Biogeochemical Changes in Aquifers from Injected Waste Water

Contribution to Peter Dillon’s ASR feasibility study

by Robert G Gerritse

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Introduction

Important issues in ASR of waste water are sustainability of the injection and quality of the recovered water. Sustainability of injection is affected by clogging of well screens and of the neighbouring aquifer as well as by dissolution (accelerated weathering) of aquifer material.

Clogging can be mechanical from particulate matter in the waste water, chemical from precipitation reactions in the aquifer and biological from accumulation of bacterial slimes and redox products. These problems can be prevented by proper filtration, addition of chelating agents and by disinfection (chlorination, ozonisation) of waste water before injection.

Accelerated weathering cannot be prevented and can be driven by abrasion of a soft matrix (e.g. calcite) at high rates of flow (Gerritse, 1994), but also by increased solubilities of silicates at higher concentrations of dissolved organic matter (Bennett & Siegel, 1987; Dove & Rimstidt, 1994). Calcite and other carbonates can be mobilised by complexation reactions of Ca and Mg with dissolved organic matter (DOM) and by increased CO$_2$ concentrations (Vengosh & Keren, 1996).

The quality of the recovered water can be affected by microbial oxidation in the aquifer of DOM through Fe- and Mn-oxides and dissolved sulphate (see references in Appendix I p88-105). These reactions can cause a significant increase in dissolved Fe and Mn and can generate pyrites, sulphides, siderite. Solubilities of other elements such as U and Th can be increased to unacceptable levels by DOM and increased CO$_2$ concentrations. These changes cannot be prevented, but can be remediated by appropriate treatment of the water before (in situ) or after recovery.

In this report the conditions for dissolution/precipitation of carbonates after injection of waste water into a calcareous aquifer are explored. Also a worst possible case scenario is investigated for oxidation in the anoxic aquifer of DOM in waste water by sulphate with subsequent saturation of Fe-oxides by sulphide.

Calcite/Dolomite reactions

Average compositions of treated effluent from the Bolivar waste water treatment plant and of waste water used in other studies (Harman et al., 1996; Vengosh & Keren, 1996; Wilhelm et al.,1996; Whitworth, 1995) are compared in Table 1. Concentrations of Mg are high relative to Ca in the Bolivar waste water and probably reflect the Ca/Mg ratio of Murray River water. The high concentrations of sulphate in the Bolivar waste water are associated with the relatively high salinity.
Table 1 Comparison of compositions of treated and filtered Bolivar waste water (*) with treated waste waters from Albuquerque (†: Whitworth, 1995) and El Paso (‡: Whitworth, 1995) and from Tel-Aviv+Jaffa (#: Vengosh & Keren, 1996) and with effluents from septic tanks (§: Harman et al., 1996 and ¶: Wilhelm et al., 1996).

<table>
<thead>
<tr>
<th></th>
<th>Bolivar*</th>
<th>Albuquerque†</th>
<th>El Paso‡</th>
<th>Tel-Aviv#</th>
<th>Septic I§</th>
<th>Septic II¶</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>7.5</td>
<td>7.0</td>
<td>7.8</td>
<td>-</td>
<td>7.6</td>
<td>7.2</td>
</tr>
<tr>
<td>Ca mg L⁻¹</td>
<td>48</td>
<td>43.6</td>
<td>54.2</td>
<td>74</td>
<td>137</td>
<td>41</td>
</tr>
<tr>
<td>Mg mg L⁻¹</td>
<td>35</td>
<td>6.4</td>
<td>3.9</td>
<td>36</td>
<td>25</td>
<td>14</td>
</tr>
<tr>
<td>K mg L⁻¹</td>
<td>50</td>
<td>21.8</td>
<td>15.6</td>
<td>26</td>
<td>43</td>
<td>12</td>
</tr>
<tr>
<td>Na mg L⁻¹</td>
<td>320</td>
<td>13.2</td>
<td>163.2</td>
<td>238</td>
<td>107</td>
<td>90</td>
</tr>
<tr>
<td>Cl mg L⁻¹</td>
<td>420</td>
<td>60</td>
<td>180</td>
<td>360</td>
<td>207</td>
<td>40</td>
</tr>
<tr>
<td>S-SO₄ mg L⁻¹</td>
<td>70</td>
<td>30</td>
<td>25</td>
<td>30</td>
<td>20</td>
<td>7</td>
</tr>
<tr>
<td>N-NOx mg L⁻¹</td>
<td>0.1-3</td>
<td>18</td>
<td>6</td>
<td>0.06</td>
<td>0</td>
<td>1.3</td>
</tr>
<tr>
<td>N-NH₄ mg L⁻¹</td>
<td>3-30</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>128</td>
<td>32</td>
</tr>
<tr>
<td>N-org mg L⁻¹</td>
<td>3-10</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>20</td>
<td>-</td>
</tr>
<tr>
<td>P-PO₄ mg L⁻¹</td>
<td>0.2</td>
<td>-</td>
<td>-</td>
<td>6</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>DOC mg L⁻¹</td>
<td>12-20</td>
<td>-</td>
<td>-</td>
<td>17</td>
<td>20</td>
<td>38</td>
</tr>
<tr>
<td>Org. C/N ratio</td>
<td>1-6</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>Alkalinity meq. L⁻¹</td>
<td>4.1</td>
<td>2.7</td>
<td>3.3</td>
<td>5.4</td>
<td>16</td>
<td>7.5</td>
</tr>
<tr>
<td>Fe mg L⁻¹</td>
<td>0.05</td>
<td>0.2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0.1</td>
</tr>
<tr>
<td>Si mg L⁻¹</td>
<td>4</td>
<td>13</td>
<td>13</td>
<td>-</td>
<td>5</td>
<td>-</td>
</tr>
<tr>
<td>F mg L⁻¹</td>
<td>1</td>
<td>1.2</td>
<td>0.9</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>B mg L⁻¹</td>
<td>0.53</td>
<td>-</td>
<td>-</td>
<td>0.54</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Before recharge the Bolivar effluent is treated by Dissolved Air Flotation and Filtration (DAF/F). Infiltration experiments at labscale in columns of aquifer material were conducted with small batches of aerated and filtered Bolivar effluent. The compositions of DAF/F and batch treated effluent (=column influent) and the composition of groundwater from the Northern Adelaide Plains ASR site (observation well 42357) are given in Table 2.
Because of high concentrations of both Ca and Mg in groundwater (Table 2), it is likely that aquifer material at the ASR site (reported to contain about 40 to 50% CaO and 2 to 5% MgO) consists of a solid solution of Mg in calcite. Busenberg and Plummer (1989) suggest that Mg calcites are best described as a solid solution with calcite and dolomite as end-members (see also Appelo and Postma, 1993). The waters, with composition shown in Table 2, were reacted with a solid solution of Mg in calcite (calcite and dolomite as end members) and with dolomite or calcite as single mineral phases using the geochemical modelling package PHREEQE (Parkhurst et al., 1980). Only equilibrium conditions are calculated by PHREEQE, while often attainment of equilibrium concentrations is severely limited by slow rates of precipitation or dissolution (Helgeson et al., 1984; Anbeek et al., 1994; Manning, 1994; Dreybrodt et al., 1997). PHREEQE does, also, not account for complexation of Ca and Mg by dissolved organic matter (DOC in Table 1).

**Table 2** Compositions of DAF/F and batch treated effluent (=column influent) from the Bolivar waste treatment plant and the composition of groundwater from the Northern Adelaide Plains ASR site (observation well 42357), as were used in the geochemical simulation of their reaction with aquifer material.

<table>
<thead>
<tr>
<th></th>
<th>DAF/F effluent</th>
<th>Column influent</th>
<th>Groundwater</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>-</td>
<td>7.5</td>
<td>7.21</td>
</tr>
<tr>
<td>Eh mV</td>
<td>-</td>
<td>-</td>
<td>-38</td>
</tr>
<tr>
<td>Temperature °C</td>
<td>-</td>
<td>-</td>
<td>25.7</td>
</tr>
<tr>
<td>Ca mg L⁻¹</td>
<td>44</td>
<td>44</td>
<td>157</td>
</tr>
<tr>
<td>Mg mg L⁻¹</td>
<td>38</td>
<td>38</td>
<td>82.3</td>
</tr>
<tr>
<td>Na mg L⁻¹</td>
<td>340</td>
<td>345</td>
<td>494</td>
</tr>
<tr>
<td>K mg L⁻¹</td>
<td>48</td>
<td>47</td>
<td>14.3</td>
</tr>
<tr>
<td>Cl mg L⁻¹</td>
<td>480</td>
<td>480</td>
<td>940</td>
</tr>
<tr>
<td>S-SO₄ mg L⁻¹</td>
<td>83</td>
<td>83</td>
<td>94</td>
</tr>
<tr>
<td>N-NO₃ mg L⁻¹</td>
<td>1.6</td>
<td>1.6</td>
<td>0</td>
</tr>
<tr>
<td>Alkalinity meq. L⁻¹</td>
<td>3</td>
<td>3</td>
<td>4.4</td>
</tr>
</tbody>
</table>

Results of the geochemical simulation with PHREEQE of the reaction of waste water and groundwater with aquifer material are shown in Figs.1-7.
In Fig. 1 the change in concentration of Ca or Mg relative to the initial concentration in groundwater (Table 2) is plotted as a function of the partial pressure of CO₂, when in equilibrium with calcite+dolomite, with dolomite or with calcite. The corresponding relationship between pH, alkalinity and pCO₂ is given in Fig.2. The actual composition of groundwater (Table 2) fits this relationship for a partial pressure of CO₂ of about 0.014 atm (~1.4 kPa). Figures 1 and 2 indicate that groundwater is in equilibrium with mainly calcite at a partial pressure of CO₂ of ~1.4 kPa.

Results of simulating the reaction of DAF/F treated effluent or column influent (Table 2) with aquifer material are given in Fig. 3 for non sulphate-reducing conditions (Eh>-200 mV: Fig. 7). The corresponding relationship between pH, alkalinity and pCO₂ is given in Fig. 4. The actual composition of waste water (Table 2) fits this relationship for a partial pressure of CO₂ of about 0.0046 atm (~0.47 kPa). Figures 3 and 4 suggest that dissolution of calcite is likely at Eh>-200 mV in columns of aquifer material, leached with treated waste water, and that the Ca concentration in the effluent can increase to between 125 and 150% of the concentration in the influent. Increases in the concentration of Mg in the effluent are predicted to be much smaller than of Ca.

The effects of sulphate reduction on the reaction of waste water with aquifer material are given in Figures 5 and 6 for otherwise the same conditions that apply to Figures 3 and 4. Sulphate reducing conditions (Figure 7) increase the partial pressure of CO₂ at which dissolution of calcite and dolomite begins. Sulphate reduction in the aquifer will be accompanied by an increase in the partial pressure of CO₂ through the associated oxidation of DOC. And the magnitude of this increase will strongly determine the extent of dissolution of aquifer material as formation and removal of CO₂ are critically important in both precipitation and dissolution of Ca and Mg carbonates (Dreybrodt et al. 1997).

A knowledge of the ranges of the parameters of Figs.1-7 along the recharge plume in the aquifer is essential for a proper assessment of potential changes in permeability of the aquifer from dissolution or precipitation. Actual changes will always be limited by kinetic effects (Dreybrodt et al., 1997; Suarez & Simunek, 1997) and can best be quantified by simulating aquifer conditions in leached columns of aquifer materials (Von Gunten & Zobrist, 1993; Gerritse, 1996).

Iron sulphides

Sulphate in the waste water is able, by being an electron acceptor for microorganisms, to indirectly oxidise DOC and the solid (natural) organic matter in the aquifer materials. Reaction rates with natural (solid) organic matter are slow (Jakobsen & Postma, 1994), but are still sufficient to produce H₂S and lead to formation of iron sulphides (Kimblin & Johnson, 1990; Johnson & Wood, 1993). Reaction rates with DOC are faster (Von Gunten & Zobrist, 1993). The decrease in Eh in anoxic aquifers, necessary for sulphate reduction to occur (Fig.7), depends on the relative rates of reaction of DOC with Fe-oxides in aquifer materials and with dissolved sulphate (Lensing
et al., 1992), and is not always sufficient for sulphate reduction to occur. The stoechiometry of the reaction of DOC with sulphate can vary with the “quality” of DOC and thus lead to production of different amounts of CO$_2$ and H$_2$S (Fig.8). The generation of CO$_2$ from oxidation of DOC can enhance the dissolution of calcite (Figs. 1, 3 and 5). The H$_2$S reacts with Fe-oxides to form Fe-sulphides. The capacity of the aquifer to “absorb” H$_2$S depends on its Fe content and, once saturated, will lead to H$_2$S appearing in the recovered waste water. In stead of H$_2$S, high concentrations of dissolved Fe(II) and Mn(II) will occur in recovered water and precipitation of siderite (FeCO$_3$) is possible, when sulphate reducing conditions are not established. In Fig.9 the volume of aquifer, saturated annually with sulphide from sulphate in waste water, is given for different contents of Fe. The estimates in Fig.9 assume all Fe eventually to react with sulphide to pyrite (FeS$_2$) (Gerritse, 1998). According to Fig.9, between 0.5 and 0.025 GL of aquifer space will then, at least, be saturated each year with pyrite for a (reported) concentration of 1-5% Fe in aquifer material and for annual injection of 15-50 GL of waste water. However, the stoechiometry of the oxidation of DOC by sulphate (Fig.8) and the composition of waste water is such that only about half of the sulphate in waste water can be reduced by the DOC. The remainder can react further with the solid organic matter in the aquifer (range 0.15 to 0.5 %), but according to aquifer data (Eh--38 mV,Tables 2 and 7) is not likely to do so.
References


Figure 1 Results of equilibrating groundwater from observation well 42357, of the Northern Adelaide Plains ASR site, with mixed calcite/dolomite, with dolomite and with calcite at different partial pressures of CO$_2$ (pCO$_2$ = -log [partial pressure of CO$_2$ in atm]). The resulting precipitation or dissolution of Ca and Mg are indicated on the Y axis and were calculated with PHREEQE from the groundwater composition given in Table 2 and for non sulphate-reducing conditions at 25.7°C. Arrows on the X-axis indicate the partial pressure of CO2 in the atmosphere (a) and in the aquifer (b), estimated from Fig.2).
Figure 2  Nomogram of pH, alkalinity and pCO₂ (= -log [partial pressure of CO₂ in atm] ) for groundwater from observation well 42357 of the Northern Adelaide Plains ASR site (Table 2) in equilibrium with calcite and dolomite, with dolomite or with calcite. Data were calculated with PHREEQE for non sulphate-reducing conditions. Temperature = 25.7°C. The arrows point to the actual composition of the groundwater (Table 2). The corresponding partial pressure of CO₂ is about 0.014 atm (1.4 kPa).
Figure 3  Results of equilibrating DAF/F treated effluent and influent, used to leach labscale columns of aquifer material, with mixed calcite/dolomite, with dolomite or with calcite, at different partial pressures of CO₂ (pCO₂ = -log [partial pressure of CO₂ in atm]). The resulting precipitation or dissolution of Ca and Mg are indicated on the Y axis and were calculated with PHREEQE from the waste water composition given in Table 2 for non sulphate-reducing conditions at 25° C. Arrows on the X-axis indicate the partial pressure of CO₂ in the atmosphere (a) and in the leached columns of aquifer material (b), estimated from Fig.4).
Figure 4  Nomogram of pH, alkalinity and pCO$_2$ (= -log [partial pressure of CO$_2$ in atm] ) for DAF/F treated effluent and influent for lab columns of aquifer material (Table 2) in equilibrium with calcite and dolomite, with dolomite or with calcite. Data were calculated with PHREEQE for non sulphate-reducing conditions. Temperature = 25°C. The arrows indicate the actual composition of effluent from lab columns of aquifer material (Table 2). The corresponding partial pressure of CO$_2$ is about 0.0046 atm (0.47 kPa).
Figure 5 Results of equilibrating DAF/F treated effluent and influent, used to leach labscale columns of aquifer material, with mixed calcite/dolomite, with dolomite or with calcite, at different partial pressures of CO$_2$ (pCO$_2$ = -log [partial pressure of CO$_2$ in atm] ). The resulting precipitation or dissolution of Ca and Mg are indicated on the Y axis and were calculated with PHREEQE for sulphate reducing conditions from the waste water composition given in Table 2. The Eh was chosen to give about 50% reduction of sulphate (Fig.7). Temperature = 25° C.
Figure 6  Nomogram of pH, alkalinity and pCO₂ (= -log [partial pressure of CO₂ in atm]) for DAF/F treated effluent and influent for lab columns of aquifer material (Table 2) in equilibrium with calcite and dolomite, with dolomite or with calcite. Data were calculated with PHREEQE for sulphate-reducing conditions. 50% of initial sulphate (Table 2) was reduced at 25°C. The arrows indicate the actual composition of effluent from a lab column of aquifer material. Sulphate-reducing conditions quite clearly do not apply to the columns.
Figure 7  The redox potential (Eh) as a function of pH for about 50% reduction of sulphate in DAF/F treated sewage effluent. Data were calculated with PHREEQE for the effluent composition given in Table 2.
some thoughts!!

4 CH₄O + 3 SO₄²⁻ → 3 H₂S + 4 CO₂ + 6 OH⁻ + 2 H₂O

2 CH₂O + SO₄²⁻ → H₂S + 2 CO₂ + 2 OH⁻

oxidized

8 CH₂O + SO₄²⁻ → H₂S + 8 CO₂ + 2 OH⁻ + 2 H₂O

CH₂O + 4 Fe(OH)₃ → 4 Fe(OH)₂ + CO₂ + 3 H₂O

Fe(OH)₂ + H₂S → FeS + 2H₂O

Fe(OH)₂ + H₂S₂ → FeS₂ + 2H₂O

7 CH₂O + 4 SO₄²⁻ → 2 H₂S₂ + 7 CO₂ + 8 OH⁻ + H₂O

HS⁻ is main species!

Fe₂O₃ + 3 H₂S → Fe₂S₃ → FeS + FeS₂

**Figure 8** Stoichiometry of potential, microbially mediated, oxidation- and associated reactions of dissolved organic matter in waste water with sulphate and iron oxide.
Figure 9  Estimated ranges of annual storage volume in an aquifer associated with saturation -adsorption H$_2$S from injected waste water to iron oxides.
APPENDIX 1

REFERENCES for “ASR+aquifer processes” related topics

TI: Hydrogeology and selected water-quality aspects of the Hueco Bolson aquifer at the Hueco Bolson Recharge Project Area, El Paso, Texas.
AU: Buszka,-P.M.; Brock,-R.D.; Hooper,-R.P.
PY: 1994
LA: English
LS: English
PT: R (Report)
AB: Samples of ground water and tertiary-treated water were evaluated to determine the distribution of injected water and trihalomethane compounds in the Hueco bolson aquifer near El Paso, Texas. Chloride and nitrate concentrations and oxygen-18/oxygen-16 (beta180) values were used with end-member mixing analysis to estimate the fractional contributions of injected water, irrigation-affected water, saline ground water, and freshwater to ground-water chemistry. Several laterally continuous sand and gravel layers are the principal water-yielding lithologies in the aquifer. The potentiometric surface sloped toward the south and southwest during January 1990. Average linear ground-water velocities were as large as 1.4 feet per day near the zone of largest hydraulic conductivity, and were substantially smaller farther south and east. Ground-water samples from as far as 2,900 feet from an injection well contained injected-water tracers and trihalomethane compounds. Ground-water samples with injected-water tracers and no trihalomethane compounds may indicate infiltration from septic systems or oxidation ponds. Apparent breakthrough velocities of injected water in the aquifer ranged from 0.13 to 1.3 feet per day. Irrigation-affected water and saline water also were identified in water from several wells. Ground-water transport of bromoform and dibromochloromethane was attenuated relative to injected water, chloroform, and dibromochloromethane. Microbial transformation of bromoform and dibromochloromethane probably was responsible for their disappearance from ground water. Chloroform and dichlorobromomethane concentrations were affected principally by advective and dispersive transport of injected water.
DE: USA,-Texas; geohydrology-; groundwater-recharge; potentiometric-level; water-quality; organic-compounds; water-pollution-sources; groundwater-movement; permeability-coefficient; Hueco-Bolson-Recharge-Project-Area
CL: Groundwater (0840)
AN: 3783120

TI: The effects of historic abstraction of groundwater from the London basin aquifers on groundwater quality.
AU: Kinniburgh,-D.G.; Gale,-I.N.; Smedley,-P.L.; Darling,-W.G.; West,-J.M.; Kimblin,-R.T.; Parker,-A.; Rae,-J.E.; Aldous,-P.J.; O'Shea,-M.J.
AF: British Geol. Surv., Wallingford OX10 8BB, UK
SO: APPL.-GEOCHEM. 1994 vol. 9, no. 2, pp. 175-195
IS: 0883-2927
PY: 1994
LA: English
LS: English
PT: J (Journal-Article)
AB: The Basal Sands and Chalk aquifers in the Lee Valley and Enfield-Haringey areas of north London have considerable potential for artificial recharge having been dewatered by groundwater abstraction since the late 1800s. Trials have been undertaken periodically since the mid 1950s. However, one of the drawbacks is the
potential for developing poor-quality groundwater as a result of pyrite oxidation in the Basal Sands. Analysis of pumped groundwaters from the Basal Sands has confirmed the presence of relatively high concentrations of dissolved SO\(_4\) along with K, Ca, total Fe and Li. Porewater chemistry profiles have been obtained from fresh cores through the Basal Sands and underlying Chalk at four sites. The site with the highest SO\(_4\) concentration (up to 33,000 mg/l) had a porewater pH of 3.45 and has remained dewatered owing to overpumping for more than 70 a. Water pumped from the Chalk showed little evidence of these extreme conditions. There was no overall correlation between the bulk pyrite (or gypsum) content of the sediment and the porewater SO\(_4\) concentration within the sediment. The principal mechanism governing the generation of SO\(_4\) is the oxidation of pyrite which is present in small amounts (<0.1%-1.2%, average 0.4%) throughout the Basal Sands. The acid released during this oxidation reacts with smectite, illite, glauconite, feldspar and calcite, leading to high concentrations of Mg, K and Ca and other solutes in the porewater. The extremely high concentrations of SO\(_4\) in the porewaters indicate that the extent of oxidation is controlled by the entry of air rather than the input of dissolved oxygen or nitrate in the groundwater or recharge water. Abstraction from the Chalk aquifer over many decades has resulted in the dewatering of the overlying Basal Sands aquifer allowing air entry and has led to the localized oxidation of pyrite and the accumulation of poor-quality porewater in the Basal Sands. The rate of oxidation is probably greatest near to wells and boreholes which allow ready access of air. The solutes produced are only available for abstraction after the water table has risen. Dilution with native Chalk groundwater will tend to minimize potential water quality problems. Future oxidation will be minimized by maintaining a high water table.

DE: groundwater-; aquifers-; water-quality; artificial-recharge; water-analysis; geochemistry-; British-Isles,-England,-London; drinking-water; groundwater-abstraction
CL: Groundwater-management (2040); Chemical-processes (0880)
AN: 3558322

TI: Geochemical Assessment of Aquifer Recharge Effects in the Southwest Denver Basin.
AU: Aikin,-A.-R.; Turner,-A.-K.
PY: 1989
AB: Recharge of the Denver groundwater basin by injection recharge has been proposed as a result of increasing depletion of the water supply. However, injection recharge can cause physical and chemical changes in the geologic materials of the recharged aquifers, depending on the chemistry of both the host and injected waters, as well as the mineralogy of the aquifer's rock matrix. The Denver groundwater basin contains four principal bedrock aquifers, of which the Arapahoe aquifer is considered to be the best in terms of water quality and quantity. Some preliminary field injection tests have been undertaken using drinking water supplies. However, water that meets drinking water standards contains constituents which may react upon injection, resulting in aquifer damage. The field injection test results have not been publicly released. As a preliminary step in designing future field tests, analyses of aquifer water and Denver Water Board municipal drinking water were evaluated by a geochemical equilibrium computer model (PHREEQE), developed by the U.S. Geological Survey, to determine the potential for reaction. The results of these simulations confirm that the Arapahoe aquifer is a good candidate for injection recharge. No fatal flaw appears to exist, from a geochemical standpoint, which would prevent the use of drinking water to recharge the Arapahoe aquifer. (Ward-CO WRRI) 35 006683006
DE: *Colorado-; *Drinking-water; *Geochemistry-; *Groundwater-recharge; *Recharge-wells; Arapahoe-Aquifer; Denver-basin; Injection-; Model-studies; Potable-water; Water-supply
CL: Groundwater-management (2040)
AN: 9309919

TI: Effect of Wastewater Injection on Ground Water Quality.
AU: Legeas,-M.; Carre,-J.; Merot,-P.
AF: Ecole Nationale de la Sante Publique, Departement Environnement et Sante, Avenue du Professeur Leon
AB: Effluents from the treatment plant of Saint Jean de Monts and Saint Hilaire de Riez (France) have been injected into a confined groundwater aquifer for twelve years. The effluents have been treated to remove 90% of the concentrations of suspended solids, 70% of the oxidizability, but less than 10% of the nitrogen. The groundwater is connected with the sea. Effluent floats on the surface of the aquifer and disperses by dilution at the freshwater/saltwater interface. The aquifer acts as a direct overflow pipe. This injection of effluent has preserved the water quality in the coastal area and in the Breton Marsh. If the inflow rate were increased, the balance of the system would probably be disturbed and the time required for diffusion of wastewater seawards would no longer be sufficient. (See also W93-05228) (Author's abstract)

DE: *Dilution-; *Effluents-; *Groundwater-; *Groundwater-movement; *Path-of-pollutants; *Wastewater-disposal; Aquifers-; Coasts-; Flow-rates; Marine-environment; Nitrogen-; Oxidation-; Saline-freshwater-interfaces; Suspended-solids; Water-chemistry; Water-quality-standards

CL: Ultimate-disposal-of-wastes (3050); Sources-and-fate-of-pollution (3020)

AN: 9305257

TI: Water Banking Through Artificial Recharge, Las Vegas Valley, Clark County, Nevada.

AU: Katzer,-T.; Brothers,-K.

AF: Las Vegas Valley Water District


PY: 1990

AB: Artificially recharging the Las Vegas Valley groundwater system is one water resource management option available to the Las Vegas Valley Water District (District) to help meet increasing summer peak water demands. At the present time (1988) the water supply for Las Vegas Valley is made up of ca. 75% Colorado River water and ca. 25% groundwater, which is used primarily in the summer to meet peak demands. The District is investigating the feasibility of increasing the importation of treated Colorado River water into the valley during winter months, banking the water by artificially recharging the groundwater system, and subsequently withdrawing this water to meet summer peak demands and future needs. There were two major concerns regarding the feasibility of artificially recharging treated Colorado River water by deep aquifer injection. The first was the potential for calcite precipitation resulting from native groundwater and aquifer sediments mixing with treated Colorado River water which could reduce the aquifer permeability. The second was the long-term effects on well performance and production longevity by injecting through production wells. Although previous laboratory studies predicted that calcite precipitation would occur, a small-scale artificial recharge pilot study, conducted by the District in 1987, showed insignificant calcite precipitation. A larger scale demonstration project, initiated in February 1988, injected a total of 1153 acre-feet of treated Colorado River water into the principal groundwater system through two existing production wells. Injection was completed in late April and recovery of the native groundwater and Colorado River water mixture continued throughout the summer and fall. Recharge was accomplished by injection through the existing pump columns with minimal retrofitting of the existing wells and no detrimental effects to the pumps or well production rates have been determined. Water quality analyses and geochemical modeling indicate very little, if any, calcite precipitated during recharge and recovery. (Author’s abstract)

DE: Artificial-recharge-Groundwater-availability-Groundwater; management-Groundwater-recharge-Nevada-Water-resources; management-Aquifer-characteristics-Calcite-Colorado-River; Groundwater-chemistry-Groundwater-quality-Model-studies; Production-wells-Pumpage-Water-demand

CL: Groundwater-management (2040); Groundwater (0840); Evaluation-process (4020)

AN: 9100880

TI: Artificial Recharge in Las Vegas Valley, Clark County, Nevada.

AU: Katzer,-T.; Brothers,-K.

AF: Las Vegas Valley Water District NV

SO: Ground Water GRWAAR Vol. 27, No. 1, p 50-56, January-February 1989. 3 fig, 5 tab, 9 ref.

PY: 1989

AB: The existing water supply system for Las Vegas Valley is limited since peak water used demand periods in
10-20 yr or less will require the construction of additional facilities. To prepare for these short-term (and longer) demands, the Las Vegas Valley Water District, in cooperation with the U.S. Bureau of Reclamation, conducted a limited groundwater recharge demonstration project using treated Colorado River water. A major concern of water managers regarding artificial recharge is the resulting water chemistry when treated (potable) Colorado River water is injected into the groundwater system. Both waters are high in calcium, creating a potential for calcite precipitation which, in addition to clogging the perforations in the water well casing, could potentially reduce aquifer permeabilities by clogging the pore space of the flow media. Approximately 525,000 gallons of potable water were injected into a semiconfined groundwater aquifer over a three-day period interspersed with two pumping periods. Water chemistry samples taken throughout the injection project showed no imbalance with regard to calcium or any other chemical constituent. Therefore, artificial recharge is feasible and is one water resource technique available to meet an increasing water demand based on the existing water quality of the Colorado River and the quality of the groundwater in the area of injection. (Author’s abstract)

DE: Artificial-recharge; Groundwater-recharge; Las-Vegas-Valley; Nevada--; Colorado-River; Water-quality; Surface-groundwater-relations; Calcite--; Precipitation--; Feasibility-studies
CL: Groundwater-management (2040); Groundwater (0840)
AN: 8906204

TI: Geochemical Assessment of Aquifer Recharge Effects in the Southwest Denver Basin.
AU: Aikin,-A.R.; Turner,-A.K.
AF: Colorado School of Mines Golden. Dept. of Geology
PY: 1987
AB: Recharge of the Denver groundwater basin by injection has been proposed as a result of increasing depletion of the water supply. However, injection recharge can cause physical and chemical changes in the geologic materials of the recharged aquifer, depending on the chemistry of both the host and injected waters as well as the mineralogy of the aquifer ‘s rock matrix. The Denver groundwater basin contains four principal bedrock aquifers, of which the Arapahoe aquifer is considered to be the best in terms of water quality and quantity. Some preliminary field injection tests have been undertaken using drinking water supplies. However, water that meets drinking water standards contains constituents which may react upon injection, resulting in aquifer damage. The field injection tests have demonstrated that permeability apparently decreases after a few hours, but the cause was not known. As a preliminary step in designing future field tests, analyses of aquifer water and Denver Water Board municipal drinking water were evaluated by a geochemical equilibrium computer model (PHREEQE), developed by the U.S. Geological Survey, to determine the potential for reaction. The results of these simulations confirm that the Arapahoe aquifer is a good candidate for injection recharge. No fatal flaw appears to exist, from a geochemical standpoint, which would prevent the use of drinking water to recharge the Arapahoe aquifer. (USGS)

DE: Denver--; Injection-recharge; Groundwater-recharge; Geochemistry--; Recharge-wells; Colorado--; Computer-models; Arapahoe-aquifer; Drinking-water; Water-supply; Municipal-water
CL: Groundwater-management (2040); Chemical-processes (0880); Groundwater (0840)
AN: 8810028

TI: Chemical and Microbiological Monitoring of a Sole-Source Aquifer Intended for Artificial Recharge, Nassau County, New York.
AU: Katz,-B.G.; Mallard,-G.E.
AF: Geological Survey Towson, MD. Water Resources Div
PY: 1981
AB: The Cedar Creek water reclamation project in Nassau County, New York, was designed to study the feasibility of recharging the groundwater reservoir with reclaimed water. Baseline information on water quality
was gathered by sampling in observation wells at depths of 50, 100, and 200 ft below land surface. Preliminary results indicated that groundwater at the recharge site contained elevated concentrations of nitrate, chloride, sulfate, and ammonium ions; however, the concentrations of these ions generally decreased with depth. Chlorinated hydrocarbons (low-molecular weight, pesticides, and polychlorinated biphenyls) were present in significant concentrations in the upper glacial aquifer and Magothy aquifer. Fecal indicator bacteria were found in very few cases in low numbers. Sources of pollution in this area are cesspool and septic tank effluent, domestic cleaners and solvents, fertilizers, insecticides for pest control, and storm water runoff.

DE: Pollutant-identification; Water-analysis; Water-pollution-sources; Artificial-recharge; New-York; Water-reuse; Water-quality; Recharge--; Aquifers--; Nassau-County; Groundwater-recharge; Monitoring--; Baseline-studies; Septic-tanks; Cesspools--; Organic-compounds; Chlorinated-hydrocarbons; Bacterial-analysis

CL: Identification-of-pollutants (3010); Sources-and-fate-of-pollution (3020)

AN: 8603527

TI: Aquifers as Processing Plants for the Modification of Injected Water.
AU: Hanor,-J.S.
AF: Louisiana State Univ. Baton Rouge. Dept. of Geology
SO: Available from the National Technical Information Service, Springfield VA 22161 as PB81-185332, Price codes: A05 in paper copy, A01 in microfiche. Louisiana Water Resources Research Institute, Louisiana State University, Bulletin 11, August, 1980. 81 p, 26 Fig, 7 Tab, 47 Ref, 5 Append. OWRT-A-031-LA(6).
PY: 1980
AB: Gulf Coast (Baton Rouge) Region aquifer systems offer potential for infested water storage and water composition modification. Study of natural processes on groundwater chemistry provides information on processes potentially influencing water composition during artificial recharge. Baton Rouge area fresh-water aquifer processes include fermentive breakdown of organic matter, sulfate reduction, Donnan behavior, and dissolution/formation of new silicates. Although appearing to be in exchange equilibrium with sediment clay minerals, ion-exchange influences native water composition less than previously thought. Potentially-occurring artificial recharge reactions (carbon dioxide formation and reaction with minerals; ion-exchange; diffusion) were studied. Altering montmorillonite appears to control water composition. Clay contents down to 0.1 weight-% rapidly cause dissolved calcium removal and water softening during simulated injection/storage/production of fresh waters from brackish/saline Gulf Coast aquifers, corroborating field study results. Aquiclude clays soften injected water only if pore water concentrations of calcium and magnesium are less than in injected water. Of a variety of other possible reactions/processes (oxidation-reduction; membrane effects), many are incompletely understood. (Zielinski-IPA)

DE: Aquifer-systems; Aquifer-testing; Injection-wells; Water-treatment; Louisiana--; Water-purification; Impaired-water-quality; Aquifers--; Aquifer-management; Aquifer-characteristics; Bodies-of-water; Confined-water; Water-sources; Water-supply; Water-injection; Inflow--; Water-quality-control; Coastal-aquifers
CL: Wastewater-treatment-processes (3040)
AN: 8102412

TI: Microbiological Effects of Recharging the Magothy Aquifer, Bay Park, New York, With Tertiary-Treated Sewage.
AU: Ehrlich,-G.G.; Ku,-H.F.H.; Vecchioli,-J.; Ehlke,-T.A.
AF: Geological Survey Menlo Park, CA. Water Resources Div
PY: 1979
AB: Injection of highly treated sewage (reclaimed water) into a sand aquifer on Long Island, N.Y., stimulated microbial growth near the well screen. Chlorination of the injectant to 2.5 milligrams per liter suppressed microbial growth to the extent that it did not contribute significantly to head buildup during injection. In the absence of chlorine, microbial growth caused extensive well clogging in a zone immediately adjacent to the well screen. During a resting period of several days between injection and well redevelopment, the inhibitory effect of chlorine dissipated, and microbial growth ensued. The clogging mat at the well-aquifer interface was loosened during this period, probably as a result of microbial activity. Little microbial activity was noted in the aquifer beyond 20 feet from the well screen; it probably resulted from small amounts of biotransformable
substances not completely filtered out of the injectant by the aquifer materials. Movement of bacteria from the
injection well into the aquifer was not extensive. In one test, in which injected water had substantial total-
coliform, fecal-coliform, and fecal-streptococcal densities, no fecal-coliform or fecal-streptococcal bacteria,
and only nominal total-coliform bacteria, were found in water from an observation well 20 feet from the point
of injection. (Kosco-USGS)

DE: Microbiology-; Artificial-recharge; Aquifers-; Tertiary-treatment; Sewage-; Long-IslandNY; New-York;
Waste-water-disposal; Injection-wells; Well-screens; Chlorination-; Reclaimed-water; Bacteria-; Coliforms-;
Water-quality; Path-of-pollutants; Water-chemistry; Trubidity-; Water-reuse; Well-clogging

CL: Sources-and-fate-of-pollution (3020)

AN: 8005455

TI: Toward a Rational Development of Artificial-Recharge Research.

AU: Wood,-W.W.

AF: Geological Survey Lubbock, TX. Water Resources Div

1976.

PY: 1976

AB: Artificial recharge can be an effective water-management technique if the hydrogeologic conditions of the
aquifer system are quantified and if rational design criteria are established. The successful application of
artificial recharge depends upon the development of methods for evaluating the changes in aquifer
characteristics in both the saturated and unsaturated zones as a function of chemical, biological, and physical
changes associated with the introduction of foreign water into the subsurface environment. Also, additional
methods need to be developed to predict resulting variations of water quality in time and space. (Woodard-
USGS)

DE: Artificial-recharge; Groundwater-recharge; Water-managementApplied; Aquifer-characteristics; Water-
quality; Recharge-wells; Injection-wells; Chemical-properties; Biochemical-properties; Water-chemistry;
Water-transfer

CL: Groundwater-management (2040); Groundwater (0840)

AN: 7900632

TI: Chemical Aspects of Ground Water Recharge with Wastewaters.

AU: Russell,-L.L.

AF: California Univ. Berkeley

SO: Available from University Microfilms International, Ann Arbor Michigan 48106; Order No. 77-15,842.

