# *USE ATTAINABILITY ANALYSIS*

# *VALLEY CREEK*

**Alabama Department of Environmental Management**
**December 2001**

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# *1.0 Introduction*

The purpose of this Use Attainability Analysis (UAA) is to provide evidence that supports the proposed use classification change for the upper segment of Valley Creek being upgraded from Agricultural and Industrial Water Supply (A&I) to Limited Warmwater Fishery (LWF). More specifically, a UAA is required by EPA when States assign a use classification to surface waters that is considered less than the "fishable/swimmable" goal as defined in Section 101(a)(2) of the Clean Water Act. The use classification change for Valley Creek is considered an upgrade because the water uses and corresponding water quality criteria are more stringent for waters classified as LWF as opposed to A&I. However, the LWF classification does not fully meet the water quality uses and criteria associated with the "fishable/swimmable" goal, therefore a UAA is necessary. Alabama's Fish and Wildlife (F&W) use classification, is considered a "fishable/swimmable" designated use by EPA, therefore the objective of this analysis is to document the conditions that prevent the upper segment of Valley Creek from attaining Fish and Wildlife status.

On August 1, 2000, the Environmental Management Commission adopted new regulations (effective September 7, 2000) which eliminated the Industrial Operations (IO) category from the use classification regulations as defined by ADEM's Water Quality Program. At the same time, a segment of Valley Creek (9.7 miles) and all of Opossum Creek (8.5 miles) were upgraded from Industrial Operations to Agricultural and Industrial Water Supply. At that time, a UAA was prepared by ADEM for Valley Creek and Opossum Creek (October 2000) for the purpose of documenting the reasons why the streams could not attain F&W status. The October 2000 UAA continues to be the supporting document for Opossum Creek's current A&I classification. Tables 1-1 & 1-2 below provide a summary of how the rule revisions changed the use classification structure for Valley Creek and Opossum Creek from their previous classification to their current classification.

**Table 1-1-Previous Classification**

| Stream Segment | Basin | Geographic Description | Length (miles) | Previous Classification |
|---|---|---|---|---|
| Valley Creek | Black Warrior | from Bankhead Lake (confluence of Mud Creek) to county road crossing $1^1/_2$ miles NE of Johns (Jefferson County Rd. 36) | 24.7 | A&I |
| Valley Creek | Black Warrior | from county road crossing $1^1/_2$ miles NE of Johns (Jefferson County Rd. 36) to Opossum Creek | 9.7 | IO |
| Valley Creek | Black Warrior | from Opossum Creek to its source | 11.9 | A&I |
| | | **Total A&I/IO length for Valley Creek ⇒** | **46.3** | |
| Opossum Creek | Black Warrior | from Valley Creek to its source | 8.5 | IO |

**Table 1-2-Current Use Classification as of September 7, 2000.**

| Stream Segment | Basin | Geographic Description | Length (miles) | Classification (as of 9/7/00) |
|---|---|---|---|---|
| Valley Creek | Black Warrior | from Bankhead Lake (confluence of Mud Creek) to its source | 46.3 | A&I |
| Opossum Creek | Black Warrior | from Valley Creek to its source | 8.5 | A&I |

**Table 1-3-Proposed Use Classification as of December 23, 2001.**

| Stream Segment | Basin | Geographic Description | Length (miles) | Proposed Classification |
|---|---|---|---|---|
| Valley Creek | Black Warrior | from Bankhead Lake (confluence of Mud Creek) to Blue Creek | 22.6 | F&W |
| Valley Creek | Black Warrior | from Blue Creek to its source | 23.7 | LWF |

As shown in Table 3 above, the proposed use classification changes of Valley Creek split the stream approximately in half, with the lower segment of Valley Creek being proposed for Fish and Wildlife and upper segment of Valley Creek being proposed for Limited Warmwater Fishery (See Attachment 1, Figure 1). Blue Creek was chosen as the geographic boundary between F&W and LWF as a result of ADEM's water quality modeling. According to the modeling results, Blue Creek was the approximate location at which dissolved oxygen levels rebounded from the sag to back above 5.0 mg/l, which is the required criteria for waters designated Fish and Wildlife. (See Attachment 5, Summer A&I Model Run)

In accordance with the Federal Water Quality Standards Regulation (40 CFR 131.3), a use attainability analysis is a structured scientific assessment of the factors affecting the attainment of a use which may include physical, chemical, biological, and economic factors as described in Section 131.10(g). As indicated below, results of this use attainability analysis indicate at least two of the six applicable factors as defined in Section 131.10(g) are preventing the segment of Valley Creek from attaining ADEM's Fish and Wildlife use classification.

***<u>Applicable Factors for Valley Creek (40 CFR Part 131.10(g)):</u>***

(1) Naturally occurring pollutant concentrations prevent the attainment of the use; or

(2) Natural, ephemeral, intermittent or low flow conditions or water levels prevent the attainment of the use, unless these conditions may be compensated for by the discharge of sufficient volume of effluent discharges without violating State water conservation requirements to enable uses to be met; or

➡ (3) Human caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct than to leave in place; or

(4) Dams, diversions or other types of hydrologic modifications preclude the attainment of the use, and it is not feasible to restore the water body to its original condition or to operate such modification in a way that would result in the attainment of the use; or

➡ (5) Physical conditions related to the natural features of the water body, such as the lack of a proper substrate, cover, flow, depth, pools, riffles, and the like, unrelated to water quality, preclude the attainment of aquatic life protection uses; or

(6) Controls more stringent than those required by Sections 301(b) and 306 of the Act would result in substantial and widespread economic and social impact.

## *2.0 Overview of the Limited Warmwater Fishery Classification*

On August 1, 2000, the Environmental Management Commission (EMC) adopted regulations (effective September 7, 2000) which created a new use classification, Limited Warmwater Fishery (LWF), within ADEM's Use Classification System (Administrative Code 335-6-11). On December 23, 2001, ADEM proposed regulations that would reclassify the upper portion of Valley Creek to LWF. The key element of the LWF classification is that it establishes seasonal uses and water quality criteria for waters that otherwise cannot maintain the Fish & Wildlife criteria on a year-round basis. The following italicized paragraphs provide the specific water quality criteria associated with the LWF use classification as it appears in ADEM's Water Quality Criteria (Administrative Code 335-6-10-.09(6)).

### *(6) LIMITED WARMWATER FISHERY*

*(a) The provisions of the Fish and Wildlife water use classification at Rule 335-6-10-.09(5) shall apply to the Limited Warmwater Fishery water use classification, except as noted below. Unless alternative criteria for a given parameter are provided in paragraph (e) below, the applicable Fish and Wildlife criteria at paragraph 10-.09(5)(e) shall apply year-round. At the time the Department proposes to assign the Limited Warmwater Fishery classification to a specific waterbody, the Department may apply criteria from other classifications within this chapter if necessary to protect a documented, legitimate existing use.*

*(b) Best usage of waters (May through November): agricultural irrigation, livestock watering, industrial cooling and process water supplies, and any other usage, except fishing, bathing, recreational activities, including water-contact sports, or as a source of water supply for drinking or food-processing purposes.*

*(c) Conditions related to best usage (May through November):*

*1. The waters will be suitable for agricultural irrigation, livestock watering, and industrial cooling waters. The waters will be usable after special treatment, as may be needed under each particular circumstance, for industrial process water supplies. The waters will also be suitable for other uses for which waters of lower quality will be satisfactory.*

*2. This category includes watercourses in which natural flow is intermittent, or under certain conditions non-existent, and which may receive treated wastes from existing municipalities and industries. In such instances, recognition is given to the lack of opportunity for mixture of the treated wastes with the receiving stream for purposes of compliance. It is also understood in considering waters for this classification that urban runoff or natural conditions may impact any waters so classified.*

*(d) Other usage of waters: none recognized.*

*(e) Specific criteria:*

*1. Dissolved oxygen (May through November): treated sewage, industrial wastes, or other wastes shall not cause the dissolved oxygen to be less than 3.0 mg/l. In the application of dissolved oxygen criteria referred to above, dissolved oxygen shall be measured at a depth of 5 feet in waters 10 feet or greater in depth; and for those waters less than 10 feet in depth, dissolved oxygen criteria will be applied at mid-depth.*

