

PRELIMINARY TREATMENT (aka PRETREATMENT)

WE WILL DISCUSS THE HEADWORKS:

- **WET WELL (PUMPS)**
- **SCREENS**
- **GRIT REMOVAL**
- **SHREDDERS**



**MOST TREATMENT
PLANTS ARE BUILT
DOWN-GRADIENT
FROM THE AREA
SERVED**

WWTP

**SAVES \$ TO MAKE USE OF "NATURAL"
FORCES—GRAVITY, SUNLIGHT, WIND
BIOLOGICAL ACTIVITY**

**SOMETIMES, PLANTS HAVE TO
BE LOCATED "UP-GRADIENT...**

- LAND AVAILABILITY
- HIGH GROUND WATER TABLE

MIGHT REQUIRE LOW-LIFT PUMPS

PUMPS

REQUIREMENTS FOR A GOOD PUMP ARE:

- **HANDLES VARIABLE FLOW**

- **MUST HANDLE DEBRIS**

- **FEWER MOVING PARTS—
THE BETTER**

SCREW PUMPS





**ARCHIMEDES
INVENTED THE
SCREW PUMP**

**ALSO KNOWN AS THE
"ARCHIMEDES SCREW"**

**ARCHIMEDES MORE FAMOUS FOR
HIS "LAW OF BUOYANCY"**

ALSO INVENTED/DEVELOPED:

- **CATAPULTS**
- **BURNING MIRRORS**
- **LEVER THEORY**

SCREW PUMPS

USED FOR:

- RAW AND TREATED SEWAGE
LIFT STATIONS
- ACTIVATED SLUDGE RETURN
- STORM WATER PUMPING
- LAND DRAINAGE/INDUSTRIAL
WASTE

SCREW PUMPS

- AVAILABLE FROM 1-FOOT TO 12 FEET DIAMETER

- HANDLES FLOWS FROM:
100 to 95,000 GAL/MIN

- LIFTS FROM 6 to 40 FEET



CLOSED SCREW PUMP

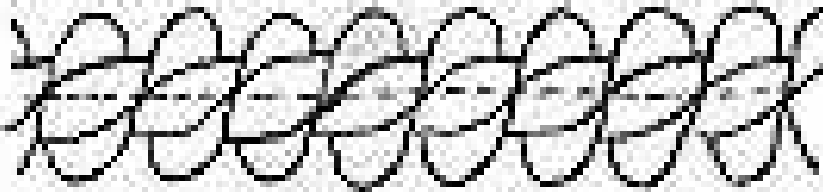


OPEN SCREW PUMP

ONE
FLIGHT



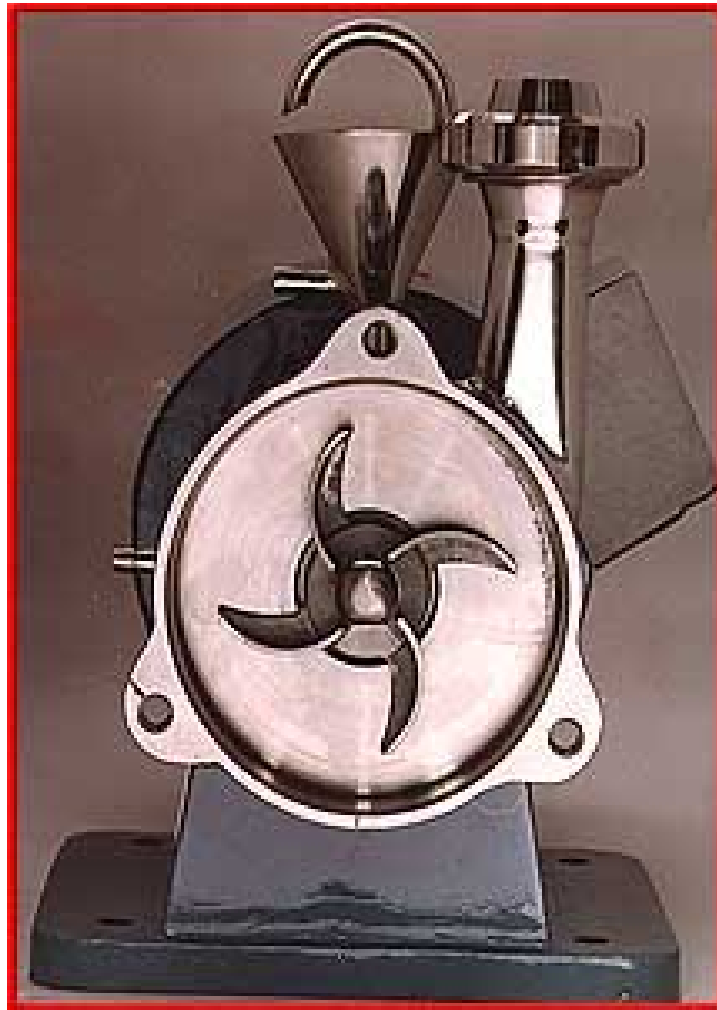
TWO
FLIGHT



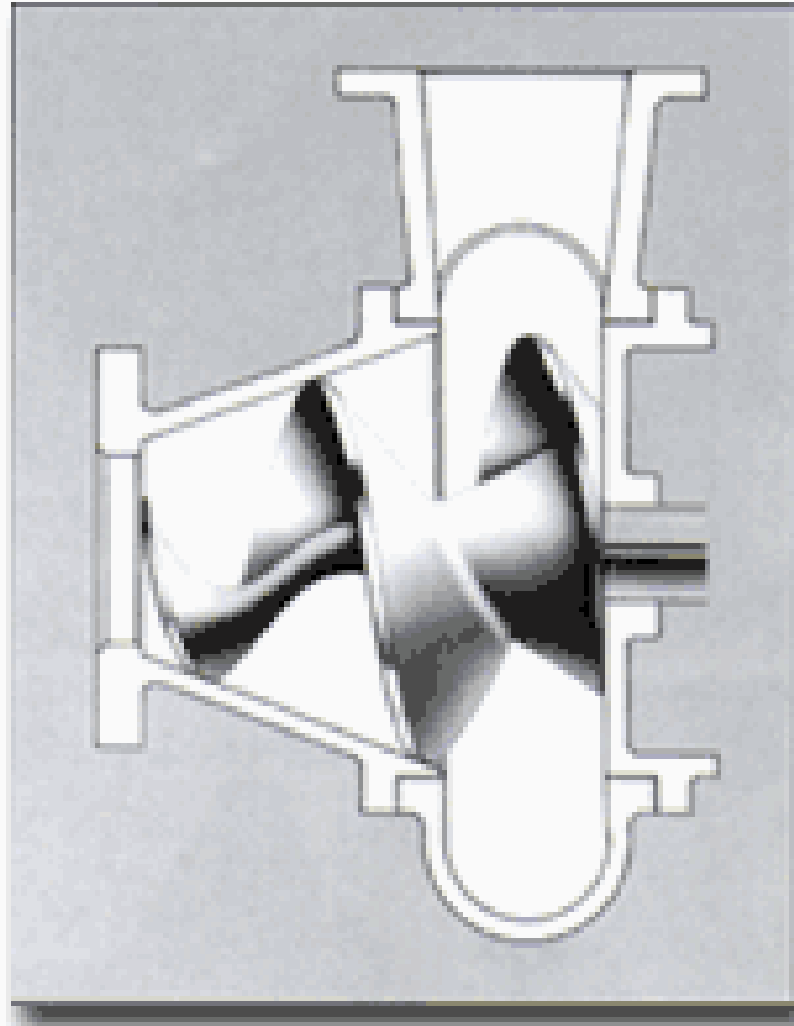
THREE
FLIGHT



**FLIGHTS (or HELIXES) ON A
SCREW PUMP**



CENTRIFUGAL PUMP



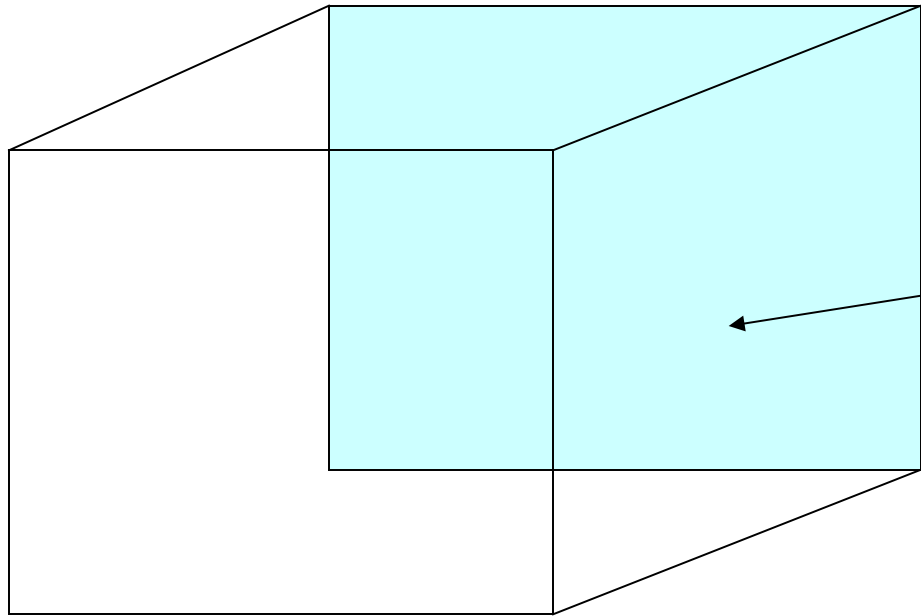
CENTRIFUGAL SCREW PUMP

"HEAD" and "HEAD LOSS"

**"HEAD" REFERS TO FLUID
PRESSURE or ENERGY**

**"HEAD LOSS" REFERS TO
ENERGY or FRICTION LOSS**

**BOTH ARE EXPRESSED IN INCHES
or FEET of WATER**



**One
cubic
foot of
water**

WEIGHS 62.4 POUNDS

**ONE FOOT OF "HEAD" IS
EQUIVALENT TO 0.433 pounds/sq in**

PRELIMINARY TREATMENT (aka PRETREATMENT)

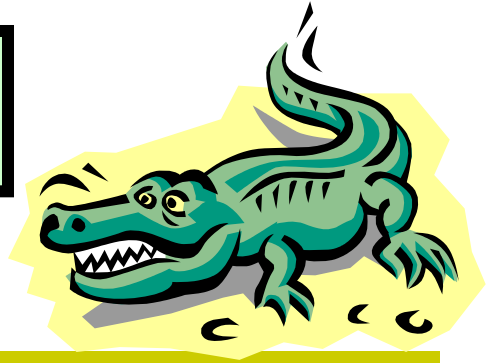
- SCREENING: TO REMOVE
LARGE

DEBRIS

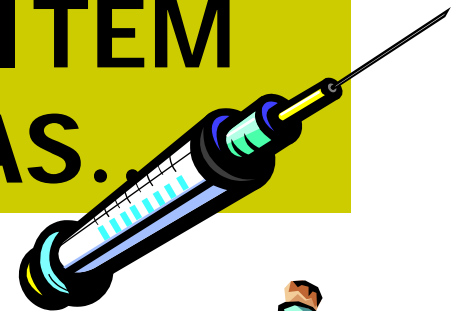
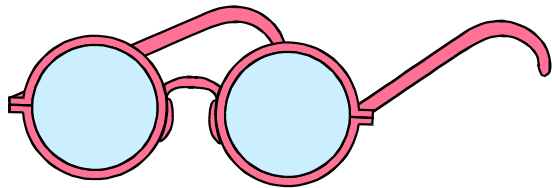
- **RACKS** and BAR **SCREENS**



SCREENING



PURPOSE: TO REMOVE LARGE, NON-BIODEGRADABLE ITEM FROM SEWAGE SUCH AS.



