



Technical Memorandum

Date: December 10, 2020
To: Harney Basin Water Collaborative
From: Nicholas Teague, Technical Coordinator
Harmony Burright, Planning Coordinator
Subject: Summary of Harney Basin Groundwater Level Declines

Contents

Purpose and Scope.....	1
Background	2
Methods.....	3
Results.....	4
Maps	6
Table.....	8

Purpose and Scope

The Department is providing information to help the Collaborative generally understand groundwater level declines in the Harney Basin. This information is intended to complement the OWRD Technical Memo describing groundwater development and use for irrigation (dated 12/10/2020). The information contained in this memo was derived from publicly available data housed in the Oregon Groundwater Information System.

The Department prepared two basin-scale maps summarizing observed groundwater level declines in various areas of the Harney Basin. The first map shows the recent (2016-2020) annual rates of groundwater level changes observed in wells across the basin and the second shows the greatest total magnitude of observed groundwater level declines for various geographic areas of the basin. The recent rates and total magnitudes of groundwater-level declines vary across the Harney Basin due to local geology as well as patterns of groundwater development. For hydrogeologic reasons, the decline in some areas is most acute in the deeper part of the groundwater system and elsewhere it is most acute in the shallower part of the groundwater system. Hydrographs of representative wells can be provided in follow-on materials (if requested) to show changes in groundwater levels in the shallow and deep parts of the groundwater system for each subarea.

Relative to the current USGS Harney Basin Groundwater Studies, the analyses done to complete this TA request were performed within a much shorter period of time, involved fewer collaborators, and

went through a less-rigorous peer-review process. This is an interim product to support planning efforts and discussions in the basin while the USGS Harney Basin Groundwater Study reports are undergoing peer review and should not be considered as representative of the larger body of work. The Groundwater Study Reports are expected to be published in 2021 and will provide a more comprehensive understanding of the groundwater system.

The scope of this request focuses exclusively on areas of decline. The analysis relies on measured water levels in individual wells within known areas of decline to describe rates of decline and overall magnitude of decline over available periods of record. To further explore groundwater level changes or look at hydrographs associated with individual wells, the Department encourages use of the Harney Basin Data Mapper developed and maintained by the US Geological Survey (https://or.water.usgs.gov/projs_dir/harney_gw/). Information about individual wells, including groundwater level measurements, can also be accessed via the Department's Groundwater Information System (https://apps.wrd.state.or.us/apps/gw/gw_info/gw_info_report/gw_search.aspx).

Questions about this TA request should be directed to the Department through the Harney Basin Community-Based Water Collaborative (<http://hcwatershedcouncil.com/community-based-water-planning/>).

Background

The Harney Basin is a hydrologic area defined by and including the drainages that feed into Harney and Malheur Lakes (Silvies River, Silver Creek, Donner Und Blitzen River). In April 2016 the Water Resources Commission updated the Malheur Lake Basin Program rules to designate a Greater Harney Valley Groundwater Area of Concern within the Harney Basin. This update to the rules was in response to analysis of groundwater-level data and aquifer recharge estimates that indicated annual groundwater use and other discharge likely exceeded annual groundwater recharge in the Harney Basin. In addition to the designation of a groundwater area of concern, the Department began a multi-year groundwater basin study in cooperation with the US Geological Survey to improve understanding of the Harney Basin groundwater system and also began working with the community and other interested stakeholders to determine future management actions to achieve reasonably stable groundwater levels. The Department is working with the community and groundwater users to identify and encourage voluntary actions to reduce groundwater use while also pursuing regulatory actions in the event that voluntary actions do not succeed in achieving reasonably stable groundwater levels.

At the final meeting of the Harney Basin Groundwater Study Advisory Committee (SAC) on December 13, 2019, committee members requested information about the distribution and characteristics of groundwater decline areas within the Harney Basin, including current decline rates, total measured declines, and estimated groundwater use within those areas. Following subsequent conversations, the SAC request became a technical assistance (TA) request for the Collaborative to inform the collaborative planning efforts. This document and the accompanying maps, and table describe the rates of decline and overall declines. An accompanying memo describes the estimated groundwater use for irrigated agriculture (dated 12/10/20).

The information contained in this memo and supporting memos can support multiple ongoing conversations and initiatives, including, but not limited to:

- Increase basin-wide awareness and understanding of groundwater-level declines;

- Support conversations of the Collaborative to define “reasonably stable” groundwater levels consistent with Oregon statutes and rules;
- Assist with prioritization or identification of focus areas for different projects pursued by the Collaborative; and,
- Support conversations between groundwater users interested in pursuing voluntary agreements.