*2. Toxic substances and taste-, odor-, and color-producing substances attributable to treated sewage, industrial wastes, and other wastes: only such amounts as will not render the waters unsuitable for agricultural irrigation, livestock watering, industrial cooling, and industrial process water supply purposes; interfere with downstream water uses; or exhibit acute toxicity or chronic toxicity, as demonstrated by effluent toxicity testing or by application of numeric criteria given in Rule 335-6-10-.07, to fish and aquatic life, including shrimp and crabs in estuarine or salt waters or the propagation thereof. For the purpose of establishing effluent limitations pursuant to Chapter 335-6-6 of the Department's regulations, the minimum 7-day low flow that occurs once in 2 years ($7Q_2$) shall be the basis for applying the chronic aquatic life criteria. The use of the $7Q_2$ low flow for application of chronic criteria is appropriate based on the historical uses and/or flow characteristics of streams to be considered for this classification.*

*3. Bacteria: bacteria of the fecal coliform group shall not exceed a geometric mean of 1000/100 ml; nor exceed a maximum of 2000/100 ml in any sample. The geometric mean shall be calculated from no less than five samples collected at a given station over a 30-day period at intervals not less than 24 hours.*

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The above water quality criteria are commensurate with surface waters designated Limited Warmwater Fishery. In general, the water quality criteria associated with the Limited Warmwater Fishery classification are the same as the Fish and Wildlife criteria except for the following:

- Minimum dissolved oxygen requirements are reduced from 5 mg/l to 3 mg/l during May through November.

- The seven-day, two-year ($7Q_2$) low flow instead of the seven-day, ten-year ($7Q_{10}$) low flow is used to establish the chronic aquatic life criteria for point source discharges.
- Bacteriological criteria for incidental water contact and recreation during the months of June through September are not required.

## *3.0 Physical Characteristics of Valley Creek*

Valley Creek originates in the City of Birmingham, Jefferson County, Alabama and meanders to the west until it reaches the impounded waters of Bankhead Lake of the Black Warrior River. The Valley Creek watershed lies within two distinct physiographic provinces of north central Alabama, namely the Valley and Ridge and the Appalachian Plateau. The Valley and Ridge drains the eastern portion of Valley Creek (Upper Valley) and is characterized by parallel ridges and valleys having a wide variety of widths, heights and geologic materials, including limestone, dolomite, shale, siltstone, sandstone, chert and marble. The stream primarily exhibits a dendritic drainage pattern as it flows across gently dipping rocks in the basin. The western portion (Lower Valley) of the watershed lies within the Cumberland Plateau section of the Southwestern Appalachian province and is underlain by horizontal sedimentary bedrock layers that are deeply dissected by streams. The types of geology typically encountered are interbedded dark-gray shale, siltstone, medium-gray sandstone and numerous coal seams. The landscape consists of low hills in an irregular pattern, which have broad, gently rolling summits and steep slopes. Relief is on the order 200 to 250 feet and the hills are generally capped with massive beds of sandstone.

Valley Creek is a major tributary of the Black Warrior River and has a total drainage area of 257 square miles and has a total length of approximately 46 miles. The 7-day, 10-year ($7Q_{10}$) and 7-day, 2-year ($7Q_2$) low flows of Valley Creek at its mouth are 12.9 cubic feet per second (cfs) and 27.2 cfs, respectively. Major tributaries of Valley Creek within the proposed Limited Warmwater Fishery segment include Blue Creek, Fivemile Creek, and Opossum Creek with drainage areas of 19.3, 16.5, and 13.2 square miles respectively. Of the tributaries mentioned, Opossum Creek has considerable impact on Valley Creek due to the major point and nonpoint sources of pollution located within its watershed. In addition, the Opossum Creek watershed is one of the most highly industrialized areas of Birmingham and the stream has been on Alabama's 303(d) use impairment list since 1998 for organic enrichment and low dissolved oxygen. Nonpoint sources are believed to be the most significant source of CBOD in the Opossum Creek watershed. The overall land use in the Opossum Creek subwatershed is 52% urban, 40% forested, 8% open area. Opossum Creek originates in Fairfield, Jefferson County, Alabama and travels 8.5 miles until it enters Valley Creek just upstream of the St. Louis/San Francisco Railway bridge. The $7Q_{10}$ and $7Q_2$ low flows at the mouth of Opossum Creek are 0.6 cfs and 1.7 cfs, respectively. See Figure 1 for the location of Opossum Creek within the Valley Creek watershed.

The Valley Creek watershed includes a broad spectrum of land-use activities. In general, the land use transforms considerably from Upper Valley Creek to Lower Valley Creek. Heavy industrial and commercial activities as well as high/low intensity residential land uses dominate the landscape within Upper Valley Creek. Upper Valley Creek drains a major metropolitan area and has typical urban stream characteristics such as poor habitat and degraded water quality and stressed biological communities. The degraded condition of Upper Valley Creek is primarily due to the extensive industrial and commercial land use within its watershed. The urbanized landscape creates dynamic flow events, reduced riparian zones, increased siltation, and other conditions that destroy habitat and impair water quality, thus making it difficult to sustain a healthy aquatic community. In contrast, the Lower Valley Creek watershed is predominantly rural, with sivicultural, agricultural, and some mining operations comprising the land use. The less intensive land use activities contribute to the improved chemical, physical and biological conditions within Lower Valley Creek. Table 3-1 below is a summary of land use activity within the three subwatersheds that define Valley Creek. The land use information was obtained from the EPA Region 4 Land Cover Data Set, South Central Portion, Version 1. Figure 2 of Attachment 1 provides a pictorial representation of the land uses within the Valley Creek watershed.

**Table 3-1 – Land Use Activity within the Valley Creek Watershed**

| Code | Land Use | Subwatershed | | | Total |
|---|---|---|---|---|---|
| | | Upper Valley | Lower Valley | Shoal | |
| 11 | Open Water | 0.54% | 0.38% | 5.88% | 1.35% |
| 21 | Low Intensity Residential | 19.40% | 2.09% | 0.15% | 7.32% |
| 22 | High Intensity Residential | 7.20% | 0.22% | 0.00% | 2.43% |
| 23 | Commercial/Industrial/Transport | 10.46% | 0.33% | 0.27% | 3.57% |
| 31 | Bare Rock/Sand | --- | --- | --- | --- |
| 32 | Quarry/Strip Mine/Gravel Pits | 1.03% | 0.70% | 1.24% | 0.90% |
| 33 | Transitional Barren | 0.58% | 0.92% | 0.28% | 0.70% |
| 41 | Deciduous Forest | 20.02% | 38.17% | 38.84% | 32.46% |
| 42 | Evergreen Forest | 9.18% | 22.75% | 22.78% | 18.40% |
| 43 | Mixed Forest | 19.90% | 29.11% | 28.71% | 26.09% |
| 81 | Pasture/Hay | 4.47% | 2.90% | 1.06% | 3.10% |
| 82 | Row Crops | 2.23% | 1.69% | 0.74% | 1.70% |
| 85 | Other Grasses | 4.99% | 0.73% | 0.04% | 1.98% |
| 91 | Forested Wetland | 0.01% | --- | --- | 0.00% |
| 92 | Emergent Wetland | 0.01% | --- | 0.01% | 0.01% |

The overall health of Valley Creek is dependent upon good physical characteristics such as proper flow, adequate riparian zones, diverse substrate, and other features that offer good habitat to sustain a healthy aquatic community. Upper Valley Creek is a typical urban stream, containing large amounts of impervious landscape, which in turn allow flash floods to easily occur during rain events that destroy habitat via erosion and sedimentation. Over the years, urbanization of Valley Creek has created many channelized areas within the stream which offer little, if any, habitat for a healthy aquatic community. Subsequently, the concrete channels, coupled with high nutrient loads and excessive light/heat penetration, allow dense periphytic algae and microbial communities to form, which in turn produce significant fluctuations in dissolved oxygen levels via photosynthesis and respiration.

When comparing the physical characteristics of Upper and Lower Valley Creek, the differences that distinguish the two watersheds are primarily land use activity. The less intensive land uses of Lower Valley Creek lend to its ability to attain a Fish and Wildlife use classification. In contrast, it is primarily the poor physical characteristics of Upper Valley Creek that are preventing the stream from attaining a Fish and Wildlife use classification. For this reason, the proposed Limited Warmwater Fishery classification is appropriate for Upper Valley Creek.

