Asset Management Approach for Wellfields

1. Overview
2. Asset Management Approach
3. City of Berlin Wellfield
Inspection, monitoring and maintenance based planning process for maintaining groundwater engineering assets
Asset Management Approach for Wellfields

Early Recognition of Problem → Timely Completion of Repair → More Reliable Service → Lower Outage Costs → Cheaper O&M

Short Term Benefit
Asset Management Approach for Wellfields

Extended Asset Life

More Efficient Planning

Reduced Capital Needs

Lower Bond/Debt Costs

Long Term Benefit
Asset Management Approach for Wellfields

Approach

Well Inventory → Compile Records

Assign MEAV

Condition Assessment

Performance Monitoring

Identify Replacements → Replacement Planning/Impl

Identify Rehabilitation → Rehabilitation Planning/Impl

Update Asset Values
Asset Management Approach for Wellfields

Approach

Well Inventory

Assign MEAV

Condition Assessment

Compile Records

Performance Monitoring

Identify Replacements

Replacement Planning/Impl

Update Asset Values

Identify Rehabilitation

Rehabilitation Planning/Impl
Asset Management Approach for Wellfields

Well Inventory

- Operational Wells
- Standby Wells
- Wells Awaiting Rehabilitation
- Non-commissioned Wells
Asset Management Approach for Wellfields

- Water Availability
- GW/SW Interactions
- Existing Wells
- Potential Transfers
- New Wells Needed

Regulatory Issues
Asset Management Approach for Wellfields

Infrastructure Inventory

- Pumps
- Pipes
- Monitoring Controls
Asset Management Approach for Wellfields

Approach

- Well Inventory
  - Assign MEAV
  - Assess Condition
  - Compile Records

Performance Monitoring

- Identify Replacements
- Identify Rehabilitation

Replacement Planning/Impl

Rehabilitation Planning/Impl

Update Asset Values
Asset Management Approach for Wellfields

Well Records

- Well Construction
- Pump Data
- Initial Development
- Water Quality
- Static Water Level
- Pumping Drawdown
- Inspection Reports
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Well Records

Top of Well (flange): 87.69 m
Ground Elevation (Geodetic): 87.17 m

Top soil

Diameter: 250 mm (10")

Elevation (m geod.)

High static water level 50.7
Low static water level 47.0
High pumping water level 48.0
Low pumping water level 42.3

Pump intake
K packer 38.5
0.120" slot screen 32.5 - 35.5
0.100" slot screen 29.5 - 32.5
0.080" slot screen 26.0 - 26.5

Specific capacity (l/min)

Remaining water column (%)
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Approach

- Well Inventory
- Compile Records
- Assign MEAV
- Condition Assessment
- Performance Monitoring
  - Identify Replacements
  - Identify Rehabilitation
- Replacement Planning/Impl
  - Rehabilitation Planning/Impl
- Update Asset Values
Asset Management Approach for Wellfields

Condition Assessment
Asset Management Approach for Wellfields

Approach

Well Inventory → Compile Records

Assign MEAV → Condition Assessment

Condition Assessment → Identify Replacements → Replacement Planning/Impl → Update Asset Values

Condition Assessment → Identify Rehabilitation → Rehabilitation Cost

Performance Monitoring

Identify Replacements

Identify Rehabilitation
Modern Equivalent Asset Value (MEAV)

Quantifies an asset's value by assessing its differences with a reference asset in terms of differences in maintenance and other operating costs even though the two assets may differ in scale/technology and service potential.
Asset Management Approach for Wellfields
Asset Management Approach for Wellfields

- Pump Operation/Efficiency
- Yield/Specific Capacity
- Water Quality
- Biofouling/Encrustation
- Mechanical Plugging
- Inspection Opportunities
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Well Performance

Reasons for Decline:

- Mechanical plugging in aquifer/gravel pack
- Bacterial deposits in screen, gravel pack or aquifer
- Well construction
- Well development
- Operations
Asset Management Approach for Wellfields

Example Application

Regional District of Nanaimo

Historical Operations - Fairwinds Well 2

- Pumping Rate (gpm)
- Specific Capacity (gpm/ft drawdown)

Example Application
Regional District of Nanaimo
Asset Management Approach for Wellfields

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- Identify Rehabilitation
- Rehabilitation Planning/Impl
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Asset Management Approach for Wellfields

