Applying Green Infrastructure Solutions to Road Projects, New Road Construction, and Roadway Redevelopment in Summit County

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GPD Group

Projects

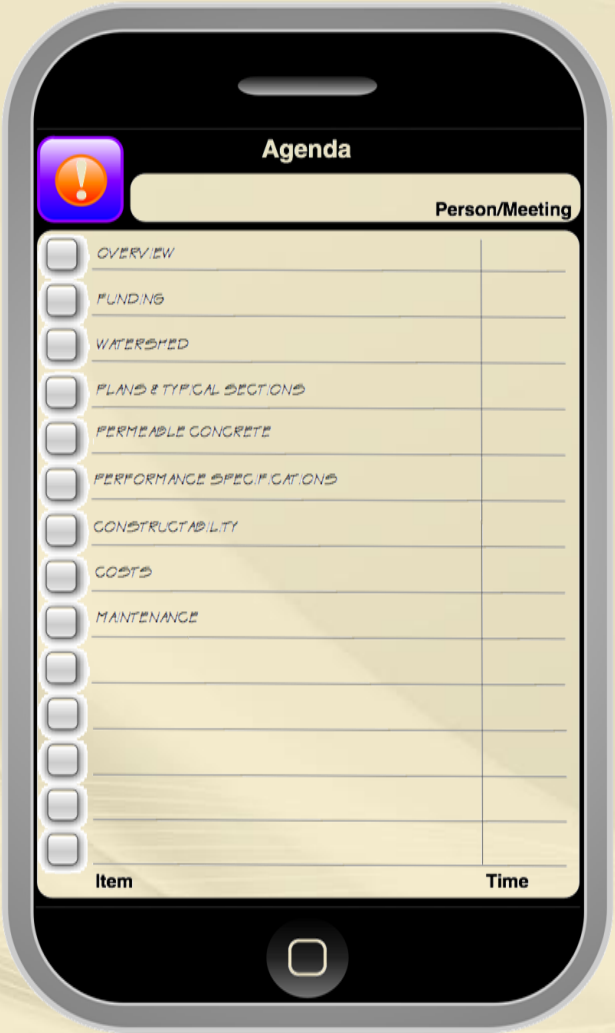
- SUM-Frank Blvd (Akron, Ohio)
- SUM-31st Street (Barberton, Ohio)
- Lakeside Drive (Barberton, Ohio)

SUM – Frank Blvd. PID#86385 Roadway & Drainage Improvements

A Case Study on Permeable Concrete Pavement Applied in Roadway Redevelopment Applications

Outline

. . . .what's he talking about? . . .



- OVERVIEW
- FUNDING
- WATERSHED
- PLANS & TYPICAL SECTION
- PERMEABLE CONCRETE
- SPECIFICATIONS
- COSTS
- MAINTENANCE

Overview

Mentor
Lorain
Cleveland
Elyria
Warren
Akron
PHASE 3
Youngstown
Wadsworth
Boardman
Canton
Wooster
Pittsburgh
Bethel Park
Wheeling
Newark
PHASE 2
Zanesville
Richmond
Dayton
Columbus
Lancaster
Beavercreek
Morgantown
Logan
Hamilton
Mason
Marietta
Athens
Fairmont
Chillicothe
Clarksburg
Cincinnati
Parkersburg
Weston
Florence
Ravenswood
Gallipolis
Ripley
Portsmouth
Ashland
PHASE 1
St Albans
West Virginia
Cynthiana
Huntington
Charleston
Frankfort
500 feet
100 m

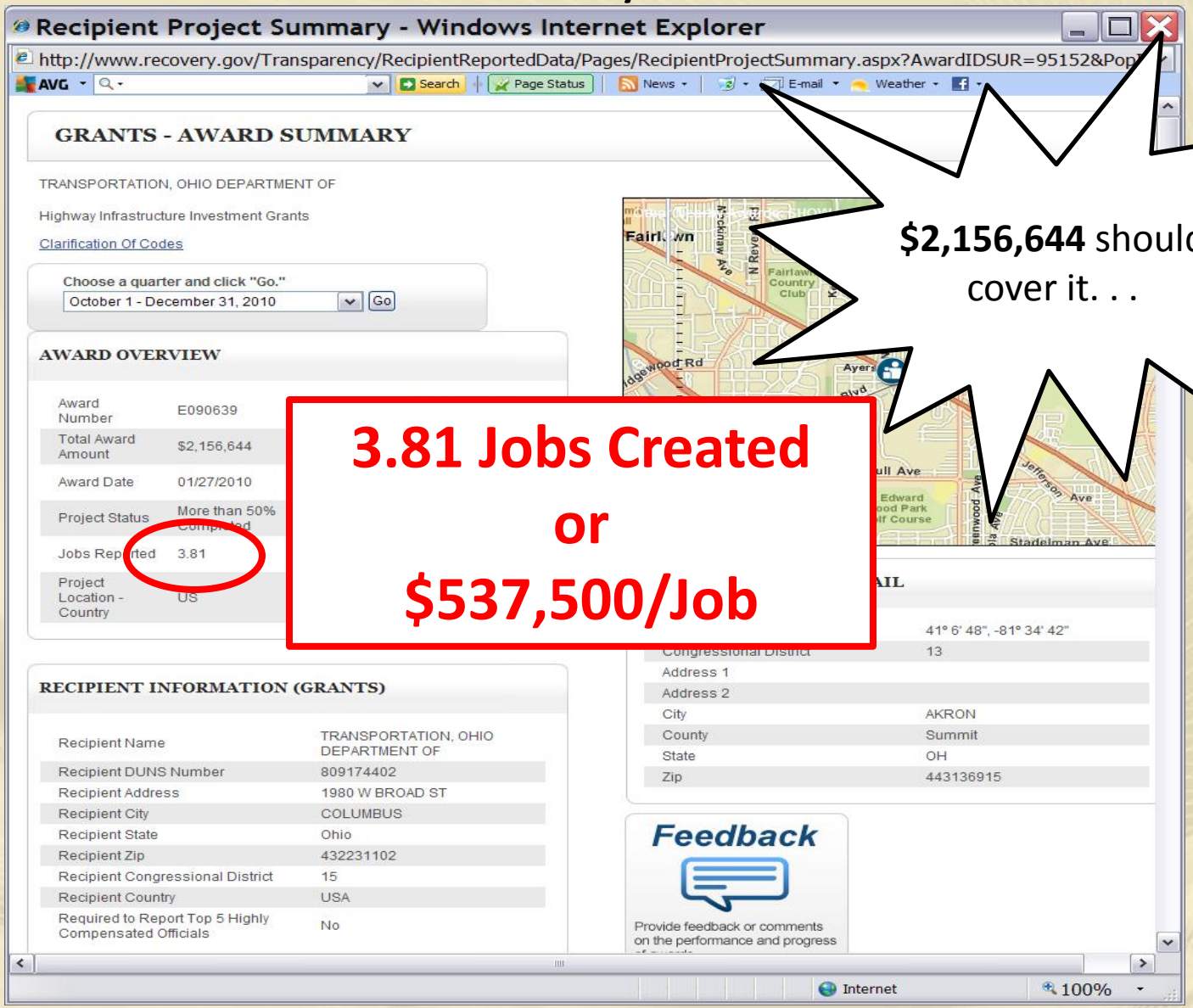
Overview (cont.)

