Adopted 10/25/2016

CMP POLICY & IMPLEMENTATION COMMITTEE MEETING
Richard J. Sullivan Center
Terrence D. Moore Room
15 C Springfield Road
New Lisbon, New Jersey
August 26, 2016 - 9:30 a.m.

MINUTES

MEMBERS IN ATTENDANCE: Sean Earlen (Chairman) Candace Ashmun (via telephone), Robert Barr, Ed Lloyd, Richard Prickett and Joe DiBello (Alternate)

MEMBER ABSENT: Paul E. Galletta and Ed McGlinchey

OTHER COMMISSIONER PRESENT: Mark Lohbauer

STAFF PRESENT: Executive Director Nancy Wittenberg, Larry L. Liggett, Susan R. Grogan, Ed Wengrowski, Paul D. Leakan and Betsy Piner. Also present (by telephone) was Ms. Lisa LeBoeuf with the Governor's Authorities Unit.

Chairman Earlen called the meeting of the Policy and Implementation (P&I) Committee to order at 9:37 a.m.

All present pledged allegiance to the Flag.

1. Adoption of minutes from the July 29, 2016 CMP Policy & Implementation Committee meeting

Commissioner Barr moved the adoption of the July 29, 2016 meeting minutes. Commissioner DiBello seconded the motion. The minutes were adopted with all Committee members voting in the affirmative.

2. Alternate Design Treatment Systems Pilot Program

Mr. Wengrowski made a PowerPoint presentation on the alternate design wastewater treatment system pilot program (*Attachment A to these minutes and posted on the Commission's web site at: http://www.state.nj.us/pinelands/home/presentations/Alt%20Design%20Pilot%20Program%20Annual%20Report%20to%20Commission%20Aug.%202016.pdf*)

Mr. Wengrowski provided an overview of the pilot program, recognizing some of the original members of the Pinelands *ad hoc* Committee on Alternative Septic Systems who were present at this meeting and noting that, although septic systems are not a glamorous topic, they are essential to the protection of the environment. His presentation highlighted the basis of the program, the ecological implications of not protecting Pinelands waters and the siting, function and design of onsite wastewater treatment systems. Finally he reviewed the recommendations of the 2016 Pilot Program Report, noting that the Committee had reviewed a draft rule proposal at its last meeting.

In response to a question from Commissioner Lloyd regarding the upgrade of septic systems on quarter-acre lots, Mr. Wengrowski said that the traditional systems are grandfathered as long as the home retains its current configuration. But, if the house is expanded and the flow is increased, the system must be updated to one of the advanced treatment systems.

Also, in response to a question from Commissioner Lloyd if the expansion of commercial uses involved community wastewater treatment systems, Mr. Wengrowski said these were not community systems, rather Amphidrome on-site systems, enhanced over what is used in residential applications.

In response to a question from Commissioner McGlinchey regarding the process to permit an innovative system to serve the expansion of a commercial project, Mr. Wengrowski said that the first question to ask is "in which management area is the project located?" If it is located in the (non-growth-oriented) Rural Development Area, the use of an advanced treatment system to meet Pinelands water quality standards would currently not be permitted if the lot were "undersized" and incapable of meeting the water quality standard by dilution alone. He said the P&I Committee had been presented with a proposed CMP amendment (*see minutes of meeting of July 29, 2016*) that, if adopted, would allow for (pre-CMP) pre-existing facilities to expand or change use (to another conforming use) even if located in a non-growth-oriented Pinelands Management Area.

Mr. Wengrowski said, the next question is "is the technology capable of treating the constituents of the wastewater to meet CMP standards?" For instance, the wastewater from a butcher shop is different from that of a law office. One needs to know the wastewater characteristics. He noted that there is more dilution of wastewater in a residential environment than in a typical CVS store, for example. He said that the vendor of the proposed technology must demonstrate that they have used the system to serve a similar facility elsewhere and that it is capable of meeting CMP water quality standards. Proof of performance would be made through the submission of effluent monitoring reports.

Only if an application for non-residential expansion/change of use passes these two tests (management area and appropriate treatment of effluent) can an innovative system be considered for use, Mr. Wengrowski said. Upon approval, the installation must be performed by an installer meeting the New Jersey Department of Environmental Protection (NJDEP) definition of an "authorized installer" and the system would need to be monitored by an individual meeting NJDEP's definition of an "authorized service provider."

Commissioner Ashmun said that this program has proven to be even better than envisioned originally. She reminded those present that these systems are permitted only on existing lots and they are not intended to change Pinelands zoning. She said they are to permit development on lots that are otherwise too small to meet the dilution standards. She congratulated Mr. Wengrowski on his work.

3. Plan Review

- **Update on Kirkwood/Cohansey aquifer groundwater withdrawal discussions**

Mr. Liggett made a PowerPoint presentation (*Attachment B to these minutes and posted on the Commission's website at: http://www.state.nj.us/pinelands/home/presentations/Kirkwood-Cohansey%20Water%20management%20presentation.pdf*) that provided an overview of the ongoing discussions and April 2016 meeting conducted with experts regarding water management and the protection of the Kirkwood-Cohansey (K/C) aquifer system. Mr. Liggett said the Commission has an obligation to plan for future development. He said, in the Pinelands, most water supply needs are met with sub-surface waters. He said the current demand is 100 million gallons per day (mgd). The estimates for the future are for the equivalent of 40 additional wells to provide for a total 140 mgd, yet there have been no new wells in the last eight to ten years. He said the CMP prohibits the export of water more than ten miles beyond the Pinelands boundary. In addition, the K/C can be used only if there is no viable alternative or no adverse local or regional ecological impact, a term that is not described. The ten mile perimeter allows treated wastewater to be transferred to Atlantic City where it is discharged into the Atlantic Ocean and to Camden where treated wastewater goes to the Delaware River. Mr. Liggett noted the difficulty in assessing the adverse regional and local impacts from the loss of water that is exported rather than recharged. He said the experts discussed a number of models to help assess regional (watershed), local (wetlands) and ongoing impacts.

