Poly Met Mining, Inc.
Hoyt Lakes, Minnesota

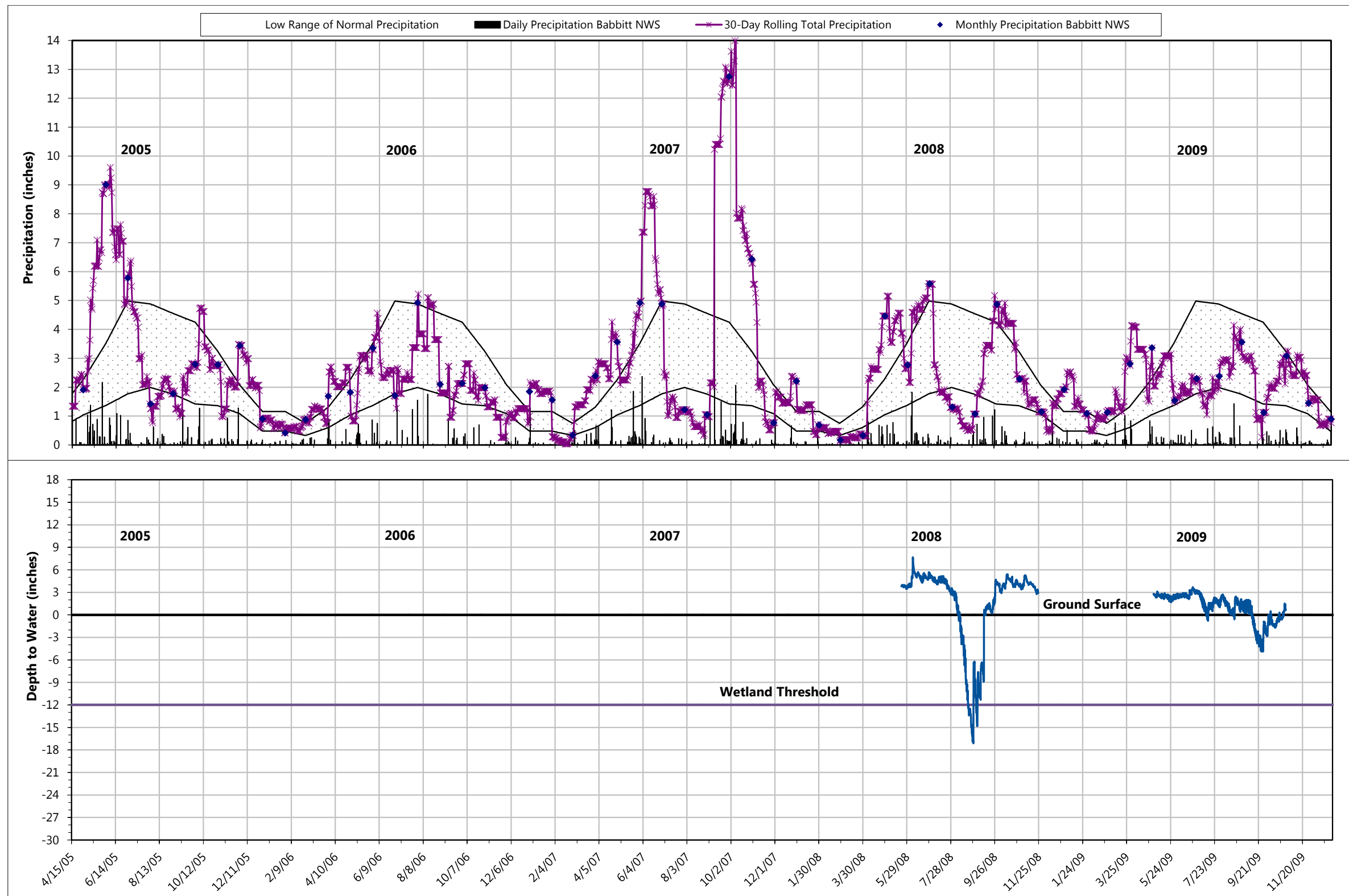


Figure Ref2-2a
WETLAND MONITORING WELL Ref2
2008-2009 WETLAND HYDROLOGY MONITORING DATA
NorthMet Project
Poly Met Mining, Inc.
Hoyt Lakes, Minnesota

