

**Harvesting and
Planting
Adventitious
Rooting Material**

**Cutting, bundling, and
soaking adventitious
rooting material for the
Toledo projects
August 2008**

Matt Horvat with a chain saw & time on his hands



Toledo Zoo Teens carrying cut willow poles



Hard working **Toledo Zoo Teens** harvested over 1,000 poles !!



Teen volunteers stripping branches & leaves from poles



Using twine to bundle poles into manageable bundles



Great looking cleaned and bundled poles ready to soak



Bundles in truck ready for transport to the stream



Bundles will soak for 10 days in the Ottawa River. Research by Dr. Doug Shields showed that soaking 10 days will increase root production by 2,600% when planted, & 100% of poles will flush



Effects of Pre-Planting Soaking on Growth and Survival of Black Willow Cuttings

by Stephen D. Schaff; S. Reza Pezeshki & F. Douglas Shields, Jr.

Restoration Ecology, Vol 10, No. 2, pp. 267-274

- Black Willow cuttings 1.5 inches diameter by 4 ft long, were harvested, covered with black weed guard material & completely soaked for 10, 3, and zero days, then planted in four different soil moisture regimes
- There was no discernable difference between posts soaked zero or 3 days except the root to shoot ratio was greater for the 3 day
- For posts subjected to the 10 day soaking, 100% flushed, and compared to the control (unsoaked) posts: twice as many survived, live shoot biomass increased 16 fold, live root biomass increased 32 fold, and number of live roots increased by 2,600%, and much greater survival was recorded under drought conditions
- Research by others on Cottonwood poles showed that 10 days of soaking resulted in flushing, whereas non-soaked poles did not!

Live Staking

(Also Called "Sprigging", Pencils" or "Whips")

Description: Manual vertical insertion of small sharpened willow cuttings (branches 18 to 36 inches in length, 1/2 to 3/4 inch diameter) in the lower sections of stream banks. Can either be pushed in by hand or pounded in or rebar used to poke a hole in the bank, with the branch inserted in the hole. Can be placed within "hard" structures (joint planting).

- No mechanized support needed.
- Inexpensive, simple, versatile, and quick!
- No material cost items.
- Two man crew can install up to 500 sprigs a day.
- Can be planted from on-bank or canoe.

**If a live stake
splits, replace
it, it will not
grow**



Drillin' & Live Staking,

Duck Hill, MS



1-19-2003

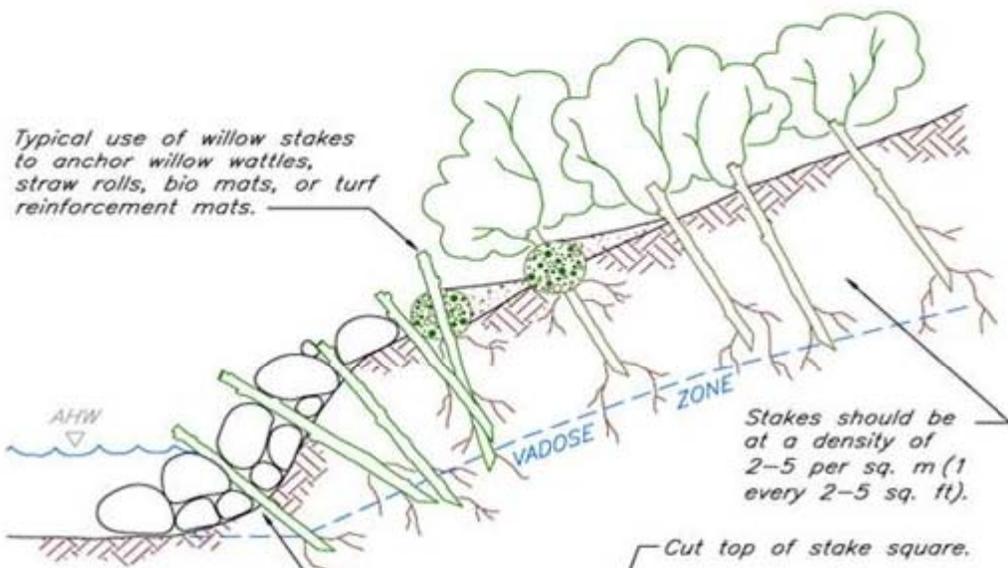
Live Stakes catching sediment just days after installation





**Live Stakes, at
the end of the
first growing
season, Middle
Fork**

**Worsham
Creek, Duck
Hill, MS
{rural, clay-
sand bed, <1%
slope, incised,
straightened}**



Typical - drive or plant willow stakes through openings in riprap or gabions.

Plant 80% of stake length into the ground.

0.5 m (18in.) min.

Cut top of stake square.

2 to 5 buds scars shall be above the ground.

Trim branches close.

20-75 mm (3/4-3in.) diameter.

Make angled cut at butt-end, plant butt-end down.

NOTES:

1. Harvest and plant stakes during the dormant season.
2. Use healthy, straight and live wood at least 1 year old.
3. Make clean cuts and do not damage stakes or split ends during installation; use an iron bar and pilot hole in firm soils.
4. Soak cuttings for at least 24 hours prior to installation. Soak for 5-7 days for best results.
5. Tamp the soil around the stake.

LIVE STAKING AND JOINT PLANTING

FILE: LVSTK

Joint Planting is the same as Live Staking except it is driven through, or better yet, integrated into the riprap or other armor (through the joints or interstices of the armor material)