In response to Commissioner McGlinchey's question regarding the "cone of depression" , (a model to assess the impact of pumping near wetlands), and over what period of time and at what distance is that well pump test studied, Mr. Liggett says one is looking for equilibrium between pumping and resulting drawdown. He said a 24-hour test does not reach equilibrium generally and even three to five days may not. But, one is reluctant to have test wells run for a long period of time and have difficulties in disposing of the water.

In response to Commissioner Lohbauer's question if the Commission is looking at what California is doing in terms of treated wastewater recharge, Mr. Liggett said that staff have not looked in much detail.

Mr. Liggett said the Science Office has a new grant to look at pollutants in wastewater and they will be testing hundreds of new constituents in addition to total Nitrogen. He said Buena Borough was required to install a membrane system to help control pollutant outflow from their treatment plant.

Mr. Liggett said using recharge water is a financial issue as systems need to be developed to treat the wastewater. He said New Jersey has about 50" of annual rainfall and about 20" of recharge. This may be insufficient so a problem looms in the future.

In response to a comment from Commissioner Prickett, Mr. Liggett said the Town of Hammonton uses both surface and subsurface recharge. He said some years ago the Commission tried to encourage the beneficial use of treated wastewater on golf courses but there was no support for those efforts. He said that efforts to encourage recharge should be undertaken with NJDEP due to the financing and the scale of the project.

When Commissioner Prickett asked about agricultural applications of treated wastewater, Mr. Liggett responded that blueberries and cranberries require pristine waters. However, there are other agricultural applications for which the nitrates in wastewater are an asset and he noted that the Commission may have missed an opportunity regarding beneficial use of wastewater at the golf course fairways associated with the Renault Winery. He said it might have been possible for Renault's wastewater to be discharged on the land rather than going through a sewer to the Atlantic Ocean.

Mr. Liggett noted that Mr. Joe Hochreiter and Mr. Rich Bizub, here in the audience today, had participated in the April meeting.

4. Public Comment

Mr. Rich Bizub, with the Pinelands Preservation Alliance, referencing the alternate design wastewater system pilot program, said in the late 1980's, (the late) Don Kirkhoffer harangued the Commission about the septic systems that were being installed on lots where CMP standards were not being met. Now, he said, the Commission has an excellent program, monitored in a vigorous way, and the staff should be commended for its success. He said the Kirkwood-Cohansey project is a similarly daunting project that will take much effort to deal with such technical issues as basin size, etc. but eventually it will be resolved. He said he reviews new water wells and finds that they are mostly increased allocations for existing wells. *(Editor's note: the impact standards being considered will cover both new wells and increased allocations.)* He said that California's water problems are the result of both a drought and policy failures due to the issuing of too many allocations. He said some non-profits are buying water rights from farmers in order to preserve streams. He said if the Commission proceeds with the HUC-11 basins, it needs to consider the headwaters of these basins and the low-flow margin must be set very low. He said the NJDEP looks at only a 1-foot drawdown but that works only in a confined aquifer. He said a drawdown of 1 foot in the K/C would be devastating. He said the Commission is the gatekeeper of the K/C as NJDEP will not protect wetlands under its current regulations.

5. Other Items of Interest

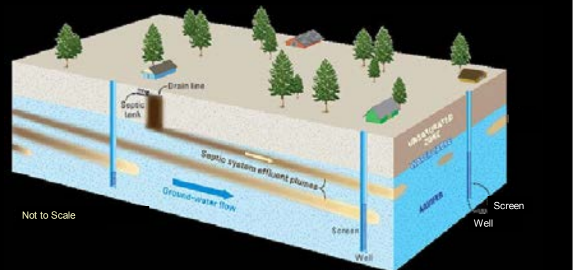
There being no other items of interest, the meeting adjourned at 11:30 a.m. (moved by Commissioner McGlinchey and seconded by Commissioner Prickett.)

Certified as true and correct:

Betsy Piner,
Principal Planning Assistant

Date: September 14, 2016

Alternate Design Treatment Systems Pilot Program



http://pubs.usgs.gov/fs/2007/3103/

August 26, 2016
New Jersey Pinelands Commission

Alternate Design Treatment Systems Pilot Program -Basis for the Program

Water Quality Protection

•Federal and State Pinelands Statutes call for preservation, protection and enhancement of Pinelands water resources.

• Pinelands standard is 2 mg/l (2 ppm) Nitrate-N (anti-degradation)

Why monitor Nitrogen?

- Useful indicator of both surface and groundwater quality in the Pinelands.
  - Limiting nutrient, naturally present < [0.17mg/l];
  - Conservative (persistent) pollutant (as nitrate);
  - Mobility marker due to solubility in water;
  - Inexpensive laboratory tests are readily available.

Alternate Design Treatment Systems Pilot Program

Pinelands Ad Hoc Committee on Alternative Septic Systems

Members:

- **S. Joseph Kowalski, Pinelands Commissioner**
- **Candace McKee Ashmun, Pinelands Commissioner**
- **Sally Dudley, Pinelands Commissioner**
- **Linda M. Eckenhoff, Pinelands Commissioner**
- **Theodore Gordon, Pinelands Commissioner**
- **Jay Edward Mounier, Pinelands Commissioner**
- **Norman F. Tomasello, Pinelands Commissioner**
- **Edward McGlinchey, Pinelands Municipal Council**
- **Lee Rosenson, Pinelands Preservation Alliance**
- **John Sheridan, New Jersey Builders Association**

Ecological Implications

- Rising nutrient levels can tip the balance and provide competitive advantage to non-native plants and animals
- Ammonia toxicity to fish life & oxygen depletion via nitrification of ammonia in receiving streams (NOD)
- Nitrate from septic systems generally affects shallow groundwater which discharges as "base flow" to lakes, ponds and streams during times of low flow.