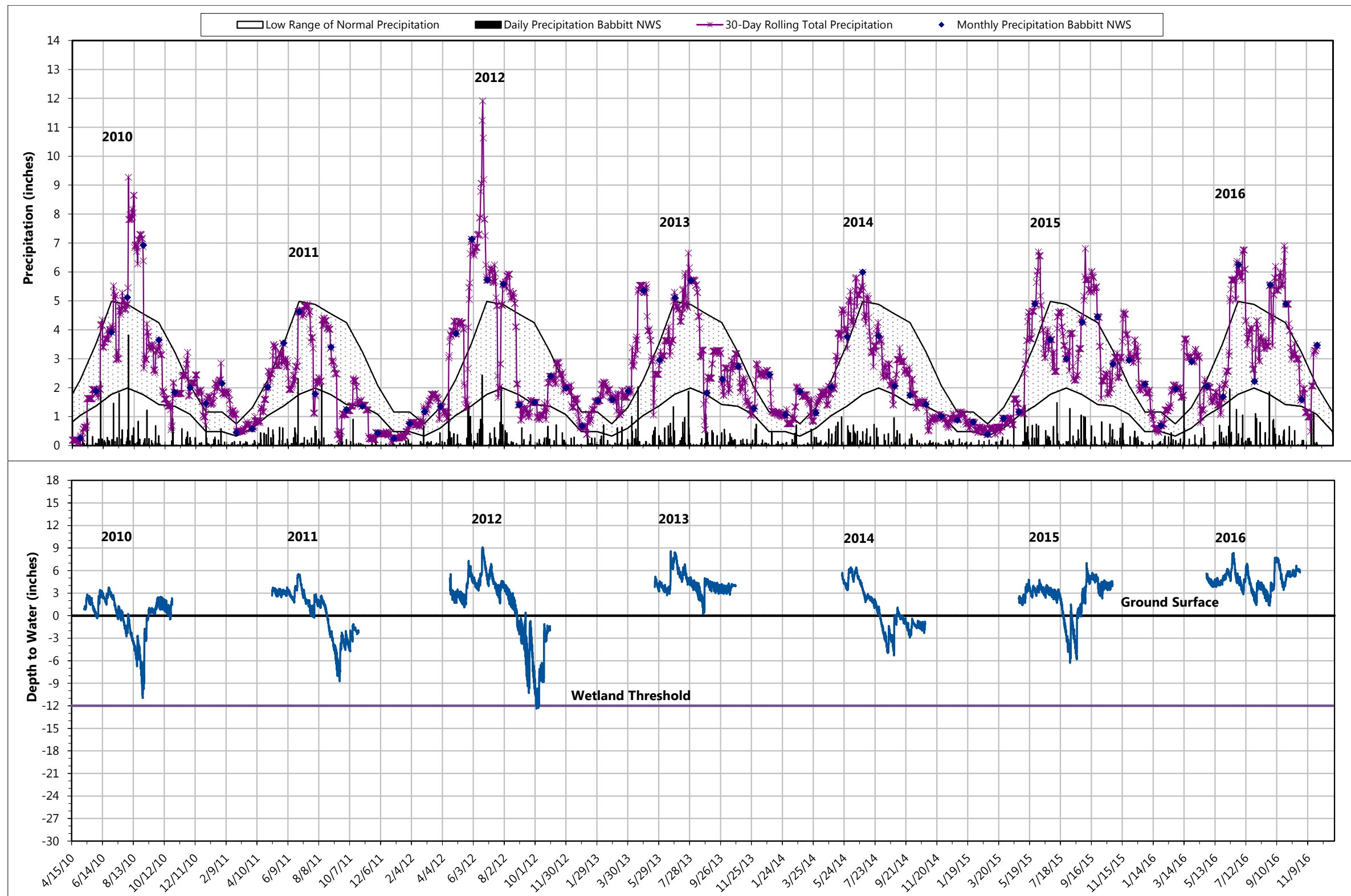


Figure Ref2-2b
 WETLAND MONITORING WELL Ref2
 2010-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

NorthMet Project Hydrology Monitoring – Well Ref2



May 2008



June 2009



June 2010



June 2011



June 2012



June 2013

NorthMet Project Hydrology Monitoring – Well Ref2



June 2014



May 2015



June 2016

Well ID: Ref3

NorthMet Project Area: Mine Site

Wetland Number: 394A

Wetland Type: Coniferous Swamp (Type 7)

UTM Coordinates (NAD 83 Zone 15)

Easting: 573030

Northing: 5271869

Well Type(s): In-Situ Troll

Date Recording Well Installed: 7/1/2014

Installed By: Barr

Water Level Recorded Every: 2 hours

Date Manual Well Installed: NA

Installed By: NA

Manual Water Levels Read: See notes

Growing Season: May 9-October 6 (151 days)

Monitored by: Barr

Water Level Fluctuation for All Years: 19.7 inches

Notes: A manual reading is completed twice per monitoring period - prior to initial installation of logger and when logger is removed at end of period.