## *4.0 Chemical Characteristics of Valley Creek*

The chemical characteristics of Upper Valley Creek demonstrate the influence a major metropolitan area (i.e. heavy industrial, commercial, and residential land use) has on water quality. When comparing the water quality data and associated land uses between the Upper and Lower Valley Creek subwatersheds, it can be shown that land use activity provides a good indication of the types of water quality impacts to be expected within the stream. Upper Valley Creek is characterized as having significant industrial, commercial and residential land uses; likewise it has poor dissolved oxygen levels, high pathogen levels, and elevated biochemical oxygen demand (BOD) and nutrient concentrations. Lower Valley Creek is characterized as having primarily a forested and low-intensity residential land use; therefore it has healthier dissolved oxygen levels, lower pathogen and BOD concentrations.

The USGS data collected as part of the ongoing Birmingham Watershed Project confirms the previous water quality impacts encountered by EPA and ADEM within Upper Valley Creek. Review of the data indicates the key parameters preventing a Fish and Wildlife use classification are dissolved oxygen, nutrients, and bacteria. As illustrated in Table 4-1 below, samples collected at stations VAL-1 and VAL-2 reported dissolved oxygen levels less than 5.0 mg/L, which is the required concentration for streams classified as Fish and Wildlife. Fecal Coliform levels at these stations were elevated well above ADEM's required criteria for a Fish and Wildlife stream. Review of bacteriological data collected, indicate the fecal coliform criteria (200 colonies/100 ml) necessary to protect swimming and other whole-body water contact recreation during the months of June through September would easily be exceeded. These high pathogen levels can be attributed primarily to sewer overflows, leaking sewer lines, and other regulated and nonregulated stormwater runoff. See Attachment 1, Figure 1 for sampling station locations within the Valley Creek subwatershed. See Attachment 2 for a complete list of field/laboratory data and sampling station descriptions. See Attachment 6 for a detailed recreational use attainability analysis for Village and Valley Creeks using data and analysis from Village Creek that is applicable to Valley Creek.

**Table 4-1: Selected USGS Water Quality Data, 2000-2001.**

| Station ID | Date (yy/mm/dd) | Flow (cfs) | DO (mg/L) | BOD (mg/L) | Fecal Coliform (col/100 ml) | Total Nitrogen (mg/l) | Total Phosphorous (mg/l) |
|---|---|---|---|---|---|---|---|
| VAL-1 | 2000/03/01 | 1.83 | 8.2 | | 3700 | 2.2 | 0.096 |
| VAL-1 | 2000/03/31 | 1.77 | 7.12 | | 22000 | 2.8 | 0.158 |
| VAL-1 | 2000/06/29 | 33.4 | 5.1 | | > 33001 | 2 | 0.166 |
| VAL-1 | 2000/08/02 | 2.25 | 5.3 | 4.9 | 64000K | 2.3 | 0.252 |
| VAL-1 | 2000/08/31 | 1.12 | 5 | 4.8 | 4000 | 2.5 | 0.244 |
| VAL-1 | 2000/10/03 | 1.12 | 3.3 | 1.7 | 2100 | 2.2 | 0.269 |
| VAL-1 | 2000/11/09 | 37 | 8.2 | | 85000K | 1.4 | 0.123 |
| VAL-1 | 2000/12/12 | 1.64 | 4.2 | 4.8 | 44000E | 2.6 | 0.162 |
| VAL-1 | 2001/01/23 | 2.49 | 7.8 | 2.4 | 3800 | 2.8 | 0.236 |
| VAL-1 | 2001/02/12 | 120 | 10.4 | 4.4 | 5900 | 0.77 | 0.136 |
| VAL-2 | 2000/02/29 | 13 | 13.1 | | 41K | 1.4 | 0.034 |
| VAL-2 | 2000/03/31 | 20.7 | 8 | | 1000 | 1.6 | 0.167 |
| VAL-2 | 2000/05/16 | 9.7 | 6.8 | | 400 | 0.36 | 0.033 |
| VAL-2 | 2000/06/29 | 22.6 | 5.6 | | > 6001 | 1.2 | 0.093 |
| VAL-2 | 2000/08/03 | 18.2 | 7.8 | 1.2 | 1700 | 1.6 | 0.079 |
| VAL-2 | 2000/08/29 | 6.03 | 4.3 | 2.4 | 640K | 0.64 | 0.034 |
| VAL-2 | 2000/10/05 | 5.2 | 4.7 | 0.9 | 150 | 0.57 | 0.058 |
| VAL-2 | 2000/11/15 | 8.73 | 9.9 | 0.9 | 16000K | 1.9 | 0.085 |
| VAL-2 | 2000/12/13 | 7.84 | 11 | 0.8 | 720 | 1.4 | 0.05 |
| VAL-2 | 2001/01/25 | 13.98 | 9.3 | | 80K | 3 | 0.057 |
| VAL-2 | 2001/02/09 | 374 | 6.1 | | | 2.9 | 0.421 |

Note: shaded areas indicate sample was collected during a rain event.    E = non-ideal colony count    K=estimated value

As you travel downstream from the headwaters of Upper Valley Creek to Lower Valley Creek, water quality appears to be improving. As shown in the following Tables 4-2 & 4-3, samples collected at stations VAL-3, VA1 and VC-5 show improvement in dissolved oxygen, fecal coliform, and biochemical oxygen demand (BOD) concentrations as compared to Stations VAL-1 and VAL-2. Some of the improvement is most likely due to dilution effects as base flow increases due to the addition of incremental flow between the upper and lower sampling stations.

**Table 4-2: Selected USGS Water Quality Data, 2000-2001.**

| Station ID | Date (yy/mm/dd) | Flow (cfs) | DO (mg/L) | BOD (mg/L) | Fecal Coliform (col/100 ml) | Total Nitrogen (mg/l) | Total Phosphorus (mg/l) |
|---|---|---|---|---|---|---|---|
| VAL-3 | 00/02/29 | 27.3 | 10.07 | | 72K | 1.2 | 0.025 |
| VAL-3 | 00/03/29 | 42 | 10.4 | | 120 | 1.5 | 0.021 |
| VAL-3 | 00/06/28 | 14.7 | 7 | | 330 | 1.3 | 0.056 |
| VAL-3 | 00/08/03 | 32.9 | 7.2 | 1 | 1400 | 1.2 | 0.087 |
| VAL-3 | 00/08/31 | 11.7 | 11.1 | 8.6 | 71K | 0.6 | 0.028 |
| VAL-3 | 00/10/02 | 12.3 | 10.2 | 0.5 | 40K | 0.41 | 0.021 |
| VAL-3 | 00/11/09 | 240 | 6.5 | | 16000 | 1.2 | 0.117 |
| VAL-3 | 00/12/13 | 13.67 | 13.9 | 0.7 | 75 | 0.96 | 0.018 |

| Station ID | Date (yy/mm/dd) | Flow (cfs) | DO (mg/L) | BOD (mg/L) | Fecal Coliform (col/100 ml) | Total Nitrogen (mg/l) | Total Phosphorus (mg/l) |
|---|---|---|---|---|---|---|---|
| VAL-3 | 01/01/25 | 33 | 11.1 | | 10K | 2.2 | 0.027 |
| VAL-3 | 01/02/13 | 960 | 10.1 | 8.4 | 4700 | 1.2 | 0.203 |

Note: shaded areas indicate sample was collected during a rain event. E = non-ideal colony count K=estimated value

Station VAL-3 indicates that sanitary sewer overflows during rain events are a likely cause of elevated fecal coliform levels. During the 2000-2001 winter season USGS collected two fecal coliform samples during wet weather conditions. At the time samples were collected, stream flows were recorded at 240 cfs and 960 cfs and fecal coliform concentrations of 16,000-col/100 ml and 4700-col/100 ml, respectively. These are high pathogen concentrations considering the large volume of water in the stream. However, high fecal coliform levels during low flow conditions indicate that leaking sewers and/or septic tanks coupled with a shallow groundwater table may be the primary cause of elevated pathogen levels in the upper reaches of the watershed. The shallow groundwater table is not unexpected due to the proximity of Red Mountain, which comprises the southeastern portion of the Upper Valley Creek subwatershed.