RACKS

- BAR SPACING 3 to 4 INCHES

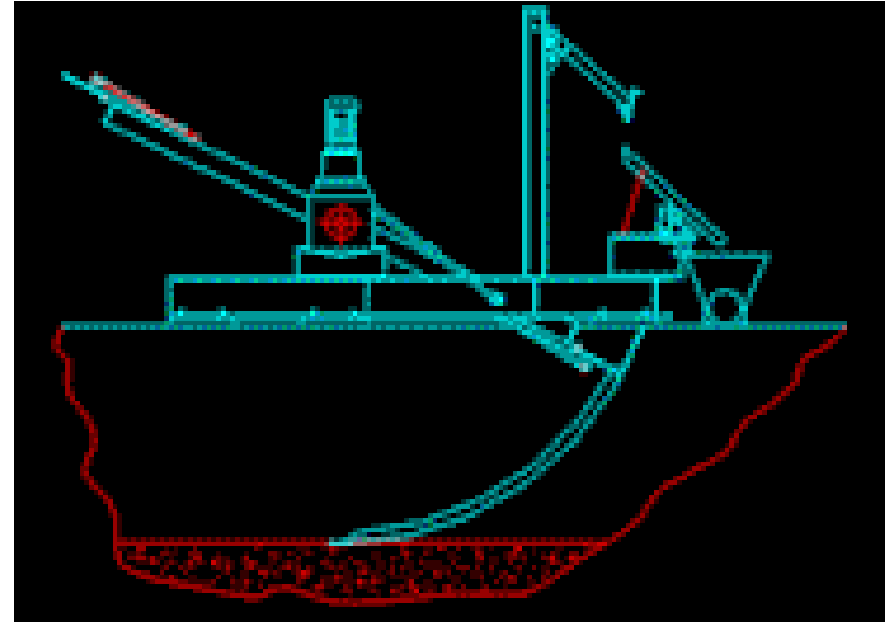
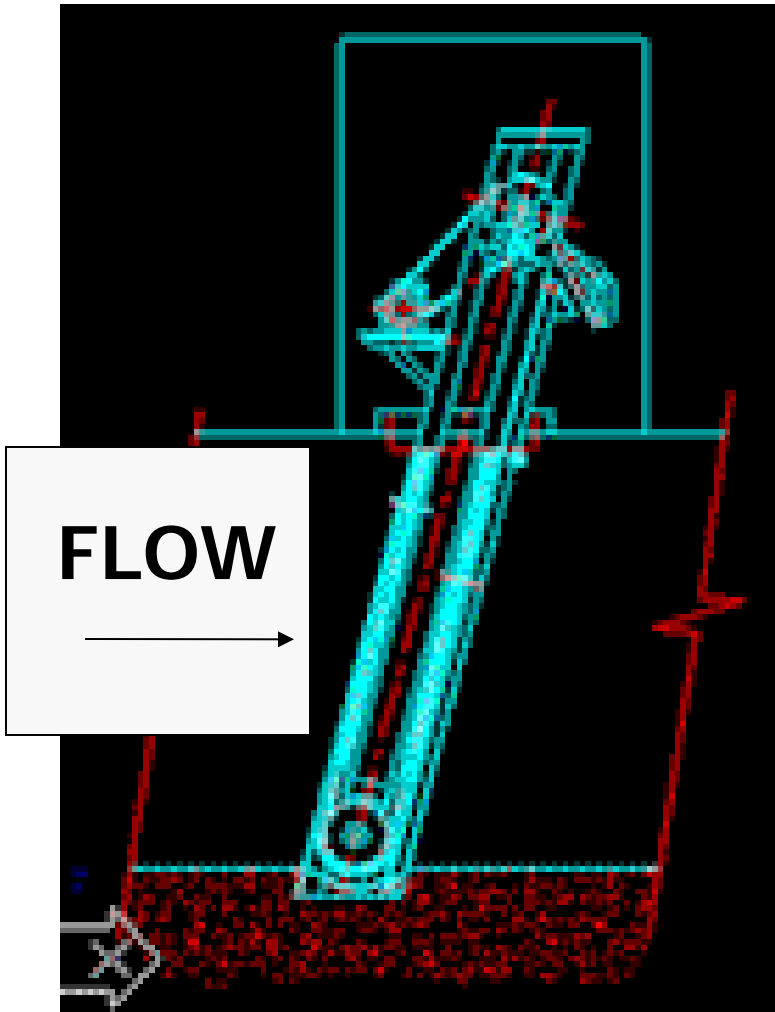
- INCLINED UP TO 45 DEGREES

