EROSION CONTROL GUIDELINES, PART 4 DEWATERING, 3rd Edition

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SYNOPSIS: Any volume of water, pumped from any source to any discharge area, will create some degree of impact in each of those habitat areas. We have included a brief review of dewatering, including definitions, chemical, biological and physical co-factors which may be relevant. Discharge volumes should be calculated as a function of time. Thermal differentials should be carefully considered. FW habitats may change by up to sixty degrees seasonally but marine habitats have a much narrower thermal envelope. Discharge sites should be monitored for diversity. Reduction in micro to meso species diversity usually signals anomalous stress levels.

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I. DEFINITIONS

1. Short or long term removal of a water volume encountered, when the scope of a project requires temporary access below sea level or within the groundwater lens.
2. Removal of water is determined to be necessary, in order to facilitate safe installation of structural components or utilities.
3. Dewatering may be “same source” (FW to FW or well; salt water to salt water).
4. Dewatering may be “conflicting sources” (FW to salt water; FW to dry land)
5. Discharge is pumped to dry land, 2ndary well, wetland or open water.

6. Characteristics of Cape Cod Aquifer:
   a. Rainfall percolates through sandy soils into the fresh water lens.
   b. Horizontal migration moves ground water towards shorelines.
   c. This fresh water lens may elevate and subside seasonally.
   d. Near the coast, the freshwater lens may fluctuate diurnally.
   e. Lens elevations are reflected in wetland and pond levels.
   f. Cape water bodies are all groundwater fed, not discharge fed.
7. Substrate particle mix affects rate of horizontal migration at a source area, and rate of percolation at a discharge site. Smaller particle mix will have slower rates, larger particle mix will demonstrate faster rates.
8. Substrate particle size has a direct relationship to water retention rates: Coarser particles have lower retention rates, fine particles contribute to higher retention rates.

II. SCOPE

1. Small scale: boats, basements, foundations.
2. Medium (meso) scale: wharf construction, roadway.
3. Large (macro) scale: river crossing.
4. These guidelines will discuss meso scale dewatering but most techniques may be successfully applied to smaller scale projects.

III. DURATION

1. Short term: 24-72 hours or periodic.
2. Long term: Extended, 24/7 for up to 100 days.

IV. VOLUMES

1. Low volume: (5K GPH) Gasoline or diesel powered pumps.
2. Medium volume: (10-100 KGPH) Diesel or electric pumps.
3. High volume: (+1 MGD) Electric generators provide power.

V. TECHNIQUES

1. Collection:

   a. Open hose: direct removal of ground water from excavation.
   b. Well extraction: well points are inserted adjacent to the area.

2. **Discharge:**
    a. Direct: open hose
    b. Indirect: diffuser; filter bag; filter sock; stabilization tank.
    c. Closed (limited) site: pond; swale; bog, field swale; well.
    d. Open (unconfined) site: intertidal; open water; open field areas.

VI. IMPACTS

1. **Removal site impacts:**
    a. Depression of the water table may impact adjacent tree roots.
    b. Depression of water table may impact adjacent vernal pools.
    c . Removal of water can mobilize contaminants at source.
2. **Closed site discharge impacts: FW-FW**
    a. Physical impacts
        i. Existing water could be displaced.
        ii. High volume could alter circulation in wetlands.
        iii. High velocity could erode subsurface sediments.
        iv. Introduced sediment and silt may alter phonic zone.
        v. Sediment and silt could smother vegetation.
        vi. direct discharge of ground water is habitat anomaly.

    b. Chemical impacts: Source pH could vary from discharge pH
        i. pH is a key water quality parameter, influencing a wide array of hydrochemical and biochemical functions.
        ii. Altered pH could create chemical precipitation.
        iii. Altered pH could weaken macro, micro invertebrates (Ion rebalancing requires excess bio energy).
        iv. Altered pH could reduce micro rhizome function.
        v. Lower pH could impact phytoplankton exoskeletons.
    c. Biological impacts
        i. Altered temperatures impact metabolism rates
        ii. Altered temperatures change available dissolved oxygen
        iii. Discharge may alter available nutrient levels.
        iv. Discharge may contain non-systemic nutrients
        v. Discharge flow could free sediment nutrients
        vi. Temperature stratification may be interrupted
        vii. Thermal mass differential introduced at discharge contributes to lethality indices of aquatic and marine species.