Drawing from
McCullah's

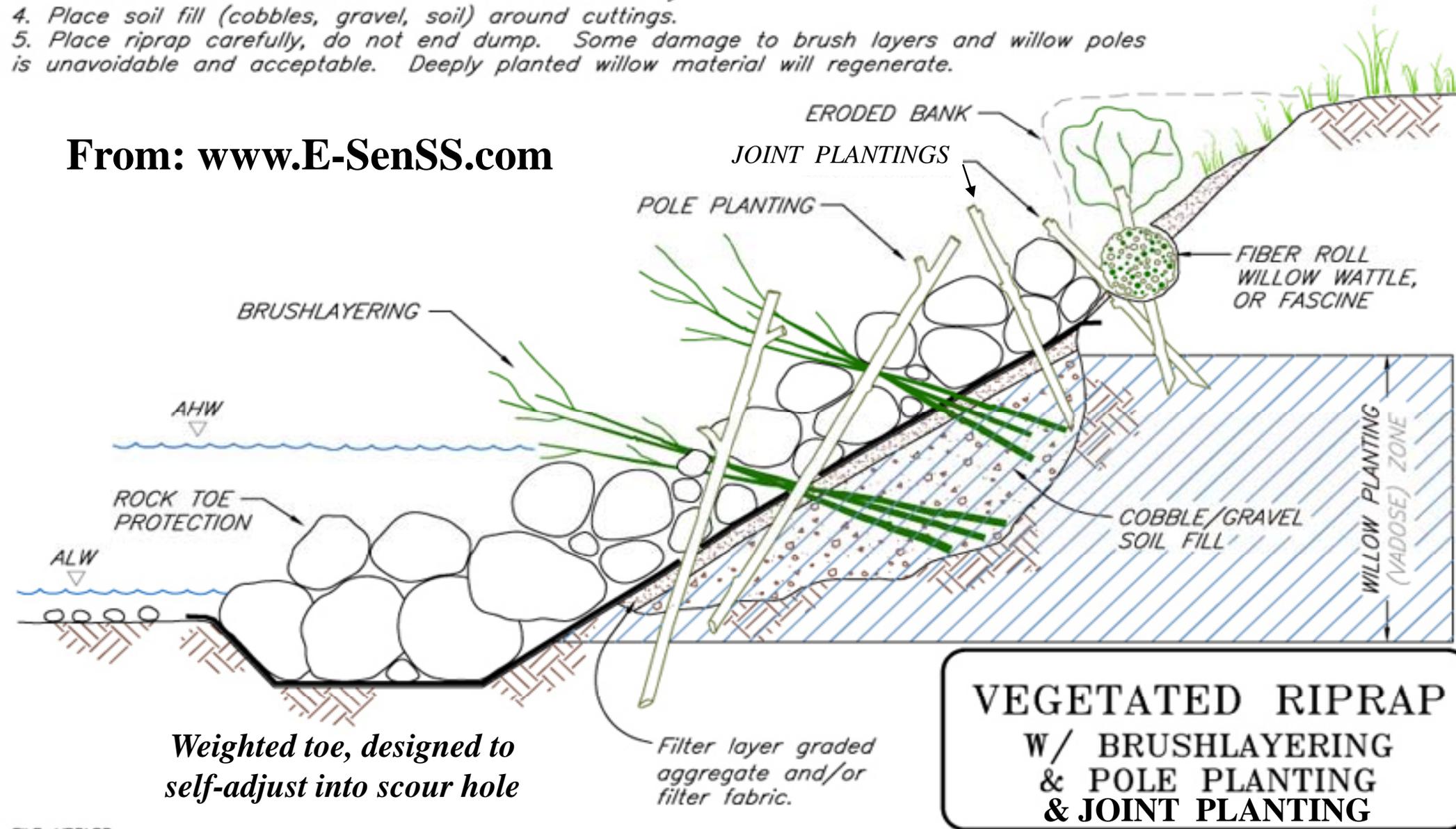
www.E-SenSS.com



**Willow poles integrated into riprap boulders
Branciforte Creek, Santa Cruz, CA**

1. Install willow pole planting and brushlayering during bank grading and riprap placement to ensure good contact with 'native ground' and/or soil fill.
2. Willow poles and brush layers should extend down into expected soil moisture zones (vadose).
3. Cut small holes or slits in filter fabric as necessary.
4. Place soil fill (cobbles, gravel, soil) around cuttings.
5. Place riprap carefully, do not end dump. Some damage to brush layers and willow poles is unavoidable and acceptable. Deeply planted willow material will regenerate.

From: www.E-SenSS.com



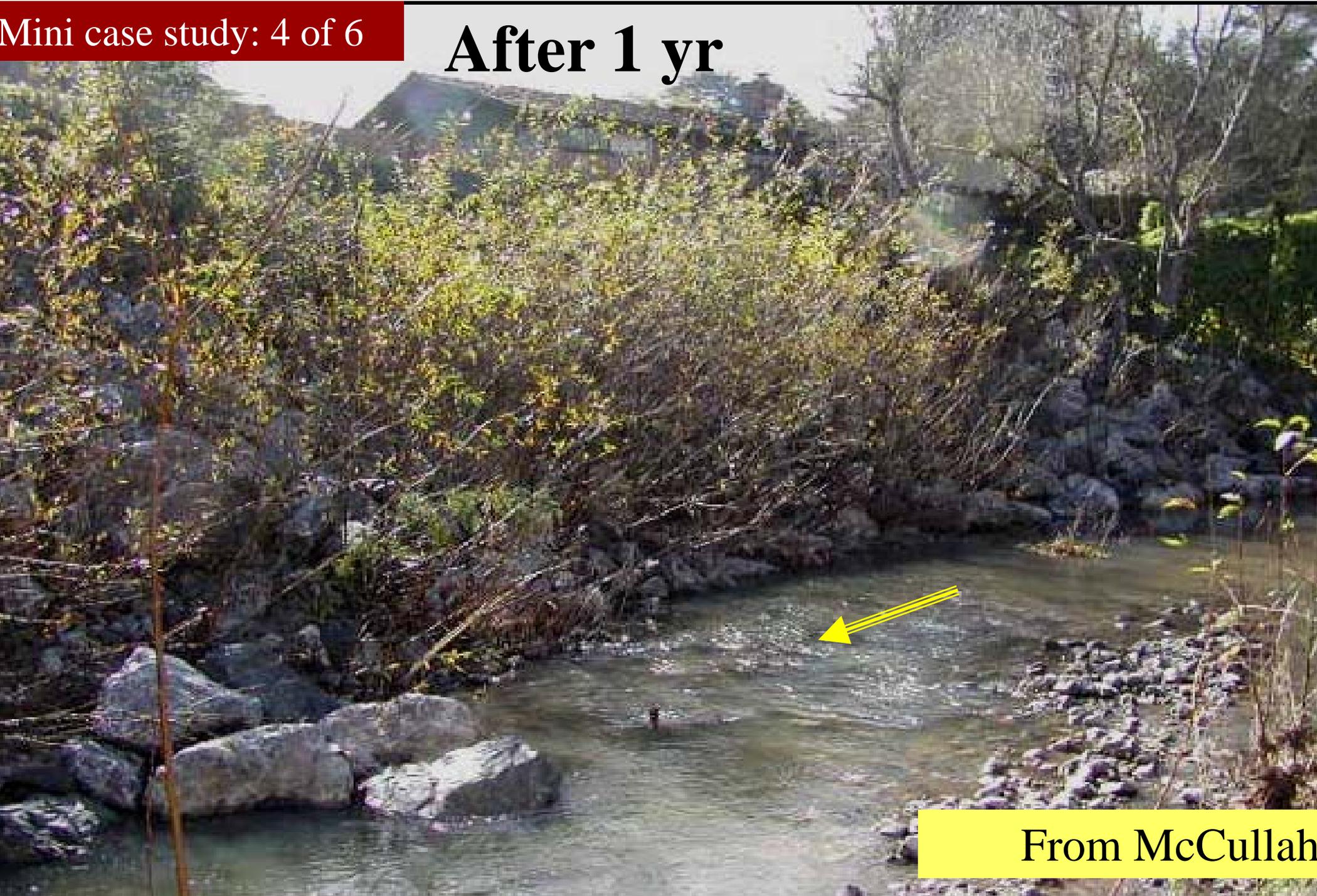
Weighted toe, designed to self-adjust into scour hole

Filter layer graded aggregate and/or filter fabric.

Mini case study: 3 of 6



After 1 yr



From McCullah

After 2 yrs



Adventitious Rooting Plants

(when trunk or branches are in contact with soil the plant will sprout roots)

- **Banker's Willow-** *Salix x cottetii*, **Streamco Willow-** *Salix purpurea*, **Black Willow-** *Salix nigra*, **Pussy Willow-** *Salix discolor*, & **Crack, Autumn etc.**
- **Red Osier Dogwood-** *Cornus stolonifera*
- **Silky Dogwood-** *Cornus amomum*
- **Buttonbush-** *Cephalanthus occidentalis*
- **Sycamore-** *Platanus occidentalis*
- **Cottonwood-** *Populus deltoides*
- **Box Elder-** *Acer negundo*
- **Speckled Elder-(bark was scarred)-** *Alnus rugosa*
- **Elderberry-** *Sambucus Canadensis*
- **Elm-** *Ulmus Americana*
- **Bois d'arc, Mock Orange, Bow Wood, Hedge Apple, Horse Apple, Osage Orange-** *all are Maclura pomifera.*
- **River Birch-** (*Betula nigra*)
- **Black Locust-** (*Robinia pseudoacacia*)
- **Northern Catalpa-** (*Catalpa speciosa*)

Anyone know of any others???