The Collaborative may request additional information or analysis for areas of interest or focus areas. These areas will be determined by the Collaborative with input and feedback from the Department. At this time the Department has not delineated management areas and any discussion of an “area” is for analysis purposes only. Questions about this TA request should be directed to the Department through the Harney Basin Community-Based Water Collaborative (<http://hcwatershedcouncil.com/community-based-water-planning/>).

Methods

Groundwater-level data from the Department’s publicly-available Groundwater Information System¹ database formed the dataset for this analysis. Data from wells with consistent measurements and longer periods of records (greater than two measurements spanning at least two years) were used in calculating groundwater level changes. Wells that were deepened or noted as altered by other means over the period of analysis were not used in calculating groundwater level changes. Spring measurements (February-April) were used to avoid groundwater level changes due to seasonal recharge and pumping variations. The data are provided as values rounded to the nearest foot to account for differences in the precision of the data resulting from differences in measurement methods, measuring points, and data sources.

Recent (2016-2020) Annual Rates of Groundwater Level Change

Annual rates of change in groundwater levels were calculated for the period of 2016-2020 to provide information on recent changes which may help the Collaborative to focus actions on areas that are currently experiencing the most acute decline rates. The period of record for the wells is generally 2016-2020; however, some wells have shorter periods that fall within 2016-2020 (for example, the period of record for well HARN50958 is 2016-2018), which affects the ability to make direct comparisons given that the seasonal effects of wet and dry years have a greater impact on this short term analysis as compared to the total magnitude analysis over longer periods.

Total Magnitude of Observed Groundwater Level Declines

The greatest total decline in groundwater level observed at a given well for the period of record was calculated using the greatest groundwater level value and the subsequently lowest groundwater level value. Again, spring measurements were used to avoid groundwater level changes due to seasonal variation. Because the period between the highest and lowest recorded measurements differs between wells, the period of record is noted in the tables and figures. Individual hydrographs should be examined to better understand when declines occurred relative to the overall period of record. For instance, HARN 1387 was relatively stable until the 1990s and most of the ~18 feet of decline has happened since 2000.

¹ Data accessed in September 2020 from the Groundwater Information System https://apps.wrd.state.or.us/apps/gw/gw_info/gw_info_report/Default.aspx.

The period of record used in the analysis was from 1962-2020 implying ~18 feet over 38 years even though the actual decline occurred in more recent years (~18 feet over ~20 years).

This analysis was performed for individual wells only, and did not assess water level trends from composite hydrographs that can be more representative of aquifers. For example, the total magnitude of decline in the Weaver Springs area is noted to be as much as 77 feet from 2012 to 2019. While this is the greatest magnitude of decline for a single well (HARN0051448), the starting water level in 2012 was much lower than the actual starting water level of the aquifer before groundwater development began in the 1950s. A composite hydrograph of more than 25 wells in the Weaver Springs Area shows the total magnitude of decline in the aquifer is greater than 100 feet over the full period of available record from about 1955 to present. Therefore, the values reported in this document should be looked at as a conservative minimum total magnitude of decline for any given area.

Results

Recent (2016-2020) changes in groundwater levels measured in wells across the Harney Basin range from declining between zero and one foot per year (ft/yr) to declining as much as 20 ft/yr. In the Figures, Tables and text below, a declining groundwater level trend is denoted with a negative value. The greatest groundwater level decline rates were measured in wells in the Weaver Springs vicinity, where the rates of change range from -2 to -20 ft/yr. Generally, the locations with the greatest recent rates of decline in groundwater levels are also the areas where the greatest total magnitude of declines have been observed. The largest declines in groundwater levels have most often occurred in the deeper portion of the groundwater system. Groundwater level change rates and total observed magnitude of declines for the various geographic locations are described below.