3. **Open intertidal discharge impacts: FW-SW**
   a. Physical impacts
      i. High volume could create chronic erosion patterns
      ii. High velocity could create abnormal erosion rate.
      iii. High volume and or velocity can generate sediment transport
      iv. Sediment and silt transport may alter photic zones
      v. Deposition may impact benthic invertebrates
      vi. Direct discharge of ground water is habitat anomaly

   b. Chemical impact:
      i. Groundwater pH would be lower than seawater.
      ii. Lower pH could create chemical precipitation .
      iii. Lower pH could weaken macro and micro invertebrates (ion rebalancing requires bioenergy).
      iv. Lower pH could alter available nutrients.
      v. PH below 7 reduces phytoplankton and larval invertebrate's accretion of exoskeletons.
      vi. Discharge may contain different dissolved gasses.

   c. Biological impacts:
      i. Altered temperatures impact metabolic rates.
      ii. Thermal shock from discharge can be lethal to organisms
      iii. Altered temperatures impact dissolved oxygen.
      iv. Discharge could introduce additional nutrients.
      v. Silt and sediment loading can reduce light levels.
      vi. High volume, long term freshwater flow would alter localized benthic population and diversity.
      vii. Discharge may be a vector for introducing bacteria.

4. **Open intertidal discharge impacts: SW-SW**
   a. Physical impacts
      i. High volume could create chronic erosion patterns
      ii. High velocity could create abnormal erosion rate.
      iii. High volume and or velocity can generate sediment transport
      iii. Sediment and silt transport may alter photic zones
      iv. Deposition may smother benthic invertebrates
   b. Chemical impacts:
      i. Discharge may contain different dissolved gasses.

ii. Discharge may contain benthic contaminants.

c. Biological impacts:

i. Discharge could introduce additional nutrients.

ii. Silt and sediment loading can reduce light levels.

VII. MITIGATION STRATEGIES

1. Velocity, volume and duration:

a. Reduce pumping.
b. Phase pumping.
c. Reduce discharge intensity with manifold system.
d. Reduce discharge intensity with diffuser system.
e. Reduce point source impacts with multiple lines.
f. Discharge using spray heads.
g. Utilize outgoing tide for dispersal.

2. Suspended particles:

a. Eliminate particles at source with filters.
b. Use well points with filter screens.
c. Use filter bag at discharge point.
d. Discharge into straw lined surface swale.
e. Discharge into excavated swale.
f. Use settling tank.
g. Fine particle films may require removal in discharge area.

3. Temperature:

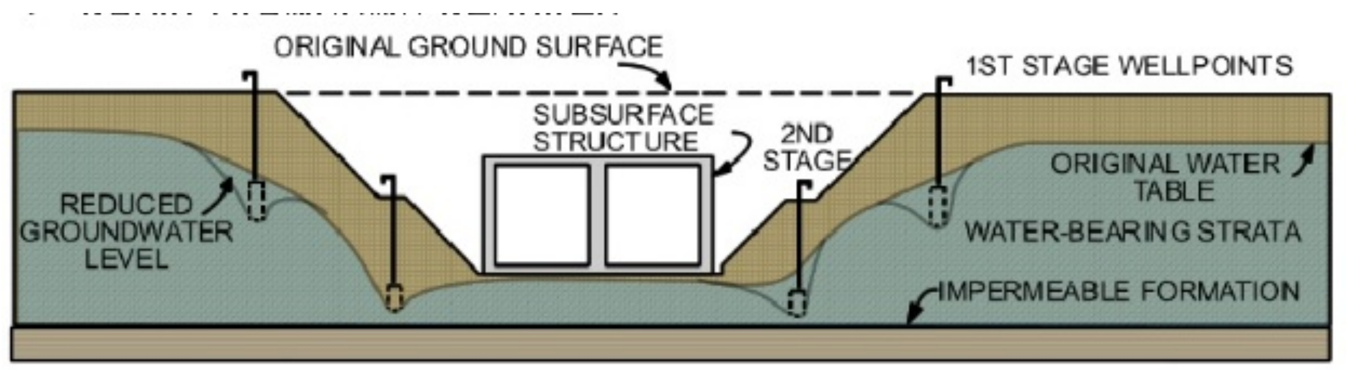
a. Open surface waters may reflect air temperatures.
b. Ground water will reflect Earth temperature.
c. Differentials may require above grade holding basin for adjustment.
d. Spray heads can expose ground water to air temperature.
e. Reverse differentials may require diffused discharge.
f. Water body temperature may vary as a function of depth.
g. Reduce thermal differential by utilizing natural thermal layering