Project Components:

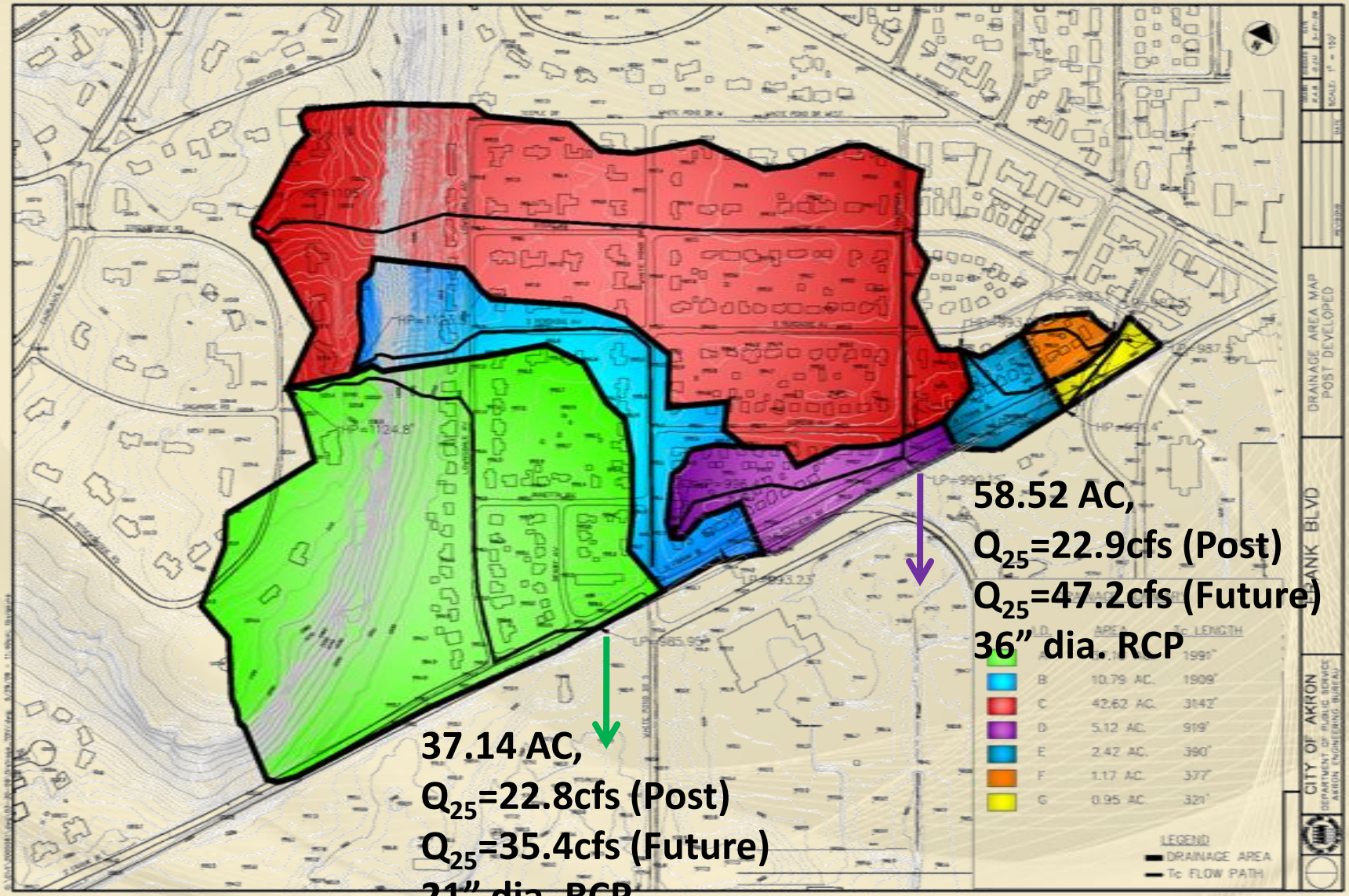
1. 2,210 LF roadway Reconstruction
    a. Subgrade Stabilization w/ aggregate refill and geogrid
    b. Correct deficient sight distance issues at W&LE at grade rail crossing
    c. No Right-of-Way Impact Tolerated
2. Stormwater Collection System
    a. Two bored & jacked culvert replacement s under W&LE railroad
3. Watermain Replacement
4. Traffic Signalization & Control
5. Pedestrian & residential access management
6. LED Street Lighting (NEW FOR CITY OF AKRON),
7. Streetscaping, and
8. On-street parking utilizing **PERMEABLE CONCRETE PAVEMENT**

Funding

2009 American Recovery & Reinvestment Act



Watershed


58.52 AC,
Q_{25}=22.9cfs (Post)
Q_{25}=47.2cfs (Future)
36" dia. RCP
37.14 AC,
Q_{25}=22.8cfs (Post)
Q_{25}=35.4cfs (Future)
21" dia. RCP
DRAINAGE AREA MAP
POST DEVELOPED
CITY OF AKRON
LEGEND
DRAINAGE AREA
Tc FLOW PATH

Watershed (cont.)