Identify Replacements

Well Aging

- 1972: 25
- 1976: 18.6
- 1980: 11.5
- 1984: 7.0
- 1988: 3.9
- 1991: 2.8
- 1992: 3.7
- 1994: 2.8
- Aug 97: 2.8
- Aug 97: 7.8
- Jun 98: 5.1
- Oct 98: 4.7

Specific Capacity (gpm/ft/dd)

New Well
Asset Management Approach for Wellfields

Approach

Well Inventory

Compile Records

Assign MEAV

Condition Assessment

Performance Monitoring

Identify Replacements

Replacement Planning/Impl

Update Asset Values

Identify Rehabilitation

Rehabilitation Planning/Impl
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Well Replacement Costs

- Regulatory Issues - $10,000+
- Land Acquisition - $60,000+
- Site Preparation - $5,000+
- Engineering - $100,000+
- Well Construction/Development - $200,000+
- Infrastructure Work - $300,000+
- $675,000+
Asset Management Approach for Wellfields

Approach

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- Identify Rehabilitation
- Rehabilitation Planning/Impl
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Asset Management Approach for Wellfields

Clogging Process

Entrance resistance

kiwa
Partner for progress
Asset Management Approach for Wellfields

Approach

- Compile Records
- Condition Assessment
- Assign MEAV
- Well Inventory

Performance Monitoring

- Identify Replacements
- Identify Rehabilitation

Replacement Planning/Impl.

- Rehabilitation Planning/Impl
- Update Asset Values
Asset Management Approach for Wellfields

Well Rehabilitation

- Test
- Mech.
- Video
- Technology
- Extraction

- Monitor
- Removal
- Chemical (If used)
- Video
- Test
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Well Rehabilitation

Monitor Progress

Sediment Removal Volumes

- First Cycle
- Second Cycle
- Third Cycle

Volume (ml/1000)

Screen Interval

1 2 3 4 5 6
Asset Management Approach for Wellfields

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Asset Management Approach for Wellfields

Update MEAV

New Well Cost – $1,000,000

Debt costs - $100,000 (10% of cost)
Additional Annual Operating Costs for Existing Well - $15,000

Debt Cost of Existing Well - $100,000 - $15,000 = $85,000 per annum or 15%

Updated MEAV of Existing Well - $850,000
Asset Management Approach for Wellfields

City of Berlin, Germany

- 3.5 Million People
- 14 wellfields
- 850 wells
- 160 MGD
- Vertical Wells
- Horizontal Wells
Asset Management Approach for Wellfields

City of Berlin, Well Field

Well data:
- Survey year built
- Well function
- Construction material
- Screen length
- Current building condition features

Pump data:
- Input performance
- Electrical supply rate
- Installation number
- Location
- Data maintenance: after purchase, repair

Standard pump management

Current working report

Maintenance report data: well and pump activities, details on pump, water meter

Standard well management

Current well production and performance data

Well production data:
- Watermeter status
- Operation hours
- Water level
- Pump operation data
## Asset Management Approach for Wellfields

### City of Berlin, Well Field

#### Well Monitoring System

### Berliner Wasser Betriebe

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### Bemerkungen:

- (gesamt) (gesamt) (Mittelw.) (Mittelw.) (Mittelw.) (Mittelw.) (Mittelw.)
- 1,610,907 | 10,766 | 14.38 | 135 | 143 | 119 | 1.9 | 44.6 | 0.297
Asset Management Approach for Wellfields

City of Berlin, Well Field

Spec. Capacity in $m^3/h/m$

with Well Services

without Well Services

In Berlin 5 years

“Life“ Time

In Berlin 5 years

“Life“ Time
Asset Management Approach for Wellfields

City of Berlin, Well Field

Planning/Design

Operational Data

- Economic Conditions
- Financial Conditions

- Environmental Conditions
- Maintenance & Investment Plan

- Rehabilitation Costs
- Maintenance Costs
- New Borehole Costs

No Action Required

Rehabilitation

Drilling of New Wells

Submersible Pump Management

Continued Monitoring
Asset Management Approach for Wellfields

City of Berlin, Well Field

Well Condition Ranking

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Well Condition Ranking:

- 1: Routine Monitoring
- 2: Priority Inspection
- 3: Rehabilitate
- 4: Replace

Graphical representation showing risk ranking and well condition ranking with corresponding actions.
Asset Management Approach for Wellfields

Summary

- Proactive Management of Groundwater Assets Saves Money
- Inspection/Monitoring Based Approach to Assess Well Condition
- Successful Management Requires Planned Maintenance & Assessment of Risk
Asset Management Approach for Wellfields

Questions