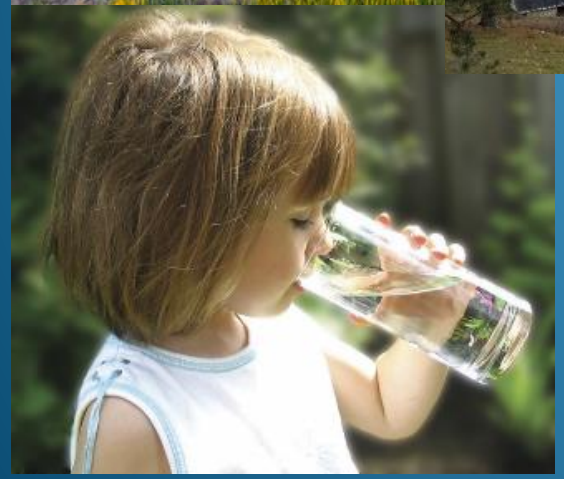
Knowing Your Well and Tracking Its Performance











By: Mike Wei, P. Eng.
For: Small Water Systems BC
Webinar #1
January 20, 2026

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About this Webinar

- 1 hour presentation
- Questions
- CEUs – 0.1 (EOCP) & 1 hour (EGBC)



Recognizing Indigenous Peoples & Territories



Introduction

Questions:

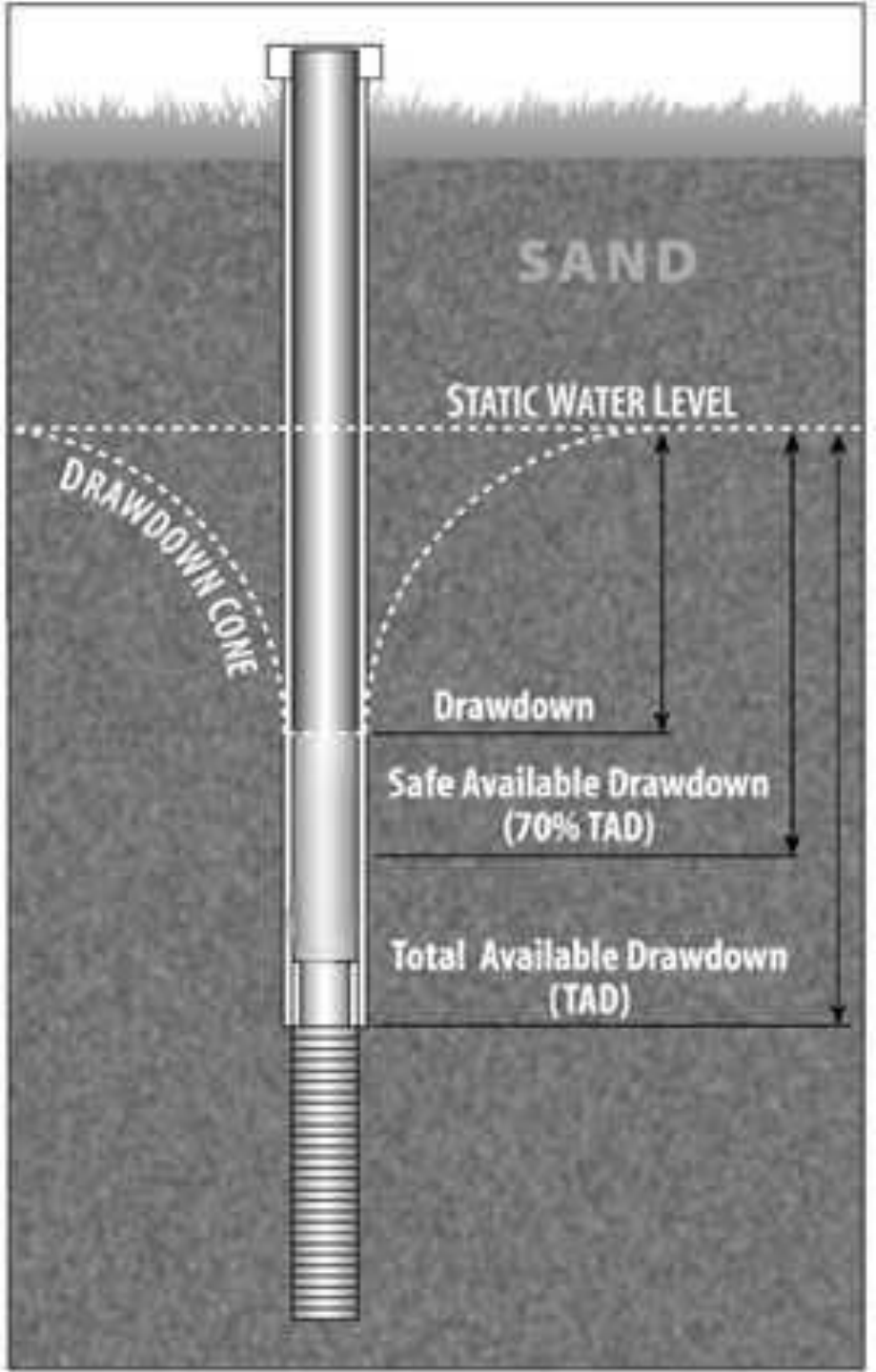
1. Does your water supply system rely on a well?
2. What % of your time as a water operator is spent dealing with your well?
3. Do you monitor:
   a. the water level in your well?
   b. quantity pumped?
   c. *specific capacity* of your well?
4. Do you look at the monitoring results to understand your well's performance over time?



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Agenda

1. Knowing your well from the well record
2. Understanding well performance & well yield
3. Understanding factors that govern well yield
4. What to measure to track well performance
5. Questions

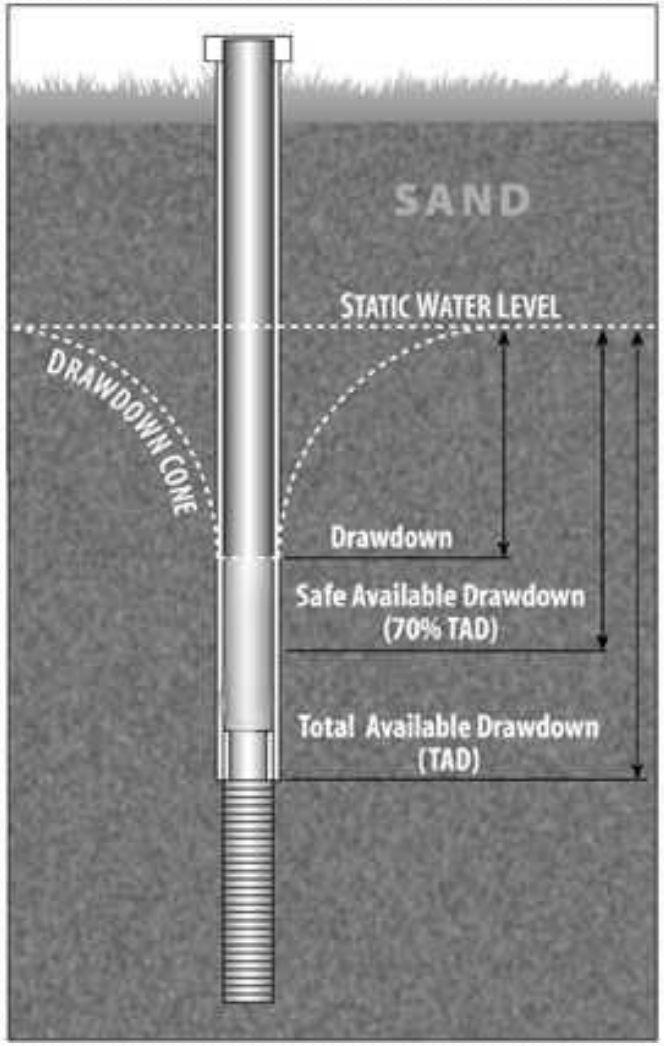


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Wells

Learning Objectives

- Basic components of a well
- Search for record of a specific well in the GWELLS database
- Interpret the well's structure and lithology from the well record
- Diagram the well
- Identify the source aquifer from the well record



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Situation

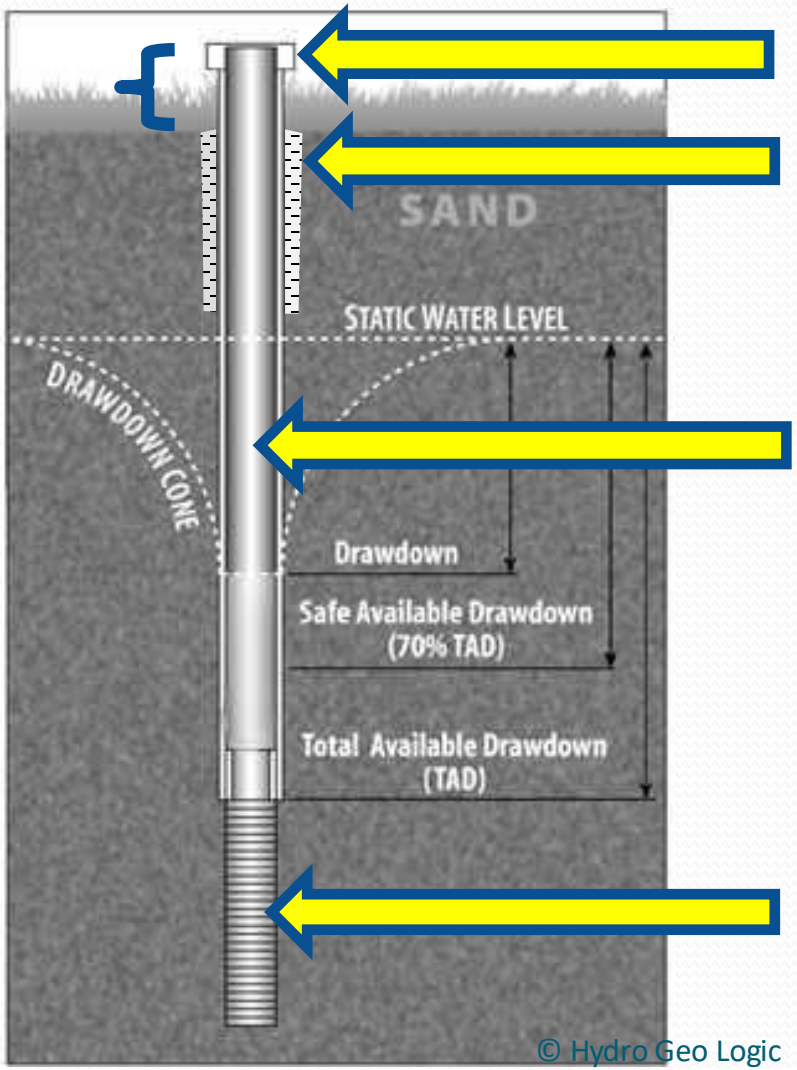
Water operator: “I just started working for a water supply system. I don’t know much about the well because no one kept any records.”



Basic well components: wells drilled in unconsolidated aquifers

Casing stick-up – prevents any water from over-topping the wellhead



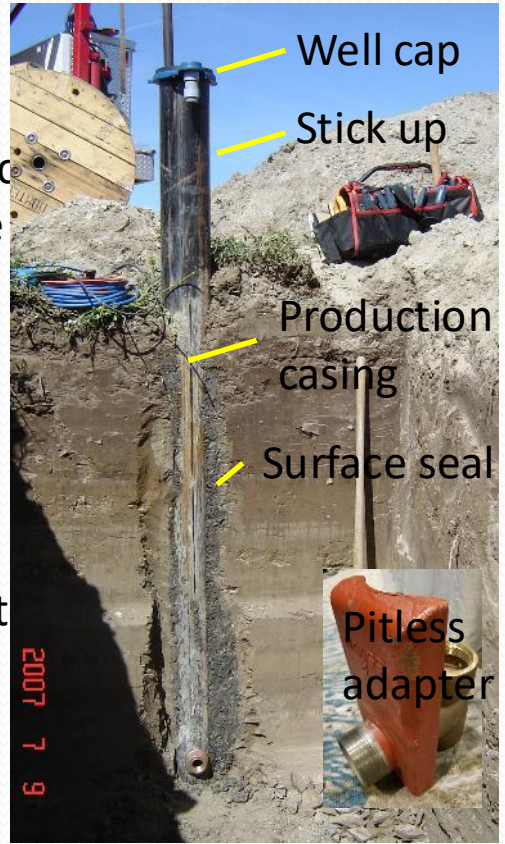


Well cap – prevents stuff from falling into the well

Surface seal – prevents contaminated run-off from seeping down the outside of the well

