



Water Treatment Residuals Recycling: *Use as a Soil Amendment*

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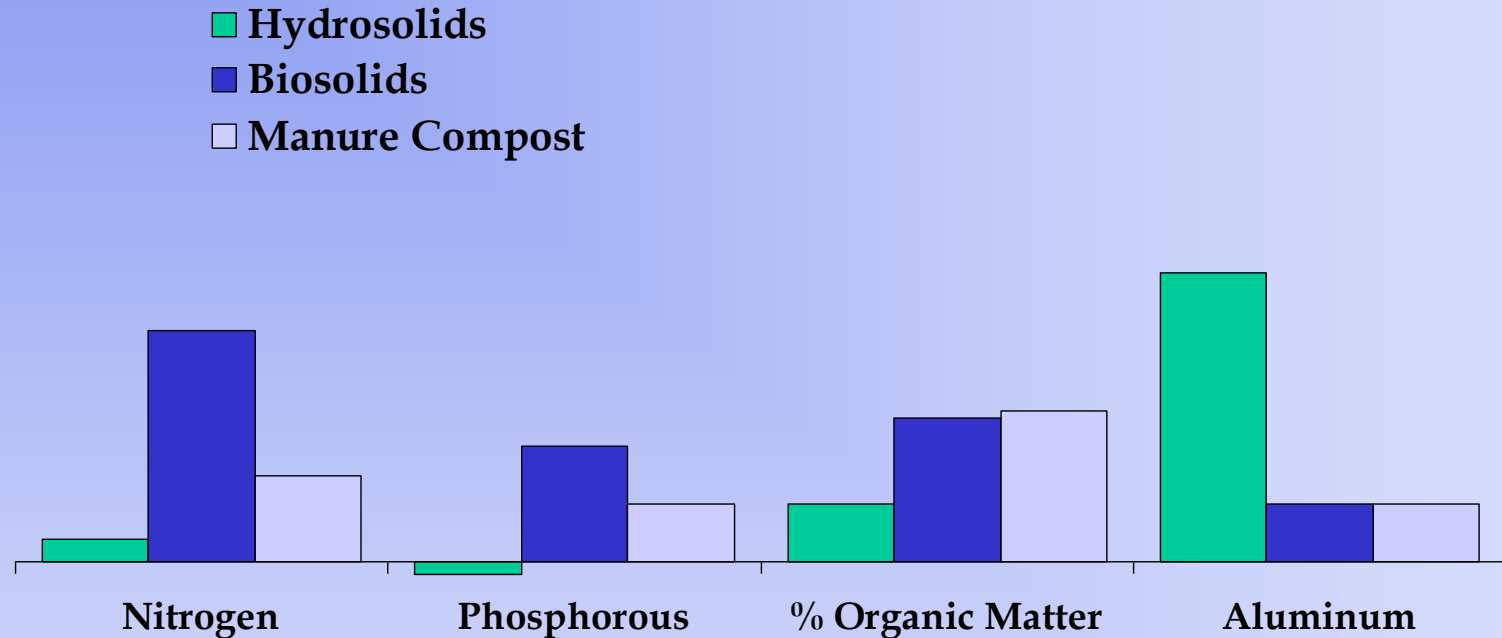
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What Are Water Treatment Residuals?



- **Semi-solid residuals generated during the treatment of drinking water**
- **Sometimes referred to as Hydrosolids**
- **In this presentation:**
 - **Hydrosolids will refer to drinking water residuals that have been identified as suitable for use as a soil amendment**
 - **This presentation will focus specifically on Alum-based Hydrosolids**

Nutrient Characteristics of Hydrosolids Relative to Other Soil Amendments



- Hydrosolids are low in macro-nutrients and organic matter content when compared with other commonly used soil amendments
- Total aluminum content of alum hydrosolids is very high
- The lack of any obvious nutrient or organic matter benefit is part of the reason that the recycling of hydrosolids is slow to catch on

