NEW YORK MINE RECLAMATION

Ecosystem Enhancement & Wetland Mitigation Opportunities

WORKING LANDS
INVESTMENT PARTNERS, LLC

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WORKING LANDS
INVESTMENT PARTNERS, LLC

- Restoration and remediation focused turn-key contracting firm
- Team-building approach
- Develop models

Working Lands' Goals

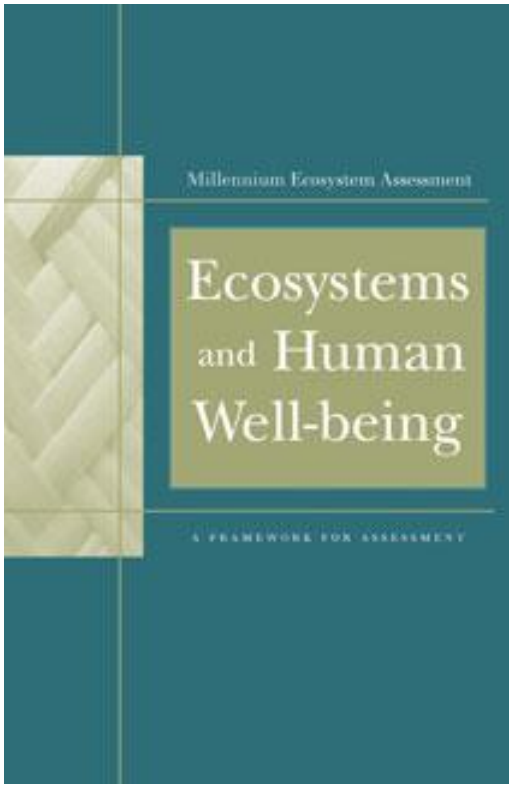
- Repair damaged natural resources
- Create sustainable ecosystems
- Collaborate with public partners and private firms
- Develop models that can be shared and followed

Incorporating Private Capital for Mine Reclamation

- Reclamation is required for mine closure and bond release
- WLIP has developed a model to integrate mitigation capital and mined land reclamation
  - Revenue generation
  - Ecosystem services enhancement

Ecosystem Services: A Platform for Assessing Environmental Condition

- From the Millennium Ecosystem Assessment, 2001 – 2005
- Assesses consequences of ecosystem change on human well-being
- State-of-the-art scientific appraisal of conditions and trends in world ecosystems
- = Functions & values assessments



Ecosystem Services - Terminology

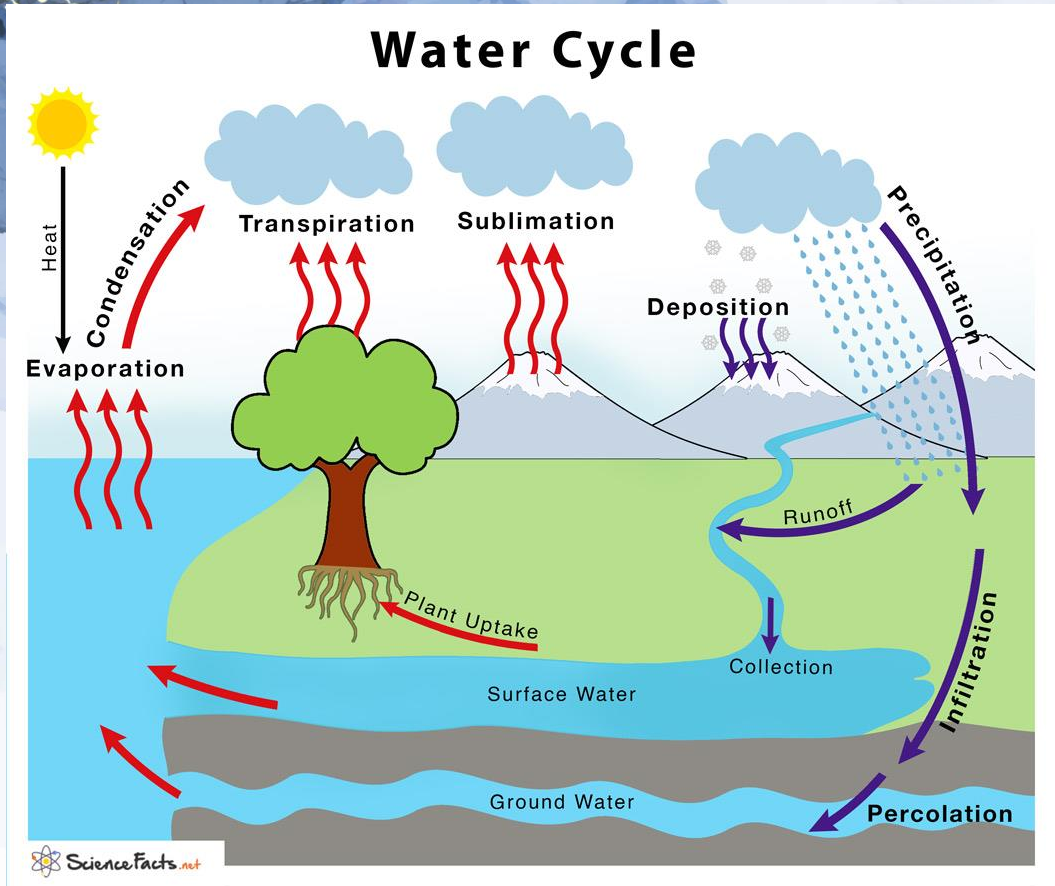
- the benefits ***to humans*** provided by the natural environment and from healthy ***ecosystems***
- **Ecosystem** (*noun*) – a community of interacting organisms and their physical environment, including ***biotic*** and ***abiotic*** elements.
- Scale and extent of an ecosystem is ***defined by the observer***
- Ecosystem examples: forests, agrohabitats, grasslands, aquatic habitats, **mined lands**

Ecosystem Service Categories

1

Provisioning Services – provide needed resources

e.g., food, fiber, fuel, water, medicine



Ecosystem Service Categories

2

Supporting Services – processes or functions that support life function and environmental "health"

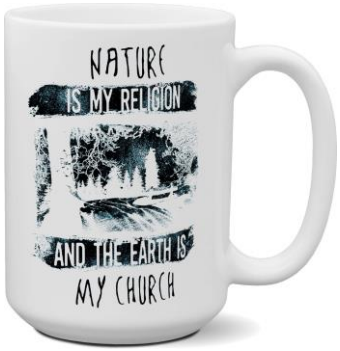
e.g., biodiversity, nutrient cycles, water cycles, soil formation, photosynthesis

Ecosystem Service Categories

3

Regulating Services – stabilize/moderate ecosystem elements and processes

e.g., thermal regulation (large water bodies), soil stabilization (roots), erosion control (soil permeability), air quality



Ecosystem Service Categories

4

Cultural Services – provide or support human culture and values

e.g., recreation, tourism, education, aesthetics, religious, spiritual, and inspirational values (holy places or resources), existence value, ethics

Mining and Reclamation Effects on Ecosystem Services

- MINING
  - Vegetation clearing – Air quality, soil stability, biodiversity, water quality
  - Material removal – soil permeability, water cycles, aesthetics
- RECLAMATION
  - Planting – biodiversity, air quality, soil stability, water quality
  - Habitat creation/restoration – biodiversity, wildlife habitat, water cycling, nutrient cycling, aesthetics