B-3	8' Rt. of centerline
B-4	Station 117+15 9' Lt. of centerline
B-5	Station 121+56 7' Rt. of centerline
B-6	Station 130+92 2' Lt. of centerline

Boring B-2 contained soils identified
coarse sand (A-3a), extending to a
surface. **Possible fill**, consisting of
encountered beneath the **fill** in this b
the existing pavement surface. Below
natural **slightly organic** stiff to very-s
below the existing pavement surface.
in order to determine the organic con
3.64% organic content which, pe
Explorations (ODOT SGE), designate

Natural inorganic soils were enco
Borings B-1 and B-3 through B-6)
pavement surface and extended to th
natural soils encountered were predo
coarse sand with varying amounts
However, we did encounter medium
and A-6b) in Boring B-1 (from below t
2 (from about 8 feet to about 10 feet)
(from about 11.5 feet to about 13 fe
soils (A-4b) in Borings B-2 (from abou
and B-3 (from about 12 feet to about

Seepage was encountered in Borings
about 14.5 feet below the existing g
Boring B-2 at a depth of about 13.5
drilling and upon completion. It shou
may cause the groundwater table to f
observed at the time of drilling.

LOCATION: Sta. 107+56.20
9.61' Rt. of Centerline
Frank Boulevard

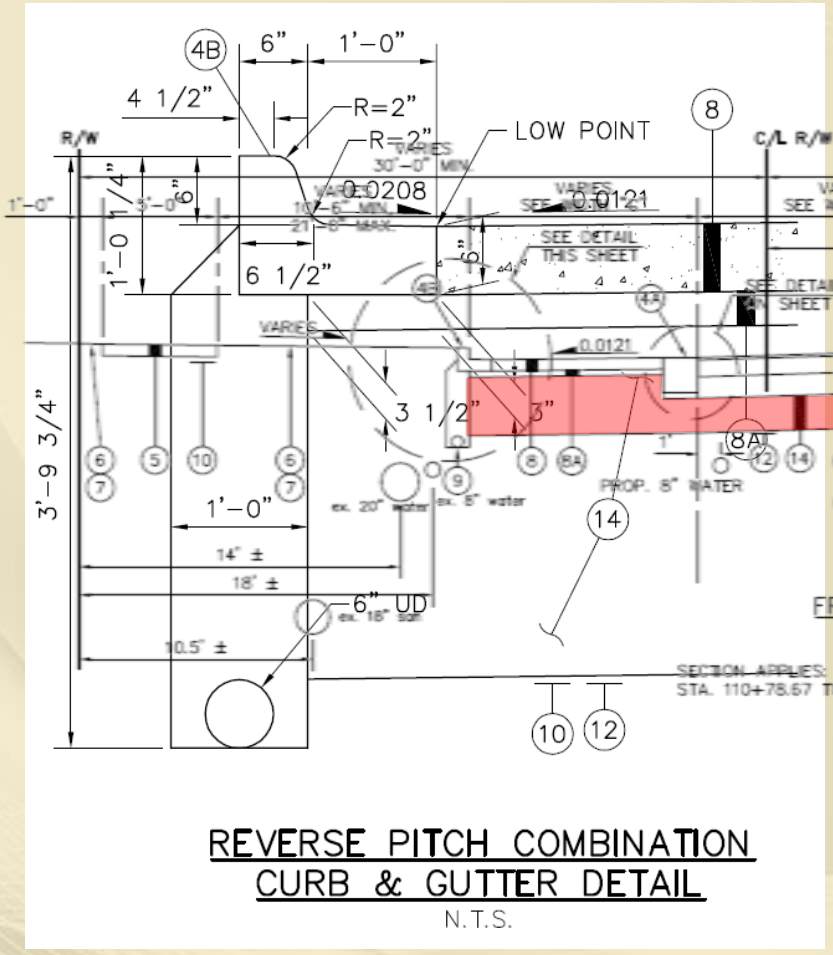
mple c-%	Description	Samp. No.	% Agg.
	1.0 ASPHALT - 12 INCHES		
00	FILL: Medium-dense black fine to coarse sand, trace fine to coarse gravel, trace silt, contains many cinders, few brick fragments and glass pieces. 3.0	1	
40	POSSIBLE FILL: Very-loose brown fine to coarse sand, trace fine to coarse gravel, trace silt. 5.5	2	
00	Stiff to very-stiff brown silty clay, some fine to coarse sand, trace fine gravel, slightly organic. 8.0 - Fraction of Organic Content (LOI) = 3.64%.	3	3
00	Stiff brown clayey silt, some fine to coarse sand. 10.0	4	
00	Very-loose to loose gray fine to coarse sand, trace silt.	5	
00		6	
00	19.0	7A	
00	Loose brown silt, trace fine to medium sand. 20.0	7B	

NOTES:
- Encountered seepage at 10.0' during drilling.
- Encountered water at 13.5' during drilling.

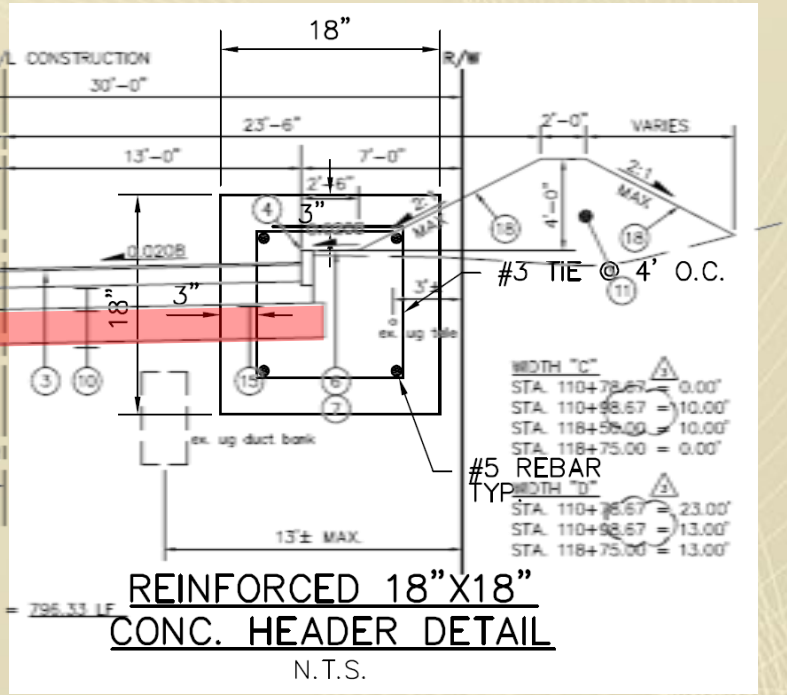
▼ 14.0 ▼ "Dry"

. . .what does this mean?!!!!

