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Decommissioning of Westwold Flowing Artesian Well

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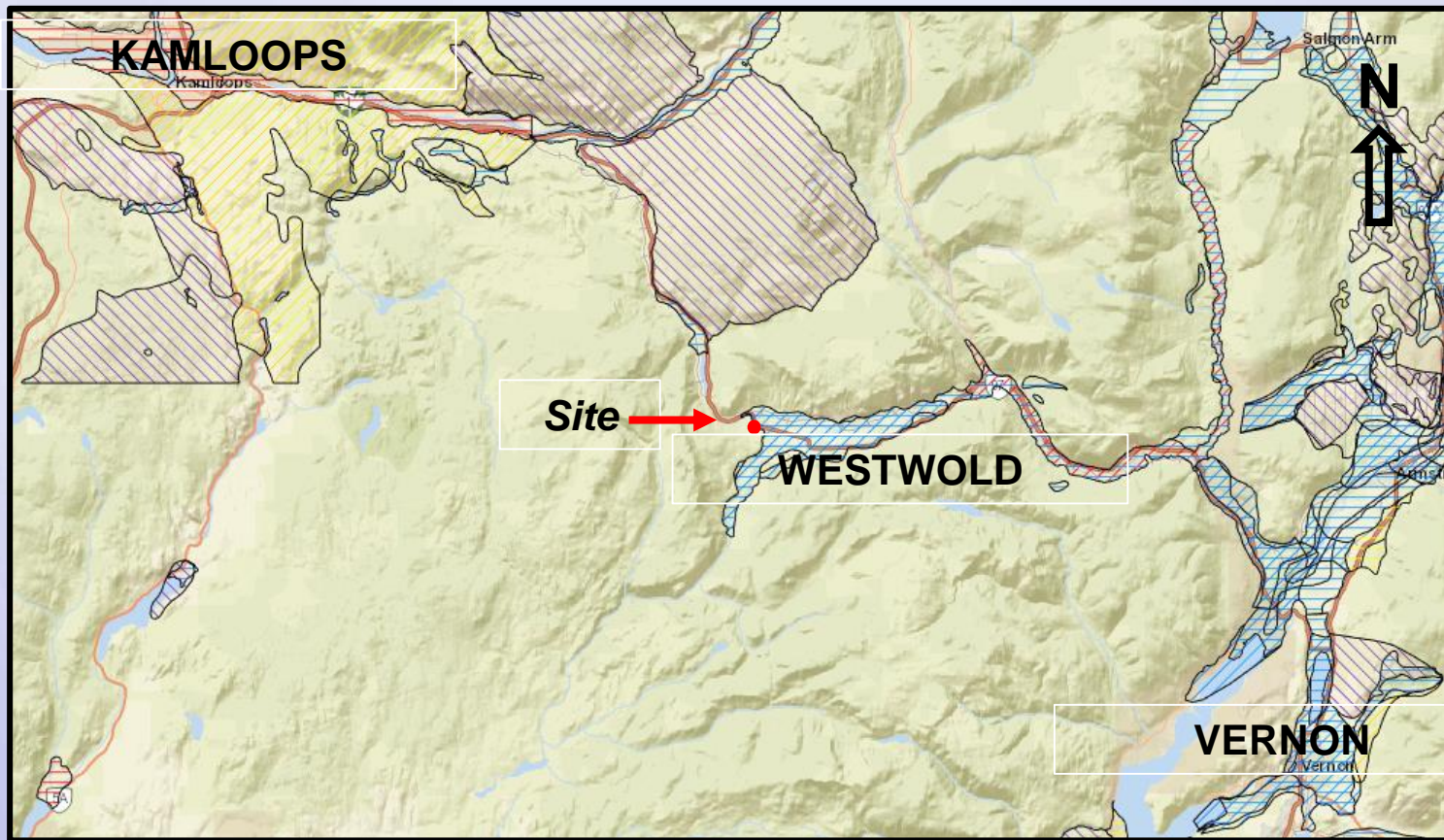
Outline