Production casing – through whic
conveyed from the aquifer to the

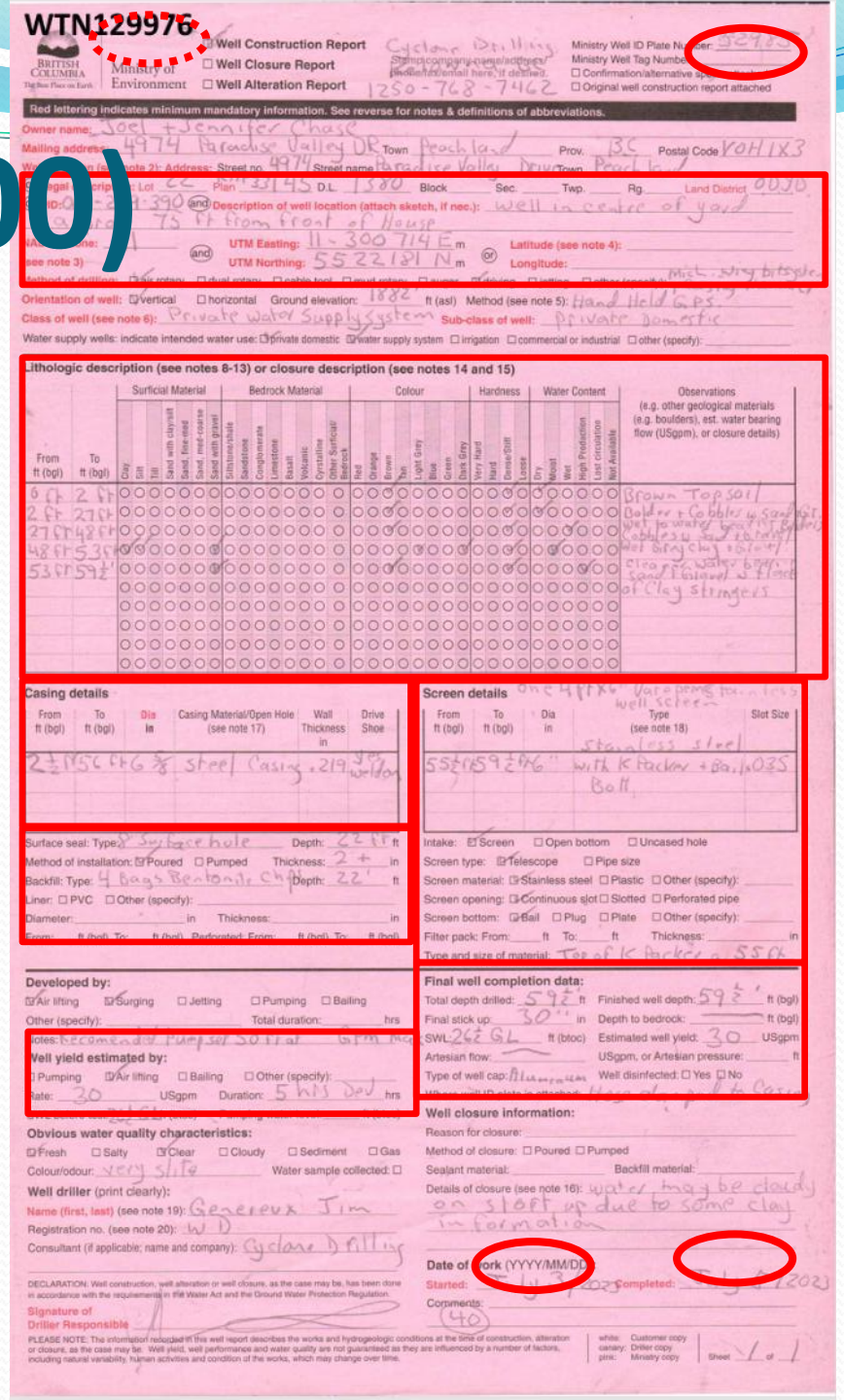
Well screen – allows water to ent
keeps the sediments out



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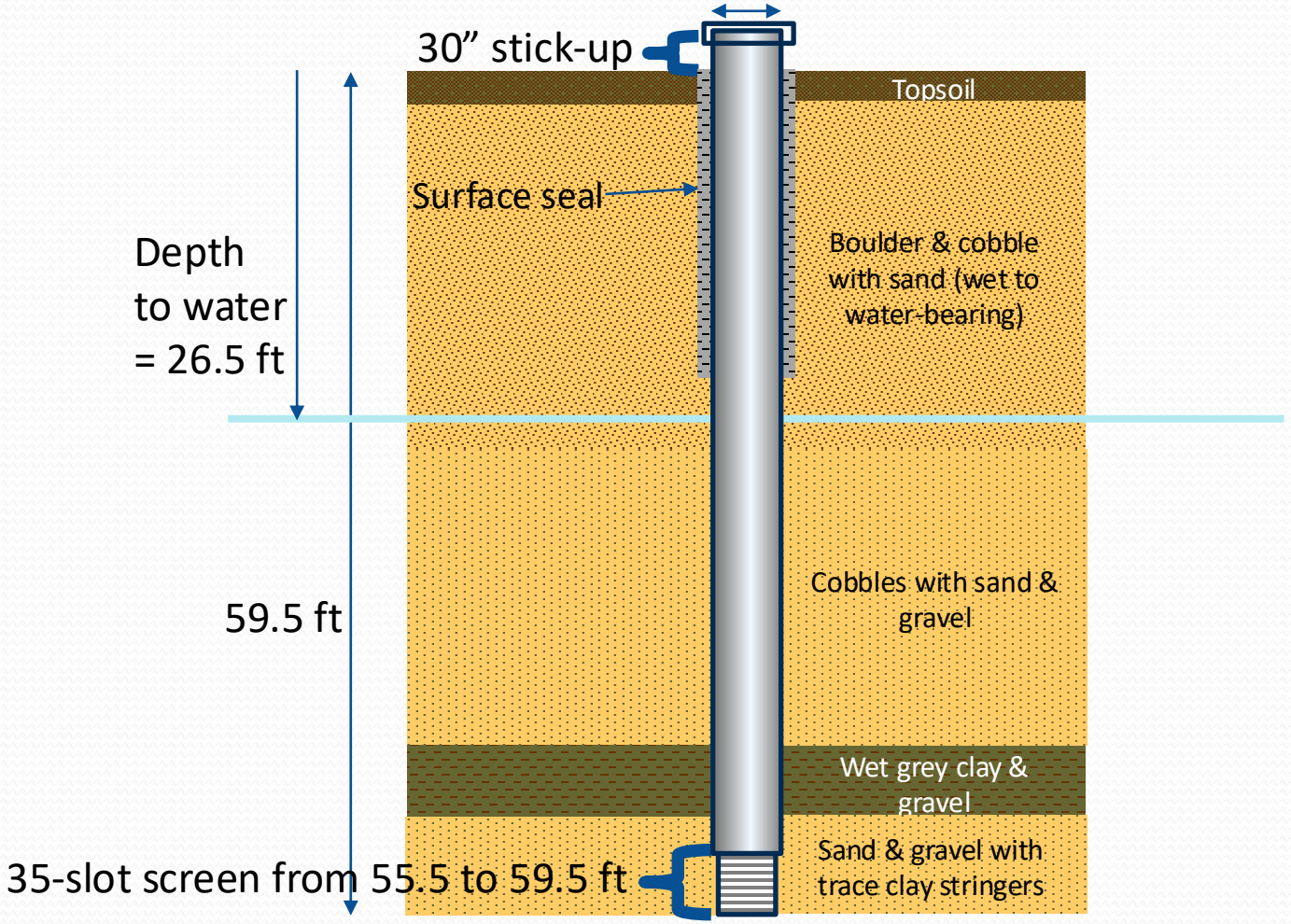
The Well Record (> 2000)

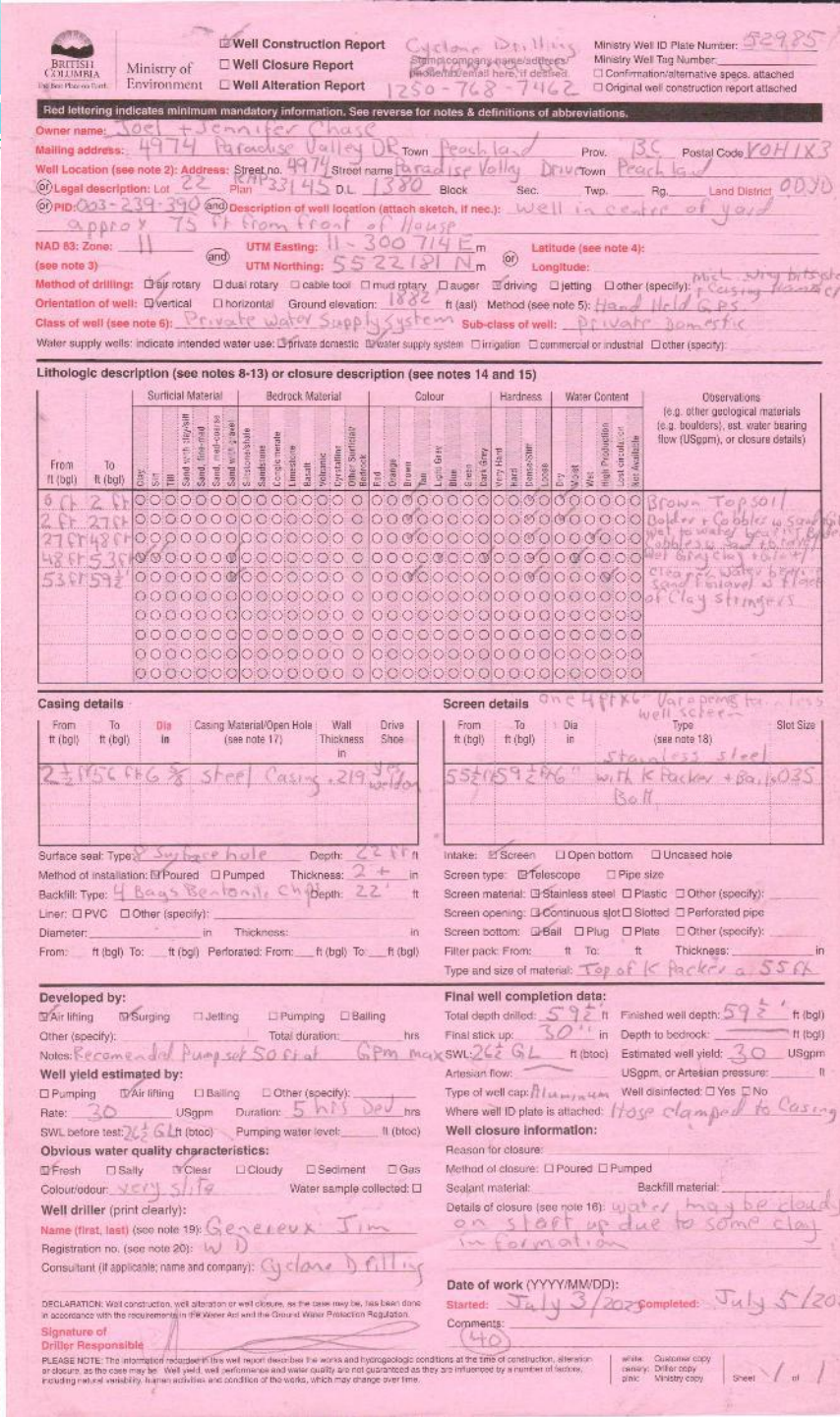
- Driller provides all information
- Well ID Plate Number (WID#) = number on the well ID plate attached to well
- Well Tag Number (WTN) = number assigned in the GWELLS database for the record
- A well is most referred to by its WTN, WID#, or name (e.g., Main St. well)



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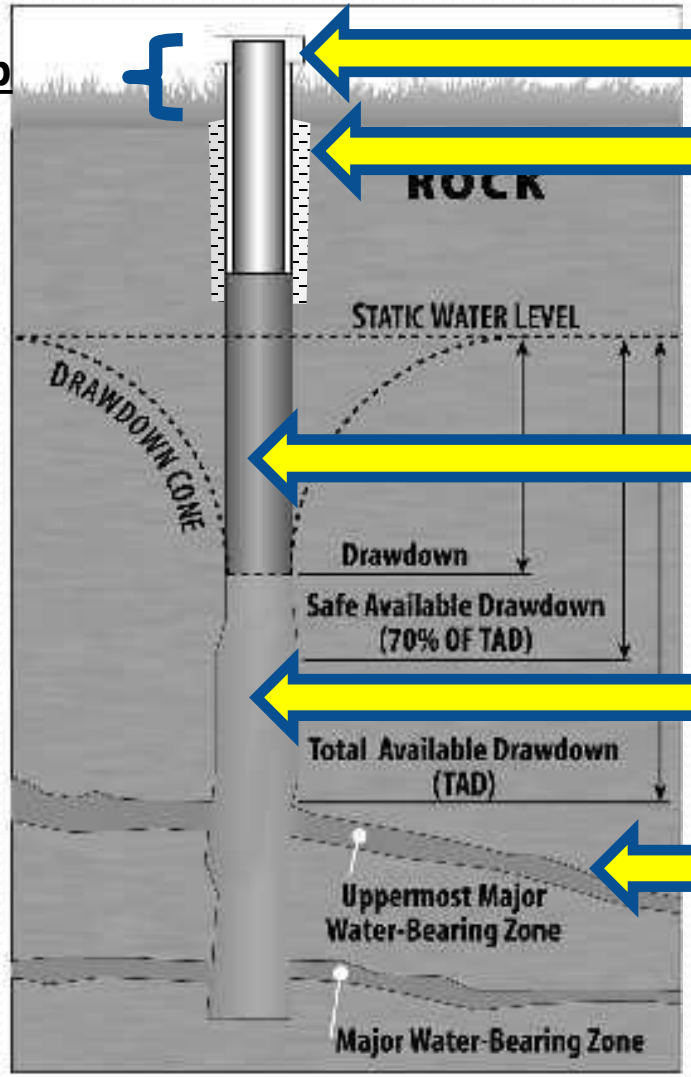
Well Record: WTN 129976