4. Chemical:

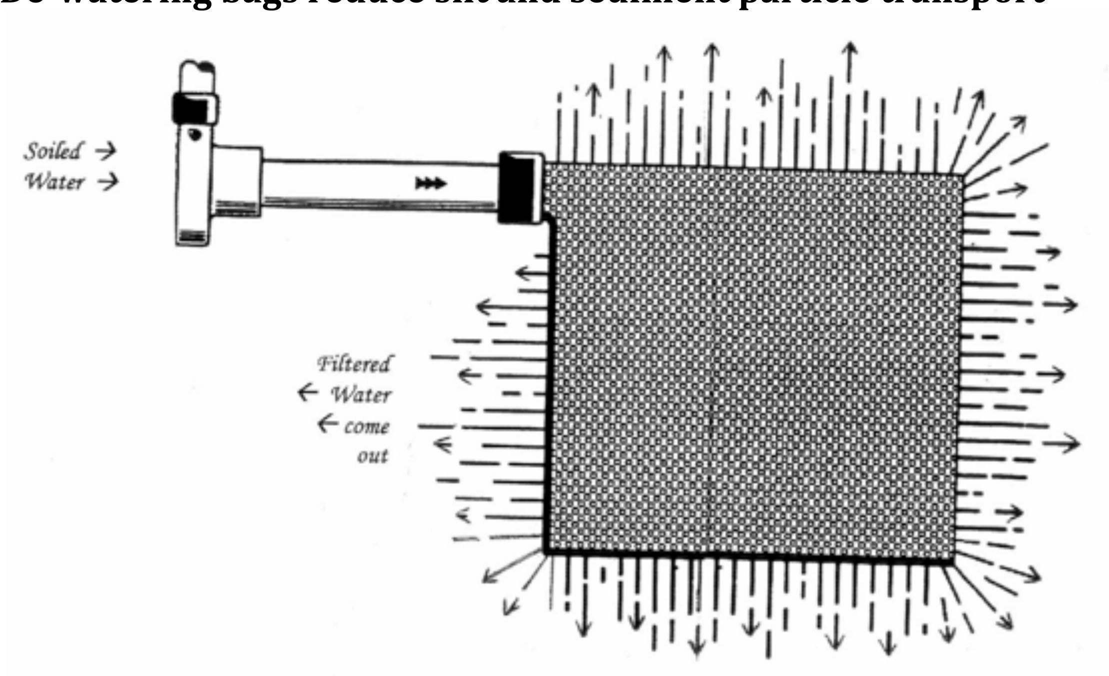
a. Cape ground water pH is approximately 5.5 -6.5.
b. FW Wetlands may also have lower, more acidic pH.
c. Sea water pH is usually between 7.9-8.2.
d. Holding tanks would allow adjustment of pH.
e. Filter bag also would allow adjustment of pH .
f. Swimming pool chemicals can adjust pH before discharge.