Table Ref3-1. Monitoring Period Each Year¹. See the hydrographs in Figure Ref3-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Start Date	---	---	---	---	---	---	---	---	---	7/1	5/13	5/4
End Date	---	---	---	---	---	---	---	---	---	10/29	10/28	10/11
Total Days	---	---	---	---	---	---	---	---	---	121	169	161
Grow. Seas. Days	---	---	---	---	---	---	---	---	---	98	147	151

¹ Manual (M) well only at this location. No wells at the location (---). Day ranges and Growing Season (Grow. Seas.) Days in this table represent full calendar days.

Table Ref3-2. Precipitation During Each Growing Season and Water Year¹. See the yearly hydrographs in Figure Ref3-2.

Year		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Growing Season	May	A	N	A	N	B	B	A	A	N	A	A	B
	June	A	B	N	A	B	N	N	A	A	A	N	A
	July	B	A	B	B	B	A	B	A	A	N	B	B
	Aug	B	B	B	B	N	A	N	B	B	N	N	A
	Sept	B	B	A	A	B	N	B	B	B	B	N	A
Water Year		A	B	A	A	B	N	B	A	A	N	B	A

¹ The growing season includes precipitation during May through September and the water year includes precipitation from October 1 of the previous year through September 30 of the current year. Each time period, the precipitation is represented as: within the normal range of precipitation (N), below the normal range of precipitation (B), or above the normal range of precipitation (A).

Table Ref3-3. Hydroperiod(s) for Each Year During the Growing Season¹. Total number of days water level is $\geq 12"$ below ground level for 14 or more consecutive days during the growing season. The yearly hydrographs are shown in Figure Ref3-2.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# of Periods ≥ 14 Consecutive Days	---	---	---	---	---	---	---	---	---	2	2	1
Total Days	---	---	---	---	---	---	---	---	---	81	143	151
% Grow. Seas.	---	---	---	---	---	---	---	---	---	83%	97%	100%

¹ Hydroperiods were not determined for locations with only a Manual (M) well. No wells at the location (---). The total days counted for the hydroperiod may not match the total days monitored within a growing season (Grow. Seas.) because the hydroperiod date count does not include partial days.

Table Ref3-4. Water Level Fluctuations During the Growing Season (inches)¹. Yearly fluctuations are shown in Figure Ref3-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum (in.)	---	---	---	---	---	---	---	---	---	-14.3	-13.4	-4.9
Maximum (in.)	---	---	---	---	---	---	---	---	---	-2.3	5.4	2.6
Fluctuation (in.)	---	---	---	---	---	---	---	---	---	12.0	18.7	7.5

¹ Fluctuations in water level were not determined for locations with only a Manual (M) well. No wells at the location (---). Some water level depths were deeper than the bottom of the well casing (<) resulting in greater fluctuations than indicated in the data (>).