Ministry of Environment
☑ Well Construction Report
☐ Well Closure Report
☐ Well Alteration Report
Ministry Well ID Plate Number: 52985
Red lettering indicates minimum mandatory information. See reverse for notes & definitions of abbreviations.
Owner name: Joel + Jennifer Chase
Mailing address: 4974 Paradise Valley DR Town Peachland Prov. BC Postal Code V0H1X3
Well Location (see note 2): Address: Street no. 4974 Street name Paradise Valley Drive Town Peachland
Legal description: Lot 22 Plan KAP33145 D.L. 1380 Block Sec. Twp. Rg. Land District ODYD
PID: 003-239-390 and Description of well location (attach sketch, if nec.): well in center of yard approx 75 ft from front of house
NAD 83: Zone: 11 and UTM Easting: 11-300 714 E m or Latitude (see note 4):
(see note 3) UTM Northing: 55 22 121 N m Longitude:
Method of drilling: ☐ air rotary ☐ dual rotary ☐ cable tool ☐ mud rotary ☐ auger ☑ driving ☐ jetting ☐ other (specify): pvc casing driven
Orientation of well: ☐ vertical ☐ horizontal Ground elevation: 1882 ft (asl) Method (see note 5): Hand Held GPS
Class of well (see note 6): Private water Supply System Sub-class of well: private Domestic
Water supply wells: indicate intended water use: ☑ private domestic ☐ water supply system ☐ irrigation ☐ commercial or industrial ☐ other (specify):
Lithologic description (see notes 8-13) or closure description (see notes 14 and 15)
From ft (bgl) | To ft (bgl) | Surficial Material | Bedrock Material | Colour | Hardness | Water Content | Observations (e.g. other geological materials (e.g. boulders), est. water bearing flow (USgpm), or closure details)
0 ft 2 ft: Brown Topsoil
2 ft 27 ft: Boulder + Cobbles w Sand Wet to water bearing
27 ft 48 ft: Cobbles w sand + boulders wet bearing to water
48 ft 53 ft: Wet grey clay + gravel
53 ft 59½ ft: clean (minor) Sand + Gravel with layers of Clay stringers
Casing details
From ft (bgl) | To ft (bgl) | Dia in | Casing Material/Open Hole (see note 17) | Wall Thickness in | Drive Shoe
2½ 55 ft 6 in: steel Casing .219 wall
Screen details
From ft (bgl) | To ft (bgl) | Dia in | Type (see note 18) | Slot Size
55 ft 59½ ft 6": one 4 ft x 6" Variopond stainless steel well screen with K Packer + Baffle
Surface seal: Type: Surface hole Depth: 22 ft
Method of installation: ☑ Poured ☐ Pumped Thickness: 2+ in
Backfill: Type: 4 Bags Bentonite Chips Depth: 22' ft
Liner: ☐ PVC ☐ Other (specify):
Diameter: in Thickness: in
From: ft (bgl) To: ft (bgl) Perforated: From: ft (bgl) To: ft (bgl)
Intake: ☑ Screen ☐ Open bottom ☐ Uncased hole
Screen type: ☑ Telescope ☐ Pipe size
Screen material: ☑ Stainless steel ☐ Plastic ☐ Other (specify):
Screen opening: ☑ Continuous slot ☐ Slotted ☐ Perforated pipe
Screen bottom: ☐ Ball ☐ Plug ☐ Plate ☐ Other (specify):
Filter pack: From: ft To: ft Thickness: in
Type and size of material: Top of K Packer @ 55 ft
Developed by:
☑ Air lifting ☑ Surging ☐ Jetting ☐ Pumping ☐ Bailing
Other (specify): Total duration: hrs
Notes: Recommended Pump set 50 ft at 6 GPM max
Well yield estimated by:
☐ Pumping ☑ Air lifting ☐ Bailing ☐ Other (specify):
Rate: 30 USgpm Duration: 5 hrs 5 Dev hrs
SWL before test: 26½ GL ft (btoc) Pumping water level: ft (btoc)
Obvious water quality characteristics:
☑ Fresh ☐ Salty ☑ Clear ☐ Cloudy ☐ Sediment ☐ Gas
Colour/odour: very slight Water sample collected: ☐
Well driller (print clearly):
Name (first, last) (see note 19): Genereux Jim
Registration no. (see note 20): WD
Consultant (if applicable; name and company): Cyclone Drilling
Final well completion data:
Total depth drilled: 59½ ft Finished well depth: 59½ ft (bgl)
Final stick up: 30" in Depth to bedrock: ft (bgl)
SWL: 26½ GL ft (btoc) Estimated well yield: 30 USgpm
Artesian flow: USgpm, or Artesian pressure: ft
Type of well cap: Aluminum Well disinfected: ☐ Yes ☐ No
Where well ID plate is attached: Hose clamped to Casing
Well closure information:
Reason for closure:
Method of closure: ☐ Poured ☐ Pumped
Sealant material: Backfill material:
Details of closure (see note 16): water may be cloudy on start up due to some clay in formation
Date of work (YYYY/MM/DD):
Started: July 3/20 Completed: July 5/20
Comments:
(40)
DECLARATION: Well construction, well alteration or well closure, as the case may be, has been done in accordance with the requirements of the Water Act and the Ground Water Protection Regulation.
Signature of Driller Responsible
PLEASE NOTE: The information recorded in this well report describes the works and hydrogeologic conditions at the time of construction, alteration or closure, as the case may be. Well yield, well performance and water quality are not guaranteed as they are influenced by a number of factors, including natural variability, human activities and condition of the works, which may change over time.
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Sheet 1 of 1

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Basic well components: wells drilled in bedrock aquifers



Well cap

Surface seal

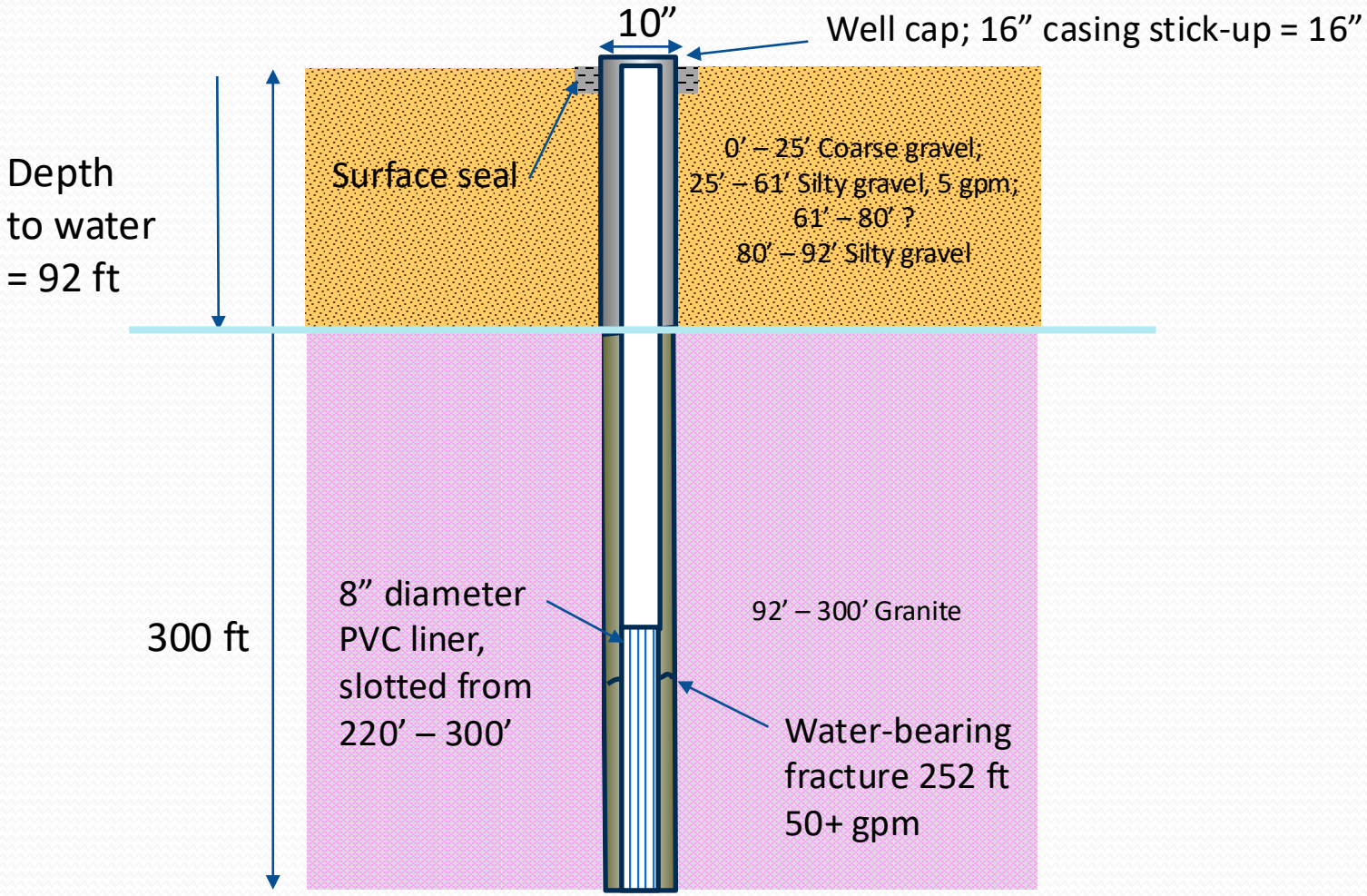
Production casing – cased only into the top of the bedrock

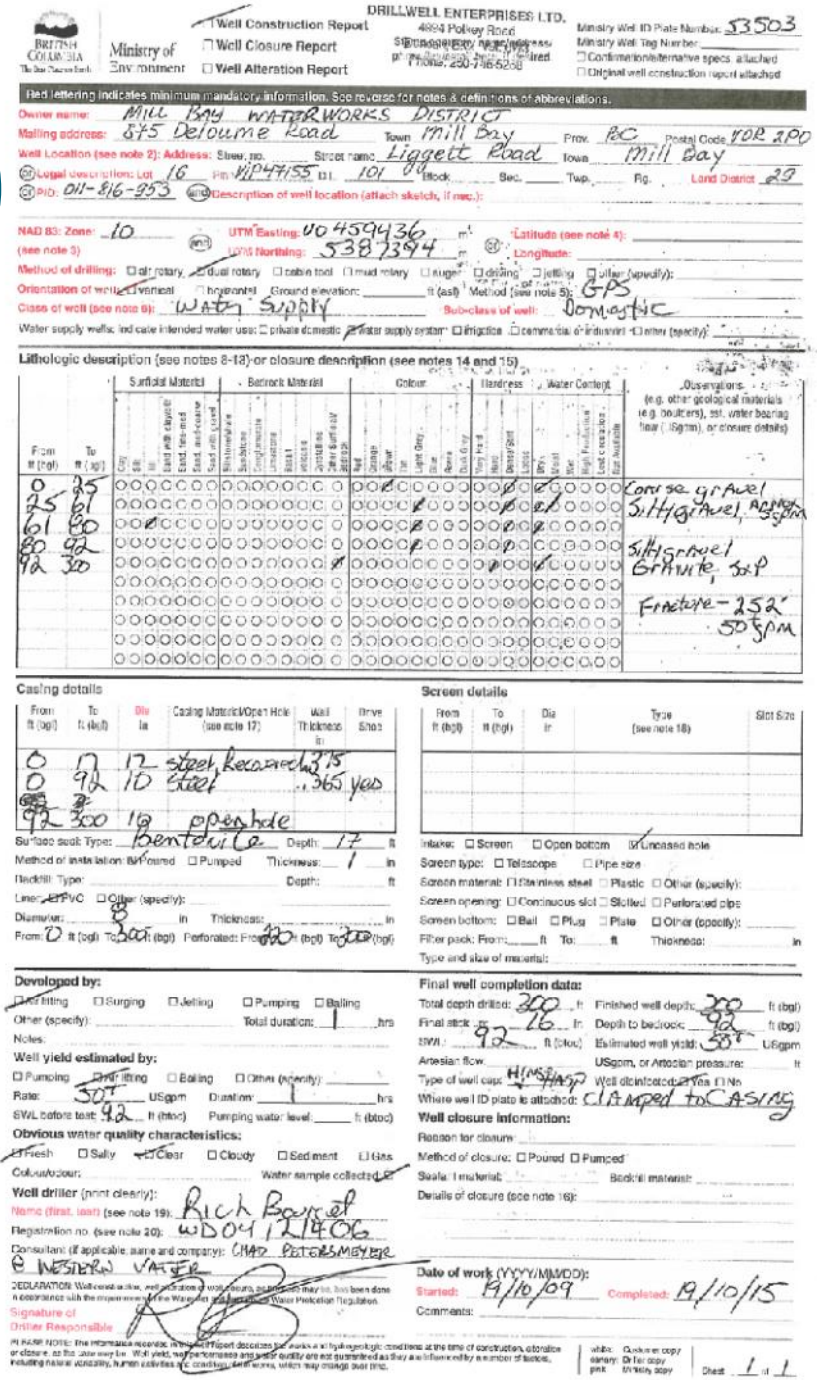
Open hole – may need to be lined to protect pump

Upper-most major water-bearing fracture – water level in well should never be drawn down below this level (reduces productivity; alters natural water chemistry)