- USUALLY MANUALLY CLEANED

BAR SCREENS

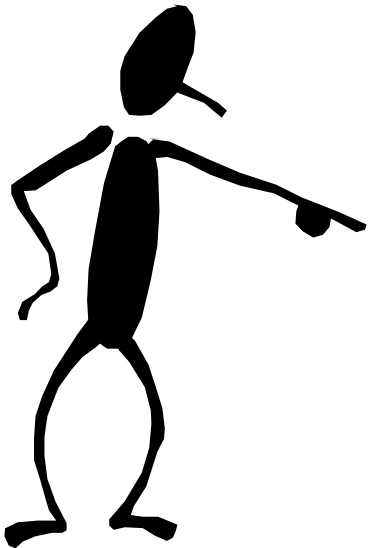
- BAR SPACING 3/8 to 2 INCHES

- OFTEN MECHANICALLY CLEANED

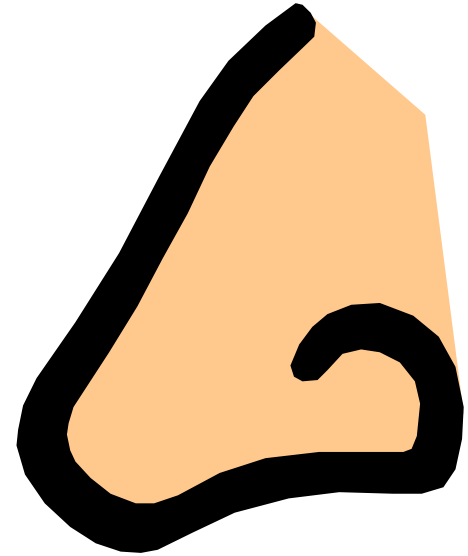
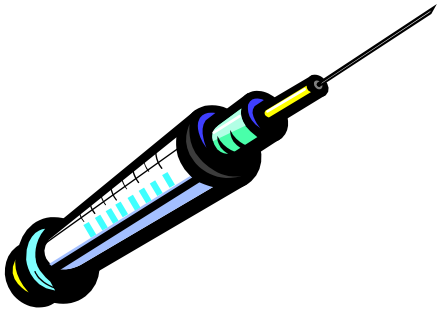


INCLINED & RADIAL BAR SCREENS

**TURN OFF AND LOCK-OUT
ANY ELECTRICAL
EQUIPMENT BEFORE YOU
WORK ON THEM!**

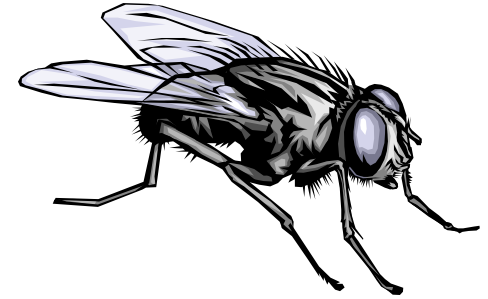


**KEEP THE SCREENS
CLEAN TO REDUCE HEAD
LOSS (AND COSTS)**



**SCREENINGS "STINK" AND MAY
BE HAZARDOUS**

**DISPOSE OF BY BURIAL OR
INCINERATION**



- **BURY WITH AT LEAST 6 INCHES OF COVER- - TO DISCOURAGE VECTORS**

- **NO ADVERSE AFFECTS ON GROUND OR SURFACE WATERS**

GRIT REMOVAL

RECALL:

**“GRIT” IS HEAVY INORGANIC
MATERIAL SUCH AS SAND, EGG
SHELLS, CINDERS**

**"GRIT", WHEN MIXED
WITH GREASE, TAR AND
OTHER CEMENTING
MATERIALS...**

**• WILL CAUSE EXCESSIVE WEAR
ON PUMPS**

• WILL CLOG PIPES and SUMPS

**GRIT + OIL + GREASE =
DETRITUS**

**IN SOME AREAS, GRIT
CHAMBERS (or
CHANNELS) ARE CALLED
"DETRITUS TANKS"**

WASTEWATER CONTAINS
SOME SOLIDS THAT WILL
NEITHER SINK NOR FLOAT!

- COLLOIDS = FINELY DIVIDED
DISPERSED SOLIDS
- EMULSIONS = LIQUIDS THAT
WILL NOT DISSOLVE IN EACH
OTHER (GREASE, FATS, OIL in
WATER)

FLOATATION PROCESS

AIR IS PUMPED INTO THE
WASTEWATER THEN REMOVED BY
VACUUM OR RELEASED UNDER
PRESSURE TO REMOVE COLLOIDS and
EMULSIONS

TYPES OF GRIT CHAMBERS

1) HORIZONTAL FLOW

2) AERATED

3) VORTEX (cyclone separator)

HORIZONTAL GRIT CHAMBER

- **OLDEST TYPE AND
MOST COMMON**

- **EXPERIENCE HAS SHOWN A
VELOCITY AROUND 1 ft /sec IS
BEST FOR GRIT REMOVAL**

**MAINTAINING A CONSTANT
FLOW THROUGH THE CHAMBER**

**BECAUSE INFLUENT QUANTITIES
VARY, YOU MUST:**

- **VARY THE NUMBER OF CHAMBERS
ON LINE**
- **USE A PROPORTIONAL (aka SUTRO)
WEIR AT THE OUTLET OF THE CHAMBER**

WHAT'S A PROPORTIONAL WEIR?

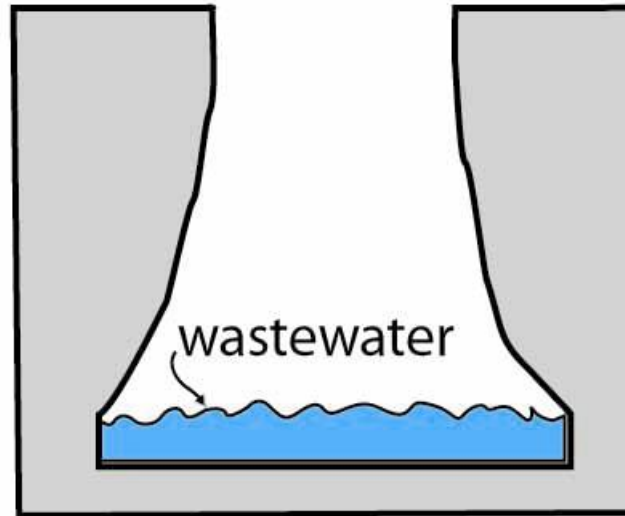
**A SPECIALLY DESIGNED
CONSTRICTION TO GO IN THE
EFFLUENT END OF A GRIT
CHAMBER**