Mine Reclamation Opportunities

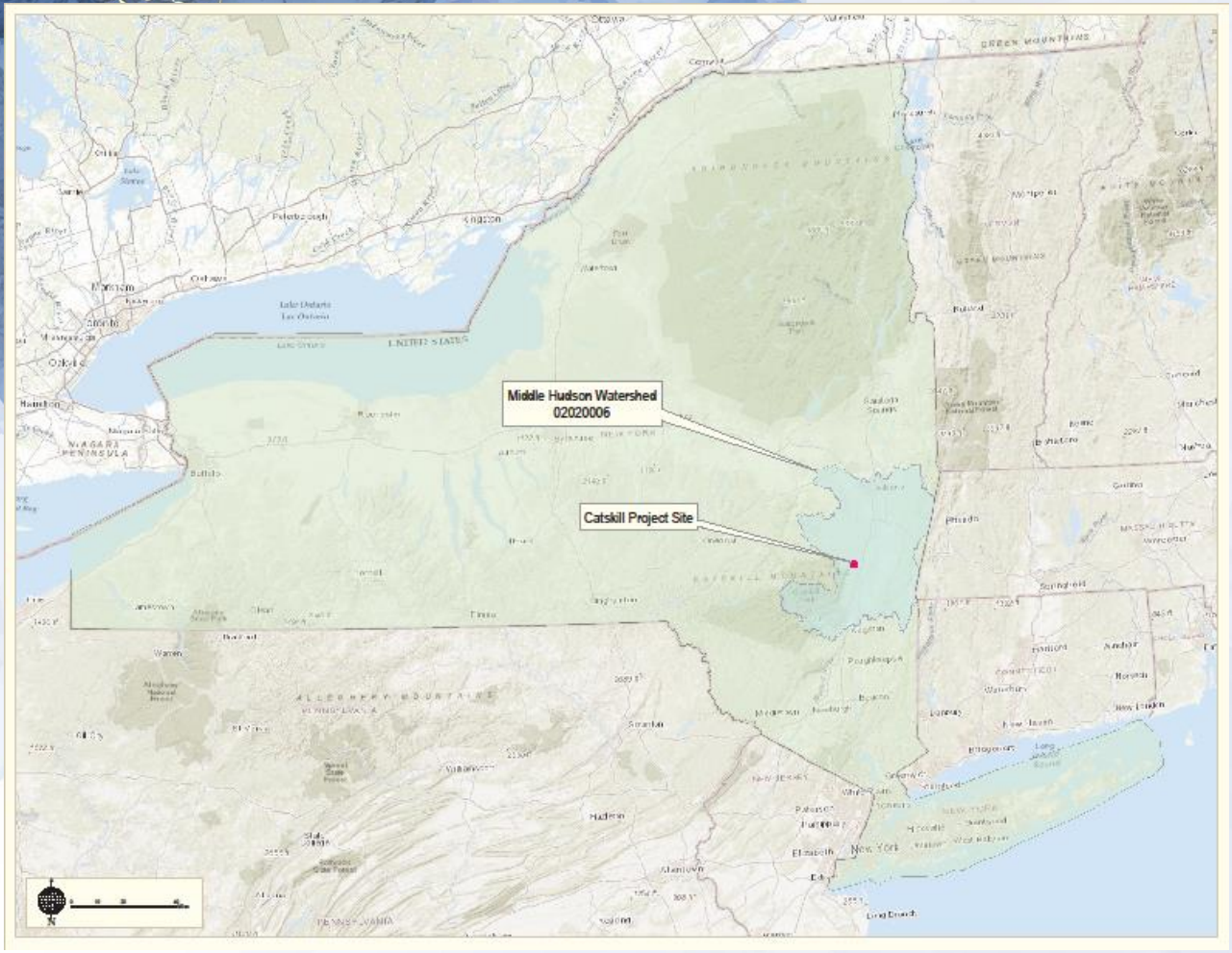
PROVIDE HABITAT STRUCTURAL DIVERSITY

- Early successional habitats:
  - **Grasslands**
    - Benefits declining bird species in vanishing habitat
    - Establishes quickly
  - **Wetlands/water bodies**
    - Restores water quality
    - Provides water resource for wildlife and people
    - Water cycle
  - **Reforestation**
    - Air quality
    - Thermal regulation
    - Soil conservation
  - **Recreation**
    - Human/cultural/community benefits

CATSKILL MITIGATION SITE

South Cairo, NY


Parcel Boundary
Mitigation Area



Catskill Mitigation Need

- Compensation for impacts due to railroad project
  - Middle Hudson HUC8 watershed
  - 0.61 acres of permitted, permanent wetland impacts and 17.5 linear feet of stream impacts
- Evaluated 31 potential mitigation sites, assessing:
  - Size, hydrology, soils, existing vegetation, landowners, invasive species, etc.

Catskill Mitigation Site Selection: McLaren Mine

- Former 4.5-acre shale mine within 86.5-acre parcel
- Two distinct, broad, flat basins
- Landowner willing to sell
- Open water features
- Groundwater seeps
- Forested buffer
- Few invasive species

Site Approval

Permit approved in May 2016 for mitigation at McLaren Mine Site

Permit requirements:

Establishment of 1.53 acres PSS wetland (scrub-shrub) and 0.38 acres PEM wetland (emergent)	Protection of 0.34 acres of existing wetland/open water	Restoration and protection of 4.38 acres of upland buffer

Site Needs

Wetlands are defined by their unique soils, hydrology, and vegetation (SOIL-WATER-PLANTS)

Establishing wetlands at the site required addressing all three parameters

- Grading to capture and hold water
- Addition of topsoil to hold and support plants
- Management of hydrology to support plant life
- Planting of wetland species

Implementation

Fall 2016
construction (grading)

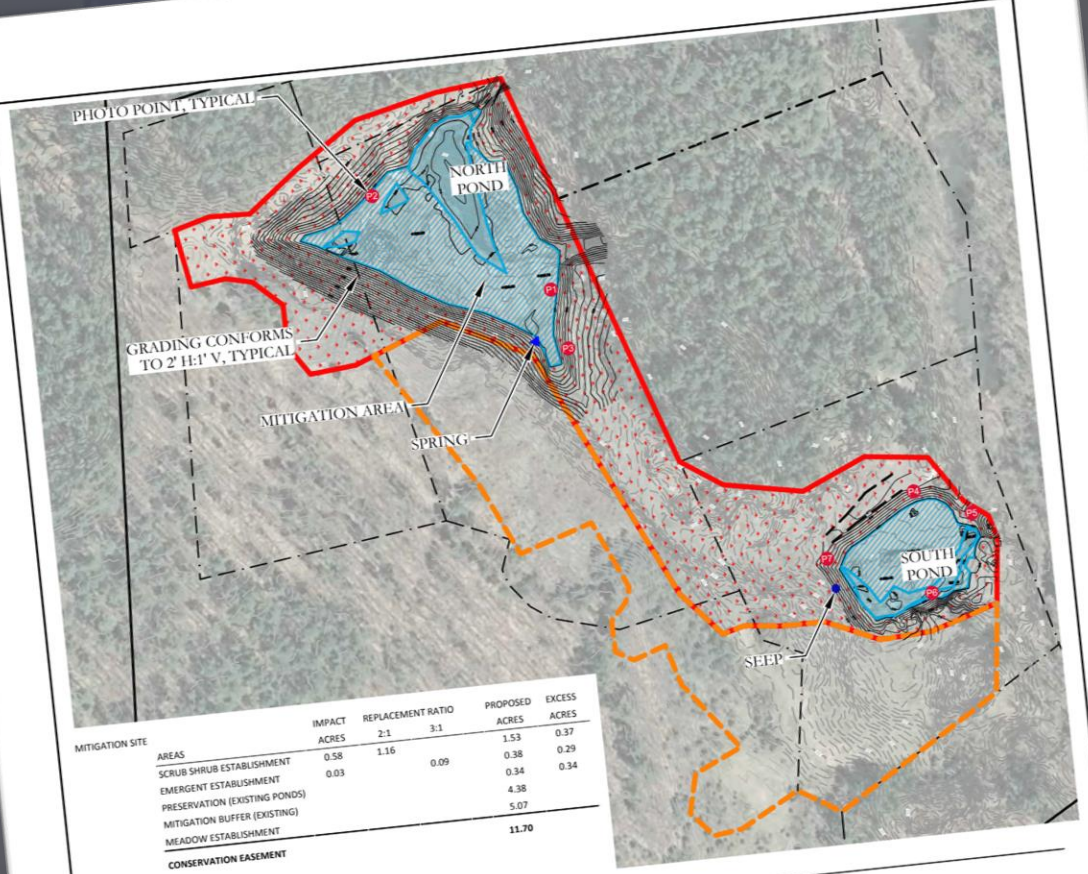
Spring 2017
planting of upland buffer

Wetland areas too wet to plant

Throughout 2017
hydrology monitoring & adjustment

2018
topsoil added & wetland plantings completed

2018 – 2022
monitoring & reporting



MITIGATION SITE

AREAS	IMPACT ACRES	REPLACEMENT RATIO 2:1	REPLACEMENT RATIO 3:1	PROPOSED ACRES	EXCESS ACRES
SCRUB SHRUB ESTABLISHMENT	0.58	1.16		1.53	0.37
EMERGENT ESTABLISHMENT	0.03		0.09	0.38	0.29
PRESERVATION (EXISTING PONDS)				0.34	0.34
MITIGATION BUFFER (EXISTING)				4.38	
MEADOW ESTABLISHMENT				5.07	
CONSERVATION EASEMENT				**11.70**	

LEGEND

PROPERTY BOUNDARY

EXISTING MINE PLAN

MITIGATION AREA , 7.32 Ac.