**Table 4-3: Selected ADEM Trend Station Data, 1997-2001.**

| Station Number | Date (yy/mm/dd) | Dissolved Oxygen (mg/l) | T-PO4 (mg/l) | NO2/NO3 (mg/l) | BOD-5 (mg/l) | NH3 (mg/l) | Fecal Coliform (col/100 ml) |
|---|---|---|---|---|---|---|---|
| VC-5 | 97/06/05 | 6.33 | 0.151 | 1.753 | 1.9 | 0.148 | 3600 |
| VC-5 | 97/08/14 | 6.97 | 0.089 | 0.519 | 1.9 | 0.005 | 340 |
| VC-5 | 97/11/19 | 10.20 | 0.095 | 1.069 | 1.5 | 0.005 | |
| VC-5 | 98/08/19 | 6.25 | 0.084 | 0.774 | 1.1 | 0.005 | 164 |
| VC-5 | 98/10/14 | 7.15 | 0.005 | 0.649 | 0.5 | 0.005 | 114 |
| VC-5 | 99/06/02 | 5.82 | | 0.624 | 0.1 | | 240 |
| VC-5 | 99/08/04 | 6.12 | 0.029 | 0.5644 | 0.3 | | 124 |
| VC-5 | 99/10/13 | 6.73 | 0.043 | 0.052 | 1.5 | 0.878 | 240 |
| VC-5 | 00/06/07 | 7.00 | 0.004 | 0.015 | 0.7 | 1.15 | 370 |
| VC-5 | 00/08/09 | 7.50 | 0.018 | 0.551 | 0.6 | 0.015 | 310 |
| VC-5 | 00/10/11 | 9.40 | 0.005 | 0.68 | 0.8 | 0.015 | 124 |
| VC-5 | 01/06/06 | 7.25 | 0.07 | 0.221 | 1 | 0.015 | 270 |
| VC-5 | 01/08/08 | 5.88 | 0.02 | 0.73 | 0.4 | 0.26 | 760 |
| VA1 | 97/01/22 | 5.00 | 0.141 | 2.846 | 1.2 | | 116 |
| VA1 | 97/03/19 | 7.00 | 0.107 | 2.821 | 2.1 | | 58 |
| VA1 | 97/04/23 | 5.70 | 0.107 | 4.061 | 1.7 | | 148 |
| VA1 | 97/05/14 | 8.80 | 0.457 | 6.163 | 1.1 | | |
| VA1 | 97/06/04 | 6.50 | 0.278 | 3.022 | 0.8 | | 500 |
| VA1 | 97/08/14 | 7.55 | 0.443 | 6.518 | 0.9 | 0.102 | 350 |
| VA1 | 97/11/19 | 8.30 | 0.474 | 6.237 | 1.4 | 0.123 | |
| VA1 | 98/08/19 | 6.15 | 0.302 | 3.957 | 1.1 | 0.005 | 108 |

| Station Number | Date (yy/mm/dd) | Dissolved Oxygen (mg/l) | T-PO4 (mg/l) | NO2/NO3 (mg/l) | BOD-5 (mg/l) | NH3 (mg/l) | Fecal Coliform (col/100 ml) |
|---|---|---|---|---|---|---|---|
| VA1 | 98/10/14 | 7.24 | 0.409 | 5.382 | 0.6 | 0.005 | 27 |
| VA1 | 99/06/02 | 5.80 | 0.115 | 2.009 | 0.2 | | 184 |
| VA1 | 99/08/04 | 5.58 | 0.478 | 5.2564 | 0.9 | 0.055 | 63 |
| VA1 | 99/10/13 | 6.30 | 0.249 | 0.107 | 2 | 2.166 | 240 |
| VA1 | 00/06/07 | 6.20 | 0.45 | 0.015 | 0.9 | 2.838 | 188 |
| VA1 | 00/08/09 | 7.50 | 0.446 | 5.146 | 0.9 | 0.015 | 164 |
| VA1 | 00/10/11 | 6.40 | 0.602 | 0.618 | 1.5 | 0.3 | 44 |
| VA1 | 01/06/06 | 6.68 | 0.37 | 3.98 | 1.2 | 0.015 | 176 |
| VA1 | 01/08/08 | 6.57 | 0.15 | 1.59 | 0.3 | 0.2 | 500 |

In summary, the primary chemical characteristics preventing Upper Valley Creek from attaining ADEM's Fish and Wildlife use classification are dissolved oxygen and fecal coliform. Data collected by USGS, EPA and ADEM during the past several years validate the differences in water quality between Upper and Lower Valley Creek. The Department believes the fundamental reason for the degraded water quality in Upper Valley Creek is the widespread and intense urbanization of its watershed. These impacts are a result of primarily non-point sources of pollution, such as urban runoff and sanitary sewer overflows/leaks, which typically accompany older metropolitan areas such as Birmingham.

Jefferson County, the operator of the regional collection and treatment systems, is in the sixth year of a scheduled activities included in a Consent Agreement with the U.S. EPA. Mitigation efforts by Jefferson County include rehabilitation of the sewer collection system and installation of additional treatment facilities for wet weather flows at the Village Creek and Valley Creek WWTP's, as well as other WWTP's in the Birmingham Metropolitan area. The overflows from the system are currently a significant source of nutrients and other pollutants to receiving streams in the watershed, including Village Creek. Also, the City of Birmingham is currently conducting a flood water control study with the U.S. Corps of Engineers and the U.S. Geological Survey. This study should be completed by December 2002. The aforementioned mitigation activities should result in improved management of water quality and quantity of the Village Creek watershed.

## *5.0 Biological Characteristics of Valley Creek*

In 1989, the U.S. EPA conducted a comparative study of Village, Valley, Opossum, and Fivemile Creeks. As a result of the study, EPA reported that Opossum Creek, a tributary to Upper Valley Creek, appeared to be the most-stressed of the systems examined. Poor habitat and deposits of tar-like substances were the key factors limiting aquatic life. Short-term toxicity tests using the fathead minnow revealed growth impairment at one station on Opossum Creek. The 1989 toxicity tests also revealed significant mortality to the Daphnid on two of the five stations within Valley Creek.

In 1997, a U.S. EPA biological survey of Valley Creek documented significantly degraded habitat at two of the three sampling stations in Upper Valley Creek with habitat scores of 66 and 64 versus 125 in the reference F&W stream. In addition, there were limited pollution sensitive species present in the upper two sampling stations as evidenced by the EPT index scores of 0 and 1. Fewer species of fish were also reported in the upper watershed versus the lower. EPA biologists recommended not upgrading the segment to F&W unless significant enhancements could be made to improve the stream habitat and remove the sources of excess nutrients. Results of the study revealed that Opossum Creek, scored the lowest, with a 0 EPT index, in comparison to the reference F&W stream, which scored a 3.

In 1999-2000, USGS collected benthic macroinvertebrate data at two locations within Upper Valley Creek. As shown in the following Table 5-1, evaluation of the macroinvertebrate data collected indicate poor results in both EPT Family Richness and Total Taxa Richness at stations VAL-1 and VAL-2, compared to the reference F&W stream. USGS Station VAL-1 had the worst macroinvertebrate scores with EPT Family Richness = 0 and Total Taxa Richness = 10. The USGS Station VAL-2, downstream of VAL-1, also had degraded benthic macroinvertebrates, with EPT Family Richness = 2 and Total Taxa Richness = 24. The low scores reported at these stations are not unexpected due to the degraded physical and chemical characteristics as discussed in previous sections. The recent biological data collected for Upper Valley demonstrate the significant improvements that will be necessary to improve stream habitat and water quality to achieve the Fish and Wildlife use classification. The chronic aquatic life protections required under Limited Warmwater Fishery, even though less restrictive than F&W requirements, will be difficult to achieve. However, the Department believes with continued remediation efforts by Jefferson County and the City of Birmingham to improve stream habitat and water quality, the LWF classification is attainable for the subject segment of Valley Creek.

**Table 5-1: Birmingham Watershed Project, USGS Benthic Macroinvertebrate Data, 2000-2001**

| Station ID | Station Location | EPT Family Richness | Total Taxa Richness |
|---|---|---|---|
| VAL-1 | Valley Creek at 5th Ave and 7th Street | 0 | 10 |
| VAL-2 | Valley Creek at Cleburne Avenue | 2 | 24 |
| Reference | Five Mile Creek at Nevel Road | 8 | 38 |

## *6.0 Point Source Analysis & Water Quality Modeling of Valley Creek WWTP, USX Fairfield, and Koppers Organics*

A total of three point sources operating under NPDES permits are located within the Valley Creek watershed. Of the three, two are major industrial discharges located on Opossum Creek, namely USX Fairfield Works and Koppers Organics. Valley Creek

WWTP is the third discharge and is located on Valley Creek approximately 1.4 miles upstream of the Fivemile Creek confluence. Valley Creek WWTP is considered a major municipal facility and is owned and operated by Jefferson County. Refer to Attachment 1, Figure 1 for the location of these point sources.

