

## **Proposed Nutrient Removal at Ashville Water Resource Recovery Facility (WRRF)**

A three channel, oxidation ditch is proposed at the Village of Ashville WRRF to provide nitrogen and phosphorus removal. The three channel ditch provides for the oxidation of ammonia to nitrogen gas (i.e. nitrification-denitrification) and biological phosphorus removal. The outer oxidation ditch channel is an aerated anoxic reactor where a majority of the biological treatment will take place. This channel typically has 50% of the total ditch volume and is operated in an oxygen deficit mode to remove ammonia by converting it to nitrogen gas. This low oxygen environment also encourages the growth bacteria known as phosphate accumulating organisms (PAOs) that accumulate polyphosphate and remove phosphorus from wastewater. Dissolved oxygen concentrations in the second channel will be operated in a swing mode and will be varied with daily load conditions and oxygen demand requirements. The third channel will provide a polishing mode to remove remaining BOD and ammonia before the flow exits to final clarifiers.

The channels will be aerated with aeration discs which provide high oxygen transfer and mixing efficiency. Daily changes in wastewater oxygen demand are handled by changing the immersion of the discs and by varying their rotation speeds. Surges in oxygen demand will be handled by turning on/off individual aeration disc assemblies. The number of discs installed and operated in each channel will be varied to meet oxygen demand requirements.

A biological nutrient removal control panel will be incorporated into the design of the oxidation ditch. This panel will control the oxygen and mixed liquor suspended solids concentration in the channels by adjusting the speed of the disc aerators and the return rate from the return activated sludge pumps. Control will be based on continuous readings from ORP and DO probes and a suspended solids meter installed in the oxidation ditch channel and at other locations.

Design details of the Ashville WRRF oxidation ditch are presented below:

1. Process: Three Channel Oxidation Ditch
2. Total Volume at High Water Level: 642,539 gallons
3. Outer Channel Volume: 308,276 gallons
4. Middle Channel Volume: 214,180 gallons
5. Inner Channel Volume: 120,083 gallons
6. Overall Dimensions: 114' Long x 94' Wide x 11' Side Water Depth
7. Type of Aeration: Surface Aerators (Disc Type)
8. No. of Motors: 4
9. Power: 10 Hp (2), 25 Hp (2)

### **Walnut Creek Description**

The proposed Ashville WRRF will discharge to Walnut Creek. Walnut Creek at this location has the following use designations in the Ohio Water Quality Standards:

Recreational Beneficial Use:      Primary Contact Recreation (PCR)

Aquatic Life Use:                      Warm Water Habitat (WWH)

The Ashville WRRF discharge location is in HUC 05060001-170 as shown on the attached figure from the Walnut Creek TMDL report. Other excerpts from the Walnut Creek TMDL report are also attached.