Weaver Springs Vicinity

- Observed groundwater level declines:
 - Recent annual rate (primarily 2017-2020): -2 to -20 ft/yr (HARN0001094, HARN0001990, HARN0051445, HARN0051448, HARN0051761, HARN0052630, HARN0052631)
 - Total observed decline: As much as -77 ft from 2012-2019 (HARN0051448)
- Shallow and deep groundwater levels are nearly coincident

Sunset Valley – Dog Mountain Vicinity

- Observed groundwater level declines:
 - Recent annual rate:
 - Sunset Valley: About -1 ft/yr to -3 ft/yr (HARN0052606, HARN0052629)
 - Shallow and deep groundwater declines are nearly coincident.
 - Dog Mountain:
 - Shallow: About -1 ft/yr (HARN0051409, 2018-2020 only)
 - Deep: -3 ft/yr (HARN0051783, 2018-2020 only)
 - Total observed decline: As much as -24 ft from 1983-2017 (HARN0001125)

North Harney Valley Vicinity

- Observed groundwater level declines:
 - Recent annual rate (primarily 2016-2020): About -1 to -2 ft/yr (HARN0050362, HARN0050422, HARN0050460, HARN0051738)
 - Long-Term: As much as -38 ft from 2007-2019 (HARN0050362)

Crane Vicinity

- Observed groundwater level declines:
 - Recent annual rate (2016-2020): About -1 ft/yr (HARN0001245, HARN0050751, HARN0051004, HARN0051076, HARN0051237, HARN0051238)
 - Note: Transfer of certificate 89885 moved pumping away from HARN0001245 and HARN0051004, apparently decreasing annual decline rate at these wells
 - Total observed decline: As much as -17 ft from 2008-2020 (HARN0050751)
- Shallow and deep groundwater levels are nearly coincident

Windy Point North Vicinity

- Observed groundwater level declines:
 - Recent annual rate (primarily 2016-2020): About -1 ft/yr (HARN0001384, HARN0001387, HARN0001414, HARN0051837)
 - Total observed decline: About -18 ft from 1962-2020 (HARN0001387) – present total decline primarily occurs after 1990
- Shallow and deep groundwater levels are nearly coincident

Central Harney Valley Vicinity

- Observed groundwater level declines:
 - Shallow:
 - Recent annual decline rate: About -1 ft/yr (HARN0050178, HARN0051547, HARN0051584, HARN0052234)
 - Deep:
 - Recent annual decline rate: About -1 to -4 ft/yr (HARN0000958, HARN0000960, HARN0001014, HARN0050789, HARN0051524, HARN0051585, HARN0051586, HARN0051587, HARN0051701, HARN0051944, HARN0051972, HARN0052235)
 - Total observed decline: As much as -37 ft from 2010-2017 (HARN0051585)
- Pre-Groundwater Development: Shallow and deep groundwater levels are nearly coincident
- Post-Groundwater Development: Growing divergence of shallow and deep groundwater levels

Virginia Valley Vicinity

- Observed groundwater level declines:
 - Recent annual rate (primarily 2017-2020): About -1 ft/yr (HARN0001488, HARN0001495, HARN0051727, HARN0052607, HARN0052608)
 - Total observed decline: As much as -8 ft from 2012-2020 (HARN0001495)
- Shallow and deep groundwater levels are nearly coincident