PY: 1976

AB: Studies on waste water-soil systems and recharge water quality indicated that nitrification in the soil rather
than in a waste water treatment plant could substantially reduce percolant water quality. This was attributed to
low carbon dioxide concentrations in aerated effluents which could also dissolve calcareous soils, resulting in
high calcium concentrations of up to 200 mg/liter. Field studies at the 14-mgd Whittier Narrows Water
Reclamation Plant and the 26-mgd San Jose Creek Water Renovation Plant indicated that 90-95% of the CO2
produced during treatment was stripped during aeration. A systematic, mathematical model for the chemistry of
a waste water-soil system is presented. The effects of minor buffering systems, complex ion formation,
temperature, and ionic strength are incorporated into the model. The model is useful in simulating the effects of
waste water treatment on effluent quality and the effects of land application on percolant quality, mixing,
dilution, and subsequent chemical reactions during percolation. (Schulz-FIRL)

DE: Artificial-recharge; Groundwater-recharge; Water-managementApplied; Aeration-; Carbon-dioxide;
Waste-water-disposal; Soils-; Soil-chemistry; Soil-contamination-effects; Nitrification-; Mathematical-models;
Waste-water-treatment; Waste-water-disposal

CL: Sources-and-fate-of-pollution (3020); Groundwater-management (2040); Ultimate-disposal-of-wastes
(3050)

AN: 7806141

TI: Geochemical Effects of Recharging the Magothy Aquifer, Bay Park, New York, with Tertiary-Treated
AB: Thirteen recharge tests using tertiary-treated sewage (reclaimed water) and six tests using city (drinking) water were completed between 1968 and 1973 as part of an experimental recharge program at Bay Park, New York. In the longest test, reclaimed water was injected during 84.5 days over a 199-day period. Although iron concentration of reclaimed water and native water in the recharge zone is less than 0.5 mg/liter, the iron concentration in samples taken 20, 100, and 200 feet from the recharge well approached 3 mg/liter at times. Within a 20-ft radius of the recharge well, dissolved oxygen in the reclaimed water oxidized pyrite and caused iron to be released to solution. Because the amount of iron in water increases with distance from the recharge well even though dissolved oxygen is no longer present in water reaching the 20-ft radius, the exact dissolution mechanism is not understood. Some cation exchange occurs. Ammonium and potassium cations exchange with the proton in clay, resulting in a decrease in pH of over 1 pH unit at times. Phosphorus and organic compounds can react chemically and biologically to degrade water quality. Reclaimed water contains an average of 0.17, 0.07, and 9 mg/liter of phosphate, MBAS (methylene blue active substances), and COD (chemical oxygen demand), respectively. During recharge, phosphate concentrations remain at native-water levels at the 20-, 100-, and 200-foot observation wells, which indicates retention by the aquifer; MBAS and COD are partly retained at the 100- and 200-foot wells, presumably by adsorption reactions. (Woodard-USGS)

DE: Artificial-recharge; Aquifers-; Tertiary-treatment; Sewage-; Chemical-reactions; New-York; Bay-ParkNY; Magothy-aquiferNY; Geochemistry-; Water-chemistry; Oxidation-reduction-potential; Sorption-; Ion-exchange; Groundwater-recharge; Data-collections; Evaluation-

CL: Sources-and-fate-of-pollution (3020); Groundwater-management (2040); Ultimate-disposal-of-wastes (3050)

AN: 7804261


AU: Vecchioli,-J.

AF: Geological Survey Albany, N.Y


PY: 1976

AB: From 1968 to 1973, water reclaimed from sewage was used in a series of deep-well artificial-recharge experiments at Bay Park, N. Y., by the U. S. Geological Survey in cooperation with the Nassau County Department of Public Works. This paper summarizes water-quality aspects of the recharge tests. Microbial growth around the well screen caused significant well clogging when unchlorinated water was injected. The higher filter efficiency of the fine to medium sand of the aquifer restricted movement of bacteria away from the point of injection. In tests in which chlorinated water was recharged, clogging by microbial growth was insignificant. However, whenever there was an appreciable pause between the end of injection and the start of repumping, the first water repumped had a strong sulfide odor, was highly turbid, and was laden with bacteria. Chemical quality of the reclaimed water was modified by interaction with the aquifer. Iron concentration of the mixed native and reclaimed waters increased to as much as 3 milligrams per liter from background levels of a few tenths in each; pH decreased to a low of about 4.5 from levels of about 5.5 for native water and 6.1 for reclaimed water. Residual phosphorus was removed almost completely, but nitrogen uptake by the aquifer was minimal. (Woodard-USGS)

DE: Water-reuse; Injection-wells; Artificial-recharge; Water-quality; New-York; Aquifers-; Reclaimed-water; Water-treatment; Sewage-treatment; Tertiary-treatment; Chemical-reactions; Water-chemistry; Chemical-analysis; Waste-water-treatment

CL: Wastewater-treatment-processes (3040); Groundwater-management (2040)

AN: 7700492
TI: CHEMICAL INTERACTION DURING DEEP WELL RECHARGE, BAY PARK, NEW YORK.
AU: RAGONE,-S.E.; VECCHIOLI,-J.
AF: GEOLOGICAL SURVEY, MINEOLA, N.Y. WATER RESOURCES DIV
SO: GROUND WATER, VOL 13, NO 1, P 17-24, JANUARY-FEBRUARY 1975. 7 FIG, 3 TAB, 14 REF.
PY: 1975
AB: tertiary-treated sewage (reclaimed water) was recharged into the magogy aquifer in 13 recharge experiments in long island, n. Y., Between 1968 and 1973. The recharge resulted in a degradation in water quality with respect to iron concentration and ph. Iron concentration increased from the range 0.14 to 0.30 milligrams per litre to as much as 3 mg per litre at the 20-, 100-, and 200-foot or 6.1-, 30-, and 61-metre observation wells as the reclaimed water displaced native water. The increase was probably a result of pyrite dissolution. The ph of the water decreased from the range 5.22 to 5.72 to a low of about 4.50, predominantly as a result of cation-exchange reactions. (Knapp-usgs)
de: *path-of-pollutants; *artificial-recharge; *new-york; *waste-disposal-wells; iron-; injection-wells; water-chemistry; water-quality; water-pollution-sources; ion-exchange; *long-islandny
CL: Sources-and-fate-of-pollution (3020); Groundwater (0840); Groundwater-management (2040)
AN: 7505656

TI: PILOT SCALE INVESTIGATIONS OF WELL RECHARGE USING CORED SAMPLES.
AU: SMITH,-H.F.; SCHICHT,-R.J.; HUMPHREYS,-H.W.
AF: ILLINOIS STATE WATER SURVEY, URBANA
PY: 1971
AB: laboratory studies were conducted in illinois to determine if artificial recharge of sandstone aquifers with sewage effluent is feasible. The apparatus used in this research consisted of four main components: (1) permeameter; (2) filters; (3) chlorinator; and (4) constant head tank. The ironon-galesville sandstone, since it is the most productive formation in the deep sandstone aquifer, was selected for investigation. The core samples are described by the illinois state geological survey as fine to medium grained sandstone, moderately well sorted, and friable. The median grain size is 0.30 mm, with the maximum grain size about 0.75 to 1.0 mm. After discharge of deionized water through the sandstone core has stabilized, filtered and chlorinated sewage effluent was recharged. A pretreated effluent of the type used could be successfully recharged through a sandstone well having similar characteristics to the cores used. The pretreatment would consist of removal of solids, a disinfectant, and control of ph. Sand filters are the most reliable type of filter with fewer problems of maintenance. (Knapp-usgs)
de: *artificial-recharge; *injection-wells; *reclaimed-water; *waste-water-treatment; *water-reuse; *illinois-; sandstones-; water-quality; water-chemistry
CL: Wastewater-treatment-processes (3040); Groundwater-management (2040)
AN: 7403823

TI: BOREHOLE RECHARGE: THE COMPATABILITY OF RECHARGE WATER WITH THE AQUIFER.
AU: KRONE,-R.B.
AF: CALIFORNIA UNIV., DAVIS. DEPT. OF CIVIL ENGINEERING
PY: 1971
AB: for waters to be recharged through wells, the dissolved gas concentrations should be less than the saturation concentrations at temperatures and pressures that will occur in the aquifer. Aeration should be avoided and the recharge water temperature should be the same or greater than that of the aquifer. The dissolved solids concentration should be such that a sodium adsorption ratio less than 3 and as low as is feasible be maintained, and the concentrations of dissolved substances should be suitable for the most sensitive use at the discharge sites. Precipitation of compounds resulting from combination of recharge water and aquifer
water should be avoided. The suspended solids concentration should be as low as is attainable. The recharge waters should be chlorinated to minimize biological growths. While these requirements are restrictive, they are justified in most cases by the high permeability necessary for a satisfactory well, by the high costs of constructing recharge wells, and by the uncertain results of clogged well rehabilitation. (Knapp-usgs)

de: *artificial-recharge; *injection-wells; *water-quality; *clogging-; *dissolved-solids; aquifer-characteristics; permeability-; water-chemistry; boreholes-

CL: Groundwater-management (2040); Chemical-processes (0880); Sources-and-fate-of-pollution (3020)

AN: 7403822

TI: PROBLEMS OF GROUNDWATER USE AND CONSERVATION IN LITHUANIA (VOPROSY ISPOL'ZOVANIYA I OKHRANY PODZEMNYKH VOD YUZHNOY PRIBALTIKI).

SO: LITOVSKII NAUCHNO-ISSLEDOVATEL'SKIY GEOLOGORAZVEDOCHNYY INSTITUT TRUDY, NO 17, VILNIUS, V. JUODKAZIS, EDITOR, 1971. 156 P.

PY: 1971

AB: groundwater occurrence, movement, and conservation in lithuania were investigated in this collection of 13 papers published by the lithuanian scientific research institute of geological exploration. Problems relating to well hydraulics, artificial recharge, bacteriological contamination in aquifers, and chemical quality of groundwater are discussed, and estimates are given of maximum feasible withdrawal of groundwater for aquifers in a region of glacial sediments. (Josefson-usgs)

de: *groundwater-; *water-utilization; *water-conservation; groundwater-movement; groundwater-recharge; groundwater-mining; hydrogeology-; aquifers-; water-storage; water-table; water-levels; water-level-fluctuations; drawdown-; withdrawal-; safe-yield; water-wells; well-filters; water-pollution; water-quality; water-chemistry; glacial-sediments; ussr-; *lithuania-ssr; estonia-ssr; paleogeography-; mineralization-

CL: Groundwater-management (2040); Hydraulics (6020)

AN: 7314606

TI: WATER-MINERAL REACTIONS RELATED TO POTENTIAL FLUID-INJECTION PROBLEMS.

AU: BARNES,-I.

AF: GEOLOGICAL SURVEY, MENLO PARK, CALIF. WATER RESOURCES DIV


PY: 1972

ab: reinjection of formation waters creates few chemical problems if no large change in temperature has occurred, no gas or vapor has separated, and access of air has been prevented. The fluids already have had an opportunity to react with the minerals to the point of compatibility. Injection of incompatible fluids, however, may cause chemical problems; thus, prediction of fluid-mineral reactions should be attempted. Reactions should be studied in both reaction directions. All the species in a solution generated by complete solution of the solid must be considered. Using incongruent reactions (reactions producing a new solid directly from the reactant solid) introduces the unwarranted assumption of equilibrium. In general, hydroxide species such as amorphous silica, limonite, and brucite, as well as simple carbonates, have been found to dissolve or precipitate in natural systems. More complex silicates including serpentine, kenyaitie, and magadiite may not precipitate from solutions. Sulfides such as covellite, chalcocite, and pyrite may not precipitate even where supersaturation exceeds 30 kcal, although some sulfide minerals will dissolve readily where oxidation of sulfur can take place. (Knapp-usgs)

de: *waste-disposal-wells; *water-chemistry; *mineralogy-; *water-pollution-effects; *chemical-reactions; injection-wells; thermodynamics-; water-quality; carbonates-; silicates-; clay-minerals; geochemistry-; chemical-precipitation; corrosion-; *water-compatibilityinjection

CL: Sources-and-fate-of-pollution (3020); Chemical-processes (0880); Groundwater (0840)

AN: 7310034

TI: METHODS OF SUSTAINING GOOD INFILTRATION RESULTS.
infiltration in the Dutch dunes includes great improvement of quality. Starting from a highly polluted source followed by a restricted pretreatment, it relies entirely upon passage through a shallow aquifer. The oxygen demand of the water to be infiltrated is high. There is no possibility of a new oxygen supply after it has nearly been exhausted by its consumption in the immediate environment of the infiltration basins. The elimination of organic matter is by chemical or biological oxidation processes. In the chemical treatment powerful reagents such as chlorine or ozone are used, and the biological processes make use of oxygen or nitrates. The main part of this concept of purification lies in the pretreatment, the infiltration acting as a final resource and safeguard. Pretreatment should go far; in some aspects it should even surpass common drinking water standards. The complete removal of suspended matter and iron allows the use of high infiltration rates without causing too much clogging. It is advantageous to exclude the other cause of clogging, algal growth, by covering the infiltration basins. (Knapp-usgs)
that this pattern will be appreciably changed in the future. It does appear, however, that the deliberate use of treated effluent for groundwater recharge will increase in the future, particularly in arid and semi-arid areas of the country that are rapidly depleting their groundwater resources. Although the technological capability for treating municipal effluent for any type of reuse including the recharge of potable groundwater supplies has existed for many years, many psychological problems remain to be solved to win public acceptance for its widespread use. Physical problems include clogging of soils of aquifers, chemical precipitation, and algal or bacterial growth. The legal problems include liability for damages to aquifers, ownership of recharged water, and ownership of effluent water. (Knapp-usgs)
de: *water-reuse; *reclaimed-water; *municipal-wastes; *artificial-recharge; legal-aspects; aesthetics-;
aquifers-; soil-water-movement; groundwater-movement; infiltration-; water-chemistry; water-quality; soil-
contamination; waste-water-recharge
CL: Wastewater-treatment-processes (3040); Water-treatment-and-distribution (3060)
AN: 6908620

Document Type: Thesis or dissertation
Monograph Title: Hydrogeology and hydrochemistry of a sewage effluent plume in the Barnstable Outwash of the Cape Cod Aquifer, Hyannis, Massachusetts
Monograph Author: Cambareri, Thomas Christian
Pages (collection): 130
Date: January 1, 1986
Degree Institution: University of Massachusetts, Amherst, MA, United States
Degree: Master's
Language: English
Country: United States
Number of references: 43
Bibliographic level: Monograph
Index information: Barnstable County Massachusetts; Barnstable Outwash; Cape Cod Aquifer; chemical composition; distribution; environmental geology; ground water; Hyannis; Massachusetts; mathematical models; movement; pollutants; pollution; sewage; southeastern Massachusetts; surveys; United States
Category Type: Hydrogeology; Environmental geology

GeoRef ID (Update Code): 96-81717 (199624)
Document Type: Serial; Conference Document
Serial Title: Studies in Environmental Science (Amsterdam)
Analytic Title: Input of chemical substances into seepage and groundwater in a suburban region
Monograph Title: Quality of groundwater; proceedings of an international symposium
Analytic Author: Bittersohl, J.; Merkel, B.; Nemeth, G.
Monograph Author: van Duijvenbooden, W. (editor); Glasbergen, P. (editor); van Lelyveld, H. (editor)
Volume: 17
Pages (analytic): 79-82
Publisher: Elsevier, Amsterdam, Netherlands
Date: January 1, 1981
Meeting Name: International symposium on the Quality of groundwater
Meeting Location: Noordwijkerhout, Netherlands
Meeting Date: Mar. 23-27, 1981
Affiliation (analytic): Technical University of Munich, Munich, Federal Republic of Germany
Affiliation (monograph): National Institute for Water Supply, Leidschendam
ISBN: 0-444-42022-3
ISSN: 0166-1116
Coordinates: N480800N480800E0113500E0113500
Language: English
Country: Netherlands
Number of references: 11
Bibliographic level: Analytic
Illustration: illus.
Index information: aquifer vulnerability; aquifers; chemical waste; coal mines; effluents; England; Europe; Great Britain; ground water; industrial waste; Lancashire England; landfills; liquid waste; mines; Scotland; sludge; solid waste; underground disposal; United Kingdom; waste disposal; waste disposal sites; Western Europe
Category Type: Environmental geology

GeoRef ID (Update Code): 96-81766 (199624)
Document Type: Serial; Conference Document
Serial Title: Studies in Environmental Science (Amsterdam)
Analytic Title: Underground disposal of wastes in Britain
Monograph Title: Quality of groundwater; proceedings of an international symposium
Analytic Author: Williams, G. M.
Monograph Author: van Duijvenbooden, W. (editor); Glasbergen, P. (editor); van Lelyveld, H. (editor)
Volume: 17
Pages (analytic): 421-426
Publisher: Elsevier, Amsterdam, Netherlands
Date: January 1, 1981
Meeting Name: International symposium on the Quality of groundwater
Meeting Location: Noordwijkerhout, Netherlands
Meeting Date: Mar. 23-27, 1981
Affiliation (analytic): Institute of Geological Sciences, Harwell, United Kingdom
Affiliation (monograph): National Institute for Water Supply, Leidschendam
ISBN: 0-444-42022-3
ISSN: 0166-1116
Coordinates: N532000N543000W0020000W0031500
Language: English
Country: Netherlands
Number of references: 11
Bibliographic level: Analytic
Illustration: illus.
Index information: aquifer vulnerability; aquifers; chemical waste; coal mines; effluents; England; Europe; Great Britain; ground water; industrial waste; Lancashire England; landfills; liquid waste; mines; Scotland; sludge; solid waste; underground disposal; United Kingdom; waste disposal; waste disposal sites; Western Europe
Category Type: Environmental geology

GeoRef ID (Update Code): 96-81743 (199624)
Document Type: Serial; Conference Document
Serial Title: Studies in Environmental Science (Amsterdam)
Analytic Title: Effects of discharging sewage to the Chalk
Monograph Title: Quality of groundwater; proceedings of an international symposium
Analytic Author: Baxter, K. M.; Edworthy, K. J.; Beard, M. J.; Montgomery, H. A. C.
Monograph Author: van Duijvenbooden, W. (editor); Glasbergen, P. (editor); van Lelyveld, H. (editor)
GeoRef ID (Update Code): 96-80199 (199624)
Document Type: Serial; Conference Document
Serial Title: Environmental Toxicology and Chemistry
Analytic Title: Chemical fate and transport in a domestic septic system; biodegradation of linear alkylbenzene sulfonate (LAS) and nitrilotriacetic acid (NTA)
Monograph Title: Symposium on Integrated field evaluation of chemical fate and transport in the subsurface; a case study
Analytic Author: Shimp, R. J.; Lapsins, E. V.; Ventullo, R. M.
Monograph Author: Shimp, R. J. (convener); Rapaport, R. A. (convener)
Volume: 13
Pages (analytic): 205-212
Issue Number: 2
Publisher: Pergamon, New York, NY, United States
Date: January 1, 1994
Meeting Name: 10th annual meeting of the Society of Environmental Toxicology and Chemistry ; symposium on Integrated field evaluations of chemical fate and transport in the subsurface; a case study
Meeting Location: Toronto, ON, Canada
Meeting Date: Oct. 28-Nov. 2, 1989
Affiliation (analytic): Proctor & Gamble Company, Cincinnati, OH, United States
Affiliation (monograph): Procter & Gamble Company, Cincinnati, OH, United States
ISSN: 0730-7268
Language: English
Country: United States
Number of references: 36
Bibliographic level: Analytic
Illustration: illus. incl. 3 tables
Index information: alkylbenzene sulfonate; aquifers; biodegradation; Cambridge Ontario; Canada; chemical waste; concentration; detection; discharge; drinking water; Eastern Canada; effluents; ground water; industrial waste; migration of elements; mobility; nitrilotriacetic acid; Ontario; plumes; pollutants; pollution; shallow aquifers; soils; waste water; water quality; water supply; water table
Category Type: Environmental geology

GeoRef ID (Update Code): 96-80198 (199624)
Document Type: Serial; Conference Document
Serial Title: Environmental Toxicology and Chemistry
Analytic Title: Chemical fate and transport in a domestic septic system; unsaturated and saturated zone geochemistry
Monograph Title: Symposium on Integrated field evaluation of chemical fate and transport in the subsurface; a case study
Analytic Author: Wilhelm, Sheryl R.; Schiff, Sherry L.; Robertson, William D.
Monograph Author: Shimp, R. J. (convener); Rapaport, R. A. (convener)
Volume: 13
Pages (analytic): 193-203
Issue Number: 2
Publisher: Pergamon, New York, NY, United States
Date: January 1, 1994
Meeting Name: 10th annual meeting of the Society of Environmental Toxicology and Chemistry ; symposium on Integrated field evaluations of chemical fate and transport in the subsurface; a case study
Meeting Location: Toronto, ON, Canada
Meeting Date: Oct. 28-Nov. 2, 1989
Affiliation (analytic): University of Waterloo, Waterloo Centre for Groundwater Research, Waterloo, ON, Canada
Affiliation (monograph): Procter & Gamble Company, Cincinnati, OH, United States
ISSN: 0730-7268
Language: English
Country: United States
Number of references: 48
Bibliographic level: Analytic
Illustration: illus. incl. 4 tables, sect.
Index information: aquifers; Cambridge Ontario; Canada; chemical composition; detection; drinking water; Eastern Canada; effluents; ground water; mobility; nitrate ion; Ontario; phosphate ion; plumes; pollutants; polluted water; pollution; porous materials; residence time; saturated zone; seepage; shallow aquifers; surface water; transport; unsaturated zone; variations; waste water; water supply; water table
Category Type: Environmental geology

GeoRef ID (Update Code): 96-80201 (199624)
Document Type: Serial; Conference Document
Serial Title: Environmental Toxicology and Chemistry
Analytic Title: Chemical fate and transport in a domestic septic system; application of a variability saturated model for chemical movement
Monograph Title: Symposium on Integrated field evaluation of chemical fate and transport in the subsurface; a case study
Analytic Author: Shutter, S. B.; Sudicky, E. A.; Robertson, W. D.
Monograph Author: Shimp, R. J. (convener); Rapaport, R. A. (convener)
Volume: 13
Pages (analytic): 223-231
Issue Number: 2
Publisher: Pergamon, New York, NY, United States
Date: January 1, 1994
Meeting Name: 10th annual meeting of the Society of Environmental Toxicology and Chemistry; symposium on Integrated field evaluations of chemical fate and transport in the subsurface; a case study
Meeting Location: Toronto, ON, Canada
Meeting Date: Oct. 28-Nov. 2, 1989
Affiliation (analytic): University of Waterloo, Waterloo Centre for Groundwater Research, Waterloo, ON, Canada
Affiliation (monograph): Procter & Gamble Company, Cincinnati, OH, United States
ISSN: 0730-7268
Language: English
Country: United States
Number of references: 23
Bibliographic level: Analytic
Illustration: illus. incl. 1 table
Index information: aquifers; biodegradation; Cambridge Ontario; Canada; chemical waste; concentration; detection; detergents; discharge; drinking water; Eastern Canada; effluents; ground water; hydraulic conductivity; industrial waste; migration of elements; mobility; models; Ontario; plumes; pollutants; pollution; shallow aquifers; simulation; soils; solute transport; spatial variations; transport; two-dimensional models; waste water; water quality; water supply; water table
Category Type: Environmental geology

GeoRef ID (Update Code): 96-80200 (199624)
Document Type: Serial; Conference Document
Serial Title: Environmental Toxicology and Chemistry
Analytic Title: Chemical fate and transport in a domestic septic system; sorption and transport of anionic and cationic surfactants
Monograph Title: Symposium on Integrated field evaluation of chemical fate and transport in the subsurface; a case study
Analytic Author: McAvoy, D. C.; White, C. E.; Moore, B. L.; Rapaport, R. A.
Monograph Author: Shimp, R. J. (convener); Rapaport, R. A. (convener)
Volume: 13
Pages (analytic): 213-221
Issue Number: 2
Publisher: Pergamon, New York, NY, United States
Date: January 1, 1994
Meeting Name: 10th annual meeting of the Society of Environmental Toxicology and Chemistry; symposium on Integrated field evaluations of chemical fate and transport in the subsurface; a case study
Meeting Location: Toronto, ON, Canada
Meeting Date: Oct. 28-Nov. 2, 1989
Affiliation (analytic): Procter & Gamble Company, Cincinnati, OH, United States
Affiliation (monograph): Procter & Gamble Company, Cincinnati, OH, United States
ISSN: 0730-7268
Language: English
Country: United States
Number of references: 30
Bibliographic level: Analytic
Illustration: illus. incl. 2 tables
Index information: alkylbenzene sulfonate; aquifers; biodegradation; Cambridge Ontario; Canada; chemical waste; concentration; detection; detection limit; detergents; discharge; ditallow dimethyl ammonium chloride; drinking water; Eastern Canada; effluents; ground water; horizons; industrial waste; ion exchange; migration of elements; mobility; Ontario; plumes; pollutants; pollution; septic tanks; shallow aquifers; soils; surfactants; waste water; water quality; water supply; water table
Category Type: Environmental geology

GeoRef ID (Update Code): 95-18391 (199507)
Document Type: Serial
Serial Title: Journal of Environmental Health
Analytic Title: Septic system efficiency; parallel and serial methods for distributing effluent
Analytic Author: Mote, C. R.; Mucke, F. A.; Allison, J. S.
Volume: 52
Pages (analytic): 283-287
Issue Number: 5
Publisher: National Environmental Health Association, Denver, CO, United States
Date: April 1, 1990
Affiliation (analytic): University of Tennessee, Agricultural Engineering Department, Knoxville, TN, United States
ISSN: 0022-0892
Language: English
Country: United States
Number of references: 17
Bibliographic level: Analytic
Illustration: illus. incl. 3 tables
Index information: aquifer vulnerability; chemical composition; discharge; effluents; experimental studies; filtration; ground water; monitoring; nitrogen; phosphorus; pollutants; pollution; septic tanks; soils; transport; waste disposal; waste water; water quality
Category Type: Environmental geology
GeoRef ID (Update Code): 97-19704 (199707)
Document Type: Serial
Serial Title: Environmental Science and Pollution Control Series
Analytic Title: Agricultural pesticides and groundwater
Monograph Title: Groundwater contamination and control
Analytic Author: van den Berg, Reinier; van der Linden, Ton M. A.
Monograph Author: Zoller, Uri (editor)
Volume: 11
Pages (analytic): 293-313
Publisher: Marcel Dekker, New York - Basel - Hong Kong, United States
Date: January 1, 1994
Affiliation (analytic): National Institute of Public Health and Environment Protection, Bilthoven, Netherlands
Affiliation (monograph): Haifa University-Oranim, Kiryat Tivon
ISBN: 0-8247-8991-1
CODEN: #03947
Language: English
Country: United States
Number of references: 57
Bibliographic level: Analytic
Illustration: illus. incl. 7 tables, sketch map
Index information: agricultural waste; agrochemicals; alachlor; aldicarb; aquifer vulnerability; aquifers; case studies; chemical properties; chloride ion; discharge; effluents; erosion; Europe; ground water; hazardous waste; herbicides; industrialized countries; infiltration; irrigation; leaching; metabolites; migration of elements; mineral composition; models; monitoring; Netherlands; nitrate ion; nitrogen; pesticides; pollutants; pollution; protection; residence time; runoff; soil erosion; soils; solutes; sulfate ion; surface water; triazines; waste disposal; waste water; water quality; water supply; Western Europe
Category Type: Environmental geology

GeoRef ID (Update Code): 97-15900 (199706)
Document Type: Serial
Serial Title: Journal of Contaminant Hydrology
Analytic Title: Chemical modifications of groundwater contaminated by recharge of treated sewage effluent
Analytic Author: Vengosh, Avner; Keren, Rami
Volume: 23
Pages (analytic): 347-360
Issue Number: 4
Publisher: Elsevier, Amsterdam, Netherlands
Abstract: Long-term monitoring of the chemical composition of recharge sewage effluent and associated contaminated groundwater from the Dan Region Sewage Reclamation Project shows, after 16 years of recharge operation, the presence of a distinct saline plume (up to 400 mg/l Cl), extending 1600 m downgradient in the Coastal Plain aquifer of Israel. The recorded electrolyte composition of groundwater in the vicinity of the recharge area reflects the variations in the compositions of the sewage effluents, as well as water-rock interactions induced by the recharge of treated sewage effluents. The original sewage composition was
modified, particularly during early stages of effluent migration in the unsaturated zone, by cation-exchange and adsorption reactions. Since the soil sorption capacity is finite these reactions caused only limited modifications, and once the system reached a steady state the inorganic composition of the contaminated groundwater became similar to that of the recharge water. Decomposition of organic matter in the unsaturated zone resulted in CO$_2$ generation and dissolution of CaCO$_3$ minerals in the aquifer. It was shown that chemical and/or bio-degradation of organic matter takes place mainly in the unsaturated (vadose) zone. Hence, monitoring the efficiency of the vadose zone to retain contaminants is essential for evaluating the quality of groundwater since it was shown that organic compounds behave almost conservatively once the effluents enter and flow within the saturated zone.

Date: August 1, 1996
Affiliation (analytic): Hydrological Service, Jerusalem, Israel
ISSN: 0169-7722
CODEN: #54256
Coordinates: N320000N321000E0345000E0344000
Language: English
Country: Netherlands
Number of references: 12
Bibliographic level: Analytic
Illustration: illus. incl. 2 tables, sketch map
Index information: annual variations; aquifers; Asia; biodegradation; boron; calcium ion; carbon dioxide; cation exchange capacity; chemical composition; chemical waste; coastal plains; concentration; Dan; dissolved materials; effluents; electrolytes; finite difference analysis; ground water; industrial waste; infiltration; ions; Israel; Mediterranean region; Middle East; monitoring; plumes; pollutants; pollution; potassium ion; recharge; reclamation; saturated zone; sewage; sodium ion; sorption; statistical analysis; Tel Aviv Israel; unsaturated zone; variations; water quality
Category Type: Environmental geology

GeoRef ID (Update Code): 96-32043 (199611)
Document Type: Serial; Conference Document
Serial Title: Annual Meeting - Israel Geological Society
Analytic Title: Chemical modifications of groundwater contaminated by recharge treated sewage effluent
Monograph Title: Israel Geological Society annual meeting, 1995
Analytic Author: Vengosh, A.; Keren, R.; Barkan, G.
Monograph Author: Arkin, Yaacov (editor); Avigad, Dov (editor)
Volume: 1995
Pages (analytic): 118
Publisher: Israel Geological Society, Jerusalem, Israel
Date: January 1, 1995
Meeting Name: Israel Geological Society annual meeting
Meeting Location: , Israel
Meeting Date: March 20-22, 1995
Affiliation (analytic): Hydrological Service, Research Department, Jerusalem, Israel
Affiliation (monograph): Geological Survey of Israel, Jerusalem
ISSN: 0334-0694
Language: English
Country: Israel
Bibliographic level: Analytic
Summary only: Yes
Index information: adsorption; alkali metals; aquifers; Asia; B-11/B-10; biodegradation; boron; calcium carbonate; carbonate ion; chloride ion; clay minerals; Coastal Plain Aquifer; Dan Region Plant; effluents; geochemistry; ground water; hydrochemistry; isotopes; Israel; metals; Middle East; organic materials; pollutants; pollution; potassium; recharge; salinity; saturated zone; sewage; sheet silicates; silicates; sodium; solution; stable isotopes; unsaturated zone
GeoRef ID (Update Code): 97-19700 (199707)
Document Type: Serial
Serial Title: Environmental Science and Pollution Control Series
Analytic Title: Inorganic contaminants in groundwater/aquifers
Monograph Title: Groundwater contamination and control
Analytic Author: Altissimo, Lorenzo; Malagoli, Mario; Marcomini, Antonio; Stelluto, Susanna
Monograph Author: Zoller, Uri (editor)
Volume: 11
Pages (analytic): 221-240
Publisher: Marcel Dekker, New York - Basel - Hong Kong, United States
Date: January 1, 1994
Affiliation (analytic): Aziende Industriali Municipalizzate, Vicenza, Italy
Affiliation (monograph): Haifa University-Oranim, Kiryat Tivon
ISBN: 0-8247-8991-1
CODEN: #03947
Coordinates: N444800N464100E0130500E0104000
Language: English
Country: United States
Number of references: 32
Bibliographic level: Analytic
Illustration: illus. incl. 10 tables, sketch map
Index information: alluvium aquifers; aquifers; calcium ion; carbon dioxide; carbonate ion; case studies; chemical properties; chloride ion; concentration; conductivity; discharge; dissolved materials; effluents; Europe; ground water; hazardous waste; hydrogen sulfide; hydrology; infiltration; inorganic materials; ions; irrigation; Italy; landfills; leaching; mineral composition; nitrate ion; nitrogen; oxygen; phosphorus; pollutants; pollution; recharge; salinity; sanitary landfills; sewage; soils; solutes; Southern Europe; statistical analysis; sulfate ion; surface water; time series analysis; trace elements; unconfined aquifers; variations; Veneto Italy; waste water; water quality; water supply; water table; water treatment
Category Type: Environmental geology

GeoRef ID (Update Code): 97-01424 (199720)
Document Type: Serial; Report
Serial Title: PNL-SA (Pacific Northwest Laboratory)
Monograph Title: Theoretical study of ion/macrocycle interactions using both hybrid quantum mechanical-molecular mechanical and ab initio methods
Monograph Author: Thompson, M. A.; Glendening, E. D.; Feller, D.; Kendall, R.
Pages (collection): 4
Report Number: PNL-SA-26481; CONF-950801-15
Publisher: Pacific Northwest Laboratory, Richland, WA, United States
Availability: National Technical Information Service, (703)487-4650, order number DE96002635NEG, Springfield, VA, United States,
Abstract: Synthetic macrocycles have drawn much experimental and theoretical interest since Pederson first synthesized the crown-ether 18-crown-6 (18c6) in 1967. Crown-ethers show a remarkable range of specificity for a wide variety of cations that depends, in part, on the size of the ether, the type of donor atoms (e.g. oxygen, nitrogen, sulfur), and the polarity of the solvent. Crown-ethers and related macrocycles are of particular interest to research efforts in chemical separations applied to environmental remediation. For example, at the Hanford nuclear facility (super 90) Sr (super +) and (super 137) Cs (super +) are two major generators of heat which complicate the disposal of nuclear waste. One example of the use of crown-ethers for radionuclide separation is the Strontium Extraction (SREX) process which uses di-t-butylcyclohexano-18-crown-6 for recovering (super
Sr (super 2+) from acidic solution. A more thorough understanding of fundamental interactions of cation/crown-ether solution chemistry may provide the basis for rational design of new ligands useful in the separation of these and other radionuclides from radionuclide-containing waste streams at hazardous waste storage facilities. There is also a growing interest in the use of crown-ethers, cryptands, and other ligands for use in chemical sensors. Specifically, fluoroionophores, which consisting of a fluorophore (e.g. dye-molecule) linked to an ionophore (e.g. crown-ether), exhibit measurable changes in the photophysical properties of the fluorophore upon ion binding by the ionophore. Fluoroionophores would be useful for monitoring groundwater aquifers and industrial effluent streams for low-levels of hazardous radionuclides and other toxic metals.

Date: August 17, 1995
Corporate Affiliation (monograph): Battelle Pacific Northwest Laboratories, Richland, WA, United States - performer
ISSN: 0271-9320
Language: English
Country: United States
Bibliographic level: Monograph
Annotation: Presented at the 210th national meeting of the American Chemical Society (ACS), Chicago, IL, Aug. 20-25, 1995
Source Note: Contract AC06-76RL01830
Index information: acids; alkaline earth metals; applications; aquifers; cations; chemical reactions; crown ethers; cryptands; ground water; Hanford Reservation; hazardous waste; industrial waste; ions; isotopes; ligands; macrocycles; mechanics; metals; monitoring; pollutants; pollution; radioactive isotopes; radioactive waste; separation; solution; Sr-90; storage; strontium; theoretical studies; United States; Washington; waste disposal
Category Type: Environmental geology; General geochemistry

GeoRef ID (Update Code): 96-65003 (199620)
Document Type: Thesis or dissertation
Monograph Title: Oxygen enhancement of groundwater using an oxygen releasing compound in a funnel-and-gate system
Monograph Author: Thomas, David G.
Abstract: ORC, produced by Plant Research Laboratories (PRL) of Corona Del Mar, California, is a fine white powder of magnesium peroxide (MgO (sub 2) ) that is treated with a patented process so that a slow, relatively steady release of oxygen occurs when the powder is in contact with water. Recent work has suggested that ORC could potentially be used to increase the dissolved oxygen (DO) concentration of groundwater and thereby enhance the biodegradation of dissolved phase contaminants such as benzene and toluene. However, very little is known about the oxygen release characteristics of the ORC over extended periods of time. Field and laboratory tests were performed to evaluate the oxygen release characteristics of ORC when it is mixed with filter sand (FS) and exposed to groundwater from the CFB Borden aquifer. Column tests were performed to evaluate the oxygen release rate of ORC. Falling head permeameter tests were performed to evaluate changes in hydraulic conductivity of the sand due to the presence of gas bubbles caused by the ORC reaction with water. A field test was performed to evaluate the oxygen release characteristics of an FS-ORC mixture in a Funnel-and-Gate system. A tracer test was performed to investigate the groundwater flow regime through the Funnel-and-Gate field cell. A quasi steady state oxygen release rate of between 0.013 and 0.030 mg O (sub 2) /day-g ORC was determined from the column tests and a rate of 0.030 mg O (sub 2) /day-g ORC was calculated from the field data. Column tests indicated that the development of quasi steady state oxygen release conditions from the ORC required approximately 90 days after initial contact with water. However, field data indicated that the oxygen release rate may continue to decrease, although the rate of decrease may decline with time. Observations made during the column study indicated that up to 20% of the total amount of oxygen released by the ORC may have migrated through the porous medium and escaped to the atmosphere as a gas thereby reducing the effective DO enhancement of the effluent water. Falling head permeameter tests indicated that a maximum drop of hydraulic conductivity occurred in the permeameter columns within the first 48 hours of exposure of the ORC to water. After 72 hours the hydraulic conductivity was found to have increased back to a value close to that which was determined for saturated conditions. Both laboratory and field studies indicated
that water which contacted the ORC oncreased in pH. Field investigations indicated that the Borden sand may act as a buffer against the pH increase caused by ORC water interactions. The field studies further suggested an inverse correlation between a pH increases and the ability of the ORC to enhance the DO concentration of groundwater. The use of ORC in a funnel-and-gate scheme appears to be an effective means of increasing the DO concentration in groundwater, thereby stimulating the in-situ bioremediation of many organic contaminants. Further work is required to investigate the effects of variations in groundwater chemistry on ORC performance and the effect of ORC and its products on the in situ biodegradation of organics.