Bioengineering & “Funnel” Strategy Workshop @ Nichols Road Bridge, Onondaga Creek, NY

**A completed project needed some
“tweaking” and veg. Top bank stone
was removed the week before. All stone
placement & planting occurred on
Tuesday May 15, 2007.**

Onondaga Creek @ Nichol Road Bridge,
LaFayette, NY – project planted 5-15-2007

**PLANT
PLANTS WITH
LARGE
YELLOW
MACHINES**

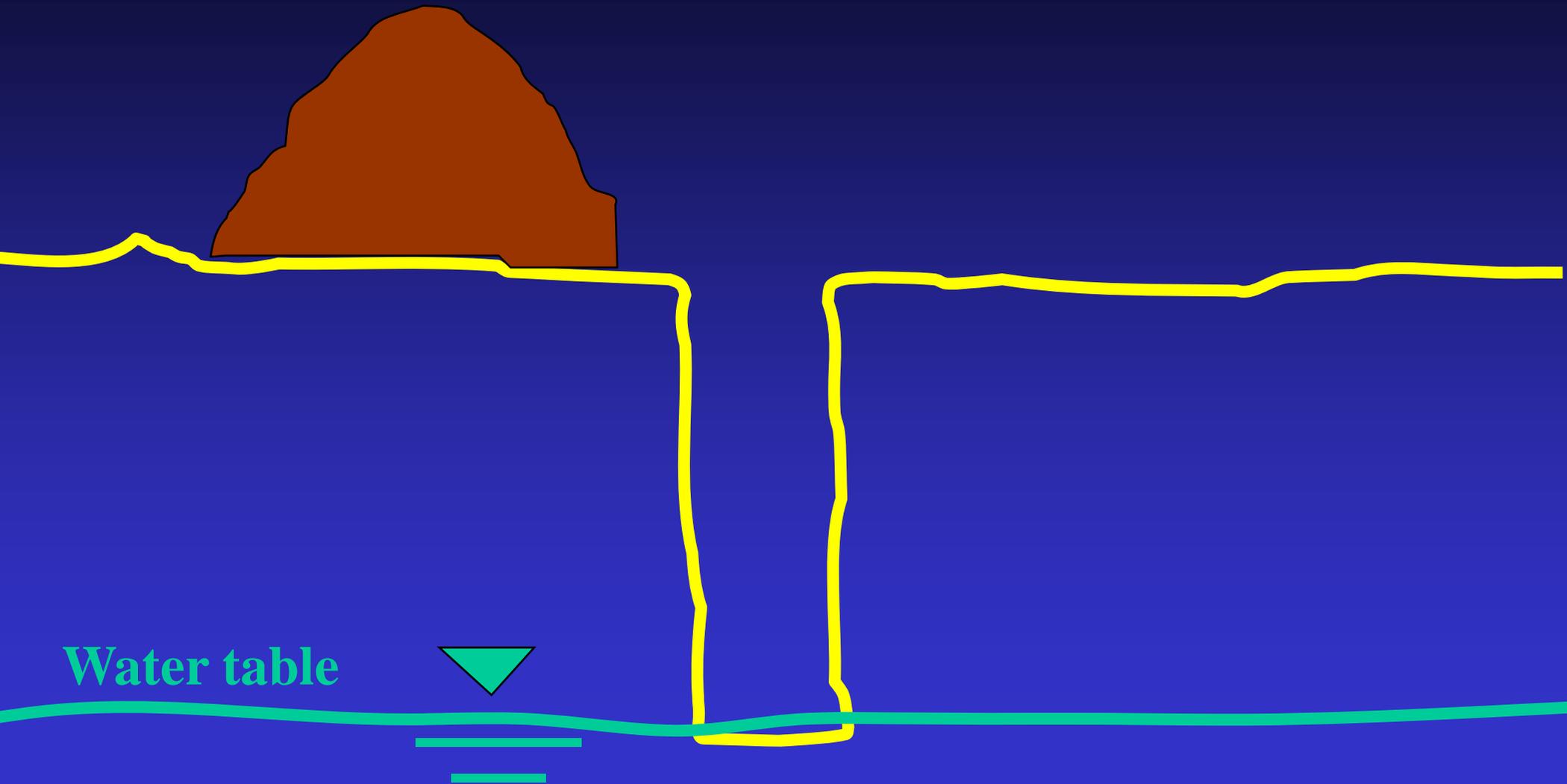
**Onondaga Creek @ Nichol Road Bridge,
LaFayette, NY – project planted 5-15-2007**



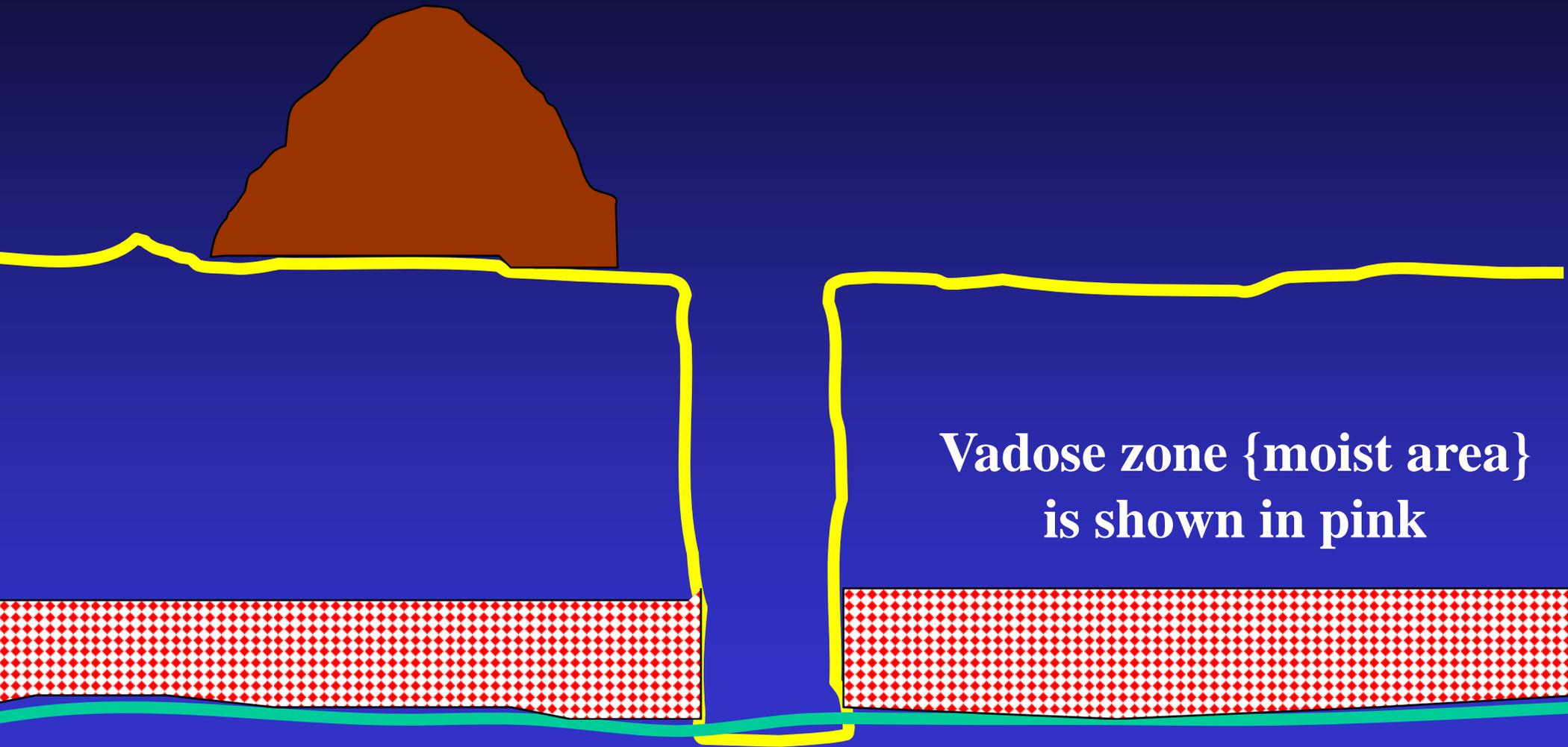
**Rubber tired
backhoe digs
4-5 ft deep
trench with a
narrow
bucket. Pix
by Bill
Frederick**