NJ Pinelands

•Unique nitrogen-sensitive ecosystem characterized by acidic, nutrient-poor streams fed by shallow water table aquifer

• Overlies the 17.7 trillion gallon unconfined Kirkwood-Cohansey Aquifer

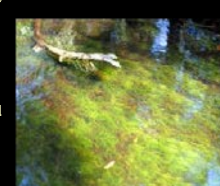
• Habitat for 41 T&E animal species and 54 T&E plant species

• Headwaters to both Atlantic and Delaware Basin Watersheds

Ecological Implications

- Eutrophication of surface waters - nitrate from septic systems "fertilize" the waters greatly increasing algae growth
- Phytoplankton and algae blooms increase turbidity, decrease sunlight penetration: stress and kill eelgrass beds - fish and shellfish habitat in coastal estuaries
- Blooms die off, decomposition leads to low dissolved oxygen levels stressing aquatic animals
- Speeds the natural process of hydrarch succession in which lakes and ponds fill via deposition of organic matter and siltation.

(lake ⟶ marsh ⟶ dry land)



Pinelands Centralized Sewer and Onsite Wastewater System Service Areas

- Onsite (septic and advanced) systems are relied upon throughout the Pinelands area and are a permanent component of the region's wastewater infrastructure.
- Standard septic systems achieve nitrogen standard through dilution on larger lots.
- Advanced systems meet the nitrogen standard through active treatment and dilution on smaller lots.

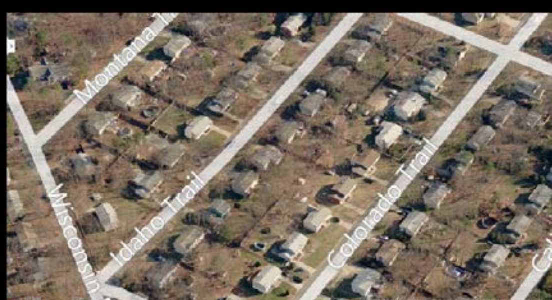

(Graphic source: NJ DEP via Stone Environmental)

Siting and Designing an Onsite Wastewater System in the NJ Pinelands

The Pinelands Site Evaluator : A state of the art Desk Top Soil Evaluation Tool:

* SSURGO (Soil Survey Geographic database)

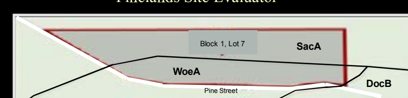
Onsite Wastewater Systems in the Pinelands



Approximately 22,000 existing septic systems in the Pinelands Area

Siting and Designing an Onsite Wastewater System in the NJ Pinelands

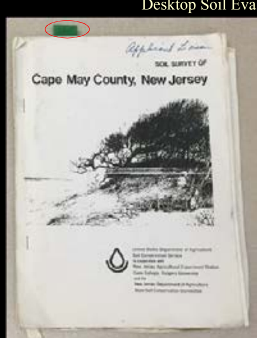
Pinelands Site Evaluator



- Locate area of interest and draw polygon around the parcel
- Zoom in to see soil map unit symbols for soil types likely present in the area of concern
- Create reports containing relevant (engineering, agricultural, etc.) soil properties

Siting and Designing an Onsite Wastewater System in the NJ Pinelands

Desktop Soil Evaluation Tools



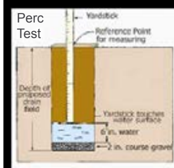
Map Unit Symbol	Map Unit Name	Map Unit Acreage	% of Total Acreage	
DocB	Downer loamy sand, 0 to 5 percent slopes	0.12	2%	
	Component Name	Component Acreage	Component % of Map Unit Acreage	Component Disposal Field Rating
	Albion	0.01	5%	Very limited
	Evesboro	0.01	5%	Not limited
	Downer	0.10	80%	Not limited
	Hammonton	0.01	5%	Somewhat limited
	Mullica	0.01	5%	Very limited
Map Unit Symbol	Map Unit Name	Map Unit Acreage	% of Total Acreage	
SacA	Sassafras sandy loam, 0 to 2 percent slopes	2.32	38%	
	Component Name	Component Acreage	Component % of Map Unit Acreage	Component Disposal Field Rating
	Woodstown	0.12	5%	Somewhat limited
	Downer	0.12	5%	Not limited
	Sassafras	1.86	80%	Not limited
	Fallsington	0.12	5%	Very limited
	Aura	0.12	5%	Very limited
Map Unit Symbol	Map Unit Name	Map Unit Acreage	% of Total Acreage	
WoeA	Woodstown sandy loam, 0 to 2 percent slopes	3.69	60%	
	Component Name	Component Acreage	Component % of Map Unit Acreage	Component Disposal Field Rating
	Fallsington	0.37	10%	Very limited
	Downer	0.18	5%	Not limited

Component Name	Component Acreage	Component % of Map Unit Acreage	Month	Component Depth to Water Table (in)
→ Sassafras	1.70	80%	January	> 79 in
SacA			February	> 79 in
			March	> 79 in
			April	> 79 in
			May	> 79 in
			June	> 79 in
			July	> 79 in
			August	> 79 in
			September	> 79 in
			October	> 79 in
			November	> 79 in
			December	> 79 in
Component Name	**Component Acreage**	**Component % of Map Unit Acreage**	**Month**	**Component Depth to Water Table (in)**
→ Woodstown	0.11	5%	January	20 - 39 in
WoeA			February	20 - 39 in
			March	20 - 39 in
			April	20 - 39 in
			May	40 - 59 in
			June	40 - 59 in
			July	> 79 in
			August	> 79 in
			September	> 79 in