Date: January 1, 1994
Degree Institution: University of Waterloo, Waterloo, ON, Canada
Degree: Master's
Language: English
Country: Canada
Bibliographic level: Monograph
Illustration: illus.
Source Note: Contract AC06-76RL01830
Index information: biodegradation; dissolved materials; experimental studies; ground water; hydraulic conductivity; hydrochemistry; methods; oxygen; permeameters; pH; pollution; steady-state processes
Category Type: Environmental geology; Hydrochemistry

GeoRef ID (Update Code): 96-64308 (199620)
Document Type: Serial; Report
Serial Title: U. S. Geological Survey Water-Supply Paper
Monograph Title: A nitrogen-rich septage-effluent plume in a glacial aquifer, Cape Cod, Massachusetts, February 1990 through December 1992
Monograph Author: DeSimone, Leslie A.; Barlow, Paul M.; Howes, Brian L.
Pages (collection): 89
Report Number: W 2456
Publisher: U. S. Geological Survey, Reston, VA, United States
Abstract: Physical, chemical, and microbial processes controlled transport of a nitrogen-rich ground-water plume through a glacial aquifer. Lithologic heterogeneity and vertical head gradients influenced plume movement and geometry. Nitrate was the predominant nitrogen form and oxygen was depleted in the ground-water plume. However, denitrification transformed only 2 percent of plume nitrogen because of limited organic-carbon availability. Aerobic respiration, nitrification and cation exchange (unsaturated zone) and ammonium sorption (saturated zone) had larger effects.
Date: January 1, 1996
Affiliation (monograph): U. S. Geological Survey, United States
ISSN: 0886-9308
Coordinates: N414700N414700W0700000W0700000
Language: English
Country: United States
Number of references: 149
Bibliographic level: Monograph
Annotation: Supersedes Open-file report 95-290
Illustration: illus. incl. sects., 12 tables, sketch maps
Source Note: Prepared in cooperation with the Massachusetts Department of Environmental Protection, Office of Watershed Management
Index information: ammonium ion; aquifers; Barnstable County Massachusetts; Cape Cod; denitrification; effluents; electromagnetic logging; geochemistry; ground water; hydrochemistry; ions; mass balance; Massachusetts; microorganisms; monitoring; nitrogen; plumes; pollutants; pollution; sorption; transport; United States; USGS; waste water; water quality; well-logging
Category Type: Environmental geology; Hydrochemistry; Hydrogeology
Abstract: The University of Idaho irrigates portions of campus with secondary treated municipal sewage effluent. The purpose of this study was to evaluate effluent irrigation as part of an artificial recharge program. The objective was to assess the ground water impacts of effluent irrigation and the potential for artificial recharge from over-irrigation. A 30X30 m plot was selected as the research site. The irrigation season lasted from June 24 to October 13, 1990. Data were collected from May 12 through December 18, 1990. Water quality samples and daily water level elevation measurements were collected from monitor wells. Soil-water contents in the unsaturated zone were measured using a neutron probe. Lysimeters were used to collect soil-water samples for a tracer test. Physical and chemical soil properties were determined for site characterization. The normal irrigation rate is 0.43 cm/day, 3 days per week. Four over-irrigation applications rates were studied. These rates were 1.3 cm/day, 2.6 cm/day, 3.9 cm/day, and 5.2 cm/day. A three day running irrigation average was used to analyze irrigation impacts. Weekly water budgets were calculated to estimate evapotranspiration and recharge. Estimated evapotranspiration was between 0.60 and 0.75 m for the irrigation season. Groundwater recharge equalled approximately 0.5 m over the irrigation season. Variations in soil-water content and water quality data reflect average irrigation events which exceeded 0.4 cm/day. Rapid increases in water levels were observed after the average irrigation application exceeded 0.9 cm/day. Nitrate and chloride analyses indicated that groundwater quality mirrors the effluent irrigation water quality when the average irrigation application exceeds 0.9 cm/day. Nitrate concentrations in the aquifer were high and exceeded 10 mg/L when the average irrigation application exceeded 0.9 cm/day. Tracer test results verified the rapid hydraulic response indicated by the water level data at high irrigation rates. Research results indicate that approximately 0.5 to 1.0 m of recharge to the shallow aquifer can be accomplished using over-irrigation. However, groundwater quality becomes essentially identical to effluent water quality at high irrigation application rates.

Date: January 1, 1991
Degree Institution: University of Idaho, Moscow, ID, United States
Degree: Master's
Language: English
Country: United States
Number of references: 33
Bibliographic level: Monograph
Source Note: Prepared in cooperation with the Massachusetts Department of Environmental Protection, Office of Watershed Management
Index information: aquifers; chemical properties; chloride ion; effluents; evapotranspiration; ground water; Idaho; irrigation; Latah County Idaho; lysimeters; neutron probe; nitrate ion; observation wells; physical properties; recharge; sewage; soils; tracers; United States; University of Idaho; unsaturated zone; water balance; water quality; wells
Category Type: Hydrogeology
Abstract: The model WASTEN was used to compare several nitrogen input scenarios and to predict the levels of nitrate in groundwater for a proposed wastewater treatment facility at Fort Dix, New Jersey. The primary variables tested were input concentration of NO$_3$-N (nitrate nitrogen) and NH$_4$-N (ammonium nitrogen) and long-term application of wastewater. Two NO$_3$-N loading rates, 4 and 10 mg NO$_3$-N/L, were tested for 168-day simulations. The system's response was estimated from the NO$_3$-N concentration in water draining below 150 cm. For both input NO$_3$-N concentrations, the predicted NO$_3$-N concentrations in the leachate below 150 cm were less than 2 mg NO$_3$-N/L. The initial NO$_3$-N in the soil profile represented typical background levels for this site. The final NO$_3$-N in the soil profile was affected by both denitrification and leaching. The initial NH$_4$-N in the simulated soil profile was equal to the extractable NH$_4$-N from soil samples taken at the Fort Dix site. Because a portion of the extractable NH$_4$-N exists as exchangeable rather than solution NH$_4$-N, the soil profile values for the solution NH$_4$-N used in the simulation were greater than actual soil solution values would be. Moreover, by adjusting model coefficients, all the initial NH$_4$-N was forced to leach in the model simulations rather than be subjected to nitrification, denitrification, immobilization or plant uptake. Due to the retardation effects on NH$_4$-N mobility caused by soil-ion sorption, the NH$_4$-N leaching was distributed over an extended time rather than moving rapidly below the unsaturated zone. With these assumptions, the WASTEN model predicted that the NO$_3$-N at 150 cm would be less than 1 mg NO$_3$-N/L if the applied NO$_3$-N was 4 mg NO$_3$-N/L, and less than 2 mg NO$_3$-N/L if 10 mg NO$_3$-N/L was applied. The predicted concentration in the leachate was very low, even when an initial, uniform saturation of 5.0 mg NH$_4$-N/L in the soil profile was assumed. In field situations there would be little, if any, NO$_3$-N present following tertiary treatment of wastewater. Based on these calculations, the predicted NO$_3$-N concentration of NH$_4$-N in the applied effluent would remain within regulatory requirements.

Date: February 1, 1995

Affiliation (monograph): U. S. Army Cold Regions Research and Engineering Laboratory, Geochemical Sciences Branch, United States

ISSN: 0501-5782
CODEN: XCRRAV
Language: English
Country: United States
Number of references: 13
Bibliographic level: Monograph
Annotation: Includes three appendices
Illustration: illus.
Source Note: Prepared in cooperation with the Massachusetts Department of Environmental Protection, Office of Watershed Management

Index information: aquifer vulnerability; bioremediation; case studies; chemical composition; computer programs; concentration; data processing; denitrification; Fort Dix New Jersey; ground water; interactive techniques; leaching; models; monitoring; New Jersey; nitrate ion; pollutants; pollution; preventive measures; remediation; simulation; soils; United States; waste water; WASTEN; water quality

Category Type: Environmental geology
The Dan Region Project is the largest water reclamation scheme in Israel which provides for collection, treatment, groundwater recharge and reuse of municipal wastewater from Tel-Aviv metropolitan area and several other neighboring municipalities. The project serves a total population of about 1.3 million with an average municipal wastewater flow of 270,000 cu.m/d. The special recharge-recovery method developed and practiced successfully in the Dan Region Project is rather a soil aquifer treatment (SAT) which should be considered as an integral part of the municipal wastewater treatment process. SAT consists of controlled passage of effluent through the unsaturated zone and the aquifer, mainly for purification purposes, as well as for seasonal and multiannual storage. The recharge operation is carried out by means of spreading basins which are surrounding by adequately spaced recovery wells which permit separating the recharge zone from the rest of the aquifer. The major purification processes occurring in the soil aquifer system are: slow-sand filtration, chemical precipitation, adsorption, ion exchange, biological degradation, nitrification, denitrification and disinfection. Water quality control in the recharge zone is virtually complete and the very high quality of reclaimed water obtained after SAT is suitable for a variety of non potable uses especially for unrestricted agricultural irrigation. During the last five years, about 400 million cu.m of reclaimed water was supplied for unrestricted irrigation to the south of the country.

DE: Israel,-Tel-Aviv; wastewater-renovation; water-reuse; urban-areas; municipal-wastewater; water-quality-control; wastewater-treatment; artificial-recharge; irrigation-water; aquifers-; soil-treatment; water-reclamation; water-supply; groundwater-recharge; water-supplies; Dan-Region-Project; SAT-CL: Use-of-water-of-impaired-quality (1030)

TI: Chemical modifications of groundwater contaminated by recharge of treated sewage effluent.

AU: Vengosh,-A.; Keren,-R.

AF: Hydrological Serv., P.O. Box 6381, Jerusalem 91063, Israel


IS: 0169-7722

PY: 1996

LA: English

LS: English

PT: J (Journal-Article)

AB: Long-term monitoring of the chemical composition of recharge sewage effluent and associated contaminated groundwater from the Dan Region Sewage Reclamation Project shows, after 16 years of recharge operation, the presence of a distinct saline plume (up to 400 mg/l Cl), extending 1600 m downgradient in the Coastal Plain aquifer of Israel. The recorded electrolyte composition of groundwater in the vicinity of the recharge area reflects the variations in the compositions of the sewage effluents, as well as water-rock interactions induced by the recharge of treated sewage effluents. The original sewage composition was modified, particularly during early stages of effluent migration in the unsaturated zone, by cation-exchange and adsorption reactions. Since the soil sorption capacity is finite these reactions caused only limited modifications, and once the system reached a steady state the inorganic composition of the contaminated groundwater became similar to that of the recharge water. Decomposition of organic matter in the unsaturated zone resulted in CO sub(2) generation and dissolution of CaCO sub(3) minerals in the aquifer. It was shown that chemical and/or bio-degradation of organic matter takes place mainly in the unsaturated (vadose) zone. Hence, monitoring the efficiency of the vadose zone to retain contaminants is essential for evaluating the quality of groundwater since it was shown that organic compounds behave almost conservatively once the effluents enter and flow within the saturated zone.

DE: groundwater-pollution; wastewater-disposal; groundwater-recharge; plumes-; cation-exchange; decomposing-organic-matter; Israel-; sewage-; sewage-disposal; saline-intrusion; waste-disposal-sites; water-resources; water-supply; water-resources
AU: DeSimone,-L.A.; Howes,-B.L.
PY: 1995
LA: English
LS: English
PT: R (Report)
AB: Hydrogeologic, water-quality, and biogeochemical data were collected at the site of a septage-treatment facility in Orleans, Massachusetts, from October 1988 through December 1992, where a nitrogen-rich effluent is discharged to the underlying glacial aquifer. The data were collected as part of a study done by the U.S. Geological Survey, in cooperation with the Massachusetts Department of Environmental Protection, Office of Watershed Management, to investigate the effect of effluent discharge on ground-water quality and the transport of effluent nitrogen through the aquifer. Hydrogeologic data include lithologic logs and ground-water levels. Water-quality data include chemical analyses of the treated septage effluent, of ground water at the water table beneath the infiltration beds, and of ground water throughout the aquifer. Dissolved concentrations of dinitrogen gas, nitrous oxide, and dissolved inorganic carbon also were measured. Biogeochemical data include concentrations of total ammonium and solid-phase carbon and nitrogen in aquifer sediments and sediments from the effluent-infiltration beds.
DE: geohydrology-; water-quality-; biogeochemistry-; data-collections-; septic-wastewater-; groundwater-pollution-; glacial-drift-; nitrogen-; USA-; Massachusetts-; Cape-Cod
CL: Ultimate-disposal-of-wastes (3050)
AN: 3874230

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TI: Chemical controls on colloid generation and transport in a sandy aquifer.
AU: Seaman,-J.C.; Bertsch,-P.M.; Miller,-W.P.
AF: Div. Biogeochem., Savannah River Ecol. Lab., Univ. Georgia, Drawer E, Aiken, SC 29802, USA
SO: ENVIRON.-SCI.-TECHNOL. 1995  vol. 29, no. 7, pp. 1808-1815
IS: 0013-936X
PY: 1995
LA: English
LS: English
PT: J (Journal-Article)
AB: Colloid generation and transport in a highly weathered subsurface material from the Upper Coastal Plain (Aiken, SC) was controlled by factors other than the Na super(+) concentration of the leaching solution. Repacked columns were leached with solutions of various Na super(+) to Ca super(2+) and Mg super(2+) ratios. Following injection of the treatment solution, the columns were leached with deionized water (DIW). For the mixed cation solutions prepared from Cl super(-) salts, colloid generation occurred only when the treatment solution was replaced with DIW, but the level of effluent turbidity decreased with increasing Na super(+) concentration and increasing duration of exposure to the high Na super(+) solution. CaCl sub(2) solutions produced substantial mobile colloids during injection that coincided with a decrease in effluent pH. The mobile colloids possessed a positive electrophoretic mobility, suggesting that the drop in pH during salt injection, thought to be the result of specific cation adsorption and Al exchange and hydrolysis, may enhance dispersion by increasing the positive surface charge on both the mobile colloids and the immobile matrix. These results suggest that even minor changes in groundwater composition can influence surface charge and colloid generation in an iron oxide-dominated system.
This article deals with the water quality changes of infiltrated water through a soil profile, located near the discharge site of Khirbet Es-Samra Stabilization Ponds. Suction cups were installed at different depths (30, 70, 100 and 140 cm) to collect the infiltrated water. The chemical constituents of the sucked water such as Ca, Mg, SO$_4$, Cl and Na as well as the EC are found to increase dramatically with increasing depths, where the recorded EC at 140 cm reached about 20 fold that of the water used for infiltration. On the other hand, ammonium concentrations are found to decrease by increasing depth. The conversion of ammonium to nitrate (nitrification) is the main process which causes the nitrate concentration to increase with depth. The converted amount of ammonium to nitrate is found to represent around 45% of the original ammonium concentration in the applied water. In addition, the soil profile played a vital role in reducing the chemical oxygen demand concentration from 415 mg/l in the effluent water to 43.5 mg/l at 140 cm depth. But, the available soluble salts found in the soil profile and the aggressive behavior of the applied to dissolve mineral constituents of the soil are made responsible for the abrupt increase in the different chemical constituents of the infiltrated water. The waters of three wells penetrating the shallow aquifer composed of alluvial deposits are found to be highly affected by the infiltrated water as well as the seepages from pond bottoms. The chemical constituents of the wells waters increased in their concentrations by many folds after the construction of Khirbet Es-Samra Stabilization Ponds. This trend attenuates along the groundwater flow direction (East to West), due to dilution by the better quality of the already present groundwater.

The biodegradation of linear alkylbenzene sulfonate (LAS) and nitrilotriacetic acid (NTA) was assessed in an established septic tank system and an adjoining shallow sand aquifer (located near Cambridge, Ontario).
Studies were conducted on soil, aquifer sediment, and groundwater samples from a transect of the septic tank effluent plume. LAS and NTA were readily biodegraded in the vicinity of the discharge, with mineralization half-lives in soil and sediment samples collected near the tile field ranging from 9 to 17 d and 1 to 3 d, respectively. Similar results were obtained for ground water. Adaptation was a key process in the system, as illustrated by the rapid biodegradation near the tile field and limited biodegradation at locations far downgradient or ungradient of the system, where little or no LAS or NTA loading occurred. The results demonstrated that properly functioning septic tank systems can effectively remove synthetic organic chemicals such as LAS and NTA.

DE: solute-transport; domestic-wastes; septic-tanks; biodegradation-; pollutants-; aquifers-; wastewater-disposal; Canada,-Ontario; conferences-; linear-alkylbenzene-sulfonate; nitrilotriacetic-acid; wastewater-treatment
CL: Sources-and-fate-of-pollution (3020)
AN: 3575103
pollutants, such as toluene and phthalates, that are considered to be biodegradable. Pollutant concentrations generally increased with depth. On the other hand, pollutant concentrations at the two control sites decreased significantly with depth through the unsaturated zone. The downward mobility of organic pollutants may be enhanced by the sewage itself. Because sewage effluent is considered to be a readily available source of irrigation water in many parts of the world, the results of the study suggest that what may seem to be a relatively simple solution to water scarcity problems may have potentially long-term and dangerous effects on groundwater quality. (Author's abstract)

DE: *Groundwater-pollution; *Israel-; *Organic-compounds; *Path-of-pollutants; *Unsaturated-zone; *Wastewater-irrigation; *Water-reuse; Citrus-crops; Phthalates-; Toluene-; Unconfined-aquifers; Wastewater-renovation

CL: Sources-and-fate-of-pollution (3020); Ultimate-disposal-of-wastes (3050)

AN: 9308509

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TI: Virus Transport and Removal in Wastewater during Aquifer Recharge.
AU: Powelson,-D.-K.; Gerba,-C.-P.; Yahya,-M.-T.
SO: Water Research WATRAG, Vol. 27, No. 4, p 583-590, April 1993. 5 fig, 3 tab, 20 ref.
PY: 1993
AB: To assess soil/aquifer treatment of sewage effluent for removal of viruses, studies were conducted at a recharge/recovery site near Tucson, Arizona. Two 13-sq-m basins were constructed in coarse sand alluvium, one for secondary-treated effluent and one for tertiary-treated effluent. Bacterial viruses, MS2 and PRDI, and a chemical tracer, potassium bromide (KBr), were added to effluent applied to these basins. Infiltration rates ranged from 0.2 to 16.8 m/d. Samples of unsaturated flow from depths of 0.30-6.08 m below the basin were taken through porous stainless-steel suction-samplers. Bromide and virus results indicated the presence of preferential flow conditions that produced irregular concentration profiles with depth. Virus transport was retarded (R = 0.47) when applied after the infiltration rate had declined following 4 days' flooding. Virus-specific removal rates (b) during percolation through soil were 2.3-120 times greater than in bottles of effluent or groundwater. PRDI was removed more rapidly during percolation (b = 0.65/h) than MS2 (b = 0.23/h). Effluent type did not significantly affect b for MS2, but the PRDI rate was nearly 3 times greater with secondary effluent (1.0/h) compared to tertiary effluent (0.35/h). Virus removals at the 4.3 depth ranged from 37 to 99.7%. (Author's abstract) 35 000951018

DE: *Groundwater-recharge; *Path-of-pollutants; *Soil-treatment; *Viruses-; *Wastewater-disposal; *Wastewater-treatment; Land-disposal; Reclaimed-water; Secondary-wastewater-treatment; Tertiary-treatment; Tracers-

CL: Ultimate-disposal-of-wastes (3050); Wastewater-treatment-processes (3040)

AN: 9306847

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TI: Effect of Wastewater Injection on Ground Water Quality.
AU: Legeas,-M.; Carre,-J.; Merot,-P.
AF: Ecole Nationale de la Sante Publique, Departement Environnement et Sante, Avenue du Professeur Leon Bernard, 35043 Rennes Cedex, France
PY: 1992
AB: Effluents from the treatment plant of Saint Jean de Monts and Saint Hilaire de Riez (France) have been injected into a confined groundwater aquifer for twelve years. The effluents have been treated to remove 90% of the concentrations of suspended solids, 70% of the oxidizability, but less than 10% of the nitrogen. The groundwater is connected with the sea. Effluent floats on the surface of the aquifer and disperses by dilution at the freshwater/saltwater interface. The aquifer acts as a direct overflow pipe. This injection of effluent has preserved the water quality in the coastal area and in the Breton Marsh. If the inflow rate were increased, the balance of the system would probably be disturbed and the time required for diffusion of wastewater seawards would no longer be sufficient. (See also W93-05228) (Author's abstract)

DE: *Dilution-; *Effluents-; *Groundwater-; *Groundwater-movement; *Path-of-pollutants; *Wastewater-
Nitrate Reduction by In-Situ Bio-denitrification in Groundwater.

AU: Dahab, M.-F.; Lee, P.-Y.
PY: 1992
AB: A preliminary investigation was performed to assess the potential of using in-situ biodenitrification to reduce the nitrate concentration in contaminated groundwater. The main objectives were to: identify problems that may be expected to arise in in-situ groundwater denitrification; to study chemical, physical and biological factors controlling subsurface biodenitrification; and to evaluate the effects of biological reactions on the resulting groundwater quality. The laboratory investigation was carried out using an idealized aquifer model (sand tank) designed as a one-dimensional flow model to simplify the modeling task and to represent a small slice of a large actual aquifer system, operated in continuous and intermittent modes. The aquifer was equipped with a recharge well where feed solution was injected and a discharge well where treated water was pumped out, each at the tank ends. The aquifer silica sand was coated with a thin bacterial film. Daily effluent and influent samples were tested for nitrate, chemical oxygen demand, total and volatile suspended solids, pH, and turbidity. Results confirmed the technical feasibility of using in-situ nitrate removal. The relative stability of denitrification performance was observed at high carbon concentration (carbon:nitrogen ratio equal to 1.5), providing a maximum nitrate removal efficiency of 80%. The proliferation of biomass profoundly affected the potential interactions of contaminants and microorganisms in the subsurface region. Relatively high solids accumulation in the vicinity of the wells and their nearby aquifer matrix caused severe clogging problems and created high head-loss in the aquifer system. The immediate response of restarting the system and the ability of the system to recover after short periods of dormancy suggests that in-situ treatment can be operated intermittently. (See also W93-04432) (Fish-PTT)
DE: *Bioremediation-; *Denitrification-; *Groundwater-pollution; *In-situ-treatment; *Nitrates-; *Nitrogen-removal; *Site-remediation; *Water-pollution-treatment; *Aquifer-characteristics; Biological-treatment; Biomass-; Carbon-; Cleanup-operations; Effluents-; Flow-models; Groundwater-quality; Groundwater-recharge; Laboratory-methods; Sand-aquifers
CL: Water-quality-control (3070)
AN: 9304853


AU: Farrell, J.; Reinhard, M.
PY: 1992
AB: While much work has been done in characterizing sorption of halogenated organic solvents onto soils and aquifer materials in water saturated systems, few studies have addressed the sorption of these compounds in unsaturated systems, i.e., conditions similar to those in the vadose zone. A technique was developed to measure organic vapor sorption of chloroform (CF), trichlorethylene (TCE) and perchloroethylene (PCE) onto water coated solids such as soils and aquifer materials. The solids were coated with a surface layer of water and were in equilibrium with a gas phase at 100% relative humidity, simulating conditions in the unsaturated zone. Isotherms were measured by sorbing the organic vapor onto a column of the solid followed by eluting the organic while monitoring the effluent with a flame ionization detector (FID). Advantages of the method include: the ability to measure isotherms over at least 5 orders of magnitude in organic vapor concentration; the ability to measure sorption onto very low sorbing solids; and the ability to allow an indefinite time for equilibrium to be reached. (See also W93-03592) (Brunone-PTT)
DE: *Aquifers-; *Data-acquisition; *Halogenated-organic-compounds; *Pollutant-identification; *Soil-gases; Chemical-analysis; Chloroform-; Equilibrium-; Flame-ionization-detector; Groundwater-quality; Humidity-;
Reuse Rules.

AU: Bouwer, H.

AF: Water Conservation Laboratory, Department of Agriculture, Phoenix, AZ


PY: 1992

AB: Cities that discharge sewage effluent to surface water are under increasing pressure to reduce concentrations of heavy metals, ammonium and nitrate, and other toxic substances in their wastewater in order to protect aquatic life and human receptors better. As a result, municipalities are looking into zero discharge and complete reuse of wastewater as a less expensive way to protect the quality of receiving waters and conserving water resources. Reuse options include irrigation, industrial process and cooling water, construction applications, fire fighting, restricted recreational uses, toilet flushing, and in rare cases restoration to potability. Quality and treatment criteria vary, depending upon the end use, and the toughest criteria are for unrestricted agricultural use. Because of the variety of chemicals found in urban wastewater, post-treatment monitoring is difficult and potable recycling requires that treatment processes be specified. Depending upon local climate and hydrogeological conditions, soil-aquifer treatment may be appropriate, relying upon the natural capacity of soils to improve water quality through physical and chemical processes. Where local soils are unable to achieve the desired level of treatment, advanced water treatment may be necessary prior to surface application or deep well injection. (Tappert-PTT)

DE: *Wastewater-renovation; *Wastewater-treatment; *Water-reuse; Artificial-recharge; Irrigation-water; Metropolitan-water-management; Water-conservation; Water-quality-management; Water-resources-management

CL: Wastewater-treatment-processes (3040); Water-treatment-and-distribution (3060); Water-quality-control (3070)

AN: 9302236

Effect of Sodium Chloride on Transport of Bacteria in a Saturated Aquifer Material.

AU: Gannon, J.; Tan, Y.; Baveye, P.; Alexander, M.

AF: Department of Soil, Crop, and Atmospheric Sciences, Bradfield Hall, Cornell University, Ithaca, New York


PY: 1991

AB: Determinations were made of the influence of NaCl concentration, cell density, and flow velocity on the transport of Pseudomonas sp. strain KL2 through columns of aquifer sand under saturated conditions. A pulse-type boundary condition was used. The experiments were conducted by using 0.3-m-long Plexiglas columns with an internal diameter of 0.05 m. When a 1-hr pulse of a 0.01 M NaCl solution containing 100 million cells per ml was added at a flow rate of .0001 m/sec, the bacterial density in the effluent never exceeded 2.2% of the density of cells added, and only 1.5% of the bacteria passed through the aquifer material. In contrast, when the bacteria were applied in distilled water, the relative cell density in the effluent approached 100%, and 60% of the bacteria were transported through the aquifer solids. Under these conditions, the breakthrough of Pseudomonas sp. strain KL2 was slower than chloride. When the flow rate was .0002 m/sec, the cell density in the effluent reached 7.3% of that added in 0.01 M NaCl solution, but only 3.9% of the bacteria were transported through the aquifer particles. On the other hand, the density in the effluent approached 100% of that added in deionized water, and 77% of the added bacteria were recovered. When the density of added cells was 10 million cells per ml at a flow rate of .0001 m/sec, the densities in the effluent reached 70 and 100% of those added in salt solution and deionized water, respectively, and 44 and 57% of the bacteria were transported
through the aquifer solids. Replacement of the NaCl solution with deionized water caused some of the retained cells to be carried through the column. It is suggested that the movement of bacteria added to sandy aquifers for bioremediation of contaminated sites may be promoted by modifying the chemical composition of the carrying solution. (Author's abstract)

DE: *Aquifers-; *Bacteria-; *Bioremediation-; *Cleanup-; *Pseudomonas-; *Salinity-; *Site-remediation; *Sodium-chloride; *Water-pollution-treatment; Flow-velocity; Groundwater-movement; Porous-media; Sand-aquifers; Solute-transport

CL: Water-quality-control (3070)

AN: 9202151

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TI: Modelling Nitrate from Agriculture into Public Water Supplies.
AU: Whitehead,-P.-G.
PY: 1990

AB: Although, river water quality in the U. K. has been improving in recent years, in certain rivers (i.e., the Thames), the situation with regard to nitrate has deteriorated. A range of modeling techniques have been developed to simulate and predict the movement of nitrate from agricultural sources to public water supplies. A series of component models has been developed to simulate hydrological and chemical behavior of the Thames River basin. These components included: (1) a daily hydrological model for the Thames basin, which included 17 tributary sub-catchments and several major aquifer systems (the model provided input flows such as tributaries, groundwater, surface runoff, effluent returns as well as abstraction flows); (2) a soil zone and aquifer model for calculating the nitrate concentrations of surface runoff and groundwater given a particular land use and fertilizer application rate; and, (3) an integrated model of flow and water quality for the main river, which provided mass balance along the 22-reaches of the main river, allowed for denitrification processes and incorporated all inputs from the non-point sources derived by the first two components. The modeling approach used for the Thames river basin gave adequate information on likely trends in nitrate given broad changes in agricultural strategy. However, if more detailed information is required on nitrate levels in a particular part of the catchment to protect a surface on sub-surface supply, a more sophisticated model might be required. (Korn-PTT)

DE: Agricultural-runoff; Agriculture-; Model-studies; Nitrates-; Path-of-pollutants; Water-supply; Chemical-properties; Denitrification-; Fertilizers-; Groundwater-; Hydrologic-models; Land-use; Rivers-; Surface-runoff; Time-series-analysis; Water-quality

CL: Sources-and-fate-of-pollution (3020); Evaluation,-processing-and-publication (5080)
AN: 9108250

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TI: Tracing the Influx of Sewage From a Leaky Sewer Into a Very Thin and Fast-Flowing Aquifer.
AU: Rettinger,-S.; Ronen,-D.; Amiel,-A.-J.; Magaritz,-M.; Bischofsberger,-W.
PY: 1991

AB: Groundwater samples obtained by a pump or a sampler lowered into a well are known to provide mixed water samples that do not reflect the vertical distribution of the chemical components. Therefore, the results obtained from monitoring groundwater quality with a multilayer sampler and a conventional groundwater pump were compared. Water parcels of different chemical composition were detected in a 1 m thick and up to 17 m/d fast-flowing groundwater system using a multi-layer sampler (MLS) based on the dialysis cell technique. The parcels result from the infiltration of sewage effluents and also probably due to the leaching of sewage sludge from the agricultural land surface. Samples obtained at depth intervals as small as 3 cm in a natural gradient flow field revealed relatively high concentrations and variable profiles of Na (+), NO3 (-), HCO3 (-), SO4 (--), and DOC 9 m downstream of the infiltration pipe. A pump used to obtain water samples during a 2 year period, in the same research field, proved to be an inadequate sampling technique to trace the movement of sewage effluent. This is probably due the production of mixed water samples from different horizons of the aquifer. In clear contrast with the pump sample data, chemical profiles obtained with the MLS suggested the presence of a
pollution source upstream from one the six sampling wells. (Doyle-PTT)

DE: Aquifers-; Groundwater-pollution; Path-of-pollutants; Samplers-; Sampling-; Sewage-; Bicarbonates-; Dialysis-; Dissolved-organic-carbon; Leaching-; Nitrates-; Sulfates-; Well-seepage
CL: Sources-and-fate-of-pollution (3020); Data-acquisition (5040); Groundwater (0840)
AN: 9106867

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TI: Relationships Between Groundwater Contamination and Major-Ion Chemistry in a Karst Aquifer.
AU: Scanlon,-B.R.
AF: Kentucky Univ
PY: 1990
AB: Groundwater contamination was examined within a rural setting of the Inner Bluegrass Karst Region of central Kentucky, where potential contaminant sources include soil organic matter, organic and inorganic fertilizer, and septic tank effluents. Data on nitrate concentrations and indicator bacteria in water from wells and springs were compared with physical and chemical attributes of the groundwater system. Bacterial densities greater than the recommended limit were found in all springs and approximately half of the wells, whereas nitrate concentrations > 45 mg/L were restricted to 20% of the springs and 10% of the wells. Nitrate concentrations varied markedly in closely spaced wells and springs, which indicates that land use is not the primary control on groundwater contamination. Groundwater contamination is related to the distribution of chemical water types in the study area. All Ca subtype water was contaminated with nitrate and bacteria. Temporal fluctuations in nitrate concentrations of Ca subtype water are attributed to seasonal fluctuations in recharge and in plant growth. Ca-Mg subtype water generally was not contaminated and Na-HCO3 and Na-Cl water types were not contaminated. Ca-Mg subtype water, and Na-HCO3 and Na-CL water types are associated with longer residence times and reducing conditions, which allow bacterial die-off and denitrification, respectively. Differences in residence time and reducing conditions among the chemical water types and subtypes are attributed to variations in rock permeability and to occurrence of horizontal shales that control the rate and depth of active groundwater circulation. This relationship between chemical water types and contaminant concentrations is important for groundwater monitoring programs and the siting of waste-disposal facilities. (Author’s abstract)

DE: Groundwater-pollution-Karst-Aquifers-Kentucky-Path-of-pollutants; Water-chemistry-Bioindicators-Fertilizers-Groundwater-movement; Monitoring-Nitrates-Organic-matter-Self-purification-Site; selection-Waste-disposal-Water-classification-Water-pollution; sources-CL: Sources-and-fate-of-pollution (3020); Groundwater (0840); Chemical-processes (0880)
AN: 9104403

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TI: Wastewater Reuse Case Studies in the Middle East.
AU: Banks,-P.A.
AF: Acer Consultants Ltd
PY: 1991
AB: Within the past few decades the accelerating demand on natural resources to provide water for urban use, and the associated cost of meeting that demand, has led to an increased interest in the reuse of wastewaters for municipal, industrial and groundwater recharge purposes. The oil economies of the Middle East have severely arid climates which means that vegetation of every sort, except highly adapted desert micro plants, rely upon groundwater raised from underground aquifers or in recent times, desalinated seawater blended with groundwater. In some projects in the Middle East the potential for effluent use has been recognized at an early stage and sewage treatment facilities developed accordingly. Particular emphasis has been placed on operation and maintenance capabilities, availability of chemicals and spare parts, process reliability, capital and revenue funding and land areas required. Case studies portray reclamation installations in Abu Dhabi and Dubai in the United Arab Emirates, Doha in the State of Qatar and Taif in Saudi Arabia. Similar installations exist in Kuwait and other parts of Saudi Arabia and Israel. The practice of wastewater reuse in arid areas of the Middle East is well established and successful. From this success further and different uses could be found for this
valuable resource, such as industrial or groundwater recharge. However, the use for amenity and agricultural irrigation is in line with traditional features of the pastoral activities of these societies. As a result, very significant improvements in the local urban environment have been made and the feasibility of crop production using effluent tested and proven. Conventional methods of treatment and irrigation have sufficed to achieve this with minor problems being overcome without difficulty. (Mertz-PTT)

DE: Middle-East-Reclaimed-water-Wastewater-utilization-Water-reuse; Case-studies-Groundwater-recharge-Irrigation-water-Qatar-Saudi; Arabia-United-Arab-Emirates-Wastewater-facilities-Wastewater; treatment-Water-resources-management

CL: Use-of-water-of-impaired-quality (1030); Wastewater-treatment-processes (3040)

AN: 9105543

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TI: Land Use Effects on Ground Water Quality in Carbonate Rock Terrain.
AU: Steele,-K.F.; Adamski,-J.C.
AF: Arkansas Univ. Fayetteville. Dept. of Geology
PY: 1987

AB: A control site with a natural setting and an experimental site with significant agriculture land use were studied in the Ozark Region of Arkansas in order to determine the effect of land use on water quality in a carbonate rock terrain. The vast majority of the two sites have the Boone Limestone exposed which combined with the underlying St. Joe is the major aquifer for drinking water in the area. The sites also are similar in terms of lineament patterns (number, length and orientation), soil, slope and vegetation. Ground water samples were collected primarily from springs during three seasons (late summer-early fall, winter and spring). All three seasonal collections exhibited statistically higher NO3 (2.31 versus 0.81 mg/L) and Cl (9.9 versus 2.7 mg/L) concentrations in the experimental site. During the winter and spring collections, the experimental site also exhibited statistically higher concentrations (0.5 to 3x) of PO4, SO4, Na, K and Ca. Heavy metals were analyzed in the winter samples; however, the differences between the two sites were small because the absolute values for the two sites were low. For example, the largest difference for a heavy metal was 19 microgram/L for Mn (12 versus 31 microgram/L). Bacteria determined from the spring season samples showed that the experimental site had significantly higher counts of fecal coliform (86 versus 0.4 colonies/100 mL) and fecal Streptococcus (39 versus 3 colonies/100 mL) types than the control site. Three springs were also sampled periodically following a rain event of 10 cm. Whereas levels of specific conductance, NO3, Ca and Na decreased in all three springs, PO4, K, SO4 and fecal coliform increased significantly, primarily in the two experimental springs. The increase of these parameters indicates that they are more available in the experimental area. Based on these results and elemental correlations, it appears that cattle manure, the spreading of chicken manure and commercial fertilizers, and septic tank effluent, individually or in combination, are affecting the water quality of the experimental site. However, most of the ground water samples meet EPA drinking water standards with the possible exception of bacteria. (Author ’ s abstract)

DE: Groundwater-quality; Land-use; Carbonate-rocks; Nonpoint-pollution-sources; Water-pollution-sources; Agricultural-runoff; Aquifers-; Chemical-analysis; Bacterial-analysis; Arkansas-

CL: Effects-on-water-of-human-nonwater-activities (2060); Groundwater (0840); Sources-and-fate-of-pollution (3020)

AN: 9004491

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TI: Effects of Agricultural Practices and Septic-System Effluent on the Quality of Water in the Unconfined Aquifer in Parts of Eastern Sussex County, Delaware.
AU: Denver,-J.M.
AF: Delaware Geological Survey Newark
PY: 1989
AB: The unconfined aquifer in eastern Sussex County, Delaware consists mainly of quartz sand and gravel; its shallow water table is susceptible to contamination by nitrate and other chemical constituents associated with agricultural practices and septic-system effluent. The distribution and movement of nitrate and other fertilizer components were studied by measuring water levels and by collecting and analyzing groundwater samples from piezometers screened at various depths around a 220-acre irrigated field. There is a direct relation between concentrations of nitrate and specific conductance. Therefore, specific conductance was used to estimate nitrate concentrations in water samples and to indicate the degree of agricultural influence on water chemistry. Factors including upgradient land use, groundwater pumping, fertilizer application rates, magnitude and timing of recharge, and heterogeneous aquifer properties affect the distribution of agricultural chemicals in the aquifer. Concentrations of nitrate ranged from less than 2 to greater than 40 mg/L. Although chemical constituents associated with agriculture generally decreased with depth in the aquifer, nitrate (as nitrogen) concentrations were as high as 29 mg/L near the base of the aquifer. Eleven wells where water quality is affected solely by septic-system effluent were located and sampled. The chemical components of septic-system effluent also are present in manures, fertilizers, and pesticides, and their presence cannot be used to identify uniquely the source of groundwater contamination. (USGS)

DE: Land-use; Water-pollution-sources; Nitrates-; Unconfined-aquifers; Water-quality; Fertilizers-; Septic-wastewater; Groundwater-pollution; Delaware-; Agricultural-irrigation; Land-use; Groundwater-movement; Groundwater-recharge; Chemical-reactions; Natural-waters; Atlantic-Coastal-Plain

CL: Effects-on-water-of-human-nonwater-activities (2060); Effects-of-pollution (3030)

AN: 9005209
Artificial recharge experiments were conducted at East Meadow, Long Island, New York, from October 1982 through January 1984 to evaluate the degree of groundwater mounding and the chemical effects of artificially replenishing the groundwater system with tertiary-treated wastewater. More than 800 million gallons of treated effluent was returned to the upper glacial aquifer through recharge basins and injection wells in the 15-month period. Reclaimed water was provided by the Cedar Creek advanced wastewater treatment facility in Wantagh, 6 miles away. The chlorinated effluent was pumped to the recharge facility, where it was fed to basins by gravity flow and to injection wells by pumps. Observations during the recharge tests indicate that the two most significant factors in limiting the rate of infiltration through the basin floor were the recharge test duration and quality of reclaimed water. Head buildup in the aquifer beneath the basins ranged from 4.3 to 6.7 ft, depending on the quantity and duration of water application. Head buildup near the injection wells within the aquifer ranged from 0.3 to 1.2 ft. Recharge basins provided a more effective means of moving large quantities of reclaimed water into the aquifer than injection wells. Results of 3-day and 176-day ponding tests in two basins indicate that reclaimed water is relatively unchanged chemically by percolation through the unsaturated zone because: (1) the sand and gravel of the upper glacial aquifer is unreactive, (2) the water moves to the water table rapidly, and (3) the water is highly treated before recharge. The quality of water in the aquifer zones affected by recharge improved, on the whole. Groundwater concentrations of nitrate nitrogen and several low molecular weight hydrocarbons, decreased to well within drinking water standards as a direct result of recharge. Sodium and chloride concentrations increased above background levels as a result of recharge but remained well within drinking water standards and the New York State effluent standards established for this groundwater recharge study. (Lantz-PTT)

Tertiary-wastewater; Artificial-recharge; Reclaimed-water; Groundwater-recharge; Long-Island; New-York; Sodium-; Chemical-analysis; Injection-wells; Infiltration-; Chlorides-; Water-quality; Water-quality-standards; Percolation-

Groundwater-management (2040); Groundwater (0840); Use-of-water-of-impaired-quality (1030)

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In 1983, a sewage plume on Cape Cod, Massachusetts, was chosen by the U.S. Geological Survey’s Toxic Waste--Ground-Water Contamination Program for studies of contaminant transport and attenuation in aquifers. The site was chosen because of its 45-yr history of contamination, its relatively simple hydrogeologic setting, and its similarity to many contamination sites nationwide. Since 1936, infiltration beds at the site have been used to dispose of sewage that has undergone secondary treatment. For most of its history, the flow from the plant has averaged 1.1 million L/day. The effluent contains about 170 mg/L dissolved solids, which is four times greater than the dissolved-solids content of the native groundwater. The treated sewage recharges a glacial-outwash aquifer that is composed of 30 to 40 m of stratified sand and gravel and is underlain by silty sand and till. In 1979, the plume was 20-25 m thick, 750-1100 m wide, and more than 3500 m long. About 6-15 m of uncontaminated groundwater from areal recharge overlay the plume. Initial study showed that contaminants in the plume were transported with the groundwater, were altered by chemical reactions, and had entered the aquifer at different rates. Bacterial populations near the infiltration beds were 2 million/ml, but 1000 m from the beds had decreased to 250,000/ml. These numbers seemed to correlate with availability of degradable organic compounds (dissolved organic carbon decreased from 12 mg/L to less than 2 mg/L over the same distance). Volatile organic compounds were found in the plume in 1983. Concentrations of these toxic
compounds were greater than 50 microgram/L in a zone from 500 to 2600 m from the infiltration beds, which suggested that they are mobile and not readily degraded in this aquifer. Trichloroethene, tetrachlorethene, and dichlorobenzene had traveled farther than nonylphenol, in accord with estimated retardation rates based on the hydrophobicity of the compounds. Data gaps existing at present include lack of knowledge of the history of the chemical quality of the treated sewage and inadequate methods for measuring rates of dispersion and reactions within the aquifer. (See also W89-10313) (Rochester-PTT)

DE: Cape-Cod; Massachusetts-; Groundwater-pollution; Wastewater-pollution; Fate-of-pollutants; Path-of-pollutants; Solute-transport; Organic-compounds; History-; Aquifer-properties; Glacial-aquifers; Volatile-organic-compounds

CL: Sources-and-fate-of-pollution (3020); Groundwater (0840)

AN: 8910319

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TI: Groundwater Recharge as a Treatment of Sewage Effluent for Unrestricted Irrigation.