Mini-Case study: 2 of 16

TWO-STAGE SLIT TRENCH TECHNIQUE



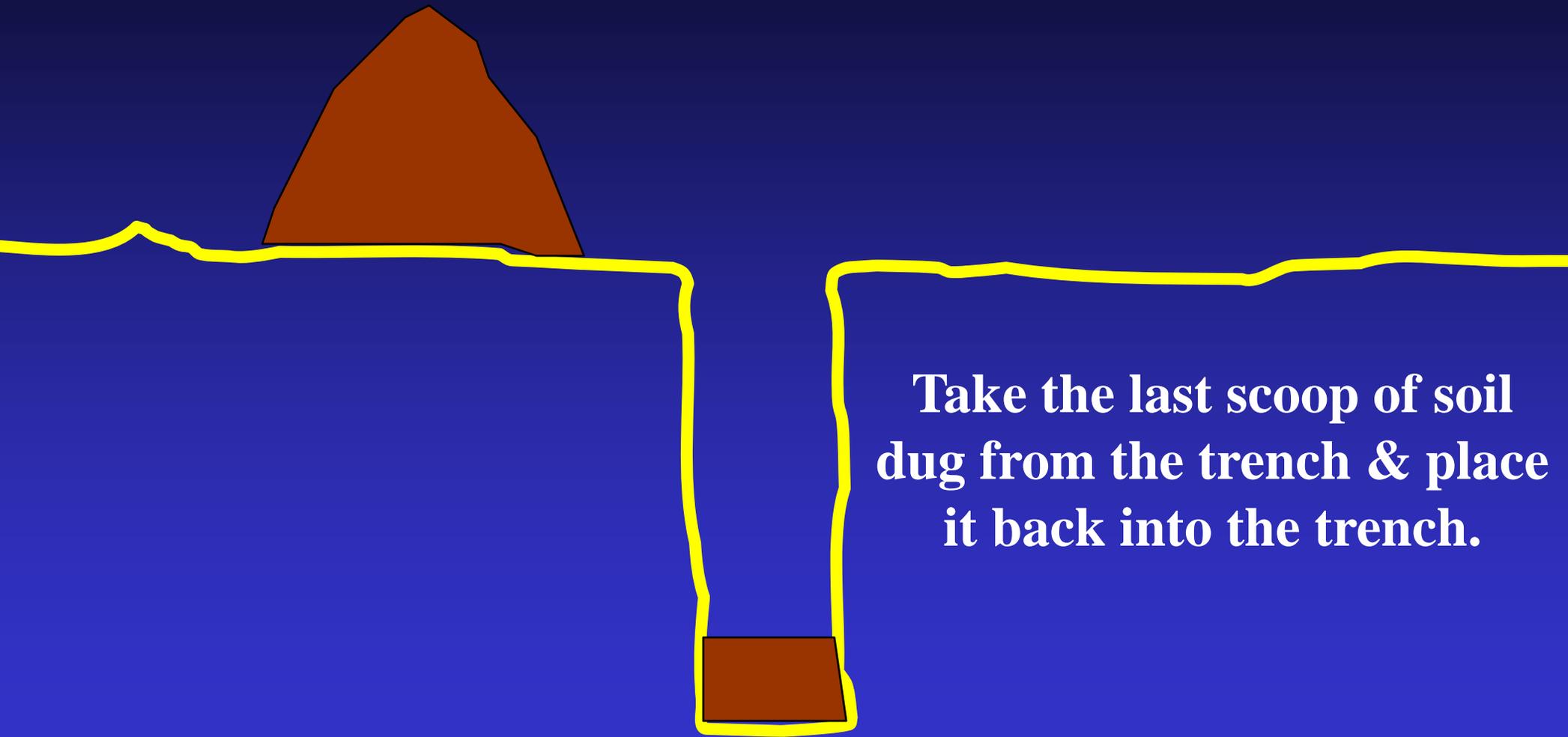
TWO-STAGE SLIT TRENCH TECHNIQUE



Water table

Mini-Case study: 4 of 16

TWO-STAGE SLIT TRENCH TECHNIQUE



Take the last scoop of soil dug from the trench & place it back into the trench.

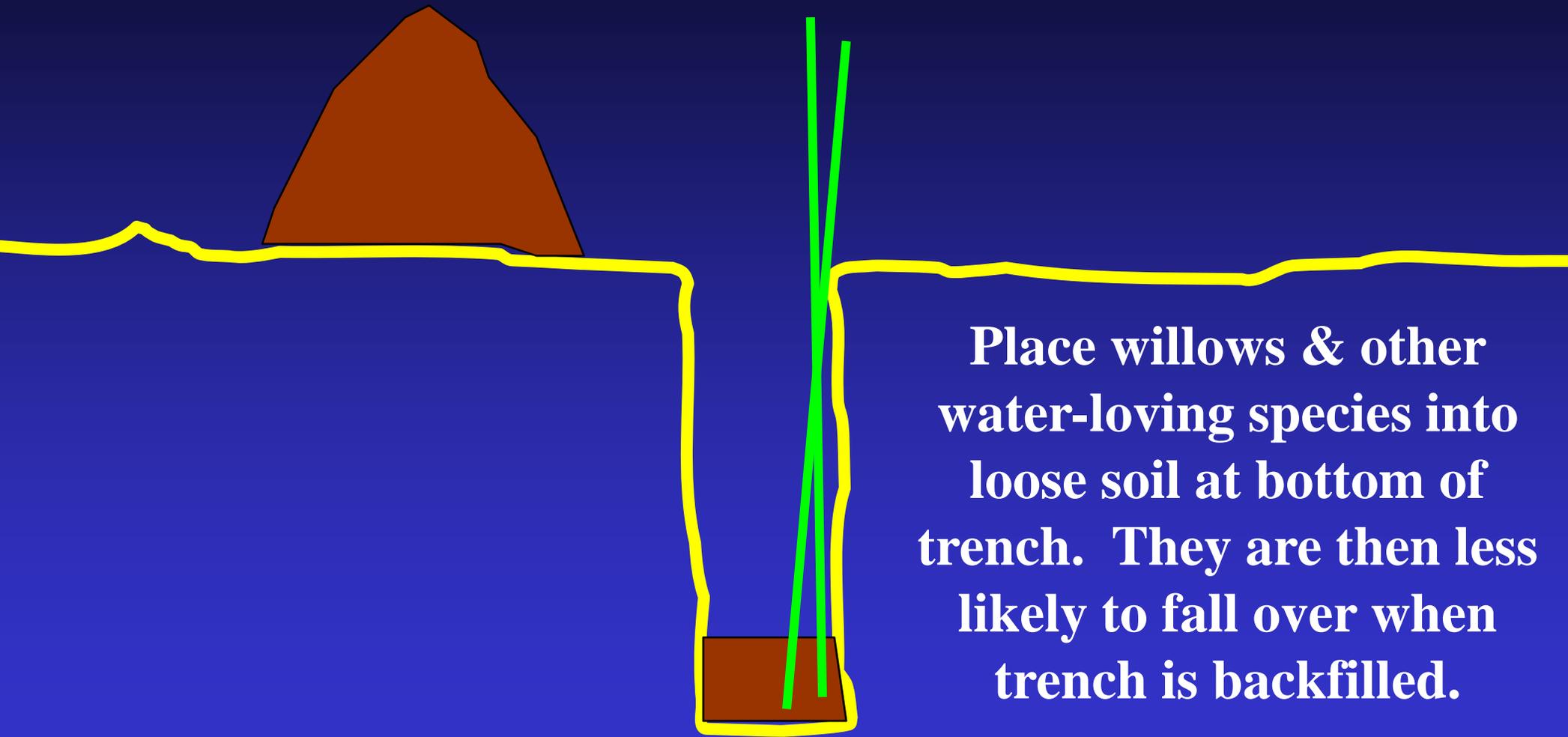
**Onondaga Creek @ Nichol Road Bridge,
LaFayette, NY – project planted 5-15-2007**