- 2016
 - Initial Drilling
 - Enforcement and response
- 2017
 - Options Review
- 2018
 - Prepare Funding Submission
 - RFP prepared, posted and awarded
- 2019
 - Well closure and ongoing monitoring



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Setting

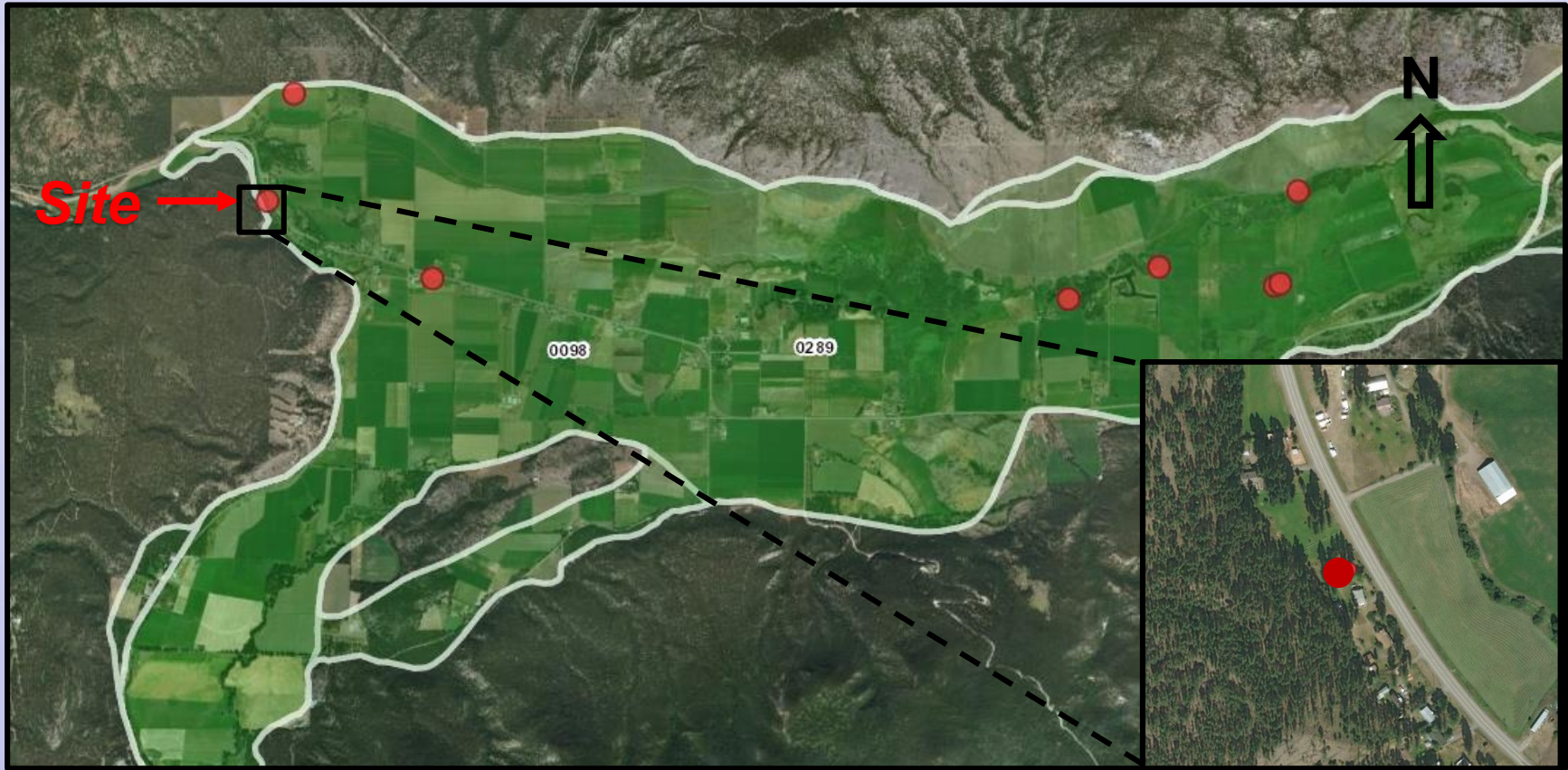




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Site (and other artesian wells)





