Septic systems in the Rattlesnake

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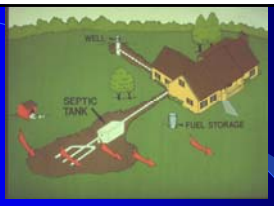
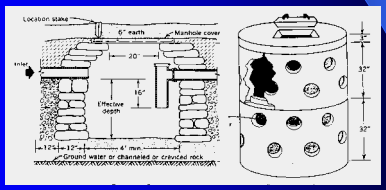
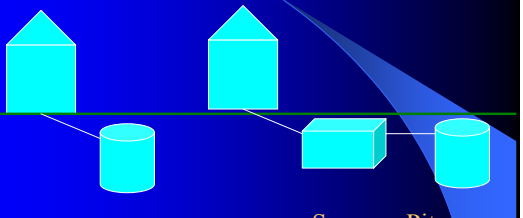


Drainfield



Cesspool Seepage Pit



Septic system contaminants

- Nitrates
- Bacteria and Viruses
- Chemicals
  - Household Hazardous Wastes
  - Commercial Wastes
    - Paints, pesticides, solvents, petroleum products

Characteristics of typical residential wastewater

Parameter	Avg. Conc. Milligrams/liter or # organisms/liter
Total Solids	840
BOD5	245
Total Nitrogen	67
Total Phosphorous	23
Total Coliform bacteria	100 billion
Fecal Coliform bacteria	1 billion

Water Borne Diseases Associated with Septic system Waste

- Salmonellosis
- Typhoid Fever
- Paratyphoid Fever
- Bacillary dysentery
- Cholera
- Campylobacter enteritis
- Traveler's Diarrhea

Human Pathogens that may be transported to groundwater

Microorganism	Disease
Poliovirus	poliomyelitis
Hepatitis A	Infectious hepatitis
Rotavirus	Diarrhea
E. Coli (pathogenic)	Diarrhea
Salmonella Typhi	Typhoid Fever
Vibrio Cholera	Cholera
Shigella spp.	Bacillary Dysentary

Survival of pathogens in groundwater

Salmonella paratyphi	60-70 days
Salmonella typhi	8-23 days
Shigella	10-35 days
Coliform bacteria	7-8 days
E. Coli	10-45 days
Viruses (polio, hepatitis, entero)	16-140 days

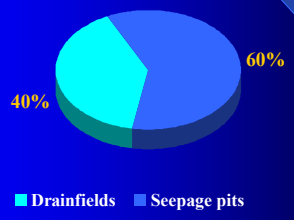
Nitrate-nitrogen

- Indicator of presence of sewage or other contaminants in groundwater
- Drinking Water standard is 10 mg/l
  - Set in 1951 – no safety margin
  - Standard is 5 or less in some other countries
- Health effects
  - Blue baby disease – methemoglobinemia
  - Miscarriage
  - Potential Thyroid disruption, birth defects, cancer

1996 Unsewered Areas Study

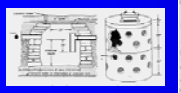
- R-snake Ranked 5th priority for public sewer
- Several wells affected by nitrates and bacteria
- Two high density quarter sections
- High percentage of seepage pits and replacement permits
- Groundwater from R-snake recharges Missoula aquifer, contributes to elevated nitrates in Northside and West Broadway areas

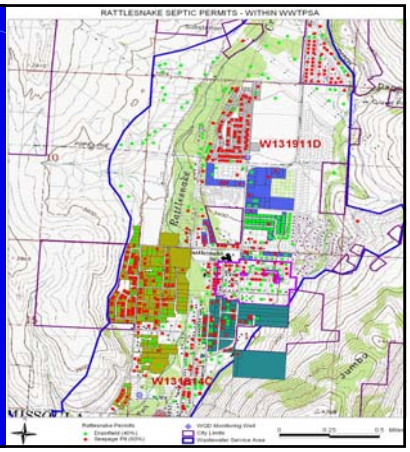
Rattlesnake: Septic System Permits 876*



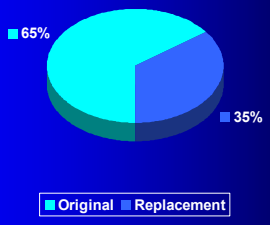
* All permits within sewer service area 1967-2002