MITIGATION BUFFER AREA, 4.38 Ac.

MEADOW ESTABLISHMENT AREAS, 5.19 Ac.
(WITHIN MITIGATION AREA)

CONSERVATION EASEMENT AREA, 11.70 Ac.
NOTE: INCLUDES MITIGATION AND MITIGATION BUFFER AREAS

WETLAND ESTABLISHMENT AREAS, 2.13 Ac.
NOTE: SIDE SLOPE GRADING CONFORMS TO 2' H: 1' V, TYPICAL

EXISTING POND/EMERGENT, 0.47 Ac.

SCRUB SHRUB, 1.66 Ac.

Applied Ecological Services, Inc.
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WORKING LANDS
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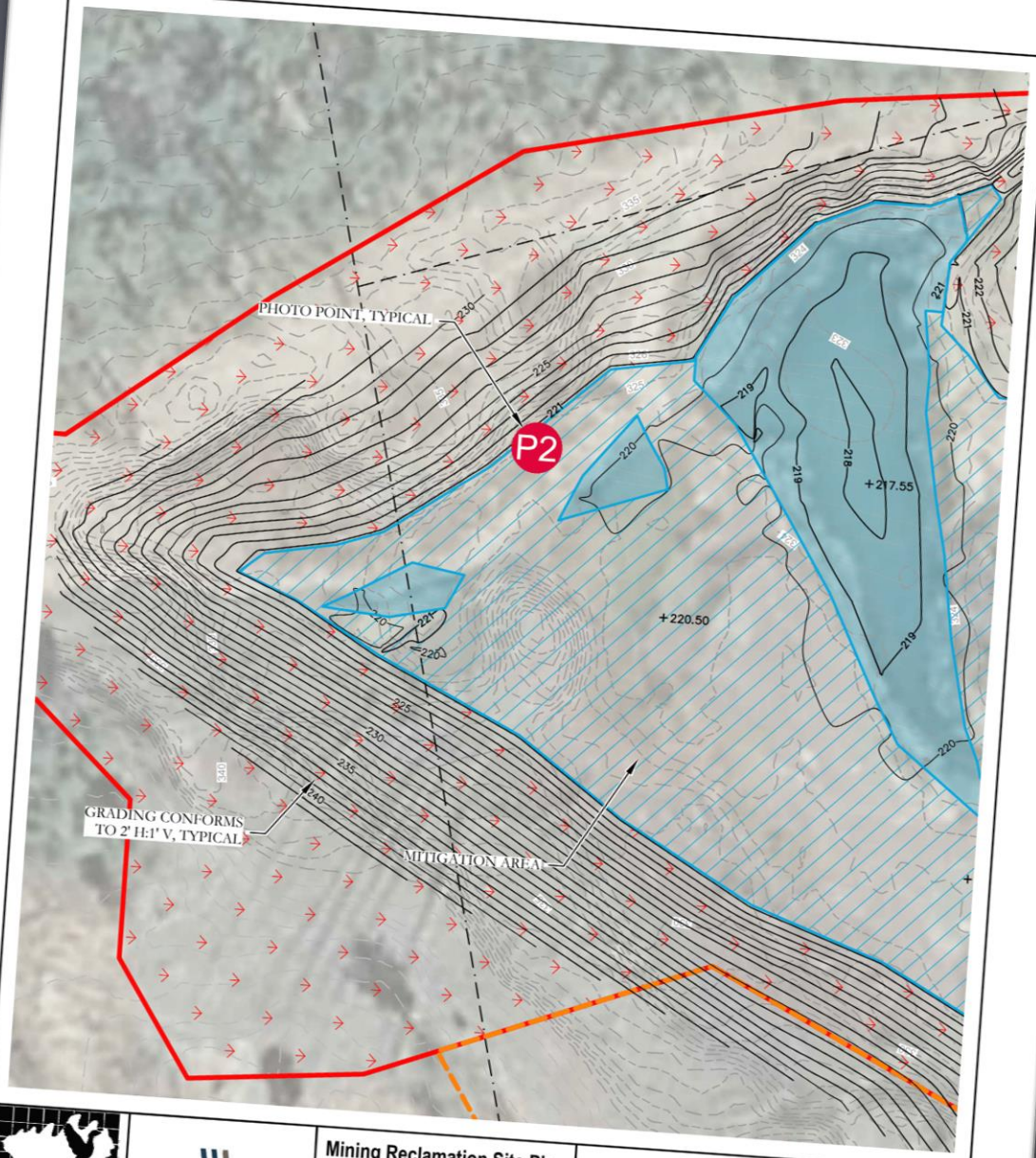
Mining Reclamation Site Plan
Mower McClairen Pit
Town of Catskill, Greene County, New York
As-Built Mitigation Plan
8 February 2016
(Rev. 02/23/2017)

N

0 100' 200' 400' Feet

Scale: 1" = 200'
To Scale When Printed at 8.5" x 11"



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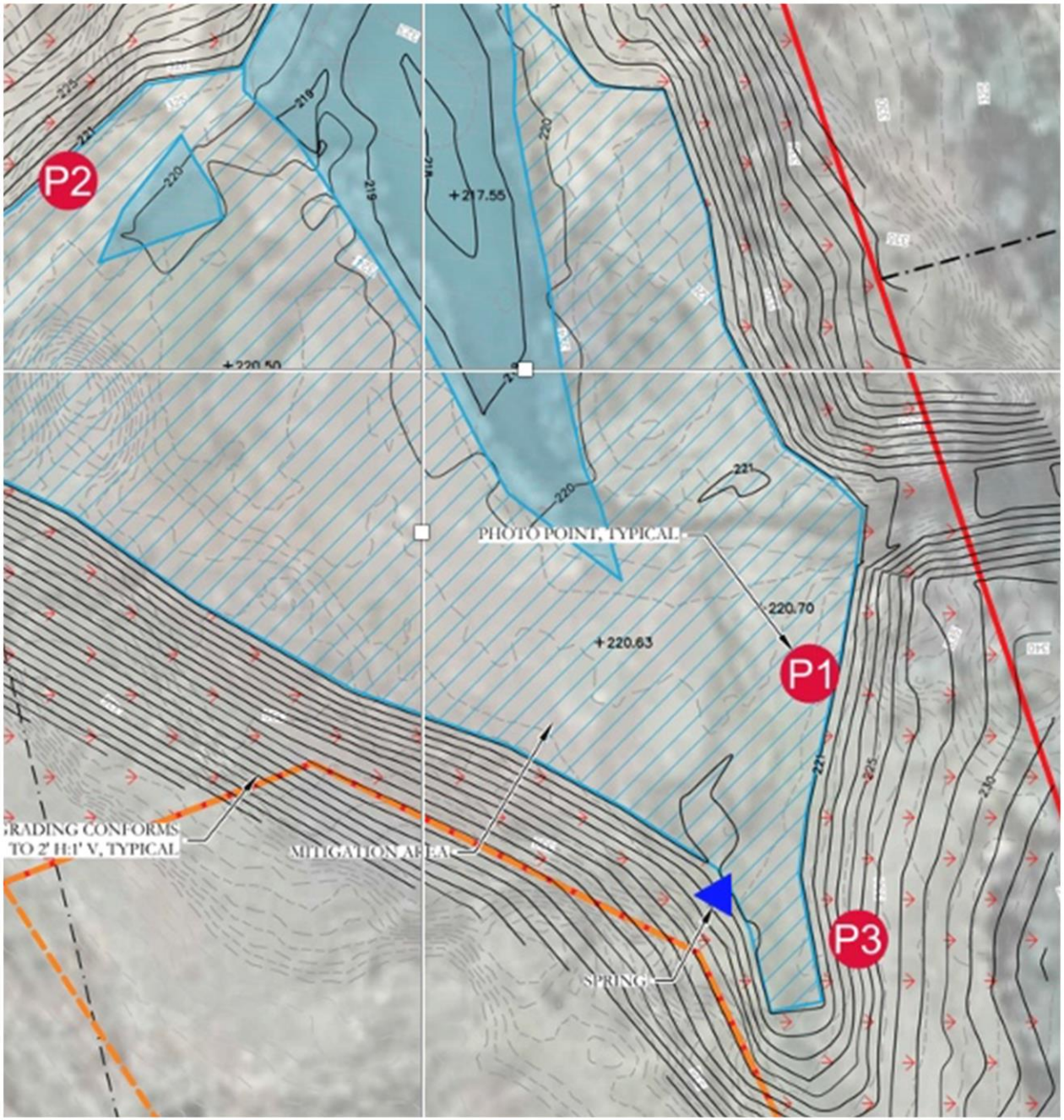
WORKING LANDS
INVESTMENT PARTNERS, LLC