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Chronology

- March 10-11, 2016
 - WTN 112429 drilled to 280 feet below ground
 - Initially reported flowing artesian at 60 US GPM
 - Subsequently estimated up to 750 US GPM
 - Four inch reducer welded onto six inch casing





Drilling Logs

Lithologic description (see notes 7-14) or **closure description** (see notes 15 and 16)

From ft (bgl)	To ft (bgl)	Relative Hardness	Colour	Material Description (Use recommended terms on reverse. List in order of decreasing amount, if applicable)	Water Estima (US
0	30	5/m	Br.	GRAVEL & SAND	
30	40	5/m	Br.	GRAVEL with CLAY DAND	
40	60	5	Bk/Grey	CLAY with silt & GRAVEL	
60	100	5	Bk/Grey	SILT/CLAY mixed rocks	
100	140	5/m	Grey	CLAY/SILT mixed rocks	
140	240	5	Grey	CLAY/SILT - 3/4 m	
240	260	5	Grey	CLAY	
260	270	m	Grey	CLAY	
270	280	n	Grey	GRAVEL	

Original

Lithologic description (see notes 7-14) or **closure description** (see notes 15 and 16)

From ft (bgl)	To ft (bgl)	Relative Hardness	Colour	Material Description (Use recommended terms on reverse. List in order of decreasing amount, if applicable)	Water-bearing Estimated Flow (USgpm)	Observations (e.g., fractured, weathered, well sorted, silty wash), closure details
0	38		BROWN	SAND & GRAVEL W.B. @ 32'		WATER BEARING @ 32-38'
38	57			CLAY w GRAVEL		
57	64			SAND & GRAVEL		
64	97			GRAVELY TILL		
97	106			SAND & GRAVEL W.B.		LOTS OF WATER
106	112			TILL		
112	114			SAND & GRAVEL W.B.		
114	131			TILL		
131	146		GREY	CLAY w GRAVEL		
146	195			SILT, CLAY & SAND LAYER. SOME NARROW ZONES MAKING UP TO 10 GPM.		

Decommissioning



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Section 52 (2) states that

If a well driller or a professional encounters artesian conditions while constructing a well or supervising the construction of a well, the well driller or professional must ensure, as soon as practicable, that

- (a) any artesian flow is stopped or brought under control, or
- (b) if the artesian well is likely to flow periodically, steps are taken to ensure that artesian flow will be stopped or controlled during those periods.

"professional" means

- (a) a professional engineer, or a professional geoscientist, who is registered or licensed under the [*Engineers and Geoscientists Act*](#), or
- (b) a holder of a limited licence under the [*Engineers and Geoscientists Act*](#) acting within the scope of the limited licence;



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53 (1) The owner of a flowing artesian well must engage a well driller who is qualified in respect of the activity or a professional and ensure that the well driller or professional, as applicable, stops the flow of that well or brings the flow of that well under control.

(2) If the owner of a flowing artesian well fails to comply with subsection (1) and the owner of the land on which the well is located does not know who owns the well, the owner of that land must comply with subsection (1).



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52 (1) For the purposes of this section and section 53, artesian flow of a well is under control when

(a) the artesian flow

(i) is clear of sediment,

(ii) is entirely conveyed through the well's production casing to the wellhead, if the well has a production casing,

(iii) may be mechanically stopped for an indefinite period in a manner that prevents leakage onto the surface of the ground or into another aquifer penetrated by the well, and

(iv) does not pose a threat to property, public safety or the environment, or



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2016

- Well owner and Well Driller initially operating under voluntary compliance
- June and July: Non-compliance warning and advisory letters sent to Well Driller and Well owner during summer





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2016

- August: Driller and Professional installed modified wellhead and discharge lines
- Fall: Regular monitoring with new wellhead leading up to options analysis report by the Professional as part of compliance
- Ministry of Transportation placed jersey barriers due to concerns about well failure close to highway (~ 40 feet)



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2017

- FLNRORD commissioned review of initial options analysis
- Regular monitoring and reporting by Driller ceased due to disputes about financially responsible party