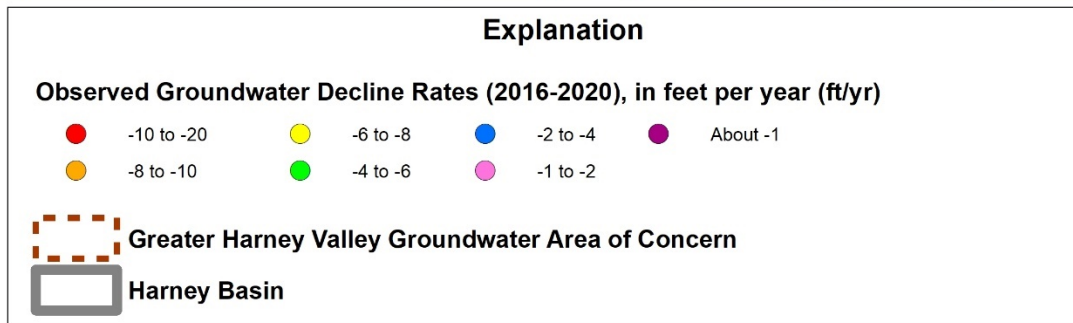
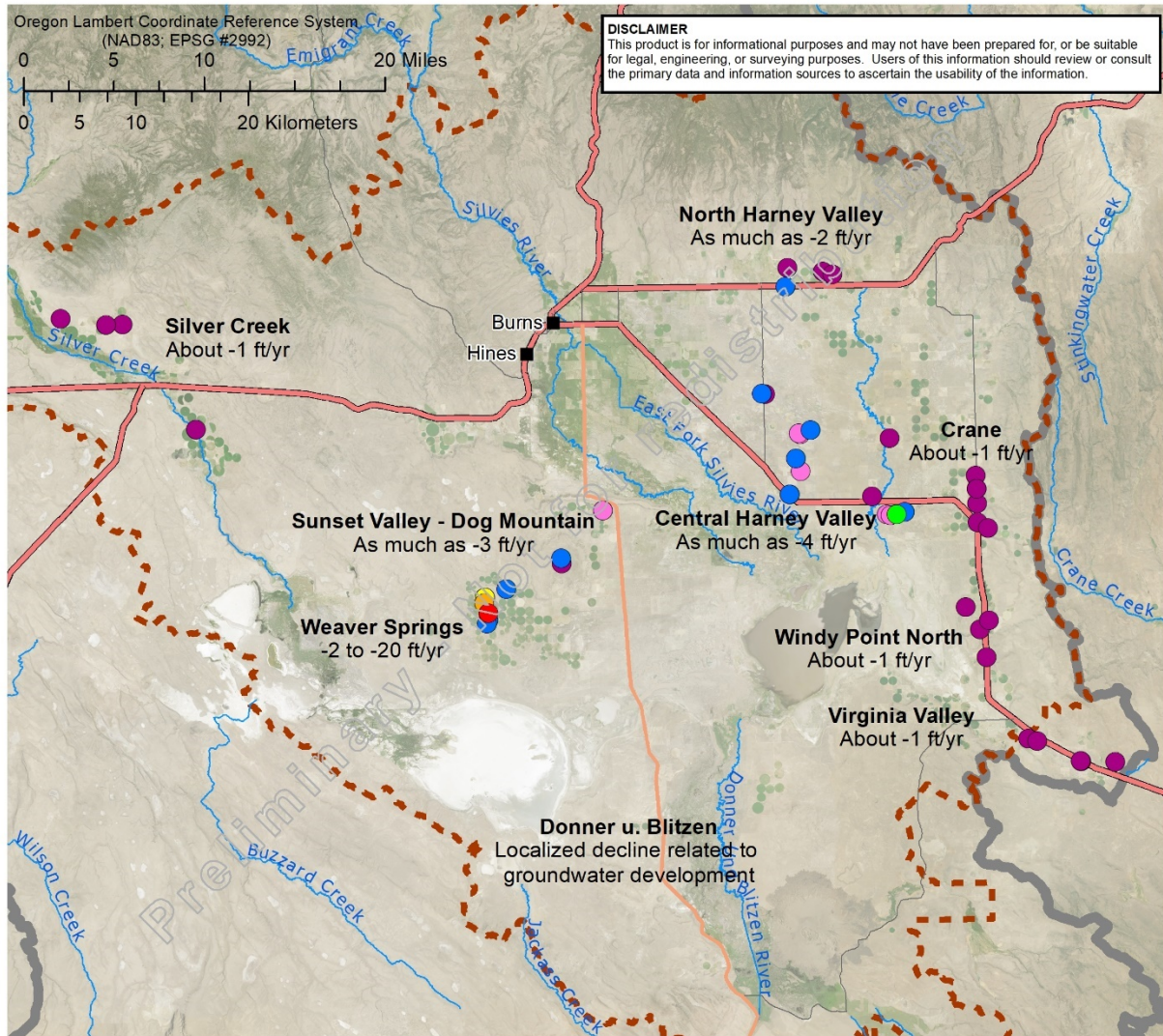
Silver Creek Valley Vicinity

- Observed groundwater level declines:
 - Recent annual rate (primarily 2016-2020): About -1 ft/yr (HARN0000260, HARN0000754, HARN0050958, HARN0052102)
 - Total observed decline: As much as -5 ft from 1979-2019 (HARN0000260)
- Shallow and deep groundwater levels are nearly coincident