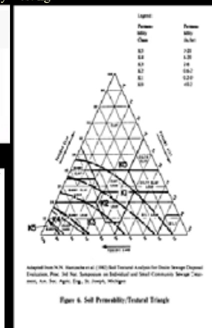
Siting and Designing an Onsite Wastewater System in the NJ Pinelands

Hydraulic Conductivity – Permeability Testing

Laboratory Tube Permeameter



Stacked soil sieves for SPCR Test



Siting and Designing an Onsite Wastewater System in NJ

NJDEP's Septic Reg's – Desk top tool

Soil Series Name (Map Unit Symbol)	Typical Classification(s) (Severity of limitations)	Type of Leach Field Permitted
Sassafras (SacA)	I	Conventional
Woodstown (WoeA)	IIIWr (IIWr)	Unsuitable in the Pinelands Area if SHWT < 5' (IIIWr) Unsuitable outside Pinelands Area if SHWT < 2' (If SHWT > 2' and < 7' mounded system would be required)

Rules Governing Onsite Wastewater Systems in the Pinelands

STANDARDS FOR INDIVIDUAL SUBSURFACE SEWAGE DISPOSAL SYSTEMS

New Jersey Department Of Environmental Protection N.J.A.C 7:9A

System design, use and management standards

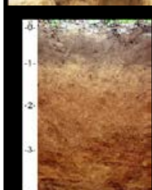
PINELANDS COMPREHENSIVE MANAGEMENT PLAN

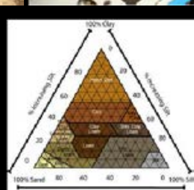
New Jersey Pinelands Commission N.J.A.C 7:50

5' to SHWT
2 ppm NO_3^-
System management standards

Siting and Designing an Onsite Wastewater System in the NJ Pinelands

Site Specific Field Work – Soil Test Pit Log





Block 1, Lot 7 Pinelands Twp.
SL-16
Existing grade elevation = 32.1'

0"-3" very dark grayish brown (10YR 3/1) **sandy loam**, weak fine granular; very friable, many fine to medium roots; abrupt smooth boundary.

3"-6" yellowish brown (10YR 5/4) **sandy loam**, weak fine granular, friable, 5% fine gravel, common medium roots, clear smooth boundary.

6" - 12" brown (10YR 5/6) **sandy loam**, weak fine subangular blocky; friable, 5% fine gravel, common medium roots, clear smooth boundary.

12" - 17" brown (10YR5/6) **loam,** moderate medium subangular blocky; friable, 5% fine gravel, common medium roots, clay bridging between sand grains, clear smooth boundary.

17" - 41" yellowish brown (10YR 5/6) **sandy clay loam,** moderate medium subangular blocky; firm; 5% fine gravel; clay bridging between sand grains; abrupt wavy boundary.

41" - 54" reddish yellow (7.5YR 5/8) **loamy coarse sand;** massive; very friable, 10 % fine gravel; abrupt wavy boundary.

54'-96" brownish yellow (10YR 6/8) **sand**, single grain, loose, gradual wavy boundary

96" – 144" brownish yellow (10YR 6/8) **sand**, single grain, loose, common medium prominent white (10YR 8/1) mottles beginning at 96" and extending to 144". Moderate groundwater seepage at 101", water stabilized at 101" after 3 hours.

Test pit completed at 144"
Mottles encountered at 96"
Groundwater seepage encountered at 101"
Estimated SHWT at 96" (Mottles)
Date Completed May 15, 2016

Siting and Designing an Onsite Wastewater System in the NJ Pinelands

Septic tank size is determined by design flow – number of bedrooms for residential systems

Minimum size septic tank = 1000 gal (Required for 4 bedroom and smaller homes)

Add 250 gal for each additional bedroom over four

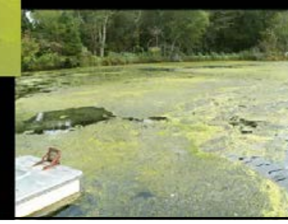
Multiple compartment tanks retain solids better that single compartment tanks

Siting and Designing an Onsite Wastewater System in the NJ Pinelands

Leach field size is determined by wastewater volume to be infiltrated and the permeability of the receiving soil. Low permeability soils require larger area to absorb a given volume of wastewater.

A typical residential leach field, designed by current standards is on the order of 1050 SF (21' x 50')

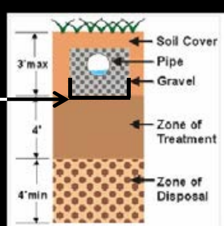
Effects of Local Nutrient Pollution



Sept. 11, 2014 Pancoast Mill Pond, Buena Vista Township

Wastewater renovation via soil-treatment systems

Bio-Mat



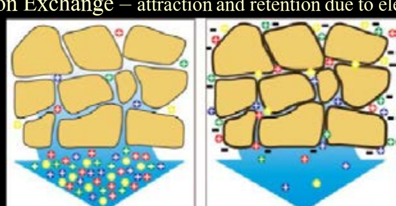
- Wastewater solids, dead and living microorganisms, microbial secretions, insoluble compounds and non-degradable synthetic fibers.
- 3/16 to 1-3/8 thick with permeability on the order of 0.25 inches per hour (K1)
- Removes organic material and pathogens but no sustained nitrogen removal

Nutrient-fueled Phytoplankton Bloom off the New Jersey Coast

July 6, 2016 NASA Aqua Satellite Image
http://earthobservatory.nasa.gov/NaturalHazards/view.php?id=88340

Soil as a treatment medium –removal of viral pathogens and positively charged pollutants

Cation Exchange – attraction and retention due to electric charge



Sandy soils often lack the negative charge on clay & organics & don't retain positively charged (cation) pollutants.