Water quality modeling was conducted for the above mentioned point sources to predict effluent limits that would be required for the various use classifications, namely, A&I, LWF, and F&W. The study reach for the model extends from just above the USX outfall on Opossum Creek to Bankhead Lake of the Black Warrior River. Results of the water quality modeling indicate that the Limited Warmwater Fishery classification is achievable. According to the modeling results, Valley Creek WWTP would receive the most stringent effluent limits as a result of the use classification upgrade of Valley Creek. However, USX Fairfield Works and Koppers Organics would also receive some permit modifications as a result of the upgrade due to their close proximity to Valley Creek. These changes would primarily result in each facility being required to conduct chronic toxicity biomonitoring at 7Q2 flow conditions. USX would also receive a slightly more stringent BOD limit during the winter season. Water quality modeling shows the dissolved oxygen sag below the USX and Koppers outfalls to be occurring in the proposed LWF segment of Valley Creek, therefore the CBOD limit (winter only) for USX was adjusted slightly to meet the dissolved oxygen concentration of 5 mg/l during the winter season. See Attachment 4 for the current and predicted effluent limits of USX, Koppers, & Valley Creek WWTP. Refer to Attachment 5 for the schematic diagrams and model runs supporting the predicted limits.

The current design capacity of the Valley Creek WWTP is 65 million gallons per day (MGD), however they were recently authorized by the Department to expand their capacity to 85 MGD. The treatment system consists of mechanical screening, aerated grit removal, pre-aeration and primary clarification. Biological treatment follows with two stages of aeration and clarification. Effluent is metered, chlorinated and dechlorinated prior to discharge. Biosolids are treated in the anaerobic digesters prior to being dewatered by filter belt presses and/or drying beds. Dried biosolids are blended with lime and then applied at the County's beneficial land use site. According to Valley Creek WWTP's discharge monitoring reports (DMRs) the plant is operating at very efficient levels and providing a high degree of treatment. For the period January 1998 through June 2001 the facility had an average wasteflow of 42.3 MGD, and average effluent carbonaceous biochemical oxygen demand-5 day test ($CBOD_5$), ammonia nitrogen ($NH_3$-N) and dissolved oxygen (DO) values of 2.0, 0.2 and 7.2 mg/l, respectively (See Attachment 3).

The facility's current treatment performance, demonstrates their capability to meet the effluent limits necessary to achieve the water quality criteria required for the Limited Warmwater Fishery classification. The Valley Creek WWTP will be required to conduct chronic toxicity test based on a 7Q10 flow (F&W requirement) instead of the 7Q2 flow usually required for LWF classified waters. The more stringent chronic toxicity biomonitoring is required due to the close proximity (i.e. within 24-hour travel time) of the WWTP's outfall to the downstream F&W segment of Valley Creek. Table 6-1 that follows provides the current and predicted effluent limits for the Valley Creek WWTP.

**Table 6-1: Current and Predicted Effluent Limits for Valley Creek WWTP, Water Quality Modeling, ADEM 2001.**

***2001 Modeling Results @ 85 MGD***

| | ***Current A&I Limits*** | | ***Predicted LWF Limits*** | | ***Predicted F&W Limits*** | |
|---|---|---|---|---|---|---|
| ***Parameter*** | ***Summer*** | ***Winter*** | ***Summer*** | ***Winter*** | ***Summer*** | ***Winter*** |
| **$CBOD_5$** (*mg/l*) | 8 | 14 | 8 | 8 | 4 | 8 |
| **$NH_3$-N** (*mg/l*) | 1 | 2 | 1 | 1 | 0.5 | 1 |
| **TKN** (*mg/l*) | 3 | 5 | 3 | 3 | 2.5 | 3 |
| **DO** (*mg/l*) | 5 | 5 | 5 | 6 | 6 | 6 |

## *7.0 Conclusion*

Results of the use attainability analysis indicate the following applicable factors as defined by EPA are preventing the LWF segment of Valley Creek from attaining ADEM's Fish and Wildlife use classification.

- Human caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct than to leave in place; or

- Physical conditions related to the natural features of the water body, such as the lack of a proper substrate, cover, flow, depth, pools, riffles, and the like, unrelated to water quality, preclude the attainment of aquatic life protection uses; or

The use classification upgrade of Upper Valley Creek from Agricultural and Industrial Water Supply (A&I) to Limited Warmwater Fishery (LWF) will provide the necessary criteria to protect existing uses within the stream. The Department believes the LWF classification is appropriate because it adequately characterizes the water quality conditions that are reasonably attainable for this waterbody.

No currently available information exists that suggests that the F&W use classification is attainable. Data presented in this document demonstrate nutrient enrichment and highly elevated bacteria levels from monitoring locations in upper Valley Creek, both upstream and downstream of permitted discharges. In general, water quality corresponds to land use patterns in the upper and lower portions of Valley Creek. Nutrient concentrations (nitrogen and phosphorus) are particularly high in monitoring locations upstream of permitted discharges in upper Valley Creek. Excess nutrients, combined with shallow depth, high water table, and increased light and heat penetration from lack of shading produce dense periphytic algae and microbial communities whose photosynthesis and respiration result in dissolved oxygen concentrations that frequently fall below criteria levels for F&W.

In the proposed LWF segment, bacteria levels are consistently elevated above those required for primary contact recreation, as provided in the F&W use classification during June-September. The pattern illustrated by the data from Valley Creek show variable levels at monitoring locations at various points along Valley Creek similar to the variable pattern exhibited by data from nearby Village Creek. The analysis presented in Attachment 6 demonstrates the correspondence of bacteria levels with the pattern of precipitation in Village Creek, a pattern that indicates a strong relationship to nonpoint sources.

Leaking sewer lines, domestic animal and wildlife populations, and leaking septic tanks are nonpoint sources of both nutrients and bacteria to Valley Creek. Sewer overflows are also a source of both nutrients and bacteria to Valley Creek that is driven by precipitation. The Valley Creek WWTP currently achieves an extremely high level of treatment. Jefferson County is estimated to expend $800 million to resolve sewer overflows and replace leaking sewer lines. It is anticipated that this substantial capital investment will improve water quality.

It is not currently possible to determine the percent contribution from the known categories of nonpoint sources, nor is it possible to project the degree of success in terms of measurable water quality improvements that will result from ongoing efforts to resolve sewer overflows and replace leaking sewer lines. The available information suggests that the magnitude of nutrient and bacteria levels, the variety of sources, and the physical characteristics of the waterbody indicate that the F&W use classification is not attainable, and the highest attainable use is LWF. Therefore, F&W is not designated at this time as a result of a combination of human-caused conditions (that may not be feasible to fully remedy) and natural physical conditions of the watershed unrelated to water quality (e.g., high water table). However, as new information becomes available that pertains to attainability of the F&W use classification, it will be considered and water quality standards revised accordingly.

# *Attachment 1*

## *WATERSHED MAPS*

***Attachment 2***

***Valley Creek Sampling Stations & Water Quality Data***

**Table 2-1: USGS Sampling Station Locations and Types of Data Collected.**

| Station ID | Station Description | Drainage Area ($mi^2$) | Stream Flow | Type & Frequency of Water-Quality Parameters Sampled | | | | Type of Biological Parameters Sampled | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Field, Nutrients, and Bacteria | Pesticides | PAHs | Trace Elements | Fish, Benthic Invertebrate, and Algal Community Surveys | Bed Sediment and Fish Tissue | Habitat Survey |
| VAL-1 | Valley Creek at 5th Street and 7th Avenue | 4.94 | Partial | y | y | y | y | y | y | y |
| VAL-2 | Valley Creek at Cleburne Avenue | 20.1 | Partial | y | y | y | y | y | y | y |
| VAL-3 | Valley Creek at Route 11 | 30.0 | Partial | y | y | y | y | n | n | n |

**Table 2-2: ADEM Trend Station Locations and Types of Data Collected.**

| Station ID | Station Description | Drainage Area ($mi^2$) | Stream Flow | Type & Frequency of Water-Quality Parameters Sampled | | | | Type of Biological Parameters Sampled | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Field, Nutrients, and Bacteria | Pesticides | PAHs | Trace Elements | Fish, Benthic Invertebrate, and Algal Community Surveys | Bed Sediment and Fish Tissue | Habitat Survey |
| VC-5 | Valley Creek at 18th Avenue Bridge (upstream of WWTP) | 34.9 | visual | y | n | n | n | n | n | n |
| VA-1 | Valley Creek at Jefferson County Road 36 (downstream of WWTP) | 93.0 | visual | y | n | n | n | n | n | n |

