

*Index***A**

- Acidity, 26
- Activated sludge:
 - activated aeration, 164
 - aeration, 159-73, 215-17, 235-97
 - complete mixing, 165
 - contact stabilization, 163, 208
 - diffused aeration, 153
 - Donaldson Index, 159
 - efficiency and removal, 158
 - extended aeration, 164, 206, 215-17, 235-97
 - final settling tanks, 172-73
 - general, 150
 - Hatfield process, 164
 - high-rate process, 165
 - hydrogen Ion Concentration (pH), 158
 - Kraus process, 164
 - loading, 154
 - Mohlman Index, 156
 - oxidation ditch, 235-70
 - recycle ratio, 155
 - ridge and furrow, 165
 - sludge age, 154-55
 - sludge bulking, 152
 - sludge concentration factor, 155
 - sludge produced, 155
- Activated sludge (*cont.*)
 - step aeration, 164
 - suspended solids control, 157
 - tapered aeration, 164
 - temperature, 152
- Aerated lagoons:
 - alpha factor, 275, 284, 288
 - basin geometry, 276
 - biological oxygen requirements, 274
 - BOD removal, 273
 - clear water transfer rate, 275
 - design example, 295
 - detention time, 274, 277
 - equipment, 279
 - extended aeration, 291-98
 - biodegradable portion, 293
 - characteristics, 294
 - design example, 295
 - design procedure, 291
 - endogenous respiration factor, 293
 - MLSS, 293
 - tank volume, 291
 - VMLSS, 293
 - field transfer rate, 275
 - horsepower, 277
 - K factor, 273, 284, 286, 290
 - mechanical vs diffused air, 291

Aerated lagoons (cont.)

- mixing requirements, 276, 277
- multiple cell BOD removal, 274
- nitrogen absence, 274
- oxygen transfer rate, 275
- phosphorus absence, 274
- rate removal coefficient K_e , 273
- requirements, 273
- retention time, 274, 277
- saturation concentration O_2 , 275
- sludge production, 276
- temperature correction factor, 274

Aeration:

- aeration design, 159-73, 215-17, 235-97
- blower capacity (package plants), 218
- conventional activated sludge, 159
- diffusers, 159-61, 169-70
- freeboard, 162
- minimum, 166-67
- spargers, 159-61
- spiral roll, 165
- swirl mix, 166
- tank depth, length, and width, 162
- total flow, 162
- total volume, 162

- Air flotation, 133-35
 - pressure type, 134
 - vacuum type, 134

Air system:

- blowers, 167-69, 230
- cleaners, 172
- general, 166-72
- minimum air, 166-67
- pipng, 170-72

Alkalinity, 26

Assimilation, 119

B

- Bioassay, 27, 29
- Biochemical oxygen demand (BOD):
 - general, 22
 - percent removal, 3, 217, 227

C

- Chemical oxygen demand (COD), 24
- Chemical parameters, 21
- Chlorides, 27
- Chlorination:
 - calculations, 396
 - chlorination (general), 387-404

Chlorination (cont.)

- chlorinator sizing guide, 397
- coliform bacteria, 385
- Control public water supplies, 386
 - design (sewage), 402
 - disinfection and pathogen removal, 385
 - field investigations, 389
 - sewage chlorination, 399
 - vacuum chlorination, 392-402
- Chlorine contact tank volume, 216
- Coagulation, 27
- Color, 28
- Comminutor, 231
- Concrete corrosion, 100, 102, 336, 337

D

- Darcy, 69
- Dazey churn, 131
- Design period, 10
- Dissolved oxygen, 24
- Distillation, 325
- Dry-pit pump stations, 348

E

- Electric motors and motor heaters, 380
- Electrodialysis, 322
- Emergency start panels, 383
- Engine drives for pumps, 381

F

- Fecal solids production:
 - animal, 67-68
 - human, 59
- Filters:
 - adsorption (carbon), 318
 - diatomite, 311
 - fine screens, 307-11
 - microstrainers, 307-11
 - mixed-media, 318
 - porous ceramic, 318
 - sand:
 - grain characteristics, 312, 315
 - horizontal, 315-17
 - vertical, 315
- Flocculation and pre-aeration, 135-38
- Flow pattern:
 - housing development, 216
 - school, 216
- Flow velocity in aquifer, 69

Foam separation, 321
Freezing waste treatment, 328

G

Grease and oil removal, 133-36
Grit chambers and removal, 128-33

H

Hardness, 28
Horsepower:
 aeration, 220, 265, 276, 277
 mixing requirements, 277
 pump, 382
 solids suspension, 277
Hydrogen sulfide, 100-102