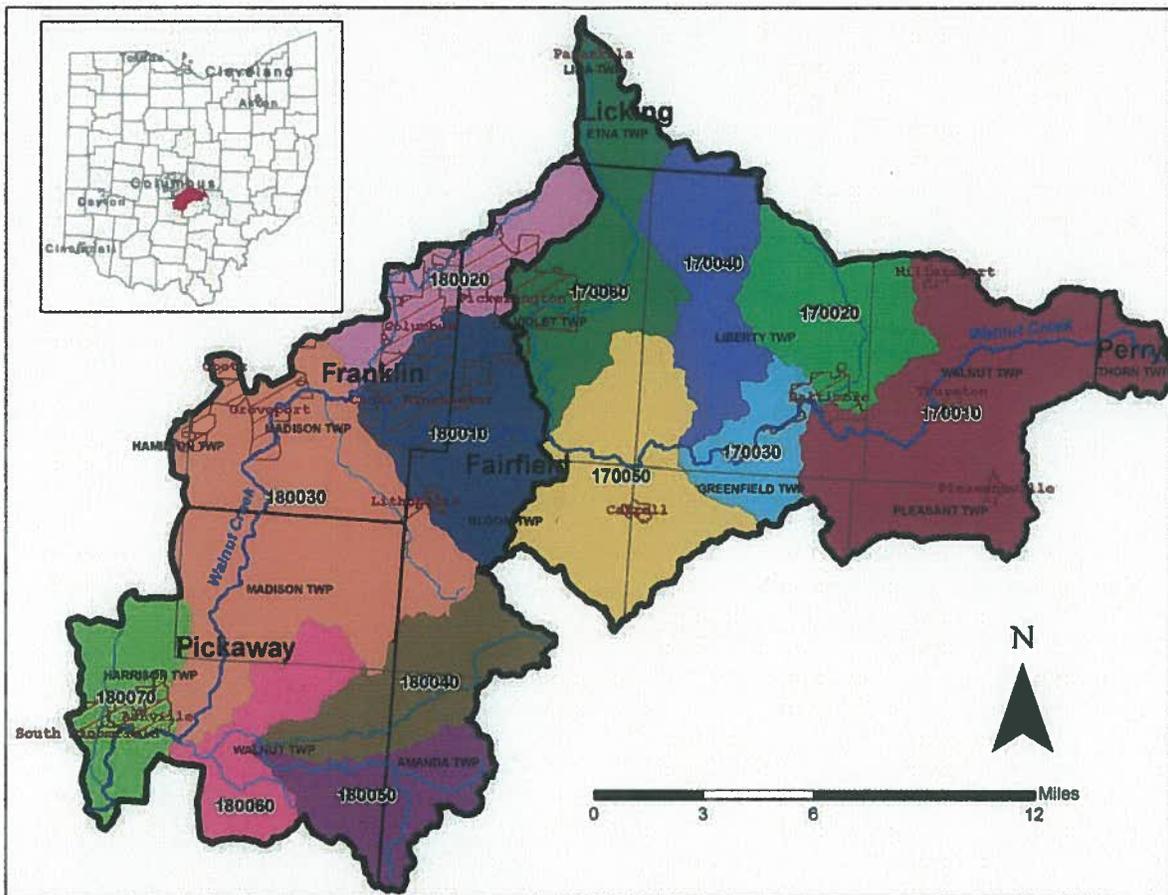


Figure 2.1 Walnut Creek's 14-digit HUCs and various political boundaries.

Table 2.1 14-digit HUC watersheds within the Walnut Creek watershed.

HUC14	TMDL Watershed or Assessment Unit	Narrative Description	Area (square miles)	
05060001-170	010	Upper Walnut	Walnut Creek above Pawpaw Creek	42.5
	020	Upper Walnut	Pawpaw Creek	17.5
	030	Upper Walnut	Walnut Creek below Pawpaw Creek to above Poplar Creek	9.6
	040	Upper Walnut	Poplar Creek	17.4
	050	Upper Walnut	Walnut Creek below Sycamore Creek to above George Creek	27.4
	060	Upper Walnut	Sycamore Creek	23.6
05060001-180	010	Lower Walnut	Walnut Creek Below Sycamore Creek to above George Creek	23.0
	020	Lower Walnut	George Creek	14.6
	030	Lower Walnut	Walnut Creek Below George Creek to above Little Walnut Creek	52.1
	040	Lower Walnut	Little Walnut Creek Headwaters to above Turkey Run	17.0
	050	Lower Walnut	Turkey Run	14.3
	060	Lower Walnut	Little Walnut Creek Below Turkey Run to Walnut Creek	12.7
	070	Lower Walnut	Walnut Creek Below Little Walnut Creek to Scioto River	13.9

### 3 APPLICABLE WATER QUALITY STANDARDS

Under the Clean Water Act, every state must adopt water quality standards to protect, maintain and improve the quality of the nation's surface waters. These standards represent a level of water quality that will support the Clean Water Act goal of "swimmable and fishable" waters. TMDLs are required when a waterbody fails to meet water quality standards (WQS) that have been established for a stream.

#### 3.1 Ohio WQS

Ohio's WQS, set forth in Chapter 3745-1 of the Ohio Administrative Code (OAC), include four major components:

- Beneficial use designations
- Narrative criteria
- Numeric criteria
- Antidegradation provisions

Beneficial use designations describe the existing or potential uses of a waterbody. They consider use and value of a waterbody for public water supply; protection and propagation of aquatic life; recreation in and on the water; and agricultural, industrial or other purposes. Ohio EPA assigns beneficial use designations to each waterbody in the state. There may be more than one use designation assigned to a water body. Examples of beneficial use designations include: public water supply, primary contact recreation, and aquatic life uses (warmwater habitat, exceptional warmwater habitat, etc.) Use designations are defined in paragraph (B) of rule 3745-1-07 of the OAC and are assigned in rules 3745-1-08 to 3745-1-32. Attainment of uses is based on numeric and narrative criteria.

Numeric criteria are chemical concentrations, degree of aquatic life toxicity, and physical conditions allowable in a waterbody without adversely affecting its beneficial uses. To ensure protection of those beneficial uses, Ohio EPA determines maximum acceptable concentrations for over 100 chemicals.

Narrative criteria describe general water-quality goals that apply to all surface waters. These criteria state that all waters shall be free from sludge, floating debris, oil, scum, color and odor producing materials; substances that are harmful to human or animal health; and nutrients in concentrations that may cause nuisance algal growth.