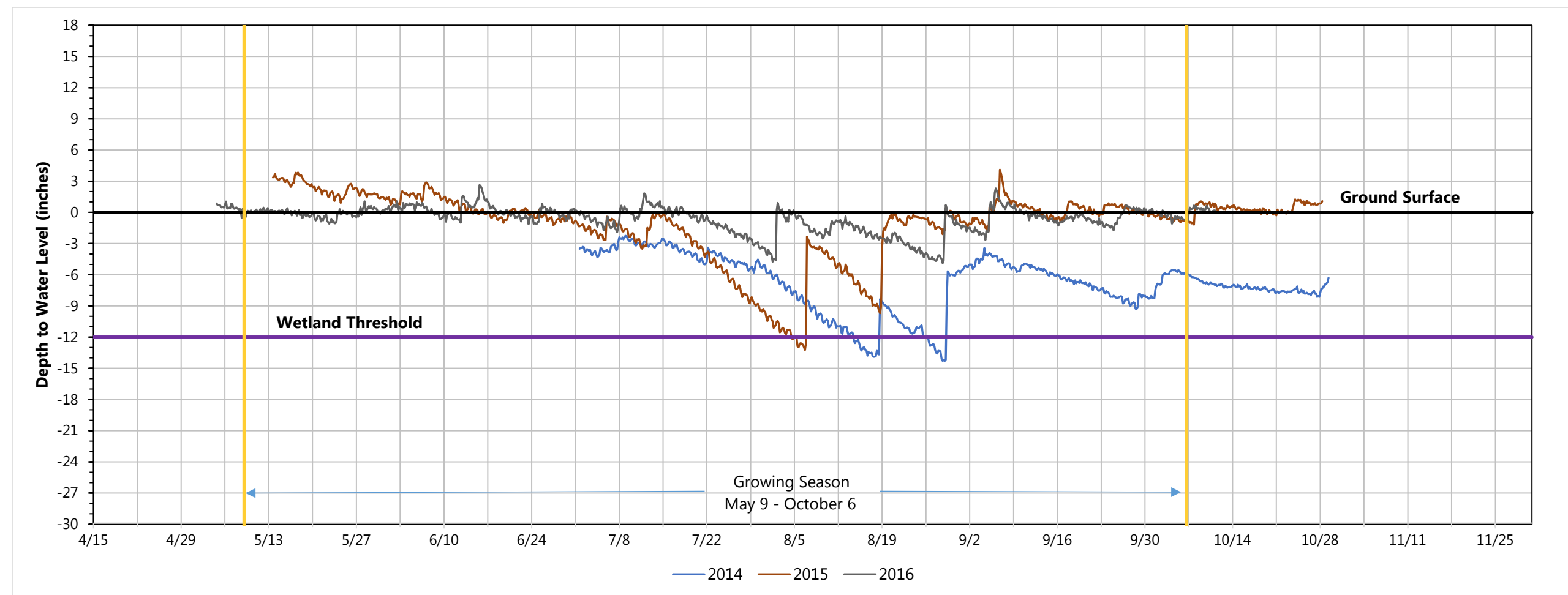


Figure Ref3-1
WETLAND MONITORING WELL Ref3
2014-2016 WETLAND HYDROLOGY MONITORING DATA
NorthMet Project
Poly Met Mining, Inc.
Hoyt Lakes, Minnesota

NorthMet Project Hydrology Monitoring – Well Ref3



July 2014



May 2015



May 2016

Well ID: RefTB1
NorthMet Project Area: Plant Site

Wetland Number: 989
Wetland Type: Coniferous Swamp (Type 7)

UTM Coordinates (NAD 83 Zone 15)
Easting: 567361
Northing: 5279442

Growing Season: May 9-October 6 (151 days)

Water Level Fluctuation for All Years: 16.5 inches

Well Type(s): In-Situ Troll

Date Recording Well Installed: 7/3/2014
Installed By: Barr
Water Level Recorded Every: 2 hours

Date Manual Well Installed: NA
Installed By: NA
Manual Water Levels Read: See notes

Monitored by: Barr

Notes: A manual reading is completed twice per monitoring period - prior to initial installation of logger and when logger is removed at end of period.

Table RefTB1-1. Monitoring Period Each Year¹. See the hydrographs in Figure RefTB1-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Start Date	---	---	---	---	---	---	---	---	---	7/3	5/13	5/5
End Date	---	---	---	---	---	---	---	---	---	10/29	10/28	10/13
Total Days	---	---	---	---	---	---	---	---	---	119	169	162
Grow. Seas. Days	---	---	---	---	---	---	---	---	---	96	147	151

¹ Manual (M) well only at this location. No wells at the location (---). Day ranges and Growing Season (Grow. Seas.) Days in this table represent full calendar days.

Table RefTB1-2. Precipitation During Each Growing Season and Water Year¹. See the yearly hydrographs in Figure RefTB1-2.

Year		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Growing Season	May	A	N	A	N	B	B	A	A	N	A	A	B
	June	A	B	N	A	B	N	N	A	A	A	N	A
	July	B	A	B	B	B	A	B	A	A	N	B	B
	Aug	B	B	B	B	N	A	N	B	B	N	N	A
	Sept	B	B	A	A	B	N	B	B	B	B	N	A
Water Year		A	B	A	A	B	N	B	A	A	N	B	A

¹ The growing season includes precipitation during May through September and the water year includes precipitation from October 1 of the previous year through September 30 of the current year. Each time period, the precipitation is represented as: within the normal range of precipitation (N), below the normal range of precipitation (B), or above the normal range of precipitation (A).

Table RefTB1-3. Hydroperiod(s) for Each Year During the Growing Season¹. Total number of days water level is $\geq 12"$ below ground level for 14 or more consecutive days during the growing season. The yearly hydrographs are shown in Figure RefTB1-2.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# of Periods ≥ 14 Consecutive Days	---	---	---	---	---	---	---	---	---	1	1	1
Total Days	---	---	---	---	---	---	---	---	---	95	146	151
% Grow. Seas.	---	---	---	---	---	---	---	---	---	99%	99%	100%

¹ Hydroperiods were not determined for locations with only a Manual (M) well. No wells at the location (---). The total days counted for the hydroperiod may not match the total days monitored within a growing season (Grow. Seas.) because the hydroperiod date count does not include partial days.

Table RefTB1-4. Water Level Fluctuations During the Growing Season (inches)¹. Yearly fluctuations are shown in Figure RefTB1-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum (in.)	---	---	---	---	---	---	---	---	---	-3.4	2.1	-2.1
Maximum (in.)	---	---	---	---	---	---	---	---	---	3.9	13.1	7.1
Fluctuation (in.)	---	---	---	---	---	---	---	---	---	7.3	11.0	9.3

¹ Fluctuations in water level were not determined for locations with only a Manual (M) well. No wells at the location (---). Some water level depths were deeper than the bottom of the well casing (<) resulting in greater fluctuations than indicated in the data (>).