Typical Section



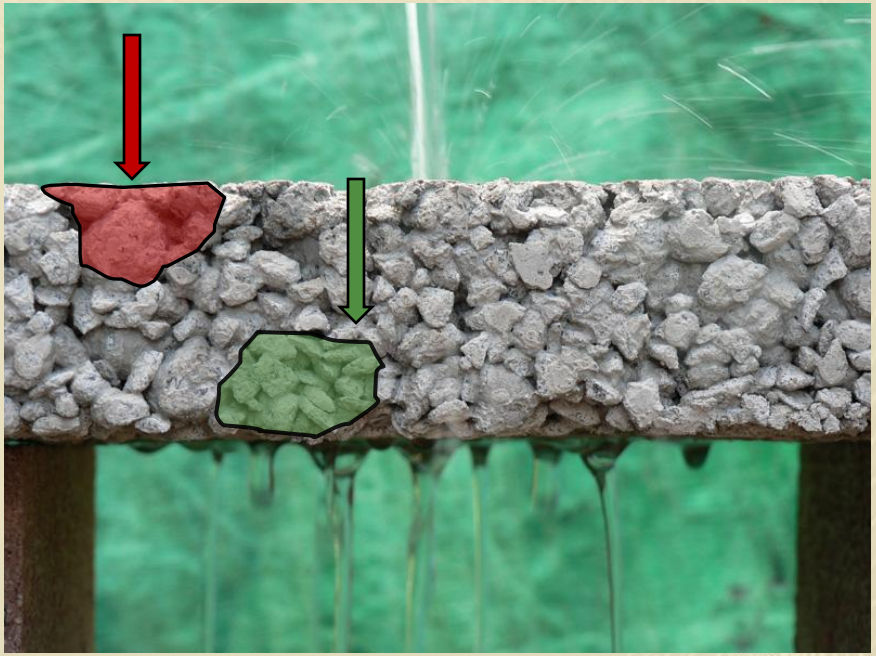
REVERSE PITCH COMBINATION
CURB & GUTTER DETAIL
N.T.S.



REINFORCED 18"X18"
CONC. HEADER DETAIL
N.T.S.

Permeable Concrete

. . . What is It?

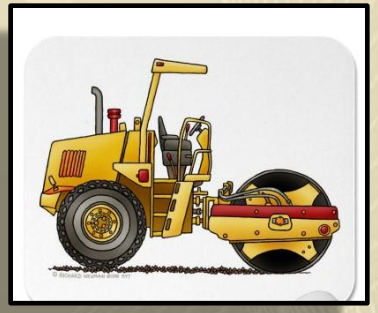


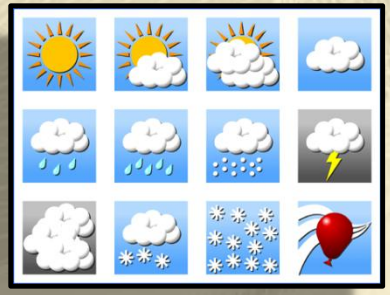
1. *Special high porosity concrete that has little or no fine aggregate*
2. *Commonly referred to as:*
   a. *"Porous Concrete"*
   b. *"No-fines Concrete"*
   c. *"Gap-Graded Concrete" or*
   d. *"Enhanced-Porosity Concrete"*
3. *Mainly comprised of normal portland cement, coarse aggregate, carefully controlled amounts of water, and chemical admixtures*
4. *Has low workability, hence the need for admixtures such as retarding, viscosity modifying or enhancing, and hydration stabilizing chemicals.*
5. *Lack of fine aggregate allows for a porosity range between 15 to 35%; typically falls around 20%. Allows for the passage of water and air.*
6. *Single –sized coarse aggregate or graded between 3/4" and 3/8".*
   a. ***Frank Blvd. project utilized uniform No. 9***
7. *Infiltration rates range b/w 2 to 18 gallons per minute per square foot or 0.04 to 0.4 cfs*

Permeable Concrete Specs

. . . What the contractor needs to know . . .

1. *Quality Assurance:*
   a. *Does the contractor have a working history with this material?*
   b. *Is at least one member certified by the ORMCA Pervious Concrete Contractor Certification*
   c. *Are 30% of his/her crew certified by the ACI Certified Concrete Flatwork Finisher program*
   d. *Qualified Testing Laboratories*
2. *Special Equipment:*
   a. *Requires specific equipment for compaction and jointing*
   b. *Steel pipe roller or hydraulically actuated rotating tube screed capable of spanning entire width of section placed and exerting vertical pressure b/w 10 to 30 psi*
   c. *¼" thick minimum "Pizza cutter roller" w/ beveled fin for creating rolled contraction joints*
3. *Project Conditions:*
   a. *Weather limitation when ambient temperatures are between 40 and 90 F*

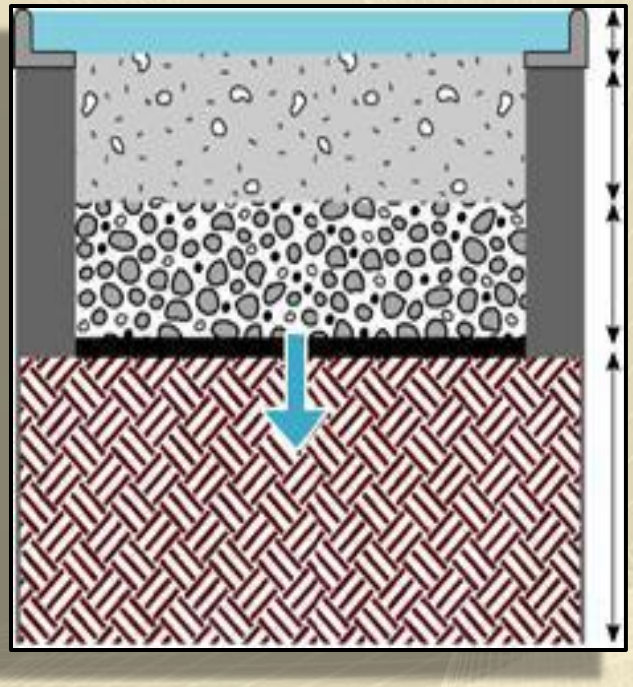




Permeable Concrete Specs (cont.)

