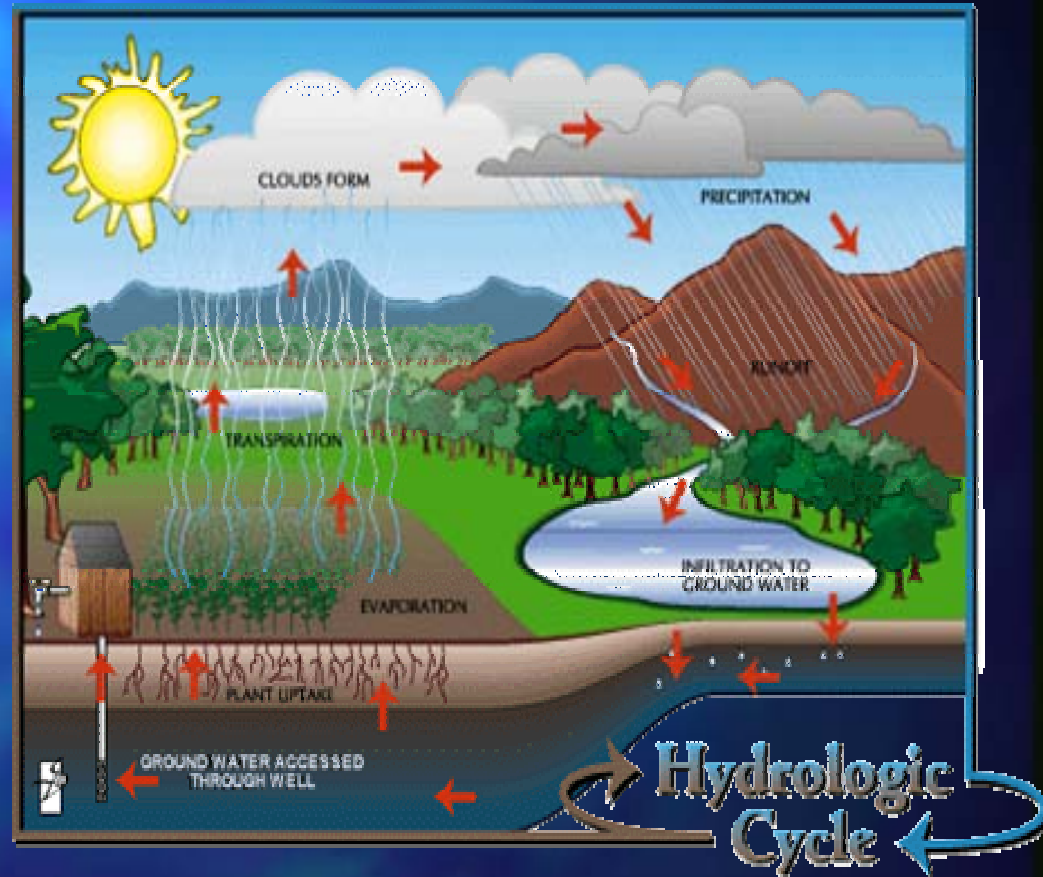


# Groundwater Protection In Karst

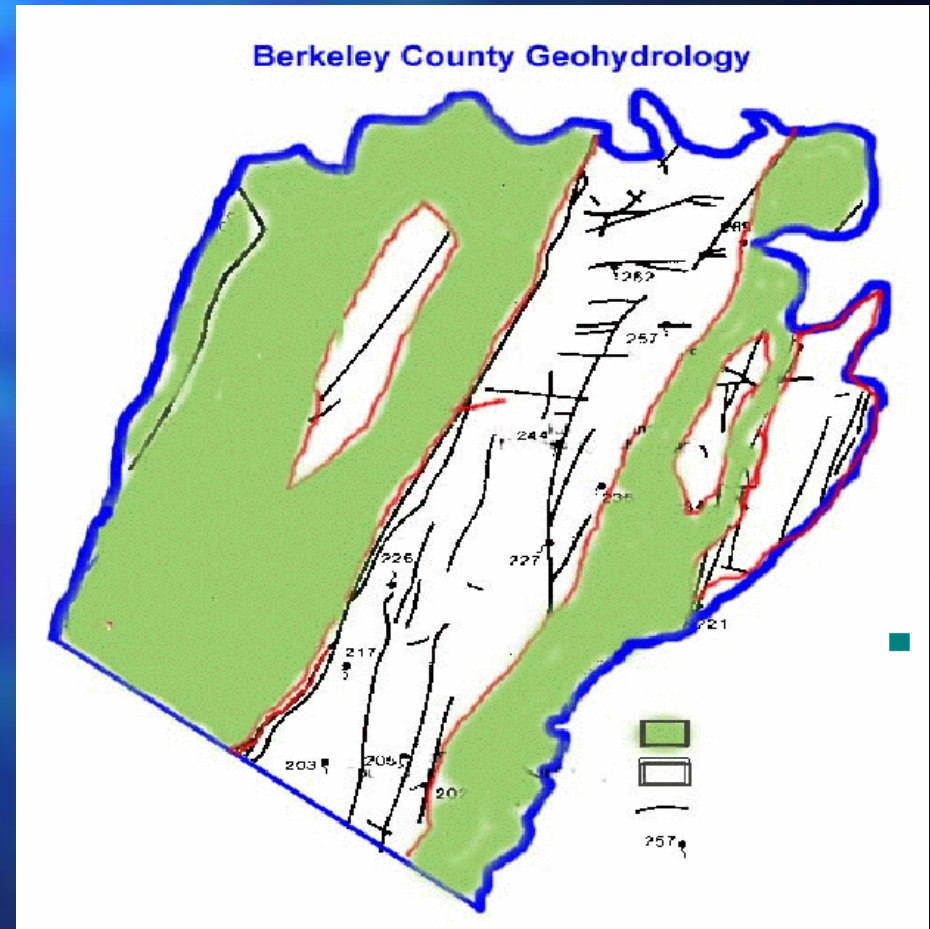
## A WVDEP Presentation

Water is our most vital resource. Many public water supplies and most private water supplies (wells) use groundwater as their drinking water source.



# Groundwater In Karst

Groundwater quality is affected by geology, location, and land use. Fractured or karst limestone bedrock provides a direct channel between the land surface and the groundwater system. Berkeley County is particularly vulnerable.