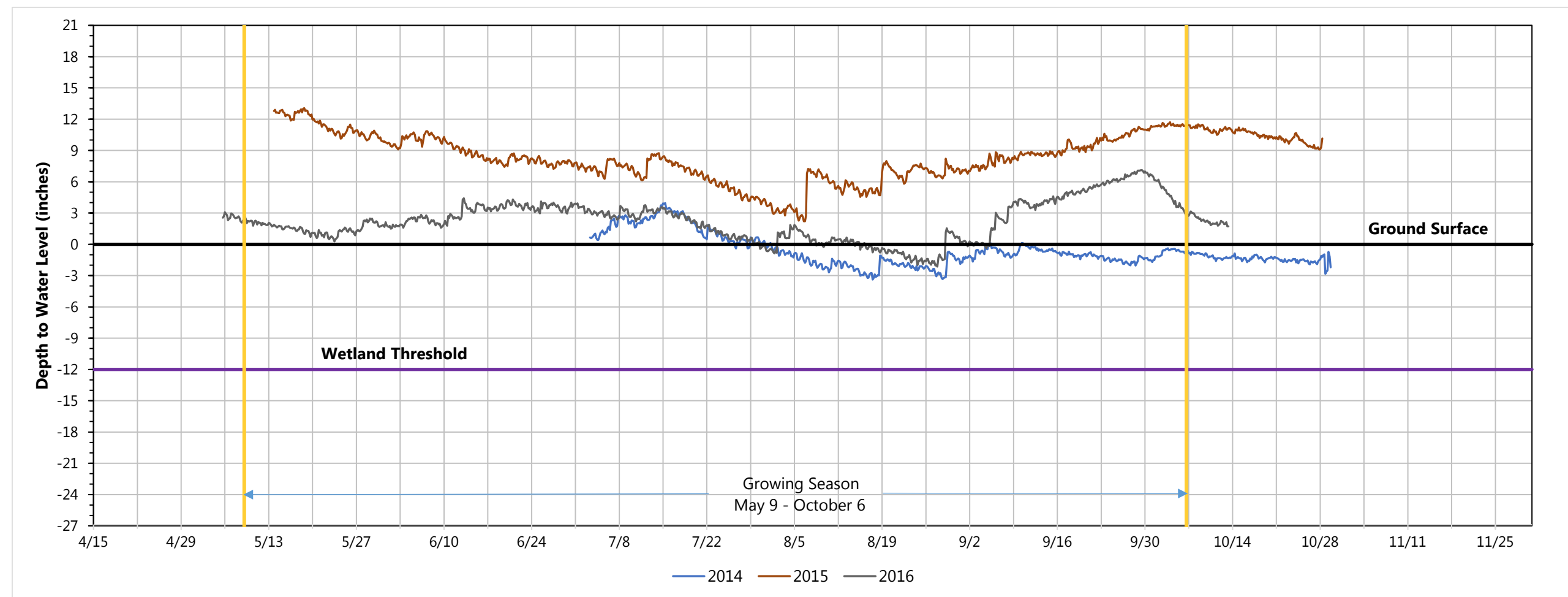


Figure Ref TB1-1
 WETLAND MONITORING WELL Ref TB1
 2014-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