**FLOW THROUGH THE WEIR IS
PROPORTIONAL TO THE HEIGHT OF
THE WATER IN THE CHANNEL**

HOW A PROPORTIONAL WEIR WORKS:

$$Q = \underline{V} \times \underline{A}$$

WHERE: Q IS
THE FLOW;
 V IS THE
VELOCITY, AND
 A IS THE
CROSS-
SECTIONAL
AREA



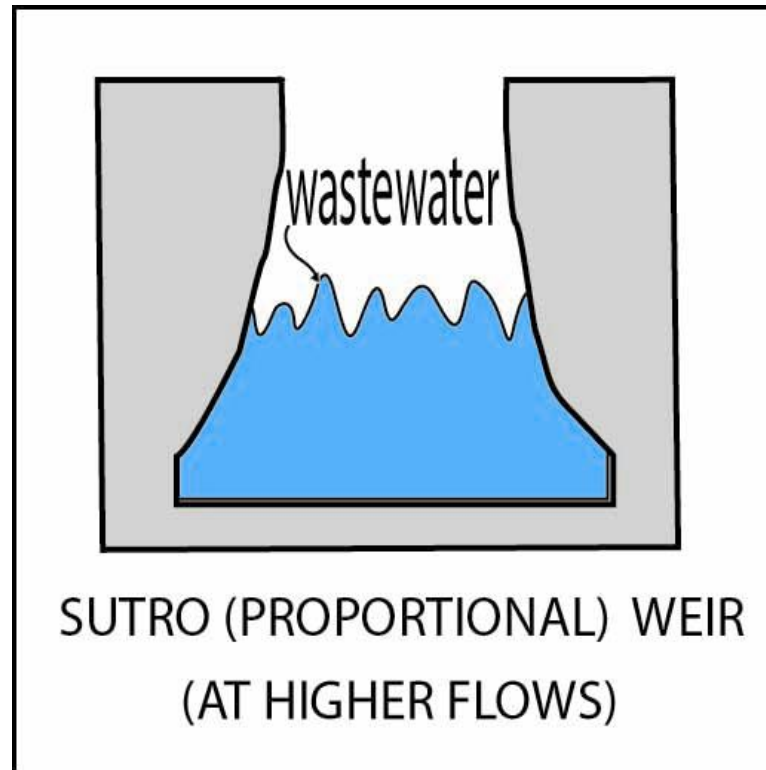
SUTRO (PROPORTIONAL) WEIR
(AT LOW FLOWS)

VELOCITY = 1 FPS

HOW A PROPORTIONAL WEIR WORKS:

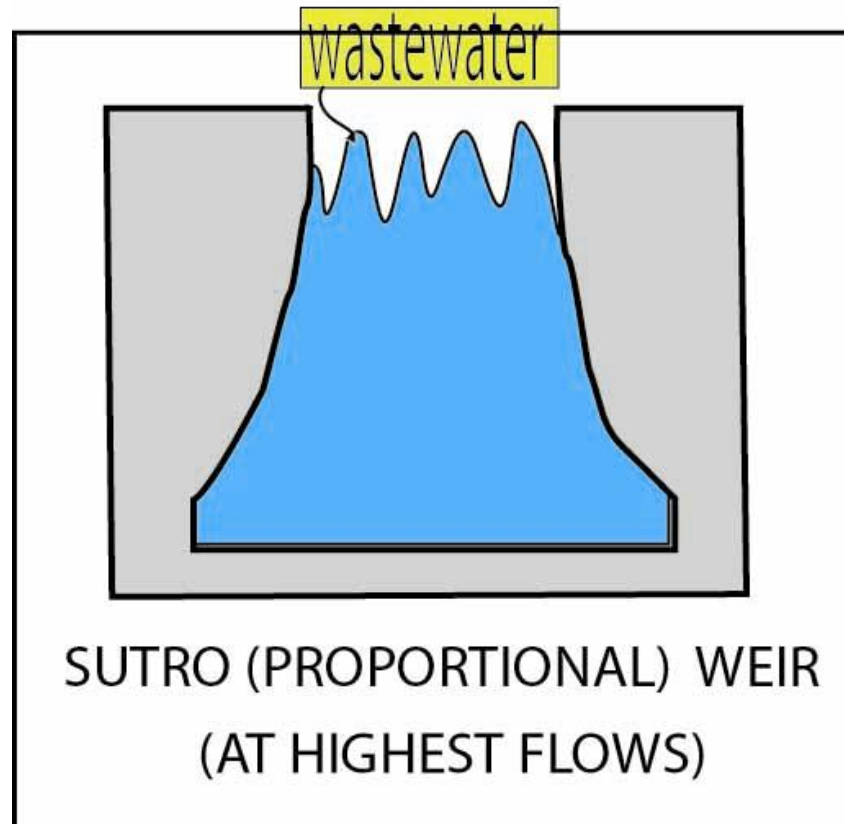
$$V=Q/A$$

AS Q
INCREASES,
 A MUST
DECREASE
FOR V TO
REMAIN AT
1 FPS.