I

Ion exchange, 329
Irrigation:
 ridge-and-furrow, 307
 seepage lagoon, 307
 spray, 301-7

L

Lift stations:
 applications, 334
 types, 335
wet-pit pump stations, 335

M

Marinas, 16
Microorganisms:
 algae, 37, 42
 bacteria, 37, 39-40
 bacteriophages, 41
 coliform, 13, 37
 crustaceans, 37, 42
 fecal coliform, 37
 fungi, 37, 40
 pathogens, 37, 43-48
 pathogen survival, 44-47, 57-62
 protozoa, 37, 41-42
 rickettsiae, 37, 40
 rotifers, 37, 42

Microorganisms (*cont.*)
 viruses, 14, 37, 38, 40-41
 worms, 43, 45, 47
MLSS, 218-20

N

Nutrients, 29

O

Odor, 29
Organic loading aeration tank, 215
Oxidation ditch:
 activated sludge, 243-45, 263
 BHP, 265
 calculations
 baffle design, 269
 clarifier, 249-52
 design data, 245
 ditch size, 248-49
 return sludge, 252
 rotor length, 248
 sludge quantity, 253
 weirs, 251-53, 254
 lining, 260
 maximum size, 265-70
 process flow, 236
 process theory, 237
 rotor, 238-41, 248-49, 254-60, 265-70
 small plant designs, 246
 special designs, 265-70

P

Package plants:
 air requirements, 217-18, 222, 230-31
 calculations, 214-21
 chlorination, 223
 chlorinator, 231
 comminutor, 231
 corrosion protection, 232
 design standards, 221-24
 diffused aeration, 224
 evaluation, 212
 froth control, 231
 general, 5
 horsepower, 220
 manufacturer, 230
 mechanical aeration, 225
 MLSS, 218-19
 National Sanitation Foundation, 207, 212

- Package plants (*cont.*)
 - nitrification, 227
 - organic loading, 215
 - problems, 213
 - service area, 230
 - settling zone, 223
 - sludge tanks, 223
 - startup and solids accumulation, 225
 - structural design, 232
 - types, 207-12
 - volume, 215-17
 - weir loading, 223
 - pH, 29
 - Pneumatic sewage ejector, 360
 - Pollution travel in groundwater:
 - ash dumps, 64
 - bored hole latrine, 60
 - coliform bacteria in sand, 58
 - distance of pollution travel, 54
 - envelope pit privy, 61
 - hydraulic gradient, 56
 - open dumps, 65
 - permeability, 56
 - pit privies, 57
 - privy vaults, 59
 - sanitary landfills, 64
 - septic tanks, 61
 - sewage irrigation, 62
 - sorption, 56
 - sources and types, 54
 - trenches, 59
 - vertical percolation, 57
 - waste stabilization ponds, 61
 - wastewater wells, 63
 - Pollution travel from surface sources:
 - birds, 69
 - farm wastes, 65-68
 - fish, 69
 - motorboats, 69
 - pesticides and herbicides, 68
 - Population estimate, 8
 - Pumping cost, 350
 - Pumps (*see also* Pumps (sump)):
 - accessories, 377
 - capacity, 348-50
 - cavitation, 367
 - characteristic curves, 351
 - check valves, 356
 - constant speed, 373
 - construction, 351
 - dry pit, 364
 - flexible shafting, 377
 - frame, 352
 - head variations, 357
 - impeller materials, 354
 - Pumps (*cont.*)
 - impeller rotation speed, 352
 - intakes and submergence, 365, 375
 - line surges, 354
 - mechanical seals, 354
 - multiple pump performance, 369
 - packing vs mechanical seals, 353
 - physical characteristics, 371
 - pumping day, 368
 - selection, 367
 - shaft sleeves, 353
 - solid-passing size, 358
 - two speed, 373
 - variable speed, 374
 - vibration and cavitation, 354
 - water seal unit, 376
 - Pumps (sump):
 - bearing life, 347-48
 - bearing lubrication, 339
 - bearings (special), 340
 - capacity, 343, 348-50
 - construction, 339
 - floats and rods, 340
 - head, 344
 - miscellaneous, 342
 - pressurization, 348
 - pumping rate, 350
 - submergence, 346
- ## R
- Rainfall:
 - frequency, 94-95
 - rates, 94
 - rational method, 93, 95-97
 - refractory materials, 29
 - surface runoff, 95
 - Residue:
 - filterable, 24
 - total, 24
 - Reverse osmosis, 326
 - Right angle drives, 381
 - Runoff:
 - rational method, 93, 95-97
 - time of concentration, 95-96
- ## S
- Sedimentation:
 - circular tanks, 145-50
 - general, 138-50
 - rectangular tanks, 140-45

Screens:

- bar, 121
- mechanical, 122-28
- screen head loss, 121-22

Sewage:

- BOD per day, 12
- composition, 11
- domestic, 22
- ejectors, 355-57
- flow per day, 12
- fungus, 40
- hydraulic flow estimates, 11
- irrigation, 62-63
- parameters, 21
- suburban, 14

Sewage treatment:

- industrial, 16
- package plants (*see* Package plants)
- plants, 14
- processes, 2
- process selection, 4, 14
- recreation areas, 16
- roadside rest areas, 16
- rural restaurants, 16
- towns, 16

Sewage treatment plants:

- arrangement, 117, 119
- bypasses, 119
- construction materials, 119
- grading, 120
- hydraulic flows, 118
- landscaping, 121
- loading cycle, 117-18
- mechanical equipment, 119
- outfalls, 120
- painting, 119
- safety, 120

Sewers:

- alignment, 78
- appurtenances, 97-100
- cast iron pipe, 106
- clay pipe, 105-6
- combined, 78
- computations, 89
- concrete pipe, 106
- corrosion, 100-102
- depth, 78
- design, design basis, design period, 77, 81
- energy gradient, 90
- engineering report, 76-77
- extensions, 80
- flow characteristics, 80
- general, 76
- high velocity, 78
- hydraulic profile, 81

Sewers (*cont.*)

- hydraulic properties circular sewers, 84
- hydraulics, 80
- hydrogen sulfide, 100-102
- increasing size, 78
- industrial influent, 15
- infiltration rates, 13, 79
- inverted syphons, 79
- Kutter equation, 82-83
- lasers, 110-12
- lateral lines, 92
- manholes, 97-99
- Manning formula, 82-90
- Marston formula, 102-5
- pipe materials, 105-10
- pipe size, 82-87
- plastic pipe, 109
- rational method, 93
- relation to water mains, 80
- sanitary, 75
- slope, 78
- structural, 102-5
- system layout, 90-91
- tributary areas, 92-93
- trunk sewers, 91
- velocity and discharge equations, 82
- velocity head, 89

Sludge:

- age, 154, 218
- chemical composition, 198
- compressibility and composition, 198
- concentration, 199
- conditioning agents, 198
- disc centrifuge, 198
- drainability, 198
- drainage and filtrate disposal, 202
- drying beds, 200-203, 253
- excess biological, 220
- filtration rates, 198
- holding tank capacity, 216
- pathogen reduction, 199
- pH, 198
- return flow, 220
- solid-bowl centrifuge, 197
- tanks, 199, 253
- vacuum filtration, 199

Sludge digestion:

- aerobic, 185, 197
- anaerobic, 185
- controls, 197
- detention time, 186-87
- digester capacity, 187-89
- digester gas lines, 192
- fats and oils, 192
- ferric chloride, 197

Sludge digestion (cont.)

- garbage digestion, 191
- gas collection, 192
- gas disposal, 193
- gas production, 192
- heating, 193
- heat transfer 195
- heavy metals, 197
- high loading rate, 186
- mixing, 187
- quantity, 192
- sampling pipes, 196
- sludge concentration, 187
- sludge piping, 195
- supernatant withdrawal, 196
- temperature, 189
- volatile solids, 191

Soil permeability, 56, 69

Soil permeability field coefficient, 69

Solids:

- colloids, 25, 26, 28
- dissolved, 25
- nonsettleable, 25
- settleable, 25
- suspended, 25
- total, 25
- volatile, 26

Solvent extraction, 330

Spray irrigation:

- design, 303
- performance of sprinklers, 304-5
- treatment efficiency, 302

Standards (Ten States and recommended), 8

Surface settling rate, 217

T

Thermal pollution, 29

Tolerance limit:

- lethal dose, 27
- medium tolerance limit, 27-29

Total organic carbon, 25

Toxicity, 29

Trickling filter:

- design, 177-78

Trickling filter (cont.)

- general, 152, 173
- package, 208

U

Ultimate disposal, 301

Urine production:

- animal, 67-68
- human, 59

V**Volume:**

- contact stabilization, 217
- extended aeration, 216

W

Waste load on stream, 2, 23

Wastewater:

- analysis, 21
- well, 64

Water blooms, 42

Water hammer, 356

Weirs:

- control, 132
- oxidation ditch, 251-53, 254
- package plant loading, 132, 223
- proportion, 132
- sutro, 132

Wet well:

- basin size, 345-46
- cast iron, 338-39
- cathodic protection, 339
- concrete, 336-37
- design, 358
- hydrostatic lift forces, 336-360
- large stations, 365
- plastic, 339
- self priming, 360
- steel, 339
- submersible pumps, 360-61
- vitrified clay, 339