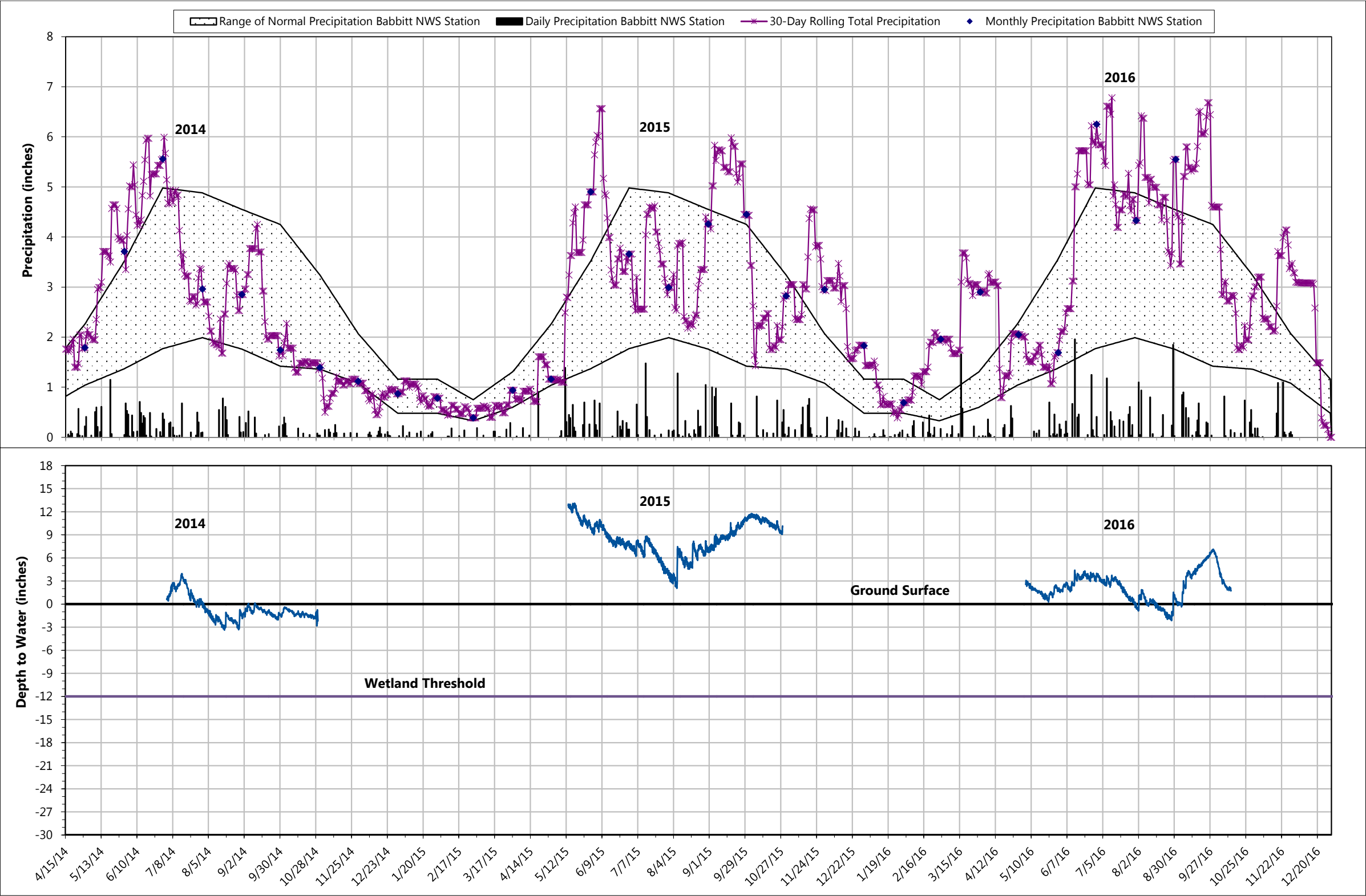


Figure Ref TB1-2
WETLAND MONITORING WELL Ref TB1
2014-2016 WETLAND HYDROLOGY MONITORING DATA
NorthMet Project
Poly Met Mining, Inc.
Hoyt Lakes, Minnesota

NorthMet Project Hydrology Monitoring – Well RefTB1



July 2014



May 2015



May 2016

Well ID: RefTB8
NorthMet Project Area: Plant Site

Wetland Number: 974
Wetland Type: Coniferous Bog (Type 8)

UTM Coordinates (NAD 83 Zone 15)
Easting: 564734
Northing: 5279401

Growing Season: May 9-October 6 (151 days)

Water Level Fluctuation for All Years: 17.2 inches

Well Type(s): Ecotone and Manual

Date Recording Well Installed: 4/26/2010
Installed By: Barr/NTS
Water Level Recorded Every: 4 hours

Date Manual Well Installed: 4/26/2010
Installed By: Barr/NTS
Manual Water Levels Read: Monthly

Monitored by: NTS

Notes: UTM coordinates are for recording well.

Table RefTB8-1. Monitoring Period Each Year¹. See the hydrographs in Figure RefTB8-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Start Date	---	---	---	---	---	4/26	5/12	4/19	5/23	5/28	5/28	4/25
End Date	---	---	---	---	---	10/25	10/26	10/29	10/30	10/27	10/26	10/27
Total Days	---	---	---	---	---	183	168	194	161	153	152	186
Grow. Seas. Days	---	---	---	---	---	151	148	151	137	132	132	151

¹ Manual (M) well only at this location. No wells at the location (---). Day ranges and Growing Season (Grow. Seas.) Days in this table represent full calendar days.

Table RefTB8-2. Precipitation During Each Growing Season and Water Year¹. See the yearly hydrographs in Figure RefTB8-2.

Year		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Growing Season	May	A	N	A	N	B	B	A	A	N	A	A	B
	June	A	B	N	A	B	N	N	A	A	A	N	A
	July	B	A	B	B	B	A	B	A	A	N	B	B
	Aug	B	B	B	B	N	A	N	B	B	N	N	A
	Sept	B	B	A	A	B	N	B	B	B	B	N	A
Water Year		A	B	A	A	B	N	B	A	A	N	B	A

¹ The growing season includes precipitation during May through September and the water year includes precipitation from October 1 of the previous year through September 30 of the current year. Each time period, the precipitation is represented as: within the normal range of precipitation (N), below the normal range of precipitation (B), or above the normal range of precipitation (A).