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Well Record: WTN 119110




DRILLWELL ENTERPRISES LTD.
Well Construction Report
Well Closure Report
Well Alteration Report
Ministry of Environment
Owner name: MILL BAY WATERWORKS DISTRICT
Mailing address: 575 Deloume Road Town Mill Bay
Well Location (see note 2): Address: Street name Liggett Road Town Mill Bay
Legal description: Lot 16 Plan VIP47155 DL 101 Block Sec. Twp. Rg. Land District 29
PID: 011-816-953
NAD 83: Zone: 10 UTM Easting: 0459436 Northing: 5387394
Method of drilling: dual rotary
Orientation of well: vertical
Class of well (see note 6): Water Supply
Subclass of well: Domestic
Lithologic description (see notes 8-13) or closure description (see notes 14 and 15)
From ft (bgl) To ft (bgl)
0 25 Coarse gravel
25 61 Silty gravel, 5gpm
61 80
80 92 Silty gravel
92 300 Granite, 50+
Fracture – 252’ 50 gpm
Casing details
0 17 17 steel, recovered 3.75
0 92 10 steel .365 wall
92 300 10 open hole
Surface seal Type: bentonite Depth: 17 ft
Method of installation: Poured Thickness: 1 in
Liner: PVC
Diameter: 8 in Thickness: in
From 0 ft (bgl) To 300 ft (bgl) Perforated: From 220 ft (bgl) To 300 ft (bgl)
Screen details
Intake: Screen Open bottom Uncased hole
Screen type: Telescope
Screen material: Stainless steel Plastic
Screen opening: Continuous slot Slotted
Screen bottom: Ball Plug Plate
Filter pack: From: ft To: ft Thickness: in
Developed by:
Surging Jetting Pumping Bailing
Total duration: 1 hrs
Well yield estimated by:
Pumping Bailing
Rate: 50+ USgpm Duration: 1 hrs
SWL before test: 92 ft (btoc) Pumping water level: ft (btoc)
Obvious water quality characteristics:
Fresh Clear
Colour/odour: Water sample collected
Well driller (print clearly):
Name (first, last) (see note 19): Rich Bourret
Registration no. (see note 20): WD041214406
Consultant (if applicable, name and company): CHAD PETERSMEYER @ WESTERN WATER
Final well completion data:
Total depth drilled: 300 ft Finished well depth: 300 ft (bgl)
Final stick up: 16 in Depth to bedrock: 92 ft (bgl)
SWL: 92 ft (btoc) Estimated well yield: 50+ USgpm
Artesian flow: USgpm, or Artesian pressure: ft
Type of well cap: HINGED Well disinfected? Yes No
Where well ID plate is attached: clamped to CASING
Well closure information:
Reason for closure:
Method of closure: Poured Pumped
Seals: material: Backfill material:
Details of closure (see note 16):
Date of work (YYYY/MM/DD):
Started: 19/10/09 Completed: 19/10/15
Comments:
DECLARATION: Well construction, well alteration or well closure, as described, has been done in accordance with the requirements of the Water Act and Well Protection Regulation
Signature of Driller Responsible
Page 1 of 1

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Searching for a well in the GWELLS database

Example search (e.g., use well ID plate number): WID#53503

- Well Search
- Water Resource Atlas of BC
- iMAPBC



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Diagram your well

- Based on information in the well record*
- Diagram to vertical scale
- Diagram the works (e.g., casing, screen, cap, surface seal), lithologies and water-bearing zones, water levels
- Allows well structure and geology and source aquifer to be visualized

* Field measurements may be needed if no well record is available

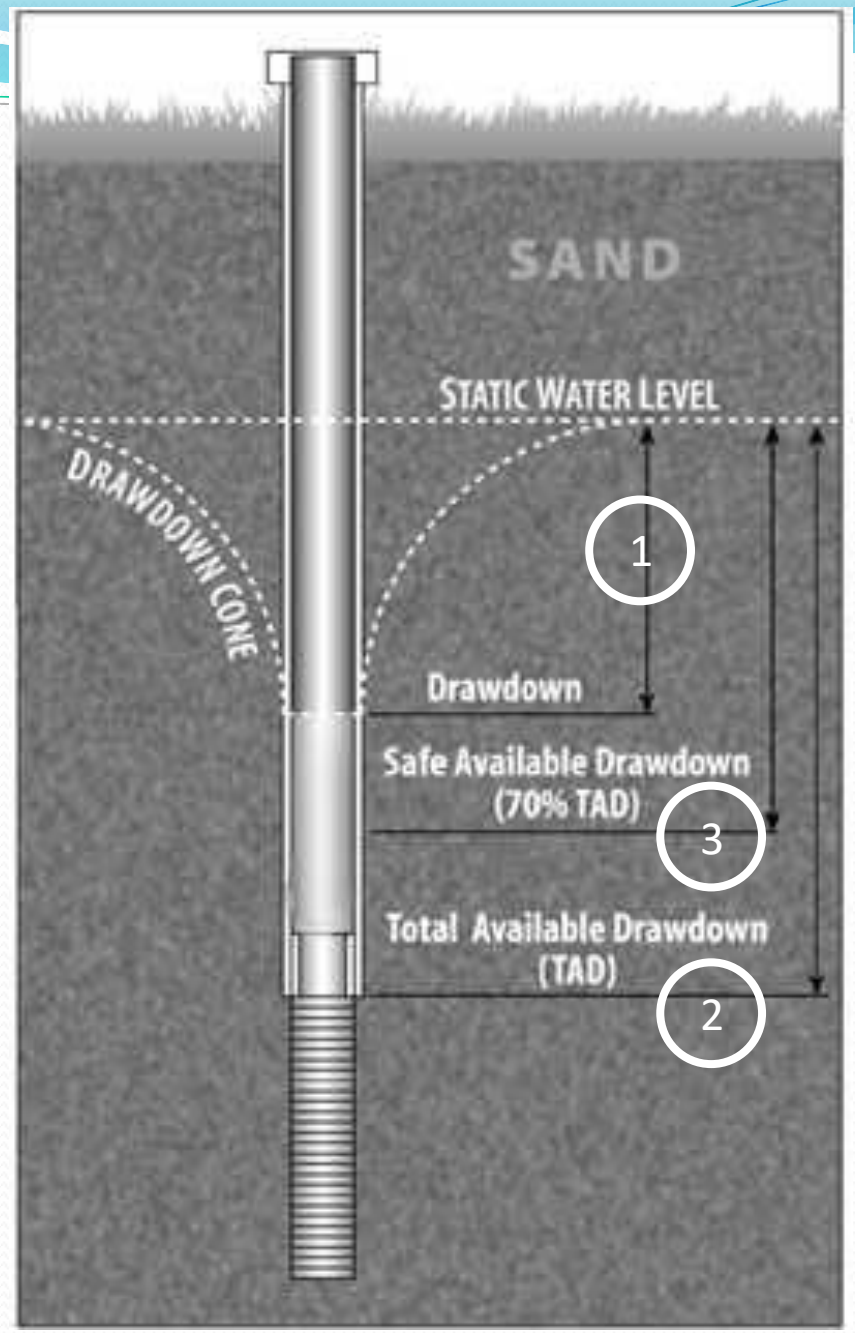
Community Well at Nicola Lake, B.C.

Depth (m)	Lithologic Description	Well Construction	Lithologic Log	Hydrogeologic Interpretation
0 - 0.6	Sandy top soil	casing		Deposited by Nicola River (moving water) during the last period of glaciation.
0.6 - 1.2	Silty brown sand, dry			
1.2 - 3	Dark grey sand, silty, saturated			
3 - 11.3	Silty sand and gravel (pebble size gravel)			
11.3 - 21.3	Silty fine sand and silt, dark grey			
21.3 - 23.2	Silt with silty sand layers, dark grey			Deposited by glacial Lake Hamilton (still water) during the last period of glaciation.
23.2 - 27.4	Silty clay, grey			
27.4 - 28.9	Clay brown			
28.9 - 32.9	Sand and gravel with clay, little water			
32.9 - 35.7	Dense clay, grey-brown			
35.7 - 50.3	Silty clay, sandy in some intervals			
50.3 - 78.9	Till, gravelly, bouldery			Deposited by glacier during the last period of glaciation.
78.9 - 84.4	Medium grained sand, some gravel and lenses of clay, also coallenses	screen		Deposited by meltwaters (moving water) ahead of advancing glacier.

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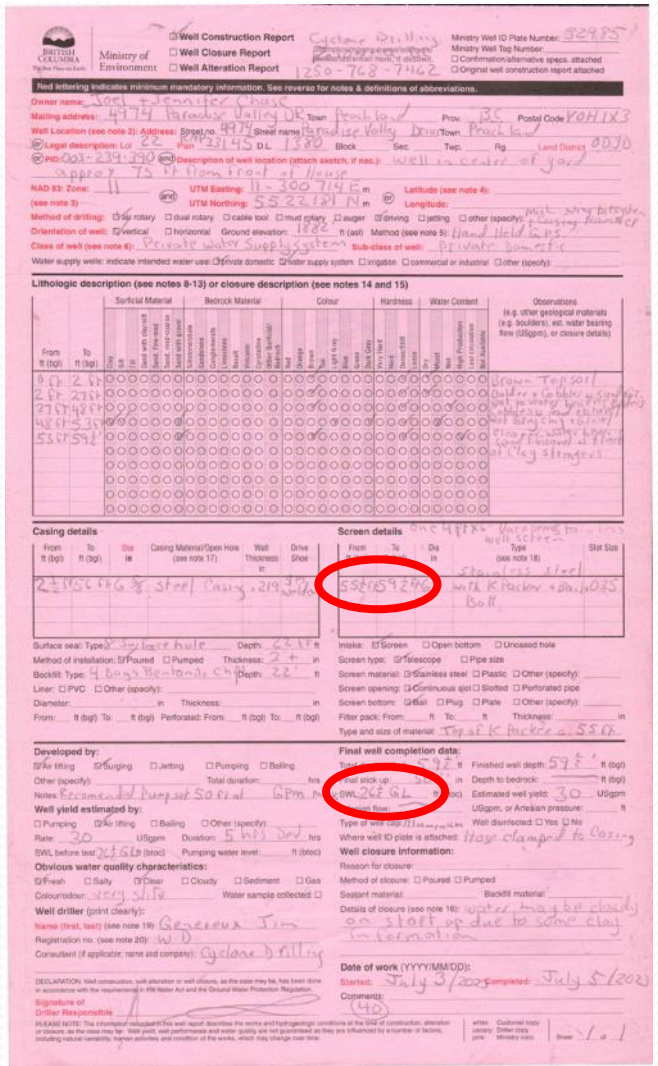
Important definitions

1. *Drawdown* (static (non-pumping) water level) – pumping water level)
2. *Total available drawdown* (static water level to top of screen or water-bearing fracture)
3. *Safe available drawdown* (70% of total available drawdown)



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Available drawdown: WTN 129976



Ministry of Environment

☐ Well Construction Report
☐ Well Closure Report
☐ Well Alteration Report

Red lettering indicates minimum mandatory information. See reverse for notes & definitions of abbreviations.

Owner name: Cyclone Drilling
Mailing address: 4974 Paradise Valley DR Town Prince George Prov. BC Postal Code V0H1X3
Well Location (see note 2): Address: Street no. 4974 Street name Paradise Valley Dr. Town Prince George
Legal description: Lot 22 Plan 31945 D.L. 1380 Block Sec. Twp. Rg. Land District 0070
PID: 003-234-390 and Description of well location (attach sketch, if nec.): well in center of yard approx 75 ft from front of house
NAD 83: Zone: 11 UTM Easting: 11-300 714 E m or Latitude (see note 4):
(see note 3) UTM Northing: 55 22 121 N m or Longitude:
Method of drilling: ☐ air rotary ☐ dual rotary ☐ cable tool ☐ mud rotary ☐ auger ☑ driving ☐ jetting ☐ other (specify): mist rotary through casing hammer
Orientation of well: ☑ vertical ☐ horizontal Ground elevation: 1682 ft (asl) Method (see note 5): Hand Held GPS
Class of well (see note 6): Private Water Supply System Sub-class of well: private domestic
Water supply wells: indicate intended water use: ☐ private domestic ☑ water supply system ☐ irrigation ☐ commercial or industrial ☐ other (specify):

Lithologic description (see notes 8-13) or closure description (see notes 14 and 15)

From ft (bgl)	To ft (bgl)	Surficial Material	Bedrock Material	Colour	Hardness	Water Content	Observations (e.g. other geological materials (e.g. boulders), est. water bearing flow (USgpm), or closure details)
0	2 ft						brown Topsoil
2 ft	27 ft						Boulder & Cobble with sand (wet to water bearing)
27 ft	55 ft						Cobbles with sand & gravel
55 ft	59 ft						Sand & gravel with trace clay stringers

Casing details

From ft (bgl)	To ft (bgl)	Dia in	Casing Material/Open Hole (see note 17)	Wall Thickness in	Drive Shoe
2 ft	55 ft	6 5/8	steel Casing	.219	

Screen details

From ft (bgl)	To ft (bgl)	Dia in	Type (see note 18)	Slot Size
55 ft	59 ft	6	stainless steel Bolt with K Packer + Ba. 1035	

Surface seal: Type: Cylinder hole Depth: 2 ft
Method of installation: ☑ Poured ☐ Pumped Thickness: 2 + in
Backfill: Type: 4 Bags Bentonite Chips Depth: 22' ft
Liner: ☐ PVC ☐ Other (specify):
Diameter: in Thickness: in
From: ft (bgl) To: ft (bgl) Perforated: From: ft (bgl) To: ft (bgl)

Intake: ☑ Screen ☐ Open bottom ☐ Uncased hole
Screen type: ☑ Telescope ☐ Pipe size
Screen material: ☑ Stainless steel ☐ Plastic ☐ Other (specify):
Screen opening: ☑ Continuous slot ☐ Slotted ☐ Perforated pipe
Screen bottom: ☑ Ball ☐ Plug ☐ Plate ☐ Other (specify):
Filter pack: From: ft To: ft Thickness: in
Type and size of material: Top of K Packer @ 55ft

Developed by:
☑ Air lifting ☑ Surging ☐ Jetting ☐ Pumping ☐ Bailing
Other (specify): Total duration: hrs
Notes: Recommend Pump at 50 ft at 6 GPM

Well yield estimated by:
☐ Pumping ☑ Air lifting ☐ Bailing ☐ Other (specify):
Rate: 30 USgpm Duration: 5 hrs Dev hrs
SWL before test: 26 ft GL (btoc) Pumping water level: ft (btoc)

Obvious water quality characteristics:
☑ Fresh ☐ Salty ☑ Clear ☐ Cloudy ☐ Sediment ☐ Gas
Colour/odour: grey Silt Water sample collected: ☐