**Rubber
tired
backhoe
digs
trench
(narrow
bucket).
Pix by
Derrick**

Mini-Case study: 6 of 16

TWO-STAGE SLIT TRENCH TECHNIQUE



Place willows & other water-loving species into loose soil at bottom of trench. They are then less likely to fall over when trench is backfilled.

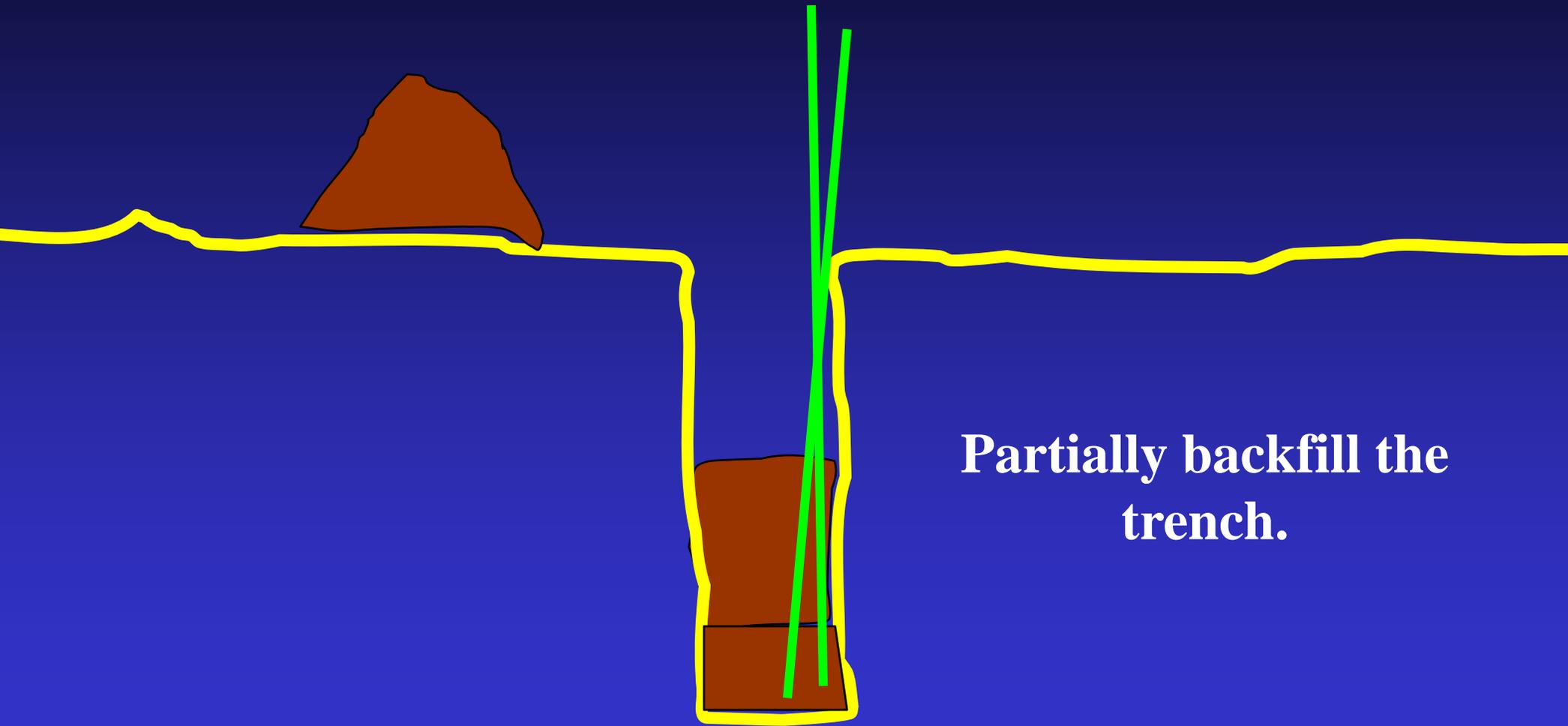
**Onondaga Creek @ Nichol Road Bridge,
LaFayette, NY – project planted 5-15-2007**