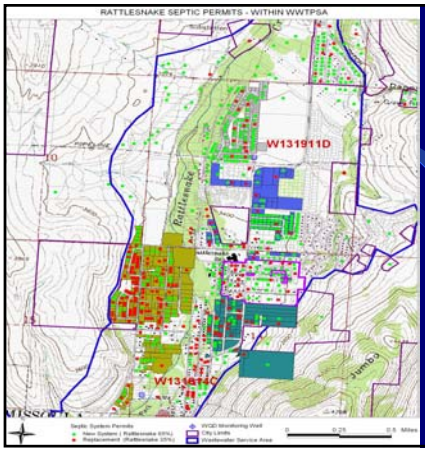
- Seepage Pit
- Drainfield





Rattlesnake Septic System Permits 876





- Original system
- Replaced

Sewer Connection Required

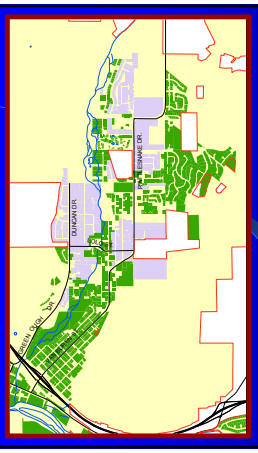
- When septic system fails and sewer main is within 200 feet of property
- When land is subdivided, and main is within 500 feet of subdivision

Seepage pit replacement

Seepage pit replacement

Lincoln Hills Drainfield

Lincoln Hills Drainfield



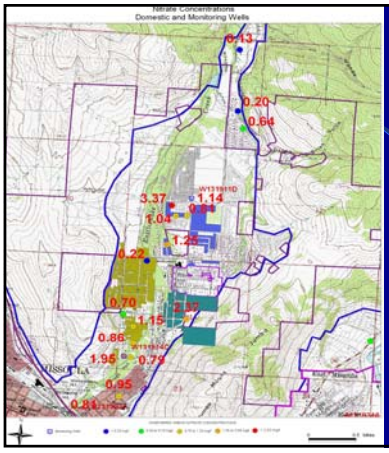
825 units* on septics in Rattlesnake

- Generate 165,000 gallons/day of sewage
- Generate 69 lbs/day of nitrogen
  - Source – 1996 Unsewered Areas Study

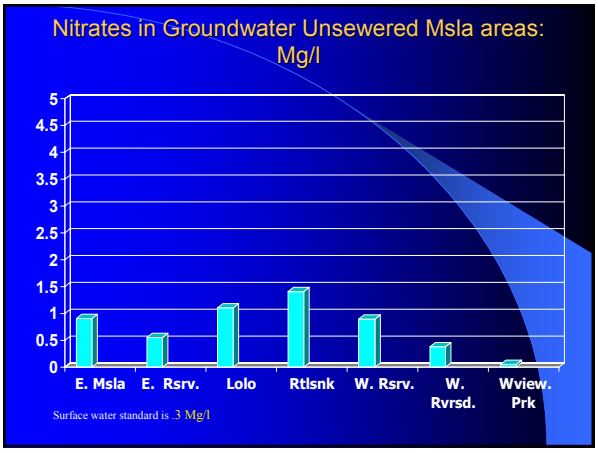
*residential units on septic systems within high density areas of Rattlesnake, - 1995

Well monitoring

- 15 private wells monitored quarterly
- Average nitrate – 1.21 mg/l
- Maximum nitrate – 3.37
- Minimum nitrate – 0.20
- One well fecal coliform positive
- One well total coliform positive
  - Source – 1996 Unsewered Areas Study
- WQD Monitoring wells 1.15 – 1.96 mg/l

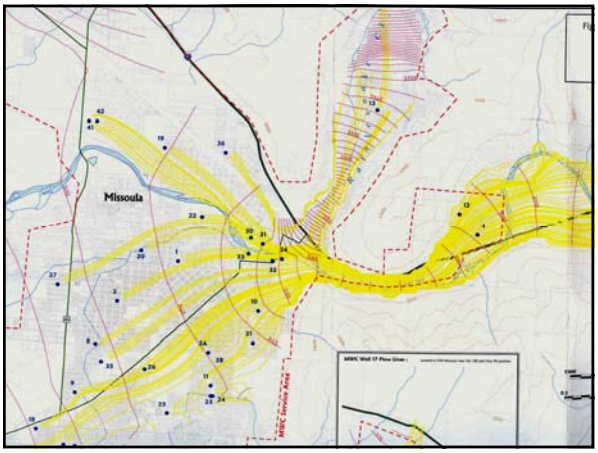


- Private well data from 1996 Unsewered Areas Study
- Monitoring well data – long-term average