. . . What the contractor needs to know . . .

4. *Products:*
   a. *Course Aggregate Base - No. 1 & No. 2 Stone per ODOT Table 703.01-1 (AASHTO M43)*
   b. *Leveling Course Aggregate - No 57 Uniformly Graded Limestone per ODOT Table 703.01-1 (AASHTO M43)*
   c. *Geogrid (Alt. Bid for Contech Tensar BX 1100 & BX 1200)*
   d. *Isolation (Expansion) Joint Material (1/4" to 1/2" Proflex Vinyl ASTM D 1751 or 1752)*
   e. *Curing Material – 6 mil thick min. Polyethylene waterproof sheeting*
   f. *Pervious Concrete Pavement*
5. *Test Panel & Execution:*
   a. Minimum of 2 panels each 100 SF and at required project thickness, consolidated, jointed and cured using specified products and equipment
   b. Performance:
      a. Compacted thickness no less than 1/4" less than specified thickness
      b. Void Structure b/w 15 – 25%
      c. Unit Weight within 5lbs +/- of design weight



Permeable Concrete Specs (cont.)

. . . What the contractor needs to know . . .

6. *Mix Design:*
   a. Aggregate/cementitious ratio: range of 4:1 to 5:1
   b. Concrete mixture unit weight: range of 105lb/ft^3 to 130 lb/ft^3 per ASTM C 29, paragraph 11, jigging procedure.
   c. Concrete mixture void content: range of 15% to 25%, per ASTM C 138, Gravimetric Air Determination.
   d. Cementitious content: 600 lb/yd ^{3} total cementitious content.
   e. Supplementary cementitious content: Fly ash: 25% maximum; slag: 25% maximum, or combined supplementary cementitious content: 35% maximum.
   f. Water – cementitious ratio: range from 0.27 to 0.35
   g. Aggregate content: The bulk weight of aggregate per cubic yard (cubic meter) shall be between 2,650 and 2,800 lbs.
   h. Admixtures: Admixtures shall be used in accordance with the manufacturer's instructions and recommendations.
   i. Mix Water: The quantity of mixing water shall be established to produce a pervious concrete mixture of the desirable workability to facilitate placing, compaction and finishing to the desired surface characteristics. Mix water shall be such that the cement paste displays a wet metallic sheen without causing the paste to flow from the aggregate.

Permeable Concrete Specs (cont.)

. . . What the contractor needs to know . . .

7. *<u>Placing, Jointing & Finishing</u>:*
   a. *Soak the subbase; failure results in a reduction in strength of the pavement*
   b. *Deposit concrete continuously by mixer truck chute, conveyor or buggy*
   c. *Strike off concrete using mechanical vibratory screed or hydraulically actuated pipe roller screed*
   d. *No other internal vibration is permitted after strike-off*
   e. *Do not disturb concrete while in the plastic state*
   f. *Overfill low spots for surface repair using hand tampers*
   g. *Joint at regular intervals not exceeding 15' (Maybe performed during the concrete's plastic state w/ small roller)*
   h. *Use edging tools and hand tampers along form lines, isolation joints, and construction joints.*
8. *<u>Curing</u>:*
   a. *Begin immediately after concrete is discharged from truck, no later than 20 mins.*
   b. *Cover pavement surface with 6 mil thick polyethylene sheet*
   c. *Cover shall remain in place for 7 days*

Permeable Concrete Specs (cont.)

. . . What the contractor needs to know . . .

9. Quality Control:
   a. Employ a testing laboratory
   b. Traditional testing for strength and slump control are not necessary
   c. One test performed per every 150 ft^3 placed or each day's placement
   d. Test for:
      a. Unit Weight (Density) – ASTM C 29
      b. Void Content – ASTM C 138
      c. Thickness
      d. Core Unit Weight – ASTM 642

10. Method of Measurement / Basis of Payment:

Item	Unit	Description	$ (2009 Bid Award)
203	SY	Subgrade compaction	$1.50
SPEC	SY	Geogrid, Contech BX 1200	$1.00
SPEC	CY	Coarse Aggregate (#1 & #2)	$40.00
SPEC	CY	Leveling Course (#57)	$35.00
SPEC	SY	Pervious Concrete Pavement	$55.00