Mini-Case study: 8 of 16



**Slit Trench
dug with
rubber-tired
backhoe with
a narrow
bucket.
Streamco
willow placed
in trench. Pix
by Derrick**

TWO-STAGE SLIT TRENCH TECHNIQUE



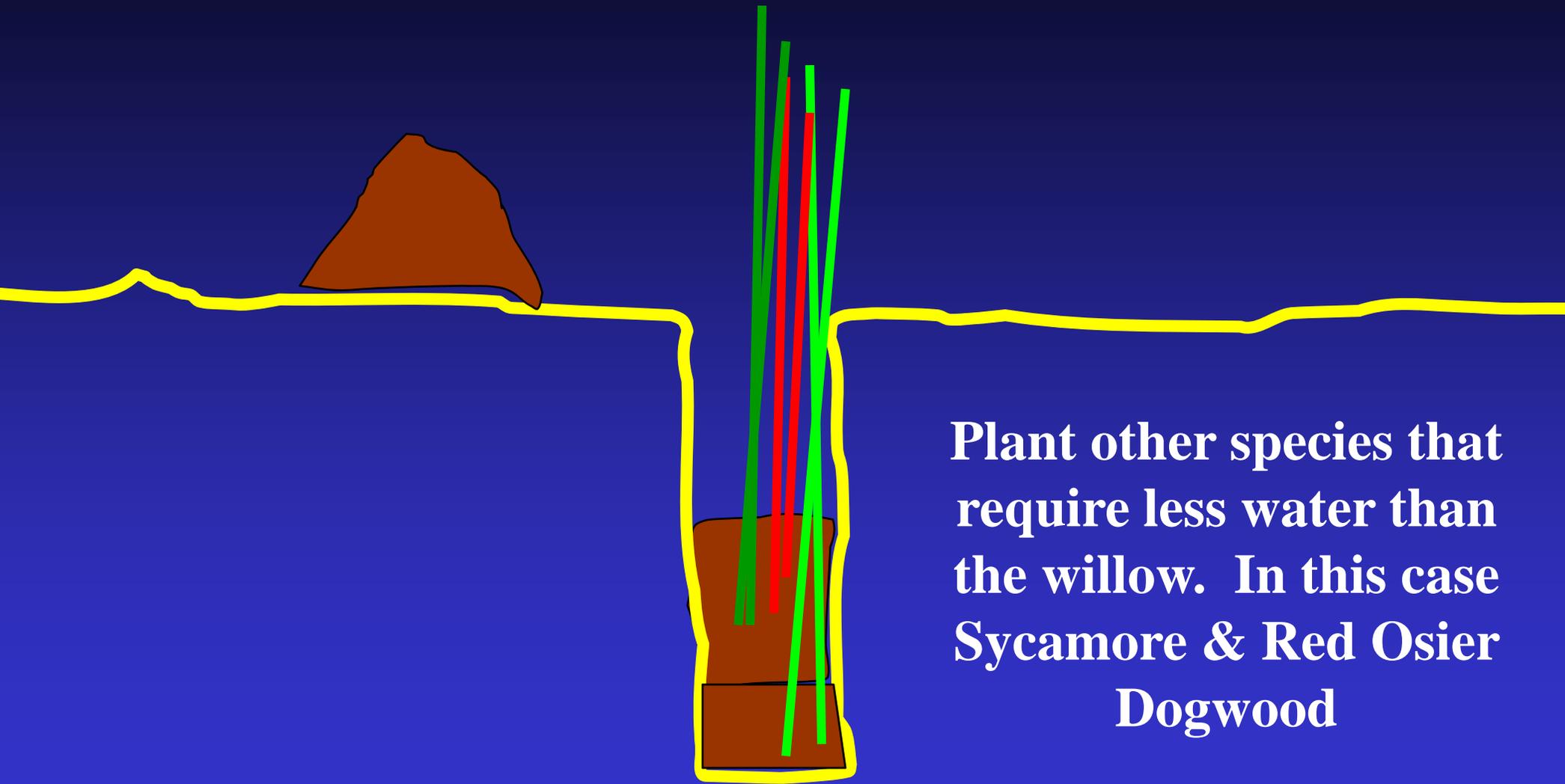
**Onondaga Creek @ Nichol Road Bridge,
LaFayette, NY – project planted 5-15-2007**

**Partially
backfill, then
plant species
that require less
water (Red
Osier Dogwood
& Sycamore).
Pix by Derrick**

Mini-Case study: 10 of 16



TWO-STAGE SLIT TRENCH TECHNIQUE



Plant other species that require less water than the willow. In this case Sycamore & Red Osier Dogwood

**Onondaga Creek @ Nichol Road Bridge,
LaFayette, NY – project planted 5-15-2007**



**Sycamore &
willow here.
Pix by Derrick**

Mini-Case study: 12 of 16

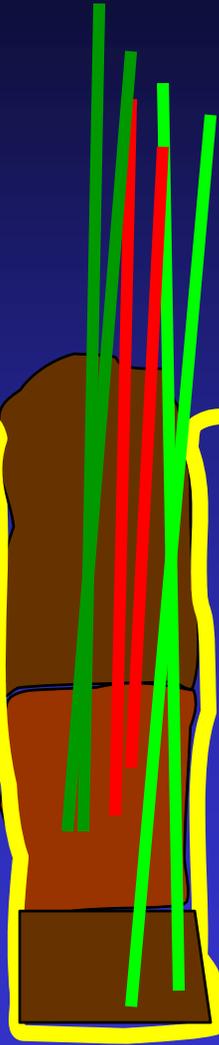
**Onondaga Creek @ Nichol Road Bridge,
LaFayette, NY – project planted 5-15-2007**

**Many hands get things done quickly, 2,740 plants planted
in about 6 hours. That's why they call it a workshop. Pix
by Derrick**



TWO-STAGE SLIT TRENCH TECHNIQUE

DONE



Completely backfill
trench & water
plants in

Mini-Case study: 13 of 16

**Onondaga Creek @ Nichol Road Bridge,
LaFayette, NY – project planted 5-15-2007**

Backfill using either the bulldozer.....Pix by Derrick



Mini-Case study: 14 of 16

**Onondaga Creek @ Nichol Road Bridge,
LaFayette, NY – project planted 5-15-2007**

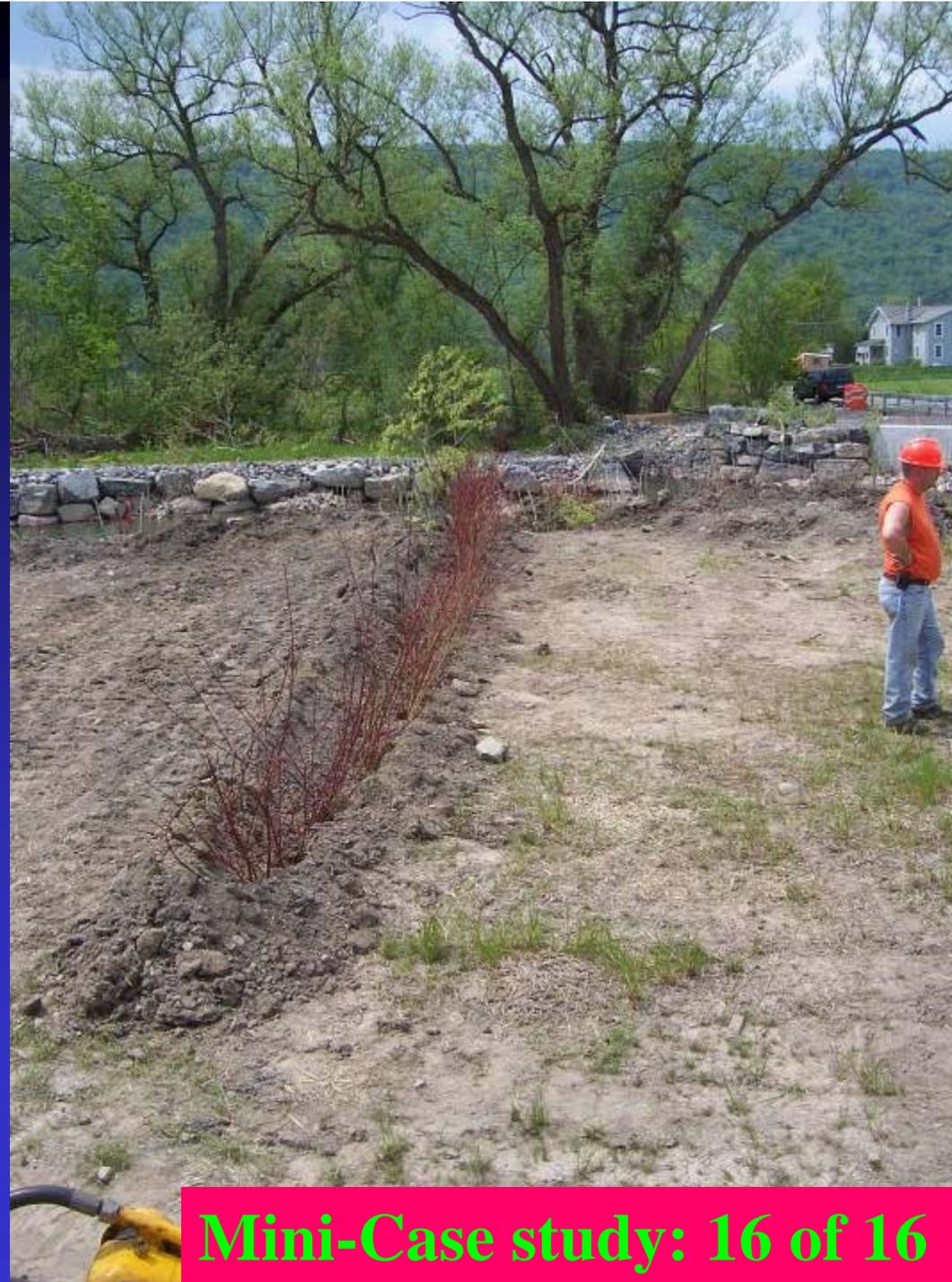
Or the backhoe..... Pix by James Bennett