Well driller (print clearly):
Name (first, last) (see note 19): Genereux Jim
Registration no. (see note 20): WD
Consultant (if applicable; name and company): Cyclone Drilling

Final well completion data:
Total depth drilled: 59 ft
Final stick up: 30 in
(+) SWL: 26 ft GL (btoc)
Artesian flow: USgpm
Type of well cap installed:
Where well ID plate is attached: Hose clamped to Casing

Well closure information:
Reason for closure:
Method of closure: ☐ Poured ☐ Pumped
Sealant material: Backfill material:
Details of closure (see note 16): water may be cloudy on start up due to some clay in formation

Finished well depth: 59 ft
Depth to bedrock: ft
Estimated well yield: 30 USgpm
USgpm, or Artesian pressure: ft
Well disinfected: ☐ Yes ☐ No

Date of work (YYYY/MM/DD):
Started: July 3/2023 Completed: July 5/2023
Comments:
(40)

DECLARATION: Well construction, well alteration or well closure, as the case may be, has been done in accordance with the requirements in the Water Act and the Ground Water Protection Regulation.
Signature of Driller Responsible
PLEASE NOTE: The information recorded in this well report describes the works and hydrogeologic conditions at the time of construction, alteration or closure, as the case may be. Well yield, well performance and water quality are not guaranteed as they are influenced by a number of factors, including natural variability, human activities and condition of the works, which may change over time.
White: Customer copy canary: Driller copy pink: Ministry copy
Page 1 of 1

Depth to water = 26.5 ft

59.5 ft

Screen & assembly 55.5 to 59.5 ft

30” stick-up

Surface seal

Topsoil

Boulder & cobble with sand (wet to water-bearing)

Total available drawdown = 29 ft

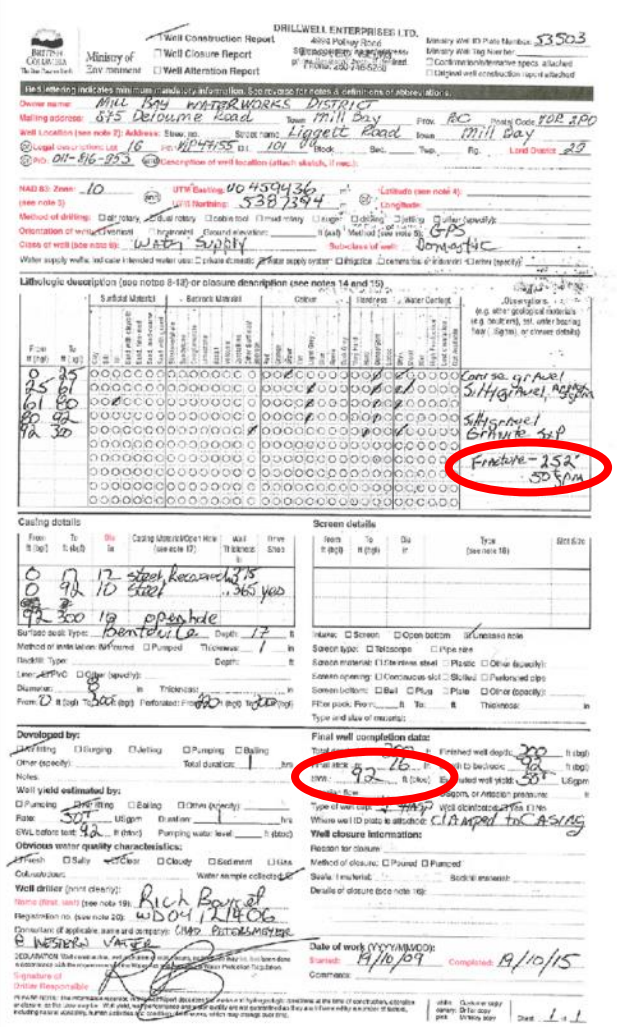
Cobbles with sand & gravel

Wet grey clay & gravel

Sand & gravel with trace clay stringers

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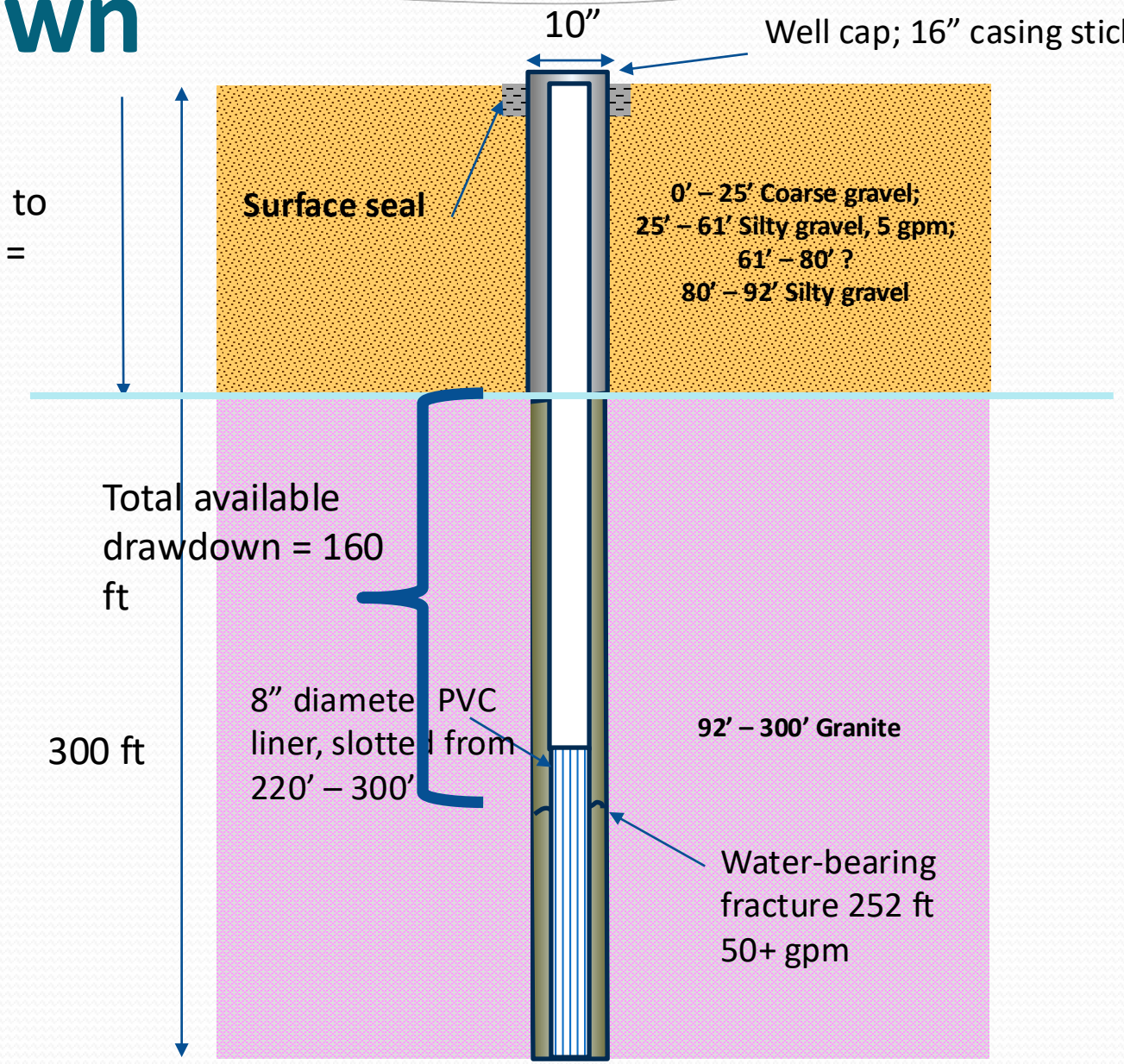
Available drawdown in a well



Depth to water = 92 ft

Total available drawdown = 160 ft

300 ft



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Wells – key points

- Two main types of aquifers (unconsolidated and bedrock); construction of wells different for unconsolidated vs. fractured bedrock aquifers
- Many wells are registered in the GWELLS database
  - Records of unregistered wells may be obtained from well owner or local driller (can be challenging)
- Diagraming well is useful to visualize its construction, lithology, and to determine *available (and safe available) drawdown*

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Learning objectives – well yield & well performance

1. How water is yielded from an aquifer during pumping
2. Difference between aquifer or formation loss, well loss, and well efficiency
3. Drawdown and specific capacity
4. Calculating well capacity using the 100-day method (Q_{100})

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Problem: Understanding and determining well yield

Well yield may be inferred from:

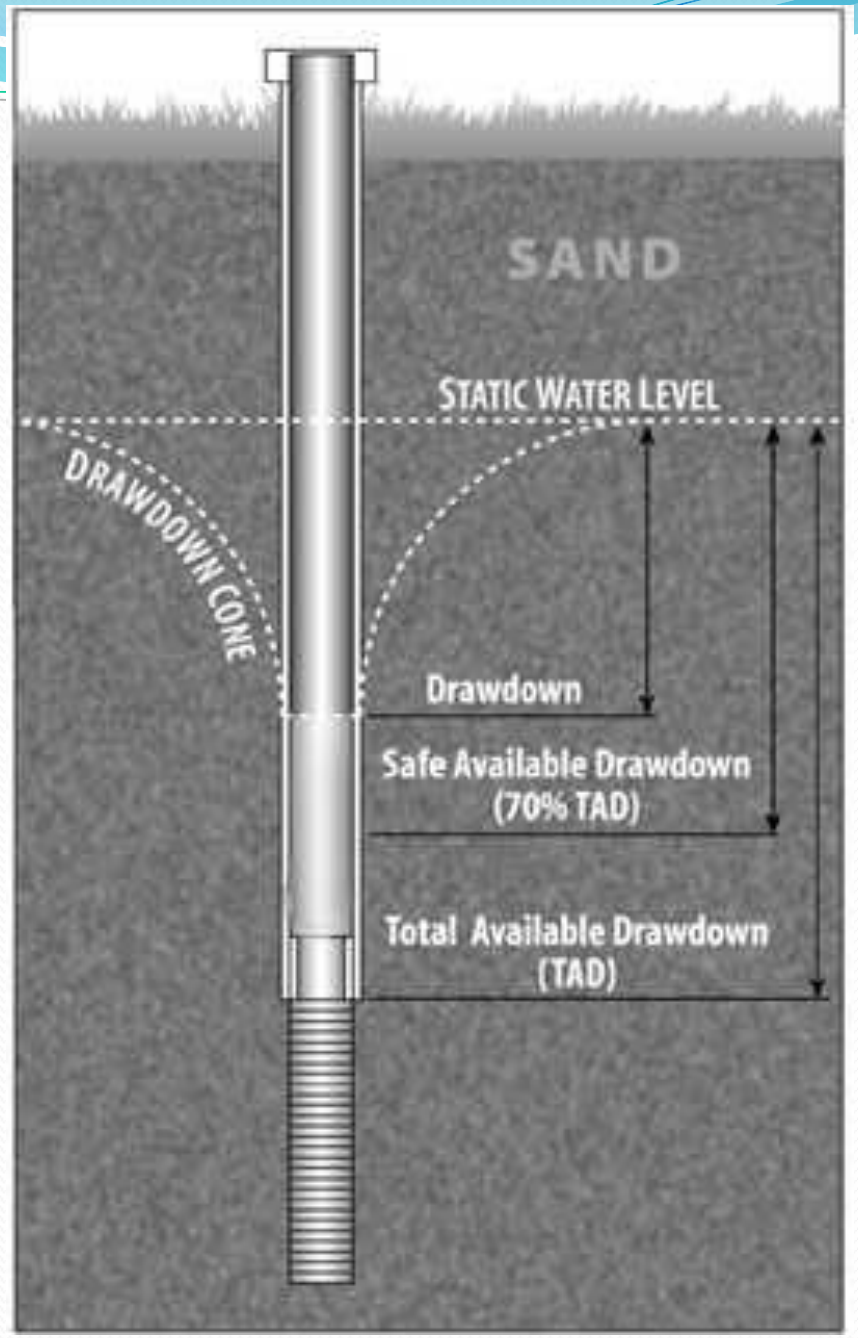
- Driller's estimate from the well record
- Well pump capacity
- **Pump testing the well** (and measuring drawdown, specific capacity)



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Pumping Test
Key Definitions