KKWWD Hydrosolids Recycling Pilot Project



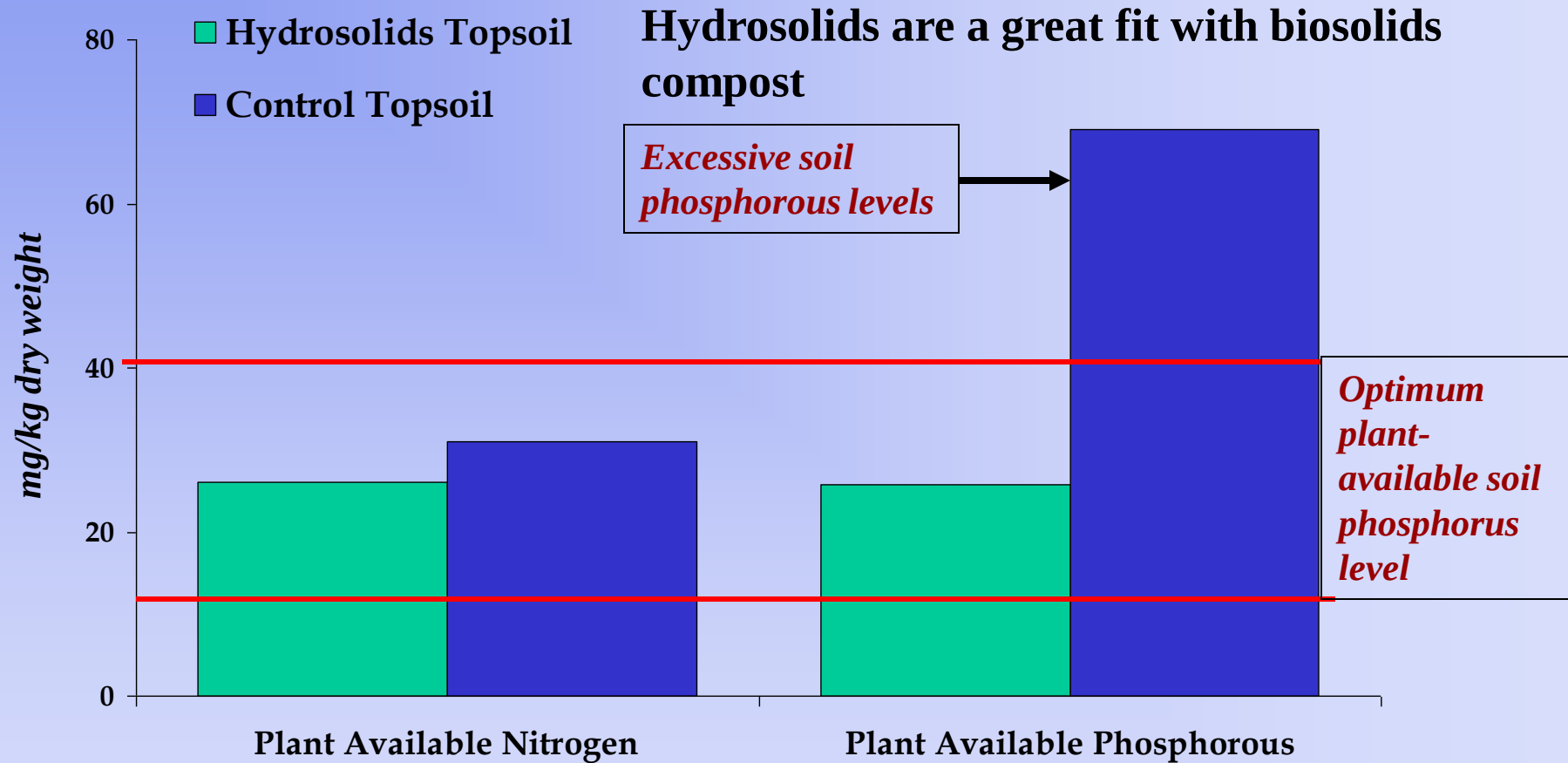
- The Kennebunk, Kennebunkport and Wells Water District treats surface water for distribution to several southern Maine communities
- KKWWD uses alum and sodium aluminate for separating sediment and organic matter from drinking water
- In the process KKWWD generates approximately 600 cubic yards per year of hydrosolids
- The KKWWD hydrosolids recycling program was the first *permitted* hydrosolids recycling effort in Maine