AU: Bouwer,-H.

AF: Agricultural Research Service Phoenix, AZ. Water Conservation Lab


PY: 1988

AB: The chemical quality requirements for using sewage effluent for irrigation are the same as those for regular irrigation water. Where hydrogeological conditions are favorable for groundwater recharge with infiltration basins, the necessary treatment can be obtained very simply by the filtration process as the sewage percolates through the soil and the vadose zone, down to the groundwater and then some distance through the aquifer. This `soil-aquifer treatment` (SAT) process removes essentially all suspended solids, micro-organisms and phosphorus, and significantly reduces the concentrations of nitrogen and heavy metals. The feasibility of the SAT process was studied with two experimental systems in Phoenix, Arizona. For both projects, most of the quality improvement of the wastewater occurred in the vadose zone (between soil surface and groundwater table). The results showed the renovated water from the projects meets the public health, agronomic and aesthetic requirements for unrestricted irrigation, including vegetable crops that are consumed raw, as well as primary contact recreation standards. The costs are relatively low and the systems do not require highly trained operators, thus, it is a viable alternative where land availability and hydrogeological conditions are favorable. (See also W89-06801) (White-Reimer-PTT)

DE: Wastewater-treatment; Reclaimed-water; Wastewater-renovation; Groundwater-; Groundwater-recharge; Groundwater-irrigation; Vadose-water; Soil-aquifer-treatment; Water-quality; Arizona-; Infiltration-; Feasibility-studies; Economic-aspects

CL: Wastewater-treatment-processes (3040); Groundwater-management (2040)

AN: 8906809

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TI: Design and Management of Infiltration Basins for Artificial Recharge of Ground Water.

AU: Bouwer,-H.

AF: Agricultural Research Service Phoenix, AZ. Water Conservation Lab


PY: 1988

AB: With artificial recharge of groundwater, surface water is infiltrated into the ground for storage in aquifers and eventual recovery from wells. Infiltration systems can be divided into in-channel and off-channel systems. Design and management criteria to maximize the hydraulic capacity of infiltration basins require permeable surface soils to obtain adequate infiltration rates, vadose zones without clay or other flow-restricting layers that would inhibit the flow to the aquifer, and aquifers that are unconfined. The basins must be regularly dried and cleaned to maintain infiltration rates. If the clogging material consists primarily of silt, clay or other inorganic matter, it must be removed by scraping or raking. Drying the basin can give considerable recovery of
infiltration rates due to the decomposition, shrinking, cracking, and curling up of sludge, bacteria, and algae. Flooding and drying cycles are sometimes used to control nuisance insects. Where surface water for recharge basins contains considerable suspended material, it can be more economical to remove this material in pre-sedimentation basins, possibly using coagulants to enhance settling of the solids. Since a number of factors (e.g., compaction, water chemistry, growth of suspended algae, groundwater level, etc.) govern the relation between water depth and infiltration rate, the water depth giving maximum infiltration rates as well as the velocity of the water (basins with stagnant water versus channels with flowing water) must be evaluated by on-site experimentation. Sources of water for artificial recharge of groundwater include surplus water in streams and rivers, storm water runoff, surplus water in aqueducts or water transfer projects, and sewage effluent or other wastewater. Some water sources are continuous and permit year-round operation of the infiltration basins. Others are seasonal or haphazard. (See also W89-07121) (Hammond-PTT)

DE: Recharge-basins; Groundwater-recharge; Artificial-recharge; Groundwater-basins; Hydraulics-; Infiltration-capacity; Maintenance-; Design-criteria; Economic-aspects; Storage-; Water-depth; Flow-velocity; Clogging-; Compaction-; Decomposition-; Suspended-solids; Insects-; Algae-; Bacteria-; Wastewater-; Water-reuse; Chemical-properties; Vadose-zone; Aquifers-
CL: Groundwater-management (2040); Hydraulics (6020)
AN: 8907131

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TI: Survival and Transport of Pathogenic Bacteria and Viruses in Ground Water.
AU: Matthess,-G.; Pekdeger,-A.
AF: Kiel Univ. (Germany F.R.). Geologisch-Palaeontologisches Inst. und Museum
PY: 1985
AB: For the assessment of groundwater protection against pathogenic microorganisms (bacteria and viruses), the mechanisms which control the two main factors for their elimination in the aquifer must be studied: (1) The persistence of bacteria and viruses under the biological and chemical conditions of the groundwater, and (2) The physical and physical-chemical processes that control the transport of microorganisms in groundwater. The groundwater may be contaminated by sewage containing the excrements of carriers or diseased persons. In municipal sewage, the concentration of E. coli is of the order to 1,000,000 to 10,000,000/mL and in surface waters about 1,000 and 10,000/mL. In Central European rivers usually 1-3 Salmonella/L are detected. The virus concentrations in the U.S. are as high as 1,000 to 100,000 PFU/L in sewage effluent, 10 to 10,000/L in treated sewage effluent, and 0 to 1,000/L in surface waters (PFU = plaque forming units). According to the EPA, drinking water that has undergone conventional treatment would contain about 1 infectious unit per 1,000,000 to 10 to the 8th power L. The purifying characteristics of river bank filtration and slow sand filtration can be only partly compared with the processes in groundwater. The biologically active layer at the boundary of water and sediment is very effective due to the high content of sorptive small particles and microbial slimes. If this layer is destroyed, bacteria and virus transport may take place, contaminating the aquifer. It needs a certain time to build up this layer again (few days to few weeks). Disturbances such as erosion or drying lead to a breakthrough into the deeper layers that will decrease after some time. During a continuous contamination of the groundwater by organic substances and microorganisms, the contamination plume becomes smaller with time. At very high bacteria concentrations flocculation and aggregation can occur at the source of contamination so that only a limited transport into the aquifer can take place. (See also W88-02533) (Lantz-PTT)

DE: Fate-of-pollutants; Pathogenic-bacteria; Viruses-; Path-of-pollutants; Groundwater-pollution; Groundwater-quality; Water-pollution-sources; Municipal-wastewater; Drinking-water; Filtration-; Flocculation-; Aggregation-; River-bank-filtration; Sand-filtration
CL: Sources-and-fate-of-pollution (3020); Groundwater (0840)
AN: 8802555

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TI: Microscale Chemical Heterogeneity in Groundwater.
AU: Ronen,-D.; Magaritz,-M.; Gvirtzman,-H.; Garner,-W.
AB: A multilayer dialysis cell device was used to obtain undisturbed, real-time samples from test wells 15 km north of Tel Aviv, Israel, and 2 km inland from the Mediterranean Sea. The test site, which overlies part of the Coastal Plain Aquifer, contains a sewage treatment plant, effluent infiltration lagoons, sludge disposal site, and fields irrigated with effluent for 20 years. Chemical profiles were obtained 42 days apart, using 76 dialysis cells over a 240-cm length. In the first test (single sampling), variations over the 240-cm length were considerable: chloride, 160-270 mg/liter; nitrate, 0-110 mg/liter; and sulfate, 45-70 mg/liter. When the same well was examined 42 days later, an entirely different pattern was found: chloride, 130-240 mg/liter; nitrate, 0-50 mg/liter; and sulfate, 10-55 mg/liter. Three-dimensional representations of the three ions measured from May 11 to October 13, 1986, further demonstrated the complexity of profiles. The results raised the question of the validity of groundwater quality data based on single samples. (Cassar-PTT)

DE: Data-acquisition; Path-of-pollutants; Groundwater-pollution; Solute-transport; Wastewater-disposal; Lagoons--; Sludge-disposal; Water-quality; Monitoring--; Chlorides-; Nitrates-; Sulfates--; Test-wells; Israel--; Dialysis-cells

CL: Sources-and-fate-of-pollution (3020); Groundwater (0840); Network-design (5010)
AN: 8807113
towards the aquifer. Statistics of the values obtained regarding the Peclet number and mobile fraction in the water filled porosity showed that spatial variation of the main transfer properties was within the limits of commonly measured soil properties. The agreement between the calculated and experimental solute profile was not as good as that which was observed for the effluent. The recovery of chloride was 99% and of nitrate 115%, a difference which could have been caused by some mineralization of the organic matter in the column. In all breakthrough curves, the chloride and nitrate came ahead of tritiated water. This well-known electrolyte exclusion phenomenon was used for checking the physical validity of the nonlinear adjustment of the theoretical curves to the experimental points. Two independent determinations of the salt exclusion volume were obtained either from the movement of tritiated water and chloride through the soil or from the specific surface (corrected for charge density) of the soil at a given ionic strength. The exclusion volume, V sub excl, was found to be .063 cu cm/g. The calculation of exclusion volume from the comparison of elution curves for tritiated water and chloride was found to give .042 cu cm/g. (Author’s abstract) 

DE: Agricultural-hydrology; Groundwater-pollution; Nitrates-; Path-of-pollutants; Loess-; Nitrates-; Soil-chemistry; Solute-transport; Physical-properties; Tritiated-water; Chlorides-; Aquifers-; Water-chemistry; Mineralization-; Organic-matter; Electrolytes-; Mathematical-studies; Porosity-; Tracers-

CL: Sources-and-fate-of-pollution (3020); Water-in-soils (0845)
AN: 8807307

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TI: Pretreatment Processes for Groundwater Recharge.
AU: Trewick,-G.P.
AF: Montgomery (James M.), Inc , Pasadena, CA
PY: 1985
AB: Unplanned, indirect wastewater reuse through effluent discharge to streams and groundwater basins for subsequent downstream use by a wide variety of interests - agricultural, industrial, or domestic - has been a long-accepted practice throughout the world. Many communities at the end of major waterways, such as New Orleans and London, ingest water that already has been used as many as five times by repeated river withdrawal and discharge. Similarly, rivers or percolation basins may recharge underlying groundwater aquifers with reclaimed wastewater, which is in turn withdrawn by subsequent communities. For example, the effluent from over 140 wastewater treatment plants partially replenishes the groundwater tapped by the water supply system for London. This means of effluent disposal, known as unplanned, indirect reuse, has become a generally accepted practice. Planned, direct reuse is practiced on a smaller scale for a limited number of purposes, primarily agricultural and industrial. The terms unplanned and planned refer to whether the subsequent reuse was an unintentional byproduct of effluent discharge, or was designed as a conscious act following effluent discharge. The planned reuse schemes discussed in this chapter incorporate wastewater reclamation processes designed to meet not only effluent discharge standards, but also reuse standards promulgated by health authorities. Two major advantages exist in utilizing groundwater recharge of reclaimed wastewater as the means for replenishing freshwater resources. First, groundwater recharge takes advantage of the subsoil’s natural ability for biodegradation and filtration, thereby providing subsequent in situ treatment of pretreated wastewaters. Depending on the requirements of downstream users, this in situ treatment may eliminate the need for costly physical-chemical treatment processes. Pretreatment processes discussed are: (1) primary sedimentation, (2) secondary biological treatment, (3) chemical clarification, (4) filtration, (5) air stripping, (6) GAC adsorption, and (7) disinfection. (See also W87-08137) (Lantz-PTT)

DE: Groundwater-recharge; Wastewater-treatment; Pretreatment-of-water; Water-reuse; Wastewater-renovation; Sedimentation-; Biological-treatment; Clarification-; Filtration-; Air-stripping; Activated-carbon; Disinfection-

CL: Wastewater-treatment-processes (3040); Groundwater-management (2040)
AN: 8708144

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AU: Idelovitch,-E.; Michail,-M.
AF: TAHAL-Water Planning for Israel Ltd. Tel-Aviv
PY: 1985
AB: The first stage of the Dan Region Sewage Reclamation Project consists of facilities for treatment and groundwater recharge of municipal wastewater discharged from the southern suburbs of the city of Tel Aviv-Jaffa and the neighboring municipalities of Holon, Bat Yam, and Rishon-Le-Zion, with a total connected population estimated at about 400,000. The wastewater pumped to the treatment plant undergoes biological treatment in two parallel series of facultative oxidation ponds with effluent recirculation and chemical treatment by the high lime - magnesium process, followed by detention of the high pH effluent in polishing ponds, mainly for free ammonia stripping and natural recarbonation. The treated effluent has been recharged to the regional groundwater aquifer since 1977 by means of spreading basins, located in the vicinity of the treatment plant. Most of the recharged effluent, after additional treatment and prolonged detention in the soil-aquifer system, will be pumped by means of recovery wells for reuse in the south of the country. In the final stage of the project, when the recovery wells will pump mostly recharged effluent, the reclaimed water will be supplied to nonpotable uses (mainly unrestricted irrigation of agricultural crops), by means of a dual system conveying separately potable and nonpotable water. At present most of the existing recovery wells pump native groundwater to the potable supply network; only a limited number of wells may pump an admixture of native groundwater and small amounts of recharged effluent. (See also W87-08137) (Lantz-PTT)
DE: Water-reuse; Groundwater-recharge; Wastewater-renovation; Dan-Region-Project; Artificial-recharge; Israel-; Wastewater-treatment; Groundwater-management; Aquifers-; Air-stripping
CL: Groundwater-management (2040); Wastewater-treatment-processes (3040)
AN: 8708152

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TI: Chemical and Microbiological Monitoring of a Sole-Source Aquifer Intended for Artificial Recharge, Nassau County, New York.
AU: Katz,-B.G.; Mallard,-G.E.
AF: Geological Survey Towson, MD. Water Resources Div
PY: 1981
AB: The Cedar Creek water reclamation project in Nassau County, New York, was designed to study the feasibility of recharging the groundwater reservoir with reclaimed water. Baseline information on water quality was gathered by sampling in observation wells at depths of 50, 100, and 200 ft below land surface. Preliminary results indicated that groundwater at the recharge site contained elevated concentrations of nitrate, chloride, sulfate, and ammonium ions; however, the concentrations of these ions generally decreased with depth. Chlorinated hydrocarbons (low-molecular weight, pesticides, and polychlorinated biphenyls) were present in significant concentrations in the upper glacial aquifer and Magothy aquifer. Fecal indicator bacteria were found in very few cases in low numbers. Sources of pollution in this area are cesspool and septic tank effluent, domestic cleaners and solvents, fertilizers, insecticides for pest control, and storm water runoff.
DE: Pollutant-identification; Water-analysis; Water-pollution-sources; Artificial-recharge; New-York; Water-reuse; Water-quality; Recharge-; Aquifers-; Nassau-County; Groundwater-recharge; Monitoring-; Baseline-studies; Septic-tanks; Cesspools-; Organic-compounds; Chlorinated-hydrocarbons; Bacterial-analysis
CL: Identification-of-pollutants (3010); Sources-and-fate-of-pollution (3020)
AN: 8603527

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AU: Quince,-J.R.; Gardner,-G.L.
SO: Hazardous Waste Management for the 80's, Ann Arbor Science, Ann Arbor, MI 1982. p 357-388, 13 fig, 2 tab.
PY: 1982
AB: An overview of techniques currently applied to recover and treat polluted groundwater is presented. The process consists of several steps: A preliminary investigation of existing site conditions, selection of a method of recovery (usually gravity collection, suction lift or positive displacement), selection of a treatment system based on the contaminant(s) being recovered, use of treatment system effluent for aquifer recharge, and monitoring. Four case histories encompassing a variety of contaminants are presented to illustrate the process. Treatment steps can be divided into three primary classifications: physical, chemical and biological. Physical techniques employ phase or component separation. Chemical treatment techniques employ the addition of a reactive material to provide for a change in chemistry of the waste stream. Biological treatment uses enhanced microbiological activity to convert contaminants to non-toxic by-products. In situ recovery and treatment techniques including biodegradation have proven more effective than excavation and disposal of contaminated material. (Halterman-PTT)

DE: Groundwater-pollution; Industrial-wastes; Water-treatment; Environment-; Groundwater-recharge; Water-quality; Biological-treatment; Chemical-treatment

CL: Water-quality-control (3070)
AN: 8602230

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TI: Geohydrology of the Meadowbrook Artificial-Recharge Project Site in East Meadow, Nassau County, New York.
AU: Aronson,-D.A.; Lindner,-J.B.; Katz,-B.G.
AF: Geological Survey Albany, NY. Water Resources Div
SO: Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report, 1983. 44 p, 19 Fig, 8 Tab, 34 Ref.
PY: 1983
AB: In Nassau and Suffolk Counties, where the quality and quantity of potable ground water has declined as the result of urbanization, the use of reclaimed wastewater to replenish the ground-water reservoir is technically feasible. A system of 11 recharge basins and 5 shallow injection wells will return 4 million gallons per day of reclaimed wastewater to the ground-water reservoir. Results of a two-dimensional flow analysis of pump-test data were incorporated into a finite-difference regional flow model to predict changes in head from artificial recharge in and around the recharge site. A maximum water-table rise of 17 feet is predicted beneath the recharge basins under ‘worst-case’ conditions; buildups will be somewhat higher near the injection wells. The predicted maximum increase in streamflow at East Meadow Brook is 3.5 cubic feet per second. The projected chemical quality of the treated effluent to be used for aquifer recharge will be superior to that of water already present in the upper part of the ground-water reservoir at the recharge site. Therefore, the recharge effort should improve both the quantity and quality aspects of the ground-water in the vicinity of the recharge site. (USGS)

DE: Groundwater-recharge; Induced-infiltration; Groundwater-movement; Reclaimed-water; Long-Island; New-York; Water-quality; Recharge-basins; Injection-wells; Computer-models; Recharge-facilities; Index-materials
CL: Groundwater (0840); Ultimate-disposal-of-wastes (3050)
AN: 8501774

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TI: Soil-Aquifer Treatment - A New Approach to an Old Method of Wastewater Reuse.
AU: Idelovitch,-E.; Michail,-M.
AF: Tahal Consulting Engineers Ltd. Tel-Aviv (Israel)
SO: Journal of the Water Pollution Control Federation Vol. 56, No. 8, p 936-943, August, 1984. 12 Fig, 6 Tab, 22 Ref.
PY: 1984
AB: The soil-aquifer system can be used efficiently as a wastewater treatment plant. The complex physicochemical and biological processes occurring in the unsaturated zone and in the aquifer include: filtration, chemical precipitation, adsorption, cation exchange, biodegradation of organics, nitrification, denitrification, biological recarbonation, bacterial die-off, and virus inactivation. The lifetime of the physicochemical
processes varies from short (removal of sodium and boron) to very long (removal of trace elements). The filtration effect of the upper soil layer and the biological processes can be effective indefinitely if the recharge operation is carefully managed. Soil-aquifer treatment (SAT) should be recognized as a modern approach to an old method of wastewater treatment and reuse, which involves low costs and simple operation. Besides its reliability with respect to effluent purification, it can also fulfill the function of seasonal and multi-annual water storage. Whenever feasible, SAT should be adopted and regarded as the nucleus of the wastewater treatment plant or reuse scheme, to be complemented when necessary, by suitable pretreatment, and post-treatment. (Baker-IVI)

DE: Water-reuse; Wastewater-renovation; Wastewater-treatment; Soil-aquifer-treatment; Nitrification-; Bacteria-; Viruses-; Land-application; Groundwater-recharge
CL: Wastewater-treatment-processes (3040)
AN: 8502573

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AU: Stout,-G.E.; Naymik,-T.F.; Larson,-T.H.; Schock,-M.R.
AF: Illinois Univ. at Urbana-Champaign. Water Resources Center
SO: Research Report No. 184 September 1984. 83 p, 41 Fig, 2 Tab, 52 Ref. Project No. Bu Rec R-0061, Contract/Grant No. 14-34-0001-7811 (1).
PY: 1984

AB: This study was designed to examine the advantages, disadvantages, and effects of artificial recharge, using sanitary plant effluent as recharge water. A numerical groundwater model was constructed for a site near Aurora, Illinois, and validated by simulating an aquifer test at a proposed pit location. Model simulations were also conducted to calculate the flow capacity of the system, the flow capacity of a pilot recharge pit, and the solute transport through and away from the pit. Based on the study’s findings, a pilot pit should be constructed at the Aurora Site, and chemical quality of the water withdrawn from the operation would be the research aspect of a pilot pit. There may be some characteristics of the effluent, such as the total dissolved solids (TDS), that exceeds the background counts of the aquifer. A TDS of 100 mg/l, which is considered excessive for many water supply uses but neither is toxic nor creates a health hazard in the effluent, could be reduced through demineralization, but this is an additional cost. Furthermore, the sole purpose of this study was to evaluate the movement and changing characteristics of the high quality effluent from tertiary-treated wastewater which is primarily domestic in nature as this effluent moves through from a pit into the aquifer. Artificial recharge is a viable concept as shown by the calculations and model simulations of the Aurora site. DE: Water-reuse; Wastewater-treatment; Artificial-recharge; Sanitary-plant-effluent; Effluent-characteristics; Effluent-movement; Recharge-pit; Aquifers-; Filter-media; Model-simulation; Illinois-; Mathematical-models
CL: Wastewater-treatment-processes (3040)
AN: 8506941

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TI: Tertiary Treatment of Municipal Wastewater by Cypress Domes.
AU: Dierberg,-F.E.; Brezonik,-P.L.
AF: Florida Inst. of Tech. Melbourne. Dept. of Environmental Sciences and Engineering
SO: Water Research Vol. 17, No. 9, p 1027-1040, September, 1983. 9 Fig, 2 Tab, 27 Ref.
PY: 1983

AB: The feasibility of using cypress domes as an alternative to physical-chemical methods for tertiary treatment of sewage effluent was demonstrated over a 5 year period. Compared to effluent concentrations, rather small reductions, less than 33%, occurred in the concentrations of nitrogen, phosphorus, BOD, sodium, potassium, chloride, and fluoride in the surface waters of domes receiving treated sewage effluent. Larger reductions or about 50% occurred for calcium, magnesium, and sulfate. The conventional treatment plant/oxidation pond itself was effective in reducing levels of BOD and total nitrate, but was ineffective in reducing levels of total phosphate and other minerals. The effectiveness of cypress domes in removing high percentages (greater than 90%) of organic matter, nutrients and minerals is more obvious when concentrations of these substances in the shallow watertable aquifer below the sewage-enriched domes are examined. Concentrations of these parameters in shallow wells in and around the sewage domes were at background levels throughout the study.
High chloride values indicated that treated sewage was percolating into the shallow aquifer. Cypress domes and their associated sediments and soils thus can reduce the levels of major water quality parameters to levels comparable to those of conventional tertiary treatment processes. Sediments and vegetation continued to release inorganic ions to the standing water for more than 20 months after the cessation of sewage inputs. Parameters associated with organic matter and with the reducing environment of the sewage-enriched domes displayed a rapid return to background levels. (Baker-IVI)

DE: Cypress-domes; Wastewater-treatment; Municipal-waste; Nitrogen-; Phosphorus-; Organic-matter; Minerals-; Dissolved-oxygen; Tertiary-wastewater-treatment
CL: Wastewater-treatment-processes (3040)
AN: 8401907

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TI: Fate of Inorganic Micro-Contaminants During Groundwater Recharge.
AU: Chang,-A.C.; Page,-A.L.
AF: California Univ. Riverside. Dept. of Soil and Environmental Sciences
PY: 1980
AB: This paper reviews the occurrence of inorganic micro-contaminants in treated wastewater effluents, their potential impact in terms of beneficial use of the water, and the capability of soils in attenuating contaminants in recharge water. The inorganic constituents of wastewater reflect the mineral composition of the source water; additional minerals may be picked up during use in urban areas. Trace elements in treated industrial effluents constitute most of the inorganic micro-contaminants in artificial groundwater recharge. In drinking water, the mineral content usually poses no health hazards but could be aesthetically unpleasant; for irrigation purposes, a high dissolved mineral content increases the soil’s salinity. Depending on the physical characteristics of the water’s impurities, the attenuation mechanisms vary. For constituents in suspended form, these include filtration, trapping and adsorption. Many micro-contaminants are present in recharged water in a dissolved state. A chemical rather than physical reaction is needed to immobilize the dissolved constituents, such as cation exchange, precipitation, surface adsorption, and chelation and complexation. Soils do not have unlimited capability in attenuating micro-contaminants, but they can retain large amounts of trace metal elements. However, long-term, continuous high rate applications of wastewater could cause substantial trace element enrichment of the surface soil, which may render the land unfit for subsequent agricultural development. For recharge systems, the composition of the specific wastewater effluent should be determined, and trace metal inputs for each case should be carefully evaluated. (Atkins-Omniplan)
DE: Inorganic-compounds; Water-quality; Water-quality-standards; Artificial-recharge; Pollutants-; Soil-absorption-capacity; Soil-profiles; Water-treatment; Treated-water; Wastewater-composition; Wastewater-pollution; Aquifers-; Beneficial-use; Minerals-; Water-properties
CL: Sources-and-fate-of-pollution (3020); Groundwater-management (2040)
AN: 8301702

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AU: Hall,-D.C.; Hillier,-D.E.; Nickum,-E.; Dorrance,-W.G.
AF: Geological Survey Lakewood, CO. Water Resources Div
SO: Geological Survey Open-File Report 81-73 (WRI) 1981. 65 p, 8 Fig, 19 Tab, 70 Ref.
PY: 1981
AB: The use of residential wastewater-treatment systems in Evergreen Meadows, Marshdale, and Herzman Mesa, Colo., has degraded ground-water quality to some extent in each community. Age of community; average lot size; slope of land surface; composition, permeability, and thickness of surficial material; density, size, and orientation of fractures; maintenance of wastewater-treatment systems; and presence of animals are factors possibly contributing to the degradation of ground-water quality. When compared with effluent from aeration-treatment tanks, effluent from septic-treatment tanks is characterized by greater biochemical oxygen demand and
greater concentrations of detergents. When compared with effluent from septic-treatment tanks, effluent from aeration-treatment tanks is characterized by greater concentrations of dissolved oxygen, nitrite, nitrate, sulfate, and dissolved solids. (USGS)

DE: Groundwater-; Water-quality; Water-pollution-effects; Septic-tanks; Colorado-; Aquifers-; Aerobic-treatment; Effluents-; Degradation-; Nitrates-; Chemical-analysis; Well-data; Observation-wells; Sites-; Jefferson-County

CL: Effects-of-pollution (3030)

AN: 8301182

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TI: Effects of Effluent Spray Irrigation on Ground Water at a Test Site Near Tarpon Springs, Florida.

AU: Brown,-D.P.

AF: Geological Survey Tallahassee, FL. Water Resources Div

SO: Open-File Report 81-1197 1982. 36 p, 9 Fig, 13 Tab, 16 Ref.

PY: 1982

AB: Secondary-treated effluent was applied to a 7.2-acre test site near Tarpon Springs, Fla., for about 1 year at an average rate of 0.06 million gallons per day and 3 years at 0.11 million gallons per day. Chemical fertilizer was applied periodically to the test site and adjacent areas. Periodic mounding of the water table occurred due to effluent irrigation, inducing radial flow from the test site. Physical, geochemical, biochemical processes effectively reduced total nitrogen concentration 90% and total phosphorous concentration more than 95% in the ground water of the surficial aquifer about 300 feet downgradient from the test site from that of the applied effluent. Downgradient, total nitrogen averaged 2.4 milligrams per liter and total phosphorus averaged 0.17 milligrams per liter. Substantial increases in total phosphorus were observed when the pH of the ground water increased. Total coliform bacteria in the ground water of the surficial aquifer were generally less than 100 colonies per 100 milliliters. Fecal coliform bacteria were generally less than 25 colonies per 100 milliliters at the test site and were not detected downgradient or near the test site. Fecal streptococcal bacteria were generally less than 100 colonies per 100 milliliters at the test site, but were detected on three occasions near the test site. (USGS)

DE: Groundwater-; Water-quality; Path-of-pollutants; Effluents-; Florida-; Spray-irrigation; Observation-wells; Monitoring-; Agricultural-chemicals; Fertilizers-; Nitrogen-compounds; Bacteria-; Aquifers-; Chemical-analysis; Tarpon-Springs

CL: Sources-and-fate-of-pollution (3020); Groundwater-management (2040)

AN: 8300068

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TI: Water Reuse in the Coastal Plain of New Jersey - A Case Study.

AU: Ahlert,-R.C.

AF: Rutgers - The State Univ. New Brunswick, NJ. Dept. of Chemical and Biochemical Engineering


PY: 1983

AB: Eastern Monmouth County has an increasing water deficit, as evidenced by declining aquifer levels and increasing salinity. Waste water reuse through aquifer recharge was considered a possible alternative to surface water development. Surface water development in the Manasquan River Basin would involve reuse through treated effluent transport in surface waters to impoundments or potable water intakes. Recharge lagoons and irrigation requirements could not provide adequate capacity. Water quality criteria would mandate considerable tertiary treatment before injection and mixing with ground water. Water Plant 21 is an example of complexity and cost for treatments prior to reuse via aquifer. A dual distribution system concept would provide some relief of demand of potable water. Treated waste water can be used for many non-potable, non-contact purposes.

DE: Water-reuse; New-Jersey; Water-supply; Wastewater-renovation; Water-deficit; Coastal-plains; Manasquan-River-basin; Recharge-; Water-quality-criteria; Wastewater-treatment

CL: Use-of-water-of-impaired-quality (1030)
During the first five years of the Flushing Meadows Project, the main objective was to maximize hydraulic loading and to determine the associated quality improvement of the effluent as it seeped down to the groundwater and moved laterally through the aquifer. During the second five years the research comprised studying maximization of nitrogen removal, which required a reduction in hydraulic loading. The Project consisted of six parallel, horizontal basins. Secondary wastewater effluent from an activated sludge process with no chlorination was pumped into the basins at one end. The 5-day BOD generally was in the 10 to 20 mg/l range for secondary effluent going into the infiltration basins, and less than 1 mg/liter for the renovated water from the East Center Well. Chemical oxygen demand of the secondary effluent was 30-60 mg/l, and that of the renovated water, 10-20 mg/l. Total nitrogen content of the secondary effluent normally ranged between 20 and 40 mg/l, with the low values occurring in the summer. Phosphorus in the secondary effluent was mostly in the orthophosphate form. Concentrations of phosphate-phosphorus showed a slightly decreasing trend in the 10 years of the research, from an average of about 11 mg/l in 1969 to about 8 mg/l in 1977. This decrease can probably be attributed to an increase in household use of low phosphate detergents. The fluoride concentration of the secondary effluent decreased during 1973-77 and averaged 20.8 mg/l in 1977. Boron concentrations averaged 0.45 mg/l in 1968 and increased to 0.85 mg/l in 1971, decreasing to 0.59 mg/l in 1977. The secondary effluent contained 21 PFU's/l; viruses could not be detected in renovated water sampled below the basins. (Baker-FRC)
development had only a slight effect on Great Egg Harbor River in comparison with sources of contamination upstream from the study area. (USGS)

DE: Urbanization-; Groundwater-; Water-quality; Surface-water; New-Jersey; Camden-County; Geohydrology-; Urban-runoff; Rainfall-; Storm-runoff; Detention-reservoirs; Wastewater-treatment; Chemical-analysis; Observation-wells; Water-level; Unit-hydrographs; Artificial-recharge; Water-analysis; Great-Egg-Harbor-River

CL: Effects-on-water-of-human-nonwater-activities (2060); Wastewater-treatment-processes (3040)

AN: 8202461

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TI: Chemical and Microbiological Monitoring of a Sole-Source Aquifer Intended for Artificial Recharge, Nassau County, New York.

AU: Katz,-B.G.; Mallard,-G.E.

AF: Geological Survey Syosset, NY. Water Resources Div


PY: 1980

AB: In late 1980, approximately 4 million gallons per day of highly treated wastewater will be used to recharge the groundwater reservoir in central Nassau County through a system of 10 recharge basins and 5 shallow injection wells. To evaluate the impact of large-scale recharge with reclaimed water on groundwater quality, the U.S. Geological Survey has collected hydrologic and water-quality data from a 1-square-mile area around the recharge site to provide a basis for future comparison. Extensive chemical and microbiological analyses are being made on samples from 48 wells screened in the upper glacial (water-table) aquifer and the upper part of the underlying Magothy (public-supply) aquifer. Preliminary results indicate that water from the upper glacial aquifer contains significant concentrations of nitrate and low-molecular-weight chlorinated hydrocarbons and detectable concentrations of organochlorine insecticides and polychlorinated biphenyls. At present, no fecal contamination is evident in either aquifer in the area studied. In the few samples containing fecal indicator bacteria, the numbers were low. Nonpoint sources provide significant loads of organic and inorganic compounds; major sources include cesspool and septic-tank effluent, cesspool and septic-tank cleaners and other over-the-counter domestic organic solvents, fertilizers, insecticides for termite and other pest control, and stormwater runoff to recharge basins. The water-table aquifer is composed mainly of stratified, well-sorted sand and gravel and, as a result, is highly permeable. In the 1-square-mile area studied, some contaminants seem to have traveled 200 feet downward to the bottom of the water-table aquifer and into the upper part of the public-supply aquifer. (USGS)

DE: Monitoring-; Chemical-analysis; Microbiology-; Reclaimed-water; Artificial-recharge; Long-IslandNY; Injection-wells; Storm-runoff; Aquifer-characteristics; Groundwater-; Groundwater-recharge; Water-table; Water-quality; Water-supply; New-York

CL: Groundwater-management (2040)

AN: 8102393

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AU: Garza,-S.; Weeks,-E.P.; White,-D.E.

AF: Geological Survey Austin, TX. Water Resources Div

SO: Available from the OFSS USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $5.50 in paper copy, $4.00 in microfiche. Geological Survey Open-File Report 80-1106, September, 1980. 38 p, 6 Fig, 4 Tab, 13 Ref, 1 Plate.

PY: 1980

AB: The U.S. Geological Survey, in cooperation with the Texas Department of Water Resources, made a preliminary study of specific factors related to recharging the Hueco bolson in the northeast El Paso area with treated sewage effluent. The city is interested in the location and spacing of injection wells relative to (1) maintaining the injected effluent in the aquifer for a predetermined amount of time (residence time) before it is pumped out, (2) recovery by pumping of as much of the injected effluent as possible, and (3) the long-term
effects of injection on water-level declines. A two-dimensional digital-computer model was developed to project short-term hydraulic gradients under various conditions of pumping and injections. A corresponding range of interstitial velocities (294-773 feet per year) was estimated by assuming idealized piston-type flow. These velocities may be used to plan the location and spacing of production and injection wells under assumed time factors related to the required residence time for the injected water. The injection sites were selected near a proposed sewage-treatment facility in an area that will allow flexibility in the locations of the production and injection wells. Maximum 20-year declines of about 35 feet were projected for areas several miles west and southwest of the facility under anticipated injection and pumping rates. The proposed injection water will require strict water-quality controls, which may involve chlorination and the removal of suspended solids. Mixing of the proposed injection water with the native groundwater probably will not clog the aquifer by mineral precipitation. The relatively large concentrations of sodium in the injection water may reduce the hydraulic conductivity of the clay layers in the aquifer, but the permeable sands should not be seriously affected. Plans for an artificial-recharge program need to include an experimental installation to evaluate the system under field conditions. (USGS)

DE: Artificial-recharge; Treated-water; Sewage-effluents; Injection-wells; Texas--; Hueco-bolson; El-Paso; Water-reuse; Aquifer-characteristics; Water-levels; Water-quality; Computer-models; Methodology--; Chemical-analysis
CL: Groundwater-management (2040); Techniques-of-planning (4010)
AN: 8102458

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TI: Influences of Sewage and Trade Effluent Discharges on Water Resources.
AU: Matthews,-P.J.
AF: Anglian Water Authority (England)
PY: 1981
AB: The abstraction of water for potable purposes is used to demonstrate the nature of the problems and policies in water resource quality management. Management of the interrelated effects of discharges of trade and sewage effluents and of diffuse sources such as rainfall, contaminated surface water, and natural organic matter, is best effected through catchment models. The concept of catchment planning is one which should help to minimize the potential effects of long and short term pollution. This concept includes the derivation of consent limits, application of development restrictions, financial investment in water and sewage treatment, and integrated monitoring programs. Such catchment planning requires a comprehensive knowledge of the toxicology of many substances, and it would therefore seem logical to maintain and improve regional and national data banks. A knowledge of the storage of bulk chemicals in the catchment is also very useful. In the past, not all direct abstraction points were provided with bankside storage, but consideration is being made for such provision at new works. Direct river abstraction points are particularly susceptible to hazards arising from short term pollution, as well as being affected by such long term pollution as nitrate. In both instances, adequate plant water treatment works should be provided to deal with the potential hazards arising in a particular catchment. Several brief case histories of catchment planning activities in Great Britain are included. (Carroll-FRC)
DE: Catchment-areas; Water-pollution; Water-quality-management; Water-quality; Water-pollution-prevention; Water-pollution-control; Industrial-wastes; Effluents--; Municipal-waste-water; Aquifers--; River-basins; Toxicity--; Planning--; Great-Britain
CL: Effects-of-pollution (3030); Evaluation-process (4020)
AN: 8104638

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TI: Groundwater Contamination in Connecticut.
AU: Woodhull,-R.S.
AF: Connecticut Dept. of Health Hartford
SO: Journal of the American Water Works Association Vol 73, No 4, p 188-189, April, 1981.
PY: 1981
AB: Although traditional health department programs in Connecticut have established and maintained good
control over groundwater contamination from sewage effluents, serious pollution problems are now developing
as a result of previously unregulated discharge of various chemicals or chemical solutions onto or into the
ground. Trace quantities of volatile organic chemicals which are potential carcinogens were discovered in 87
percent of waters supplying utilities serving 1,000 people or more. (Testing was conducted at 78 percent of the
95 water utilities in this size category). Chemical levels in excess of the U.S. Environmental Protection Agency
's (EPA's) suggested no-adverse-response level were detected at 23 wells serving 17 of the systems.