Loamy soils containing clay and organics attract and retain positively charged cations (Virus particles, heavy metals, sodium, etc.)

Neither sandy soils nor loamy (silty/clayey) soils are effective at removing NO_3^-

The Pinelands Septic Dilution Model

$$At = Af + \frac{\left(\frac{FLf}{C} - Df\right) Af}{Do}$$

Land use planning tool where:
At = total parcel area
Af = area of disposal field
F = unit conversion factor of 10
Lf = flux of nitrate-nitrogen below disposal field (kg/ha/yr)
C = concentration of nitrate-nitrogen (ppm)
Df = equivalent depth of percolate below disposal field (cm/yr)
Do = equivalent depth of percolate below open acres (cm/yr)

Parameter	Assumption
Number of persons/dwelling	3.5
Number of persons/age restricted dwelling	2.0
Residential wastewater flow (gal/capita/day)	75
Plant uptake of nitrogen	4.5% A soils / 9.0% B soils
Infiltration rainfall	20.0 inches/year
Nitrogen production (grams/capita/day)	11.2
Distribution of nitrogen in wastewater	83% blackwater / 17% greywater
Nitrogen concentration in residential wastewater	39.45 ppm

- The model assumes an average residential flow of 262.5 gpd based (3.5 persons x 75 gal/person).
- Requires 3.2 acres to meet water quality standard if using a conventional septic system.

Nitrogen Dilution Modeling

* Minimum lot size requirements

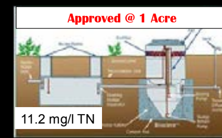
Effluent Total [N] mg/l	% Reduction N removal rate	Lot Area (acres) to meet 2 mg/l
39.45	0	3.2
32	20	2.5
26	35	2.0
19	50	1.5
14	65	1.0

* Nitrogen attenuation achieved by the pilot program technologies does not allow for the creation of more 1 acre parcels than are otherwise already permitted. Instead, these technologies permit development to occur where preexisting zoning already allows for 1 unit/acre, enabling that development to meet Pinelands water quality standards.

Original Pilot Program Technologies

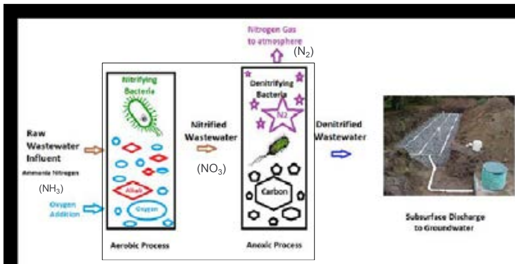
Amphidrome

Bioclere



Cromaglass

FAST



Onsite Treatment Process for Biological Nitrogen Removal

(Required in Pinelands if < 3.2 acres)

Four New Pilot Program Wastewater Systems

System Name	System Vendor	Treatment Process
Bio Barrier	Bio-Microbics, Inc.	Membrane Bioreactor
Busse GT	Busse Green Technologies, Inc.	Membrane Bioreactor
Hoot ANR	Hoot Systems, LLC.	Extended Aeration/Activated Sludge
SeptiTech	SeptiTech, LLC	Fixed Film Trickling Filter

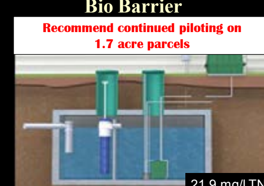
Original Five Pilot Program Wastewater Systems Selected for their Ability to Reduce Nitrogen

System	Pilot Program Status
Amphidrome	Permanently approved for use on min. one acre lots
Bioclere	Permanently approved for use on min. one acre lots
Cromaglass	Eliminated from the pilot program (Sept. 2014)
Fast	To be authorized for use on minimum 1.4 acre lots
Ashco RFS^{III}	Removed from pilot program Dec. 2007

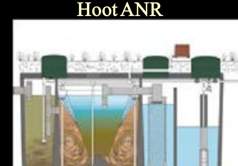
Second Round Pilot Program Technologies

Septi Tech

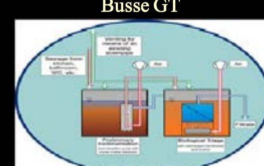
Bio Barrier



Hoot ANR



Busse GT



Installed Pilot Program Technologies

Technology	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Total Installed
Amphidrome	7	10	11	29	13	7	5	8	4	6	1	1	4	106
Bioclere	0	2	11	9	7	9	6	5	3	5	6	4	2	69
Cromaglass	0	5	39	7	4	1	0	0	0	0	0	0	0	56
FAST	0	0	0	0	2	5	3	3	3	5	2	2	0	25
SeptiTech	Admitted into pilot program in 2013										3	9	12	24
BioBarrier	Admitted into pilot program in 2013										5	7	0	12
Total	7	17	61	45	26	22	14	16	10	16	17	23	18	292

Pinelands Alternate Design Wastewater Treatment System Pilot Program

Ed Wengrowski
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www.nj.gov/pinelands

Pilot Program Technologies: Cost Information

Technology	Average Treatment System & Five Year Service Cost	Ave. Total Reported Cost
Amphidrome	$ 19,434	$32,114
Bioclere	$ 17,466	$ 27,635
Cromaglass	$ 22,553	$ 35,265
FAST	$ 17, 892	$29,508
Bio Barrier	$ 18,708	$28,783
SeptiTech	$ 19,218	$28,702
Hoot ANR	$ 14,500	N/A
Busse GT	$ 24,000	N/A

These technologies are permanent components of the region's wastewater infrastructure and help protect public health and the Pinelands ecosystem.