KKWWD Hydrosolids Manufactured Topsoil Trial

- Set up as a demonstration as a first step towards a recycling Program License from the DEP
- Grass growth response was similar in the hydrosolids topsoil and the control
 - There were some differences within the plots related to the depth of topsoil placement
- Grass growth trials with the same topsoils on a bench-scale confirmed the findings of the field trial

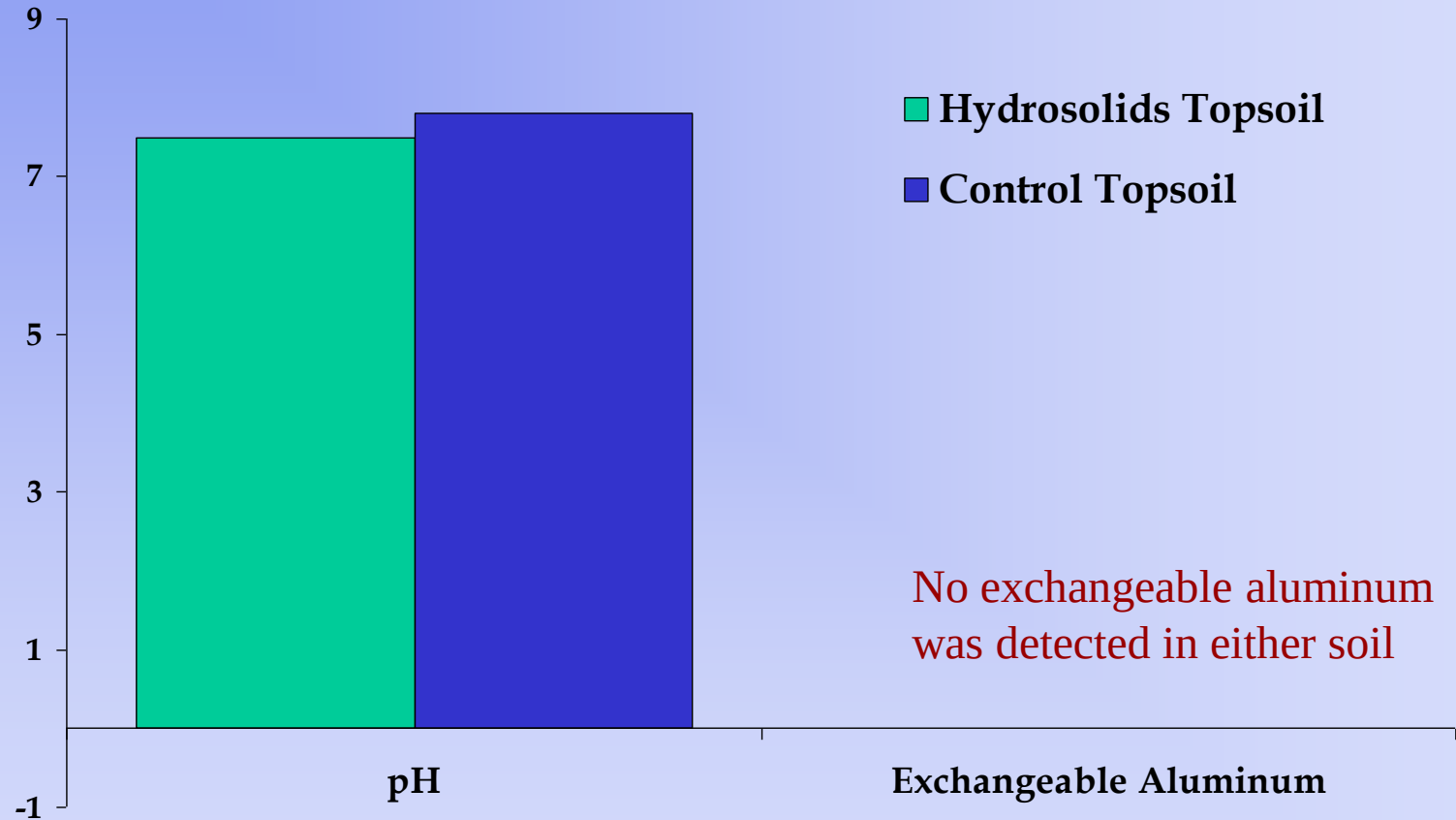


Hydrosolids Topsoil Fertility Results: Macro-nutrients



****In this case, the hydrosolids helped to reduce excessive levels of plant available phosphorous in soil**

Hydrosolids Topsoil Fertility Results: pH and Aluminum



At circum-neutral soil pH, exchangeable aluminum in soil is not significant, even with the addition of higher concentrations of aluminum in the form of alum

Alum Hydrosolids Chemical Characterization

- The trace metal content of hydrosolids is typically close to the background levels found in soils and lower than the federal trace metal standards for trace metals in biosolids
- One notable exception is **Arsenic**, which can be higher depending on the characteristics of the water source
- Additional testing is sometimes required to determine the leachability of trace metals



Arsenic in Soil



Arsenic in Soil Solution

Hydrosolids Topsoil Trace Metals Content

Trace Metals	Hydrosolids Topsoil	Control Topsoil	Maine Soil Average
Arsenic	5.1	4.7	7.4
Cadmium	1.6	1.4	0.37
Chromium	19	9	30
Copper	22	29	23
Lead	11	10	17
Mercury	0.11	0.11	0.003
Molybdenum	1.6	2.6	0.79
Nickel	10	9	18
Selenium	<8	<8	0.45
Zinc	89	133	68