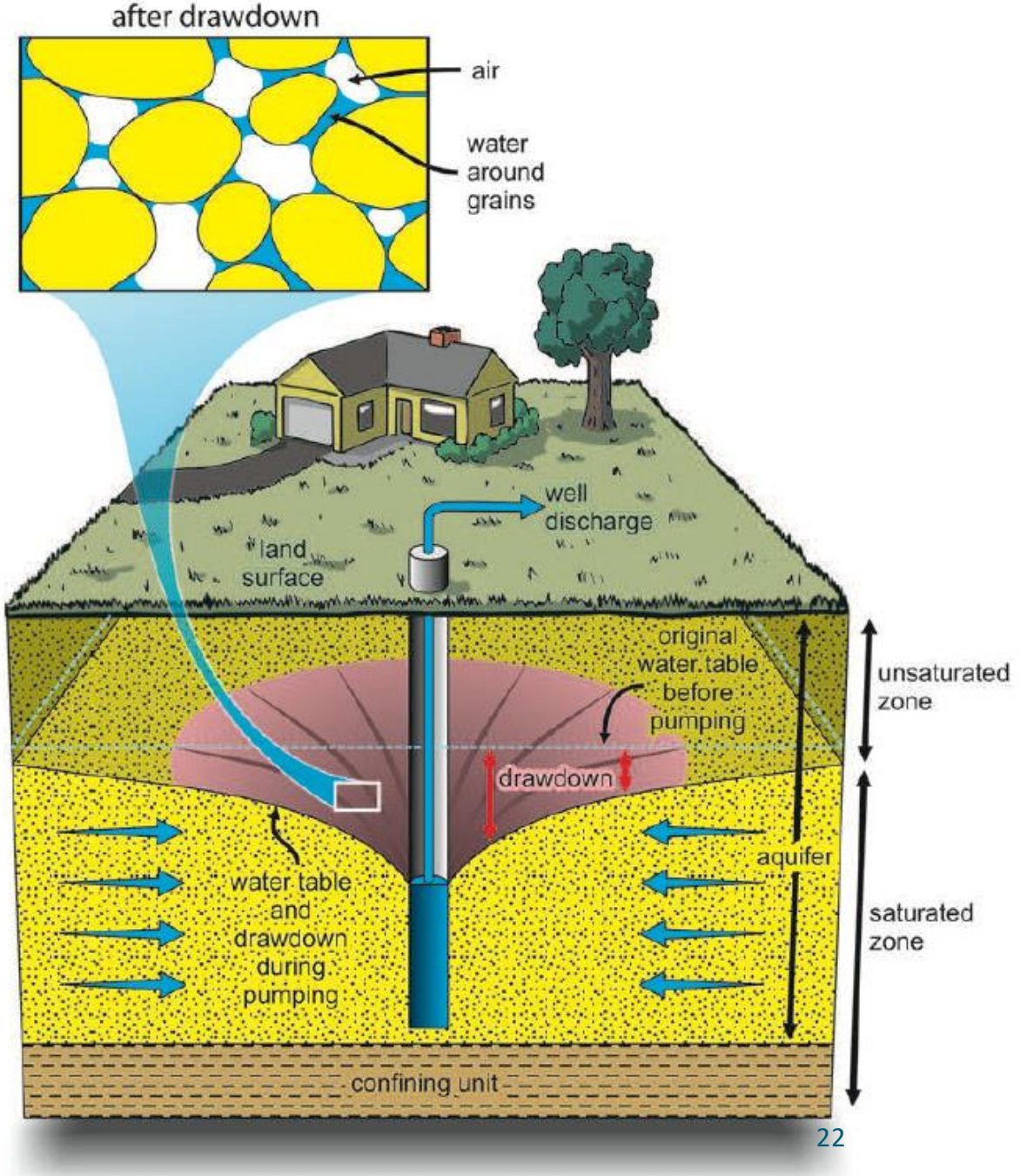
1. Static water level
2. Pumping water level
3. Drawdown (difference between static water & pumping level)
4. Specific capacity (of the well = pumping rate (Q) / drawdown)



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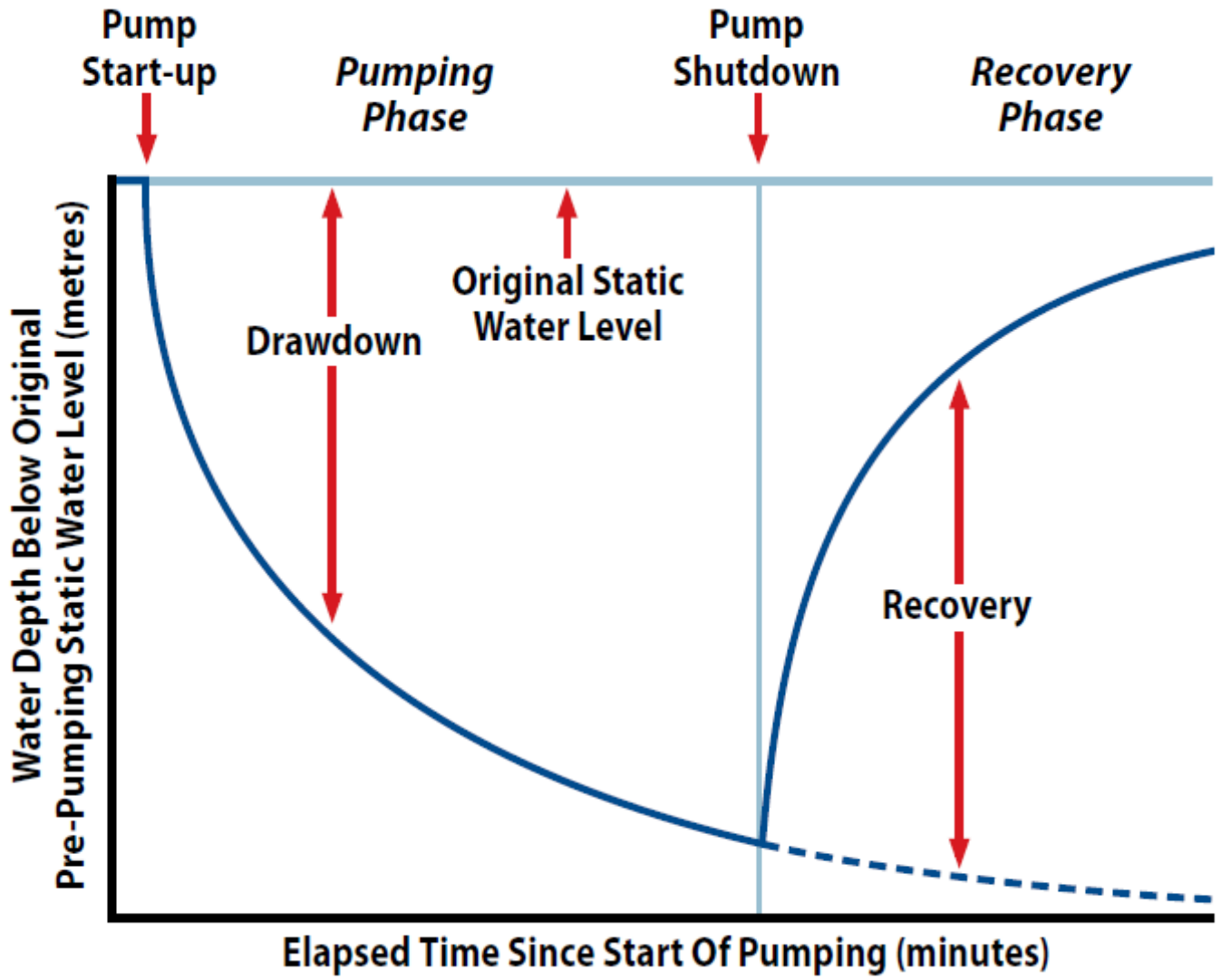
Response to pumping

- Pumping lowers the water level in and around the well
- This increases the hydraulic gradient to drive water towards the well
- The gradient is steepest at the well and decreases away from the well (increasingly greater cross-sectional area for flow)
- Pumping creates a vortex or *cone of depression* or *cone of drawdown* around the pumping well
- The cone of depression grows at an exponentially decreasing rate beyond the pumping well with time
- As long as the pumping water level in the well is dropping, the cone is growing



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Pumping Test

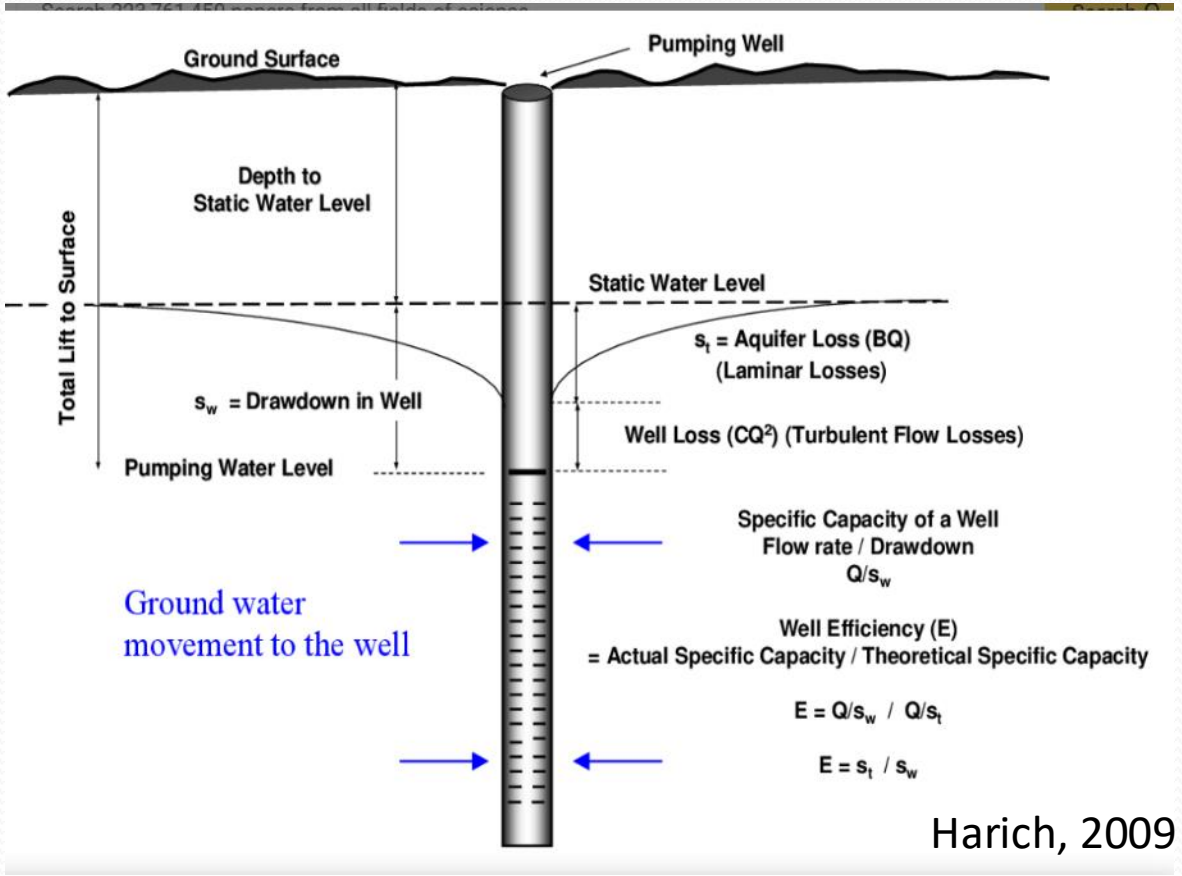


- Well is pumped for a specified (24- or 72-hour) period (pumping phase)
- Water levels are monitored in pumping well (and nearby observation wells)
- Monitoring continues after pumping stops (recovery phase)

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Aquifer Loss vs Well Loss

- Groundwater loses head (energy) to flow to the well (formation loss)
- At the well, groundwater loses additional frictional head loss (well loss) from:
  - formation damage from drilling,
  - inefficient screen design or
  - insufficient well development
- Well loss causes additional drawdown in the pumping well, thereby utilizing more available drawdown and decreasing well yield – <u>well inefficiency</u>

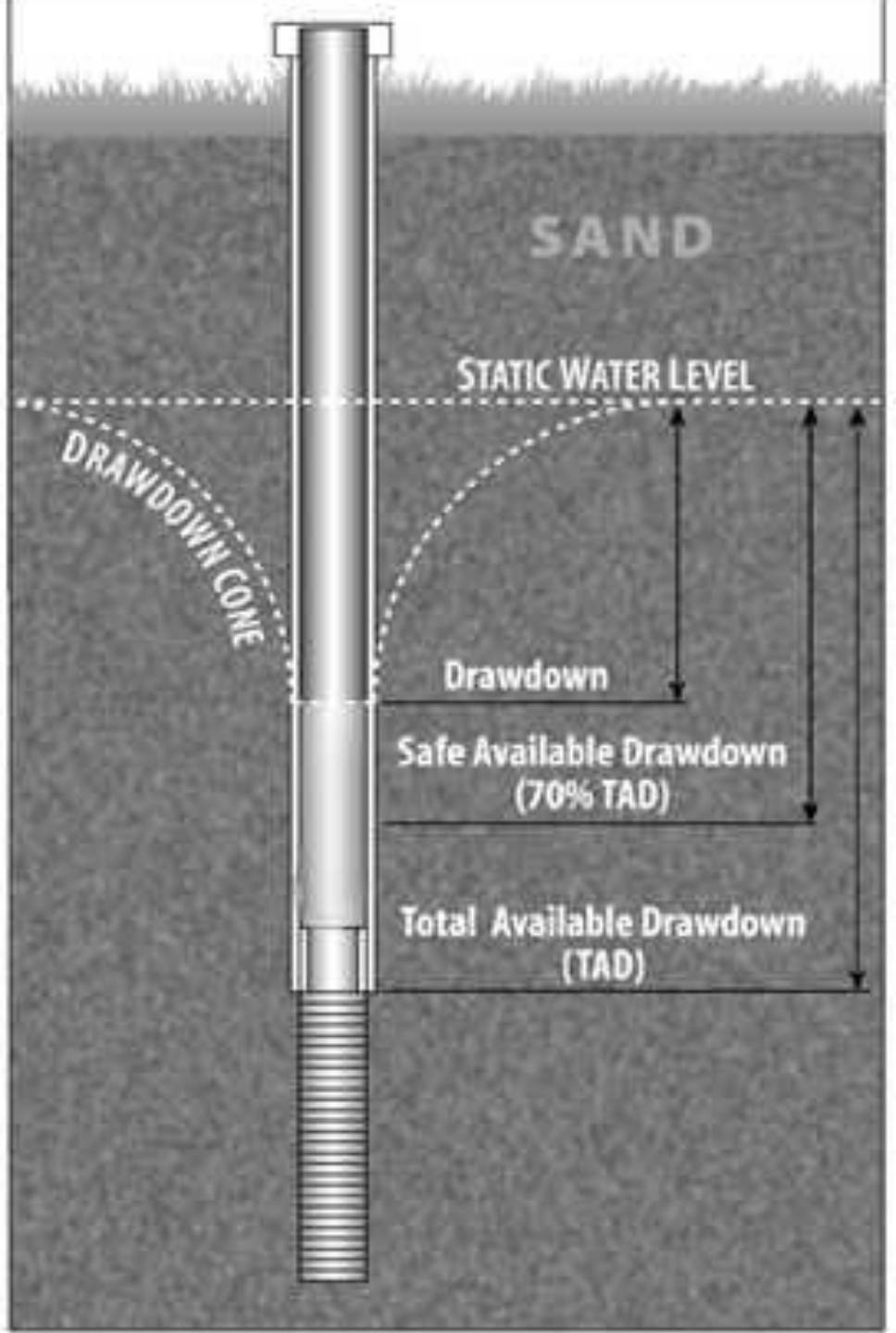


Harich, 2009

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Specific Capacity – Indicator of Well Performance