Connecticut has developed a plan to be followed by each utility in dealing with chemical contamination levels
exceeding this level, which includes finding the source of the pollution, notifying customers, correcting the
problem, and providing alternative water supplies. Trihalomethanes constituted the major pollutant where
excessive organic chemical contamination was found. A plan of action to be followed when water supplies are
found to have chemical levels exceeding 70 percent of a suggested no-adverse-response level has also been
instituted. This plan includes a sampling program, to be followed by remedial action where necessary. Other
groundwater pollutants which are causing increasing concern include road salt, fertilizers, volatile organic
solvents or degreasers, gasoline and oil from storage tanks, oil from distribution system leaks, and leachates
from municipal and industrial disposal sites. A groundwater classification scheme is currently being developed
by the state of Connecticut to help protect drinking water aquifers from chemical contamination by regulating
disposal sites. However, there is also a need for a Federal or State program to assist owners of wells which
have been contaminated. (Carroll-FRC)

DE: Groundwater-pollution; Connecticut-; Organic-compounds; Trace-levels; Carcinogens-; Chemical-wastes;
Legal-aspects; Regulations-; State-jurisdiction; Water-pollution-sources; Water-pollution-treatment;
Municipal-water

CL: Sources-and-fate-of-pollution (3020); Water-quality-control (3070)
AN: 8105613

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TI: An Anomalous Occurrence of Sodium Bicarbonate Water in a Flood Plain in a Carbonate Terrane.
AU: Krothe,-N.C.; Parizek,-R.R.
AF: Indiana Univ. at Bloomington. Dept. of Geology
SO: Ground Water Vol 17, No 6, p 595-603, November-December 1979. 6 Fig, 4 Tab, 8 Ref, OWRT A-005-
PA(10).
PY: 1979
AB: Geochemical factors controlling water chemistry in an influent stream and adjacent floodplain sediments
were determined during a four-year study. The stream has a drainage basin that is similar to many streams
draining carbonate terranes in the eastern United States. The stream receives sewage effluent and farm and
urban runoff and supplies recharge to an aquifer under extensive development. Water beneath the floodplain,
springs, and channel were calcium bicarbonate as expected; however, the prevalent chemical character of soil
water beneath the channel was sodium bicarbonate. HC03(-) within soil water beneath the stream is three times
(1,500 mg/l) that beneath the floodplain, Na(+) is two orders of magnitude greater (400 mg/l). K(+) reaches 10
mg/l, which is twice as great, while Ca(2+) and Mg(2+) may be 1/5 as high as concentrations beneath the
floodplain, with ranges from 15 to 20 mg/l and 5 to 10 mg/l, respectively. Waters 3 to 7 feet below the
floodplain contain intermediate Na(+) values from 25 to 75 mg/l. Ion exchange appears to be the mechanism
accounting for the sodium bicarbonate water observed under the channel. The same relationship should occur
in other areas with available carbonate rock, base exchange minerals, and an organic source. (Sims-ISWS)
DE: Water-chemistry; Streams-; Sediments-; Pennsylvania-; Soil-water; Sodium-compounds; Calcium-;
Magnesium-; Potassium-; Sampling-; Chemical-analysis; Flood-plains; Chemistry-; Sodium-bicarbonate
CL: Chemical-processes (0880)
AN: 8002880

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TI: The Effects of Irrigation with Meatworks-Fellmongery Effluent on Water Quality in the Unsaturated Zone
and Shallow Aquifer.
AU: Keeley,-G.M.; Quin,-B.F.
AF: Canterbury Frozen Meat Co. Ltd. Christchurch (New Zealand)
SO: Progress in Water Technology Vol 11, No 6, p 369-386, 1979. 6 Fig, 7 Tab, 23 Ref.
Land application of meatworks-fellmongery effluent has been carried out at Fairton in Canterbury (New Zealand) for 80 years. Approximately 900 mm of effluent is applied annually to 100 ha of shallow soil (overlying gravels), which is bordered for surface irrigation, sown in pasture, and used for fattening beef. Because of the high nutrient content of the effluent, much of which is attributable to the fellmongery operation, soil fertility has quickly been increased to the point where the majority of most nutrients (phosphorus being a notable exception) are lost in the drainage. Investigation showed that the chemical composition of the drainage became more homogeneous with depth. The drainage (which also totaled 900 mm annually) and effluent contained similar concentrations of the species relatively unaffected by soil processes (Cl, Na, and S04-S), but the 100 mg/liter of N in the effluent, most of which was present as NH4-N, was replaced by NO3-N in the drainage, although the lower concentration (40 mg/liter) suggested that denitrification losses were considerable. Despite the shallow nature of the soil, bacterial numbers in the gravel substrata were much lower than in the topsoil. The chemical composition of the groundwater beneath the scheme, where the water table is 21 m below ground level, was similar to that of drainage collected from a depth of 6 m. A three-depth investigation well situated 500 m from the scheme in the direction of groundwater flow showed definite chemical and bacteriological contamination from the effluent irrigation scheme only in the shallowest of the three depths. (Sims-ISWS)
environments allow biofilms to predominate microbial kinetics. Consideration of the kinetics of substrate utilization and growth of biofilms indicated that microbiological activity occurs very near the injection well. The aggregate substrate expressed, for example, as chemical oxygen demand, can be considered the primary substrate; the biofilm’s growth is supported through the utilization of the aggregate primary substrate. Individual trace organic compounds, none of which could support biofilm growth alone, were utilized as secondary substrates. Although biodegradable, secondary substrates that have slow utilization kinetics will pass through the biologically active zone undegraded. Field data from the groundwater recharge project in Palo Alto, California, illustrated that naphthalene and heptaldehyde are biodegraded, while other compounds, such as chloroform and chlorobenzene, pass through the biologically active zone without biodegradation. (Sims-ISWS)

DE: Biodegradation-; Organic-compounds; Groundwater-; Artificial-recharge; Model-studies; Mathematical-models; On-site-investigations; Injection-wells; Sewage-effluents; Sewage-treatment; Observation-wells; Chemical-oxygen-demand; Pollutants-; Water-pollution; Path-of-pollutants; Trace-organics
CL: Sources-and-fate-of-pollution (3020); Groundwater (0840)
AN: 8005749

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TI: The Role of Groundwater Recharge in Wastewater Reuse: Israel’s Dan Region Project.
AU: Idelovitch,-E.; Terkeltoub,-R.; Michail,-M.
AF: Tahal Consulting Engineers Ltd. Tel-Aviv (Israel)
SO: American Water Works Association Journal Vol 72, No 7, p 391-400, July 1980. 13 Fig, 3 Tab, 10 Ref.
PY: 1980
AB: Groundwater recharge with tertiary effluent via spreading basins is practiced in the Dan region project for indirect reuse of municipal wastewater from the Tel Aviv metropolitan area. A comprehensive monitoring program accompanies the full-scale recharge operation. The chloride ion is a reliable tracer of the recharged effluent in the aquifer. The effluent quality is substantially improved by passage through both the unsaturated zone and the calcareous sandstone aquifer, particularly with respect to organic matter, phosphorus, chemical stability, sodium adsorption ratio, and several trace elements. In addition to effluent treatment, groundwater recharge provides seasonal and multiannual storage, offers economic as well as psychological benefits, and enhances the reliability of the reclamation system. (Visocky-ISWS).
DE: Groundwater-recharge; Water-reuse; Water-spreading; Pit-recharge; Israel-; Tertiary-treatment; Sewage-effluents; Aquifers-; Municipal-wastes; Reclamation-; Water-supply; Groundwater-resources; Observation-wells; Water-wells; Chlorides-; Water-storage; Microbial-degradation
CL: Groundwater-management (2040); Use-of-water-of-impaired-quality (1030)
AN: 8006380

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AU: Schultz,-T.R.; Randall,-J.H.; Wilson,-L.G.; Davis,-S.N.
AF: Arizona Univ. Tucson. Dept. of Hydrology and Water Resources
PY: 1976
AB: Dry washes or river beds are often used by southwestern communities to dispose of treated sewage effluent. Because many of these communities rely on ground water as a water supply, there is concern that this disposal practice may contaminate local aquifers. This has led to implementation of monitoring and tracing programs to quantify effluent and ground-water interactions and to development of efficient, easily used predictive models. The treated sewage effluent from the City of Tucson treatment plant has historically been used for irrigation and/or discharged to the normally dry Santa Curz River. Numerous sampling programs have been undertaken to quantify the chemical quality, temperature, and microbiological activity of the ground water in the area ner the Santa Cruz. Ground-water regions with high chloride and nitrate concentrations tend to be associated with areas irrigated with sewage effluent. Quality degradation due to channel recharge is not as evident because the effluent recharge is restricted by fine materials plugging the channel deposits. Recharging water tends to mound near the contact between the Recent and Fort Lowell formations spreading laterally more
rapidly than downward. A new tracer, trichlorofluoromethane (trade name Freon 11, Cl3CF) with applications similar to environmental tritium is being evaluated. Cl3CF enters the hydrologic cycle when it is partitioned between the gas and liquid phases during raindrop formation. Cl3CF in water samples is separated and quantitatively measured by a gas chromatograph with pulsed electron-capture detector.

DE: Sewage-effluents; Gas-chromatography; Tracers--; Water-pollution-sources; Pollutant-identification; Ground-water-contamination
CL: Identification-of-pollutants (3010); Groundwater-management (2040); Sources-and-fate-of-pollution (3020)

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TI: Long-Term Effects of Land Application of Domestic Wastewater: Hollister, California, Rapid Infiltration Site.
AU: Pound,-C.E.; Crites,-R.W.; Olson,-J.V.
AF: Metcalf and Eddy, Inc , Palo Alto, CA
PY: 1978
AB: The effects of more than 30 years application of primary treated municipal waste water to a rapid infiltration site were evaluated by analyzing groundwater and soil chemistry at the site. The current daily flow at the Hollister, California, infiltration basins is 43.8 L/s (1.0 M gal/day). The 20 infiltration basins are flooded for one to two days every 14 to 21 days, depending on the size of the basin and the season; annual waste water application equal 15.4 m, or 51 ft/basin. Water table response to the applications was monitored, infiltration rates were determined, and subsurface hydrology was logged. Samples from the one-year analysis program included: (1) primary effluent, (2) on-site and control site soil profiles, (3) groundwater at the site and upgradient and downgradient of groundwater movement from the site. Results of the primary effluent and groundwater analyses indicated that percolation through 22 ft of unsaturated gravelly, sandy loam effectively reduced COD, BOD, TIC, nitrogen, and fecal coliform bacteria. Although effective phosphorus removal required longer travel distances, the soil sorption capacity has not been exceeded. Soil retention of trace elements was low, and only lead exceeded EPA drinking water limits in the waste water and the shallow groundwater aquifer. Slight boron removal in the percolate was observed; iron and manganese are being leached from the soil with the percolating waste water. (Davison-IPA)

DE: Waste-water-disposal; Infiltration--; Percolation--; Trace-elements; Groundwater-recharge; Soil-chemistry; Flooding--; Effluents--; Municipal-wastes; Liquid-wastes; Water-table; Infiltration-galleries; Settling-basins; HollisterCalifornia-
CL: Ultimate-disposal-of-wastes (3050)
AN: 7907512

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TI: Wastewater Reuse by Biological-Chemical Treatment and Groundwater Recharge.
AU: Idelovitch,-E.
AF: Water Planning for Israel Ltd. Tel-Aviv. Dept. of Sewage Reclamation
SO: Journal of the Water Pollution Control Federation Vol. 50, No. 12, p 2723-2739, December 1978. 10 fig, 4 tab, 33 ref.
PY: 1978
AB: The approach of indirect nonpotable reuse of municipal wastewater, after biological-chemical treatment and groundwater recharge, was adopted in Israel for the Dan Region Project--Stage I. Its implementation involves conversion of the country 's southern water supply and nonpotable water, mainly for irrigation. Chemical treatment, consisting of the high lime-magnesium process followed by detention of the effluent in polishing ponds (primarily for ammonia stripping and recarbonation), efficiently removes phosphorus, ammonia and total nitrogen, organics, trace elements including boron and fluorides, and bacteria and viruses from oxidation pond effluent. The removal efficiency of the process is higher in summer than in winter.
Groundwater recharge provides for seasonal storage, additional purification of the effluent by a variety of processes taking place in the soil and in the aquifer, and dilution with high-quality natural groundwater. The reclaimed water fulfills the quality requirements of unrestricted crop irrigation and of a wide variety of industrial uses; it also satisfies most of the requirements of prevailing drinking water standards. (Sims-ISWS)

DE: Water-reuse; Groundwater-recharge; Waste-water-treatment; Israel-; Water-treatment; Groundwater-; Recharge-; Treatment-; Irrigation-; Projects-; Municipal-wastes; Sewage-; Water-quality; Potable-water; Wells-; Water-wells; Nonpotable-reuse

CL: Wastewater-treatment-processes (3040); Groundwater-management (2040)

AN: 7903305

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TI: Purification of Secondary Effluent in a Natural Sand Filter.
AU: Aulenbach,-D.B.; Harris,-R.R.; Reach,-R.C.
AF: Rensselaer Polytechnic Inst. Troy, NY. Dept. of Environmental Engineering
SO: Journal Water Pollution Control Federation Vol. 50, No. 1, p 86-94, January, 1978. 4 fig, 3 tab, 9 ref.
PY: 1978
AB: Depths at which secondary effluent contaminants are removed by a natural sand bed filter were determined with seepage samples from observation wells and lysimeters installed at the rapid infiltration sites used by the Lake George Village, New York, Sewage Treatment Plant. Secondary effluent from trickling filters was applied to 21 sand filtration beds covering a total area of 5.4 acres. Samples in the 20-meter sand filter were collected with lysimeters at depths of 3, 7, 11, and 18 meters. Analyses of the samples indicated that coliforms, BOD, COD, orthophosphate, ammonia nitrogen, and organic nitrogen were completely removed and nitrate-nitrogen levels were reduced to approximately 8 mg/liter. Chlorides and other soluble substances passed through the sand filter unchanged. Nitrate removal increased with depth of passage through the filter and almost complete nitrate removal was achieved by a depth of 18 meters. Orthophosphate was reduced to less than 0.1 mg/liter within the first 10 meters; total phosphate reductions decreased with depth. Phosphate levels decreased to less than 0.1 mg/liter during the spring. Copper concentrations were below 0.05 mg/liter for all samples analyzed. Levels of calcium, magnesium, alkalinity, iron, sodium, and potassium were also monitored. (Lisk-FIRL)

DE: Sand-aquifers; Nitrates-; Phosphorus-; Copper-; Coliforms-; Biochemical-oxygen-demand; Chemical-oxygen-demand; Chlorides-; Seepage-; Filtration-; Lysimeters-; New-York; Waste-water-treatment; Municipal-wastes; Tertiary-treatment

CL: Wastewater-treatment-processes (3040); Ultimate-disposal-of-wastes (3050)
AN: 7805902

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TI: Use of Tracers to Confirm Ground-Water Flow.
AU: Aulenbach,-D.B.; Bull,-J.H.; Middlesworth,-B.C.
AF: Rensselaer Polytechnic Inst. Troy, NY. Dept. of Chemical and Environmental Engineering
SO: Ground Water Vol 16, No 3, p 149-157, May-June 1978. 16 fig, 1 tab, 8 ref.
PY: 1978
AB: Both rhodamine WT and tritium were found to be satisfactory tracers to determine the direction and velocity of flow of the secondary treated effluent from the Lake George Village Sewage Treatment Plant, New York. The effluent is applied to natural delta sand beds by the rapid infiltration technique. The average vertical velocity in the unsaturated portion of the sand bed was approximately 0.85 m/day (2.8 ft/day). The horizontal flow in the saturated aquifer reached between 10 and 12 m/day (33-40 ft/day). The velocity appeared to decrease with distance from the sand infiltration beds, although this may have been the result of a change in direction of the major portion of the groundwater flow with the observation well not being in direct line of the direction of flow. Unfortunately, the dye could be traced only slightly less than half the distance from the sand infiltration beds to the seepage area adjacent to West Brook. Thus, a positive determination that the seepage consists primarily of sewage effluent, and the ultimate time of flow to the seepage could not be determined in this study. (Visocky-ISWS)

DE: Tracers-; Groundwater-flow; Path-of-pollutants; New-York; Sewage-effluents; Tritium-; Lake-

GeorgeNY; Rhodamine-; Dye-concentrations; Velocity-; Infiltration-; Sewage-treatment; Saturated-flow

CL: Sources-and-fate-of-pollution (3020); Groundwater (0840); Groundwater-management (2040)

AN: 7808296


AU: Horvath,-E.; Elkan,-G.H.

AF: North Carolina Agricultural Experiment Station Raleigh


PY: 1978

AB: Planning of deep well disposal systems must take into account the biological compatibility of the waste with the aquifer. Studies have shown that microorganisms can react with highly toxic wastes. A model aquifer system was designed for the following purposes; anaerobic, aseptic compositing of effluent samples; collection of gases generated in the model elements; isolation of model elements against down-stream contamination; and imposition of normally-distributed waste concentration profile in the feed stream. An experimental run was conducted to access the effects of injection of formaldehyde-free synthetic waste to the model inoculated with aquifer flora. The model was physically and chemically similar to the existing waste disposal aquifer. Microbial activity in the model became evident due to an increase in pH of the effluents resulting from the dissimilation of acidic waste constituents and certain organic ions. The populations of aerobic and facultative heterotrophs increased sharply at first but decreased in the latter stages as waste concentration increased. By the end of the run formate degradation had ceased entirely. Acetic acid, methanol, and aromatic acids were not significantly degraded. The population decrease and formate degradation decrease coincided with the point at which the pH dropped rapidly. (Purdin-NWWA)

DE: Injection-wells; Biodegradation-; Laboratory-tests; Aquifers-; Model-studies; Industrial-wastes; Deep-wells; Waste-disposal

CL: Ultimate-disposal-of-wastes (3050); Sources-and-fate-of-pollution (3020); Groundwater-management (2040)

AN: 7810082

Chemical Quality of Effluents and Their Influence on Water Quality in a Shallow Aquifer.

TI: Chemical Quality of Effluents and Their Influence on Water Quality in a Shallow Aquifer.

AU: Purtymun,-W.D.; Buchholz,-J.R.; Hakonson,-T.E.

AF: Los Alamos Scientific Lab. N. Mex

SO: Journal of Environmental Quality Vol. 6, No. 1, p 29-32, January-February 1977. 2 fig, 4 tab, 5 ref.

PY: 1977

AB: The chemical quality of liquid effluent released from an industrial waste treatment plant at the Los Alamos Scientific Laboratory controls the quality of water in a shallow aquifer in the alluvium of Mortandad Canyon. The dilution of the effluent with surface flow in the canyon reduces the concentrations of the chemicals as they move down gradient into the aquifer. Mass estimates of residual chemicals in solution in the aquifer average 1-6% of the total chemicals released to the canyon from 1963-1974. The average annual concentration of sodium, nitrate, chloride, and total dissolved solids in the aquifer through a 12-year period was directly correlated with annual average concentrations in the effluent. This relationship provides a means of predicting the impact of the chemical effluents on the quality of water in the aquifer. Chemical concentrations in solution in the aquifer have increased over prerelease levels; however, there has not been a steady accumulation of these materials in the water with time. The rapid loss of water and its associated chemicals from the aquifer prevents chemical accumulation and indicates that cessation of effluent release to the canyon would rapidly improve the quality of water in the aquifer. (Humphreys-ISWS)

DE: New-Mexico; Water-quality; Alluvial-aquifers; Waste-water-disposal; Effluents-; Water-pollution-sources; Chemicals-; Aquifers-; Data-collections; On-site-investigations; Evaluation-; Storm-runoff; HardnessWater-; Fluorides-; Calcium-; Carbonates-; Sodium-; Nitrates-; Chlorides-; Bicarbonates-; Magnesium-; Specific-conductivity; Hydrogen-ion-concentration

CL: Sources-and-fate-of-pollution (3020); Groundwater-management (2040); Ultimate-disposal-of-wastes
Changes in Inorganic Nitrogenous Compounds from Septic Tank Effluent in a Soil with a Fluctuating Water Table.

AU: Reneau-Jr., R.B.
AF: Virginia Polytechnic Inst. and State Univ. Blacksburg. Dept. of Agronomy
SO: Journal of Environmental Quality Vol. 6, No. 2, p 173-178, April-June, 1977. 6 fig, 4 tab, 26 ref.
PY: 1977

AB: The fate of septic tank effluent inorganic nitrogenous fractions in soil was investigated. A Virginia test site had been used for nearly 15 years. The soil was a Varina sandy loam that was very slowly permeable to water and air. This resulted in a fluctuating water table. The septic tank system discharged about 700 gpd of effluent. The compounds monitored were NO3(-), NO2(-), and NH4(+), above and in the plinthic material. Redox potentials, pH, dissolved oxygen, and temperature were determined for field sub-samples. Inorganic N was found in septic tank effluent largely in the form of NH4(+). These concentrations significantly decreased with distance from the drainfield. A reduction from 23 to 4.1 micrograms/milliliter was found 12 meters from the drainfield. Nitrate and nitrite concentrations, above the plinthic materials, remained at substantially the same levels for all distances. Decreased NH4(+) concentrations, as a function of distance from the drainfield, were due to the anaerobic decomposition of organic matter and to denitrification. At the 1.27-meter distance, NO2(-) accumulations probably indicated nitrification inhibition by high NH4(+) concentrations or heterotrophic conversion of NH4((+)) to NO2(-). Nitrification and denitrification above the plinthic layer at this distance were possibly enhanced by the fluctuating water table. Data indicated that anaerobic conditions were sufficient to cause denitrification to a distance of 6.1 meters. Redox potentials near +200 mV (adjusted to 25°C and pH7) were suggested in denitrification areas. Nitrite and NO3(-) in the plinthic horizon were not subjected to denitrification. Conditions for biological denitrification were not favored in this horizon. (Collins-FIRL)

DE: Nitrogen-compounds; Septic-tanks; Water-table; Nitrification; Denitrification; Soil-disposal-fields; Waste-water-disposal; Oxidation-reduction-potential; Water-table-aquifer; Perched-water; Chemical-properties; Chemical-reactions; Adsorption; Aerobic-conditions; Anaerobic-conditions; Soils; Monitoring.
Advantages and areas of concern for and disposal of effluents are discussed. When proper pre-treatment is given to sewage effluent, thus eliminating nitrates, toxic metals, detergents, and pathogenic bacteria, the resulting effluent may be used to irrigate the soil and crops. Purification then takes place, encompassing: nutrient uptake capacity of vegetative cover; biochemical reactions caused by microorganisms in the soil; inorganic chemical absorption to some extent by non-living soil constituents; and, mechanical filtering effects of passing through the soil. Advantages of this type of land disposal include: pollutants being kept from surface waters; sewage water providing crop and vegetation fertilizer; nutrients being recycled back into the soil and water being recharged back into the ground. In addition, the process is more economical than advanced waste treatment. However, the quality of groundwater is threatened when land disposal is not properly regulated or enforced. Examples occur if: septic tanks are not properly installed and permit aquifer contamination; sewage sludge disposed of in landfills is not monitored; drainage wells dispose of unwanted stormwater from farmlands, streets, and polluted lakes, as well as some sewage plants; open dump leachate seep into groundwater; canals and flood control channels cut into underlying aquifers and permit salty or polluted water to contaminate groundwater; or if sewage treatment plant effluents are disposed of in lagoons, percolation, or evaporation ponds, and then seep underground. (Prague-firl)

A water-conservation method currently under study by Nassau County, New York, involves reclamation of wastewater and its return to the groundwater reservoir. Since 1968, the Nassau County Department of Public Works has operated an advanced waste-treatment plant at Bay Park, N.Y., near the south shore of Nassau County. Reclaimed water from this plant has been used in a series of deep-well artificial-recharge experiments. About 600,000 gal/day of effluent from an activated-sludge sewage treatment plant was further purified by clarification, filtration, activated-carbon adsorption, and chlorination. Significant quality parameters of the reclaimed water and their usual concentrations were: chemical oxygen demand approx. 10 mg/litre; phosphorus approx. 0.1 mg/litre, methylene blue active substances 0.1 mg/litre, and turbidity 1 mg/litre. Reclaimed water was injected intermittently in a series of tests into the magothy aquifer through a well screened at a depth of 418 ft to 480 ft below land surface. The rate of excessive head buildup observed during the recharge of 41,700,000 gal averaged 3 ft per 1,000,000 gal. Operation and maintenance costs (1972) of further purifying the secondary-stage effluent to rechargeable quality, but without nitrogen removal, are estimated to be about $0.27 per 1,000 gal on a 3-mgd scale. (Knapp-usgs)
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TI: PILOT SCALE INVESTIGATIONS OF WELL RECHARGE USING CORED SAMPLES.
AU: SMITH,-H.F.; SCHICHT,-R.J.; HUMPHREYS,-H.W.
AF: ILLINOIS STATE WATER SURVEY, URBANA
PY: 1971
AB: laboratory studies were conducted in illinois to determine if artificial recharge of sandstone aquifers with sewage effluent is feasible. The apparatus used in this research consisted of four main components: (1) permeameter; (2) filters; (3) chlorinator; and (4) constant head tank. The ironton-galesville sandstone, since it is the most productive formation in the deep sandstone aquifer, was selected for investigation. The core samples are described by the illinois state geological survey as fine to medium grained sandstone, moderately well sorted, and friable. The median grain size is 0.30 mm, with the maximum grain size about 0.75 to 1.0 mm. After discharge of deionized water through the sandstone core has stabilized, filtered and chlorinated sewage effluent was recharged. A pretreated effluent of the type used could be successfully recharged through a sandstone well having similar characteristics to the cores used. The pretreatment would consist of removal of solids, a disinfectant, and control of ph. Sand filters are the most reliable type of filter with fewer problems of maintenance. (Knapp-usgs)
DE: *ARTIFICIAL-RECHARGE; *INJECTION-WELLS; *RECLAIMED-WATER; *WASTE-WATER-TREATMENT; *WATER-REUSE; *ILLINOIS-; SANDSTONES-; WATER-QUALITY; WATER-CHEMISTRY

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TI: INJECTION OF ACIDIC INDUSTRIAL WASTE INTO A SALINE CARBONATE AQUIFER: GEOCHEMICAL ASPECTS.
AU: KAUFMAN,-M.I.; GOOLSBY,-D.A.; FAULKNER,-G.L.
AF: GEOLOGICAL SURVEY, TALLAHASSEE, FLA
SO: IN: UNDERGROUND WASTE MANAGEMENT AND ARTIFICIAL RECHARGE, VOL 1, P 526-551, 1973. 10 FIG, 5 TAB, 13 REF.
PY: 1973
AB: a section of carbonate rocks that includes several highly permeable cavernous zones filled with saline water underlies the south part of peninsular florida at depths from about 1,500 to 4,500 ft. Because these cavernous zones are capable of yielding or accepting large quantities of fluids, they are used for storage of industrial and municipal liquid waste at several places. One such place is at the south end of lake okeechobee, near belle glade, florida, where the effluent from a sugar mill and liquid waste from the production of furfural processed from sugar cane bagasse have been injected at depths between about 1,500 and 2,200 ft. The waste ranges in temperature from 71 to 103 deg c and in ph from 2.6 to 4.5; it is highly organic (chemical oxygen demand, 6,000-26,000 mg/liter). Injection rates range from 400 to 800 gal/minute at pressures of 30-60 lb per sq in. Anaerobic degradation of the organic waste begins near the injection well as indicated by the presence of hydrogen sulfide, methane, carbon dioxide, and nitrogen. The waste has moved both upward and laterally in the aquifer system. When upward movement of waste was detected, injection was discontinued and the well was drilled and cased several hundred feet deeper. (See also w74-03222) (knapp-usgs)
DE: *WASTE-DISPOSAL-WELLS; *WATER-CHEMISTRY; *FLORIDA-; *INJECTION-WELLS; ACIDITY-; SUGARCANE-; UNDERGROUND-WASTE-DISPOSAL; OXYGEN-DEMAND; PATH-OF-
THE DISPOSAL OF WASTEWATER UNDERGROUND.
AU: WINAR, R.M.
SO: INDUSTRIAL WATER ENGINEERING, VOL 4, NO 3, P 21-24, MARCH 1967. 3 FIG, 4 REF.
PY: 1967
AB: in recent years there has emerged an increasing awareness of the suitability of underground storage for wastes. Deep well injection into suitable aquifers as a prime method of industrial waste disposal has emerged from the slow, steady technological growth of the 1950s and has expanded rapidly in the last 10 years as indicated by the doubling of waste disposal wells between 1963 and 1966. Although 86% of the current disposal wells serve the chemical and refining industries, the great variety of effluents (brines, caustics, acids, plating liquors, chromates, cyanides, cooling waters, and a full range of organic-inorganic compounds) compatible with this disposal process indicates that many diverse industries i.e. Metal fabricating, treating and plating, mining, paper and food processing will soon follow suit as the anti-pollution pressures of the public and government increase and the economics of this method become more and more favorable when compared to the costs of a surface treatment and disposal. (Smith-nwwa)
DE: *INJECTION-WELLS; *WASTE-DISPOSAL-WELLS; *UNDERGROUND-STORAGE; *RECHARGE--; *BIOCHEMICAL-OXYGEN-DEMAND; WELLS--; WASTE-WATER-DISPOSAL; WATER-STORAGE; RESERVOIRS--; PERMEABILITY--; HYDRAULICS--; SALT-CAVITIES; FRACTURE-ZONES; HYDRAULIC-PRESSURES; CHEMICAL-COMPOSITION

PRELIMINARY RESULTS OF INJECTING HIGHLY TREATED SEWAGE-PLANT EFFLUENT INTO A DEEP SAND AQUIFER AT BAY PARK, NEW YORK.
AU: VECCHIOLI, J.; KU, H.F.H.
AF: GEOLOGICAL SURVEY, WASHINGTON, D.C
SO: AVAILABLE FROM GPO, WASHINGTON, DC 20402 - PRICE $0.30 CENTS. GEOLOGICAL SURVEY PROFESSIONAL PAPER 751-A, 1972. 14 P, 6 FIG, 8 TAB, 16 REF.
PY: 1972
AB: highly treated sewage-plant effluent is injected into a sand aquifer at bay park, n.y., Through a fiberglass-cased well finished with a gravel-packed 16-inch diameter stainless-steel screen set between 418 and 480 feet below land surface. The well is open to the magothy aquifer. Maximum recharge rate is 360 gallons per minute. Head buildup in the injection well (but not the aquifer) in each injection test exceeded that predicted by pumping-test data even though the water injected had a physical and chemical quality acceptable for drinking water. In one test, the specific capacity of the injection well was reduced to half the preinjection value after 10 days of injection. Excessive head buildup is strongly dependent upon the turbidity of the recharge water, even though turbidity levels are generally less than 2 mg per liter as sio2. The fine-grained nature of the aquifer probably accounts for the well's high sensitivity to small amounts of suspended matter. Redevelopment by pumping after each injection test resulted in restoration of most of the specific capacity prevailing prior to each test. The first slug of water recovered during redevelopment is very turbid and the concentrations of iron, phosphate, and volatile solids are many times greater than those of the injected water. Bacterial content is also many times greater, and this together with other evidence suggests that some deterioration in well capacity may be a result of biologic clogging. (Knapp-usgs)
DE: *WASTE-DISPOSAL-WELLS; *NEW-YORK; *INJECTION-WELLS; WELL-SCREENS; UNDERGROUND-WASTE-DISPOSAL; WELL-FILTERS; TURBIDITY--; PARTICLE-SIZE; WATER-QUALITY; TERTIARY-TREATMENT; BACTERIA--; LONG-ISLANDNY; WELL-CLOGGING
MANAGEMENT OF ARTIFICIAL RECHARGE WELLS FOR GROUNDWATER QUALITY CONTROL.  
AU: WILSON, L.G.  
AF: ARIZONA UNIV., TUCSON. WATER RESOURCES RESEARCH CENTER  
PY: 1971  
AB: recharge wells may be used in various problems relating to chemical water quality because of the phenomenon of in-aquifer mixing. This paper reviews specific recharge well-mixing techniques of possible utility in underground mixing operations for nitrate control. Illustrative data from field studies at a recharge site near tucson, arizona are presented. Both single- and 2-well types of mixing were investigated. In single-well operations, effluent recharge and pumping of the subsequent mixture occur at the same well. Differences in chlorine ion levels were used to distinguish between recharge effluent and native groundwater. Undiluted effluent was discharged in single-well operations until a pumped volume ratio of about 0.4 was attained. Dilution increased steadily with increased pumping and the relative concentration versus pumped volume curve was s-shaped. Seven-day pauses after effluent recharge resulted in immediate pumping of almost completely diluted water, probably because groundwater movement swept the effluent beyond the pumping unit during the pause. With 2-well pumping, the chlorine breakthrough curve reached a constant level at about 13 days and was close to that of the pause-type, single-well regime. (See also w72-02212) (casey-arizona)  
de: *groundwater-recharge; *mixing; *waste-dilution; *nitrates; *DISCHARGEWATER; ARIZONA; ARID-LANDS; WATER-WELLS; CHLORIDES; PUMPED-STORAGE; CHEMICAL-WASTE; CHEMICAL-PROPERTIES; WATER-QUALITY-CONTROL; WATER-CHEMISTRY; MODES-OF-ACTION; *RECHARGE-WELLS; *CHEMICAL-MIXING  
CL: Water-quality-control (3070); Groundwater-management (2040); Control-of-water-on-the-surface (2010)  
AN: 7202228  

ECONOMICS OF ARTIFICIAL RECHARGE FOR MUNICIPAL WATER SUPPLY.  
AU: FRANKEL, RICHARD-J.  
AF: RESOURCES FOR THE FUTURE, INC., WASHINGTON, D.C  
SO: ARTIFICIAL RECHARGE AND MANAGEMENT OF AQUIFERS, SYMPOSIUM OF HAIFA (MARCH 19-26, 1967), INTERNATIONAL ASSOCIATION OF SCIENTIFIC HYDROLOGY, PUBLICATION NO 72, P 289-301, 1967. 13 P, 1 FIG, 5 TAB, 44 REF.  
PY: 1967  
AB: a research project was undertaken to determine whether or not waste reclamation could be economically competitive with other water sources for municipal water supply. Numerous advanced waste treatment systems and recycle schemes were evaluated. Waste-water renovation through groundwater recharge proved to be the most feasible solution to reclamation of the effluent of any type treatment plant today. Further study has evaluated the chemical and physical limitations of artificial recharge using municipal wastes; the economic trade-offs between additional treatment prior to recharge and greater land utilization; and the break-even point for land values as a function of economics of scale. Finally the economics of a particular case-study in the arid west of the united states is discussed as well as proposed scheme for converting the nation'S capital, washington, d.c., In the humid east from using solely surface water supplies to using artificial recharge of undeveloped aquifers for future expansion of water supplies. (Knapp-usgs)  
de: *WATER-REUSE; *ARTIFICIAL-RECHARGE; *TERTIARY-TREATMENT; *RECLAIMED-WATER; *ECONOMIC-FEASIBILITY; COST-BENEFIT-ANALYSIS; WATER-DEMAND; WATER-
REQUIREMENTS; ARID-LANDS; HUMID-LANDS; WASHINGTON D.C.
CL: Groundwater-management (2040); Evaluation-process (4020); Wastewater-treatment-processes (3040)
AN: 7004614

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TI: INJECTION OF RECLAIMED WASTEWATER INTO CONFINED AQUIFERS.
AU: WESNER, G.M.; BAIER, D.C.
AF: TOUPS ENGINEERING, INC., SANTA ANA, CALIF.; AND ORANGE COUNTY WATER DISTRICT, SANTA ANA, CALIF
SO: JOURNAL AMERICAN WATER WORKS ASSOCIATION, VOL 62, NO 3, P 203-210, MARCH 1970. 8 P, 6 FIG, 7 TAB, 19 REF.
PY: 1970

AB: the orange county water district, california has conducted research in wastewater reclamation and subsurface injection since july, 1965. The first phase of the work was intended to determine the feasibility of treating and injecting secondary effluent. The second phase has the following objectives: (1) determine the hydraulic characteristics of the proposed injection barrier system of multi-point injection wells; (2) determine the long-term fate of reclaimed wastewater in the injection system; (3) determine the feasibility of utilizing wastewater for a barrier; and (4) determine the chemical composition of blended reclaimed water and deep groundwater. The multiple casing injection wells have performed very satisfactorily. The treated trickling filter effluent is injectable and would not cause excessive well clogging. Coliform bacteria have appeared sporadically 100 ft from the injection well, and have not been found at 245 ft. Many chemical constituents do not move conservatively in the injected water. Hardness and alkalinity increase; ammonia and other oxygen-demanding materials are significantly reduced by travel in the confined aquifer. The odor and taste which persist in the injected reclaimed water is probably the most serious deterrent to utilizing this source for injection in a barrier system. (Knapp-usgs)

DE: *RECLAIMED-WATER; *INJECTION-WELLS; *ARTIFICIAL-RECHARGE; *SALINE-WATER-INTRUSION; *CALIFORNIA-; WATER-REUSE; ODOR-; TASTE-; WATER-QUALITY; WATER-POLLUTION-CONTROL; MONITORING-; ON-SITE-TESTS; AQUIFERS-; GROUNDWATER-MOVEMENT; SALINE-WATER-BARRIER-WELLS; ORANGE-COUNTYCALIF
CL: Wastewater-treatment-processes (3040); Groundwater-management (2040)
AN: 7005880

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TI: RECLAIMED WASTEWATER FOR SANTEE RECREATIONAL LAKES.
AU: MERRELL, JOHN-C.; KATKO, ALBERG
AF: PUBLIC HEALTH SERVICE, SAN DIEGO, CALIF. SANTEE RECREATION PROJECT
SO: JOURNAL OF THE WATER POLLUTION CONTROL FEDERATION, VOL 38, NO 8, P 1310-1318, 1966. 2 FIG, 7 TAB, 3 REF.
PY: 1966

AB: the santee project in san diego county, california, has evolved into a reasonably well-balanced ecological system utilizing wastewater of the community as the productive source of a central aquatic environment that is socially accepted as recreational lakes. Following conventional activated sludge sewage treatment and a 30-day nominal storage in an oxidation pond, the effluent is pumped to a natural shallow aquifer in the valley above the lakes and later recovered as rising groundwater flow for use in three adjacent recreational lakes. Sand filtration increased removals of organics and nutrients to the 98-99% range. A nutrient balance, a comparison of chemical constituents, bacterial concentrations, and virus findings between the secondary effluent and the lakes is presented. The ecological development of these lakes is summarized; diverse algal population, occasional algal blooms, and fish kills are described. Different facets of the biological life, including phytoplankton, zooplankton, aquatic insects, benthic organisms and fisheries are presented. (Haskins-wisconsin)

DE: *RECREATION-; *RECREATION-FACILITIES; *WATER-QUALITY; SAFETY-; BOATING-; FISHING-; WATER-UTILIZATION; OXIDATION-LAGOONS; ACTIVATED-SLUDGE; COLIFORMS-; WASTE-WATER-TREATMENT; WATER-REUSE; *Fecal-COLIFORMS; *FECAL-STREPTOCCOCIC-BLOOMS; SANTEE-RECREATIONAL-LAKESCALIF; CALIFORNIA-; WATER-RECLAMATION
CL: Wastewater-treatment-processes (3040)
AB: municipal effluent has always been used for groundwater recharge. Practically all of the recharge in the past has been unintentional, resulting from the natural operation of the hydrologic cycle, and it does not appear that this pattern will be appreciably changed in the future. It does appear, however, that the deliberate use of treated effluent for groundwater recharge will increase in the future, particularly in arid and semi-arid areas of the country that are rapidly depleting their groundwater resources. Although the technological capability for treating municipal effluent for any type of reuse including the recharge of potable groundwater supplies has existed for many years, many psychological problems remain to be solved to win public acceptance for its widespread use. Physical problems include clogging of soils of aquifers, chemical precipitation, and algal or bacterial growth. The legal problems include liability for damages to aquifers, ownership of recharged water, and ownership of effluent water. (Knapp-usgs)

de: *water-reuse; *reclaimed-water; *municipal-wastes; *artificial-recharge; legal-aspects; aesthetics-; aquifers-; soil-water-movement; groundwater-movement; infiltration-; water-chemistry; water-quality; soil-contamination; waste-water-recharge

CL: Wastewater-treatment-processes (3040); Water-treatment-and-distribution (3060)

AB: over 680 wells are sampled and analyzed for conductivity, ph, ca(++) , Mg(++) , Na(+), Cl(-), so4(=), co3(=), f(-), no3(-), k(+), Sr(++) . And the trace elements, fe, mn, cu, zn, cr(+6), ni, pb, co, and cd. A new method was developed for the simultaneous chelate extraction and atomic absorption analysis of the last nine elements in water and sewage samples. The surface and subsurface movement of the nine trace elements were studied on grassed plots with effluent from a domestic sewage effluent treatment facility. Analysis of recharged water was the same as above plus c.O.D. And b.O.D. Determinations. A conceptual process-response model of the tucson basin was developed to relate ground water chemical composition to the soil, subsoil and geologic formations of the recharge and ground water flow pattern of the basin. A calcite-water chemical equilibrium model was used to determine the precipitation or dissolution of calcite in the basin aquifers.

de: *ground-water; *trace-elements; chelate-extraction; atomic-absorption-analyses; carbonate-; bicarbonate-; fluoride-; nitrate-; sulfate-; silicate-; ground-water-recharge; hydrochemical-facies; sewage-effluent; c.O.D.-; B.O.D.-; Waste-waters; hydraulic-loading; infiltration-; tucson-basin; process-response-model; instrumentation-; hydrochemical-data

cl: groundwater (0840); identification-of-pollutants (3010)

AN: 6903197
TI: REPLENISHING THE AQUIFER WITH TREATED SEWAGE EFFLUENT.
SO: GROUND WATER AGE, VOL 2, NO 8, PP 30-35, APR 1968. 6 P, 8 ILLUS.
PY: 1968

AB: treated sewage from a recently completed tertiary-treatment plant is being used experimentally at bay park, n.Y., To recharge aquifers artificially. The purpose is to see if a barrier can be created to retard the intrusion of salt water into the heavily pumped aquifers. After treatment the effluent which meets potable-water standards is stored in a 50,000 gal storage tank where the ph and eh of the water is adjusted chemically. Then it moves through a vacuum degasifier to remove air and other gases before it is pumped into the injection well. The well is a 36-in. Hole, 508 ft deep, with a 15-ft thick cement plug at the bottom. It contains 62 ft of 16-in. Stainless steel screen attached to 420 ft of 18-in. Fiberglass casing. In the annular space the well has 2 3-in. Tremie pipes for adding filter-pack material, a 4-in. Water injection pipe entering the casing 192 ft below the surface, and a 5-in. Observation well. At a pumping rate of 1,000 gpm, the specific capacity of the well is 35 gpm/ft. Injection tests are at 400 gpm (576,000 gpd). If the project is feasible, similar wells will be constructed along 15 mi of ocean front and ultimately 27 mgd of treated sewage will be injected.