Table RefTB8-3. Hydroperiod(s) for Each Year During the Growing Season¹. Total number of days water level is $\geq 12"$ below ground level for 14 or more consecutive days during the growing season. The yearly hydrographs are shown in Figure RefTB8-2.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# of Periods ≥ 14 Consecutive Days	---	---	---	---	---	1	1	1	2	2	2	1
Total Days	---	---	---	---	---	151	104	131	112	117	125	151
% Grow. Seas.	---	---	---	---	---	100%	70%	87%	82%	89%	95%	100%

¹ Hydroperiods were not determined for locations with only a Manual (M) well. No wells at the location (---). The total days counted for the hydroperiod may not match the total days monitored within a growing season (Grow. Seas.) because the hydroperiod date count does not include partial days.

Table RefTB8-4. Water Level Fluctuations During the Growing Season (inches)¹. Yearly fluctuations are shown in Figure RefTB8-1.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Minimum (in.)	---	---	---	---	---	-8.4	-19.5	-13.4	-13.0	-13.3	-14.2	-7.6
Maximum (in.)	---	---	---	---	---	-3.1	-2.5	-2.5	-3.4	-2.3	-3.6	-2.3
Fluctuation (in.)	---	---	---	---	---	5.3	17.0	10.9	9.6	11.0	10.6	5.3

¹ Fluctuations in water level were not determined for locations with only a Manual (M) well. No wells at the location (---). Some water level depths were deeper than the bottom of the well casing (<) resulting in greater fluctuations than indicated in the data (>).

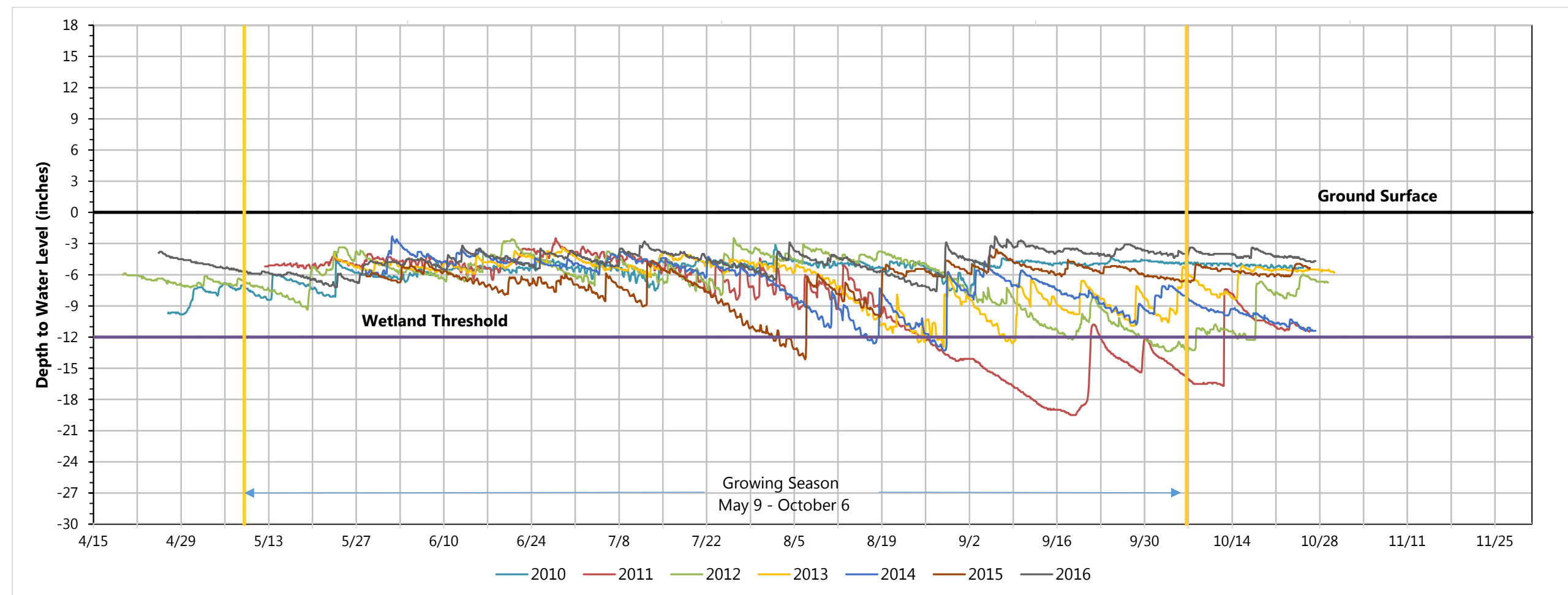


Figure RefTB8-1
 WETLAND MONITORING WELL RefTB8
 2010-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