VELOCITY = 1 FPS

HOW A PROPORTIONAL WEIR WORKS:



VELOCITY remains = 1 FPS

**HOW TO MEASURE
VELOCITY IN A GRIT
CHAMBER**

**ONE EASY WAY IS TO DROP
IN SOMETHING THAT
FLOATS AND TIME IT OVER
A MEASURED DISTANCE**

GRIT CHAMBER VELOCITY

**EXAMPLE: YOU DROP IN
A STICK AND IT TAKES
20 SECONDS TO FLOAT
25 FEET.**

$$\text{VELOCITY} = 25 \text{ FT} / 20 \text{ SEC} = \underline{1.25 \text{ fps}}$$

PARTICLE REMOVAL in a grit chamber

- **DESIGNED TO REMOVE
0.2 mm SAND PARTICLES**
- **0.2 mm SAND SETTLES AT
22 mm/sec (0.075 ft/sec)**
- **About 13 sec for a particle to
settle 1 ft (1 ft/0.75 ft/sec
= 13.3 sec)**

SHORT CIRCUITING AND "DEAD" SPOTS IN TANKS

NO TANK IS PERFECT WHEN IT
COMES TO FLOW

DEAD SPOTS (LITTLE or NO FLOW)
DEVELOP WHERE ORGANICS
CAN SETTLE OUT

DEAD SPOTS CAUSE PROBLEMS

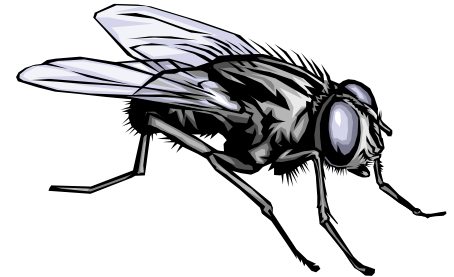
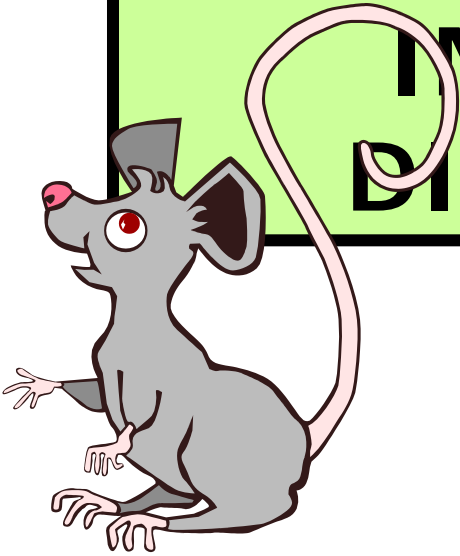
**ORGANICS BEGIN SETTLING
AND BECOME "PUTRESCIBLE"**