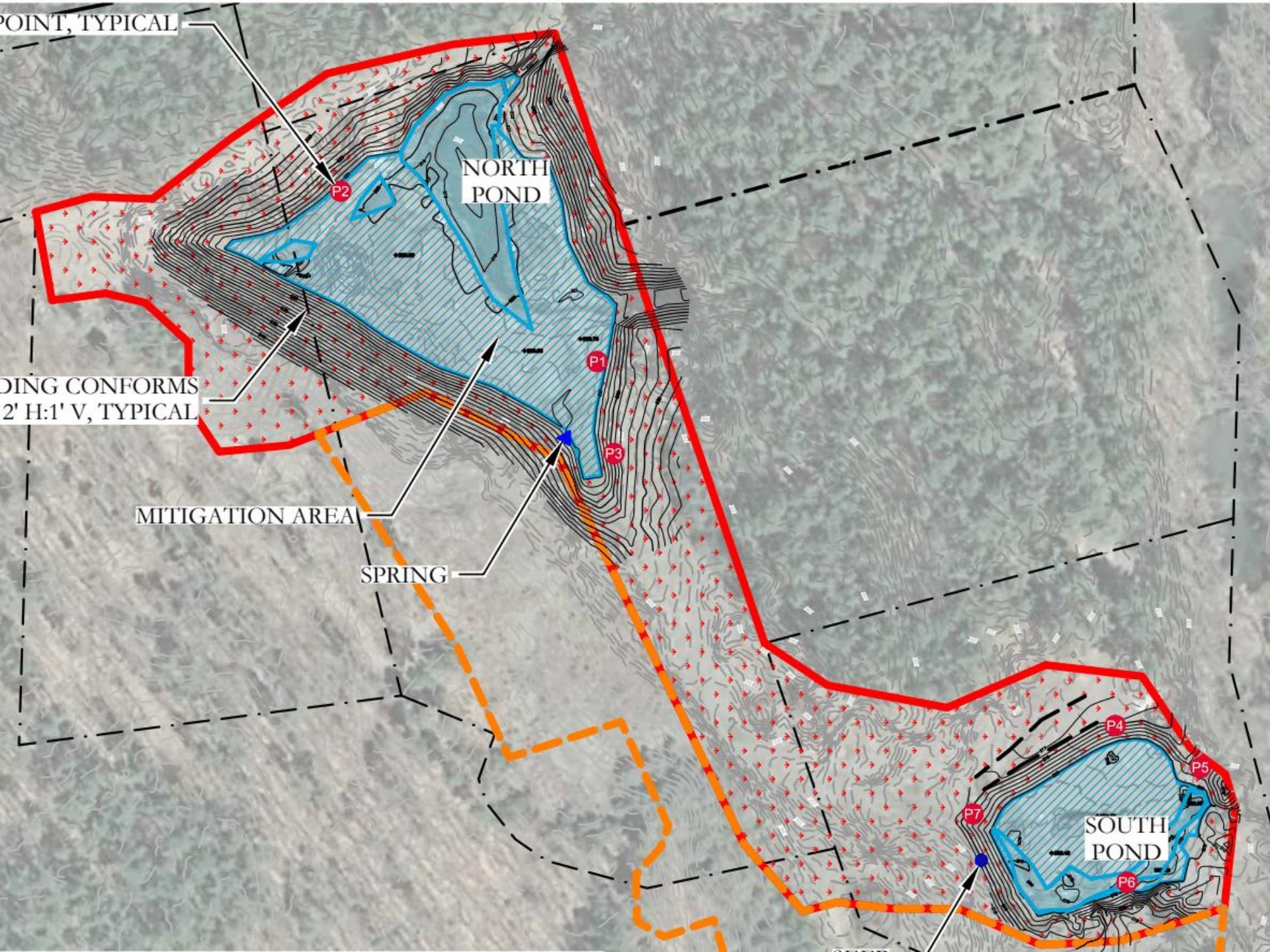
Mining Reclamation Site Plan
Mower McClairen Pit
Town of Catskill, Greene County, New York
As-Built Plan North Pond Detail (1 of 2)
8 February 2016
(Rev. 02/23/2017)

N

0 25' 50' 100' Feet

Scale: 1" = 50'
To Scale When Printed at 8.5" x 11"


P2
P1
P3
+217.55
+220.50
+220.63
220.70
PHOTO POINT, TYPICAL
GRADING CONFORMS
TO 2' H:1' V, TYPICAL
MITIGATION AREA
SPRING


POINT, TYPICAL
NORTH POND
P2
P1
P3
DING CONFORMS
2' H:1' V, TYPICAL
MITIGATION AREA
SPRING
P4
P5
P7
SOUTH POND
P6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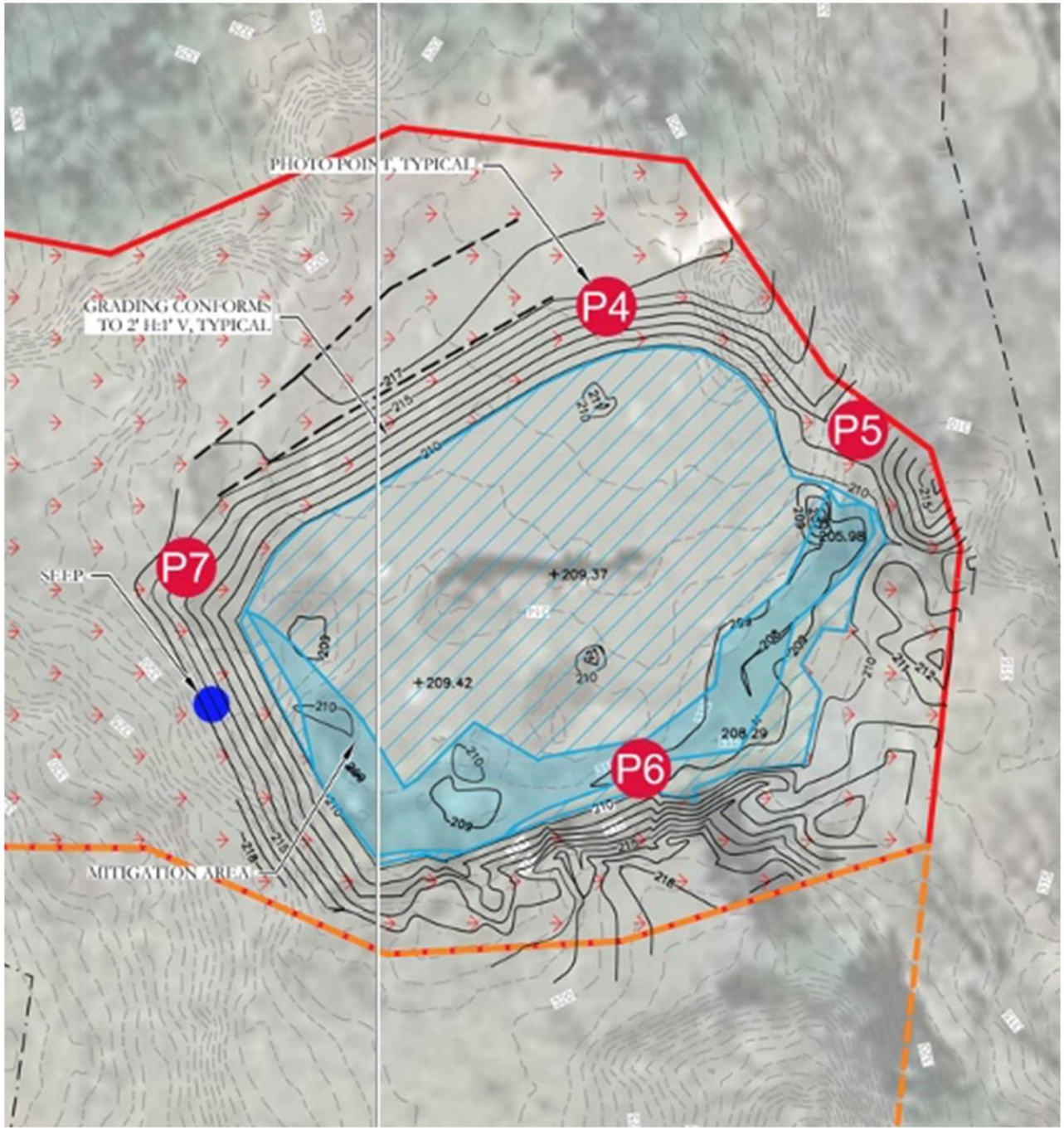