Physical Considerations: Freeze-Drying Hydrosolids

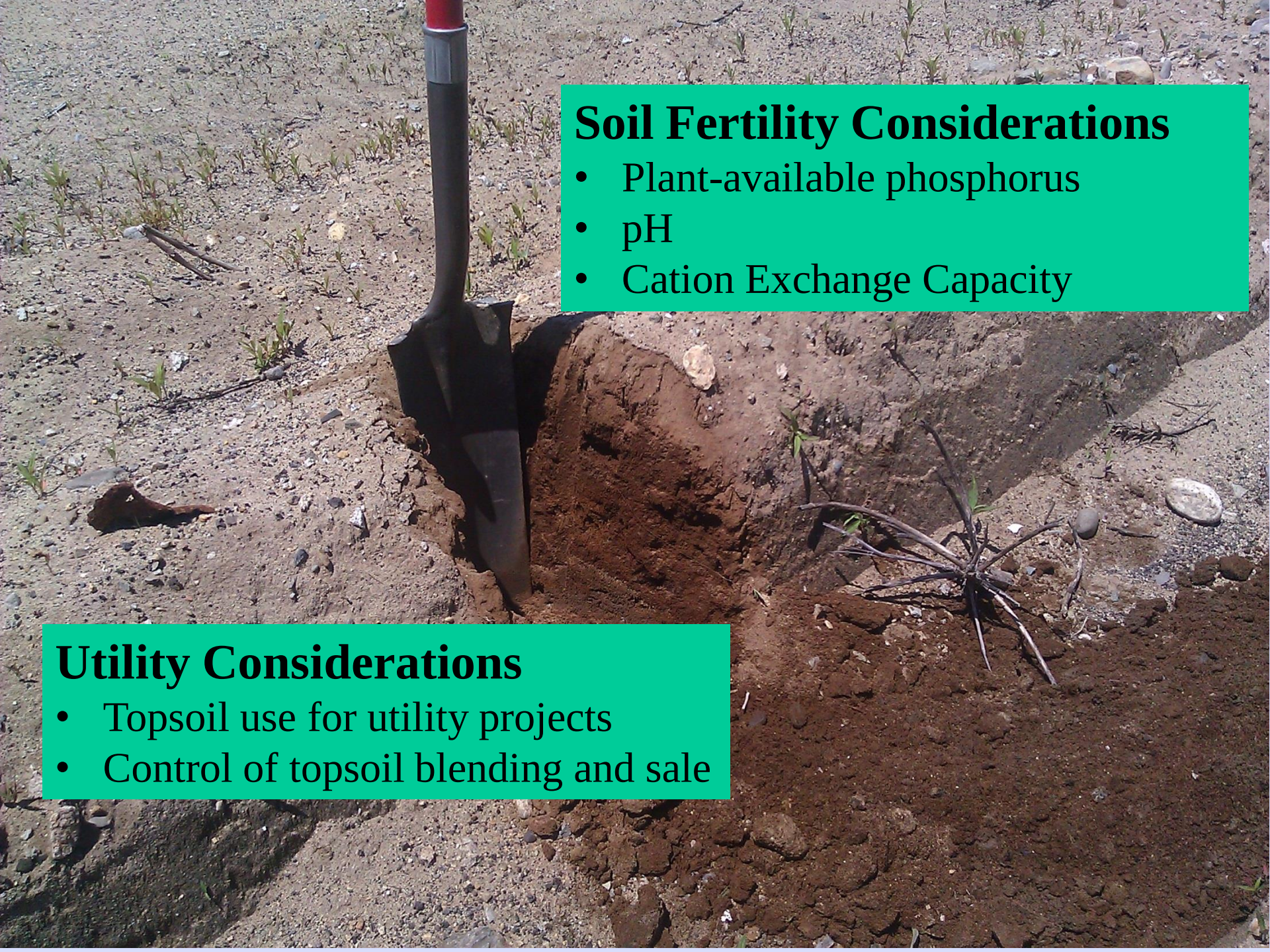
- KKWWD hydrosolids, as excavated from the open-air lagoons have the consistency of axel grease
- Through bench-scale testing, KKWWD personnel determined that freeze-drying the hydrosolids in thin layers and open-air conditions during the winter, changes the physical characteristics to a soil-like consistency
- Freeze-drying, alone, can give the alum hydrosolids the physical characteristics of a dark reddish sandy loam



Topsoil Blending

- Using conventional construction equipment (no special equipment necessary)
- Final product used in water district construction projects and used by local contractors