- Specific capacity (SC):
  - = Pumping rate / drawdown
  - reflects the productivity of the aquifer and efficiency of the pumping well
  - is a function of time since pumping started (SC decreases (unless the pumping drawdown stabilizes)) – need time reference when comparing SC from year-to-year
- A decrease year-to-year in SC indicates declining well performance

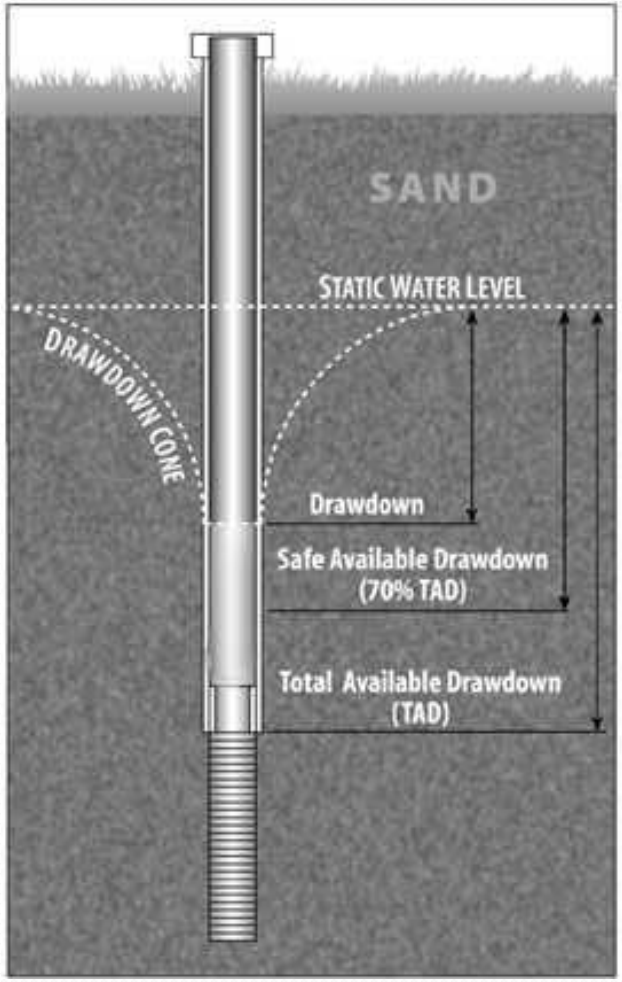


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Well Yield governed by Available Drawdown and Well Performance (Specific Capacity)

- *Well yield* is the product of *specific capacity* and *available drawdown* (ADD)

Well yield, Q = 0.7 × ADD × SC

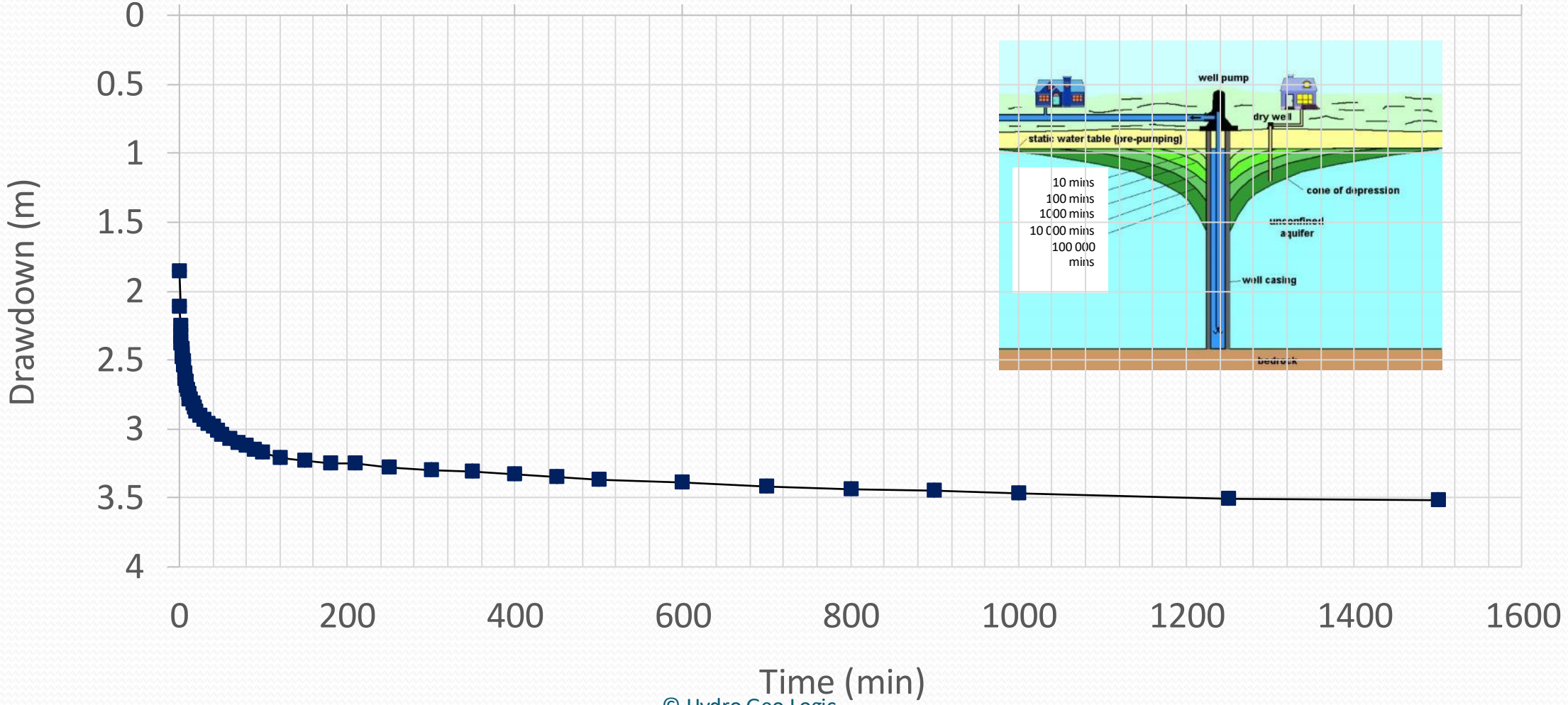


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Pumping Test

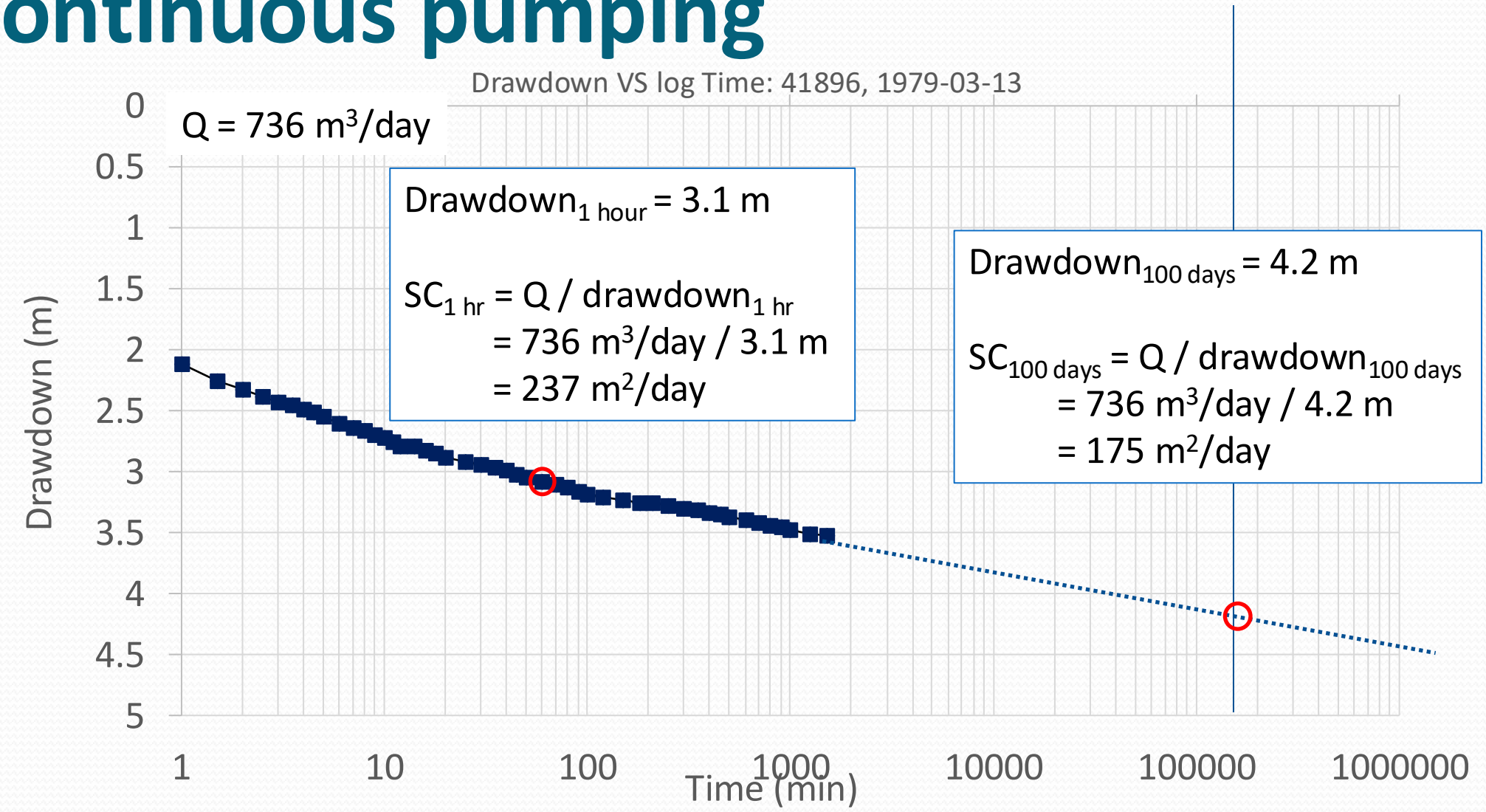
Drawdown VS log Time: 41896, 1979-03-13

Drawdown in a Pumping Well with Time (Qualicum Beach)



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Specific capacity after 1 hour or 100 days of continuous pumping



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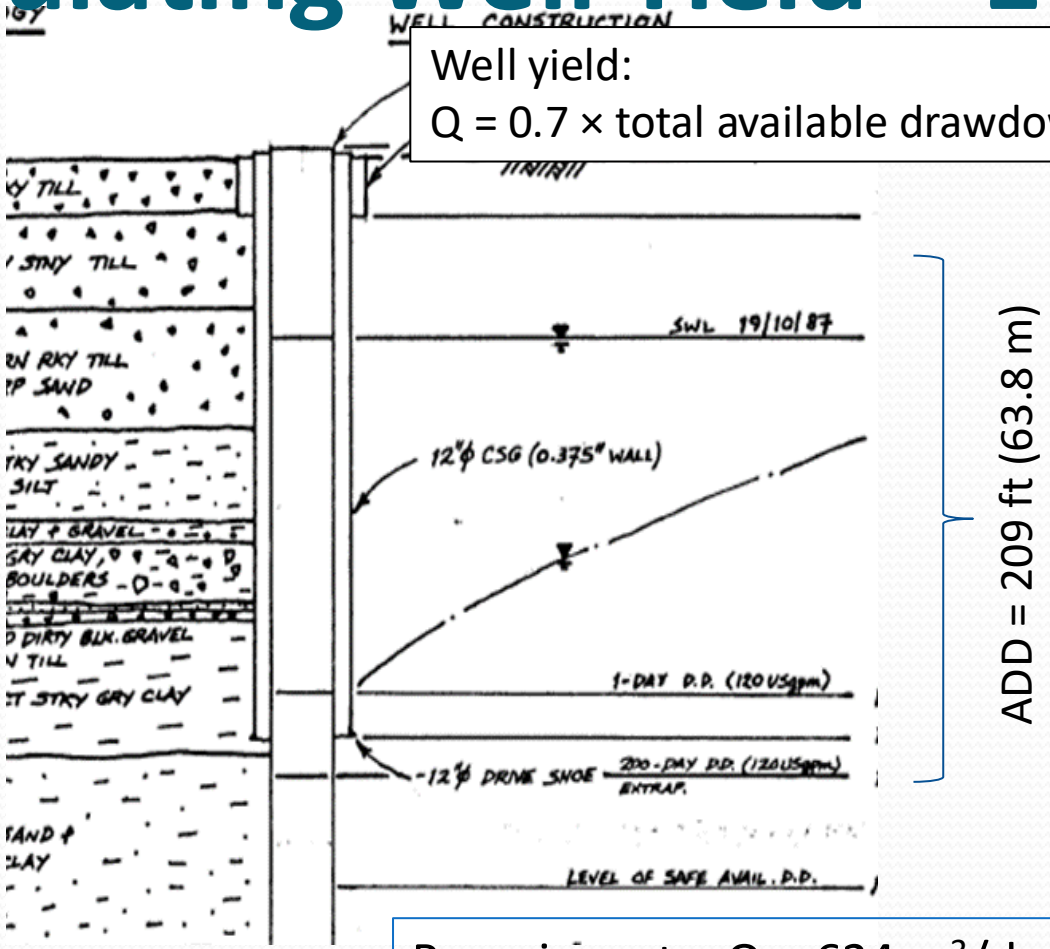
Calculating Well Yield – 100-day Method (Q_{100})