**Table 2-3: Birmingham Watershed Project, USGS Water Quality Data, 2000-2001.**

| Station ID | Date (yy/mm/dd) | Water Temp (C) | Flow (cfs) | pH (s.u.) | Cond. (umhos @25C) | TOC (mg/L) | DO (mg/L) | BOD (mg/L) | Fecal Coliform (col/100 ml) | Total Nitrogen (mg/l) | Total Phosphorous (mg/l) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| VAL-1 | 2000.03.01 | 17.8 | 1.83 | 8.053 | 473 | 4.124 | 8.2 | | 3700 | 2.2 | 0.096 |
| VAL-1 | 2000.03.31 | 19.03 | 1.77 | 7.764 | 674 | 5.352 | 7.12 | | 22000 | 2.8 | 0.158 |
| VAL-1 | 2000.06.29 | 24.6 | 33.4 | 7.425 | 175 | 16.561 | 5.1 | | > 33001 | 2 | 0.166 |
| VAL-1 | 2000.08.02 | 25.1 | 2.25 | 7.883 | 415 | 27.07 | 5.3 | 4.9 | 64000K | 2.3 | 0.252 |
| VAL-1 | 2000.08.31 | 24.3 | 1.12 | 7.878 | 421 | 3.448 | 5 | 4.8 | 4000 | 2.5 | 0.244 |
| VAL-1 | 2000.10.03 | 21.8 | 1.12 | 7.817 | 396 | 3.644 | 3.3 | 1.7 | 2100 | 2.2 | 0.269 |
| VAL-1 | 2000.11.09 | 21.2 | 37 | 7.845 | 135 | 5.88 | 8.2 | | 85000K | 1.4 | 0.123 |
| VAL-1 | 2000.12.12 | 14 | 1.64 | 7.576 | 415 | 7.048 | 4.2 | 4.8 | 44000E | 2.6 | 0.162 |
| VAL-1 | 2001.01.23 | 13.3 | 2.49 | 7.97 | 498 | 4.236 | 7.8 | 2.4 | 3800 | 2.8 | 0.236 |
| VAL-1 | 2001.02.12 | 10.9 | 120 | 7.77 | 77.7 | 8.211 | 10.4 | 4.4 | 5900 | 0.77 | 0.136 |
| | | | | | | | | | | | |
| VAL-2 | 2000.02.29 | 18.9 | 13 | 8.497 | 510 | 2.207 | 13.1 | | 41K | 1.4 | 0.034 |
| VAL-2 | 2000.03.31 | 15.4 | 20.7 | 7.932 | 459 | 2.398 | 8 | | 1000 | 1.6 | 0.167 |
| VAL-2 | 2000.05.16 | 18.9 | 9.7 | 8.08 | 509 | | 6.8 | | 400 | 0.36 | 0.033 |
| VAL-2 | 2000.06.29 | 26.6 | 22.6 | 7.155 | 266 | 6.979 | 5.6 | | > 6001 | 1.2 | 0.093 |
| VAL-2 | 2000.08.03 | 28.6 | 18.2 | 7.918 | 422 | 3.136 | 7.8 | 1.2 | 1700 | 1.6 | 0.079 |
| VAL-2 | 2000.08.29 | 30 | 6.03 | 8.357 | 416 | 4.55 | 4.3 | 2.4 | 640K | 0.64 | 0.034 |
| VAL-2 | 2000.10.05 | 19.8 | 5.2 | 7.905 | 402 | 2.705 | 4.7 | 0.9 | 150 | 0.57 | 0.058 |
| VAL-2 | 2000.11.15 | 8.8 | 8.73 | 7.813 | 548 | 2.893 | 9.9 | 0.9 | 16000K | 1.9 | 0.085 |
| VAL-2 | 2000.12.13 | 5.5 | 7.84 | 7.985 | 485 | 3.394 | 11 | 0.8 | 720 | 1.4 | 0.05 |
| VAL-2 | 2001.01.25 | 7.3 | 13.98 | 7.9 | 518 | 2.816 | 9.3 | | 80K | 3 | 0.057 |
| VAL-2 | 2001.02.09 | 15 | 374 | 7.37 | 145 | 29.161 | 6.1 | | | 2.9 | 0.421 |
| | | | | | | | | | | | |
| VAL-3 | 2000.02.29 | 13.2 | 27.3 | 7.935 | 431 | 5.173 | 10.07 | | 72K | 1.2 | 0.025 |
| VAL-3 | 2000.03.29 | 15.2 | 42 | 8.179 | 452 | 1.935 | 10.4 | | 120 | 1.5 | 0.021 |
| VAL-3 | 2000.06.28 | 26 | 14.7 | 7.878 | 349 | 3.309 | 7 | | 330 | 1.3 | 0.056 |
| VAL-3 | 2000.08.03 | 24.1 | 32.9 | 7.653 | 279 | 5.415 | 7.2 | 1 | 1400 | 1.2 | 0.087 |
| VAL-3 | 2000.08.31 | 27.9 | 11.7 | 7.828 | 384 | 2.634 | 11.1 | 8.6 | 71K | 0.6 | 0.028 |
| VAL-3 | 2000.10.02 | 21.7 | 12.3 | 8.137 | 354 | 2.751 | 10.2 | 0.5 | 40K | 0.41 | 0.021 |
| VAL-3 | 2000.11.09 | 21 | 240 | 7.738 | 168 | 5.454 | 6.5 | | 16000 | 1.2 | 0.117 |
| VAL-3 | 2000.12.13 | 7 | 13.67 | 8.209 | 461 | 2.34 | 13.9 | 0.7 | 75 | 0.96 | 0.018 |
| VAL-3 | 2001.01.25 | 9.8 | 33 | 8.07 | 503 | 2.805 | 11.1 | | 10K | 2.2 | 0.027 |
| VAL-3 | 2001.02.13 | 10.1 | 960 | 7.63 | 110 | 9.644 | 10.1 | 8.4 | 4700 | 1.2 | 0.203 |

