Groundwater Training and Capacity Building for the Olifants – Doorn WMA

Tentative Course Outline (Mostly be means of diagrams and pictures – PowerPoint presentation is planned)

1. Groundwater
    - Definition (water found in the subsurface in the saturated zone below the water table or piezometric surface i.e. the water table marks the upper surface of groundwater systems).

2. Aquifer
    - Definition (a geological formation, which has structures or textures that hold water or permit appreciable water movement through them [from National Water Act (Act No. 36 of 1998)]).
    - Types:
        - Unconfined aquifer: these are sometimes also called water table or phreatic aquifers, because their upper boundary is the water table or phreatic surface. Typically (but not always) the shallowest aquifer at a given location is unconfined, meaning it does not have a confining layer between it and the surface. Unconfined aquifers usually receive recharge water directly from the surface, from precipitation or from a body of surface water (e.g., a river, stream, or lake) which is in hydraulic connection with it.
        - Confined aquifer: Groundwater below a layer of solid rock or clay is said to be in a confined aquifer. The rock or clay is called a confining layer. A borehole that goes through a confining layer is known as an artesian well. The groundwater in confined aquifers is usually under pressure. This pressure causes water in an artesian well to rise above the aquifer level. If the pressure causes the water to rise above ground level, the well overflows and is called a flowing artesian well.
        - Fractured aquifers, - Definition, Types, Typical characteristics, Fracture elevations – the importance of knowing where they are

3. Water levels
    - (the upper surface of the saturated zone of an unconfined aquifer at which pore pressure is at atmospheric pressure, the depth to which may fluctuate seasonally.) There are two situations – rest water level and dynamic (pumped) water level

4. Borehole
    - Definition (includes a well, excavation, or any other artificially constructed or improved groundwater cavity which can be used for the purpose of

intercepting, collecting or storing water from an aquifer; observing or collecting data and information on water in an aquifer; or recharging an aquifer [from National Water Act (Act No. 36 of 1998)].)

- Types (well point, piezometers, borehole, "pit")
- Usage (water supply for domestic use, agricultural use, feedlots etc)

5. Borehole drilling (very brief)
    - Drilling supervision
        a. Geology
        b. Fracture depths/elevation
        c. Fracture yields (blow or airlift yields)

6. Pump Testing (very brief)
    - Definition
    - Aims
        a. Sustainable yield calculation
        b. Pump specification
    - Types of tests (Scientific testing versus unscientific methods)

7. Pump specification & installation (very brief)
    - Why is it important?
    - Pump specification vs sustainable yield
    - Pump installation depth vs fracture depth/elevation

8. Monitoring & Reporting
    - Importance – establishing monitoring objectives
    - Types of groundwater monitoring (water levels and water quality)
    - Collar height – the importance of noting this
    - Logbook and data capturing , plus data flow process.
    - Assessment of data
        a. Determine status of resource
        b. Identify early warning signs

c. Mitigate if required

9. Practical demonstration by instructor
    - Water level measurement (plus measurement between the 1 metre marks)
        i. How to record collar height and record also depth below ground level
        ii. Important to note – rest or dynamic (pumping water level)
        iii. The dangers of taking readings in a production borehole – need a dedicated observation tube
    - Water quality measurement
        i. Parameters to be measured (pH, temperature EC and TDS)
        ii. How to calibrate the equipment
        iii. The importance of cleaning equipment between readings
        iv. Units – especially EC – record mS/m (incl conversion table)
        v. How to take a sample – bottles, labeling, storage, chain of custody
    - Microbiological sampling
        i. Parameters to be measured
        ii. Importance of working with sterile containers
        iii. How to take a sample – bottles, labeling, storage, chain of custody
10. Practical demonstration
    - Testing of course attendees
11. Importance of data flow and feedback mechanisms
    - Interpretation of water level and water quality (EC) graphs
12. General discussion and questions

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