2016 Pilot Program Report Recommendations

- Grant permanent approval status to the FAST treatment technology for use on minimum 1.4 acre parcels.
- Increase the minimum parcel size from 1.0 acre to 1.7 acres while still piloting the SeptiTech and BioBarrier technologies based upon the latest effluent nitrogen monitoring data.
- Consider a CMP amendment to provide an opportunity for pre-existing nonresidential development to expand or change to another conforming use by using an advanced wastewater treatment system in non-growth-oriented Pinelands Management Areas.

The Pinelands Protection Program
K/C Water Management

Summary of April meeting et al with experts and continued refinement on an approach

8/26/16

Larry Liggett
Director of Land Use

BACKGROUND
Study Overview
Current Methods
Discussion with Experts

ASSESSING REGIONAL IMPACTS
Overview
Max. Percent Basin Recharge
Wetland Vulnerability Index
Low-Flow Margin

ASSESSING LOCAL IMPACTS
Overview
Cone of Depression Model (Thiem)

ON-GOING ISSUES
Recharge
Aquifer Storage & Recovery
Mitigation

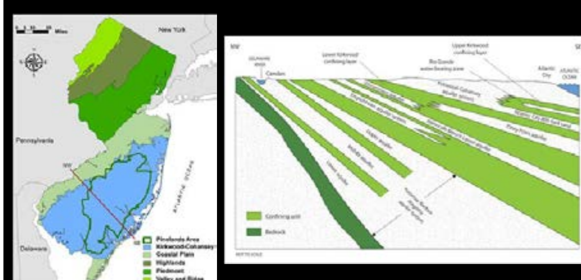
CONCLUSION

The Kirkwood/Cohansey Project

- **$5 m State Legislation**: "…determine how future water supply needs will be met while protecting the Kirkwood-Cohansey aquifer system and while avoiding any adverse ecological impacts."
- Where is sewer and water permitted in the CMP?
  - 111,000 acres in RGA, Pinelands Towns & Villages
  - Serve upwards of 130,000 new homes (35 mgd of water) plus non-residential

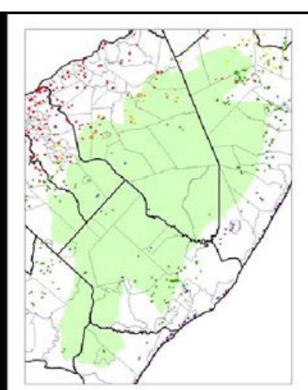
BACKGROUND
Study Overview → Current Methods → Discussion with Experts

The Kirkwood/Cohansey Aquifer



BACKGROUND
Study Overview → Current Methods → Discussion with Experts

Public Water Supply Wells in the Pinelands



ASSESSING REGIONAL IMPACTS
Overview → Max. % Basin Recharge → WVI → Low-Flow Margin → Basin Size

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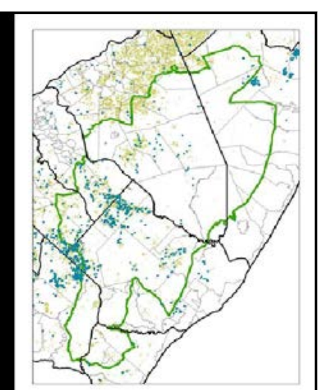
Agricultural Wells in the Pinelands



ASSESSING REGIONAL IMPACTS
Overview → Max. % Basin Recharge → WVI → Low-Flow Margin → Basin Size

Context: Wells in the Pinelands

- Current:
  - 100 million gallons/day (mgd) or, the equivalent of 100 individual mgd wells
- Future:
  - 40 mgd or, the equivalent of 40 individual mgd wells
  - 4% of daily recharge in Pinelands
- Total:
  - 140 mgd or, the equivalent of 140 individual mgd wells
  - 10% of daily recharge in Pinelands

ASSESSING REGIONAL IMPACTS
Overview → Max. % Basin Recharge → WVI → Low-Flow Margin → Basin Size

Current CMP K/C Regulations

- Avoid Inter-basin transfer of water
- No water export beyond 10 miles of boundary
- Include:
  - Water-saving devices and other conservation steps
  - Minimize impacts through well design
  - Distribution system loss reduction
- Permit only if:
  - No viable alternative, or
  - No adverse local or regional ecological impact (this assessment is limited by the absence of specificity and of tools)

BACKGROUND
Study Overview → Current Methods → Discussion with Experts

Summary of Discussions with Experts
(discussion leaders at one meeting noted below)

- REGIONAL IMPACT CONTROLS (Watershed)
  - Stream Flow Low Flow Margin: Jeff Hoffman, NJ DEP
  - Maximum % of Recharge: Dan Van Abs, Rutgers University
  - Wetlands Vulnerability/Gompertz: Bob Nicholson, USGS
- LOCAL IMPACT CONTROL (wetlands)
  - Cone of Depression Model (Thiem): Bob Nicholson, USGS
- IMPLEMENTING THE CONTROLS
  - Basin Size Selection for Regional Impacts: Joseph Sosik, PC
  - Recharge - Accompany Withdrawals: Jeff Fischer, USGS

BACKGROUND
Study Overview → Current Methods → Discussion with Experts

Maximum Percentage of Recharge
Dan Van Abs, Rutgers University

- Long-term recharge is a good proxy for stream flow in a region where most annual average stream flow is derived from ground water.
- Which recharge to use as a maximum?
  - 5% of drought recharge can be removed from a basin (insufficient for an average water supply well)
  - 10% of average recharge (what staff has been using)

ASSESSING REGIONAL IMPACTS
Overview → Max. % Basin Recharge → WVI → Low-Flow Margin → Basin Size

Maximum Percentage of Recharge

- Key points:
  - Percentage of average annual does not reflect droughts
  - Percentage of drought flow too restrictive
  - Average annual has been used by the PC for years, but without a scientifically based safe withdrawal limit
  - K/C study can provide specific safe withdrawal limits
- Work involved (if selected)
  - Select a practical measure
  - Set safe withdrawal limit

