Working Well
Program Background

• Coalbed Methane public information meetings in 2006
• Pilot (7 workshops)
  – Funded through Water for Life
• Program Launched in 2008
  – Cross-Ministry funding with 1/3 funding from Alberta Environment and Parks, Alberta Agriculture and Forestry, and Alberta Health
Working Well Program

• Steering Committee
  – Alberta Environment and Parks
  – Alberta Agriculture and Forestry
  – Alberta Health
  – Alberta Health Services
  – Alberta Water Well Drilling Association
  – Association of Alberta Agricultural Fieldmen
Working Well Program

• Technical Committee
  – 15 factsheets
  – 1 E-Learning video
  – 2 YouTube videos
  – Presentation content

• Delivery Staff
  – Sagewood Communications
    • Program delivery and coordination
  – Assistance from partner org’s
10 Years of Working Well...

- 298 workshops
- over 7900 participants
- 200 communities

The Working Well program maintains a proactive approach to encourage and empower private well owners to be stewards of our groundwater resources and is a non-regulatory approach to achieving safe, secure drinking water supplies.
Typical Workshop Agenda

- Understanding groundwater
- How your well works
- Water well problems
- Top 10 well enemies
- Shock chlorinating your well
- Taking water samples
- Take home messages
Understanding Groundwater

- “Hidden Waters” Video
How Your Well Works
Key Components of a Water Well

1. Borehole
   - Conduit to aquifer

2. Casing/Cribbing
   - Keeps borehole open
   - Houses pumping equipment
   - Excludes undesirable aquifers

3. Annular Seal
   - Prevents contamination from surface
   - Prevents mixing of aquifers
   - Sealing method is dependent on type of well construction (bentonite, drive shoe)

4. Well Intake
   - Allows groundwater into the well
   - Slotted liner/casing or screen
Key Components of a Water Well

5. Pitless Adaptor
   – Water-tight connection to distribution system
   – Preferably non-obstructive type

6. Pump
   – Properly matched to recommended pumping rate

7. Well Cap
   – Protects well from direct contamination
Typical Well Completions – *Bedrock Aquifers*

Well Completions used in *consolidated* bedrock formations (shale, sandstone)
Well Completions used in *unconsolidated* surficial materials (sand, gravel)

**Screened Well Completion** – Screen can be attached to casing or telescoped

**Bored Well Completion** – Greater than 18 inch diameter

Aquifer

Sand Screen

Sand Pack

Gravel Pack

Aquifer
Understanding Your Drilling Report

**Table 1: Well Completion**

<table>
<thead>
<tr>
<th>Depth (feet)</th>
<th>Open Hole</th>
<th>Mudtings</th>
<th>Casing</th>
<th>Slab Liners</th>
<th>Other</th>
<th>Total Depth Drilled</th>
</tr>
</thead>
<tbody>
<tr>
<td>100.0</td>
<td>200.0</td>
<td>300.0</td>
<td>400.0</td>
<td>500.0</td>
<td>600.0</td>
<td>700.0</td>
</tr>
</tbody>
</table>

**Table 2: Yield Test**

<table>
<thead>
<tr>
<th>Test Date</th>
<th>Static Water Level</th>
<th>Static Water Level + 3 ft</th>
<th>Measured Depth of Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2/2019</td>
<td>100.0</td>
<td>103.0</td>
<td>105.0</td>
</tr>
</tbody>
</table>

**Table 3: Additional Information**

- Recommended pumping rate: 10 gpm
- Water hardness: 20 ppm
- Water temperature: 70°F
- Water pH: 7.5

**Table 4: Contractor Certification**

- Name: John Doe
- Company: XYZ Drilling Company
- Certification No: 123456
- Date: 01/01/2023

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**Table 5: Well Construction**

<table>
<thead>
<tr>
<th>Well ID</th>
<th>Depth (feet)</th>
<th>Open Hole</th>
<th>Mudtings</th>
<th>Casing</th>
<th>Slab Liners</th>
<th>Total Depth Drilled</th>
</tr>
</thead>
<tbody>
<tr>
<td>WH-1</td>
<td>100.0</td>
<td>200.0</td>
<td>300.0</td>
<td>400.0</td>
<td>500.0</td>
<td>700.0</td>
</tr>
</tbody>
</table>

**Table 6: Water Quality**

- Total dissolved solids: 50 ppm
- Total hardness: 20 ppm
- Chlorides: 10 ppm
- Iron: 0.5 ppm
- Manganese: 0.1 ppm
- Alkalinity: 10 ppm

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**Table 7: Additional Information**