De: *artificial-recharge; *injection-wells; *groundwater-; *sewage-effluents; *recharge-wells; *saline-water-intrusion; new-york; tertiary-treatment; filters-; specific-capacity; well-screens; well-casings; stainless-steel; potable-water; air-entrainment; gases-; water-reuse; barriers-; water-managementapplied; water-quality-control; degasifyers-; eh-of-water; ph-of-water; fiberglass-casings; salt-water-barrier; air-clogging; water-level-monitoring

CL: Water-treatment-and-distribution (3060)
AN: 6800029

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IMPACTS ON A SAND AQUIFER FROM AN OLD SEPTIC SYSTEM - NITRATE AND PHOSPHATE

HARMAN J(Reprint), ROBERTSON WD, CHERRY JA and ZANINI L
UNIV WATERLOO, WATERLOO CTR GROUNDWATER RES; WATERLOO; ON N2L 3G1; CANADA

(Reprint)
GROUND WATER
ISSN 0017-467X

Abstract. Four hundred ground-water sampling points were used to delineate a plume in an unconfined sand aquifer at a 44 year old septic system servicing a school in Ontario, Canada. A bromide tracer test indicated a residence time of one to two weeks for sewage effluent in the 1.6 meter unsaturated zone beneath the tile bed. This is sufficient time for the oxidation of all nitrogen to nitrate to be complete and for the content of dissolved organic carbon to decrease from about 19 mg/l in the septic tank to about 1 mg/l at the water table. The 15 m wide plume core emanates more than 110 meters downgradient of the tile bed, has detectable dissolved oxygen, high nitrate (20-120 mg/l as N), chloride (42-209 mg/l), sodium (34-101 mg/l), calcium (120-249 mg/l), and above background sulphate, and potassium. Ground-water flow velocity at this site is rapid (100 m/yr); thus the mapped extent of the plume (110 m) represents about one year effluent loading. Phosphate (PO43-) concentrations at the water table (similar to 1-2 mg/l as P) appear to have reached steady state at values significantly lower than that of the effluent (9 mg/l as P). Steady-state concentrations suggest that mineral precipitation reactions control attenuation in the unsaturated zone. A comparison of phosphate sorbed (74 mg/kg) and total P in the soil (1000 mg/kg) suggests that precipitation is a more important process in the unsaturated zone than is sorption. PO43- levels in the plume,
However, remain elevated (0.3-1.8 mg/l as P) relative to background levels in ground water (0.01 mg/l as P) up to 75 meters away from the tile bed. This migration distance of PO$_4$- in ground water is greater than that observed at other younger septic system sites. The extent of the plume at this site suggests that long-term PO$_4$- migration in the ground-water zone may be controlled by adsorption processes that allow slow but progressive advancement of PO$_4$-.

SEPTIC TANK-SOAKPIT SYSTEMS IN DAR ES SALAAM, TANZANIA

GONDWE E(Reprint), MWANUZI FL and MBWETTE TSA
UNIV DAR ES SALAAM, DEPT CIVIL ENGN; DAR ES SALAAM; TANZANIA
JOURNAL OF ENVIRONMENTAL ENGINEERING-ASCE
1997, vol. 123 (1) JAN pp. 93 - 95
ISSN 0733-9372

Abstract. This paper discusses the impact of septic tank-soakpit systems widely used on the shallow un-confined aquifer at Sinza ward in the city of Dar es Salaam, Tanzania. Sinza is a hot climate, high-density area with household plots of limited area. From investigations on the shallow aquifer at Sinza, the ground water was observed to have the same quality as the septic-tank effluent, thus indicating that the ground water was heavily contaminated by the septic effluent. This suggests that the septic tank-soakpit systems failed to sufficiently treat the domestic wastewater effluent.

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MICROBIAL GROWTH AND TRANSPORT IN POROUS MEDIA UNDER DENITRIFICATION

CLEMENT TP, PEYTON BM(Reprint), SKEEN RS, JENNINGS DA and PETERSEN JN
BATTELLE MEM INST, PACIFIC NW LABS, POB 999; RICHLAND; WA; 99337; USA
(Breprint)
BATTELLE MEM INST, PACIFIC NW LABS; RICHLAND; WA; 99337; USA
WASHINGTON STATE UNIV, DEPT CHEM ENGN; PULLMAN; WA; 99164; USA
JOURNAL OF CONTAMINANT HYDROLOGY
1997, vol. 24 (3-4) JAN pp. 269 - 285
ISSN 0169-7722

Abstract. Soil column experiments were conducted to study bacterial growth and transport in porous media under denitrifying conditions. The study used a denitrifying microbial consortium isolated from aquifer sediments sampled at the U.S. Department of Energy's Hanford site. One-dimensional, packed-column transport studies were conducted under
two substrate loading conditions. A detailed numerical model was
developed to predict the measured effluent cell and substrate
concentration profiles. First-order attachment and detachment models
described the interphase exchange processes between suspended and
attached biomass. Insignificantly different detachment coefficient
values of 0.32 and 0.43 day\(^{-1}\), respectively, were estimated for the
high and low nitrate loading conditions (48 and 5 mg l\(^{-1}\) NO\(_3\),
respectively). Comparison of these values with those calculated from
published data for aerobically growing organisms shows that the
denitrifying consortium had lower detachment rate coefficients. This
suggests that, similar to detachment rates in reactor-grown biofilms,
detachment in porous media may increase with microbial growth rate.
However, available literature data are not sufficient to confirm a
specific analytical model for predicting this growth dependence.

Keywords. Author-assigned Keywords: BIOFILM; POROUS MEDIA; BACTERIA TRANSPORT;
DENITRIFICATION; DETACHMENT; MODEL; IN SITU BIOREMEDIATION
ISI-assigned Keywords Plus: PHYSICAL-PROPERTIES; BIOFILM DETACHMENT;
SHEAR-STRESS; MODEL; SUBSTRATE; AQUIFER; KINETICS; NUTRIENT; SOLUTES;
SOILS

Language: English  Article Type: ARTICLE
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recovery wells which permit separating the recharge zone from the rest of the aquifer.

The major purification processes occurring in the soil aquifer system are: slow-sand filtration, chemical precipitation, adsorption, ion exchange, biological degradation, nitrification, denitrification and disinfection. Water quality control in the recharge zone is virtually complete and the very high quality of reclaimed water obtained after SAT is suitable for a variety of non potable uses especially for unrestricted agricultural irrigation. During the last five years, about 400 million cu.m of reclaimed water was supplied for unrestricted irrigation to the south of the country. Copyright (C) 1996 IAWQ. Published by Elsevier Science Ltd.

Keywords: Author-assigned Keywords: GROUNDWATER RECHARGE; IRRIGATION WATER QUALITY; SOIL AQUIFER TREATMENT; WASTEWATER RECLAMATION; WASTEWATER REUSE

ISI-assigned Keywords Plus: SOIL-AQUIFER TREATMENT; REUSE

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No. of Refs: 6 [Loaded into SIM on 5-Mar-1997]

* Record extracted from the Current Contents Search database of the Institute of Scientific Information Inc. (ISI), Philadelphia, Pennsylvania USA [(c)1994]

Abstract. A matrix of three different levels of effluent pre-treatment and four different soil types was used in a study on the effects of soil type and effluent pre-treatment on Soil Aquifer Treatment (SAT). The objective of the study was to assess the feasibility of SAT for the recharge of groundwater and indirect potable reuse. The soils represented a wide range of hydrological and physicochemical characteristics from a proposed recharge site in Phoenix, Arizona, USA. Effluents studied included denitrified and conventional secondary effluents. These effluents contain different levels of biological oxygen demand (BOD5), organic carbon, ammonia, and nitrate. Ten 2.6 m columns were operated under different wetting/drying cycles. For the effluents studied, results indicate that effluent pre-treatment does not impact organic carbon removal efficiencies. Under optimal wetting/drying cycle times, BOD5 can be removed efficiently although a residual organic carbon concentration of 5-6 mg/l persists. Ammonia is effectively nitrified under most conditions but denitrification does not readily occur even when
denitrified effluent is applied. Soil Aquifer Treatment appears to be a robust treatment system for denitrified effluent producing total nitrogen concentrations less than 8 mg/l and organic carbon concentrations less than 6 mg/l. Copyright (C) 1996 IAWQ. Published by Elsevier Science Ltd.

Keywords. Author-assigned Keywords: AMMONIA; NITRATE; ORGANIC CARBON; SOIL AQUIFER TREATMENT; WETTING/DRYING CYCLES

ISI-assigned Keywords Plus: PROJECT

Language: English    Article Type: ARTICLE

Current Contents Edition & Subject Category: AGRI vol. 28 (10)    ENVIRONMENT/ECOLOGY

No. of Refs: 6

[Loaded into SIM on 5-Mar-1997]

* Record extracted from the Current Contents Search database of the Institute of Scientific Information Inc. (ISI), Philadelphia, Pennsylvania USA [(c)1994]

Abstract. In this paper we develop a model to estimate nitrogen loading to watersheds and receiving waters, and then apply the model to gain insight about sources, losses, and transport of nitrogen in groundwater moving through a coastal watershed. The model is developed from data of the Waquoit Bay Land Margin Ecosystems Research project (WBLMER), and from syntheses of published information. The WBLMER nitrogen loading model first estimates inputs by atmospheric deposition, fertilizer use, and wastewater to surfaces of the major types of land use (natural vegetation, turf, agricultural land, residential areas, and impervious surfaces) within the landscape. Then, the model estimates losses of nitrogen in the various compartments of the watershed ecosystem. For atmospheric and fertilizer nitrogen, the model allows losses in vegetation and soils,
in the vadose zone, and in tile aquifer. For wastewater nitrogen, the model allows losses in septic systems and effluent plumes, and it adds further losses that occur during diffuse transport within aquifers. The calculation of losses is done separately for each major type of land cover, because the processes and loss rates involved differ for different tesserae of the land cover mosaic. If groundwater flows into a freshwater body, the model adds a loss of nitrogen for traversing the freshwater body and then subjects the surviving nitrogen to losses in the aquifer. The WBLMER model is developed for Waquoit Bay, but with inputs for local conditions it is applicable to other rural to suburban watersheds underlain by unconsolidated sandy sediments.

Model calculations suggest that the atmosphere contributes 56%, fertilizer 14%, and wastewater 27% of the nitrogen delivered to the surface of the watershed of Waquoit Bay. Losses within the watershed amount to 89% of atmospheric nitrogen, 79% of fertilizer nitrogen, and 65% of wastewater nitrogen. The net result of inputs to the watershed surface and losses within the watershed is that wastewater becomes the largest source (48%) of nitrogen loads to receiving estuaries, followed by atmospheric deposition (30%) and fertilizer use (15%).

The nitrogen load to estuaries of Waquoit Bay is transported primarily through land parcels covered by residential areas (39%, mainly via wastewater), natural vegetation (21%, by atmospheric deposition), and turf (16%, by atmospheric deposition and fertilizers). Other land covers were involved in lesser throughputs of nitrogen.

The model results have implications for management of coastal landscapes and water quality. Most attention should be given to wastewater disposal within the watershed, particularly within 200 m of the shore. Rules regarding setbacks of septic system location relative to shore and nitrogen retention ability of septic systems, will be useful in control of wastewater nitrogen loading.

Installation of multiple conventional leaching fields or septic systems in high-flow parcels could be one way to increase nitrogen retention. Control of fertilizer use can help to a modest degree, particularly for optional uses such as lawns situated near shore. Conservation of parcels of accreting natural vegetation should be given high priority, because these environments effectively intercept atmospheric deposition. Areas upgradient from freshwater bodies should be given low priority in plans to control nitrogen loading, because ponds intercept much of the nitrogen transported from upgradient.

Keywords: Author-assigned Keywords: ATMOSPHERIC DEPOSITION; LAND MARGIN ECOSYSTEMS RESEARCH (LMER); NITROGEN LOADING; NITROGEN LOSSES; WAQUOIT BAY; WASTEWATER; WATERSHEDS

ISI-assigned Keywords Plus: SEPTIC-TANK EFFLUENT; ATMOSPHERIC DEPOSITION; WAQUOIT BAY; LAND-USE; NUTRIENT LIMITATION; CANOPY INTERACTIONS; MARINE ECOSYSTEMS; DISPOSAL SYSTEM; CENTRAL ONTARIO; DRY DEPOSITION

Language: English Article Type: REVIEW

Current Contents Edition & Subject Category:
AGRI vol. 28 (21) ENVIRONMENT/ECOLOGY

No. of Refs: 151 [Loaded into SIM on 21-May-1997]
DEVELOPMENT OF A CONTINUOUSLY STIRRED FLOW CELL FOR INVESTIGATING SORPTION MASS TRANSFER

Heyse E(Reprint), DAI DP, RAO PSC and DELFINO JJ

USAF, INST TECHNOL, DEPT ENGN ENVIRONM MANAGEMENT, 2950 P ST, BLDG 640; WRIGHT PATTERSON AFB; OH; 45433; USA (Reprint)

UNIV FLORIDA, DEPT ENVIRONM ENGN SCI; GAINESVILLE; FL; 32611; USA

UNIV FLORIDA, DEPT SOIL WATER SCI; GAINESVILLE; FL; 32611; USA

JOURNAL OF CONTAMINANT HYDROLOGY


ISSN 0169-7722

Abstract. This paper introduces a new reversible-flow design for a continuously stirred reactor used to study sorption mass transfer in soil and solvent systems. The stirred reactor has potential advantages over conventional packed column or batch reactors because it isolates intraparticle sorption rate limitations from advective-dispersive transport, yet allows changes to flux through the reactor for analysis of sorption kinetics under dynamic conditions. Previously, stirred reactors have often failed due to clogging of sediment on the effluent frit. The reverse-flow backwashing design allows longer life and higher confidence in maintaining mixed conditions than previous designs. Mass transfer rate coefficients estimated from stirred and column experiments are compared; both techniques produced results consistent with a published correlation. The data also show that fitted sorption mass transfer coefficients can be strongly dependent on the choice of equilibrium partition coefficient (i.e. batch or first-moment derived values), and that the conventional two-site sorption kinetics model fails to accurately predict sorption mass transfer in the presence of changing solvent velocity through the reactor. (C) 1997 Elsevier Science B.V.

Keywords. Author-assigned Keywords: SORPTION; KINETICS; SOILS; ORGANIC CARBON; POLYCYCLIC AROMATIC HYDROCARBONS; PARTITIONING; EXPERIMENTAL STUDIES; PARTITION COEFFICIENTS; MODELS

ISI-assigned Keywords Plus: HYDROPHOBIC ORGANIC-CHEMICALS; NONEQUILIBRIUM SORPTION; SOLUTE TRANSPORT; AQUIFER MATERIALS; POROUS-MEDIA; SOIL COLUMNS; COSOLVENTS; DIFFUSION; KINETICS; MODELS

Language: English Article Type: ARTICLE

Current Contents Edition & Subject Category: AGRI vol. 28 (25) ENVIRONMENT/ECOLOGY

No. of Refs: 38 [Loaded into SIM on 18-Jun-1997]

* Record extracted from the Current Contents Search database of the Institute of Scientific Information Inc. (ISI), Philadelphia, Pennsylvania USA [(c)1994]
Abstract. The research site at Otis Air Base, Cape Cod, Massachusetts, has been developed for hydrogeological and geochemical studies of sewage-effluent contaminated groundwater since 1982. Research of hydrologic properties, transport, and chemical and biological processes is ongoing, but the origin of background water chemistry has not been determined.

The principal geochemical process giving rise to the observed background water chemistry is CO2-controlled hydrolysis of Na feldspar. Geochemical modeling demonstrated that CO2 sources could vary over the project area. Analyses of unsaturated zone gases showed variations in CO2 which were dependent on land use and vegetative cover in the area of groundwater recharge. Measurements of CO2 in unsaturated-zone gases showed that concentrations of total inorganic C in recharge water should range from about 0.035 to 1.0 mmoles/L in the vicinity of Otis Air Base. Flux of CO2 from the unsaturated zone varied for 4 principal land uses, ranging from 86 gC/m²/yr for low vegetated areas to 1630 gC/m²/yr for a golf course. Carbon dioxide flux from woodlands was 220 gC/m²/yr, lower than reported fluxes of 500 to 600 gC/m²/yr for woodlands in a similar climate. Carbon dioxide flux from grassy areas was 540 gC/m²/yr, higher than reported fluxes of 230 to 490 gC/m²/yr for grasslands in a similar climate. (C) 1997 Elsevier Science Ltd.

Keywords. ISI-assigned Keywords Plus: GAS-TRANSPORT; CLIMATE; CO2
Language: English Article Type: ARTICLE
Current Contents Edition & Subject Category: PHYS vol. 37 (35) EARTH SCIENCES
No. of Refs: 44 [Loaded into SIM on 27-Aug-1997]
* Record extracted from the Current Contents Search database of the Institute of Scientific Information Inc. (ISI), Philadelphia, Pennsylvania USA [(c)1994]
Abstract. Because of global population and water developments and the need for integrated water resources management with sustainable solutions, interest in artificial recharge with normal water and sewage effluent continues to increase. Issues discussed in this paper include global water aspects, recharge with infiltration basins, environmentally friendly infiltration systems, soil-aquifer treatment of sewage effluent, potable use of water from aquifers recharged with sewage effluent, sustainability, nitrogen removal, pretreatment of sewage effluent, disinfection, disinfection byproducts, well recharge, vadose zone wells, seepage trenches, and constructed aquifers used as intermittent sand filters.

Keywords. ISI-assigned Keywords Plus: RAPID INFILTRATION; WASTEWATER; PROJECT

Language: English    Article Type: ARTICLE

Current Contents Edition & Subject Category:
TECH vol. 28 (38)     ENGINEERING MANAGEMENT/GENERAL
No. of Refs: 28 [Loaded into SIM on 17-Sep-1997]
* Record extracted from the Current Contents Search database of the Institute of Scientific Information Inc. (ISI), Philadelphia, Pennsylvania USA [(c)1994]
Abstract. Disinfection byproduct (DBP) formation was studied in nonnitrified and nitrified secondary effluents from several treatment plants and renovated water following soil aquifer treatment. The wastewater was chlorinated using different concentrations of chlorine. The study included formation of trihalomethanes (THM), haloacetic acids (HAA), and total dissolved organic halogens (DOX). In ammonia-containing effluents (nonnitrified), where stable chloramine is formed, applying a chlorine dose of 0.34 (weight ratio of Cl/C) produced an average ratio of DOX to dissolved organic carbon (DOC) of 8.5 \mu g Cl/mg C, and insignificant concentrations of THM and HAA. In nitrified-effluents forming free chlorine residual, a Cl/C dose of 0.34 (weight ratio) yielded an average DOX/DOC of 49 \mu g Cl/mg C. The THM formation varied widely with the effluent source and HAA/DOC formation was 2 to 3 \mu g Cl/mg C. The DOX formation potential (DOXFP) per mg carbon averaged 28 \mu g Cl/mg C for ammonia-containing effluents and 147 \mu g Cl/mg C for completely nitrified effluents.

The THM formation potential (THMFP) constituted 13 to 56\% and HAAFP constituted 10 to 17\% of the DOXFP, respectively. The results indicated that high concentrations of DBP are formed during chlorination of effluents, posing a contamination problem. Reduction of DBP formation can be achieved by applying treatment processes producing low-DOC effluents and leaving a small concentration of residual ammonia.

Keywords. Author-assigned Keywords: DISINFECTION BYPRODUCTS; DISSOLVED ORGANIC HALOGENS; TRIHALOMETHANES; HALOACETIC ACIDS; CHLORAMINATION; CHLORINATION

ISI-assigned Keywords Plus: TOTAL ORGANIC HALOGEN; WASTE-WATER; REMOVAL; PRECURSORS; TOX
Abstract. Groundwater dating studies have supported the concept that aquifers with low coefficients of dispersion may contain coherent records of past conditions in recharge areas. Groundwater records can provide unique information about natural or anthropogenic changes in the atmosphere and hydrosphere where long-term monitoring data are not available. Here we describe a 40-year record of halocarbon contamination in the Danube River that was retrieved from a shallow aquifer in northwest Hungary. The time scale is based on H-3 and He isotope dating of groundwaters that were recharged by the Danube River and moved horizontally away from the river in a surficial gravel aquifer with minor dispersion at a maximum rate of at least 500 m/yr. Analyses of dated groundwaters along a flow path indicate that the river loads of selected compounds (including CFC-12, CFC-113, and trichloroethane) were negligible before about 1950, rose rapidly to peak values in the 1960s and 1970s, and then decreased by varying degrees to the present. Peak concentrations are tentatively attributed to point sources in upstream urban-industrial centers; while recent decreases presumably resulted from declining manufacturing rates and(or) improvements in control of urban-industrial runoff and sewage effluent entering the river in upstream areas.

Keywords. ISI-assigned Keywords Plus: ATLANTIC COASTAL-PLAIN; CHLOROFLUOROCARBONS CCL3F; SHALLOW GROUNDWATER; HYDROLOGIC TRACERS; DATING TOOLS; CCL2F2; AGE; RELEASE; FLUOROCARBONS; CFC-11

Language: English Article Type: ARTICLE

Current Contents Edition & Subject Category:
AGRI vol. 28 (48) ENVIRONMENT/ECOLOGY
TECH vol. 28 (48) ENVIRONMENTAL ENGINEERING/ENERGY

No. of Refs: 47 [Loaded into SIM on 26-Nov-1997]

* Record extracted from the Current Contents Search database of the Institute of Scientific Information Inc. (ISI), Philadelphia, Pennsylvania USA [(c)1994]
TITLE: PT 2. EXPERIENCE AND PRACTICE AROUND THE WORLD CH 11. WATER REUSE IN ISRAEL.
AUTHOR: SHELEF, G.
INST. AUTHOR: TECHNION-ISRAEL INST TECHNOL HAIFA.
SOURCE: WATER RENOVATION AND REUSE EDITED BY H.I. SHUVAL; ACADEMIC PRESS.; NEW YORK., pp. 311-332, 22 p., 1977
MAJOR TOPIC:
  water re-use; wastewater; hydrological cycle
KEY TERMS:
  seasonal effects; process diagrams; effluent quality; cost estimates;
an aerobic processes; sewage ponds; wastewater treatment; water supply;
water resources; economic assessment; water reuse; water renovation;
agricultural use; recycling; groundwater recharge; polishing ponds;
dan region project; pollutants removal efficiency; israel; industrial use
LANGUAGE: English
PUB. TYPE: Book
LIB. LOCATION: CSIR (PRETORIA) ID1276662; 628.3:628.179WAT.
RECORD ID: 84081170
DATABASE: WATERLIT

Record (Full) 4 of 5 Total

TITLE: INVESTIGATION OF THE REACTIVITY AND FATE OF CERTAIN ORGANIC COMPONENTS OF AN INDUSTRIAL WASTE AFTER DEEP-WELL INJECTION.
AUTHOR: LEENHEER, J.A.; MALCOLM, R.L.; WHITE, W.R.
INST. AUTHOR: USA GEOL SURV.
MAJOR TOPIC:
  pollution; wastewater; wastewater
KEY TERMS:
  experimental results; water analysis; groundwater pollution; subsurface environment; plugging; observation wells; iron; industrial wastes;
organic wastes; underground waste disposal; injection wells; anaerobic conditions; chemical precipitation; iron compounds; waste analysis;
terephthalic acid; unconsolidated aquifer; compatibility; wastes management; sulphur
LANGUAGE: English
PUB. TYPE: Journal article
LIB. LOCATION: CSIR (PRETORIA).
RECORD ID: 76003121
DATABASE: WATERLIT

Record (Full) 5 of 5 Total
TITLE: Upward migration of deep-well waste injection fluids in Floridan aquifer, South Florida.

AUTHOR: KAUFMAN, M.I.; McKENZIE, D.J.


MAJOR TOPIC:
hydrology, limnology, potamology, oceanography, meteorology-groundwater flow, porous media flow; drainage and sewerage work projects - subsoil discharge of wastes and waste water; experimental research of flow through porous media; groundwater flow - dispersion of flow through porous media - general; 58 - u.s.a., central and southern states - smaller parts of a region; cities, villages, etc.; groundwater works - ground-water pollution - general

KEY TERMS:
depth wells; injection wells; waste disposal; migration pattern; soil moisture movement

GEO. AREA:
usa, fl, lake okeechobee

ABSTRACT:
Geochemical data from an industrial deep-well waste injection system southeast of Lake Okeechobee indicate a decrease in sulfate concentration concomitant with an increase in hydrogen sulfide concentration, a result of oxidation of injected organic waste by anaerobic bacteria. Subtle decreases in the sulfate-chloride ratio suggest that the waste migrated upward to a shallow monitor well about 27 mo after waste injection began and again within 15 mo of the resumption of waste injection after the injection well was deepened. The possibility of a hydraulic connection between the injection zone and overlying monitoring zone is implied.

LANGUAGE: English

LIB. CALL/CODE: WL 91 C; TH 0718

RECORD ID: 7803159

DATABASE: DELFT HYDRO

Record (Full) 3 of 25 Total, 9 Marked

TITLE: Water quality changes during soil aquifer treatment of tertiary effluent.

AUTHOR: Wilson, L.G.; Amy, G.L.; Gerba, C.P.; Gordon, H.; Johnson, B.; Miller, J.

SOURCE: WATER ENVIRON. RES.; vol. 67, no. 3, pp. 371-376; 1995

ISSN: 1061-4303

KEY TERMS:
USA, Arizona, Tucson; field tests; leaching; water quality; pathogens; nitrogen compounds; water spreading; aquifers; soil treatment; water sampling; dissolved solids; tertiary wastewater treatment; effluents; wastewater treatment; tertiary treatment

ABSTRACT:
This paper summarizes the results of field studies in Tucson, Arizona, to
estimate the soil aquifer treatment (SAT) effectiveness of a 5.7-ha (14-acre) water spreading facility, the Sweetwater Underground Storage and Recovery Facility. Groundwater samples collected from the facility during 1989 to 1990 were analyzed for pathogens. A specific basin was selected during the 1990 to 1991, 1991 to 1992, and 1992 to 1993 recharge seasons for sampling source water (tertiary effluent), pore-liquid samples from the vadose zone, and groundwater during recharge. These samples were analyzed for the nitrogen species, dissolved organic carbon (DOC), and total organic halide (TOX). The results showed that the site provides effective SAT. Enteroviruses were completely removed during travel in the 37-m (120-ft) thick vadose zone. No Giardia were detected in any of the groundwater samples. The DOC and TOX were reduced by 92% and 85%, respectively. After leaching of indigenous nitrogen from the vadose zone, total nitrogen was reduced by approximately 47% during recharge. Near-surface anaerobic conditions promote denitrification.

MAJOR TOPIC: Wastewater treatment processes [3040]
PUB. TYPE: Journal Article
LANGUAGE: English
RECORD ID: WR-3871187
DATABASE: WATER RESOURCES ABSTRACTS

Record (Full) 4 of 25 Total

TITLE: UK Experience in the Groundwater Recharge of Partially Treated Sewage: Potential for Irrigation Purposes
AUTHOR: Montgomery, H.A.C.
SOURCE: Treatment and Use of Sewage Effluent for Irrigation, Butterworths; London. 1988. p 129-135, 1 fig, 16 ref.
KEY TERMS: *wales; *wastewater treatment; *groundwater recharge; *groundwater irrigation; *water reuse; *reclaimed water; *wastewater irrigation; *wastewater disposal; *wastewater renovation; *england; water quality; nutrients; heavy metals; aquifer characteristics; nitrogen removal; phosphorus removal
ABSTRACT:
Effects of groundwater recharge were studied at nine sites in England at chalk, Triassic sandstone and alluvial gravel sites. The results showed that artificial recharge is a remarkably effective method of removing organic matter, ammonia, bacteria and viruses. Whether nitrogen removal should be encouraged or not at recharge sites depends on (a) how much of the nitrogen content of the sewage is required as a crop nutrient during irrigation; and (b) whether the water is also to be used for potable supply. Phosphate is removed by recharge into calcareous rocks. Iron and manganese are deficient in sewage effluent and might have to be supplemented in some soils. Toxic heavy metals tend to be associated with the suspended solids of sewage and would not be recharged (unless solubilized by anaerobic action). Calcium, magnesium, sodium, chloride and sulfate all tend to be conserved during artificial recharge and could restrict the use of recharged effluent for irrigation in arid climates. The method of applying the effluent to the recharge area needs to be selected based on the effluent type, climate, and soil conditions. Any site being considered for the recharge of sewage effluent should be
investigated geologically. (See also W89-06801) (White-Reimer-PTT)
MAJOR TOPIC: Wastewater treatment processes [3040]; Groundwater
management [2040]
RECORD ID: 8906810
DATABASE: SELECTED WATER RESOURCES ABSTRACTS

Record (Full) 5 of 25 Total

TITLE: Modeling Microbial Fouling in Porous Media
AUTHOR: Cunningham, A.B.; Characklis, W.G.; Escher, A.; Crawford, D.
AUTH. ADDRESS: Montana State Univ. Bozeman. Inst. for Biological and
Chemical Process Analysis.
SOURCE: Proceedings of the NWWA Conference on Solving Ground Water
Problems with Models. National Water Well Association,
Dublin; OH. 1987. p 1289-1314, 13 fig, 22 ref. U.S.
Geological Survey Grant 14-08-0001-01284, Office of Naval
Research Grant N000014-84-K-0309, Grant CTB-8420785.
KEY TERMS: *water treatment; *wastewater treatment; *porous media; *fouling;
*model studies; hydraulic resistance; mathematical models;
accumulation; bioaccumulation; biological wastewater treatment; growth;
biofilms; groundwater movement; microorganisms
ABSTRACT:
An overview of biofilm formation and effects in porous media is presented. A
biofilm consists of microbial cells and their products which attach to
an inanimate surface submerged in an aquatic environment. Thickness varies
from a monolayer to 300-400 mm thick as in an algal mat. Aerobic and
anaerobic environments exist within the biofilm. As many as five phases
can be defined in a biofilm system: substratum, base film, surface film,
liquid, gas. Interaction between phases occurs via transport processes
such as liquid transport, molecular diffusion, volumetric displacement,
cell motility, and macroorganism grazing. Biofilms extract contaminants
from water in various porous media environments. This absorption takes
place in groundwater systems and in porous and granular media used in
water treatment and wastewater treatment. Biofilms significantly influence
hydraulic resistance in porous media such as aquifers, and they can retard
recharge from a stream bottom as a result of their accumulation on a
stream bottom. The long-range goal of research in biofilm processes is the
identification of relevant parameters and quantification of their
influence on the rate and extent of microbial cell adsorption, desorption,
and growth in surfaces in porous media. Biofilm accumulation takes place
in three arbitrarily determined periods: induction, logarithmic
accumulation, and steady state. A new class of models offers the
possibility of investigating fouling/corrosion prevention and control at a
new and more detailed level of mechanisms. (See also W88-10912)
(Cassar-PTT)
MAJOR TOPIC: Groundwater [0840]; Water treatment and distribution
[3060]; Wastewater treatment processes [3040]
RECORD ID: 8810976
DATABASE: SELECTED WATER RESOURCES ABSTRACTS
TITLE: Simulation of Nitrate Degradation in Groundwater (Simulation des Nitratabbaus im Grundwasser)
AUTHOR: Schwan, M.; Kramer, D.; Gericke, C.
AUTH. ADDRESS: Institut fuer Binnenfischerei Berlin (German D.R.).
KEY TERMS: *groundwater pollution; *nitrates; *degradation; *simulation; groundwater recharge; wastewater disposal; diffusion; convection; kinetics; differential equations; model studies
ABSTRACT:
Ten reaction vessels containing 1 cu m were used as the experimental arrangement. They were filled with coarse sand or fine gravel and installed 60 cm below the floor. The pore volume (water saturation) was 227-260 l. Anaerobic conditions were established by the addition of 6 g glucose at storage. The reactors were given tap water with 50 and 200 mg/l NO-3 from KNO3 in such a way that a volumetric rate of flow of 0.2, 0.4 and 0.8 l/d was created. The volumetric rates of flow corresponded to the natural recharge of groundwater, the recharge of groundwater under the conditions of irrigation and the conditions of an intensive wastewater ground treatment. In the effluent from the reaction vessels the nitrate concentration was determined every month. It was stationary from the 7th to the 55th month after the beginning of the experiment. The experiments are evaluated by means of a model which takes into account the diffusion, convection and kinetics of the nitrate degradation according to Michaelis-Menten. A simple method for solving homogeneous non-linear differential equations of the second order is proposed. The experimental and model results show a good agreement and prove the very slow nitrate degradation in the groundwater with kM = 210 mg/l, v max = 1.5 mg/l.d or k1 = 0.005/d. (Author's abstract)
MAJOR TOPIC: Sources and fate of pollution [3020]
RECORD ID: 8600408
DATABASE: SELECTED WATER RESOURCES ABSTRACTS

TITLE: Direct Injection of Reclaimed Water into an Aquifer
AUTHOR: Roberts, P.V.; McCarty, P.L.; Roman, W.M.
AUTH. ADDRESS: Stanford Univ. CA. Dept. of Civil Engineering.
SOURCE: Journal of the Environmental Division, Proceedings of the American Society of Civil Engineers; Vol. 104, No. EE5, p 933-949, October, 1978. 8 fig, 6 tab, 1 append, 6 ref.
KEY TERMS: *water reuse; *reclaimed water; *injection; *attenuation; ground water recharge; waste water disposal; saline water intrusion; subsidence; aquifers; artificial recharge; ion exchange; water quality; water analysis; potable water; water demand; water law
ABSTRACT:
Renovating and recycling wastewater are alternate means of meeting future water demands. The Environmental and Water Studies program at Stanford University has embarked on a 3-year study concerning the changes in water quality and aquifer characteristics resulting from the injection of reclaimed water. The ultimate goal is to ascertain whether direct injection of reclaimed water is a feasible and reliable strategy for producing potable water. An advanced wastewater treatment and injection-extraction system built by the Santa Clara Valley Water District (SCVWD) not only provides reclaimed water for landscape irrigation but also inhibits saline water intrusion and subsidence. An injection pilot study at the SDVWD facility found that during passage of reclaimed water through an aquifer most contaminants were removed by various mechanisms. These include: adsorption, ion exchange, precipitation and dissolution, chemical oxidation, biological nitrification and denitrification, aerobic or anaerobic degradation of organic substrates, mechanical dispersion, and filtration. The dominant removal mechanism is believed to be ion exchange on clays. This pilot study will provide important information regarding the retention capacity of an aquifer for attenuating the movement of a wide spectrum of inorganic, organic, and microbiota pollutants. These data will be used in monitoring a full-scale well field operation.