- ✓ Determine the available drawdown in the well (from the well record)
- ✓ Plot drawdown data on a semi-log plot (versus logarithm of time)
- ✓ Extrapolate drawdown behaviour out to 100 days
- ✓ Calculate the specific capacity at 100 days
  - *Specific capacity = pumping rate/drawdown at 100 days*
- ✓ Calculate the well capacity (Q_{100})
  - Q_{100} *= 0.7 x available drawdown x specific capacity at 100 days*

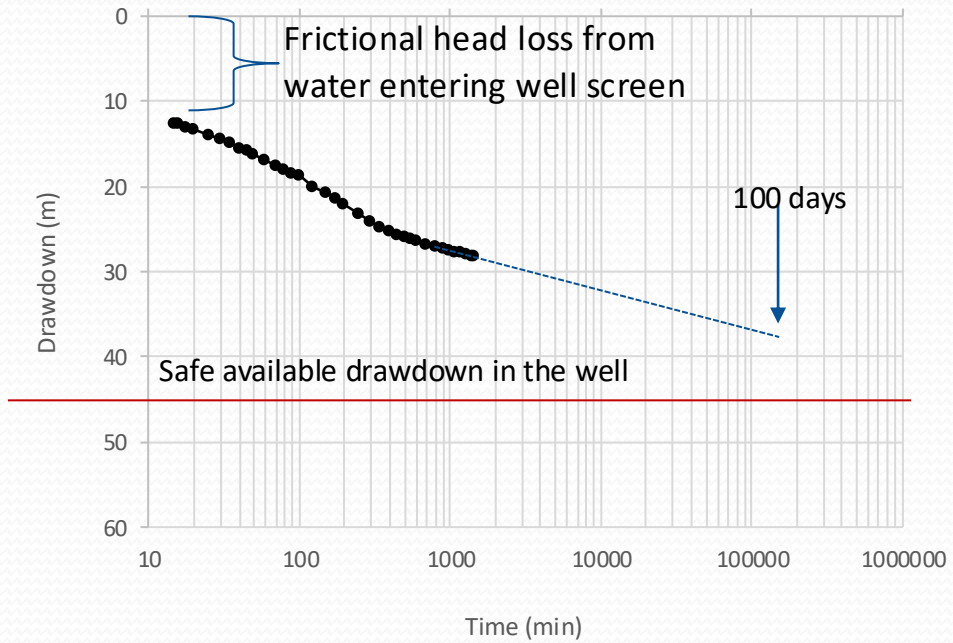
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Calculating Well Yield – 100-day Method (Q_{100})

Well yield:
Q = 0.7 × total available drawdown × specific capacity at 100 days



Drawdown VS log Time:



Pumping rate, Q = 624 m^3/day
Drawdown projected to 100 days = 37 m
Specific capacity after 100 days pumping = 624 m^3/day ÷ 37 m = 16.9 m^3/day/m
Well yield = 0.7 × 63.8 m × 16.9 m^3/day/m = 754 m^3/day

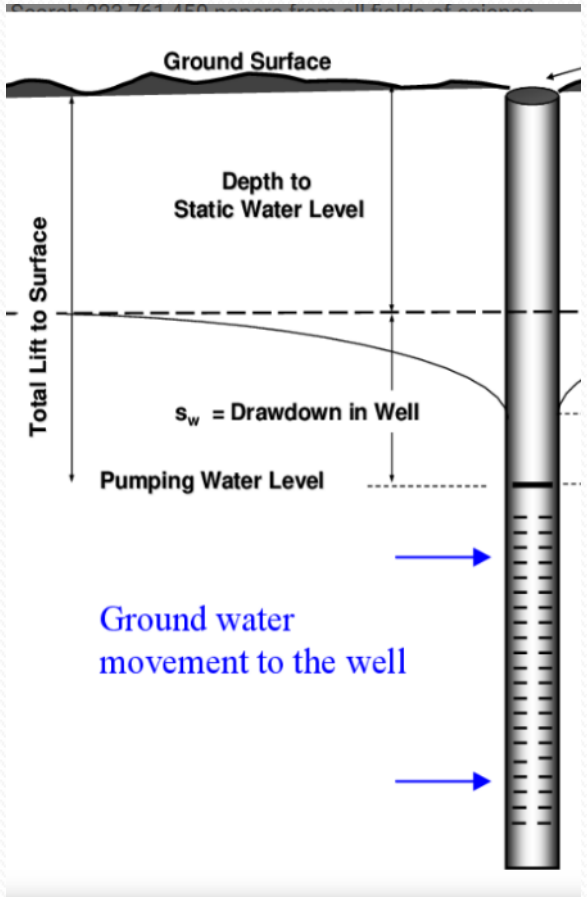
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Well efficiency

- Efficiency = drawdown if there were no well head losses / actual drawdown in the pumping well
- Inefficiency (well loss):
  - decreases well yield
  - is noticeable at start / end of pumping by a quick drop / rise, respectively in the well water level
- A properly designed and developed well should be > 80-90% efficient

ξ = drawdown if there were no well head losses / actual drawdown

ξ = (e.g., 7.95 -~1.5 m / 7.95 m) = 0.81 ~ 80%



Pumped Well Data			
Well:	Average Pumping Rate (m3/day):		
Time since pumping started, t (min)	Pumping Rate, Q (m3/day)	Water Level (ft)	Water Level (m)
0	736	17.680	5.389
0.5		23.270	7.093
1		24.100	7.346
1.5		24.560	7.486
2		24.780	7.553
2.5		24.990	7.617
3		25.120	7.657
3.5		25.230	7.690
4		25.320	7.718
4.5		25.400	7.742
5		25.520	7.778
6		25.710	7.836
7		25.840	7.876
8		25.900	7.894
9		26.000	7.925
10		26.090	7.952

Hanch, 2009

Learning objectives – tracking well performance over time

1. Explain how to measure specific capacity
2. Understand some of the causes of declining performance
3. Know when to act to rehabilitate the well
4. Appreciate distinction between declining well performance and other (external) factors causing a decline in well yield

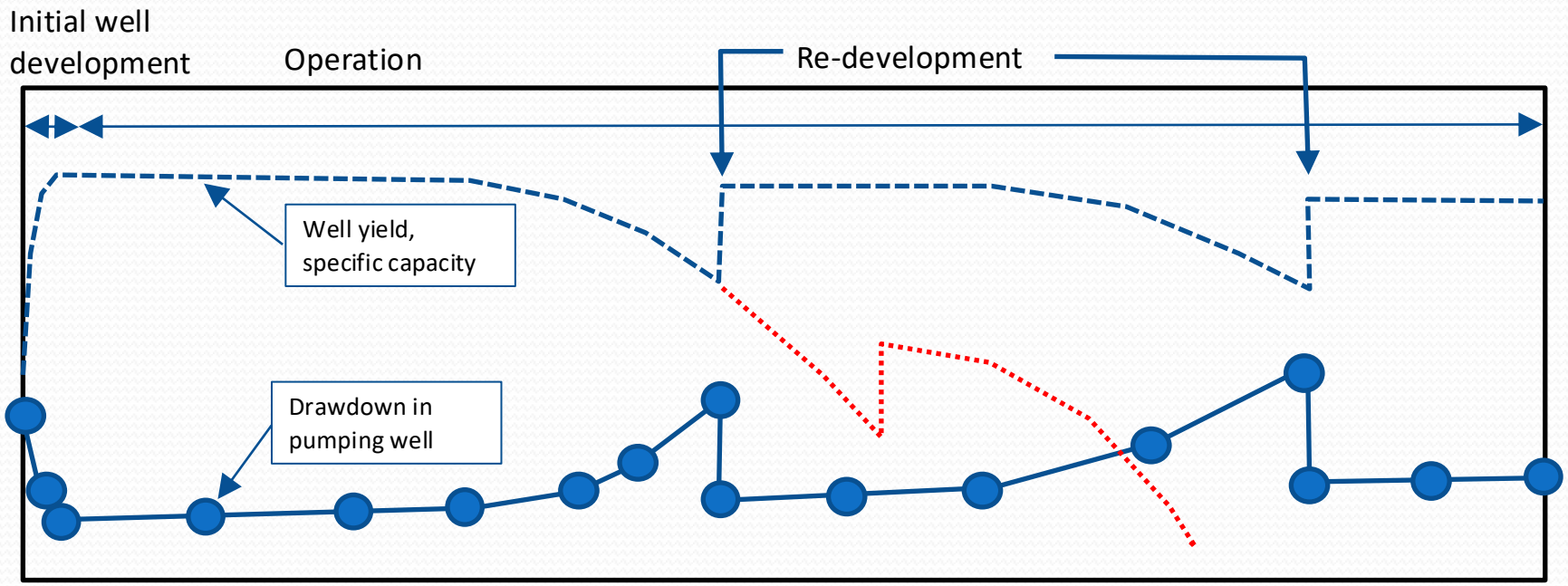
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Well performance over time

- Monitoring specific capacity is key to detecting a year-to-year decline well performance
- To measure specific capacity, pump the well at a controlled rate (e.g., the rated maximum well yield or rate at which well was test pumped) for a specified time (e.g., 1 or 2 hours)
- Measure the static water level prior to, and pumping water level after lapsed pumping time
- Calculate drawdown after 1-2 hours pumping
- Calculate the specific capacity = controlled pumping rate ÷ drawdown
- Repeat specific capacity test on a regular (annual) basis
- Plot specific capacity over the years (compare it with the original specific capacity)
- NB – Always keep the original test pump reports from the consultants!

Well Performance Over Time

- Well yield, specific capacity (i.e., well performance) typically decrease with time.
- If specific capacity decreases by more than 10-15%, the well needs to be rehabilitated (re-developed)
- Maintaining well performance lengthens the life of the well



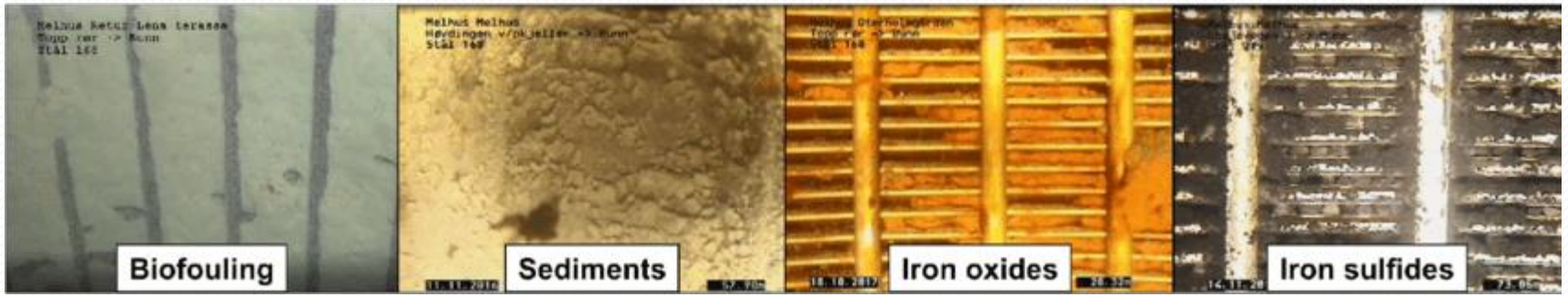
Life time of a water supply well (schematic)

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Possible Causes of Performance Decline

- Incrustation of the well screen:
  - Carbonate (Use water chemistry test to calculate (lenntech.com))
  - Iron and Manganese
- Bio-fouling of the well screen
- Plugging of screen and formation:
  - Inadequate well design
  - Inadequate development
  - Corrosion causes sand production and clogging of the screen





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Options for Well Rehabilitation

- Physical redevelopment (scrubbing, surging & bailing, jetting, air lifting)
- Chemical, e.g.,:
  - Acid treatment
  - Bactericides
- Heat
- Combination of above
- Design and install new screen
- Consult a professional hydrogeologist with competency in well rehabilitation



Factors Causing Decline in Well Yield

- Well performance:
  - A year-to-year decrease in specific capacity reflects decrease in well performance (and well yield)
- Available drawdown:
  - Decrease in available drawdown also decreases well yield (but not well performance) and can be due to:
    - Well interference from neighbouring pumping
    - Regional decline in groundwater level (e.g., drought, over-pumping from the aquifer)

$$\text{Well yield, } Q = 0.7 \times \text{ADD} \times \text{SC}$$

Case Study: Decline in well yield

- Well HM-1 was drilled in 1984 to supply a fish hatchery in Upper Arrow Lake
- Complaints in 1985 that the new well's yield had declined after only 1 year of operation

$$\text{Well yield, } Q = 0.7 \times \text{ADD} \times \text{SC}$$

	1984	1985
Static water level (m below top of casing)	0+ flowing	12
Available drawdown (m)	39.5	27.5
Specific capacity after 1 hour pumping (m^3/d/m)	129	131
Well yield (m^3/day)	1800	> 870
Observations	New well; no wells nearby.	Slow recovery, no accumulated sediments in the well but some bacterial growth in the well.

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7. Final questions and close

Mike Wei, P. Eng.

Email: waterwei@telus.net

Cell: 250-213-8228

Website: https://hydrogeo-logic.com/



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