# Karst Topography

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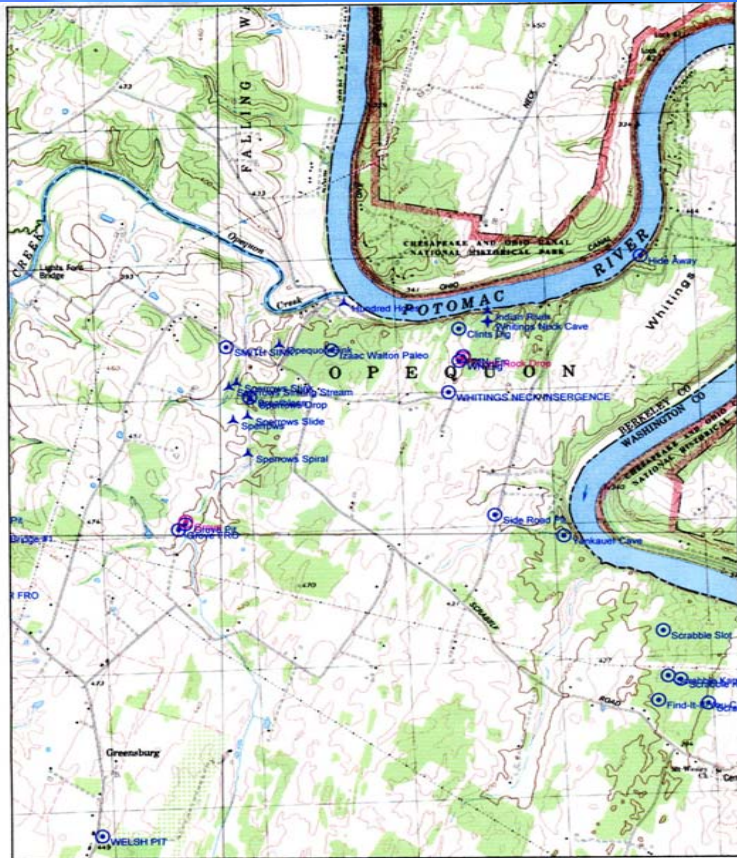
**The term karst means both a set of processes and an assemblage of land-forms. The common land-forms in karst regions are sinkholes, disrupted surface drainage, and underground drainage networks that have openings formed from solution action. These openings may be as small as a crack or as huge as a cavern.**