Much of Ohio EPA's present strategy regarding water quality based permitting is based upon the narrative free from, "no toxics in toxic amounts." Ohio EPA developed its strategy based on an evaluation of the potential for significant toxic impacts within receiving waters. Other components of this evaluation are the biological survey program and the biological criteria used to judge aquatic life use attainment.

Biological criteria are based on aquatic structural and functional community characteristics. These criteria are used to evaluate attainment of aquatic life uses. Data collected in these assessments are used to characterize aquatic life impairment and to help diagnose the cause of this impairment.

The Ohio EPA Antidegradation Policy aims to keep clean waters clean. Antidegradation provisions describe conditions under which water quality may be lowered in surface waters.

Existing beneficial uses and the existing water quality, even if better than that needed to protect existing beneficial use, must be maintained and protected unless lower quality is deemed necessary to allow important economic or social development. Antidegradation provisions are in Sections 3745-1-05 and 3745-1-54 of the OAC.

### 3.1.1 Recreational beneficial use designations

Two recreational use designations are applicable to stream segments in the Walnut Creek watershed: Primary Contact Recreation (PCR) and Secondary Contact Recreation (SCR). PCR is applied to waters suitable for full-body contact such as swimming and canoeing. Ohio EPA assigns the PCR use designation to a stream unless it is demonstrated through use attainment analysis that the combination of remoteness, accessibility, and depth makes full-body contact recreation by adults or children unlikely. In those cases, the SCR designation is assigned.

SCR is applied to waters suitable for partial-body contact recreation such as wading. Recreational use designations are in effect for only the recreation season. The recreation season is defined as May 1<sup>st</sup> through October 15<sup>th</sup>. Recreational use designations are in Section 3745-1-07 of the OAC.

Attainment of the recreation use designation is evaluated by comparison to bacteriological numeric and narrative criteria. Ohio currently has bacteriological criteria for two parameters: fecal coliform and *E. coli*. Narrative criteria state that only one of the two criteria must be met to result in attainment. Bacteriological criteria apply outside the mixing zone of permitted discharges.

The numeric criteria for PCR state the geometric-mean fecal coliform content shall not exceed 1,000 colony forming units (cfu) per 100 milliliters (ml), and fecal coliform content shall not exceed 2,000 cfu per 100 ml in more than ten percent of samples taken. The numeric criteria for PCR also state that the geometric-mean *E. coli* content shall not exceed 126 cfu per 100 ml, and *E. coli* content shall not exceed 298 cfu per 100 ml in more than ten percent of samples taken. The numeric criteria for SCR state fecal coliform and *E. coli* content shall not exceed 5,000 cfu per 100 ml and 576 cfu per 100 ml, respectively, in more than ten percent of samples taken. Fecal coliform and *E. coli* content is to be evaluated on no less than 5 samples collected within a 30-day period for both PCR and SCR. Bacteriological criteria apply outside the mixing zone of permitted discharges.

There are 180 stream miles designated as PCR while 23 miles are SCR accounting for eleven percent of all the stream miles given a recreation use designation. There are no other recreation use designations in the Walnut Creek watershed.

The SCR designations are distributed among six different streams within five unique 14-digit HUCs. Three of these 14-digit HUCs are in the 170 11-digit HUC, while only one 14-digit HUC and three streams are located in the 180 11-digit HUC. Figure 3.1 is a map of recreation use designations.