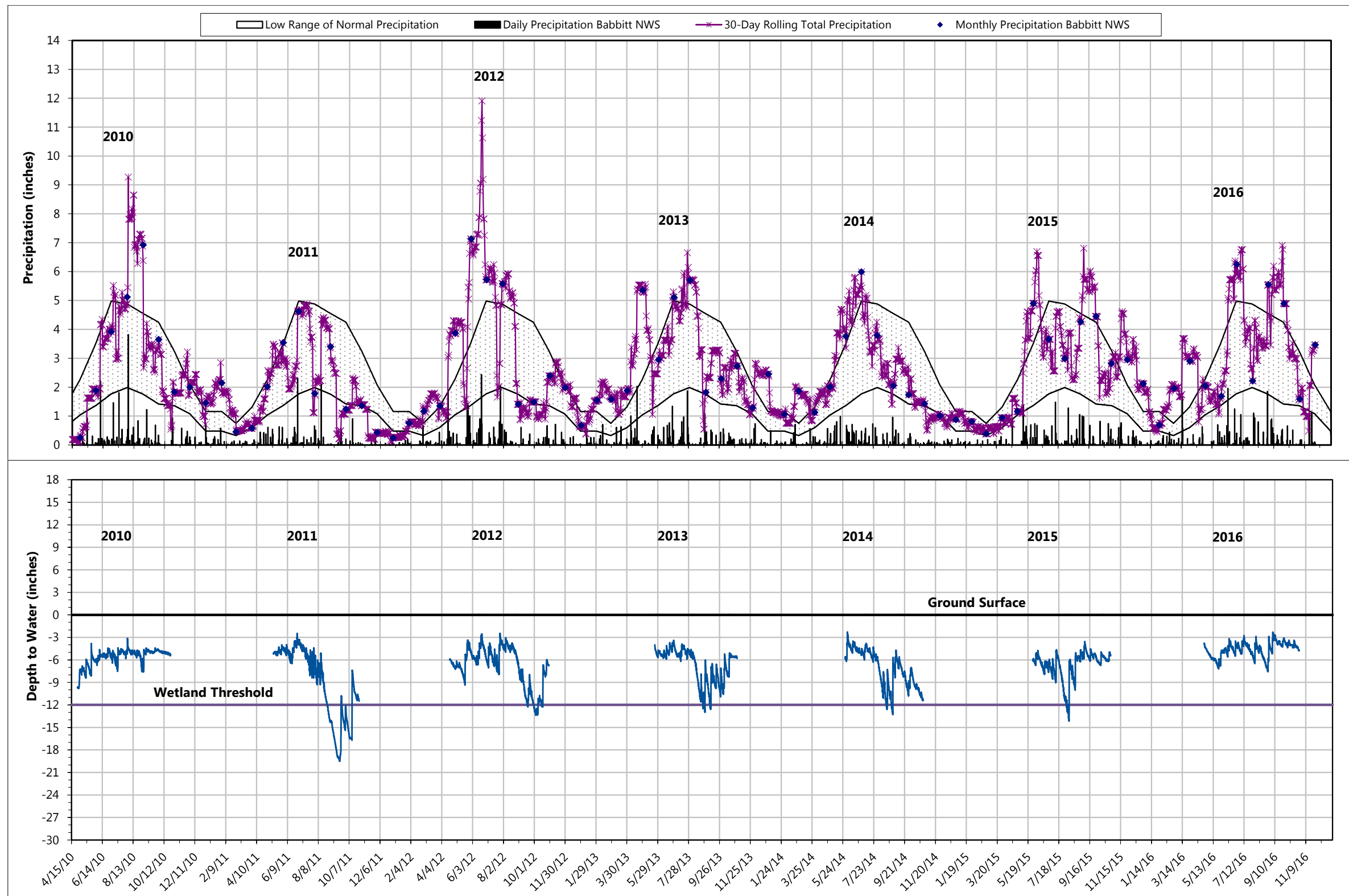


Figure RefTB8-2
 WETLAND MONITORING WELL RefTB8
 2010-2016 WETLAND HYDROLOGY MONITORING DATA
 NorthMet Project
 Poly Met Mining, Inc.
 Hoyt Lakes, Minnesota

NorthMet Project Hydrology Monitoring – Well RefTB8



May 2010



July 2011



June 2012



June 2013



June 2014



June 2015

NorthMet Project Hydrology Monitoring – Well RefTB8



June 2016

Appendix E

Water Level Data for 2005-2016

(on CD)