**SOMETIMES DEFLECTORS CAN
BE PLACED IN THE GRIT
CHAMBER TO MINIMIZE DEAD
SPOTS**

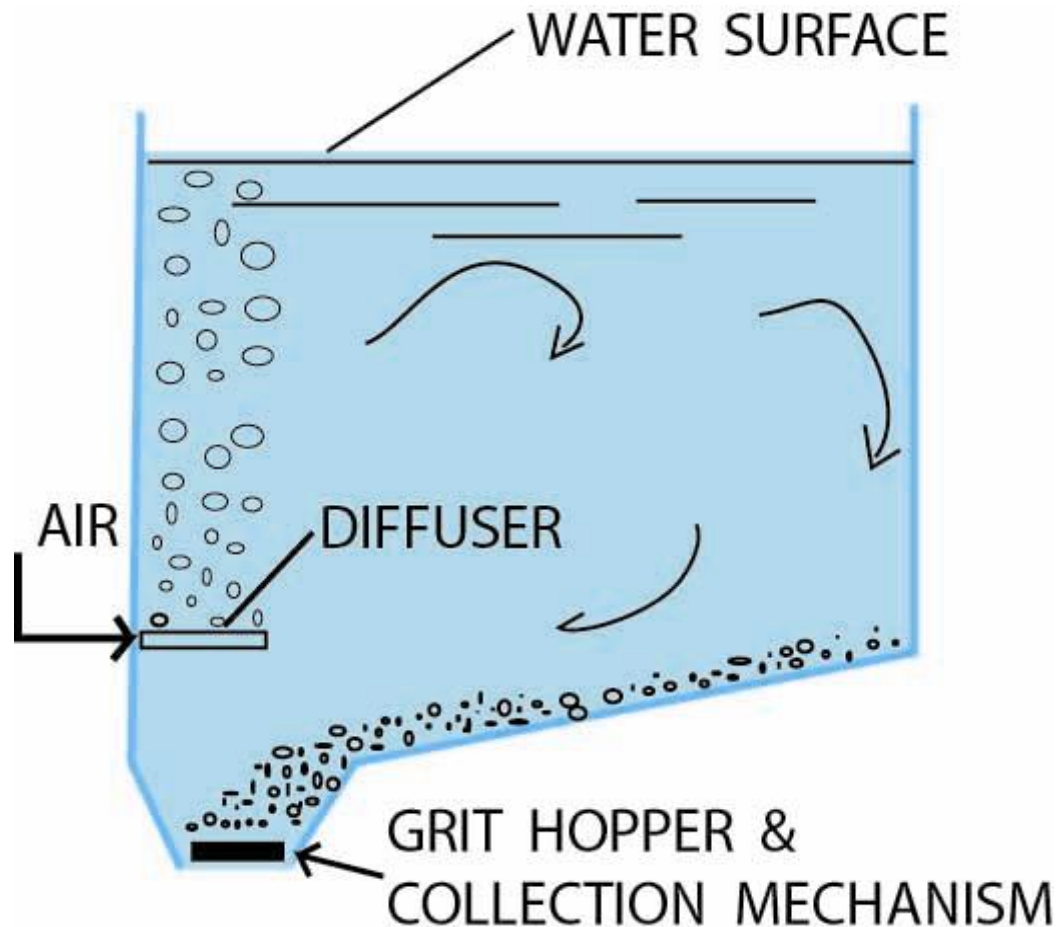
GRIT DISPOSAL

- SHOULD BE REMOVED DAILY

- BURIED WITH AT LEAST 6
INCHES OF COVER TO
DISCOURAGE VECTORS



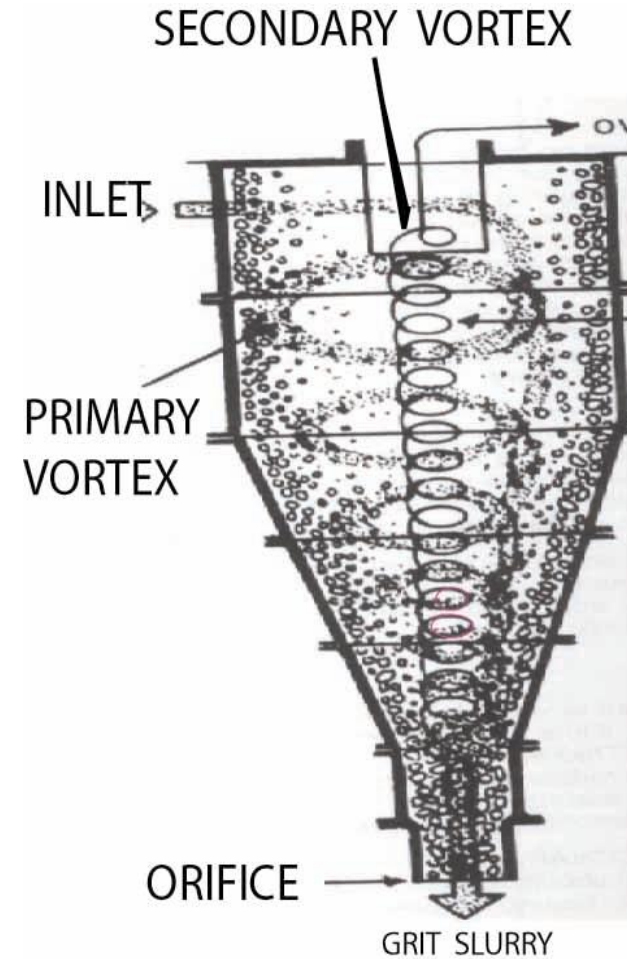
AERATED GRIT CHAMBER



AIR/WATER MIXTURE HAS LOWER SPECIFIC GRAVITY THAN WATER ALONE- GRIT SETTLES

VORTEX (CYCLONE) GRIT SEPARATOR

CENTRIFUGAL FORCE MOVES HEAVIER PARTICLES TO OUTSIDE WALL

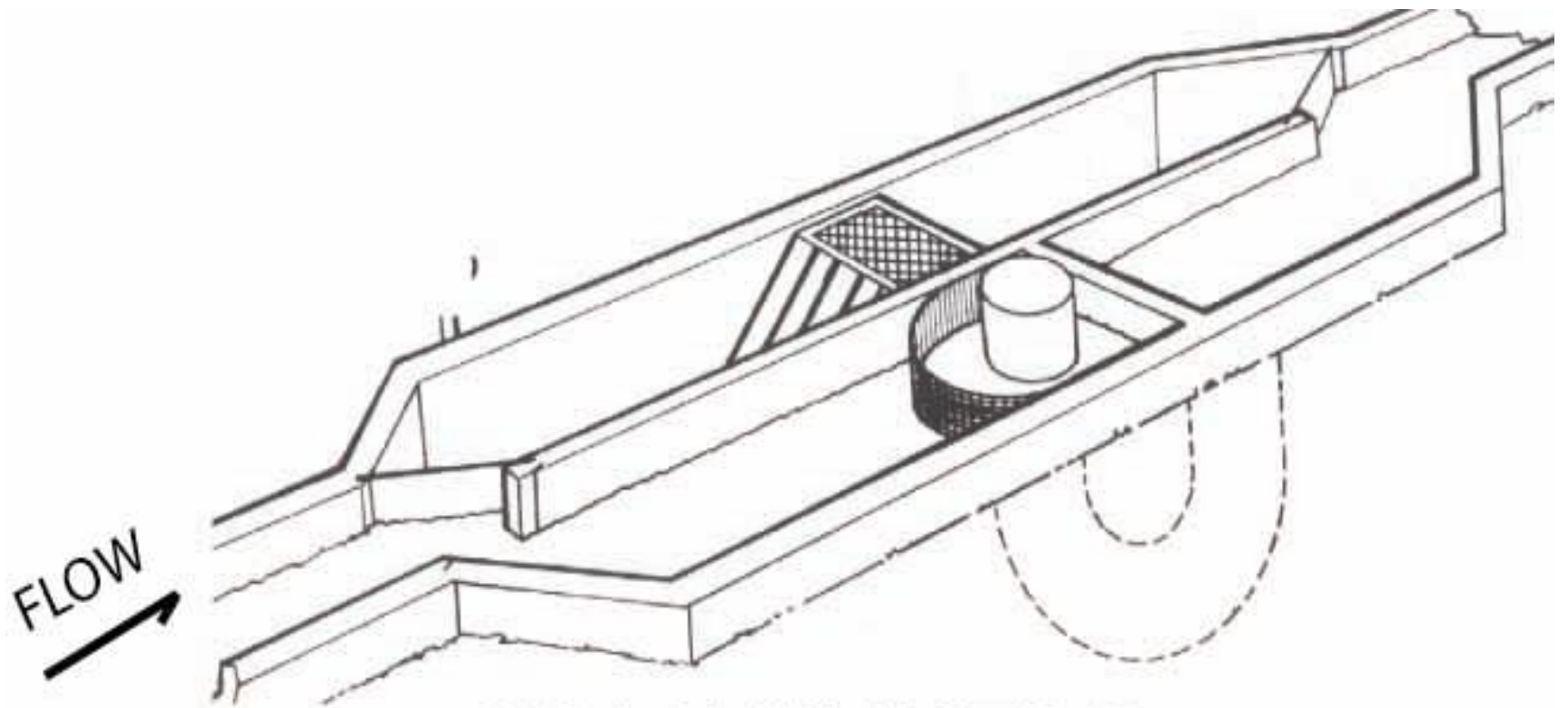


VORTEX (CYCLONE) SEPARATOR