PHOTO POINT, TYPICAL
GRADING CONFORMS TO 2' H:1' V, TYPICAL
P4
P5
P6
P7
SEEP
MITIGATION AREA
+209.37
+209.42
208.29
205.98

- Thriving wetland and upland community created
- Multiple ecosystem benefits improved
  - Erosion control
  - Pollination
  - Biodiversity
  - Soil formation
  - Nutrient cycling
  - Habitat provision

Big Picture: Success!

North wetland

South wetland

Measuring Success: 5-Year Monitoring

- Establish 1.9 acres of wetland
- Min. 85% plant survival
- Min. 85% wetland plants
- Max. 5% invasive species

Site Challenges and Adaptive Management

PROBLEM	SOLUTION
Purple loosestrife taking over wetlands	• Released *Galerucella* beetle throughout site
Herbivory affecting shrub survival	• Shrub enclosures
Inconsistent water levels	• Monitoring, adjustment (ongoing)
Rocky substrate/ bedrock	• Additional topsoil where needed

Herbivory Affected Shrub Survival

PROBLEM:

- Herbivory by goats, deer, small mammals
- Many shrubs not surviving or barely hanging on

SOLUTION:

- Coordination with adjacent property owner to stop letting goats graze in wetlands
- Shrub enclosures for protection

Inconsistent Water Levels Affected Plant Survival

PROBLEM:

- Hydrology varied significantly from near drought conditions to flood conditions
- This type of variation expected to continue as climate changes
- Plant survival affected by both extremes

SOLUTION:

- Bi-weekly monitoring to understand variability
- Adjustment of outlet in north wetland
- Studying which plants have greatest success
- New plantings

Rocky Substrate/ Bedrock Affecting Shrub Survival

PROBLEM:

- 0.2-acre area in north wetland too rocky for plant roots to take hold

SOLUTION:

- Re-excavation to bedrock of problem area
- Addition of new topsoil
- New plantings

Purple Loosestrife Invading Wetlands

PROBLEM:

- Purple loosestrife – invasive species – invading wetland areas
- Difficult species to eradicate

SOLUTION:

- Introduction of over 1,000 *Galerucella* beetles, 'host-specific' to purple loosestrife

Ecological Restoration Well Underway

PACOS MITIGATION SITE

Arkwright, NY

Windmills, Wetlands & Gravel Mine Reclamation

A case study of the Pacos Property

By: Andy Johnson, PE

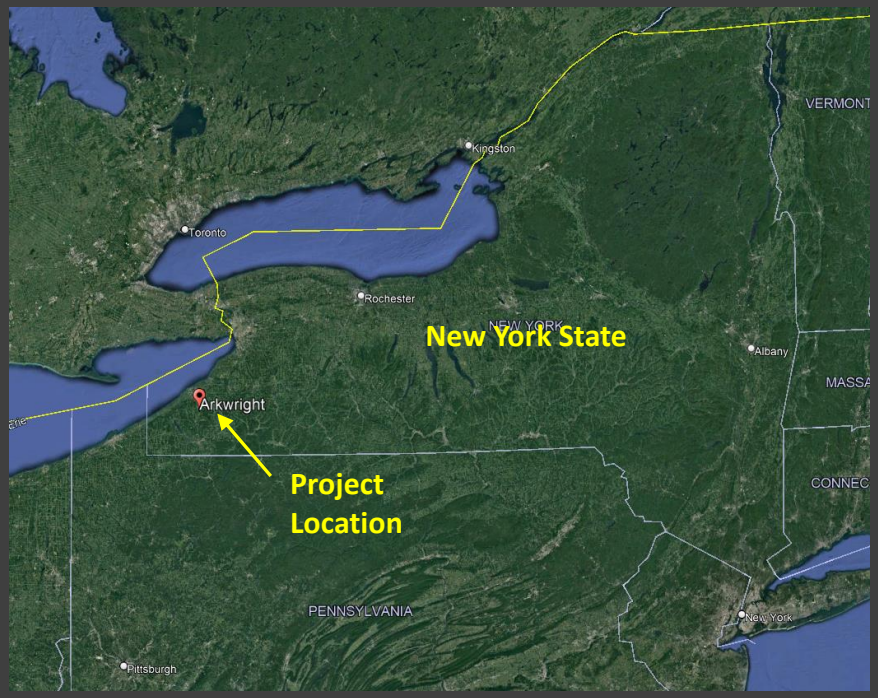
Arkwright Wind Farm

Sand & Gravel Mine

Local Wetland

Presentation Overview

- Site introduction and history
- Mitigation needs (impacts, acres needed)
- Ecosystem needs (services missing or degraded)
- Project goals and objectives
- Restoration design
- Ecosystem services enhanced + additional benefits/opportunities



Fun fact: New York State is #9 in the U.S. for construction sand & gravel mining.

Site Introduction & History

A *New Windmill Project* was constructed in the Town of Arkwright, New York

This resulted in *Wetland Impacts* & the need for *EcoSystem Services*

Mitigation Needs

- The windmills will generate 78.4 MW of electricity.
- Project impacted 8.1-acres of wetland and 32.8-acres of adjacent area impacts.

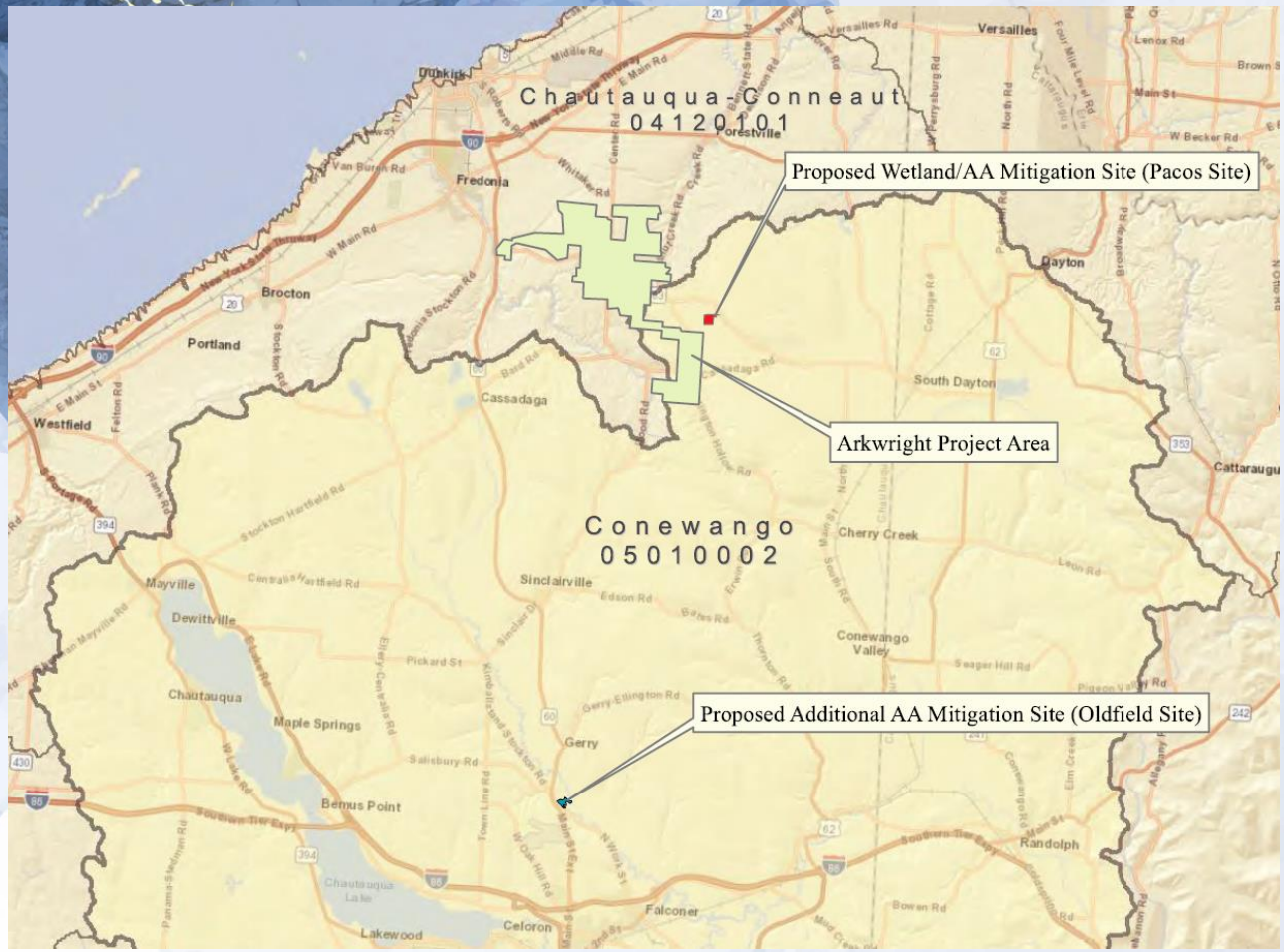
Table 2 Wetland Types Impacted by Permanent Fill