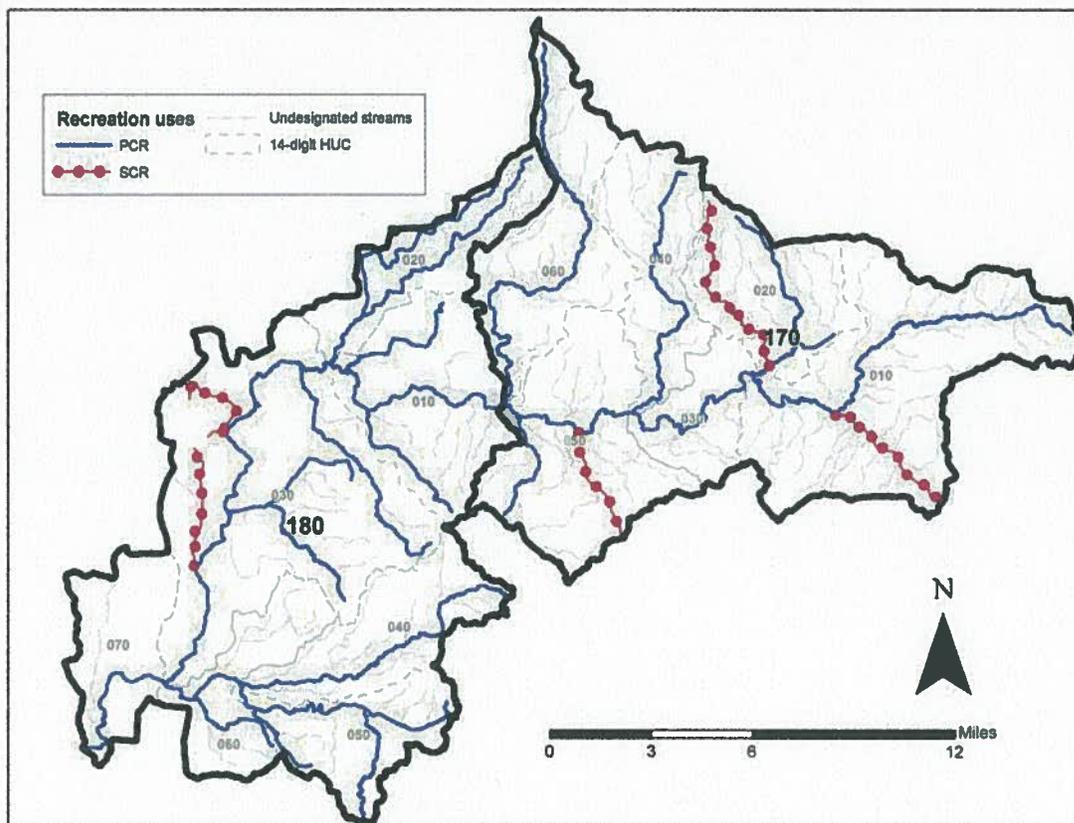


Figure 3.1 Map of recreation use designations.

### 3.1.2 Aquatic life beneficial use designations

Four aquatic life beneficial use designations are applicable in the Walnut Creek watershed:

- Warmwater Habitat
- Exceptional Warmwater Habitat
- Coldwater Habitat
- Modified Warmwater Habitat

The aquatic life use assigned to a waterbody is dependent upon its present or potential condition and the biological community it is capable of supporting. See <http://www.dnr.state.oh.us/default/tabid/11879/Default.aspx> for an overview of aquatic biological communities.

Warmwater Habitat (WWH) waters are capable of supporting and maintaining a balanced integrated community of warm water aquatic organisms. WWH represents the principal restoration target for the majority of water resource management efforts in Ohio and is in line with the Clean Water Act goal of fishable waters.

Exceptional Warmwater Habitat (EWH) represents a protection goal for the management of Ohio's best water resources. Waters designated as EWH are capable of supporting exceptional or unusual assemblages of aquatic organisms which are characterized by a high diversity of

species, particularly those which are highly pollutant intolerant and/or are rare, threatened, or endangered (i.e., declining species).

Coldwater Habitat (CWH) is applied to waters that support native communities of cold-water organisms, and/or those that support trout stocking and management under the auspices of the Ohio Department of Natural Resources.

Modified Warmwater Habitat (MWH) is applied to waters that have been subject to maintenance, which essentially permanently modifies the stream. The MWH designation is appropriate if the modification is such that WWH criteria are unattainable. Additionally, the modification must be sanctioned by state or federal law. MWH aquatic communities are generally composed of species that are tolerant to low dissolved oxygen, silt, nutrient enrichment and poor quality habitat. Where this use designation is applied, the allowable conditions in the MWH-designated stream may be driven by the need to protect a higher downstream aquatic life use designation (e.g., WWH, EWH).

Aquatic life use attainment is dependent upon numeric biological criteria (biocriteria). Biocriteria are based on aquatic community characteristics that are measured both structurally and functionally. The rationale for using biocriteria has been extensively discussed elsewhere (Karr, 1991; Ohio EPA, 1987a,b; Yoder, 1989; Miner and Borton, 1991; Yoder, 1991; Yoder and Rankin, 1995).

Attainment of aquatic life uses is determined directly by measuring fish and aquatic macroinvertebrate populations, and comparing results to expectations derived from least impacted reference sites. Attainment benchmarks (i.e., expectations) drawn from the least impacted reference population are established in the WQS in the form of biocriteria. If measurements of an aquatic community do not achieve any one of the three biocriterion (fish: Index of Biotic Integrity (IBI) and Modified Index of Well-being (MIwb)); aquatic macroinvertebrates: Invertebrate Community Index (ICI)) the stream is considered in non attainment. If the aquatic communities achieve at least one of the biological criteria and none of the other criteria are rated as poor, the stream is said to be in partial attainment. A stream that is in partial attainment is not achieving its designated aquatic life use, whereas a stream that meets all of the biocriteria benchmarks is in full attainment.