Mini-Case study: 15 of 16

Onondaga Creek @ Nichol Road Bridge,
LaFayette, NY – project planted 5-15-2007

ONE
TRENCH
DONE,
MORE
TO GO



Mini-Case study: 16 of 16

**Onondaga Creek @ Nichol Road Bridge,
LaFayette, NY – project planted 5-15-2007**



Digging trenches on a grid. Nice mix of Streamco Willow, Sycamore and Red Osier Dogwood in foreground. Pix by Kathy Blaisure

**Onondaga Creek @ Nichol Road Bridge,
LaFayette, NY – project planted 5-15-2007**

**Slit Trenches on the grid
pattern. Pix by Derrick**



Root Production Method {RPM} Plants

TREES:

- 5 Red Maple - *Acer rubrum* “Select”**
- 10 Swamp White Oak – *Quercus bicolor***
- 5 Hackberry – *Celtis occidentalis***

SHRUBS:

- 5 Indigo Bush – *Amorpha fruticosa***
- 5 Buttonbush – *Cephalanthus occidentalis***
- 5 Nanny Berry Viburnum – *Viburnum lentago***

**Onondaga Creek @ Nichol Road Bridge,
LaFayette, NY – project planted 5-15-2007**



**The RPM rooted-stock
plants. Pix by Derrick**

**Onondaga Creek @ Nichol Road Bridge,
LaFayette, NY – project planted 5-15-2007**

**LET'S SEE
HOW IT
GROWS**

**Onondaga Creek @ Nichol Road Bridge,
LaFayette, NY – project planted 5-15-2007**

**BEFORE 5-15-2007
8:00am. Pix by Derrick**



**Onondaga Creek @ Nichol Road Bridge,
LaFayette, NY – project planted 5-15-2007**

**AFTER 5-15-2007
NOON. Pix by Derrick**



**Onondaga Creek @ Nichol Road Bridge,
LaFayette, NY – project planted 5-15-2007**

**June 21, 2007. {less than 5 weeks after planting}
Looking US at right bank floodplain. Two-Stage
Slit Trench plantings. Pix by Steve Harris**



**Onondaga Creek @ Nichol Road Bridge,
LaFayette, NY – project planted 5-15-2007**



**Aug 3, 2007 Less than 3 months after installation.
Looking US at right bank floodplain. Pix by Mark Schaub**

**Onondaga Creek @ Nichol Road Bridge,
LaFayette, NY – project planted 5-15-2007**

**Aug 3, 2007 {less than 3 months after installation}. Looking
US at right bank floodplain. Pix by Mark Schaub**



**Onondaga Creek @ Nichol Road Bridge,
LaFayette, NY – project planted 5-15-2007**

**Sept 10, 2007 {less than 4 months after installation}.
Looking US at right bank floodplain. Pix by Mark Schaub**



**Onondaga Creek @ Nichol Road Bridge,
LaFayette, NY – project planted 5-15-2007**

**Oct 16, 2007 {5 months after installation}. Looking US at
right bank floodplain. Pix by Mark Schaub**



July 10, 2008. {middle of second growing season} Looking at Slit Trench Plantings 7+ ft tall (left bank). Pix by Derrick

Onondaga Creek- Year 2



**July 10, 2008. {middle of second growing season} Right overbank
lush growth, average height is 7 to 9 ft tall. Pix by Derrick**

Onondaga Creek- Year 2



**Onondaga Creek @ Nichol Road Bridge,
LaFayette, NY – project planted 5-15-2007**

RPM PLANTS & POLES ON EDGE OF STREAM

**Onondaga Creek @ Nichol Road Bridge,
LaFayette, NY – project planted 5-15-2007**

**Aug 3, 2007 {less than 3 months after installation}.
Looking US at right bank floodplain. Pix by Mark Schaub**



**Onondaga Creek @ Nichol Road Bridge,
LaFayette, NY – project planted 5-15-2007**

Oct 16, 2007 {5 months after installation}. Looking US at left bank floodplain. RPM tress & edge veg look good. Pix by Mark Schaub