. . . . Or $9.15 / SF Installed

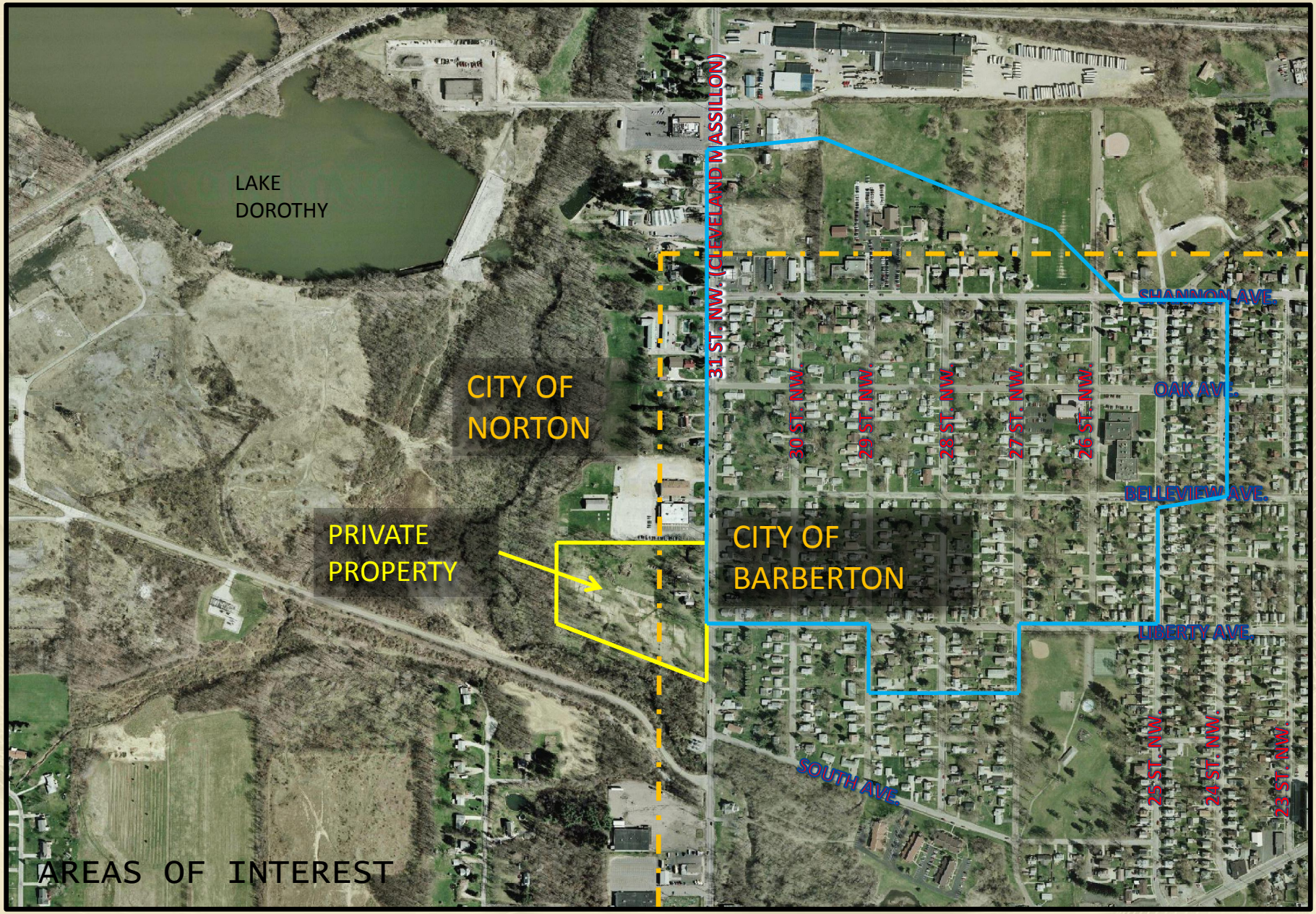
Performance & Maintenance

. . . .it works! . . . Check it out.

Maintenance:

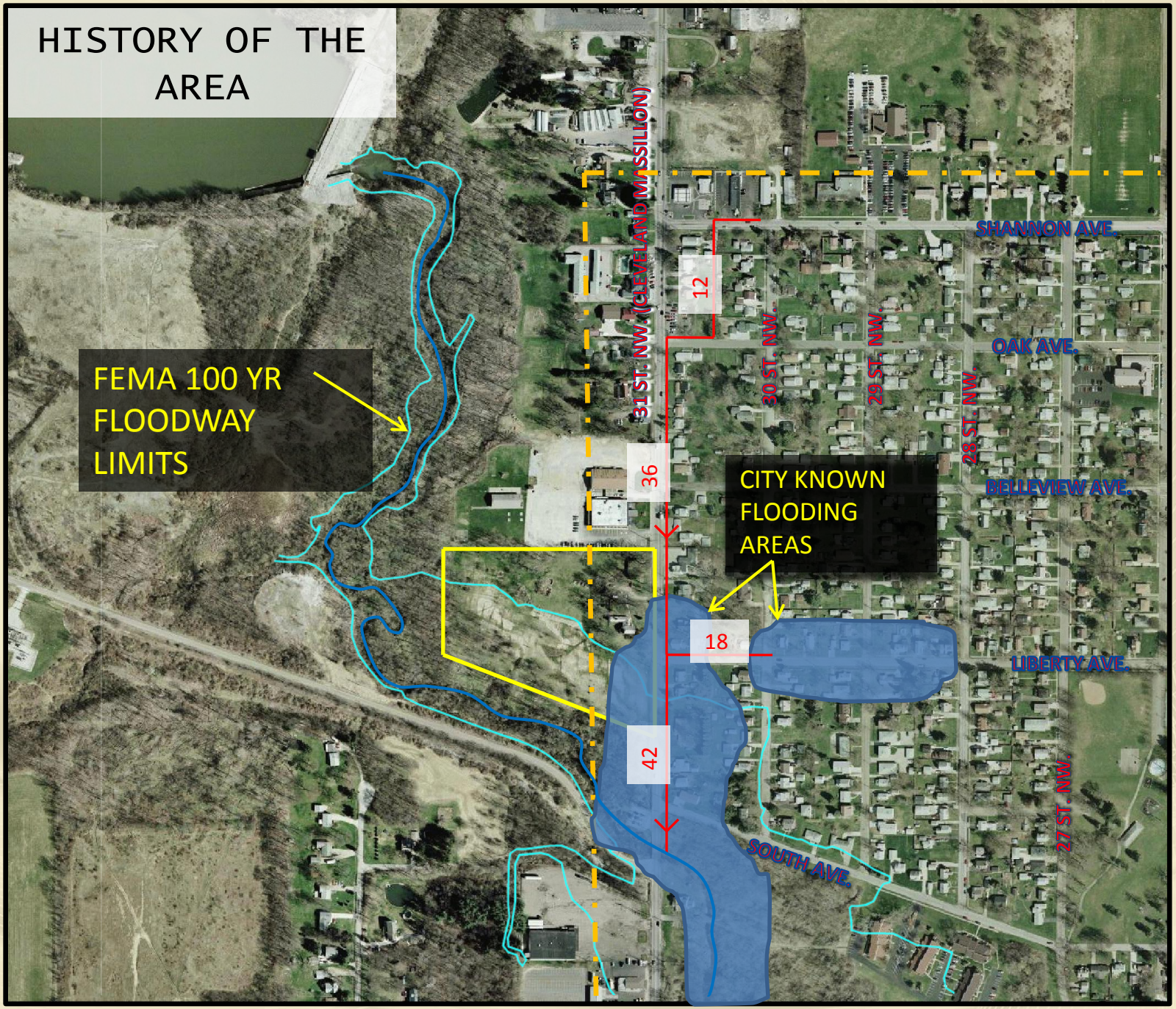
1. Will last for decades if maintained properly with common sense procedures
2. Starts with proper installation of base
3. Oil and debris (grass cuttings & leaves) can clog porous pavement
4. Use blowers and vacuum sweeps
5. Cover snow plow blades w/ rubber stripping