Table 3.1 and Figure 3.2 show the distribution of aquatic life uses in the watershed. Table 3.2 presents biocriteria applicable in the Walnut Creek watershed. Biocriteria do not currently exist for CWH; attainment is determined on a case-by-case basis.

Table 3.1. Distribution of aquatic life use designations.

Aquatic Life Uses	Stream Length (miles)	Relative %
Warmwater habitat (WWH)	163	80.3%
Coldwater habitat (CWH)	21	10.2%
Exceptional warmwater habitat (EWH)	14	7.1%
Modified warmwater habitat (MWH)	5	2.4%
<b>Total designated stream length</b>	<b>203</b>	<b>100%</b>

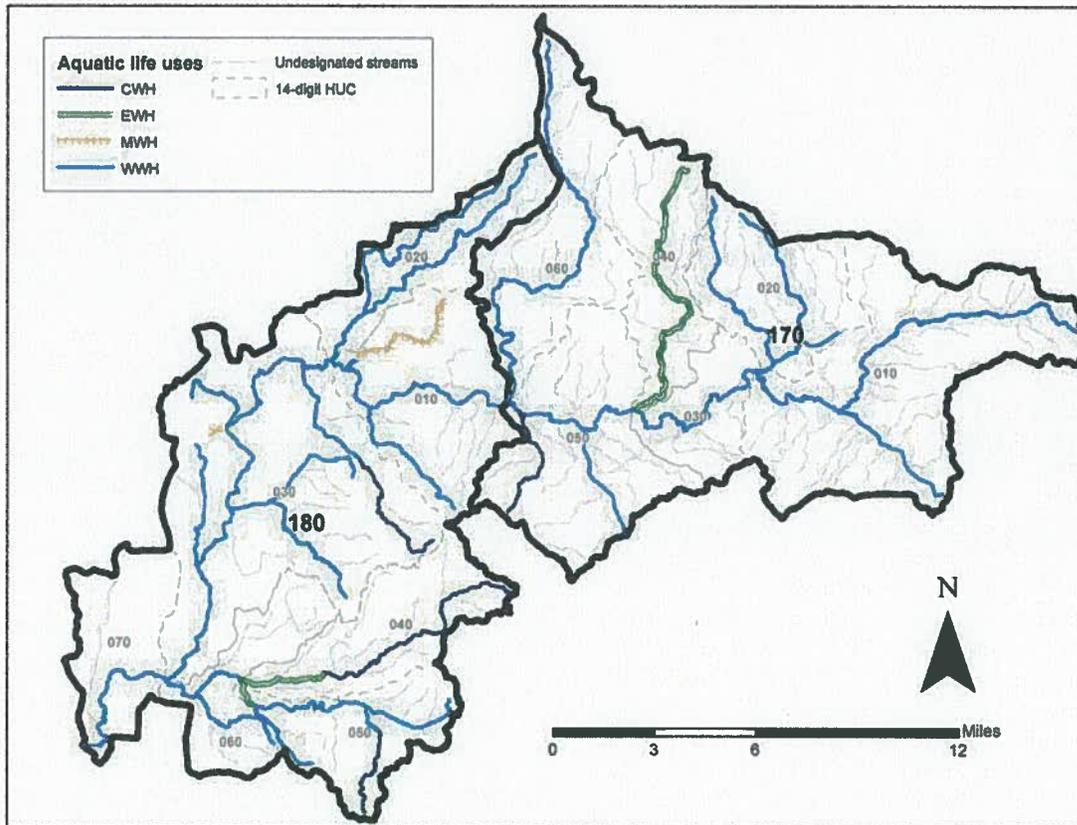


Figure 3.2 Map of aquatic life use designations .

Table 3.2 Biocriteria applicable for the Eastern Corn Belt Plains Ecoregion (ECBP)

Biological Index	Assessment Method	WWH	EWH	MWH
Index of Biotic Integrity (IBI)	Headwater	40	50	24
	Wading	40	50	24
	Boat	42	48	24
Modified Index of Well Being (MIwb)	Headwater	NA <sup>1</sup>	NA <sup>1</sup>	NA <sup>1</sup>
	Wading	8.3	9.4	4.0
	Boat	8.5	9.6	4.0
Invertebrate Community Index (ICI)	All <sup>2</sup>	36	46	22

1 Not applicable to drainage areas less than 20 mi<sup>2</sup>

2 Limited to sites with appropriate conditions for artificial-substrate placement