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2018

- Field receiving discharge still unable to be farmed
- Ministry of Transportation ongoing concerns
- Prepared funding submission to executive
- Request for proposal for well closure posted and awarded





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2019

January – desktop planning, permits/approvals

February – site preparation

March – drill relief well, test, decommission flowing well





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Improvements since 2016

- GX drilling now a restricted activity, requiring qualified well drillers
- Definition of ‘under control’ has been clarified
- Submission of well records now mandatory
- Improved mapping
- New flowing artesian advisories have been developed





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Home > Environmental Protection & Sustainability > Air, Land & Water > Water > Groundwater Wells & Aquifers > Groundwater Wells > Information for Well Drillers & Well Pump Installers > Well Drilling Advisories >

Flowing Artesian Conditions Advisories

These are the current advisories for flowing artesian conditions in B.C.

- Vernon Creek, B.C. (PDF)
- Coldstream, B.C. (PDF)
- Westwold, B.C. (PDF)
- Surrey and Langley, B.C. (PDF)
- Lower Mission Creek area of Kelowna, B.C. (PDF)
- Vancouver, Burnaby, and New Westminster, B.C. (PDF)
- Chetwynd, B.C. (PDF)

WELL DRILLING ADVISORY

Flowing artesian conditions

Westwold, BC

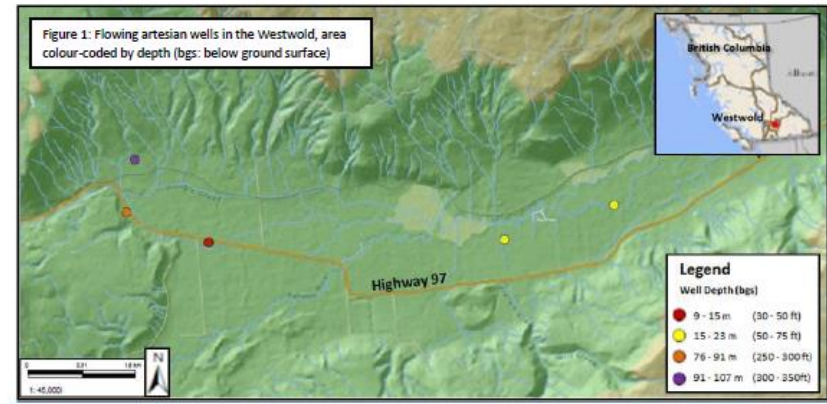


Flowing artesian conditions exist in the Westwold Valley area, BC. Well drillers and home owners should be aware of potential complications and costs of flowing artesian wells.



What is a flowing artesian well?

Flowing artesian wells occur when a well is drilled into an aquifer under pressure that is high enough to force the water level in the well to rise above the ground surface and flow over the top of the well (Figure 2). It is important to properly construct the well to control this flow. Controlling artesian flow conserves groundwater resources, preserves the pressure within the aquifer, and prevents damage to the natural environment (i.e., property damage, flooding, erosion and impacts to surface water). A flowing artesian well can cause substantial damage and incur significant and unexpected costs if not carefully planned and constructed. Well drillers and well owners should be prepared in advance in case flowing artesian conditions are encountered.



Where do artesian conditions occur?

Westwold is an area of known flowing artesian conditions. The area is located between Kamloops and Vernon, on Highway 97 (Figure 1). Please note that artesian conditions may extend beyond the boundaries of the mapped area below.

Flowing Artesian Advisories



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Research →

SFU and HydroGeoLogic mapping the risk of flowing artesian conditions throughout each region and generating an information package to support decision-making. The project will be completed in 2021.