(Purdin-NWWA)

MAJOR TOPIC: Wastewater treatment processes [3040]; Groundwater management [2040]; Ultimate disposal of wastes [3050]

RECORD ID: 7901108

DATABASE: SELECTED WATER RESOURCES ABSTRACTS

Record (Full) 8 of 25 Total

TITLE: Australia Makes Impressive Progress in Pollution Abatement

KEY TERMS:
  *pollution abatement; *treatment facilities; *water pollution control;
  *planning; industrial wastes; municipal wastes; tertiary treatment; waste water treatment; water reuse; australia

ABSTRACT:
Australian pollution control programs have recently become priority concerns. The federal ministry responsible for pollution control has passed more authority to the six Australian States. Low population numbers and coastal development have promoted the nation's swift progress in this area. The Sydney Metropolitan Water, Sewerage and Drainage Board has spent $A200 million annually. Waste treatment expenditures have been a considerable part of this total. Australians have made strides in treating industrial effluents from meat processing, sugar cane milling, food processing, and landfill leachates. The treatment facilities recycle process water for cooling, with make-up water from storm water run-off. Investigations are being made of the possibility of reusing municipal effluents through recharge of groundwater. Municipal treatment facilities are practicing irrigation with processed industrial effluents. Industries regularly recirculate process waters. Sewage farming has become popular with Melbourne treatment plants using aerobic and anaerobic lagoons. Incineration is used in Perth which operates activated sludge plants and
primary treatment processes. In Sydney, activated sludge plants, large primary treatment plants, and biological filtration are used. An advanced treatment plant is being constructed in Canberra. It will employ chemical precipitation, dewatering by centrifugation and incineration, effluent denitrification, filtration, chlorination, and dechlorination. Problems with mining industries are serious future concerns. (Collins-FIRL)

MAJOR TOPIC: Water quality control [3070]; Wastewater treatment processes [3040]

RECORD ID: 7706149
DATABASE: SELECTED WATER RESOURCES ABSTRACTS

Record (Full) 9 of 25 Total

TITLE: WATER-QUALITY ASPECTS OF GROUND-WATER RECHARGE IN ISRAEL
AUTHOR: GOLDSHMID, J.
AUTH. ADDRESS: MINISTRY OF AGRICULTURE Tel-AVIV (ISRAEL). WATER POLLUTION CONTROL UNIV.
SOURCE: JOURNAL OF THE AMERICAN WATER WORKS ASSOCIATION; VOL 66, NO 3, P 163-166, MARCH 1974. 1 FIG, 3 TAB, 7 REF.

KEY TERMS:
*artifical recharge; *water quality; *water treatment; *injection wells; *waste water treatment; water pollution sources; coliforms; algae; biodegradation; organic matter; chlorination; potable water

ABSTRACT:

MAJOR TOPIC: Wastewater treatment processes [3040]; Groundwater management [2040]; Water treatment and distribution [3060]

RECORD ID: 7406363
DATABASE: SELECTED WATER RESOURCES ABSTRACTS
TITLE: MICROBIOLOGICAL ASPECTS OF GROUND-WATER RECHARGE-INJECTION OF PURIFIED CHLORINATED SEWAGE EFFLUENT

AUTHOR: EHRLICH, G.G.; EHLKE, T.A.; VECCHIOLI, J.

SOURCE: PROF. PAPER 800-B AVAILABLE FROM GPO, WASHINGTON; D C 20402
-- PRICE $2.25. IN: GEOLOGICAL SURVEY RESEARCH 1972, CHAPTER B; U S GEOLOGICAL SURVEY PROFESSIONAL PAPER 800-B, P B241-B245, 1972. 2 FIG, 3 TAB, 16 REF.

KEY TERMS:
*artificial recharge; *reclaimed water; *water reuse; *waste water disposal; *injection wells; new york; water quality; path of pollutants; bacteria; coliforms; filtration; aquifer characteristics; sewage treatment; hydrogeology

ABSTRACT:
CHLORINATED, PURIFIED SEWAGE WAS INJECTED THROUGH A WELL AT BAY PARK, N.Y., AT RATES OF 350 GPM (GALLONS PER MINUTE) AND 200 GPM FOR 33 DAYS. OBSERVED INJECTION-HEEL HEAD BUILDUP WAS CORRELATED WITH THE CONTENT OF MOSTLY INORGANIC PARTICULATE MATTER IN THE INJECTANT. BACTERIAL SLIMES WERE NOT PRESENT IN REPUMPED WATER OR IN A SAND PROBE PLACED NEAR THE INJECTION ZONE DURING THE TEST. SEVERAL SPECIES OF AEROBIC AND FACULTATIVE ANAEROBIC BACTERIA WERE FOUND IN REPUMPED WATER SAMPLES. MICROBIAL GROWTH OCCURS IN THE AQUIFER AFTER CHLORINE HAS BEEN INACTIVATED BY THE AQUIFER MATERIALS. (KNAPP-USGS)

MAJOR TOPIC: Sources and fate of pollution [3020]; Wastewater treatment processes [3040]; Groundwater management [2040]

DATABASE: SELECTED WATER RESOURCES ABSTRACTS

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TITLE: ISRAEL TURNS TO SEWAGE FOR WATER

SOURCE: ENGINEERING NEWS RECORD; VOL 183, NO 19, P 42-43, NOV 6, 1969. 2 P, 1 FIG, 3 PHOTO.

KEY TERMS:
*water reuse; *tertiary treatment; *artificial recharge; water spreading; aerobic treatment; anaerobic treatment; arid lands; desalination; reclaimed water; groundwater movement; aquifers; pumping

ABSTRACT:
WITH 90% OF ITS WATER POTENTIAL NOW BEING USED AND FACED WITH THE PROSPECT OF A 20% TO 30% INCREASE IN DEMAND FOR THE NEXT DECADE, ISRAEL IS TURNING TO RAW SEWAGE AS A SOURCE OF SUPPLY. UNDER CONSTRUCTION IS A WASTE WATER RECLAMATION PROJECT EXPECTED TO HIKE THE NATION'S SUPPLY BY 12%. THE EFFLUENT, TO BE RECLAIMED BY TREATMENT IN SOPHISTICATED LAGOONS, WILL NOT BE PUT INTO USE DIRECTLY BUT WILL BE INFILTRATED INTO THE GROUND AND LATER RECOVERED BY WELLS. THE SPREADING BASINS WILL BE LOCATED IN SAND DUNES THAT CONNECT DIRECTLY WITH THE UNDERLYING SAND-AND-SANDSTONE AQUIFER THAT IS ONE OF ISRAEL'S PRINCIPAL STORES OF GROUNDWATER. THE TREATMENT PHASES OF THE VARIOUS LAGOONS INCLUDE ANAEROBIC LAGOONS, FACULTATIVE LAGOONS, AEROBIC
LAGOONS AND A POLISHING LAGOON. THE SPREADING LAGOONS WILL BE OPERATED IN
ROTATION TO ALLOW FOR DRYING PERIODS BETWEEN SUCCESSIVE FILLINGS TO PREVENT
CLOGGING. THE INFILTRATED WATER WILL TAKE ONE YEAR OR MORE TO REACH THE
PERIPHERY OF THE RECHARGE AREA, WHERE AN ENCOMPASSING STRING OF BOREHOLE
WELLS WILL RECAPTURE THE WATER AS A POTABLE SUPPLY. SALINITY WILL BE ABOUT 300
PPM. MOST OF THE RECLAIMED WATER WILL BE USED FOR IRRIGATION. (KNAPP-USGS)
MAJOR TOPIC: Wastewater treatment processes [3040]
RECORD ID: 7003270
DATABASE: SELECTED WATER RESOURCES ABSTRACTS

Record (Full) 16 of 1,019 Total, 8 Marked

TITLE: Identification of wastewater dissolved organic carbon
characteristics in reclaimed wastewater and recharged
groundwater.
AUTHOR: Fujita, Y.; Ding, Wang-Hsien; Reinhard, M.*
AUTH. ADDRESS: Dep. Civ. Eng., Stanford, CA 94305-4020, USA
SOURCE: WATER ENVIRON. RES.; vol. 68, no. 5, pp. 867-876; 1996
ISSN: 1061-4303
KEY TERMS: organic carbon; reclaimed water; indicators; wastewater; groundwater
recharge; fulvic acids; humic acids; water resources management;
dissolved organic carbon
ABSTRACT:
Nonvolatile dissolved organic carbon (DOC) in reclaimed wastewaters and
groundwater was characterized and indicators of wastewater origin were
identified. Over 50% of the DOC in activated carbon and reverse osmosis
effluents was classified as hydrophilic, and no humic acid was isolated.
In groundwater partially recharged by the reclaimed wastewaters, only 16%
of the DOC was hydrophilic, 50% of the DOC was fulvic acid, and humic acid
was recovered. The H:C ratios of the isolated fulvic acids were higher in
the wastewaters and recharged groundwater than in a deep well water not
affected by recharge. N:C ratios in the wastewater and recharged
groundwater fulvic and humic acid fractions were also higher than in the
deep well water. The super(1)H NMR spectra of the effluent and recharged
groundwater fulvic acid fractions exhibited a characteristic fingerprint
pattern, indicating a correlation between origin and spectral appearance.
Gas chromatography-mass spectrometry analysis confirmed the presence of
specific trace organic compounds, including EDTA and alkylphenol
polyethoxylate residues, in the wastewaters and recharged groundwater.
MAJOR TOPIC: Use of water of impaired quality [1030]; Ultimate disposal
of wastes [3050]; Groundwater management [2040]
PUB. TYPE: Journal Article
LANGUAGE: English
RECORD ID: WR-4023726
DATABASE: WATER RESOURCES ABSTRACTS

Record (Full) 17 of 1,019 Total

TITLE: Chemical modifications of groundwater contaminated by
recharge of treated sewage effluent.

AUTHOR: Vengosh, A.; Keren, R.

AUTH. ADDRESS: Hydrological Serv., P.O. Box 6381, Jerusalem 91063, Israel

SOURCE: J. CONTAM. HYDROL.; vol. 23, no. 4, pp. 347-360; 1996

ISSN: 0169-7722

KEY TERMS: groundwater pollution; wastewater disposal; groundwater recharge; plumes; cation exchange; decomposing organic matter; Israel; sewage; sewage disposal; saline intrusion; waste disposal sites; water resources; water supply; water resources

ABSTRACT:
Long-term monitoring of the chemical composition of recharge sewage effluent and associated contaminated groundwater from the Dan Region Sewage Reclamation Project shows, after 16 years of recharge operation, the presence of a distinct saline plume (up to 400 mg/l Cl), extending 1600 m downgradient in the Coastal Plain aquifer of Israel. The recorded electrolyte composition of groundwater in the vicinity of the recharge area reflects the variations in the compositions of the sewage effluents, as well as water-rock interactions induced by the recharge of treated sewage effluents. The original sewage composition was modified, particularly during early stages of effluent migration in the unsaturated zone, by cation-exchange and adsorption reactions. Since the soil sorption capacity is finite these reactions caused only limited modifications, and once the system reached a steady state the inorganic composition of the contaminated groundwater became similar to that of the recharge water. Decomposition of organic matter in the unsaturated zone resulted in CO\(_2\) generation and dissolution of CaCO\(_3\) minerals in the aquifer. It was shown that chemical and/or bio-degradation of organic matter takes place mainly in the unsaturated (vadose) zone. Hence, monitoring the efficiency of the vadose zone to retain contaminants is essential for evaluating the quality of groundwater since it was shown that organic compounds behave almost conservatively once the effluents enter and flow within the saturated zone.

MAJOR TOPIC: Groundwater management [2040]; Sources and fate of pollution [3020]; Ultimate disposal of wastes [3050]; Use of water of impaired quality [1030]

PUB. TYPE: Journal Article

LANGUAGE: English

RECORD ID: WR-3999069

DATABASE: WATER RESOURCES ABSTRACTS

Record (Full) 18 of 1,019 Total


AUTHOR: W. J. Andrews

AUTH. ADDRESS: USGS, Earth Science Information Center, Open-File Reports Section, Box 25286, MS 517, Denver, CO 80225


KEY TERMS:
*ground-water quality; *wastewater injection; *lower floridan aquifer;
ABSTRACT:
Industrial wastewater from two synthetic-fiber manufacturing plants has been injected into the Lower Floridan aquifer near Pensacola, Florida, since 1963, and near Milton, Florida, since 1975. Trend analysis of selected water-quality characteristics in water from four monitoring wells at each of these plants indicates that injected wastewater has affected ground-water quality in the Lower Floridan aquifer, which contains nonpotable water, up to 1.5 miles from the injection wells at the plant near Pensacola and at least 0.3 mile from the injection wells at the plant near Milton. No evidence for upward seepage of injected wastewater through the overlying Bucatunna Clay to the Upper Floridan aquifer was found at either of the plants.

RECORD ID: USGS000014
DATABASE: USGS REPORTS

Record (Full) 19 of 1,019 Total

TITLE: Water quality changes during soil aquifer treatment of tertiary effluent.
AUTHOR: Wilson, L.G.; Amy, G.L.; Gerba, C.P.; Gordon, H.; Johnson, B.; Miller, J.
SOURCE: WATER ENVIRON. RES.; vol. 67, no. 3, pp. 371-376; 1995
ISSN: 1061-4303

KEY TERMS:
USA, Arizona, Tucson; field tests; leaching; water quality; pathogens; nitrogen compounds; water spreading; aquifers; soil treatment; water sampling; dissolved solids; tertiary wastewater treatment; effluents; wastewater treatment; tertiary treatment

ABSTRACT:
This paper summarizes the results of field studies in Tucson, Arizona, to estimate the soil aquifer treatment (SAT) effectiveness of a 5.7-ha (14-acre) water spreading facility, the Sweetwater Underground Storage and Recovery Facility. Groundwater samples collected from the facility during 1989 to 1990 were analyzed for pathogens. A specific basin was selected during the 1990 to 1991, 1991 to 1992, and 1992 to 1993 recharge seasons for sampling source water (tertiary effluent), pore-liquid samples from the vadose zone, and groundwater during recharge. These samples were analyzed for the nitrogen species, dissolved organic carbon (DOC), and total organic halide (TOX). The results showed that the site provides effective SAT. Enteroviruses were completely removed during travel in the 37-m (120-ft) thick vadose zone. No Giardia were detected in any of the groundwater samples. The DOC and TOX were reduced by 92% and 85%, respectively. After leaching of indigenous nitrogen from the vadose zone, total nitrogen was reduced by approximately 47% during recharge. Near-surface anaerobic conditions promote denitrification.

MAJOR TOPIC: Wastewater treatment processes [3040]
PUB. TYPE: Journal Article
LANGUAGE: English
RECORD ID: WR-3871187
DATABASE: WATER RESOURCES ABSTRACTS
TITLE: Drinking recycled wastewater: Can groundwater recharge safely address the drinking-water needs of rapidly growing urban areas?

AUTHOR: Pinholster, G.

SOURCE: ENVIRON. SCI. TECHNOL.; vol. 29, no. 4, pp. 174A-179A; 1995

ISSN: 0013-936X

KEY TERMS:
- drinking water
- wastewater treatment
- water reuse
- artificial recharge
- water supply
- urbanization
- groundwater recharge
- infiltration
- wastewater renovation
- wastewater irrigation
- feasibility studies

ABSTRACT:
As the 21st century approaches, communities around the world, faced with population growth and increased urbanization, scramble to find new sources of drinking water. "Most cities have already fully exploited the readily available water resources," EPA warns. Consequently, communities throughout the United States are studying the safety, economics, and feasibility of directing treated sewer water into the ground to replenish dwindling aquifers—even those tapped for drinking water. The practice, known as artificial groundwater recharge, typically involves injecting treated city wastewater directly into aquifers or spreading it onto the ground to infiltrate the surface. It is unclear exactly how many regions practice groundwater recharge, but James Crook, director of water reuse at Black & Veatch (Cambridge, MA), estimates that "hundreds" of U.S. cities are recycling wastewater for nonpotable purposes from crop irrigation in arid western states to landscaping at Florida's Walt Disney World. A half-dozen cities, including El Paso, TX, and Los Angeles are recharging potable aquifers; a dozen more communities are considering similar projects, says Crook.

MAJOR TOPIC: Use of water of impaired quality [1030]; Water demand [4040]

PUB. TYPE: Journal Article

LANGUAGE: English

RECORD ID: WR-3787987

DATABASE: WATER RESOURCES ABSTRACTS

TITLE: Boron isotope application for tracing sources of contamination in groundwater.

AUTHOR: Vengosh, A.; Heumann, K.G.; Juraske, S.; Kasher, R.

AUTH. ADDRESS: Res. Dep., Hydrol. Serv., P.O. Box 6381, Jerusalem 91063, Israel

SOURCE: ENVIRON. SCI. TECHNOL.; vol. 28, no. 11, pp. 1968-1974; 1994

ISSN: 0013-936X

KEY TERMS:
- water pollution sources
- fate of pollutants
- groundwater pollution
- isotopic tracers
- boron
- wastewater disposal
- adsorption
- Israel
groundwater contamination; wastewater; tracers; boron isotopes; environmental protection; waste disposal

ABSTRACT:
Boron isotope composition and concentration of sewage effluent and pristine and contaminated groundwater from the Coastal Plain aquifer of Israel have been determined. The application of boron compounds, especially sodium perborate as a bleaching agent in detergents, leads to an enrichment of boron in wastewaters. Anthropogenic boron in wastewater is isotopically distinct from natural boron in groundwater and thus can be utilized to identify the source of contamination. It is shown that delta super(11)B (where delta super(11)B = [(super(11)B/super(10)B) sample/(super(11)B/super(10)B) sub(NBS 951)-1] x 1000) values of raw and treated sewage effluents from the Dan Region Sewage Reclamation Project (delta super(11)B = 5.3-12.9ppt) overlap those of natural nonmarine sodium borate minerals (-0.9ppt to +10.2ppt) but differ significantly from those of regional uncontaminated groundwater (similar to 30ppt) and seawater (39ppt). Groundwater contaminated by recharge of treated sewage yields a high B/Cl ratio with a distinctive anthropogenic isotopic signature (7-25ppt). Elemental B and delta super(11)B variations reflect both mixing with regional groundwater and boron isotopic fractionation associated with boron removal by adsorption onto clay minerals. The distinctive isotopic signature of anthropogenic boron can be recognized, however, in most samples and differs significantly from those of natural sources of contamination in the Coastal Plain aquifer of Israel, such as marine-derived saline groundwater (35-60ppt). This enables utilization of the boron isotope composition of groundwater as a tracer for identification and quantification of contaminants in groundwater.

MAJOR TOPIC: Sources and fate of pollution [3020]

TITLE: Artificial Recharge of Groundwater with Reclaimed Municipal Wastewater: Current Status and Proposed Criteria

AUTHOR: Asano, T.

AUTH. ADDRESS: California Univ. Davis. Dept. of Civil Engineering.

SOURCE: Water Science and Technology WSTED4; Vol. 25, No. 12, p 87-92, 1992. 4 tab, 7 ref.

KEY TERMS:
*aquifers; *artificial recharge; *groundwater recharge; *municipal wastewater; *reclaimed water; *wastewater treatment; *water reuse; california; environmental impact; groundwater movement; path of pollutants; water quality standards

ABSTRACT:
The increasing demand for water in semi-arid regions and in many industrialized countries has created the realization that the vast underground reservoirs formed by aquifers constitute invaluable water supply sources as well as water storage facilities. There are over 200 wastewater reclamation plants in California for distribution to over 850...
use areas, using about 300 million cu m/yr of reclaimed water. Several
constraints limit expanding use of reclaimed municipal wastewater in
groundwater recharge. Draft criteria for artificial recharge of
groundwater with reclaimed municipal wastewater were developed by the
State of California Interagency Water Reclamation Coordinating Committee,
followed by the Groundwater Recharge Committee of the Department of Health
Services. The criteria rely on a combination of controls intended to
maintain a microbiologically and chemically safe groundwater recharge
operation. Source control, wastewater treatment processes, treatment
standards, recharge methods, recharge area, extraction well proximity, and
monitoring wells are all specified, as no single method of control would
be effective in controlling the transmission and transport of contaminants
of concern into and through the environment. These regulations will be
formalized through the agency review process along with the public hearing
process and incorporated into revised Wastewater Reclamation Criteria.
(See also W93-05228) (Brunone-PTT)
MAJOR TOPIC: Ultimate disposal of wastes [3050};   Wastewater treatment
processes [3040];   Groundwater management [2040]
RECORD ID: 9305237
DATABASE: SELECTED WATER RESOURCES ABSTRACTS

Record (Full) 23 of 1,019 Total

TITLE: Effect of Wastewater Injection on Ground Water Quality
AUTHOR: Legeas, M.; Carre, J.; Merot, P.
AUTH. ADDRESS: Ecole Nationale de la Sante Publique Rennes (France).
Dept. of Environment et Sante.
SOURCE: Water Science and Technology WSTED4; Vol. 25, No. 12, p
283-286, 1992. 1 fig, 1 tab, 2 ref.
KEY TERMS:
*dilution; *effluents; *groundwater; *groundwater movement; *path of
pollutants; *wastewater disposal; aquifers; coasts; flow rates;
marine environment; nitrogen; oxidation; saline-freshwater interfaces;
suspended solids; water chemistry; water quality standards
ABSTRACT:
Effluents from the treatment plant of Saint Jean de Monts and Saint
Hilaire de Riez (France) have been injected into a confined groundwater
aquifer for twelve years. The effluents have been treated to remove 90% of
the concentrations of suspended solids, 70% of the oxidizability, but less
than 10% of the nitrogen. The groundwater is connected with the sea.
Effluent floats on the surface of the aquifer and disperses by dilution at
the freshwater/saltwater interface. The aquifer acts as a direct overflow
pipe. This injection of effluent has preserved the water quality in the
coastal area and in the Breton Marsh. If the inflow rate were increased,
the balance of the system would probably be disturbed and the time
required for diffusion of wastewater seawards would no longer be
sufficient. (See also W93-05228) (Author's abstract)
MAJOR TOPIC: Ultimate disposal of wastes [3050];   Sources and fate of
pollution [3020]
RECORD ID: 9305257
DATABASE: SELECTED WATER RESOURCES ABSTRACTS
TITLE: Advantages and disadvantages of urban stormwater infiltration.
AUTHOR: Reydon, M.J.P.; Van den Akker, C.
INST. AUTHOR: TU Delft
AUTH. ADDRESS: NL
MAJOR TOPIC:
- stormwater and waste and wastewater management; model studies; water resources
KEY TERMS:
- model studies; water resources management; water table; groundwater recharge; infiltration; urban drainage; stormwater management; pros cons alternatives; netherlands
LANGUAGE: Dutch
PUB. TYPE: Journal article
LIB. LOCATION: CSIR (Pretoria).
RECORD ID: 01721437
DATABASE: WATERLIT

TITLE: Effects of waste-water irrigation on aqueous geochemistry near Paris, Texas.
AUTHOR: Tedaldi, D.J.; Loehr, R.C.
AUTH. ADDRESS: PO Box 193965, San Francisco, California 94119-3965, US.
- 26, Oct, Sep, 1992 ISSN: 0017-467X
MAJOR TOPIC:
- wastewater and sewage and effluents; modelling studies; pollution of the freshwater environment
KEY TERMS:
- thermodynamic equilibrium; sulphates; water analysis; wastewater irrigation; overland flow; land application; dissolution rate; mineral constituents; groundwater recharge; hydraulic conductivity; salinity; groundwater pollution; hydrogeology; hydrogeochemistry; conceptual models; united states; minteqa2 model; chlorides; semiconfined aquifers
LANGUAGE: English
PUB. TYPE: Journal article
LIB. LOCATION: CSIR (Pretoria); Dept of Water Affairs (Pretoria).
RECORD ID: 00519294
DATABASE: WATERLIT

TITLE: SEWAGE WATER INFILTRATION AND GROUNDWATER QUALITY IN HET
TITLE: Effect of Wastewater Injection on Ground Water Quality
AUTHOR: Legeas, M.; Carre, J.; Merot, P.
AUTH. ADDRESS: Ecole Nationale de la Sante Publique Rennes (France).
Dept. of Environment et Sante.
SOURCE: Water Science and Technology WSTED4; Vol. 25, No. 12, p 283-286, 1992. 1 fig, 1 tab, 2 ref.
KEY TERMS:
*dilution; *effluents; *groundwater; *groundwater movement; *path of pollutants; *wastewater disposal; aquifers; costs; flow rates; marine environment; nitrogen; oxidation; saline-freshwater interfaces; suspended solids; water chemistry; water quality standards
ABSTRACT:
Effluents from the treatment plant of Saint Jean de Monts and Saint Hilaire de Riez (France) have been injected into a confined groundwater aquifer for twelve years. The effluents have been treated to remove 90% of the concentrations of suspended solids, 70% of the oxidizability, but less than 10% of the nitrogen. The groundwater is connected with the sea. Effluent floats on the surface of the aquifer and disperses by dilution at the freshwater/saltwater interface. The aquifer acts as a direct overflow pipe. This injection of effluent has preserved the water quality in the coastal area and in the Breton Marsh. If the inflow rate were increased, the balance of the system would probably be disturbed and the time required for diffusion of wastewater seawards would no longer be sufficient. (See also W93-05228) (Author's abstract)

MAJOR TOPIC: Ultimate disposal of wastes [3050]; Sources and fate of pollution [3020]
RECORD ID: 9305257
DATABASE: SELECTED WATER RESOURCES ABSTRACTS

TITLE: Modelling fresh water injection into a partially saline partially fresh (PAPSAF) aquifer.
ABSTRACT:

Studied are physical phenomena typical to injection of fresh water, like treated effluents, into an aquifer whose deep layers are saturated with saline water, and its upper layers are saturated with fresh water. Such a partially saline fresh aquifer is termed as a PASPAF aquifer. The study concerns infiltration by recharge wells as well as over an infiltrating area. The framework of the study includes the development of the appropriate numerical model as well as the performance of various numerical simulations demonstrating the applicability of the model and representing the possible physical phenomena associated with the fresh water injection. The numerical experiments with the model indicate that the fresh water injection may lead to degradation of the groundwater quality mainly around the injection site. Quantitative calculations of such an effect and the appropriate conclusions obtained by these calculations are presented.

ABSTRACT:

Field-scale transport of natural organic matter (NOM) was studied in a two-well tracer test by injecting 80,000 L of ‘brown water’ (66 mg of C/L) from a wetlands pond into a shallow, sandy, coastal plain aquifer. The basic features of NOM breakthrough observed in laboratory column studies (extending tailing and rapid decline in concentrations when NOM inputs are terminated) were observed in the field. Retardation of NOM in the field agreed with predictions from laboratory studies. In spite of natural
heterogeneities, fractionation of NOM sub-components occurred in transport. Small (<3000 MW) and more hydrophilic (by XAD-8 chromatography) components of NOM were more mobile than were larger (3-100K MW), more hydrophobic components. However, over the 2-week injection, the solid and solution phase reached an apparent steady state with respect to NOM adsorption, resulting in the unretarded transport of even the hydrophobic and macromolecular NOM. The results indicate that NOM can exhibit considerable mobility in an aquifer and suggest that NOM could alter the transport of contaminants in groundwater. (Author's abstract)

MAJOR TOPIC: Groundwater [0840]; Chemical processes [0880]; Sources and fate of pollution [3020]
RECORD ID: 9306535
DATABASE: SELECTED WATER RESOURCES ABSTRACTS

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TITLE: Effect of Wastewater Injection on Ground Water Quality
AUTHOR: Legeas, M.; Carre, J.; Merot, P.
AUTH. ADDRESS: Ecole Nationale de la Sante Publique Rennes (France). Dept. of Environment et Sante.
SOURCE: Water Science and Technology WSTED4; Vol. 25, No. 12, p 283-286, 1992. 1 fig, 1 tab, 2 ref.
KEY TERMS: *dilution; *effluents; *groundwater; *groundwater movement; *path of pollutants; *wastewater disposal; aquifers; coasts; flow rates; marine environment; nitrogen; oxidation; saline-freshwater interfaces; suspended solids; water chemistry; water quality standards
ABSTRACT:
Effluents from the treatment plant of Saint Jean de Monts and Saint Hilaire de Riez (France) have been injected into a confined groundwater aquifer for twelve years. The effluents have been treated to remove 90% of the concentrations of suspended solids, 70% of the oxidizability, but less than 10% of the nitrogen. The groundwater is connected with the sea. Effluent floats on the surface of the aquifer and disperses by dilution at the freshwater/saltwater interface. The aquifer acts as a direct overflow pipe. This injection of effluent has preserved the water quality in the coastal area and in the Breton Marsh. If the inflow rate were increased, the balance of the system would probably be disturbed and the time required for diffusion of wastewater seawards would no longer be sufficient. (See also W93-05228) (Author's abstract)
MAJOR TOPIC: Ultimate disposal of wastes [3050]; Sources and fate of pollution [3020]
RECORD ID: 9305257
DATABASE: SELECTED WATER RESOURCES ABSTRACTS

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TITLE: Simulation of Wastewater Injection into a Coastal Aquifer System Near Kahului, Maui, Hawaii
AUTHOR: Larson, S.P.; Papadopulos, S.S.; Cooper, H.H.Jr; Burnham, W.L.
Div.

SOURCE: ASCE Proceedings of Hydraulics in the Coastal Zone, College Station, Texas; August 10-12, 1977, p 107-116, 1977. 5 fig, 4 ref.

KEY TERMS:
*model studies; *waste water disposal; *injection wells; *sewage effluents; *hawaii; *maui[hawaii]; coasts; aquifers; saline water-freshwater interfaces; groundwater movement; hydrogeology; aquifer characteristics; path of pollutants; computer models; analytical techniques; kahului county[hawaii]; kahului bay[hawaii]

ABSTRACT:
Evaluation of the Wailuku-Kahului Wastewater Treatment Facility, near Kahului, Maui, Hawaii, required study of the potential impact of injection of effluent into the saline-water part of a lava aquifer system. To determine the distribution of injected fluid, a computer model was constructed to enable consideration of (1) an aquifer system containing fresh and saline water, (2) heterogeneous aquifer characteristics, (3) nonuniform boundary conditions, and (4) concurrent withdrawal of saline water near the injection site. A sharp interface was assumed to exist between freshwater and saline water in the aquifer, and a numerical model was employed to simulate ground-water flow in the freshwater zone. Withdrawal of 68 cfs of saline water within 2,600 feet of the injection site was modeled analytically, and the numerical and analytical models were coupled to provide an acceptable prediction of aquifer response to injection. A simulated injection rate of 6.2 cfs resulted in a steady-stage wastewater plume extending 1,200 feet upgradient from the injection site and displacing the interface between freshwater and saline water 500 feet seaward. Three-dimensional analysis indicated that if fluid was injected into the saline-water zone and if vertical hydraulic conductivity were less than horizontal conductivity the injected plume of wastewater would be contracted in size at the top of the freshwater zone and expanded at the bottom relative to isotropic conditions. (Woodard-USGS)

MAJOR TOPIC: Sources and fate of pollution [3020]; Ultimate disposal of wastes [3050]; Estuaries [0890]

RECORD ID: 7806186
DATABASE: SELECTED WATER RESOURCES ABSTRACTS

TITLE: Storage of Treated Sewage Effluent and Storm Water in a Saline Aquifer, Pinellas Peninsula, Florida
AUTHOR: Rosenshein, J.S.; Hickey, J.J.
SOURCE: Ground Water; Vol 15, No 4, p 284-293, July-August 1977. 5 fig, 3 tab, 11 ref.

KEY TERMS:
*waste disposal; *injection wells; *waste water disposal; *underground storage; *effluents; saline water; aquifers; test wells; aquifer characteristics; water quality control

ABSTRACT:
The Pinellas Peninsula, an area of 750 square kilometers (290 square miles) in coastal west-central Florida, is a small hydrogeologic replica of Florida. Most of the Peninsula's water supply is imported from well
fields as much as 65 kilometers (40 miles) inland. Stresses on the hydrologic environment of the Peninsula and on adjacent water bodies resulting from intensive water-resources development and waste discharge, have resulted in marked interest in subsurface storage of waste water (treated effluent and untreated storm water) and in future retrieval of the stored water for nonpotable use. If subsurface storage is approved by regulatory agencies, as much as 70 million gallons a day of waste water could be stored underground within a few years, and more than 150 million gallons a day could be stored in about 25 years. This storage would constitute a large resource of nearly freshwater in the saline aquifers underlying about 520 square kilometers (200 square miles) of the Peninsula. (Woodard-USGS)

MAJOR TOPIC: Ultimate disposal of wastes [3050]; Groundwater management [2040]; Sources and fate of pollution [3020]

RECORD ID: 7712377
DATABASE: SELECTED WATER RESOURCES ABSTRACTS

TITLE: Effect of wastewater injection on ground water quality.
AUTHOR: Legeas, M.; Carre, J.; Merot, Ph.
EDITOR: Bontoux, J.; Bebin, J.
INST. AUTHOR: Ecole Nationale de la Sante Publique, Departement Environnement et Sante.
AUTH. ADDRESS: Avenue du Professeur Leon Bernard, 35043 Rennes Cedex, FR.
SOURCE: Water science and technology; IAWPRC; GB; Comite Francais de Recherche sur la Pollution CFR; ; Association Generale des Hygienistes et Techniciens Municipaux AGHT; ; France; FR; Wastewater Management in Coastal Areas. Proceedings of the IAWPRC Specialised Conference; Montpellier, France.; 31 Mar to 2 Apr 1992; Vol. 25, Issue 12, pp. 283-286, 4 p., refs. 1, 1992; 31 Mar to 2 Apr 1992
ISSN: 0273-1223
MAJOR TOPIC: wastewater and sewage and sludge; coastal environment; groundwater quality and monitoring
KEY TERMS: municipal wastewater; aquifers; limestone; injection wells; coastal zone; groundwater pollution; water quality; wastewater treatment; saline water freshwater interfaces; france; saint hilaire de riez; saint jean de monts; coastal resorts
LANGUAGE: English
PUB. TYPE: Conference paper
LIB. LOCATION: CSIR (Pretoria); Dept of Water Affairs (Pretoria).
RECORD ID: 00755095
DATABASE: WATERLIT

TITLE: INJECTION OF FRESH WATER BY WELL IN COASTAL AQUIFERS.
AUTHOR: SUGIO, S.; UEDA, T.

MAJOR TOPIC:
hydrology, limnology, potamology, oceanography, meteorology-groundwater flow, porous media flow; other disciplines-pollution [excluding thermal pollution], water quality [modelling]; groundwater works - repulsion of the salt boundary by pumping a barrier of fresh water; flow through porous media; groundwater flow - intrusion of one fluid into another in groundwater problems; water flooding

KEY TERMS:
groundwater flow; aquifers; saline water intrusion; saline water-freshwater interfaces; salt water barriers

ABSTRACT:
When fresh water is injected from a well in coastal aquifers, three dimensional interface is formed between fresh water and salt water in the aquifers. This two-fluid flow is investigated to prevent the salt nuisance. The superposing technique of the conformal transformation is made use of the approximate analysis about the steady seepage flow.

LANGUAGE: English
LIB. CALL/CODE: WL 70 B; TH 0937
RECORD ID: 8000374
DATABASE: DELFT HYDRO

-SULPHATE REDUCTION + related----

Record (Full) 2 of 216 Total, 10 Marked

TITLE: The use of mass balance investigations in the study of the biogeochemical cycle of sulfur.
AUTHOR: Evans, H.E.; Dillon, P.J.; Molot, L.A.
AUTH. ADDRESS: RODA Environ. Res., PO Box 447, Lakefield, Ontario K0L 2H0, Canada
SOURCE: HYDROL. PROCESS.; vol. 11, no. 7, pp. 765-782; 1997
ISSN: 0885-6087
AVAILABILITY: Special issue: Geochemical mass balance.
KEY TERMS:
biogeochemistry; sulfur; peat bogs; wetlands; water table fluctuations; lakes; catchment areas; sulfates; biogeochemical cycle; water table; catchment area

ABSTRACT:
The use of mass balances in the investigation of the biogeochemical cycle of sulfur is reviewed for three systems: 1) upland catchments, 2) wetlands, and 3) lakes. In upland catchments, the major inputs of sulfur are via wet and dry atmospheric deposition, whereas outputs or losses occur primarily through volatilization and/or runoff. In addition, sulfur may be stored in vegetation and in the forest floor. In wetlands (particularly peatlands), a large proportion of the sulfur inputs are derived from surface and groundwater originating in the upland system. Because of the fluctuating water table in wetlands, they can act as a source or sink for sulfate, depending on the redox conditions. Wetlands, therefore, can significantly affect input-output budgets for lakes. In most lakes, only a small portion of the sulfate input is retained, (i.e. not lost from the lake via outflow), indicating that there is an excess of
sulfate relative to biological needs. Seepage lakes are exceptions to this generalization. Although the reactivity of the sulfate input to many lakes is low, sulfate levels, especially in regions receiving substantial atmospheric sulfur deposition, are high enough that the portion reduced results in substantial in-lake alkalinity production; in fact, in many cases, alkalinity production from sulfate reduction is greater than that resulting from not only other in-lake processes but from external sources (the catchment) as well. The importance of mass balance investigations in elucidating the biogeochemical cycling of sulfur is stressed and the need for additional studies on a whole-system basis stressed.

MAJOR TOPIC: Chemical processes [880]

PUB. TYPE: Journal Article
LANGUAGE: English
RECORD ID: WR-4080121
DATABASE: WATER RESOURCES ABSTRACTS

Record (Full) 3 of 216 Total

TITLE: In situ rates of sulfate reduction in an aquifer (Roemoe, Denmark) and implications for the reactivity of organic matter.