# Karst Formation Caves And Sinkholes

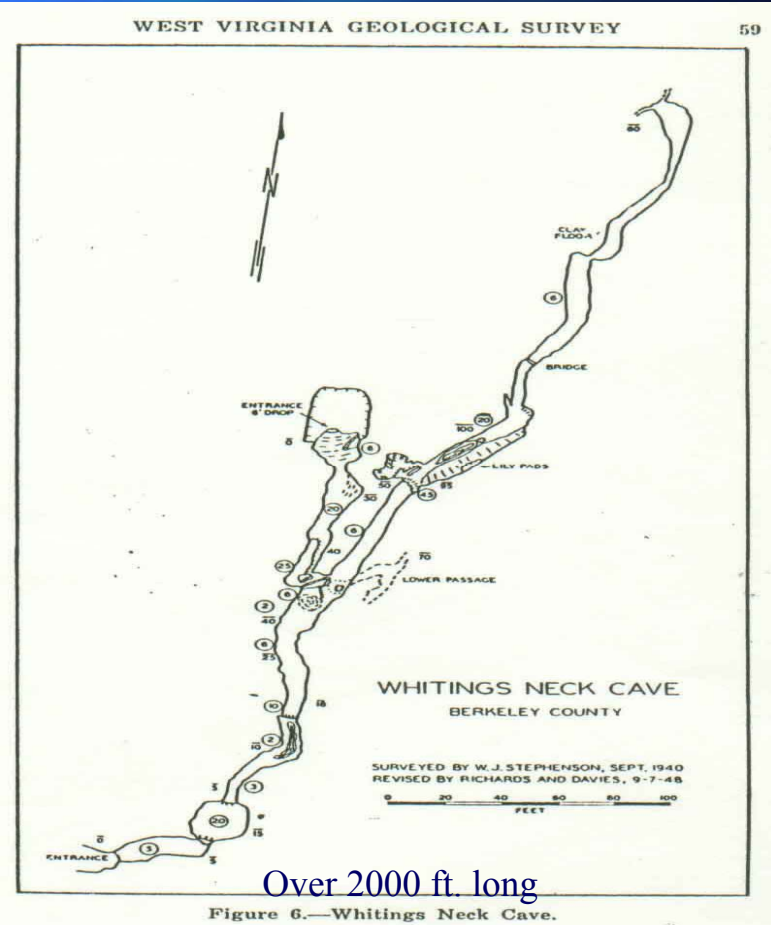
## A Section Of Berkeley County

### Numerous Caves & Sinkholes



Copyright (c) 1997, Maptech, Inc.