**Flowing
Artesian
Advisories** →

GWELLS →

Well Search | Aquifers | Groundwater Information | Registry

Aquifer Search

Search by aquifer name or number (leave blank to see all aquifers)

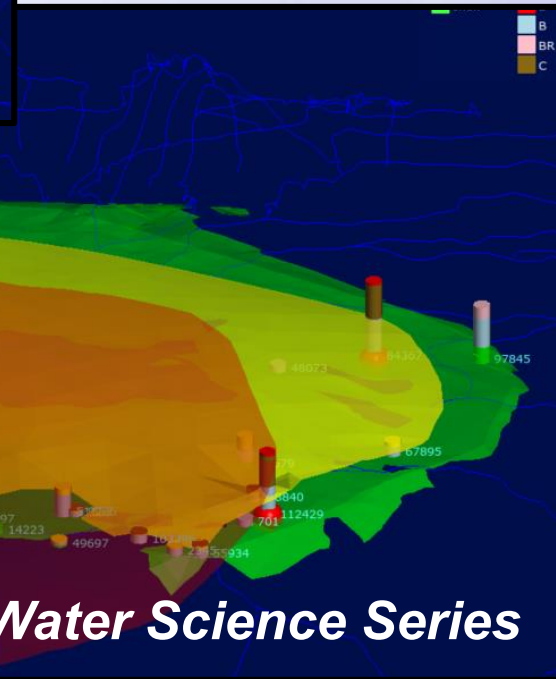
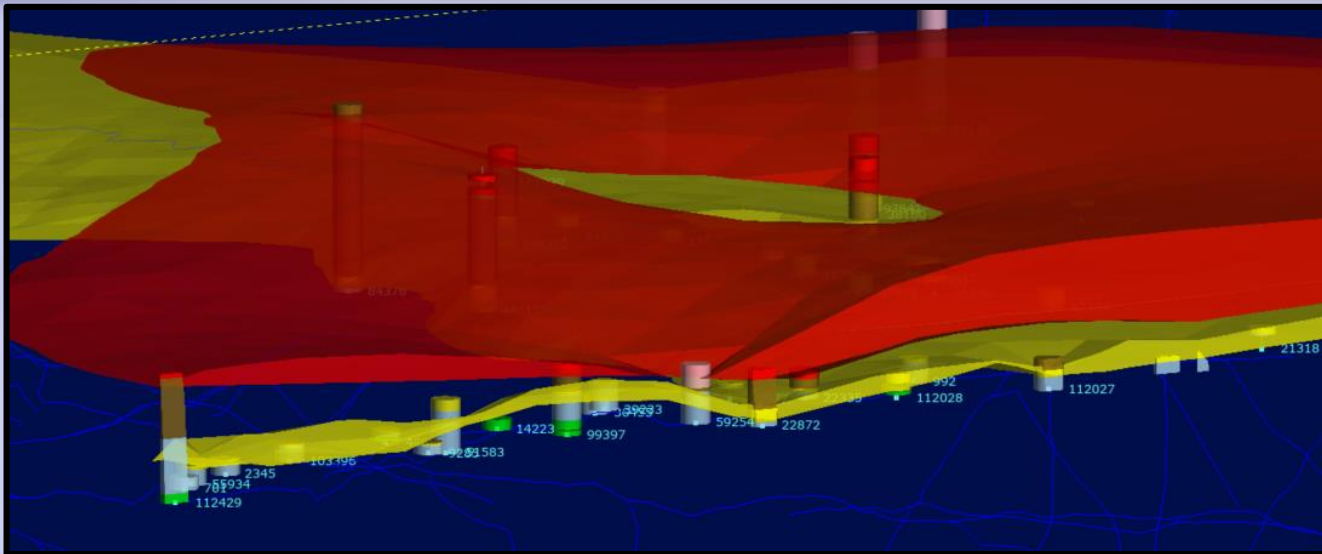
- Advanced mapping
- Artesian advisory
- Hydraulically Connected
- Numerical model
- Other information
- Pumping stress index
- Water budget



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3D Mapping of North Okanagan



Leapfrog files
and free
Viewer online
for this and
other projects

From ENV's Water Science Series



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Improvement Opportunities

- Submission of artesian well condition reports
- Reviewing artesian conditions
- Improved drilling practices
- Continue to work with BCGWA





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Recommendations

- Hire a Hydrogeologist
- Ministry staff can direct drillers to information to support pre-drilling assessments (PDA)
- Conduct PDA including:
 - Review available local well construction reports
 - Review online hydrogeologic information such as the Water Resources Atlas
 - Review artesian advisories
 - Precautionary approach where information is limited or artesian risk identified
- Have plan and equipment in place to address flowing well