ASSESSING REGIONAL IMPACTS
Overview → Max. % Basin Recharge → WVI → Low-Flow Margin → Basin Size

Wetlands Vulnerability Index

Bob Nicholson, USGS

- – Based on the PC funded study by USGS Charles and Nicholson, 2012
- – Estimates the percentage of wetlands in watersheds that experience reductions in water levels of 5, 10, 15 and 30 centimeters based on varying well withdrawals.
- Example:

Area	Net Withdrawal (MGD)	Impact of Actual Usage Wetlands Drawdown:		
		>= 5 cm	>= 15 cm	>= 30 cm
Hammonton Creek	1.5	73.4%	67.2%	56.2%

ASSESSING REGIONAL IMPACTS
Overview → Max. % Basin Recharge → WVI → Low-Flow Margin → Basin Size

Wetlands Vulnerability Index

- Key points:
  - – Predicts both regional and local impacts
  - – No recommendation for regional withdrawal limits
  - – Problematic as it is built upon multiple, layered assumptions
  - – A good planning tool, but probably not firm enough for regulatory purposes
- Work involved (if selected):
  - – Gather the necessary data to run the model
  - – What are the safe withdrawal limits (regional and local)

ASSESSING REGIONAL IMPACTS
Overview → Max. % Basin Recharge → WVI → Low-Flow Margin → Basin Size

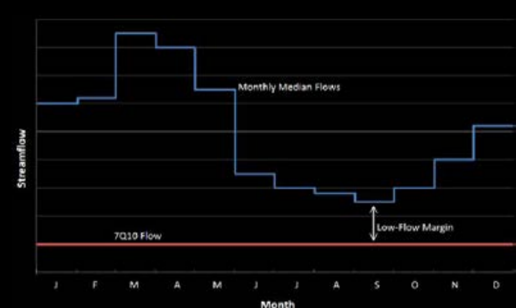
The Low-Flow Margin (LFW)

Jeffery Hoffman, DEP

- The low-flow margin is the difference between the September low flow and the 7Q10 drought flow (the lowest 7-day average flow that occurs (on average) once every 10 years.)
- A set percentage of this margin can be safely diverted thereby minimizing impacts

ASSESSING REGIONAL IMPACTS
Overview → Max. % Basin Recharge → WVI → Low-Flow Margin → Basin Size

The Low-Flow Margin



ASSESSING REGIONAL IMPACTS
Overview → Max. % Basin Recharge → WVI → Low-Flow Margin → Basin Size

Devising a Low-Flow Threshold

- *How much of the LFM should be available?*
  - – *NJ DEP has researched 10 streams state-wide for how much can be withdrawn:*
    - Using currently "stressed" areas. (Results: 20-30% max.)
    - Looking at ecological flow goals (Results: 30-40% maximum)
- *Should the % vary by area sensitivity?*
- *What size basins should it apply to?*

ASSESSING REGIONAL IMPACTS
Overview → Max. % Basin Recharge → WVI → Low-Flow Margin → Basin Size

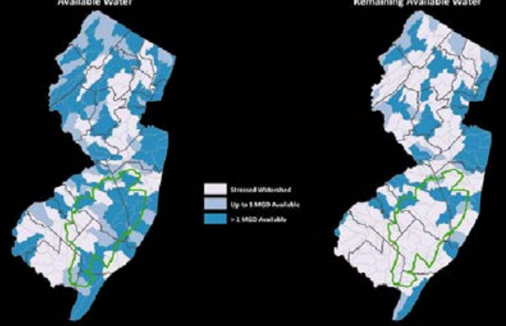
Devising a Low-Flow Threshold

Examples:

- NJ DEP?
  - – 25% of the LFM state-wide?
  - – Use Large basins? (published data)
- Highlands
  - – By area:
    - Protection Zone = 5% of the LFM
    - Conservation Zone = 5%/10% of the LFM
    - Existing Community Zone = 20% of the LFM
  - – Uses Small basins (severely limits new wells)

ASSESSING REGIONAL IMPACTS
Overview → Max. % Basin Recharge → WVI → Low-Flow Margin → Basin Size

DEP: 25% of Low-Flow of Large Basins



ASSESSING REGIONAL IMPACTS
Overview → Max. % Basin Recharge → WVI → Low-Flow Margin → Basin Size

The Low-Flow Margin

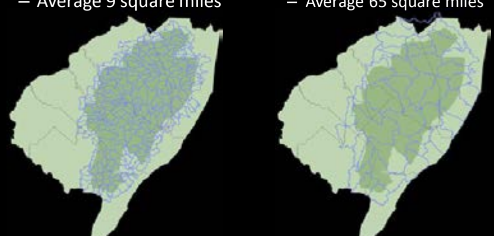
- Key points:
  - Consistent with results of K/C ecological studies
  - Better than just using an average or any particular low flow like the 7Q10,
  - Note: maintaining passing flow (a NJ DEP requirement) is a necessary complementary tool to address severe droughts
  - Basin size needs to be selected
- Work involved:
  - How relevant is the 20-25% threshold to the LFM in the Pinelands?
  - Should the % vary by management area?