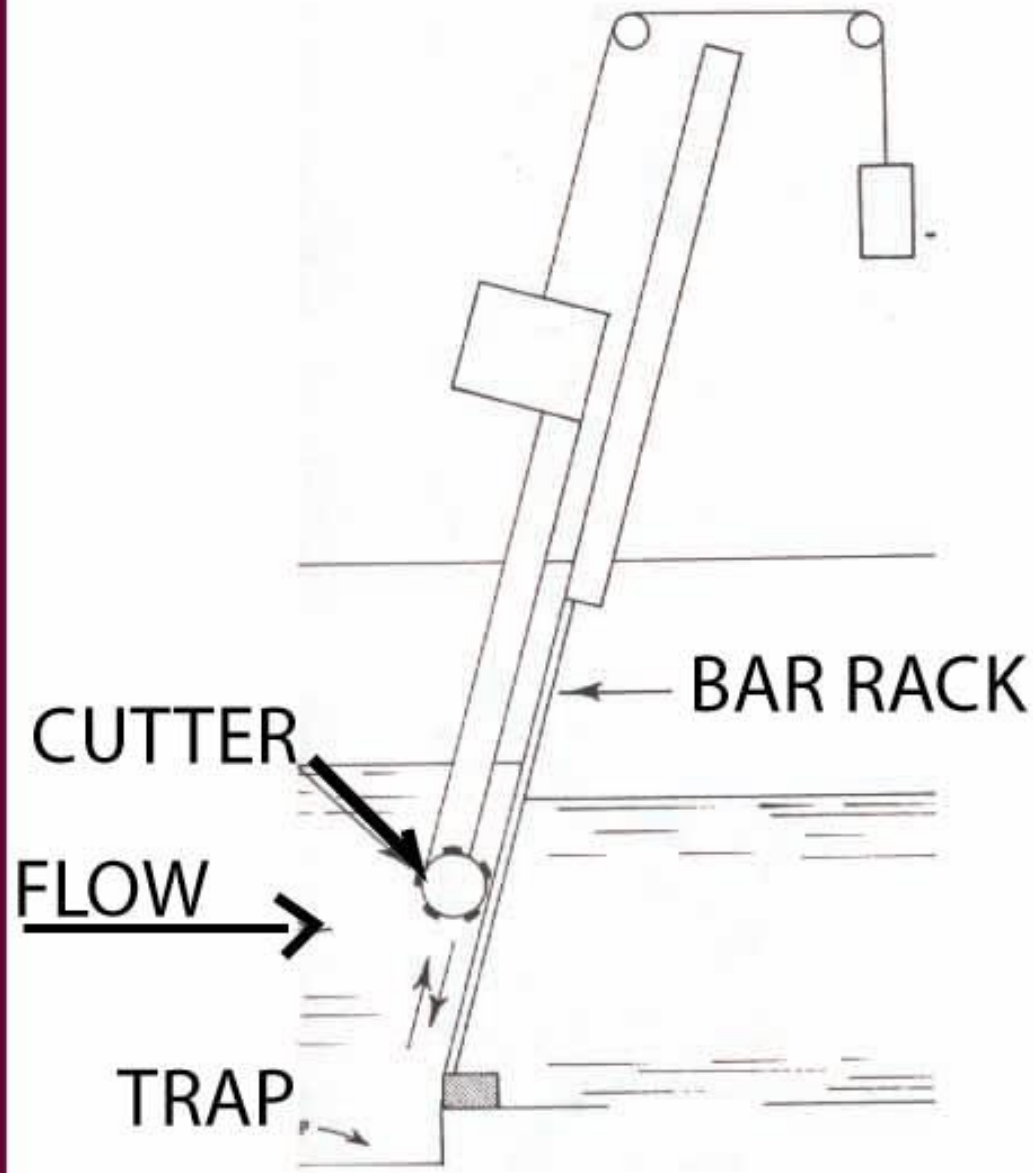
COMMINUTION (SHREDDING)

SOMETIMES...

- USED IN LIEU OF BAR SCREENS
- FOLLOW BAR SCREENS
- FOLLOW GRIT CHAMBER



COMMINUTOR



BARMINUTOR (SIDE VIEW)

NEWER TYPES OF SHREDDERS



BAR SCREEN MONSTER®

NEWER TYPES OF SHREDDERS



MUFFIN MONSTER®

**WIDELY USED IN
PRISONS TO PREVENT
SEWER BACKUPS**

NEWER TYPES OF SHREDDERS



AUGER MONSTER®

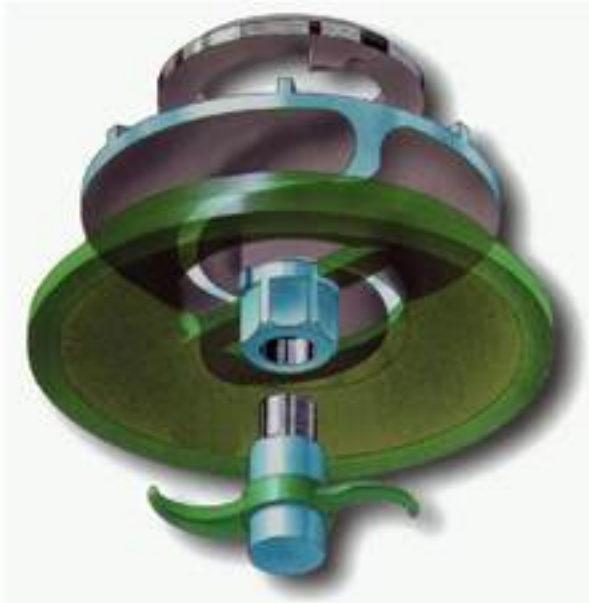
**OTHERS INCLUDE:
Mini Monster;
Macho Monster,
Channel Monster**

NEWER TYPES OF SHREDDERS

DIMMINUTOR®



NEWER TYPES OF SHREDDERS



CHOPPER PUMP