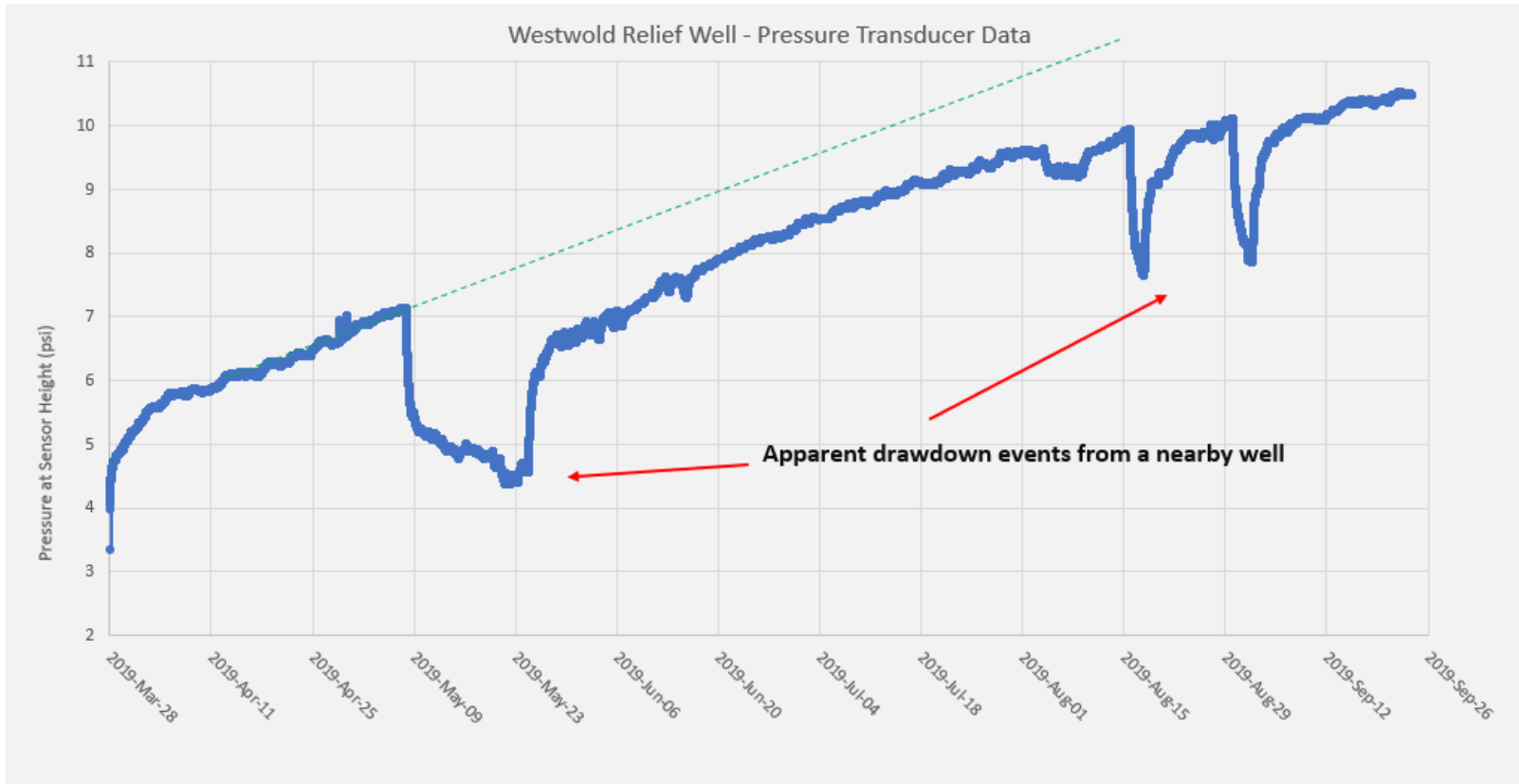


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Thanks

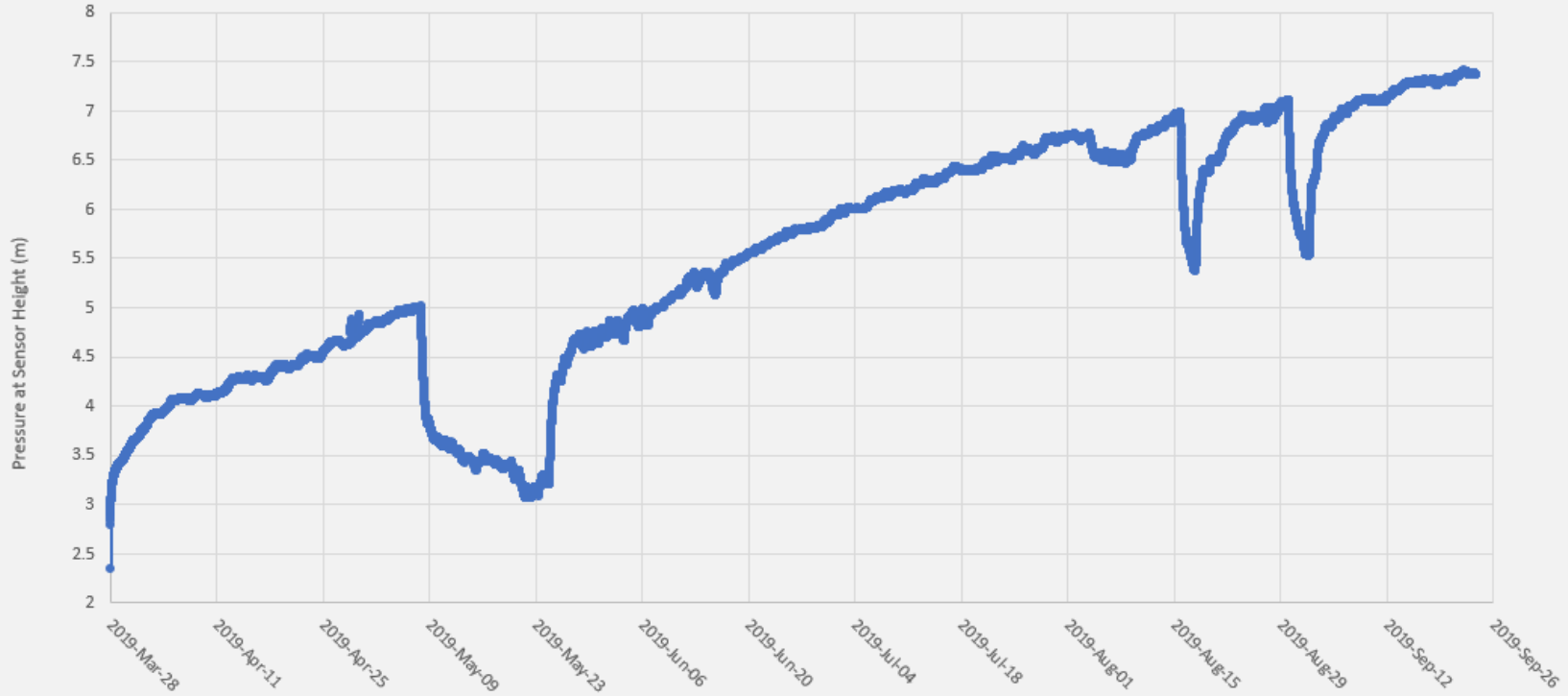
- Drillwell
- Western Water Associates Limited
- South Area Groundwater Team
- Other FLNRORD/ENV Project Staff

Relief Well Pressure Recovery Hydrograph March to September 2019 (PSI)



Relief Well Pressure Recovery Hydrograph March to September 2019 (metres of head)

Westwold Relief Well - Pressure Transducer Data





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Deep wells near site



Summary and what we learned – WWAL perspective



- Many stakeholders means good communication is key
- Experienced drillers with the right equipment made the job go smoothly
- Detailed advanced planning also contributed to success
- Long-term artesian overflow apparently reduced the aquifer pressure, which made it easier to close the well
- Incomplete recovery following extraction from the aquifer is evident
- 2016-19 pressure depletion of 5 to 6 metres....and
- Recovery may not be complete yet



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Questions?