Nitrates in Drinking Water

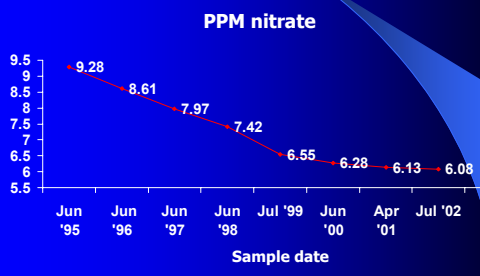
- Typical septic tank effluent 50 mg/l
- If drinking water contains 2.5 mg/l, 5% of the water may originate in nearby septic tanks – If there are no other significant sources
  - Fertilizer small source compared to septics
  - Agriculture and livestock not significant sources in Rattlesnake



Rattlesnake Aquifer as a Drinking Water Supply

- The only Mountain Water well in the Rattlesnake is shut down due to intermittent contamination with coliform bacteria
- 102 individual wells in Rattlesnake in 1995
  - 45 wells per square mile
  - Source – 1996 Unsewered Areas Study

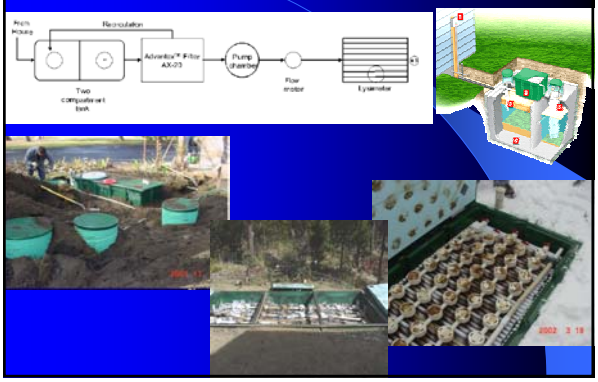
Linda Vista: Average Nitrate Value in 11 Wells Since Public Sewer Was Installed in 1995



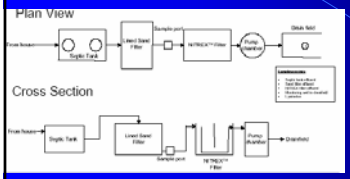
Nitrogen Removal Septic Systems

- Use same biological nitrogen removal process as the Treatment Plant
  - Anaerobic/aerobic process
- All systems remain in development, testing and approval process
- Recirculating Sand Filter
- Recirculating Trickling Filter
- Waterloo Nitrex
- Biokreisel
- Others

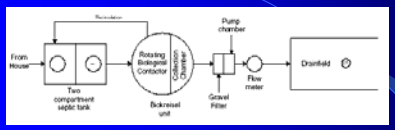
Orenco Advantex Trickling Filter



Waterloo Nitrex



Biokreisel



Recirculating Sand Filter

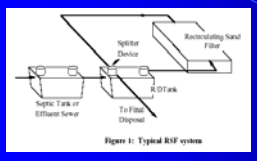


Figure 1: Typical RSF system

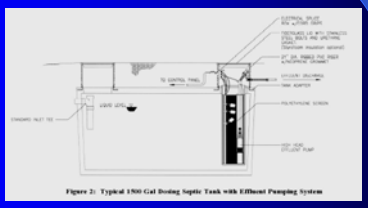
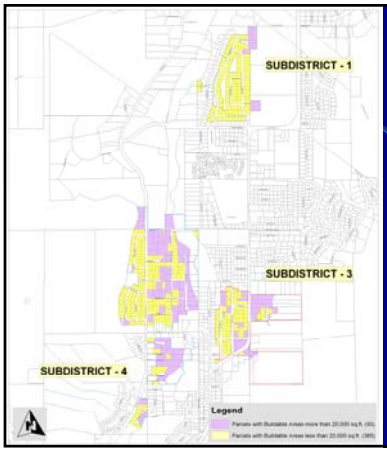


Figure 2: Typical 1500 Gal Dosing Septic Tank with Effluent Pumping System

Nitrogen Removal Systems

- Require at least 20,000 ft² for approval in new subdivisions – 1 acre if well on property
- Replacement required in about 20 years
- Best suited for community systems
- Less effective in cold weather
- Long-term performance and life-span unknown
- Pumps, controls, alarms require management and upkeep
- Maintenance and monitoring required to ensure long-term performance



- 20,000 ft² required to install septic systems, including nitrogen removal systems, in new subdivisions
- Current densities would not be permitted with on-site septic systems

Nitrogen Removal and Cost

- Cost - $7,850 to $14,000
  - Installation cost does not include ongoing maintenance or replacement
- Nitrogen Removal – 40 - 96%

Nitrogen Removal Septic Systems

- Will not fit on small lots - 20,000 ft²
  - Replacement area required
- Installation costs equal to or more than public sewer
- Require ongoing maintenance and monitoring
- No systems yet approved
- May be feasible for lower density development and areas that can not receive public sewer