Donner Und Blitzen Vicinity

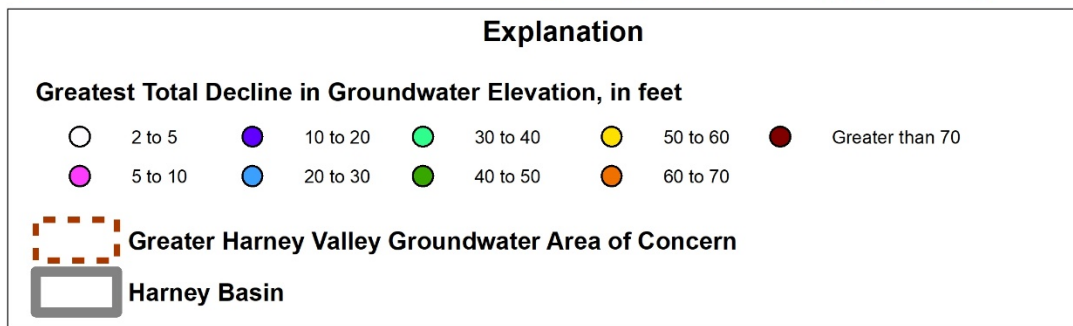
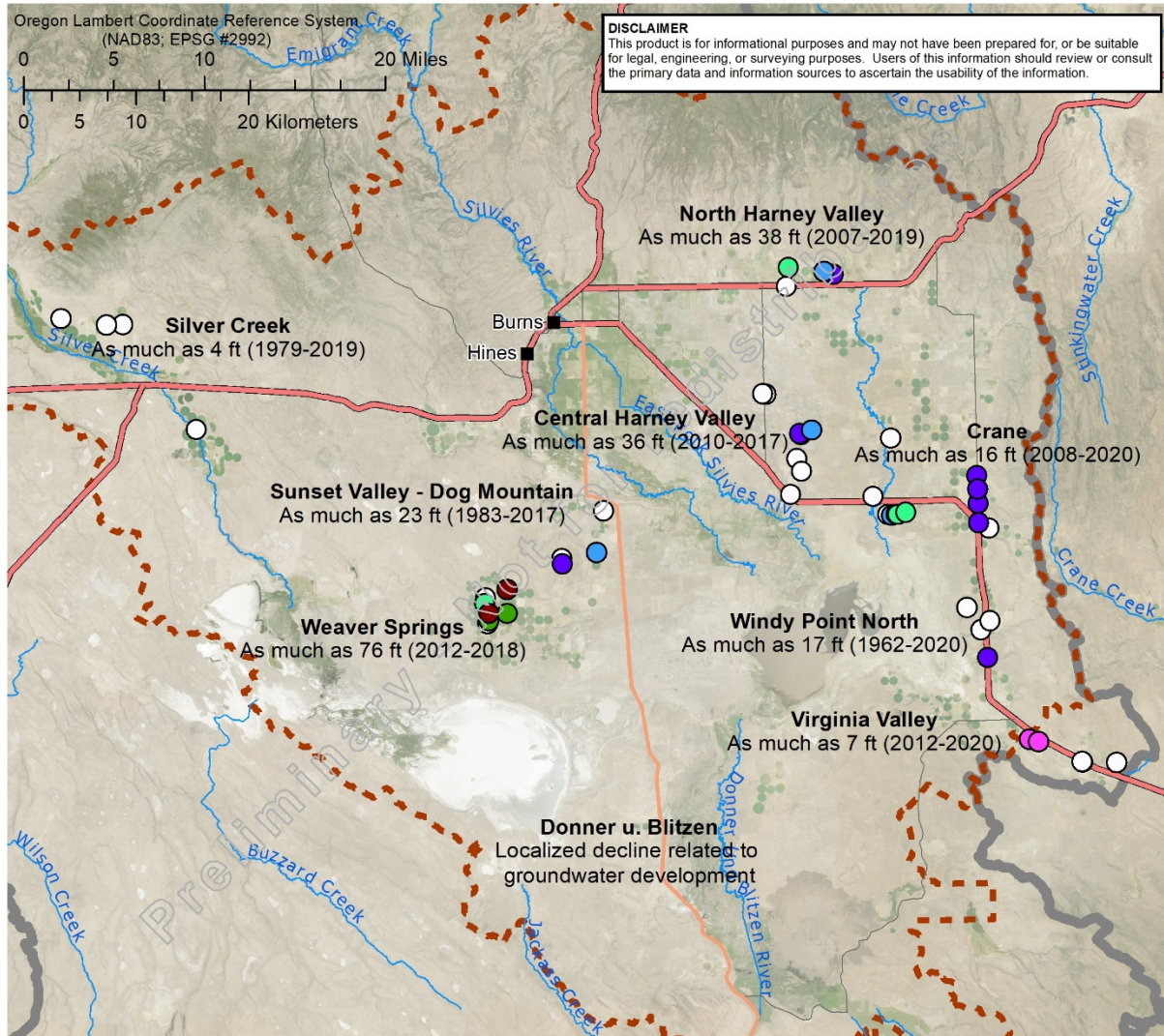
- Localized groundwater level declines where development has occurred