Wetland Type	Impacted Acreage
Palustrine Forested (PFO)	1.1
Palustrine Emergent (PEM)	0.2
Palustrine Scrub-Shrub (PSS)	0.1
TOTAL	**1.4**

Table 1 Summary of Permitted, Permanent Impacts to State Regulated Wetlands and Adjacent Areas

Impact Type	Impacted Acreage
Wetlands	
Permanent Fill	1.4
Permanent Conversion	6.7
TOTAL WETLAND IMPACTS	**8.1**
Adjacent Areas	
Permanent Fill	12.3
Permanent Conversion	20.5
TOTAL ADJACENT AREA IMPACTS	**32.8**

Mitigate at 2:1 ratio. Therefore, need minimum 1.4 x 2 = 2.8-acres. *Design for 3.0-acres + Ecosystem Enhancement Projects*

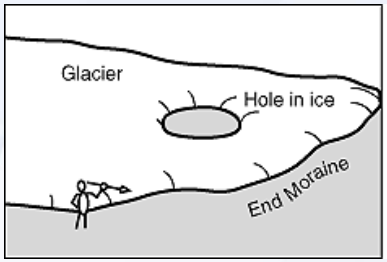


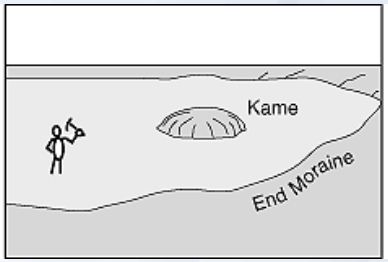
Site Selection for Mitigation

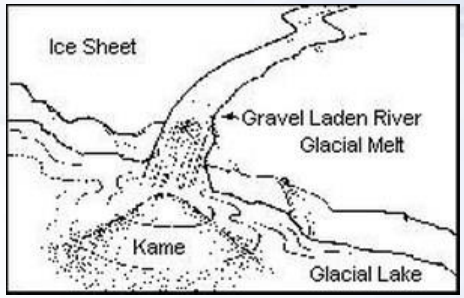
- The windmill project is shown in green.
- WLIP selected two properties for compensatory mitigation using wetland establishment, rehabilitation, enhancement, and protection activities as well as adjacent area rehabilitation and protection activities at two sites in the Conewango (05010002) Watershed.
- The focus of this presentation is on the Pacos Site (see red dot on map).

Pacos Property

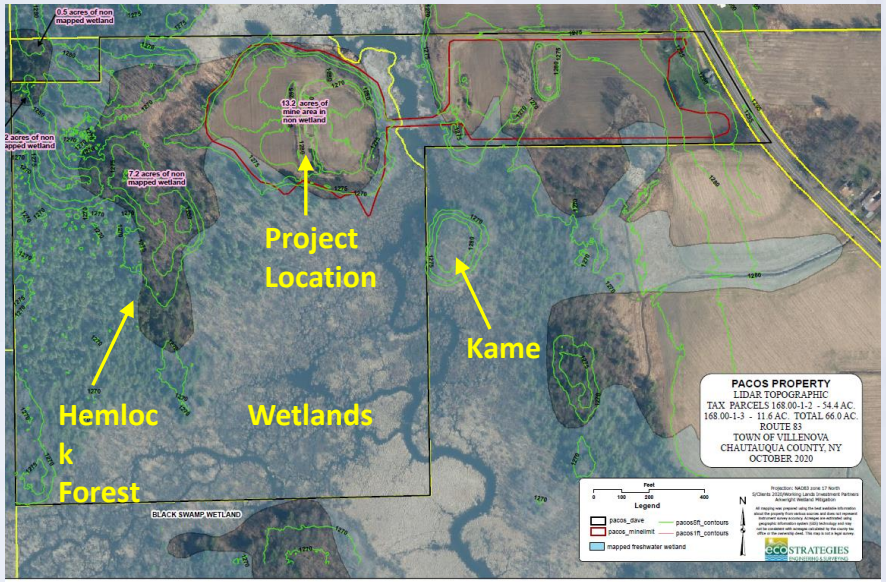
The property shown below was targeted for compensatory mitigation







Glaciers retreated 10,000 years ago leaving a Kame, which is a hill or mound of sand gravel.



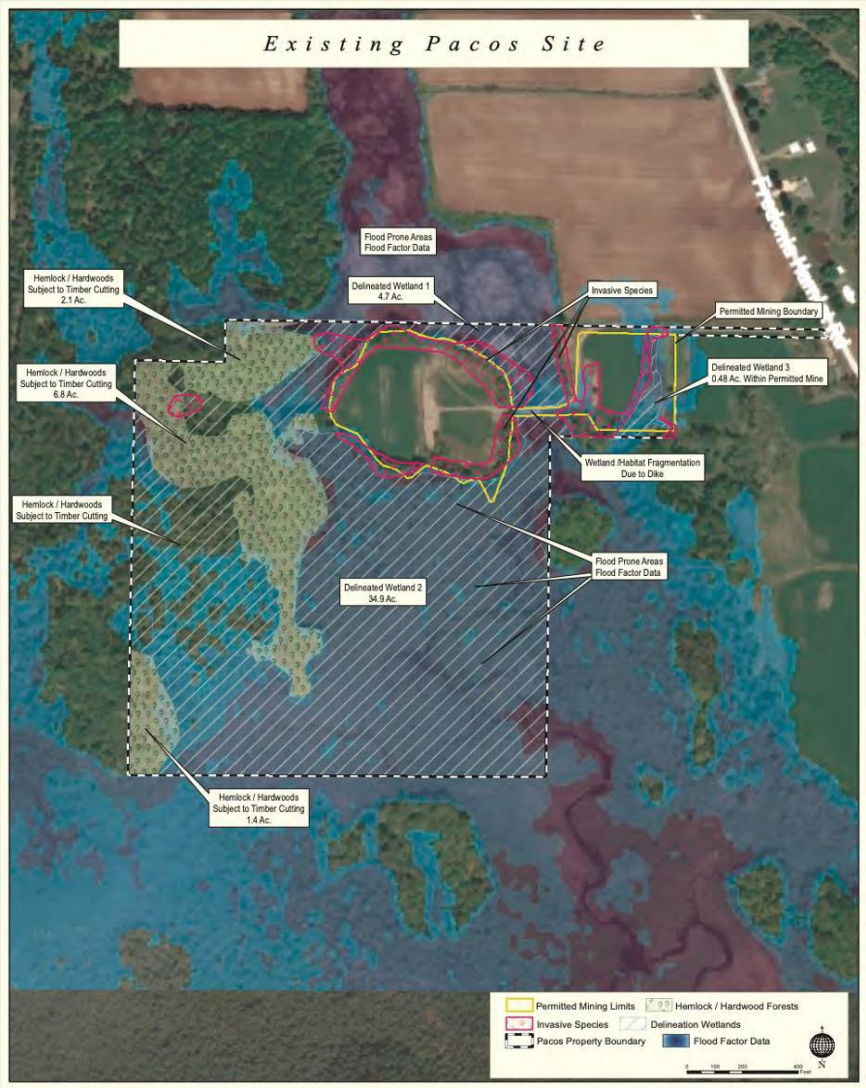
Property is 66-acres (black outline) with a mix of cover types, Including wetlands, hemlock forest, and 13.6-acre gravel mine & agricultural field (red line). Note the pit and mound topography surrounded by existing wetlands.