### Whitings Neck Cave



# Sinkholes Can Collapse A Road Or House



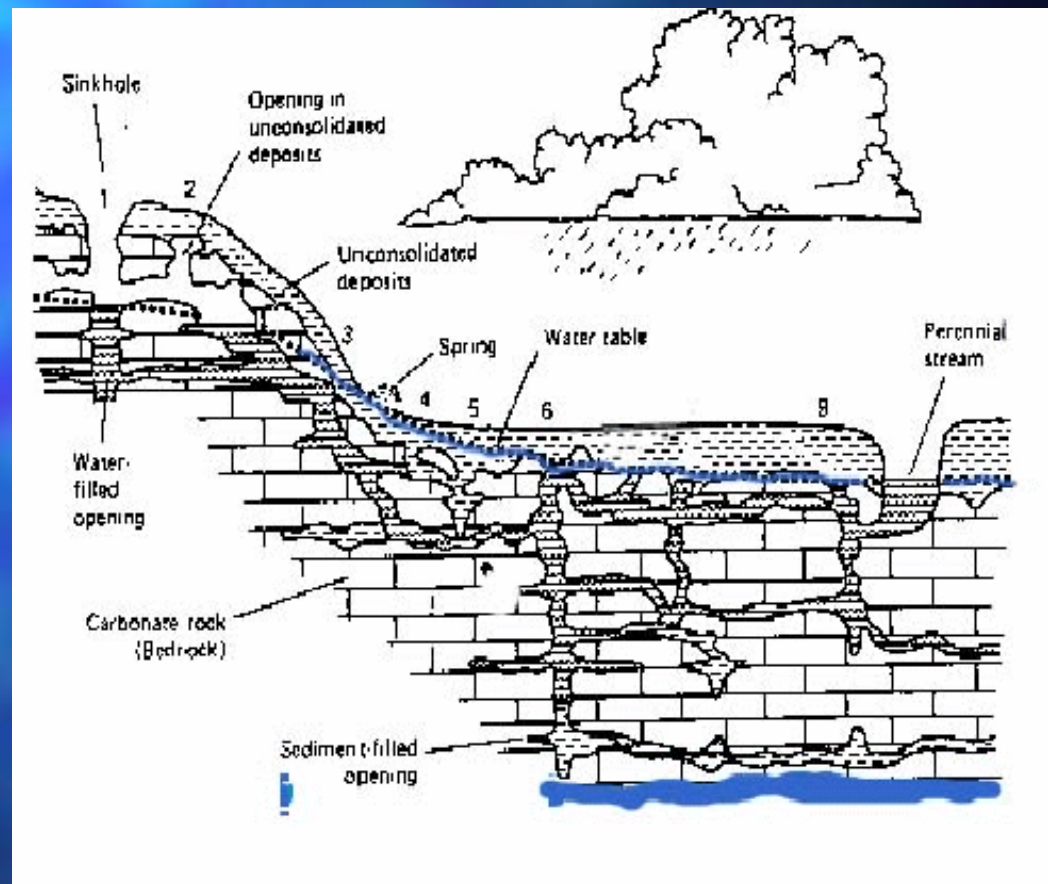


# Groundwater Flow

Groundwater flow in karst aquifers is significantly different from that of other aquifers because of the enlarged solution conduits. In porous media aquifers, groundwater moves very slowly as laminar flow, (usually only a few feet per year), but in karst aquifers, turbulently flowing underground streams have velocities approaching those of surface streams. The nature of the groundwater flow system causes karst areas to be extremely vulnerable to groundwater contamination.

# Groundwater Contamination In Karst

Groundwater contamination is the most significant problem in karst. The formation of solution channels and sinkholes create a direct avenue for the movement of inadequately treated stormwater and wastewater into the aquifer



# Protecting Our Groundwater

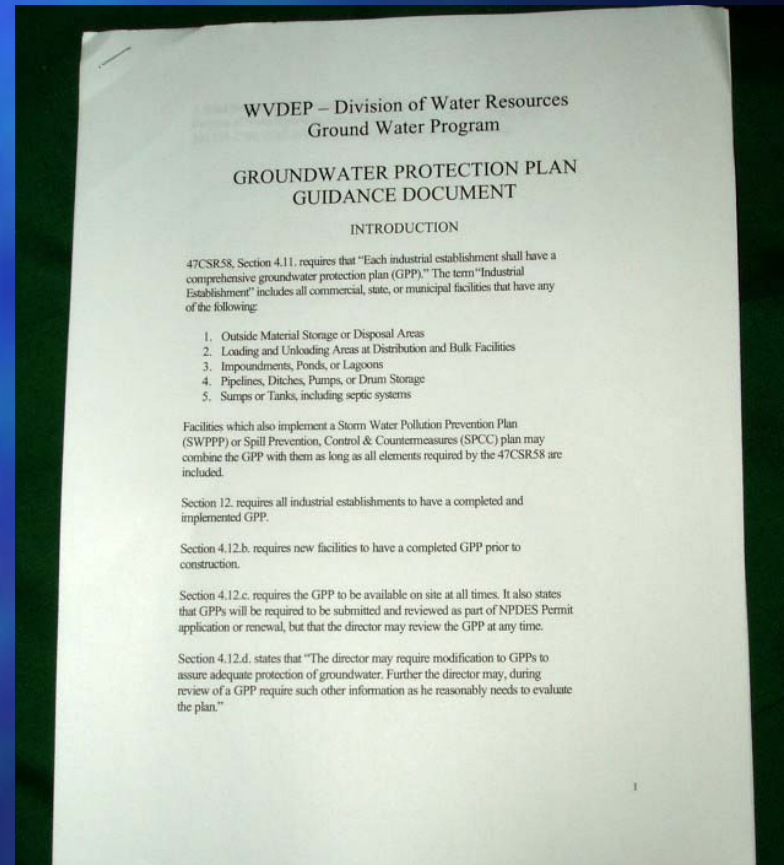
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**In 1991, WVDEP established a comprehensive groundwater management program for the protection and remediation of the state's groundwater resources. A Groundwater Protection Plan (GPP) is required to protect the groundwater.**



# What is a GPP?

**A Groundwater Protection Plan (GPP) documents practices intended to protect the groundwater. All stormwater management operations, processes, materials and activities whether industrial, commercial or residential that may contaminate the groundwater, must be inventoried and practices implemented to prevent potential contamination.**



# Two Different GPPs Required

All persons conducting activities under the Phase II Stormwater Construction Permit are required to complete and implement a **Construction (Phase II) Groundwater Protection Plan (GPP)**. The Stormwater Construction GPP is required to be kept on site.