- Recommended pumping rate: 10 gpm
- Water hardness: 20 ppm
- Water temperature: 70°F
- Water pH: 7.5

---

**Table 8: Contractor Certification**

- Name: John Doe
- Company: XYZ Drilling Company
- Certification No: 123456
- Date: 01/01/2023

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**Table 9: Water Quality**

- Total dissolved solids: 50 ppm
- Total hardness: 20 ppm
- Chlorides: 10 ppm
- Iron: 0.5 ppm
- Manganese: 0.1 ppm
- Alkalinity: 10 ppm
Drawing **Your Own** Well – Bedrock Completions

- **Surface Casing/Liner Completion**
- **Single String Completion**
Water Well Problems
Introduction

- Common well problems include:
  - Reduction in yield
  - Changes in water quality
  - Sediment in water
- Causes of well problems
  - Biofouling
  - Over pumping
Biofouling – *What Is It?*

- Nuisance bacteria that accumulate in a well
  - Iron-related bacteria (IRB)
  - Sulphate-reducing bacteria (SRB)
  - Other slime forming bacteria
- Pumping a well increases nutrients and oxygen leading to an increase in production of slime
Biofouling - Symptoms

• Slime build-up in plumbing fixtures

• Changes in water quality such as:
  – Water discolouration
  – Staining of plumbing fixtures and laundry
  – Bad taste and odour (rotten egg smell)

• Gradual decrease in yield

• Increased corrosion of metal parts of your well

Down-hole camera video footage
Biofouling – **What You Can Do**

- Regular disinfection (shock chlorination)
- May need to have well cleaned first by a licensed water well contractor
Over-pumping – *What Is It?*

Over-pumping occurs when the:
- Rate of pumping is greater than the well’s capacity
- Pumping water level is drawn down below top of perforations or top of the aquifer

Problem accentuated when pump is placed inside intake portion of well

Over-pumping may lead to:
- Sediment in water
- Well failure
- Increased biofouling
Over-pumping – **What You Can Do**

- Do not over-pump your well!
- Check your drilling report for:
  - Recommended pump intake depth
  - Recommended pumping rate
    - Apply with caution!
    - Size pump properly to match well capability
- Conserve water
- Install flow control device and additional storage, if needed
- See the fact sheet *Over-pumping Your Well* (Issue 6)
More Problems...

- Mineral Incrustation/Scale
- Sediment Plugging
- Structural Failure
Top 2 Well Enemies
Enemy #1 – Old, Abandoned Wells
Enemy #1 – **What You Can Do**

- Properly plug all unused wells and holes
- Contact your licensed water well contractor or water specialist for recommendations
- See the fact sheet *Plugging Your Well (Issue 4)*
Enemy #2 – Well Pits …

High water line is the same level as top of well casing

Metal plate cover on well

Water in pit
Enemy #2 – and Wells in Basements

Methane in water is a safety hazard

Well in basement is susceptible to flooding and sewage backup
Enemy #2 – **What You Can Do**

- **Well pits:**
  - Get rid of the pit
  - Install a pitless adapter
- **Wells in basements:**
  - Install a sanitary well seal
  - Have an emergency sump pump in basement
  - Or plug well and drill a replacement outside of house
- See the fact sheet *Upgrading Your Well in a Pit* (Issue 5)
More Enemies...

• Inadequate Well Seal
• Inadequate Well Cap
• Poor Siting and Landscaping
• Poor Septic Systems
• Hazardous Material Storage
• Poor maintenance practices
• Lack of Backflow Protection
• Poor Manure Management
Shock Chlorinating Your Well
You Will Learn

- How to disinfect a contaminated well
- A preventative maintenance measure to control biofouling
- See the fact sheet *Shock Chlorinating Your Well (Issue 3)*
When To Shock Chlorinate

• Immediately after installing a new well
• Whenever you repair or replace your well, pump or distribution system
• Following contamination by flood water
• Following change in water clarity, colour, odour or taste
• When lab tests show coliform bacteria in water
• When slime is present in toilet tank
• Every year, to prevent biofouling
Risk ...

• More chlorine is not better ... ineffective, corrosive, etc.

• On older, poorly maintained wells:
  – loosening of rust and deposits may result in leaks in the distribution system
  – Shock chlorination may not be effective without *prior* professional cleaning by a licensed water well contractor
Dosage and Types of Chlorine

• **Dosage** – 200 mg/L chlorine solution
• **Liquid**
  – Household bleach - 5.25% sodium hypochlorite
  – Industrial strength - 12% sodium hypochlorite
  – Limited shelf life
• **Pellets, granular or powder**
  – 65 to 75% calcium hypochlorite

Treatment results are the same if proportionally the same amount of chlorine is used
Methods of Shock Chlorination

1. Simple Chlorination
2. Bulk Displacement

Poor Results Much Better Results!
Procedure for Small Diameter Wells

- The latest version of *Water Wells That Last (WWTL)* was updated to reduce the concentration of chlorine from 1000 ppm to 200 ppm
Procedure for Small Diameter Wells ...