VIII. Illustrations

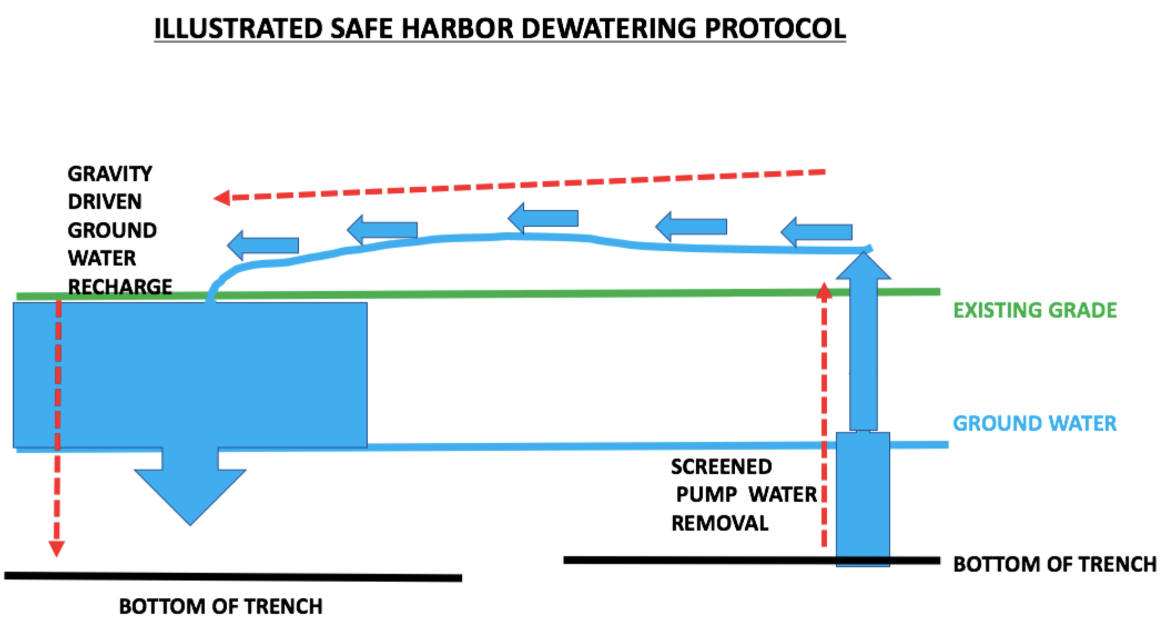
Meso scale de watering, using wells. Discharge not specified.