**Table 2-4: ADEM Trend Station Data, 1997-2001.**

| Station ID | Date (yy/mm/dd) | Air Temp (C) | Water Temp (C) | pH (su) | Cond. (umhos @25C) | Dissolved Oxygen (mg/l) | Turb. (NTU) | Weather | Velocity | TDS (mg/l) | TSS (mg/l) | Cl (mg/l) | T-PO4 (mg/l) | NO2 & NO3 (mg/l) | BOD-5 (mg/l) | NH3 (mg/l) | Fecal Coliform (col/100 ml) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| VC-5 | 970605 | 22.00 | 21.80 | 7.80 | 385.00 | 6.33 | 3.30 | | | 369 | 10 | 1 | 0.151 | 1.753 | 1.9 | 0.15 | 3600 |
| VC-5 | 970814 | 30.00 | 26.20 | 7.90 | 343.00 | 6.97 | 1.70 | | | 258 | 1 | 5 | 0.089 | 0.519 | 1.9 | 0.01 | 340 |
| VC-5 | 971119 | 14.00 | 11.50 | 7.80 | 388.00 | 10.20 | 1.40 | | | 309 | 1 | 1 | 0.095 | 1.069 | 1.5 | 0.01 | |
| VC-5 | 980819 | 30.00 | 26.00 | 8.30 | 343.00 | 6.25 | 1.00 | clear | moderate | 267 | 1 | 1 | 0.084 | 0.774 | 1.1 | 0.01 | 164 |
| VC-5 | 981014 | 15.00 | 17.90 | 7.90 | 397.00 | 7.15 | 1.00 | clear | moderate | 277 | 1 | 1 | 0.005 | 0.649 | 0.5 | 0.01 | 114 |
| VC-5 | 990602 | 23.00 | 23.30 | 7.45 | 360.00 | 5.82 | 2.40 | pc | | 234 | 1 | 1 | | 0.624 | 0.1 | | 240 |
| VC-5 | 990804 | 27.00 | 26.10 | 7.40 | 324.00 | 6.12 | 1.10 | clear | | 258 | 2 | | 0.029 | 0.5644 | 0.3 | | 124 |
| VC-5 | 991013 | 20.00 | 20.70 | 7.60 | 397.00 | 6.73 | 1.20 | cloudy | | 309 | 3 | 16 | 0.043 | 0.052 | 1.5 | 0.88 | 240 |
| VC-5 | 000607 | 25.00 | 21.00 | 7.40 | 238.00 | 7.00 | 2.70 | clear | moderate | 219 | 7 | 4.8 | 0.004 | 0.015 | 0.7 | 1.15 | 370 |
| VC-5 | 000809 | | 27.00 | 7.70 | 427.00 | 7.50 | 1.80 | clear | | 273 | 3 | 6 | 0.018 | 0.551 | 0.6 | 0.02 | 310 |
| VC-5 | 001011 | 12.00 | 11.82 | 7.61 | | 9.40 | 0.40 | clear | moderate | 250 | 2 | 6.9 | 0.005 | 0.68 | 0.8 | 0.02 | 124 |
| VC-5 | 010606 | 25.00 | 22.70 | 7.84 | 385.00 | 7.25 | 4.10 | cloudy | moderate | 257 | 6 | 7.77 | 0.07 | 0.221 | 1 | 0.02 | 270 |
| VC-5 | 010808 | 23.00 | 24.70 | 7.89 | 354.00 | 5.88 | 4.50 | cloudy | moderate | 197 | 8 | 5.63 | 0.02 | 0.73 | 0.4 | 0.26 | 760 |
| | | | | | | | | | | | | | | | | | |
| VA1 | 970122 | 10.00 | 12.00 | 7.40 | 319.00 | 5.00 | 3.90 | | | 257 | 1 | 20 | 0.141 | 2.846 | 1.2 | | 116 |
| VA1 | 970319 | 19.00 | 18.40 | 7.50 | 314.00 | 7.00 | 2.20 | | | 280 | 1 | 16.7 | 0.107 | 2.821 | 2.1 | | 58 |
| VA1 | 970423 | 12.00 | 14.50 | 7.70 | 384.00 | 5.70 | 2.40 | | | 300 | 1 | 29.8 | 0.107 | 4.061 | 1.7 | | 148 |
| VA1 | 970514 | 20.00 | 19.40 | 7.80 | 382.00 | 8.80 | 1.60 | | | 313 | 1 | 29.9 | 0.457 | 6.163 | 1.1 | | |
| VA1 | 970604 | 22.00 | 20.70 | 7.50 | 351.00 | 6.50 | 4.90 | | | 251 | 5 | 13 | 0.278 | 3.022 | 0.8 | | 500 |
| VA1 | 970814 | 30.00 | 26.20 | 6.70 | 427.00 | 7.55 | 1.60 | | | 327 | 4 | 24 | 0.443 | 6.518 | 0.9 | 0.1 | 350 |
| VA1 | 971119 | 10.10 | 13.60 | 7.30 | 377.00 | 8.30 | 1.20 | | | 306 | 1 | 1 | 0.474 | 6.237 | 1.4 | 0.12 | |
| VA1 | 980819 | 30.00 | 26.00 | 7.10 | 346.00 | 6.15 | 1.40 | clear | moderate | 274 | 1 | 1 | 0.302 | 3.957 | 1.1 | 0.01 | 108 |
| VA1 | 981014 | 25.00 | 17.30 | 7.70 | 421.00 | 7.24 | 1.00 | clear | moderate | 304 | 1 | 1 | 0.409 | 5.382 | 0.6 | 0.01 | 27 |
| VA1 | 990602 | 24.00 | 24.10 | 7.50 | 379.00 | 5.80 | 2.70 | pc | | 242 | | 1 | 0.115 | 2.009 | 0.2 | | 184 |
| VA1 | 990804 | 28.00 | 27.00 | 6.50 | 368.00 | 5.58 | 1.50 | clear | | 291 | 4 | 39 | 0.478 | 5.2564 | 0.9 | 0.06 | 63 |
| VA1 | 991013 | 22.30 | 21.50 | 7.50 | 355.00 | 6.30 | 2.40 | cloudy | | 384 | 10 | 25 | 0.249 | 0.107 | 2 | 2.17 | 240 |
| VA1 | 000607 | 26.00 | 22.00 | 6.60 | 314.00 | 6.20 | 2.30 | clear | moderate | 281 | 6 | 29.1 | 0.45 | 0.015 | 0.9 | 2.84 | 188 |
| VA1 | 000809 | | 27.00 | 7.60 | 482.00 | 7.50 | 1.80 | clear | | 308 | 4 | 26 | 0.446 | 5.146 | 0.9 | 0.02 | 164 |
| VA1 | 001011 | 14.00 | 15.18 | 7.56 | 451.00 | 6.40 | 0.80 | clear | moderate | 282 | 1 | 32.8 | 0.602 | 0.618 | 1.5 | 0.3 | 44 |
| VA1 | 010606 | 27.00 | 24.00 | 8.09 | 331.70 | 6.68 | 3.20 | cloudy | moderate | 271 | 8 | 24.54 | 0.37 | 3.98 | 1.2 | 0.02 | 176 |
| VA1 | 010808 | 23.00 | 23.52 | 7.74 | 372.00 | 6.57 | 10.90 | cloudy | moderate | 217 | 15 | 15.2 | 0.15 | 1.59 | 0.3 | 0.2 | 500 |

***Attachment 3***

***DISCHARGE MONITORING REPORTS***

# *Attachment 4*

## *CURRENT & PREDICTED EFFLUENT LIMITS:*
## *JEFFERSON COUNTY-VALLEY CREEK WWTP*
## *USX FAIRFIELD WORKS*
## *KOPPERS ORGANICS*

## Table 4-1: Jefferson County-Valley Creek WWTP Effluent Limits.

| Agricultural and Industrial | | |
|---|---|---|
| | **May-November** | **December-April** |
| Flow: | 85 MGD | 85 MGD |
| $CBOD_U$: | 24 mg/L | 33 mg/L |
| $CBOD_5$: | 8 mg/L | 11 mg/L |
| $NH_3$-N: | 1 mg/L | 2 mg/L |
| TKN: | 3 mg/L | 4 mg/L |
| D.O.: | 5 mg/L | 5 mg/L |

| Limited Warmwater Fishery | | |
|---|---|---|
| | **May-November** | **December-April** |
| Flow: | 85 MGD | 85 MGD |
| $CBOD_U$: | 24 mg/L | 24 mg/L |
| $CBOD_5$: | 8 mg/L | 8 mg/L |
| $NH_3$-N: | 1 mg/L | 1 mg/L |
| TKN: | 3 mg/L | 3 mg/L |
| D.O.: | 5 mg/L | 6 mg/L |

| Fish and Wildlife | | |
|---|---|---|
| | **May-November** | **December-April** |
| Flow: | 85 MGD | 85 MGD |
| $CBOD_U$: | 12 mg/L | 24 mg/L |
| $CBOD_5$: | 4 mg/L | 8 mg/L |
| $NH_3$-N: | 0.5 mg/L | 1 mg/L |
| TKN: | 2.5 mg/L | 3 mg/L |
| D.O.: | 6 mg/L | 6 mg/L |

| Current Permit Limits | | |
|---|---|---|
| | **May-November** | **December-April** |
| Flow: | 85 MGD | 85 MGD |
| $CBOD_U$: | 24 mg/L | 42 mg/L |
| $CBOD_5$: | 8 mg/L | 14 mg/L |
| $NH_3$-N: | 1 mg/l | 2 mg/L |
| TKN: | 3 mg/L | 5 mg/L |
| D.O.: | 5 mg/L | 5 mg/L |