Step 1:
Calculate depth of standing water in your well

150 feet \( \text{Total well depth} \) - 65 feet \( \text{Non-pumping water level} \) = 85 feet \( \text{Feet of water in your well} \)
Procedure for Small Diameter Wells ...

**Step 2:** Calculate volume of water needed to create a solution equal to 2 times the volume of standing water in the well. Place in clean tank.

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85 feet x 2.5 gal = 213 gal
```

Refer to Table 1 on fact sheet
Procedure for Small Diameter Wells ...

**Step 3:** Calculate volume of chlorine needed and add to tank.

\[
\text{Feet of water in your well (Step 1)} \times \text{Chlorine needed per foot (Table 1)} = \text{Volume of chlorine bleach for procedure}
\]

<table>
<thead>
<tr>
<th>Well Casing Diameter</th>
<th>Vol. of water needed / foot of water in your well</th>
<th>Vol. of chlorine bleach (5.25%) needed / foot of water in your well²</th>
</tr>
</thead>
<tbody>
<tr>
<td>inches</td>
<td>mm.</td>
<td>gallons</td>
</tr>
<tr>
<td>4 in</td>
<td>100 mm</td>
<td>1</td>
</tr>
<tr>
<td>6 in</td>
<td>150 mm</td>
<td>2.5</td>
</tr>
<tr>
<td>8 in</td>
<td>200 mm</td>
<td>4</td>
</tr>
</tbody>
</table>

Refer to Table 1 on fact sheet
Procedure for Small Diameter Wells ...

**Step 4:** Siphon or pump chlorine solution into well
Procedure for Small Diameter Wells ...

- **Step 5:** Open all outlets in water distribution system. Run water until smell chlorine.

- **Step 6:** Shut off outlets and leave chlorine solution in well and distribution system for 8 to 48 hours.

- **Step 7:** Open an outside outlet and run water until chlorine smell dissipates. Run water away from sensitive plants or landscaping. *Do not over-pump your well!*

- **Step 8:** Run remaining outlets to flush distribution system.
pH Adjusted Chlorination

- When conventional chlorination is not effective
- 1000 mg/L chlorine solution no longer recommended
  - Raises pH to 10.5
- Job for a **licensed water well contractor**
  - Reducing pH will increase the effectiveness of chlorine in high pH waters

<table>
<thead>
<tr>
<th>Water pH</th>
<th>Biocidal Effect</th>
<th>Oxidative Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.5</td>
<td>100%</td>
<td>0%</td>
</tr>
<tr>
<td>8</td>
<td>12%</td>
<td>88%</td>
</tr>
<tr>
<td>9</td>
<td>2%</td>
<td>98%</td>
</tr>
<tr>
<td>10</td>
<td>&lt; 1%</td>
<td>&gt; 99%</td>
</tr>
</tbody>
</table>
Effectiveness

- Must be done regularly
- Should prevent premature well failure and avoid costly cleaning or treatment

Shock chlorination is to water wells what regular oil changes are to vehicles… it keeps them operating smoothly for years!!
Take Home Messages
Keep Good Records and Monitor

- Water levels
- Water testing reports
- Record of maintenance (chlorination)
- Pump test reports
- Repairs
- Reconstruction details
Shock Chlorinate Regularly

- Required maintenance practice to keep bacteria buildup in check
- Annually or more frequently if needed
- Remember
  - 200 ppm available chlorine
  - Bulk displacement method
  - Do not over-pump your well
- Seek advice from a licensed water well contractor before chlorinating older, unmaintained wells
Test Water Regularly

• Bacteriological
  – Semi-annually
  – Additional testing for new births, unexplained illnesses, flood events, etc.

• Chemical
  – 2 to 5 years
  – Additional testing if sudden change in water

• Contact local health unit for
  – Sample bottles
  – Instructions
  – Drop off schedule
  – More information

• Keep records
Plug Old Wells and Eliminate Well Pits

• Contact a licensed water well contractor
Evaluation and Reporting

- Workshop Evaluation Form
- 6 month call back survey
  - Over 90% of workshop participants contacted have followed through on the beneficial activities they intended to do
Questions?
CONTACT US

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melissa.orr-langner@gov.ab.ca