De-watering bags reduce silt and sediment particle transport

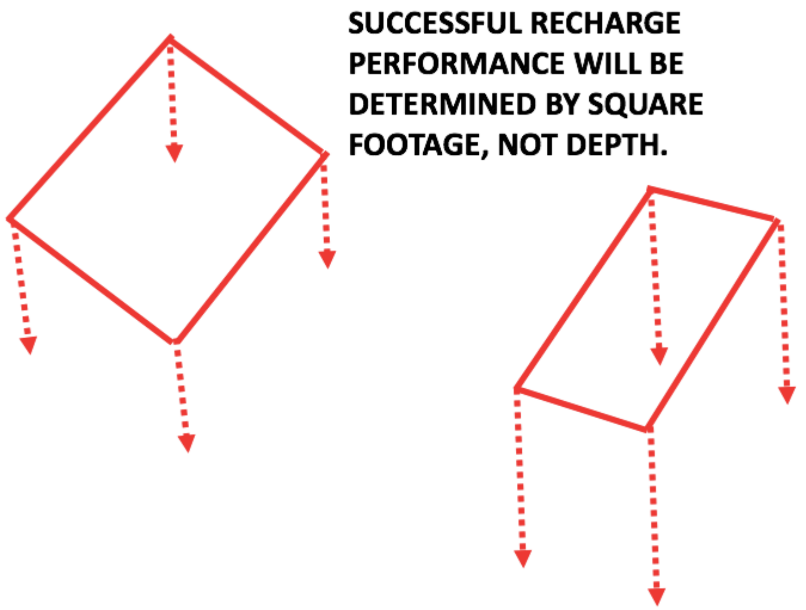


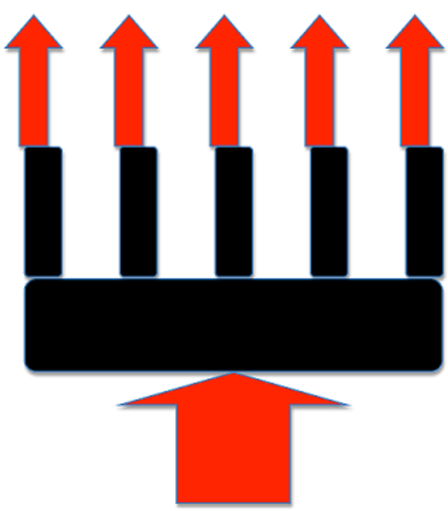
Filter bags installed in the field, filtering sediment but not total silt load



<u>Strategy of land based, ground water to ground water de-watering systems</u>

For consideration with ground water to ground water systems

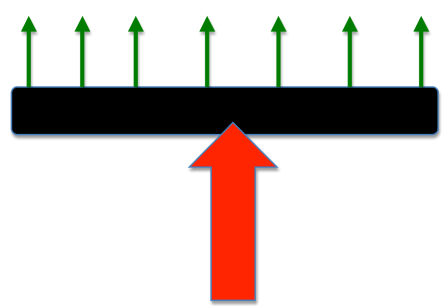




Erosion Control Guidelines: Dewatering

Use manifold to reduce velocity and volume

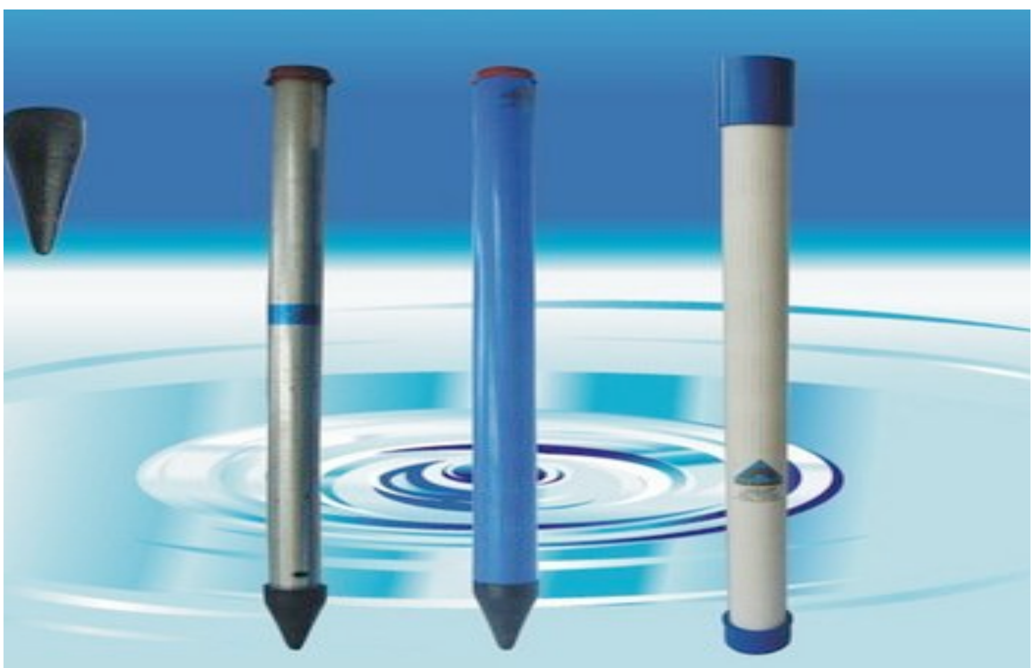
Dewatering System Mitigations: Diffuser Pipe



Conceptual sketch of PVC diffuser system.
Volume/velocity calculations necessary.
May be used with or without filter systems.
For use with enclosed or open discharges.

For consideration with direct discharge, manifolds for either type of system and diffuser for water to discharge water systems

Settling tanks can aid in controlling pH and sediment



Filter Screens on Wells, Eliminate Particle Transport