# Two Different GPPs Required

If the constructed stormwater management structure is to remain in use as a permanent fixture, an **Operation and Maintenance Phase GPP** is required. . This GPP requires an entity to be responsible for the operation and maintenance of the stormwater structure.





## *Important Note:*

# All Stormwater Structures Excavated To Bedrock In Karst

All stormwater structures excavated to bedrock in karst are required to employ a liner system or obtain an Underground Injection Control (UIC) permit from the Division of Water and Waste Management, prior to construction and operation.



**SW Pond With No Liner**

# **All Stormwater Structures Excavated To Bedrock**

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**More stringent requirements may apply for certain projects depending on the potential for contamination of karst, wellhead protection, and/or vulnerable groundwater use areas.**

# Minimum Requirements

At a minimum the following elements should be met:

*Section 4.12.a. requires all industrial establishments to have a completed and implemented GPP.*

*Section 4.12.b. requires new facilities to have a completed GPP prior to construction.*

*Section 4.12.c. requires the GPP to be available on site at all times. It also states, GPPs must be submitted and reviewed as part of the NPDES Permit application or renewal process. The director may also review the GPP at any time.*



# Minimum Requirements

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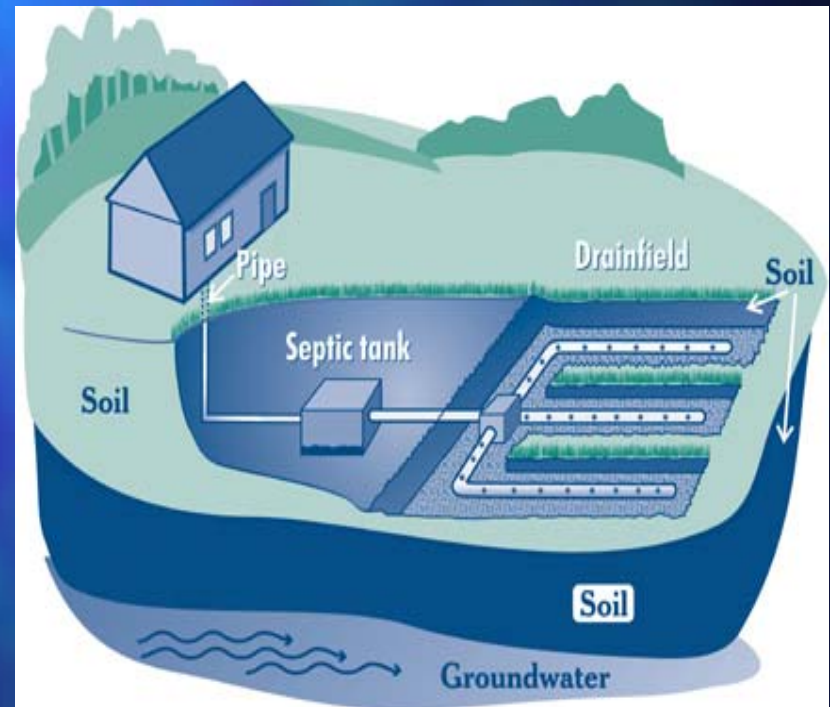
*Section 4.12.d. states, “The director may require modification to GPPs to assure adequate protection of groundwater.”*

*Section 5.1. states, “All facilities that are not included in the definition of “Industrial Establishment” may be required to develop and implement a GPP upon notification by the director.*

# Additional Groundwater Protection Requirements

## Sewage System Registration

All homeowners or operators of an onsite system are required to register their sewage systems with the WV Dept of Environmental Protection. (WVDEP) This registration is required after obtaining a sewage system permit from the local health department.



# Additional Groundwater Protection Regulations

## UIC (Underground Injection Control) Permits

The UIC Program works with state and local governments to oversee underground injection of fluids in order to prevent contamination of underground sources of drinking water. All subsurface emplacement of fluids, whether those fluids are a waste or not are subject to the permitting requirements of 47 CSR 13, the Underground Injection Control (UIC) rule.



Elgin System For Commercial Facility



# UIC (Underground Injection Control) Permits

The UIC Program includes, but is not limited to, all stormwater discharges underground including onsite sewage disposal systems other than single family residential systems, provided those systems discharge solely sanitary waste.