Maps



Groundwater Level Declines in the Greater Harney Valley Groundwater Area of Concern (GHVGAC), Malheur Lake Basin, Oregon

OWRD Technical Memo (12/10/20): Summary of Harney Basin Groundwater Level Declines



Groundwater Level Declines in the Greater Harney Valley Groundwater Area of Concern (GHVGAC), Malheur Lake Basin, Oregon

Table

Table 1. Recent annual rates of groundwater level change (2016-2020), and greatest total observed decline in groundwater level as measured in wells in the Harney Basin, Oregon.

Well ID	Annual Rate of Groundwater Level Decline, in feet per year (ft/yr)		Total Decline in Groundwater Level, in feet	
	Rate (ft/yr)	Period	Decline (ft)	Period
Weaver Springs				
HARN0001094	-9	2016-2020	-36	2015-2020
HARN0001990	-2	2017-2020	-75	1995-2020
HARN0051233	-	-	-48	2010-2017
HARN0051445	-3	2016-2018	-47	2010-2018
HARN0051448	-20	2016-2018	-77	2012-2018
HARN0051761	-2	2016-2020	-	-
HARN0052630	-7	2017-2020	-	-
HARN0052631	-8	2017-2020	-	-
Sunset Valley – Dog Mountain				
HARN0001125	-	-	-24	1983-2017
HARN0051409	-1	2018-2020	-11	2011-2020
HARN0051783	-3	2018-2020	-	-
HARN0052606	-1	2017-2020	-	-
HARN0052629	-1	2017-2020	-	-
North Harney Valley				
HARN0050362	<0 to -1	2016-2019	-38	2007-2019
HARN0050422	<0 to -1	2016-2019	-28	2007-2019
HARN0051738	<0 to -1	2016-2020	-17	2010-2020
HARN0050460	-2	2017-2020	-	-
Crane				
HARN0001245	-1	2016-2020	-13	2007-2020
HARN0050751	<0 to -1	2016-2020	-17	2008-2020
HARN0051004	-1	2016-2020	-15	2008-2020
HARN0051076	-1	2016-2020	-	-
HARN0051237	-1	2016-2020	-11	2008-2020
HARN0051238	<0 to -1	2016-2020	-15	2008-2020

OWRD Technical Memo (12/10/20): Summary of Harney Basin Groundwater Level Declines

Windy Point North				
HARN0001384	-1	2016-2019	-	-
HARN0001387	-1	2016-2020	-18	1962-2020
HARN0001414	-1	2016-2020	-	-
HARN0051837	-1	2016-2020	-	-
Central Harney Valley				
HARN0050178	-1	2017-2020	-	-
HARN0051547	<0 to -1	2017-2020	-	-
HARN0051584	-1	2017-2020	-	-
HARN0052234	<0 to -1	2017-2020	-	-
HARN0000958	-2	2018-2020	-20	2013-2019
HARN0000960	-2	2018-2020	-20	2013-2019
HARN0001014	-1	2017-2020	-	-
HARN0050789	-4	2017-2020	-	-
HARN0051524	-2	2017-2020	-20	2008-2019
HARN0051585	-4	2018-2020	-37	2010-2017
HARN0051586	-2	2017-2020	-26	2010-2018
HARN0051587	-3	2016-2020	-32	2011-2019
HARN0051701	-1	2018-2020	-28	2011-2017
HARN0051944	-2	2017-2020	-	-
HARN0051972	-3	2017-2019	-	-
HARN0052235	-3	2016-2020	-	-
Virginia Valley				
HARN0001488	-1	2016-2020	-6	2014-2019
HARN0001495	<0 to -1	2017-2020	-8	2012-2020
HARN0051727	-1	2017-2020	-	-
HARN0052607	-1	2017-2020	-	-
HARN0052608	-1	2017-2020	-	-
Silver Creek				
HARN0000260	<0 to -1	2016-2020	-5	1979-2019
HARN0000754	-1	2016-2020	-2	2016-2020
HARN0050958	<0 to -1	2016-2018	-	-
HARN0052102	<0 to -1	2016-2020	-	-