AUTHOR: Jakobsen, R.; Postma, D.
SOURCE: GEOLOGY; vol. 22, no. 12, pp. 1103-1106; 1994
ISSN: 0091-7613

KEY TERMS: sediments; chemical reactions; aquifer characteristics; organic matter; biodegradation; radioactive tracers; sulfates; Denmark, Romo; groundwater; sediment chemistry; geochemistry; sulfate-reducing bacteria; aquifers

ABSTRACT: Estimates of rates of organic matter degradation by bacterial sulfate reduction in aquifers are few, and all are obtained by indirect means. Here we present the first direct radiotracer measurements of in situ rates of sulfate reduction for an aquifer (Roemoe, Denmark). Sulfate reduction occurs in distinct reaction zones within the aquifer at rates that vary greatly over short lateral distances. In situ rates of sulfate reduction are significantly higher than previous indirect estimates. In contrast, rates of sulfate reduction in aquifers are orders of magnitude lower than in marine and limnic environments, emphasizing the low reactivity of natural organic matter in aquifers.

MAJOR TOPIC: Chemical processes [880]

PUB. TYPE: Journal Article
LANGUAGE: English
RECORD ID: WR-3740434
DATABASE: WATER RESOURCES ABSTRACTS

Record (Full) 4 of 216 Total
TITLE: Use of dissolved H sub(2) concentrations to determine
distribution of microbially catalyzed redox reactions in
anoxic groundwater.

AUTHOR: Lovley, D.R.; Chapelle, F.H.; Woodward, J.C.

Reston, VA 22092, USA

SOURCE: ENVIRON. SCI. TECHNOL.; vol. 28, no. 7, pp. 1205-1210; 1994
ISSN: 0013-936X

KEY TERMS:
hydrogen; oxygen depletion; groundwater pollution; aquifers; chemical
reactions; geochemistry; microorganisms; anoxia; groundwater
contamination; iron; sulfate; methanogenesis; redox properties;
ground water; water pollution

ABSTRACT:
The potential for using concentrations of dissolved H sub(2) to determine
the distribution of redox processes in anoxic groundwaters was evaluated.
In pristine aquifers in which standard geochemical measurements indicated
that Fe-(III) reduction, sulfate reduction, or methanogenesis was the
terminal electron accepting process (TEAP), the H sub(2) concentrations
were similar to the H sub(2) concentrations that have previously been
reported for aquatic sediments with the same TEAPs. In two aquifers
contaminated with petroleum products, it was impossible with standard
geochemical analyses to determine which TEAPs predominated in specific
locations. However, the TEAPs predicted from measurements of dissolved H
sub(2) were the same as those determined directly through measurements of
microbial processes in incubated aquifer material. These results suggest
that H sub(2) concentrations may be a useful tool for analyzing the redox
chemistry of nonequilibrium groundwaters.

MAJOR TOPIC: Sources and fate of pollution [3020]

PUB. TYPE: Journal Article

LANGUAGE: English

RECORD ID: WR-3674447

DATABASE: WATER RESOURCES ABSTRACTS

Record (Full) 5 of 216 Total

TITLE: Modeling of biologically mediated redox processes in the
subsurface.

Raats, P.A.C.; Armstrong, A.C. (eds.)

AUTH. ADDRESS: Inst. Hydromech., Univ. Karlsruhe, Kaiserstrasse 12, 76128
Karlsruhe, FRG

CONFERENCE: 17. Gen. Assembly of the European Geophysical Society,
Edinburgh (UK), 6-10 Apr 1992

SOURCE: J. HYDROL. (AMST.); vol. 159, no. 1-4; 17 GENERAL ASSEMBLY
OF EGS, EDINBURGH, 1992.; pp. 125-143
ISSN: 0022-1694

AVAILABILITY: Session HS1: Field, laboratory and modelling studies of flow
and transport processes.

KEY TERMS:
model studies; solute transport; groundwater pollution; monitoring;
bioremediation; microorganisms; subsurface water; groundwater

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To model bacterially catalyzed redox processes a multicomponent transport reaction model is presented. The transport part of the model solves the transient convection dispersion differential equations. The pure chemical submodel is conceptually similar to conventional thermodynamic equilibrium models. The kinetic submodel describes the heterotrophic metabolisms of several groups of microorganisms. To model a complete redox sequence (aerobic carbonaceous oxidation, denitrification, Fe(III)-reduction, Mn(IV)-reduction, and sulfate reduction) four functional bacterial groups are defined. Their growth and metabolisms are formulated in terms of Monod equations. As in other biofilm models, diffusion-limited exchange between the different phases (mobile pore water, biophase, and aquifer material) is also considered in this approach. The submodels are coupled by the equations of the microbially mediated redox reactions. This numerical technique permits direct mechanistic modeling of the influence of microbially catalyzed redox reactions on the chemical milieu of an aquifer. A two-step method is applied to solve the coupled transport and biochemical reaction equations. The numerical model was applied to field data of a natural subsurface flow path.

**Sulphate-reducing bacteria in deep aquifer sediments of the London Basin: Their role in anaerobic mineralization of organic matter.**

**AUTHOR:** Johnson, A.C.; Wood, M.

**AUTH. ADDRESS:** Inst. Hydro., Wallingford, Oxfordshire OX10 8BB, UK

**SOURCE:** J. APPL. BACTERIOL.; vol. 75, no. 2, pp. 190-197; 1993

**ISSN:** 0021-8847

**KEY TERMS:**
sulphate-reducing bacteria; aquifers; sediments; organic matter; mineralization; anaerobic conditions; bacteria; anaerobic degradation; sulphate

**ABSTRACT:**
Sulphate-reducing potential was measured in sandy aquifer sediments of the London Basin. Sulphate reduction could be stimulated in the laboratory by saturating the sands with groundwater, and creating an anaerobic environment. The stimulation of vigorous sulphate reduction through the addition of an external substrate was associated with an increase in Fe sub(T) concentration. Molybdate and selenate were added to sediment/groundwater slurries as specific inhibitors of sulphate-reducing bacteria. Under sulphate-reducing conditions acetate accumulated, but was inhibited by molybdate and selenate. super(14)C-acetate was used to measure the rate of acetate metabolism in the sediments.
TITLE: Biogeochemical changes in groundwater-infiltration systems: Column studies.

AUTHOR: Von Gunten, U.; Zobrist, J.

AUTH. ADDRESS: Swiss Fed. Inst. Water Resour. and Water Pollut. Control, EAWAG, CH-8600 Duebendorf, Switzerland

SOURCE: GEOCHIM. COSMOCHIM. ACTA; vol. 57, no. 16, pp. 3895-3906; 1993 ISSN: 0016-7037

KEY TERMS: geochemistry; groundwater; organic compounds; aquifers; degradation; microorganisms; chemical reactions; experimental design

ABSTRACT: A laboratory continuous flow-through sand reactor was used to study qualitatively and quantitatively the biogeochemical processes resulting from an input of an easily degradable organic substance (lactate) into a model aquifer. The primary occurring redox processes are mediated by microorganisms and can be described by the classical sequence of inorganic redox reactions in aquatic systems. In the steady state situation, the nitrate and sulfate reduction follow a pseudo first-order kinetics, with respective rate constants of (2.7 ± 0.2) x 10^(-1)/min and (2.3 ± 0.3) x 10^(-2)/min. These rate constants are within the same range of other laboratory and field studies when taking the population density of microorganisms into account. The dissolution of Mn(II) and Fe(II) follows pseudo zero-order kinetics. During the experiment (3 months) the respective rate constants for Mn(II) decrease from 100 nM/min to 1 nM/min, whereas the rate constant for Fe(II) remains almost unchanged in the range of 30 nM/min. The important inorganic geochemical processes induced by redox reactions are dissolution of CaCO_3 by CO_2, adsorption of Mn(II), precipitation of Fe(II) by sulfides (S(-II)), and the reductive dissolution of Fe(III) (hydr)oxides by S(-II) forming FeS. The last reaction consumes more than 80% of the S(-II) produced, i.e., controls the concentration of the enzymatically produced S(-II). The calculated alkalinity, carbon, and electron balance matched well with the measured concentration changes in the reactor. This shows that the microbially mediated redox processes can be expressed by a set of simple chemical reactions.

MAJOR TOPIC: Sources and fate of pollution [3020]

PUB. TYPE: Journal Article

LANGUAGE: English

RECORD ID: WR-3023591

DATABASE: WATER RESOURCES ABSTRACTS

Record (Full) 7 of 216 Total

TITLE: Sulphate-mediated iron limitation and eutrophication in
aquatic ecosystems.

**ABSTRACT:**
In large parts of the peaty lowlands of The Netherlands, alkaline, sulphate-enriched river water poor in iron is let in to compensate for decreased ground water levels. As a result, iron input rates decrease while sulphate reduction rates in the anaerobic sediment increase. Iron sulphide precipitation and decreased iron input result in iron exhaustion, sulphide accumulation and increased phosphate mobilization in the anaerobic sediments. Furthermore, iron shortage and sulphide toxicity can occur in aquatic species while disturbance of the iron cycle results in increased phosphate levels in the water layer.

**MAJOR TOPIC:** Chemical processes [880]

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**TITLE:** Competitive Exclusion of Sulfate Reduction by Fe(III)-Reducing Bacteria: A Mechanism for Producing Discrete Zones of High-Iron Ground Water

**AUTHOR:** Chapelle, F.H.; Levley, D.R.

**ABSTRACT:**
The Middendorf aquifer of South Carolina exhibits a 40-kilometer-wide zone where dissolved ferrous iron concentrations commonly exceed 1 mg/L. Downgradient of this zone, dissolved iron concentrations decrease to less than 0.05 mg/L. Geochemical and microbiologic evidence indicates that this zonation reflects the competitive exclusion of sulfate-reducing activity by Fe(III)-reducing bacteria in the high-iron zone and the emergence of sulfate reduction as the predominant process in the low-iron zone. Viable Fe(III)-reducing and sulfate-reducing bacteria coexist throughout the aquifer. However, the observed linear relationship between dissolved iron...
and dissolved inorganic carbon as well as the lack of sulfate consumption indicates that sulfate-reducing bacteria are much less active than Fe(III)-reducing bacteria in the high-iron zone. Fe(III)-reducing bacteria appear to exclude sulfate-reducing activity by maintaining dissolved hydrogen, formate, and acetate concentrations at levels lower than thresholds required by sulfate-reducing bacteria. Downgradient of the high-iron zone, Fe(III)-reducing activity becomes limited by a lack of Fe(III) oxyhydroxides as Middendorf sediments become progressively more marine in origin. Hydrogen, formate, and acetate concentrations then increase to levels that allow sulfate-reducing bacteria to become active. Increased sulfide production strips ferrous iron from solution by precipitating ferrous sulfides, and dissolved iron concentrations decrease. The observed high-iron zonation is thus one manifestation of microbial competition for scarce substrates. The wide occurrence of similar water-chemistry patterns implies that microbial competition mechanisms are important to the groundwater geochemistry of many hydrologic systems. (Author's abstract)

MAJOR TOPIC: Chemical processes [0880]; Groundwater [0840]

RECORD ID: 9205299

DATABASE: SELECTED WATER RESOURCES ABSTRACTS

Record (Full) 10 of 216 Total

TITLE: Use of Isotope Fractionation of Sulfate-Sulfur and Sulfate-Oxygen to Assess Bacterial Desulfurication in a Sandy Aquifer

AUTHOR: Strebel, O.; Bottcher, J.; Fritz, P.

AUTH. ADDRESS: Bundesanstalt fuer Geowissenschaften und Rohstoffe Hanover (Germany, F.R.).

SOURCE: Journal of Hydrology JHYDA7; Vol. 121, p 155-172, December 1990. 11 fig, 26 ref.

KEY TERMS: *aquifers; *desulfurization; *groundwater chemistry; *groundwater movement; *isotope fractionation; *sulfur compounds; denitrification; hydraulic properties; kinetics; lignite; microbial degradation; monitoring wells; nitrates; oxidation; recharge; sand; separation techniques; water chemistry

ABSTRACT:
The unconfined aquifer of the 'Fuhrberger Feld' consists of 20-30 m sands and gravelly sands with unevenly distributed reduced sulfur compounds and small lignitic pebbles. In a vertical direction two hydrochemically different zones with specific solute transformations are present, an upper portion with bacterial denitrification (with reduced sulfur compounds as electron donors) and a deeper portion with hydrochemical indications of reduction of aqueous sulfate. In the study area ten multilevel groundwater sampling wells were installed. Sampling and interpretation was based on a two-dimensional vertical-plane groundwater flownet and on the knowledge of the landuse upgradient of the multilevel wells. The concentration and isotopic composition of the sulfate at the entrance into the zone of sulfate reduction is controlled by sulfate of groundwater recharge as well as sulfate formed during denitrification. The recharge-sulfate shows clear landuse specific differences in concentration and isotopic composition. In
the denitrification zone no significant sulfur isotope fractionation occurs during oxidation of reduced sulfur. The oxygen-isotopic composition of the newly formed sulfate ('denitrification-sulfate') depends on the O-18 content of nitrate acting as an oxygen donor and on the O-18 content of groundwater in which the oxidation occurs. In the zone of sulfate reduction, both the S-34 and O-18 values of the residual sulfate increase with decreasing sulfate concentrations thus proving the existence of bacterial reduction of the aqueous sulfate. Data on concentration and isotopic composition of sulfate and on the hydraulically derived groundwater age are used for kinetic considerations. The bacterial reduction can be considered as first-order with a half-life between 75 and 100 years. (Author's abstract)

MAJOR TOPIC: Groundwater [0840]; Chemical processes [0880]; Water quality control [3070]
RECORD ID: 9109717
DATABASE: SELECTED WATER RESOURCES ABSTRACTS

Record (Full) 11 of 216 Total

TITLE: The Origin and Isotopic Composition of Dissolved Sulfide in Groundwater from Carbonate Aquifers in Florida and Texas
AUTHOR: Rye, R.O.; Back, W.; Hanshaw, B.B.; Rightmire, C.T.; Pearson, F.J.
AUTH. ADDRESS: Geological Survey Lakewood, CO.
SOURCE: Geochimica et Cosmochimica Acta; Vol 45, No 10, p 1941-1950, October, 1981. 5 Fig, 2 Tab, 27 Ref.
KEY TERMS: *aquifers; *sulfides; *florida; *texas; *carbonate aquifers; chemical composition; groundwater; hydrogen sulfide; edwards aquifer; floridan aquifer
ABSTRACT:
Evidence is presented on the co-existing and simultaneously collected reduced sulfur species in a Florida aquifer. The total sulfur values of dissolved sulfide and the sulfur isotope fractionations between dissolved sulfide and sulfate species in the groundwater generally correlated with dissolved sulfate concentrations, which were related to flow patterns and residence time within the aquifer. The dissolved sulfide derives from the slow in situ biogenic reduction of sulfate dissolved from sedimentary gypsum in the aquifer. Where the water is the oldest, the dissolved sulfide apparently had attained isotopic equilibrium with the dissolved sulfate at the temperature of the system, which was 28 degrees C. This approach to equilibrium reflects an extremely slow reduction rate of the dissolved sulfate by bacteria. This slow rate probably results from very low concentrations of organic matter in the aquifer. In the reducing part of the Edwards aquifer, located in Texas, there was a general down-gradient increase in both dissolved sulfide and sulfate concentrations, but neither the total sulfur values of sulfide nor the sulfide-sulfate isotope fractionation correlated with the groundwater flow pattern. The dissolved sulfide species appeared to be derived mainly from biogenic reduction of sulfate ions, whose source is gypsum dissolution, even though upgradient diffusion of hydrogen sulfide gas from deeper oil field brines may be significant in some places. (Baker-FRC)
TITLE: Development of Reaction Models for Ground-Water Systems
AUTHOR: Plummer, L.N.; Parkhurst, D.L.; Thorstenson, D.C.
AUTH. ADDRESS: Geological Survey Reston, VA.
SOURCE: Geochimica et Cosmochimica Acta; Vol. 47, No. 4, p 665-686, April, 1983. 3 Fig, 9 Tab, 46 Ref.
KEY TERMS: *geochemistry; *groundwater; *reaction models; thermodynamics; mass balance; simulation; reaction paths; dolomite; carbon isotopes; sulfur isotopes; gypsum; ferric hydroxide; pyrite; carbon dioxide; organic carbon; florida
ABSTRACT:
Methods are described for developing geochemical reaction models from the observed chemical compositions of ground water along a hydrologic flow path. The roles of thermodynamic speciation programs, mass balance calculations, and reaction-path simulations in developing and testing reaction models are contrasted. Electron transfer is included in the mass balance equations to properly account for redox reactions in ground water. The mass balance calculations determine net mass transfer models which must be checked against the thermodynamic calculations of speciation and reaction-path programs. Although reaction-path simulations of ground-water chemistry are thermodynamically valid, they must be checked against the net mass transfer defined by the mass balance calculations. An example is given testing multiple reaction hypotheses along a flow path in the Floridan aquifer where several reaction models are eliminated. Use of carbon and sulfur isotopic data with mass balance calculations indicates a net reaction of incongruent dissolution of dolomite (dolomite dissolution with calcite precipitation) driven irreversibly by gypsum dissolution, accompanied by minor sulfate reduction, ferric hydroxide dissolution, and pyrite precipitation in central Florida. Along the flow path, the aquifer appears to be open to CO2 initially, and open to organic carbon at more distant points down gradient. (Author's abstract)

TITLE: Interpretation of pH and Eh Trends in a Fluvial-Sand Aquifer System
AUTHOR: Jackson, R.E.; Patterson, R.J.
AUTH. ADDRESS: Department of the Environment Ottawa (Ontario). Inland Waters Directorate.
SOURCE: Water Resources Research; Vol 18, No 4, p 1255-1268, August,
103

KEY TERMS:
*groundwater recharge; *aquifer characteristics; *fluvial sediments;
*hydrogen ion concentration; *oxidation-reduction potential; sand;
acidity; hydrogeology; chemical reactions; carbonates

ABSTRACT:
The hydrogeochemical processes affecting pH and Eh in a fluvial-sand
aquifer composed primarily of alumino-silicate minerals are discussed. It
is shown that the measured pH reflects hydrogen ion uptake, biotite
weathering, and carbonate mineral dissolution. The Eh values are
interpreted as being the result of the reduction of initially oxidized
groundwater by DOC and/or Fe(II), with subsequent reactions involving
sulfate reduction and possibly denitrification. Acid neutralization
capacity measurements and X ray diffractograms suggest that acid
precipitation recharging the aquifer undergoes a two-step neutralization
process. The first step involves reactions with the surfaces of mineral
grains, mainly with plagioclase and biotite, and the second step involves
an irreversible neutralization, with biotite alteration to vermiculite and
carbonate mineral dissociation. Because of the problems of using Pt
electrodes in groundwaters it is recommended that Eh measurements be
supplemented with dissolved oxygen and sulfide measurements. (Baker-FRC)

MAJOR TOPIC: Chemical processes [0880]; Groundwater [0840]

RECORD ID: 8301201
DATABASE: SELECTED WATER RESOURCES ABSTRACTS
infiltration rate in the basin. These observations on the chemical changes in recharged water make it possible to differentiate between anaerobic bacteria and other causes of reduced hydraulic conductivity in this recharge basin. The anaerobic conditions appear to start at depth and work toward the surface, thereby suggesting a process that involves adsorption of organic material and consumption of dissolved oxygen with depth.

(WOODARD-USGS)

MAJOR TOPIC: Sources and fate of pollution [3020]; Groundwater management [2040]; Wastewater treatment processes [3040]

RECORD ID: 7511497
DATABASE: SELECTED WATER RESOURCES ABSTRACTS

Title: Deducing the distribution of terminal electron-accepting processes in hydrologically diverse groundwater systems.

AUTHOR: Chapelle, F.H.; McMahon, P.B.; Dubrovsky, N.M.; Fujii, R.F.; Oaksford, E.T.; Vroblesky, D.A.
AUTH. ADDRESS: Stephenson Center, 720 Gracern Road, Suite 129, Columbia, SC 29210, US.

MAJOR TOPIC: pollution of groundwaters; microbiological techniques and studies

KEY TERMS: aquifers; groundwater pollution; petroleum hydrocarbons; electron transport; electron acceptors; methane production; sulphides; microbiological processes; reaction products; oxidation reduction potential; total organic carbon; hydrogen; sulphate reduction; united states; floridan aquifer; black creek aquifer

LANGUAGE: English
PUB. TYPE: Journal article
LIB. LOCATION: CSIR (Pretoria); Dept of Water Affairs (Pretoria).
RECORD ID: 01337157
DATABASE: WATERLIT

Title: Modeling of reactive groundwater transport governed by biodegradation.

AUTHOR: Zysset, A.; Stauffer, F.; Dracos, T.
INST. AUTHOR: Institute of Hydromechanics and Water Resources Management.
AUTH. ADDRESS: ETH Hoenggerberg, CH 8093 Zurich, CH.
SOURCE: Water resources research; Vol. 30, Issue 8, pp. 2423-2434, 12 p., refs. 50, Aug, 1994 ISSN: 0043-1397

MAJOR TOPIC: groundwater flow; model studies

KEY TERMS: monod kinetics; groundwater flow; electron acceptors; sulphate reducing
bacteria; pollutant transport; nitrate reduction; mass balance; metabolic activity; bacteria populations; catalysis; biodegradation; conceptual models
LANGUAGE: English
PUB. TYPE: Journal article
LIB. LOCATION: Dept of Water Affairs (Pretoria); CSIR (Pretoria)
RECORD ID: 01110101
DATABASE: WATERLIT

Record (Full) 18 of 68 Total

TITLE: Recent localised sulphate reduction and pyrite formation in a fissured Chalk aquifer.
AUTHOR: Kimblin, R.T.; Johnson, A.C.
INST. AUTHOR: Universite de Paris-sud, Laboratoire d'Hydrologie et de Geochemie Isotopique.
AUTH. ADDRESS: Batiment 504, F-91405 Orsay, FR.
ISSN: 0009-2541
MAJOR TOPIC:
groundwater and hydrogeology and geohydrology
KEY TERMS:
fissures; pore water; isotope studies; petrology; chemical precipitation; sulphate reducing bacteria; sulphur compounds; iron compounds; diagenesis; hydrogeochemistry; confined aquifers; chalk; scanning electron microscopy; united kingdom; north london; meteoric water
LANGUAGE: English
PUB. TYPE: Journal article
LIB. LOCATION: CSIR (Pretoria).
RECORD ID: 0052381X
DATABASE: WATERLIT

Record (Full) 19 of 68 Total

TITLE: Dissimilatory bacterial sulfate reduction in Montana groundwaters.
AUTHOR: DOCKINS, WS; OLSON, GJ; MCFETERS, GA; TURBAK, SC
SOURCE: Geomicrobiol J [New York]; Issue 2/1; Pages 83-98; Year 1980
KEY TERMS:
groundwater; organic content of water
GEO. AREA:
montana
LANGUAGE: ENGLISH
PUB. TYPE: Journal Article
DATABASE: HYDROTITLES
TITLE: THE EFFECT OF ORGANIC CARBON ON THE CONCENTRATIONS OF IRON AND HYDROGEN SULFIDE IN GROUND WATER.

AUTHOR: STOUFER, R.N.
INST. AUTHOR: UNIV MISSOURI COLUMBIA.
SOURCE: pp. 1-93, 93 p., 1975

MAJOR TOPIC:
- hydrological cycle; analytical techniques and instrumentation

KEY TERMS:
- nitrates; sulphates; microorganisms; denitrifying bacteria; water analysis; sulphur bacteria; oxidation reduction potential; hydrogen sulphide; ammonia; organic carbon; water wells; ferrous iron; groundwater quality

LANGUAGE: English
PUB. TYPE: Technical report
LIB. LOCATION: CSIR (PRETORIA) PB291555.
RECORD ID: 83071145
DATABASE: WATERLIT

TITLE: In situ rates of sulfate reduction in an aquifer (Romo, Denmark) and implications for the reactivity of organic matter.

AUTHOR: Jakobsen, R.; Postma, D.
INST. AUTHOR: Technical University of Denmark, Department of Geology and Geotechnical Engineering.
AUTH. ADDRESS: Building 204, DK 2800 Lyngby, DK.

MAJOR TOPIC:
- geohydrology and hydrogeology and hydrogeochemistry

KEY TERMS:
- sand aquifers; hydrochemistry; groundwater; sulphates; field tests; reactivity; organic matter; sulphate reducing bacteria; radioactive tracers; reduction; shallow aquifers

LANGUAGE: English
PUB. TYPE: Journal article
LIB. LOCATION: CSIR (Pretoria).
RECORD ID: 0130402X
DATABASE: WATERLIT

TITLE: Correlation of nitrate profiles with groundwater and sediment characteristics in a shallow sandy aquifer.

AUTHOR: Pedersen, J.K.; Bjerg, P.L.; Christensen, T.H.
INST. AUTHOR: Technical University of Denmark, Department of Environmental
TITLE: Recent localised sulphate reduction and pyrite formation in a fissured Chalk aquifer.
AUTHOR: Kimblin, R.T.; Johnson, A.C.
INST. AUTHOR: Universite de Paris-sud, Laboratoire d'Hydrologie et de Geochemie Isotopique.
AUTH. ADDRESS: Batiment 504, F-91405 Orsay, FR.
ISSN: 0009-2541
MAJOR TOPIC: groundwater and hydrogeology and geohydrology
KEY TERMS: fissures; pore water; isotope studies; petrology; chemical precipitation; sulphate reducing bacteria; sulphur compounds; iron compounds; diagenesis; hydrogeochemistry; confined aquifers; chalk; scanning electron microscopy; united kingdom; north london; meteoric water
LANGUAGE: English
PUB. TYPE: Journal article
LIB. LOCATION: CSIR (Stellenbosch); Dept of Water Affairs (Pretoria).
RECORD ID: 00085774
DATABASE: WATERLIT

TITLE: A COMPARATIVE STUDY OF SEQUENTIAL REDOX PROCESSES IN THREE BRITISH AQUIFERS.
AUTHOR: EDMUNDS, W.M.; MILES, D.L.; COOK, J.M.
INST. AUTHOR: HYDROGEOLOGY RESEARCH GROUP, BRITISH GEOLOGICAL SURVEY, MACLEAN BUILDING, CROWMARSH GIFFORD, WALLINGFORD, OXON, OX10 8BB.
TITLE: THE LINCOLNSHIRE LIMESTONE - HYDROGEOCHEMICAL EVOLUTION OVER A TEN-YEAR PERIOD.
AUTHOR: EDMUNDS, W.M.; WALTON, N.R.
INST. AUTHOR: INST GEOL SCI WALLINGFORD.
SOURCE: JOURNAL OF HYDROLOGY (AMSTERDAM); Vol. 61, Issue 3, Issue 1, pp. 201-211, 11 p., 1983

MAJOR TOPIC: hydrological cycle; pollution

KEY TERMS: confined aquifers; trace elements; connate water; mixing; cation exchange; agricultural chemicals; groundwater pollution; salinity; sulphates; oxidation reduction potential; groundwater flow; unconfined aquifers; carbonate rocks; evolution; hydrogeochemistry; limestone; nitrate reduction; groundwater quality; calcium; geohydrology | carbonate sediments; water composition; transportation; jurassic

GEO. AREA: lincolnshire

LANGUAGE: English

PUB. TYPE: Journal article

LIB. LOCATION: DEPT OF WATER AFFAIRS (PRETORIA); CSIR (PRETORIA)
RECORD ID: 83071292
DATABASE: COMPOSITE RECORD | WATERLIT | HYDROTITLES

Record (Full) 24 of 68 Total

TITLE: HYDROCHEMICAL EVOLUTION OF THE EAST MIDLANDS TRIASSIC SANDSTONE AQUIFER, ENGLAND.
AUTHOR: EDMUNDS, W.M.; BATH, A.H.; MILES, D.L.
TITLE: Dissimilatory bacterial sulfate reduction in Montana groundwaters.

AUTHOR: DOCKINS, WS; OLSON, GJ; MCFETERS, GA; TURBAK, SC

SOURCE: Geomicrobiol J [New York]; Issue 2/1; Pages 83-98; Year 1980

KEY TERMS:
groundwater; organic content of water

GEO. AREA:
montana

LANGUAGE: ENGLISH

PUB. TYPE: Journal Article

DATABASE: HYDROTITLES

Record (Full) 26 of 216 Total, 9 Marked

TITLE: Use of dissolved H sub(2) concentrations to determine distribution of microbially catalyzed redox reactions in anoxic groundwater.

AUTHOR: Lovley, D.R.; Chapelle, F.H.; Woodward, J.C.


SOURCE: ENVIRON. SCI. TECHNOL.; vol. 28, no. 7, pp. 1205-1210; 1994

ISSN: 0013-936X

KEY TERMS:
hydrogen; oxygen depletion; groundwater pollution; aquifers; chemical
ABSTRACT:
The potential for using concentrations of dissolved H$_2$ to determine the distribution of redox processes in anoxic groundwaters was evaluated. In pristine aquifers in which standard geochemical measurements indicated that Fe-(III) reduction, sulfate reduction, or methanogenesis was the terminal electron accepting process (TEAP), the H$_2$ concentrations were similar to the H$_2$ concentrations that have previously been reported for aquatic sediments with the same TEAPs. In two aquifers contaminated with petroleum products, it was impossible with standard geochemical analyses to determine which TEAPs predominated in specific locations. However, the TEAPs predicted from measurements of dissolved H$_2$ were the same as those determined directly through measurements of microbial processes in incubated aquifer material. These results suggest that H$_2$ concentrations may be a useful tool for analyzing the redox chemistry of nonequilibrium groundwaters.

MAJOR TOPIC: Sources and fate of pollution [3020]
PUB. TYPE: Journal Article
LANGUAGE: English
RECORD ID: WR-3674447
DATABASE: WATER RESOURCES ABSTRACTS

Record (Full) 31 of 216 Total

TITLE: Evaluation of Phosphate Materials for Control of Acid Production in Pyritic Mine Overburden
AUTHOR: Spotts, E.; Dollhopf, D.J.
AUTH. ADDRESS: Montana State Univ. Bozeman. Reclamation Research Unit.
SOURCE: Journal of Environmental Quality JEVQAA; Vol. 21, No. 4, p 627-634, October-December 1992. 5 fig, 5 tab, 16 ref.

KEY TERMS:
*acid mine wastes; *mine wastes; *overburden; *phosphates; *pyrite; *water pollution control; acidity reduction; coal mine wastes; electron microscopy; iron; leachates; ores; oxidation; performance evaluation; sludge; sulfates

ABSTRACT:
Acid mine drainage is a serious and pervasive threat to surface and groundwater quality in the US. Recent research has indicated that phosphate can be effective at immobilizing Fe and inhibiting the production of acid associated with the oxidation of pyritic mine wastes. Four phosphate materials were replicate tested for their ability to inhibit acid production from pyritic coal overburden using a soxhlet humidity cell leaching technique. These materials included two apatite ores (Cominco ore and Texas Gulf ore) at an application rate of 30 g/kg by weight apatite (Ca$_5$(PO$_4$)$_3$OH) and two byproducts of the phosphate industry (Cominco waste and Stauffer sludge) at rates of 10, 30, and 50 g/kg apatite by weight. Results of leachate analyses indicate that all phosphate sources at all rates of application resulted in significant (P
ACIDITY reductions ranged from a low of 7% for samples treated with Cominco waste (10 g/kg) to a high of 67% for Texas Gulf ore-treated samples. Texas Gulf ore, Stauffer sludge (10, 30, and 50 g/kg) and Cominco waste (10, 30, and 50 g/kg) significantly reduced dissolved total Fe concentrations in leachate, with the most notable diminutions produced by Texas Gulf ore (63%) and 50 g/kg Stauffer sludge (62%). Maximum decreases in sulfate ($SO_4^{2-}$) concentrations of 26, 20, and 25% were achieved by applications of Texas Gulf ore (30 g/kg) and Stauffer sludge (50 g/kg). The more effective overall performance of the Stauffer sludge and Texas Gulf ore was attributed to the considerably greater relative surface area and P solubility of these amendments. Results of a scanning electron microscope examination of amendments corroborate these findings. (Author's abstract)

MAJOR TOPIC: Water quality control [3070]
RECORD ID: 9302986
DATABASE: SELECTED WATER RESOURCES ABSTRACTS

Record (Full) 32 of 216 Total

TITLE: Development of Reaction Models for Ground-Water Systems
AUTHOR: Plummer, L.N.; Parkhurst, D.L.; Thorstenson, D.C.
AUTH. ADDRESS: Geological Survey Reston, VA.
SOURCE: Geochimica et Cosmochimica Acta; Vol. 47, No. 4, p 665-686, April, 1983. 3 Fig, 9 Tab, 46 Ref.
KEY TERMS:
*geochemistry; *groundwater; *reaction models; thermodynamics; mass balance; simulation; reaction paths; dolomite; carbon isotopes; sulfur isotopes; gypsum; ferric hydroxide; pyrite; carbon dioxide; organic carbon; florida
ABSTRACT:
Methods are described for developing geochemical reaction models from the observed chemical compositions of ground water along a hydrologic flow path. The roles of thermodynamic speciation programs, mass balance calculations, and reaction-path simulations in developing and testing reaction models are contrasted. Electron transfer is included in the mass balance equations to properly account for redox reactions in ground water. The mass balance calculations determine net mass transfer models which must be checked against the thermodynamic calculations of speciation and reaction-path programs. Although reaction-path simulations of ground-water chemistry are thermodynamically valid, they must be checked against the net mass transfer defined by the mass balance calculations. An example is given testing multiple reaction hypotheses along a flow path in the Floridan aquifer where several reaction models are eliminated. Use of carbon and sulfur isotopic data with mass balance calculations indicates a net reaction of incongruent dissolution of dolomite (dolomite dissolution with calcite precipitation) driven irreversibly by gypsum dissolution, accompanied by minor sulfate reduction, ferric hydroxide dissolution, and pyrite precipitation in central Florida. Along the flow path, the aquifer appears to be open to CO2 initially, and open to organic carbon at more distant points down gradient. (Author's abstract)
MAJOR TOPIC: Groundwater [0840]; Chemical processes [0880]
RECORD ID: 8401984
TITLE: The Origin and Isotopic Composition of Dissolved Sulfide in Groundwater from Carbonate Aquifers in Florida and Texas
AUTHOR: Rye, R.O.; Back, W.; Hanshaw, B.B.; Rightmire, C.T.; Pearson, F.J.
AUTH. ADDRESS: Geological Survey Lakewood, CO.
SOURCE: Geochimica et Cosmochimica Acta; Vol 45, No 10, p 1941-1950, October, 1981. 5 Fig, 2 Tab, 27 Ref.
KEY TERMS: *aquifers; *sulfides; *florida; *texas; *carbonate aquifers; chemical composition; groundwater; hydrogen sulfide; edwards aquifer; floridan aquifer
ABSTRACT:
Evidence is presented on the co-existing and simultaneously collected reduced sulfur species in a Florida aquifer. The total sulfur values of dissolved sulfide and the sulfur isotope fractionations between dissolved sulfide and sulfate species in the groundwater generally correlated with dissolved sulfate concentrations, which were related to flow patterns and residence time within the aquifer. The dissolved sulfide derives from the slow in situ biogenic reduction of sulfate dissolved from sedimentary gypsum in the aquifer. Where the water is the oldest, the dissolved sulfide apparently had attained isotopic equilibrium with the dissolved sulfate at the temperature of the system, which was 28 degrees C. This approach to equilibrium reflects an extremely slow reduction rate of the dissolved sulfate by bacteria. This slow rate probably results from very low concentrations of organic matter in the aquifer. In the reducing part of the Edwards aquifer, located in Texas, there was a general down-gradient increase in both dissolved sulfide and sulfate concentrations, but neither the total sulfur values of sulfide nor the sulfide-sulfate isotope fractionation correlated with the groundwater flow pattern. The dissolved sulfide species appeared to be derived mainly from biogenic reduction of sulfate ions, whose source is gypsum dissolution, even though upgradient diffusion of hydrogen sulfide gas from deeper oil field brines may be significant in some places. (Baker-FRC)
MAJOR TOPIC: Chemical processes [0880]; Groundwater [0840]
RECORD ID: 8203644
DATABASE: SELECTED WATER RESOURCES ABSTRACTS

TITLE: WATER QUALITY CHANGES RELATED TO THE DEVELOPMENT OF ANAEROBIC CONDITIONS DURING ARTIFICIAL RECHARGE
AUTHOR: WOOD, W.W.; BASSETT, R.L.
AUTH. ADDRESS: GEOLOGICAL SURVEY LUBBOCK, TEX.
SOURCE: WATER RESOURCES RESEARCH; VOL 11, NO 4, P 553-558, AUGUST 1975. 6 FIG, 3 TAB, 15 REF.
KEY TERMS:
*artificial recharge; *water spreading; *chemical reactions; *anaerobic bacteria; *texas; *water quality; *water reuse; groundwater recharge; infiltration rates; gravitational water; soil properties; sulfates; bicarbonates; hydrogen ion concentration; geology; data collections; chemical analysis

ABSTRACT:
ARTIFICIAL RECHARGE BASINS OR SPREADING SITES COMMONLY EXHIBIT REDUCTIONS IN INFILTRATION RATES AFTER PROLONGED PERIODS OF SUBMERGENCE. THIS LOSS IN INFILTRATION RATE HAS OFTEN BEEN SHOWN TO BE ASSOCIATED WITH A LARGE POPULATION OF ANAEROBIC OR FACULTATIVE ANAEROBIC BACTERIA IN THE MATERIAL UNDERLYING THE BASIN FLOOR. AN ARTIFICIAL RECHARGE EXPERIMENT IN A SPREADING BASIN AT LUBBOCK, TEXAS, SHOWED A SIGNIFICANT CHANGE IN THE CHEMICAL QUALITY OF RECHARGED WATER THAT WAS ASSOCIATED WITH THE GROWTH OF ANAEROBIC BACTERIA. SULFATE-REDUCING BACTERIA REDUCED THE SULFATE CONCENTRATION OF THE RECHARGE WATER AT THIS LOCATION BY 80 MG/LITER. THE BICARBONATE CONCENTRATION WAS INCREASED BY MORE THAN 150 MG/LITER, AND THE pH DECREASED 1 UNIT DURING THE SAME TIME PERIOD. THE CHANGE IN CHEMICAL QUALITY OCCURRED SUDDENLY AND CORRESPONDED TO A DRAMATIC DECREASE IN THE INFILTRATION RATE IN THE BASIN. THESE OBSERVATIONS ON THE CHEMICAL CHANGES IN RECHARGED WATER MAKE IT POSSIBLE TO DIFFERENTIATE BETWEEN ANAEROBIC BACTERIA AND OTHER CAUSES OF REDUCED HYDRAULIC CONDUCTIVITY IN THIS RECHARGE BASIN. THE ANAEROBIC CONDITIONS APPEAR TO START AT DEPTH AND WORK TOWARD THE SURFACE, THEREBY SUGGESTING A PROCESS THAT INVOLVES ADSORPTION OF ORGANIC MATERIAL AND CONSUMPTION OF DISSOLVED OXYGEN WITH DEPTH.
(WOODARD-USGS)

MAJOR TOPIC: Sources and fate of pollution [3020]; Groundwater management [2040]; Wastewater treatment processes [3040]

RECORD ID: 7511497
DATABASE: SELECTED WATER RESOURCES ABSTRACTS