Facilities discharging co-mingled waste such as beauty parlors and RV Dump Stations are prohibited, unless authorized by permit and will require sampling to meet permit limits. These limits are established at maximum contaminate levels (MCLs) or health-based limits (HBLs) to protect underground sources of drinking water.

# **UIC**

## **(Underground Injection Control)**


### **Permits**

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**Subsurface discharge from coin operated car washes, coin operated laundromats, motor vehicle repair bays, large capacity cesspools and roof drains are prohibited.**


**Historically, conventional sewage systems with leachfields were installed base upon economic factors, land availability, and simple health measures aimed only at preventing direct public contact with untreated wastewater.**





**The widespread use of the conventional septic tank system has continued in the face of a consistent history of failure, with severe localized groundwater pollution, and almost unanimous disapproval by researchers in the field.**

**Typically, high groundwater tables, steep slopes, and inappropriate soils are primary factors that limit the effective use of conventional wastewater systems.**



**Alternative technology for on-site wastewater systems can often serve as a viable solution for sites where publicly owned sewer systems are not available and where conventional septic tank and leachfield technology have failed, or where site limitations preclude their use.**



# Alternative Systems

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- **Recirculating Sand Filters (RSF)**
- **Peat Filter Systems**
- **Intermittent Sand Filters (ISF)**
- **Low Pressure Pipe Systems**
- **Drip Irrigation Systems**
- **Constructed Wetland Systems**
- **Spray Irrigation Systems**

# Typical Wastewater Pollutants

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- **Total Suspended Solids (TSS)**
- **Biodegradable Organics (BOD)**
- **Pathogens**
- **Nutrients (Nitrogen and Phosphorus)**
- **Toxic Organics**
- **Heavy Metals**
- **Dissolved Organics**

**On-Site systems are typically only one of many potential sources of pollutants that can negatively affect groundwater and surface waters. In most cases there are other sources other than on-site systems which generate pollutants such as nutrients and pathogens.**



**Setting performance based measures or effluent limits for OWTs in individual watersheds or source water protection areas allows the agency to determine and allocate cumulative hydraulic and pollutant loads to ensure that the goals of the community and state can be met.**

**Performance Base Standards are based upon an acceptable level of pollutant removal or treatment.**

**Culmulative loadings from on-site systems must be within the parameters limits set under the loading allocations established by permits (NPDES and UIC)**

**Public Health must be protected at the site level.**

**Performance limits must be met at the point of compliance.**


**Decentralized Waste Water Treatment Systems can be protective of public health and the water quality if they are properly planned, sited, designed, constructed, installed, operated, and maintained.**



# Decentralized Waster Water Treatment

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- **Managed individual on-site or clustered systems**
- **Septic systems, private sewage systems, individual sewage systems, on-site sewage disposal systems, or package plants**
- **Collect, treat, and disperse waster water from individual dwellings, businesses, or small communities, or service areas**



**Effective management is the key to ensuring that the desired level of environmental and public health protection for any given community is achieved.**

# **EPA established levels of management**

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- **Homeowner**
- **Maintenance Contractor**
- **Operating Permit**
- **Responsible Management Entity (RME)**  
– **Operation and Maintenance**
- **Responsible Management Entity (RME) -**  
**Ownership**



# **Benefits of a Properly Trained Management Entity**

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- **Protection of Public Health and Water Resources**
- **Protection of Property Values**
- **Groundwater Conservation**
- **Preservation of Tax Base**
- **Life-Cycle Cost Savings**

**Decentralized Waste Water  
Treatment Systems that  
employ alternative wastewater  
technology with a design capacity  
of 3000 gpd or greater requires a  
level 4 or 5 management entity be  
identified before a construction  
permit and operational  
(discharge) permit will be issued.**

# **Level 4 – Responsible Management Entity (RME) – Operation and Maintenance**

- **Areas of moderate to high environmental sensitivity**
- **Reliable and sustainable system operation and maintenance**
- **Clustered systems**



# **Level 5 – Responsible Management Level (RME) - Ownership**

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- **Areas of greatest environmental sensitivity**
- **Reliable and sustainable system operation and maintenance is required**
- **Preferred management level for clustered systems serving multiple properties under different ownership (subdivisions)**

# Questions?

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**Please Contact: Dave Watkins**

**WVDEP**

**304-926-0495**