Pacos Property

- Property is within a 1,100-acre Class I Wetland Complex (Wetland FO-1).
- Property is within a NYS NHP-designated Significant Natural Community as part of the Mud Lake Swamp System.
- Property contains rich hemlock-hardwood peat swamp and unique.
- Property has a gravel mine and farm field.

- ***The Property also has several ecosystem needs…***

Ecosystem Needs



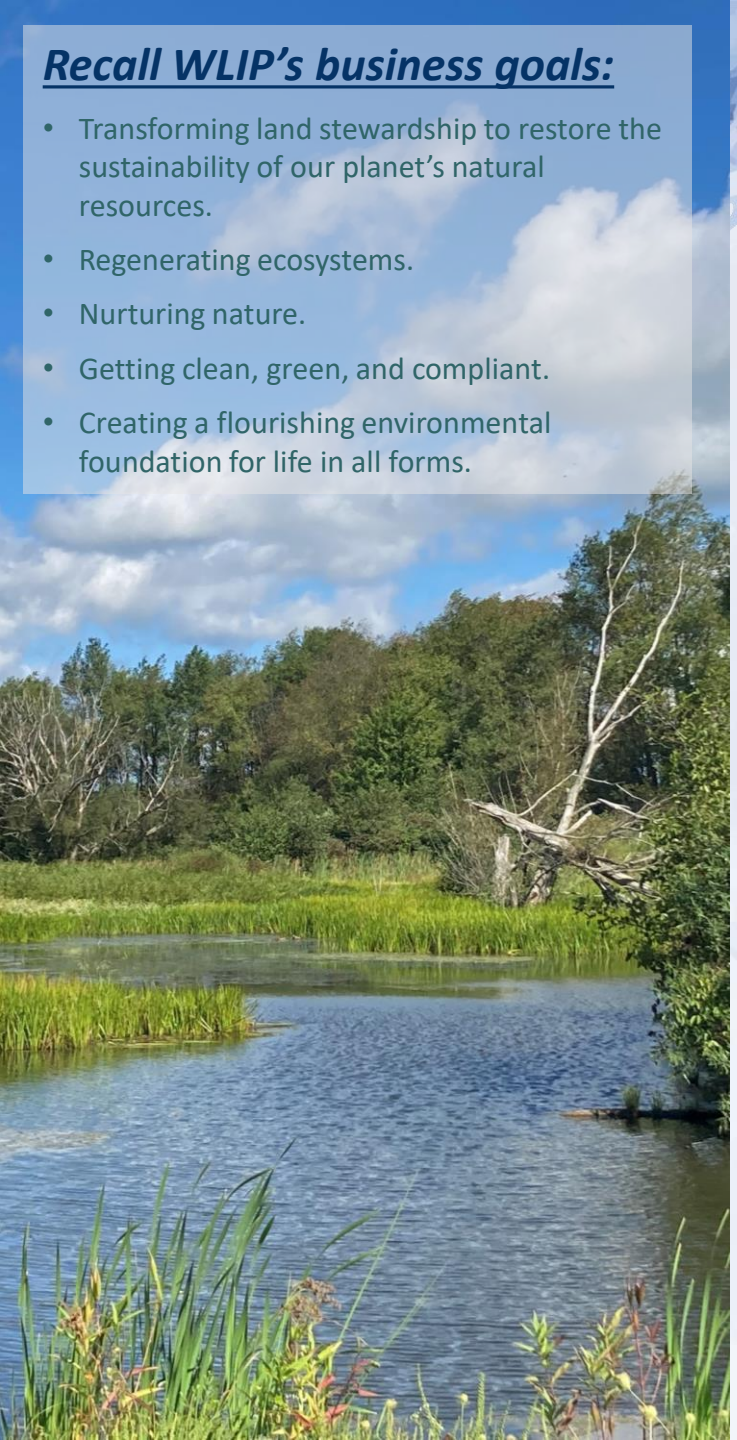
- Invasive Species Problems (pink hatching).
- Unique Hemlock / Hardwood Forest Subject to Timber Harvesting (green hatching).
- Wetland habitat fragmentation due to earth dike crossing (land bridge).
- Permitted Gravel Mine Activity since 1987.
- Agricultural Activity.
- 0.5-acres of Wetland within the permitted mine.

Invasive Mugwort

Restrictive wetland crossing

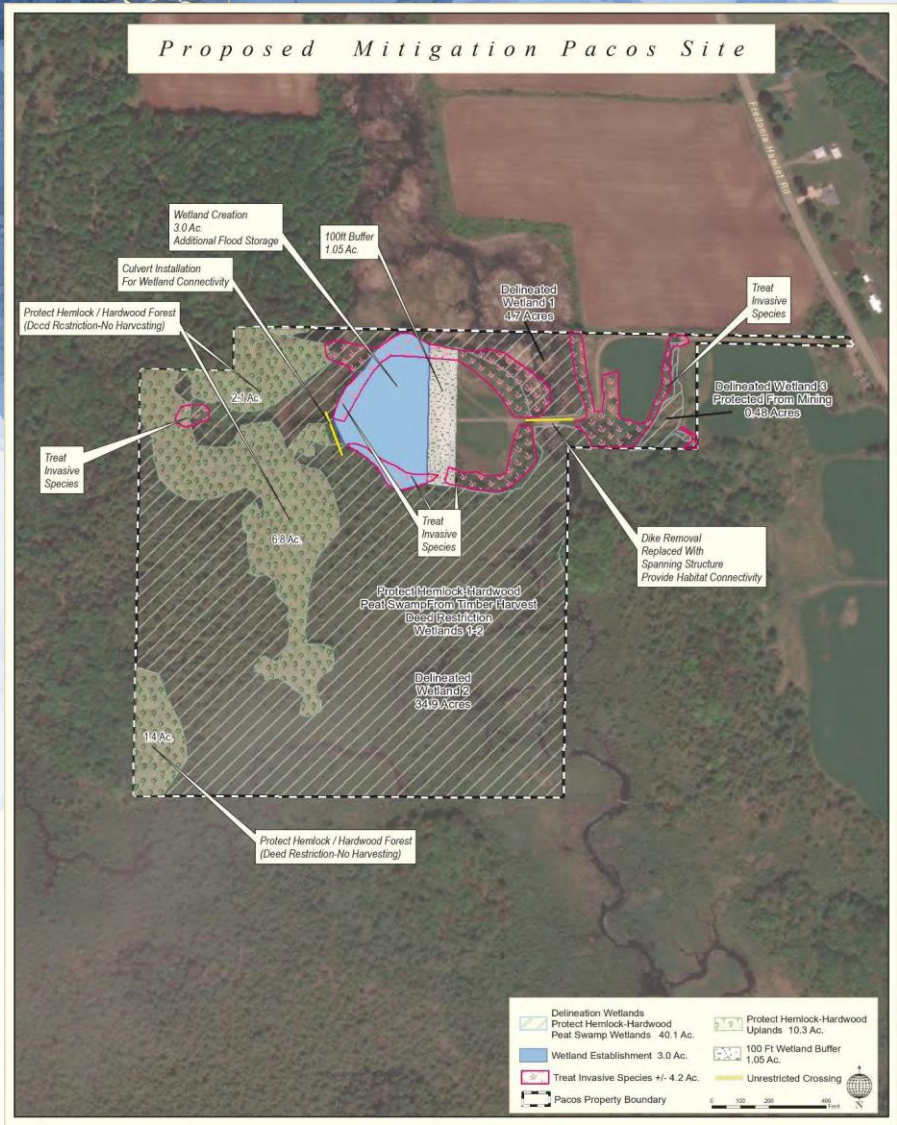
Recall WLIP's business goals:

- Transforming land stewardship to restore the sustainability of our planet's natural resources.
- Regenerating ecosystems.
- Nurturing nature.
- Getting clean, green, and compliant.
- Creating a flourishing environmental foundation for life in all forms.