Barberton-31st Improvements



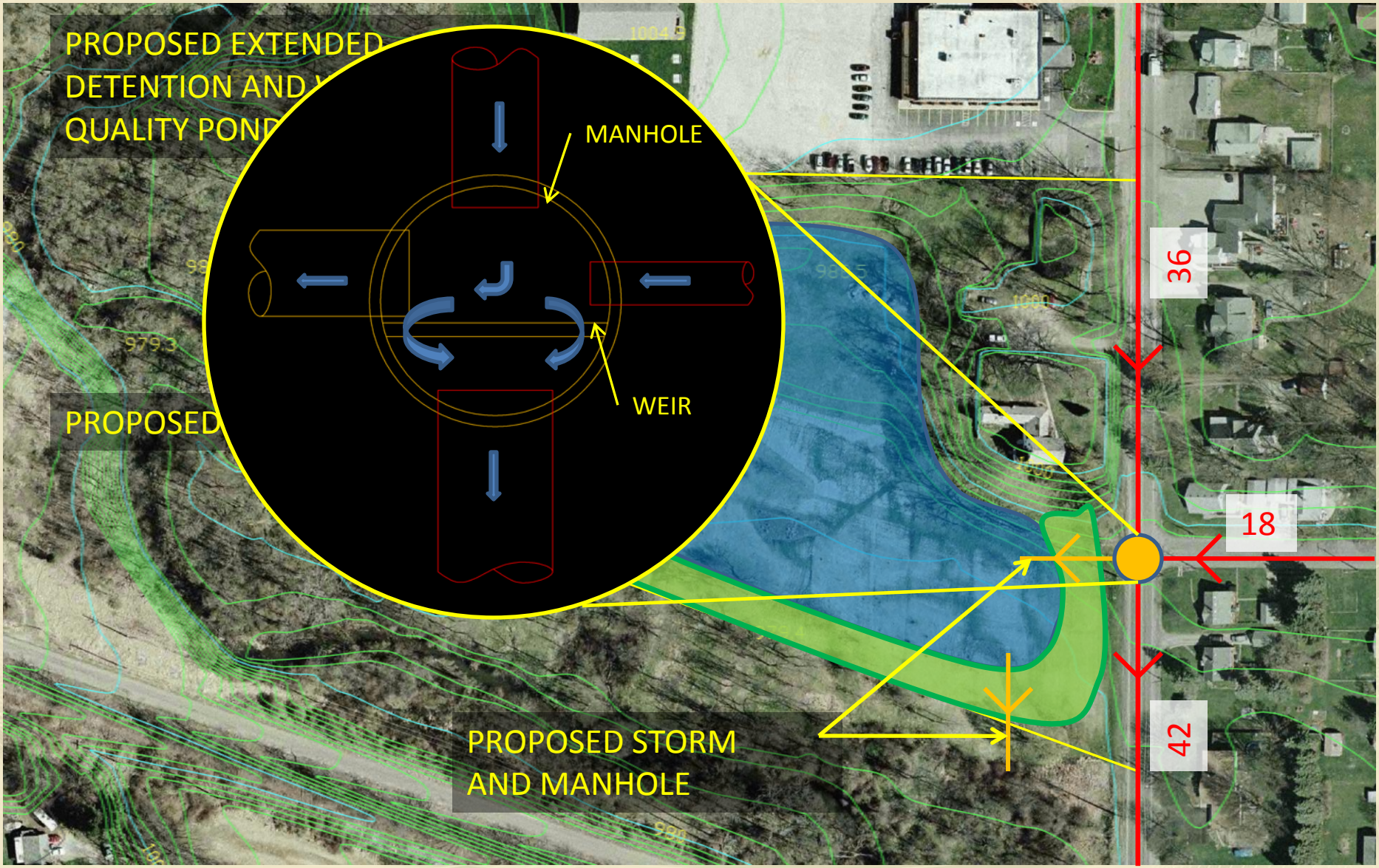
GPD GROUP

HISTORY OF THE AREA

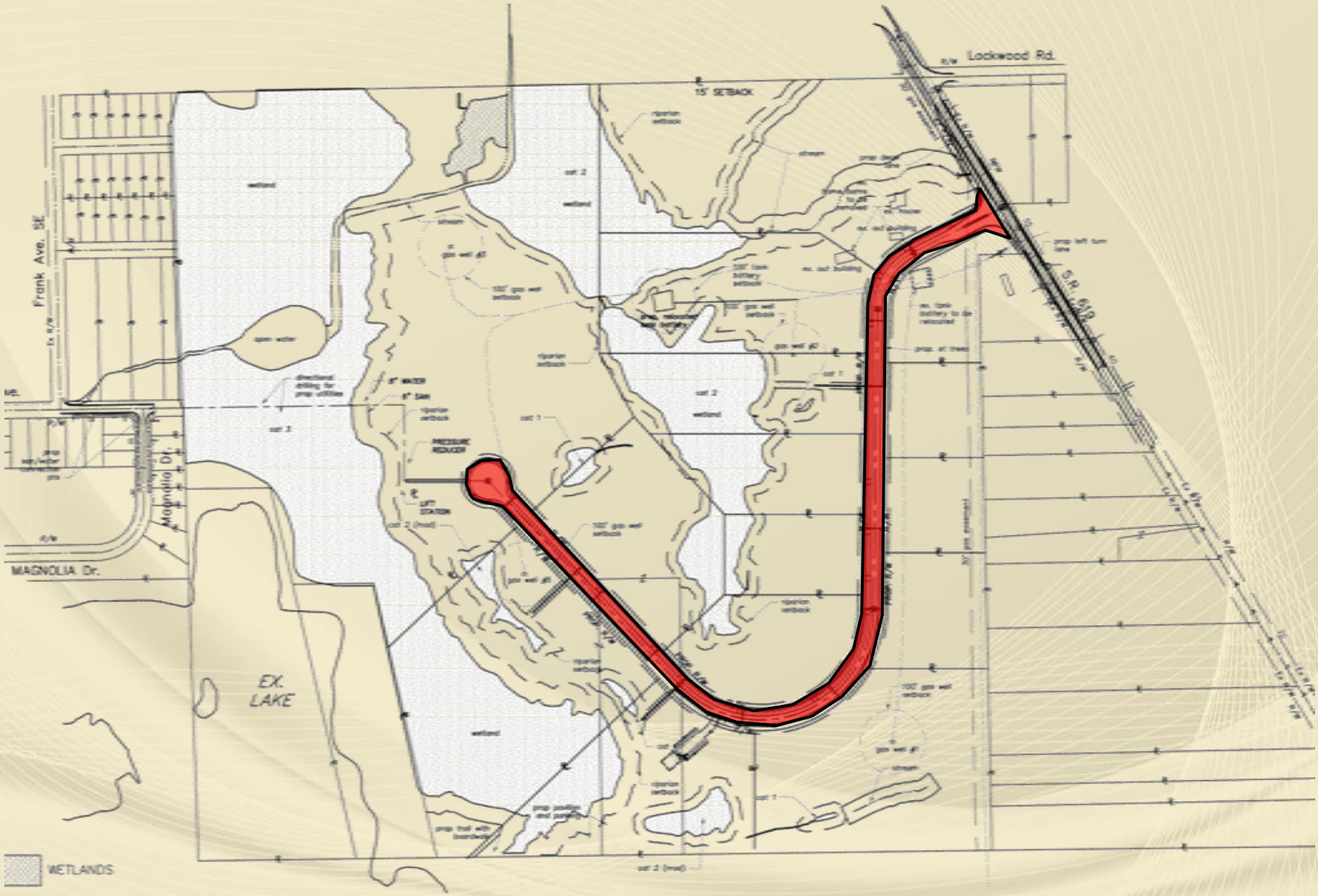


Barberton-31st Improvements

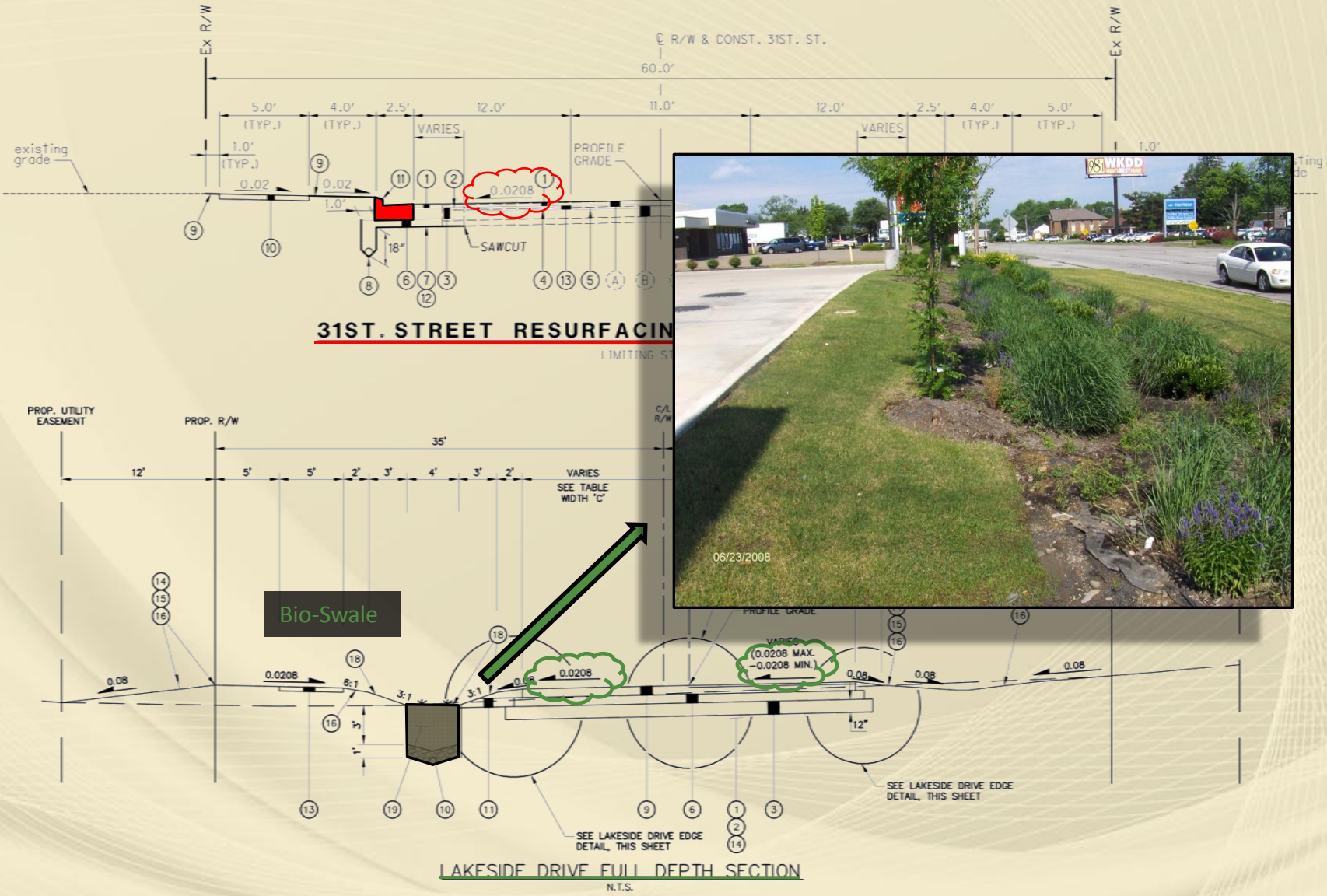
(6.37 acres)



Innovation Business Park (Roadway)



Innovation Business Park (Roadway)



LAKESIDE DRIVE FULL DEPTH SECTION

N.T.S.

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