Soil Fertility Considerations

- Plant-available phosphorus
- pH
- Cation Exchange Capacity

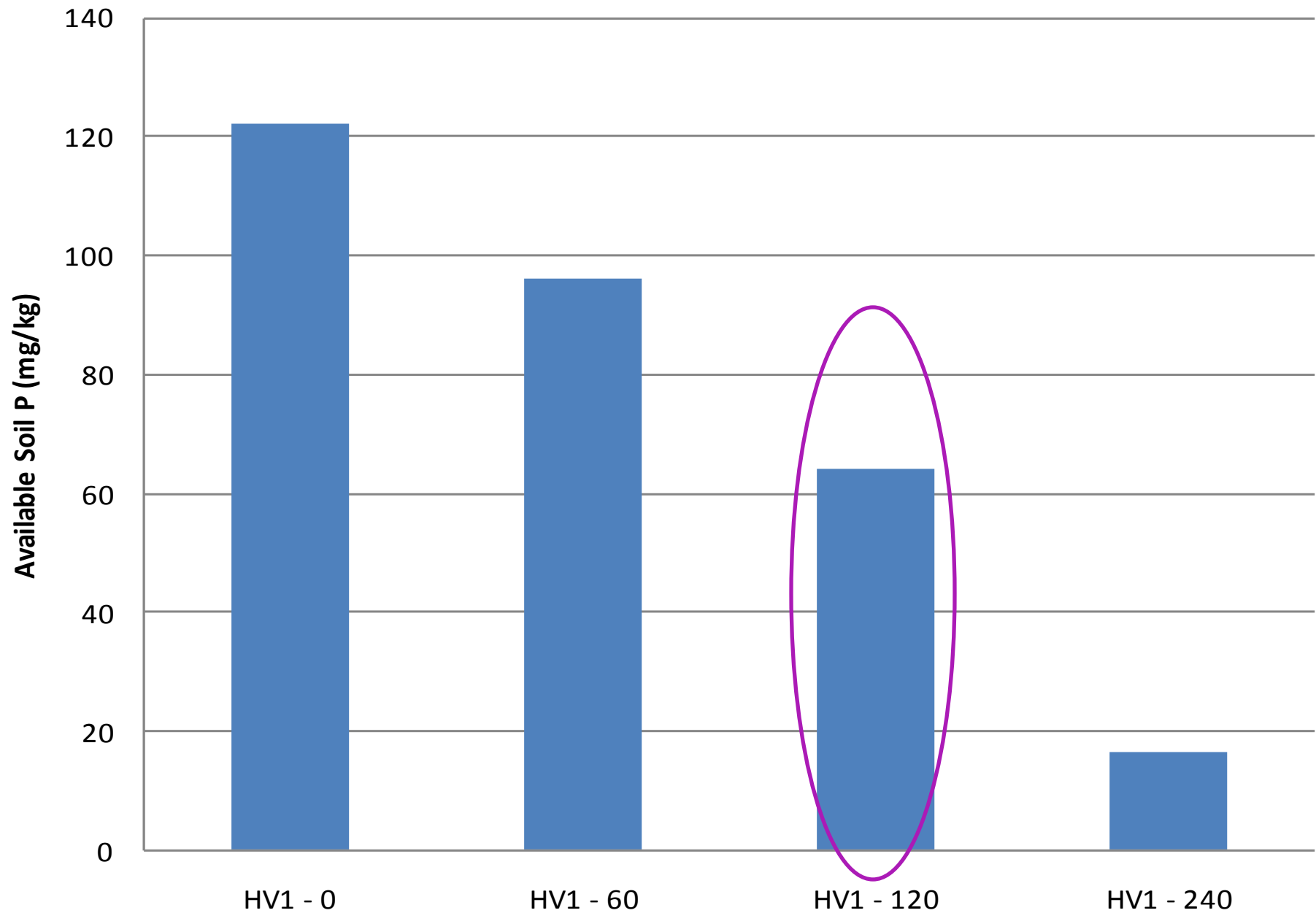
Utility Considerations

- Topsoil use for utility projects
- Control of topsoil blending and sale

Controlling Phosphorus Run-off



Available soil phosphorous - *by modified Morgan extraction*



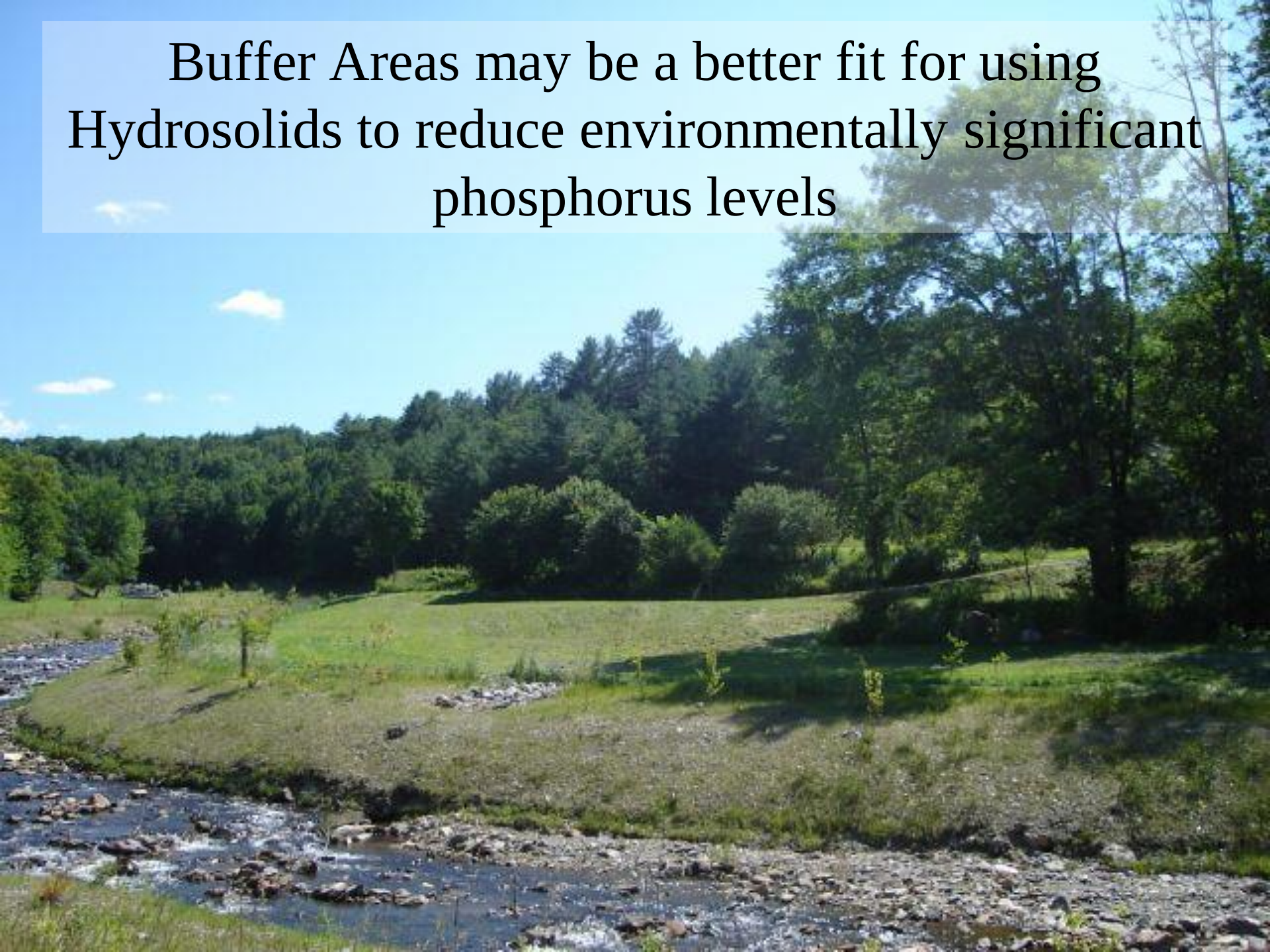
Hydrosolids Pilot Project in High-P Soils



Findings to date

- Lower soil available phosphorus, but not as low as predicted in bench-scale trial
- Otherwise, no change to soil fertility
- No loss in yield and no change in corn tissue quality

Buffer Areas may be a better fit for using
Hydrosolids to reduce environmentally significant
phosphorus levels



Summary of Hydrosolids Recycling Options

- Component in topsoil manufacturing and blending operations
 - Need to consider physical limitations of the material as well as fertility of the final product
- Tool for reducing soil phosphorus run-off
 - Large quantities needed to have significant impact
 - May be best used in buffer areas around sensitive water bodies