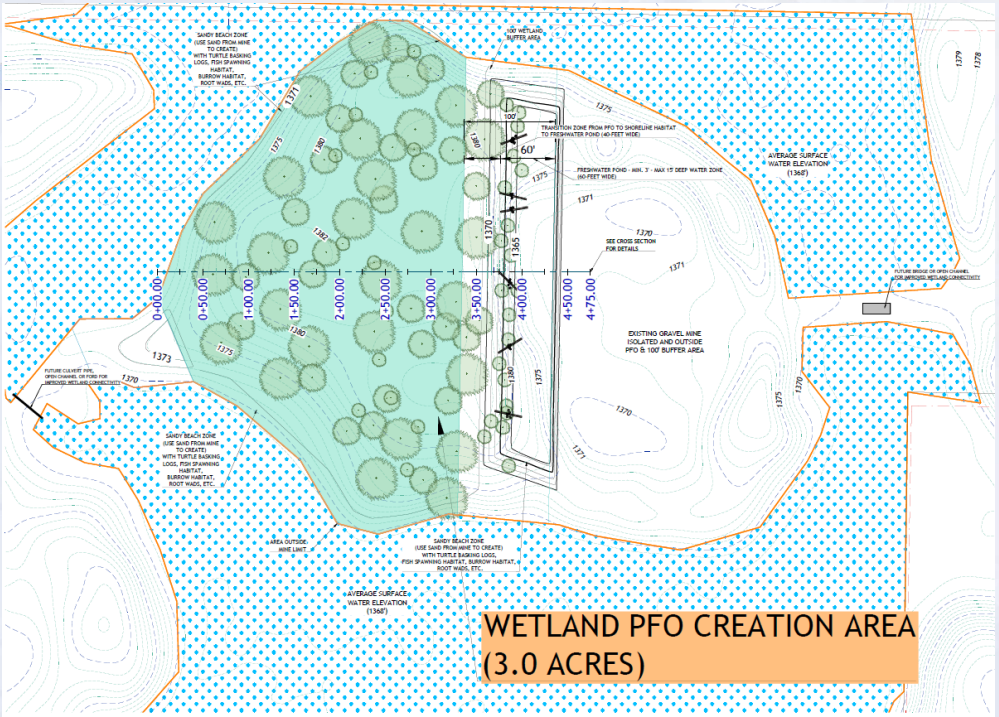
Project Goals & Objectives

- The **project goal** is to satisfy the wetland mitigation impacts from the windmill project while creating additional overlapping benefits to people and the environment.
- The **mitigation objectives** are to provide compensatory wetland and adjacent area mitigation that:
  - Is commensurate with the type and scale of permitted impacts;
  - Compensates for wetland benefits lost and reduced;
  - Is in New York DEC's preferred mitigation focus areas, if possible;
  - Responds to the opportunities for wetland and upland establishment, rehabilitation; enhancement, and preservation at selected sites; and
  - Can be implemented in acceptable timeframes.



- Alter mine reclamation plan to create 3.0-acres of wetland creation PFO area (blue shade) with 100-foot buffer (tan shade).
- Eradicate Invasive Species Problem (pink hatching).
- Protect the Unique Hemlock / Hardwood Forest & Peat Swamp that is Subject to Timber Harvesting (green hatching) with a deed restriction (no tree cutting).
- Remove restricted creek crossing to create habitat connectivity (500-acres of wetland upstream & 1,200 acres downstream).
- Protect 0.5-acres of Wetland within the permitted mine area.
- Create additional floodplain storage for climate resilience.

Restoration Design Plan

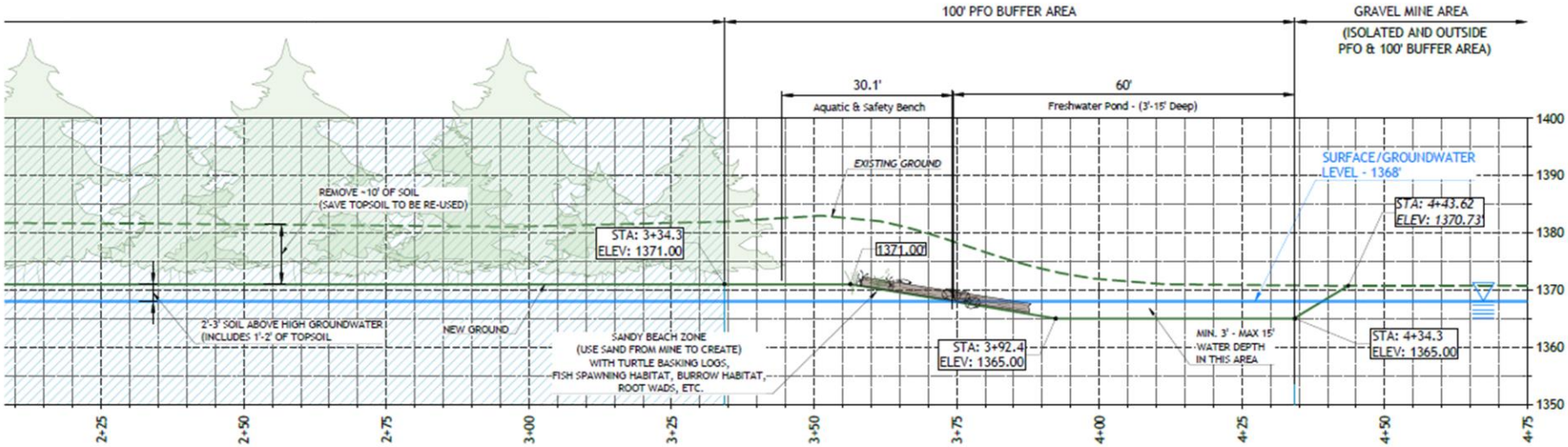


Took sample plots to observe the existing wetland features onsite:

- What are the existing trees and plant species already thriving at the various water level depths onsite?
- What is the natural topography?
- What does the natural shoreline and PFO area look like?
- Blend the compensatory mitigation goals with natural conditions.

- Remove 10–15 feet of sand/gravel and create pit and mound topography with varied water level depths to and create new wetlands with selected plantings that satisfy compensatory mitigation requirements.

Restoration Design Plan (cont.)



Apply ecological engineering and biomimicry techniques for restoration…

- Create a sandy beach shoreline zone using sand, tree logs, stumps and root wads to create ecological habitat.
- ***Habitat features*** include PFO wetland, pit and mound topography varying water levels, vernal pools, turtle basking logs, burrow habitat, fish spawning habitat, etc.

Restoration Design Plan (cont.)

Ecosystem Services

Enhanced + Additional Benefits

Ecosystem services enhanced to meet mitigation goals and objectives:

- Created 3.0-acres of new wetland area + 100-foot buffer of protection.
- Eradicated Invasive Species and establish native species.
- Deed restriction to protect the Hemlock / Hardwood Forest & Peat Swamp from timber harvesting.
- Remove restricted creek crossing to improve aquatic migration and habitat connectivity between wetlands.
- Protect 0.5-acres of wetland that encroached into the permitted mine area.
- Create additional floodplain storage for climate resilience.

Additional benefits and opportunities:

- Partnering with academia on restoration monitoring and teaching opportunities.
- Preserving unique ecosystems indefinitely to benefit people and the environment.
- Used gravel generated from the wetland creation project to help build other windmill projects. Closed loop system of "working land". **Mine sites offer unique opportunities!** **THINK ABOUT MINING OPERATIONS, RECLAMATION PLANS, AND LOCAL NEEDS!**
- Creating model examples for educational outreach and public awareness. Promoting land stewardship. (WLIP business goals).

WORKING LANDS
INVESTMENT PARTNERS, LLC

THANK YOU

Questions?