July 10, 2008. Right bank growth 7 to 9 ft tall. Pix by Derrick

Onondaga Creek- Year 2

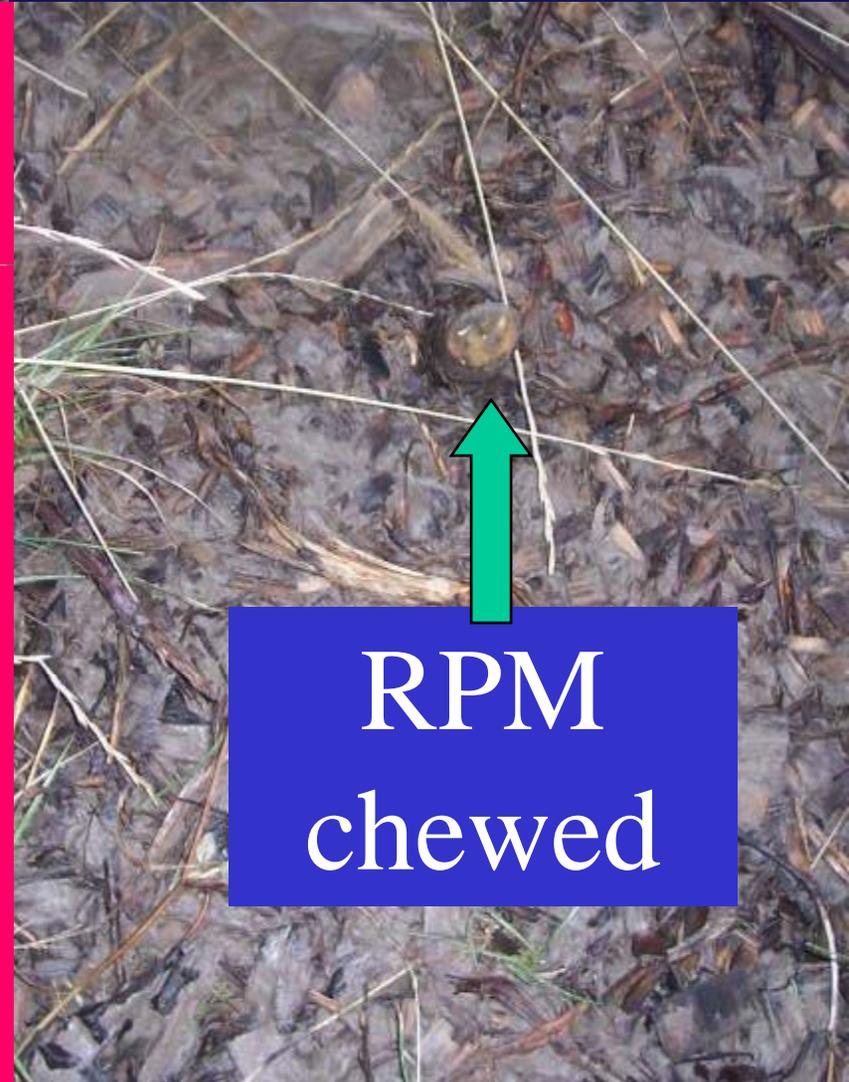


**Onondaga Creek @ Nichol Road Bridge,
LaFayette, NY – project planted 5-15-2007**

BEAVER BROWSING

**Onondaga Creek @ Nichol Road Bridge,
LaFayette, NY – project planted 5-15-2007**

**Jan 11, 2008 {less than 3 months after installation}.
Beavers chewing RPM's & poles. Pix by Derrick**



**RPM
chewed**

July 10, 2008. Beaver browsed plants rebounding well. Pix-Derrick

Onondaga Creek- Year 2



**Onondaga Creek @ Nichol Road Bridge,
LaFayette, NY – project planted 5-15-2007**

**PHASE 4: LEFT BANK
REVEGETATION-SLIT
BRUSH LAYERING,
EXTREME INSTANT
SHADE, SLIT TRENCH,
& RPM ROOTED-STOCK
PLANTS**

**Onondaga Creek @ Nichol Road Bridge,
LaFayette, NY – project planted 5-15-2007**

**Trenchfill in yellow area,
Slit Brush Layering in
black, Extreme Instant
Shade in orange. Pix by
Derrick**



**Onondaga Creek @ Nichol Road Bridge,
LaFayette, NY – project planted 5-15-2007**

TWO LAYERS OF “SLIT” BRUSH LAYERING

**Onondaga Creek @ Nichol Road Bridge,
LaFayette, NY – project planted 5-15-2007**



This is almost a Live Siltation retrofit. Pix by James Bennett

**Onondaga Creek @ Nichol Road Bridge,
LaFayette, NY – project planted 5-15-2007**

**Slit Brush Layering the
Streamco Willow close to water
surface. Pix by Kathy Blaisure**



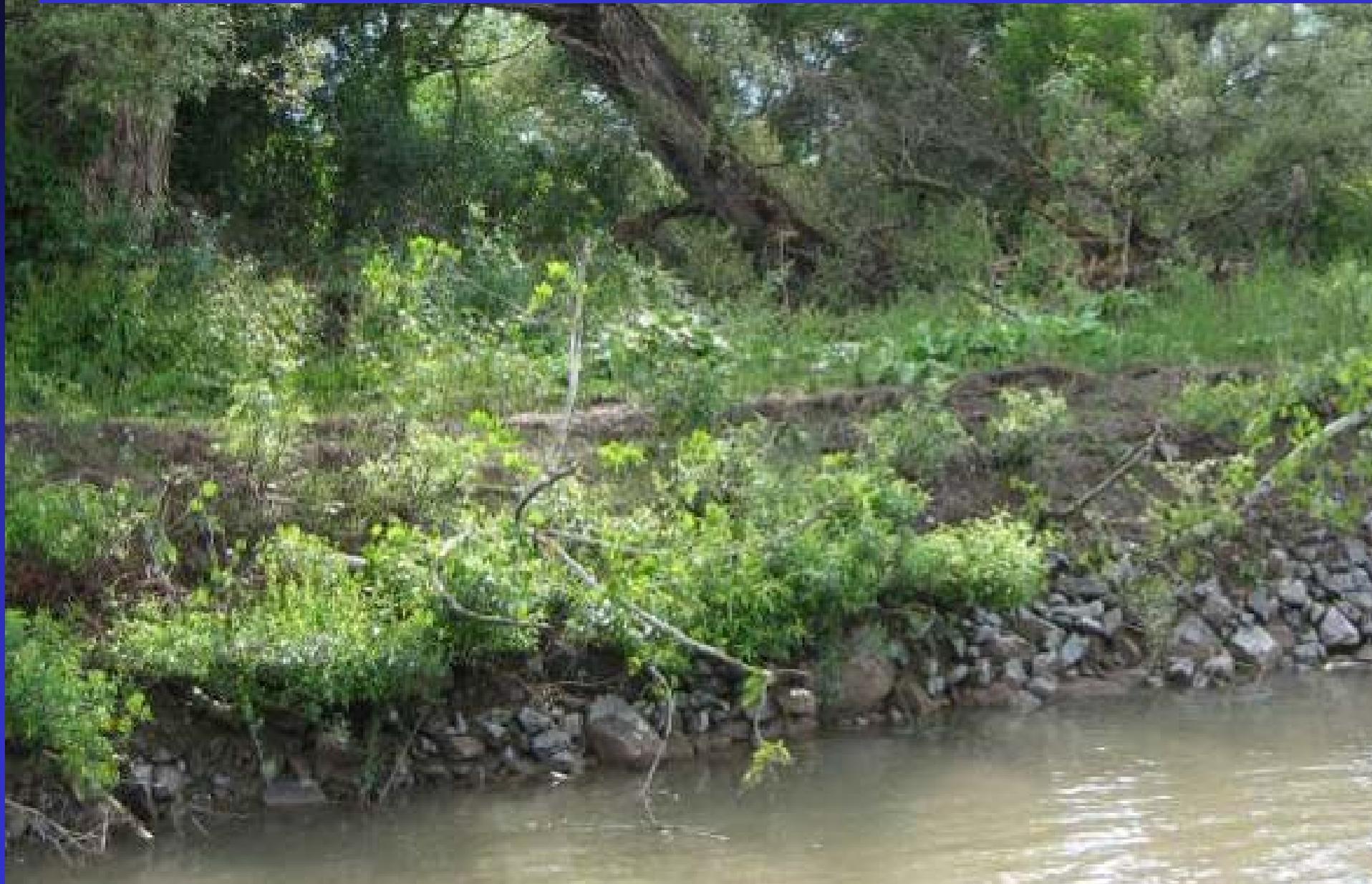
**Onondaga Creek @ Nichol Road Bridge,
LaFayette, NY – project planted 5-15-2007**



**Looking US at both
layers of Slit Brush
Layering. Pix by
Bill Frederick**

**Onondaga Creek @ Nichol Road Bridge,
LaFayette, NY – project planted 5-15-2007**

**June 21, 2007. {less than 5 weeks after planting} Looking
at Slit Brush Layering (left bank). Pix by Steve Harris**



July 10, 2008. Looking at Slit Brush Layering. Pix by Derrick

Onondaga Creek- Year 2



July 10, 2008. Looking at Slit Brush Layering. Pix by Derrick

Onondaga Creek- Year 2



RESULTS AT END OF FIRST GROWING SEASON - REPORTED BY MARK SCHAUB

- **Site – soil conditions are not ideal. Fill soil is a clay fragipan, when dry is like concrete. (Extremely dry summer -2007)**
- **Slit-Trench Black Willow-low mortality & outstanding growth, many 5 to 7 ft tall. When planted most 2-3 ft tall.**
- **Slit-Trench Streamco Willow-low mortality & outstanding growth, many 5 to 7 ft tall.**
- **Slit-Trench red osier dogwood – high mortality**
- **Slit-Trench Sycamore – med mortality & 2-4' growth**
- **Extreme Instant Shade Sycamore – med mortality.**
- **Slit Brush Layering Willow, red osier dogwood & Sycamore – med-high mortality.**
- **Pole Plantings in existing stone bank – low mortality, ~6' growth. ice out may shear them off?**
- **RPM rooted stock trees - No Mortality .**