ASSESSING REGIONAL IMPACTS
Overview → Max. % Basin Recharge → WVI → Low-Flow Margin → Basin Size

Regional Approach: Basin Sizes

Joseph Sosik, NJ Pinelands Commission

- **"Small" Basins (HUC 14)**
  - 229 with area inside PA
  - Average 9 square miles
- **"Large" Basins (HUC 11)**
  - 37 with area inside PA
  - Average 65 square miles



ASSESSING REGIONAL IMPACTS
Overview → Max. % Basin Recharge → WVI → Low-Flow Margin → Basin Size

Regional Approach: Basin Sizes

- Key points:
  - Small basins not feasible/practical for wells
  - Large basins are better suited for the large K/C surface aquifer
  - NJ DEP has published large basin analyses
  - Boundaries of Pinelands watersheds imprecise, therefore better to go with bigger basins
- Work involved:
  - Select larger basins; use DEP data

ASSESSING REGIONAL IMPACTS
Overview → Max. % Basin Recharge → WVI → Low-Flow Margin → Basin Size

BACKGROUND
Study Overview
Current Methods
Discussion with Experts

ASSESSING REGIONAL IMPACTS
Overview
Max. Percent Basin Recharge
Wetland Vulnerability Index
Low-Flow Margin

ASSESSING LOCAL IMPACTS
Overview
Cone of Depression Model (Thiem)

ON-GOING ISSUES
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CONCLUSION

Managing Local Impacts

Goal: Better Measure Impacts of pumping near wetlands

- What new ecological metrics can we derive from the K/C study?
  - Maximum drawdown thresholds
- Can we practically regulate with these metrics?
  - Cone of depression model (Thiem) as a screen coupled with enhanced pump tests

ASSESSING LOCAL IMPACTS
Overview → Cone of Depression Model (Thiem)

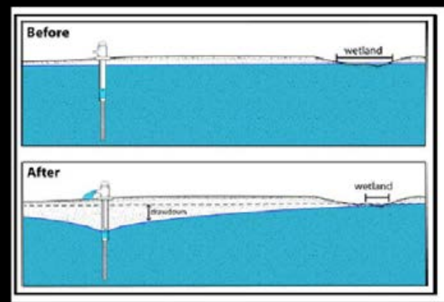
Cone of Depression Model (Thiem)

Bob Nicholson, USGS

- A published model (by Gunther Theim) was "enhanced" to provide a better match to the MODFLOW technique for use throughout the Pinelands where mod flow is not currently available
- Very comparable results were achieved, except in areas with multiple clay layers

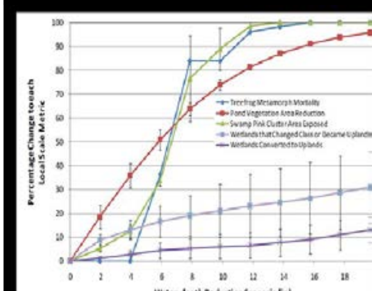
ASSESSING LOCAL IMPACTS
Overview → Cone of Depression Model (Thiem)

Cone of Depression



ASSESSING LOCAL IMPACTS
Overview → Cone of Depression Model (Thiem)

Maximum Drawdown: Some Wetlands more sensitive than others

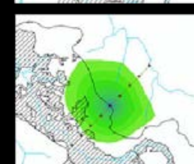


- Ponds & Pine Barrens Tree Frogs: Max 3-4" drawdown
- Other wetlands: Max 6" wetland

ASSESSING LOCAL IMPACTS
Overview → Cone of Depression Model (Thiem)

Measuring Drawdown Impacts

- MODFLOW Model
  - Complex, needs lots of data
  - So called "gold standard"
- Cone of Depression Model (Thiem)
  - Simple
  - Applicable everywhere, except where clay is prevalent
  - Less accurate than MODFLOW



ASSESSING LOCAL IMPACTS
Overview → Cone of Depression Model (Thiem)

Cone of Depression Model (Thiem)

- Key points:
  - Purveyors are amenable to using the tool
  - Probably use as a screening tool
    - Cone of depression modeling first
    - Then, Enhanced Well testing to validate
- Work involved:
  - Set limits, e.g. do not use where clay prevalent
  - Test more situations where have MODFLOW
  - Extend duration of well pump tests

ASSESSING LOCAL IMPACTS
Overview → Cone of Depression Model (Thiem)

Recharge - Water Quality

- Underground storage of water can be used in two ways:
  - ASR (Aquifer Storage and Recovery) potable water from wet periods to supplement dry periods , or
  - Treated wastewater for mitigation in basins over the limit (LFM)

ASSESSING LOCAL IMPACTS
Water Quality → Recharge → Uses

Groundwater Recharge

Jeff Fischer, USGS

- Key points:
  - Avoid areas with clay layers (e.g., Hammonton, Buena)
  - Unregulated contaminants are a concern to water quality
  - Maintenance is important
    - Injection rates are much lower than withdrawal rates
    - Concerns with surface- and waste-water fouling, geochemical reactions, and contamination
  - A possible mitigation tool in impacted basins
- Work involved:
  - What level of remaining pollutants is acceptable?
  - Can this level be feasibly attained?

ASSESSING LOCAL IMPACTS
Water Quality → Recharge → Issues

BACKGROUND
Study Overview
Current Methods
Discussion with Experts

ASSESSING REGIONAL IMPACTS
Overview
Max. Percent Basin Recharge
Wetland Vulnerability Index
Low-Flow Margin

ASSESSING LOCAL IMPACTS
Overview
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Recharge
Aquifer Storage & Recovery
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CONCLUSION

Tying it All Together

Current CMP	Direction for K/C Amendments
1. Well location guidelines: • 300' from wetlands • Allowed in any Pinelands Management Area • Allowed anywhere in basin	1. Well location guidelines: • Cone of depression model (Thiem) sets general buffer • Allowed in RGA, Towns, and Villages • Priority of placement near bottom of basin
2. No harm to wetlands (how determine?)	2a. Cone of depression model screening 2b. Minimum 3 day well test with piezometers in wetlands
3. 10% basin withdrawal	3. 20% - 25% LFM of large basins
4. Some conservation measures	4. Rigorous conservation measures
5. Well size: no limit	5. Limit well size to , e.g. 1 mgd
6. Alternatives: "show" K/C as last resort	6. Consider more analysis of alternatives (e.g., Del. River water)

Conclusion