## Table 4-2: USX Fairfield Works Effluent Limits[1].

| Agricultural and Industrial | | |
|---|---|---|
| | **May-November** | **December-April** |
| Flow: | 11 MGD | 11 MGD |
| $CBOD_U$: | 16 mg/L | 26 mg/L |
| $CBOD_5$: | 8 mg/L | 13 mg/L |
| $NH_3$-N: | 1 mg/L | 2 mg/L |
| TKN: | 2 mg/L | 4 mg/L |
| D.O.: | 6 mg/L | 6 mg/L |

| Limited Warmwater Fishery | | |
|---|---|---|
| | **May-November** | **December-April** |
| Flow: | 11 MGD | 11 MGD |
| $CBOD_U$: | 16 mg/L | 20 mg/L |
| $CBOD_5$: | 8 mg/L | 10 mg/L |
| $NH_3$-N: | 1 mg/L | 1 mg/L |
| TKN: | 2 mg/L | 3 mg/L |
| D.O.: | 6 mg/L | 6 mg/L |

| Fish and Wildlife | | |
|---|---|---|
| | **May-November** | **December-April** |
| Flow: | 11 MGD | 11 MGD |
| $CBOD_U$: | 8 mg/L | 20 mg/L |
| $CBOD_5$: | 4 mg/L | 10 mg/L |
| $NH_3$-N: | 0.75 mg/L | 1 mg/L |
| TKN: | 1.5 mg/L | 3 mg/L |
| D.O.: | 6 mg/L | 6 mg/L |

| Current Permit Limits | | |
|---|---|---|
| Flow: | 11 MGD | 11 MGD |
| $CBOD_U$: | 16 mg/L | 26 mg/L |
| $CBOD_5$: | 8 mg/L | 13 mg/L |
| $NH_3$-N: | 1 mg/L | 2 mg/L |
| TKN: | 2 mg/L | 4 mg/L |
| D.O.: | 6 mg/L | 6 mg/l |

[1] The predicted effluent limits for USX are based solely on use classification changes to Valley Creek and leaving Opossum Creek at A&I. Due to the close proximity of USX's outfall to Upper Valley Creek, their effluent has influence on instream dissolved oxygen levels within Upper Valley Creek.

**Table 4-3: Koppers Organics Effluent Limits.**

| Agricultural and Industrial | | |
|---|---|---|
| | **May-November** | **December-April** |
| Flow: | 0.036 MGD | 0.036 MGD |
| $CBOD_U$: | 37.5 mg/L | 37.5 mg/L |
| $CBOD_5$: | 15 mg/L | 15 mg/L |
| $NH_3$-N: | 20 mg/L | 20 mg/L |
| TKN: | 50 mg/L | 50 mg/L |
| D.O.: | 5 mg/L | 5 mg/L |

| Limited Warmwater Fishery | | |
|---|---|---|
| | **May-November** | **December-April** |
| Flow: | 0.036 MGD | 0.036 MGD |
| $CBOD_U$: | 37.5 mg/L | 37.5 mg/L |
| $CBOD_5$: | 15 mg/L | 15 mg/L |
| $NH_3$-N: | 20 mg/L | 20 mg/L |
| TKN: | 50 mg/L | 50 mg/L |
| D.O.: | 5 mg/L | 6 mg/L |

| Fish and Wildlife | | |
|---|---|---|
| | **May-November** | **December-April** |
| Flow: | 0.036 MGD | 0.036 MGD |
| $CBOD_U$: | 27.5 mg/L | 37.5 mg/L |
| $CBOD_5$: | 11 mg/L | 15 mg/L |
| $NH_3$-N: | 20 mg/L | 20 mg/L |
| TKN: | 50 mg/L | 50 mg/L |
| D.O.: | 6 mg/L | 6 mg/L |

| Current Permit Limits | | |
|---|---|---|
| | **May-November** | **December-April** |
| $CBOD_U$: | 37.5 mg/L | 37.5 mg/L |
| $CBOD_5$: | 15 mg/L | 15 mg/L |
| $NH_3$-N: | 20 mg/L | 20 mg/L |
| TKN: | 50 mg/L | 50 mg/L |
| D.O.: | 5 mg/L | 5 mg/L |

# *Attachment 5*

# *Water Quality Modeling Results*

## *Attachment 6*

## *Detailed Recreational Use Attainability Analysis for Village and Valley Creeks, EPA Region 4*

## INTRODUCTION

The segments of Village and Valley Creeks drain adjacent watershed in Jefferson County, Alabama. The land usage is predominantly urban and their watersheds are virtually identical in their physical characteristics and pollution stressors. Sources of bacteria in the watersheds include leaking sewer lines, discharge and overflows from wastewater treatment plants, domestic animals, wildlife, and leaking septic systems. In addition, there are little to no vegetated riparian zones to filter runoff, a high water table, and a generally steep slope to the landscape. These factors reduce travel time and increase delivery ratio (fraction of bacteria deposited on land that arrives in stream water) of bacteria to the creeks from runoff. Climate and landscape factors also tend to mitigate the process of natural decay, increasing the likelihood of delivery of bacteria to the creek waters from land-based sources. Bacteria enter the creeks from point source discharge of treated domestic sewage and overflow generated by stormwater, as well as land-based non-point sources from overland runoff and through baseflow from infiltration. The municipal dischargers currently operate disinfection processes and would meet F&W discharge limits end of pipe. Sewer overflows and leaking sewer lines are a known problem in the watersheds and Jefferson County is currently under a consent decree that involves expenditure of $800 million to fix those problems by 2006.

## DATA ANALYSIS

There are three data sets available for analysis:

1) Weekly measurements of fecal coliform bacteria during 2000 from two monitoring locations in Village Creek, one upstream from the WWTP and one downstream
2) Flow records from the same monitoring locations on the same days
3) Daily precipitation measurements during 2000 from a nearby airport

These data can help address three questions:

1) What pattern of bacteria levels are exhibited in Village Creek and likely exhibited in Valley Creek?
2) What influence do point source discharges have on bacteria levels in Village Creek and likely have in Valley Creek?
3) To what extent do precipitation events and patterns affect bacteria levels in Village Creek and likely in Valley Creek?

**Figure 1** depicts upstream and downstream single sample bacteria measurements taken during 2000 plotted again the corresponding stream flow. The data range is restricted to measures below 2000 Colony Forming Units (CFU)/100 ml to better observe the relationship. Fecal concentrations do not correlate well with flow. It is apparent that flow is greatly augmented by discharge with downstream measures associated with much higher flows. Concentrations tend to be higher upstream of the discharge.

**Figure 2** depicts downstream bacteria levels plotted against upstream bacteria levels. The data range is restricted to measures below 1000 CFU/100 ml to better observe the relationship and avoid measures that are likely associated with sewer overflow events. The unity line helps show that, regardless of magnitude, the concentration downstream does not exceed concentration upstream. This plot helps indicate that discharge of treated sewage from the WWTP is not a significant contributor to downstream bacteria levels.

**Figure 3a** is a plot of the running geometric mean (using five weekly measures taken over approximately the previous 30 days) over the course of the year for both the upstream and downstream monitoring locations. It shows an irregular pattern with downstream levels tending to follow upstream levels with an effluent dilution effect, with a notable exception of downstream geometric means plotted in early April, where highly elevated levels are likely indicative of raw sewage from a sewer overflow event. In general, bacteria levels are low in winter months, rise in early spring, remain variable yet high into the summer months, fall somewhat in late summer/early autumn, then rise again in late autumn. Values above the 1000 CFU/100 ml geometric mean bacteria criteria for LWF occur both the upstream and downstream monitoring locations.

**Figure 3b** is the same plot depicting only data from the months of June-September. The June-September 200 CFU/100 ml bacteria criteria for F&W is consistently exceeded at both monitoring locations.

**Figures 4a-c** are frequency distribution plots of year round single sample data, year round running geometric mean data, and June-September running geometric mean data. At both monitoring locations, approximately 85 percent of single sample measures are below the 2000 CFU/100 ml single sample bacteria criteria for LWF, and about 90 percent of the running geometric mean values are below the 1000 CFU/100 ml geometric mean bacteria criteria for LWF. During June-September, the running geometric mean consistently exceeded 200 CFU/100 ml and exceeded 400 CFU/100 ml almost half of the time at the downstream monitoring station and almost all of the time at the upstream monitoring station.

**Figure 5** depicts daily precipitation measurements during 2000 from a nearby airport that should accurately reflect precipitation in the Village Creek watershed. Periods of relatively heavy rains occurred in March, late July/early August, and mid November.

**Figure 6a** plots single sample bacteria measurements throughout the year on one axis and precipitation totals from the five days prior to bacteria measurement on the other axis. The plot reveals a relationship between bacteria measurements and accumulated rainfall during the few days prior to measurement during the period from mid-March through late November, where rainfall peaks correspond to either upstream or downstream (or both typically) spikes in bacteria levels. In general, approximately one inch of accumulated rainfall over 5 days corresponds to measured bacteria levels above 1000 CFU/100 ml. In particular, the heavy rains of March and November match the very high spikes in bacteria levels. Two measures appear anomalous: the upstream and downstream bacteria spike on May 10 is not associated with significant prior rainfall and the upstream measurement on June 5 seems disproportionately high in comparison to the past five days rainfall. **Figure 6b** is a close up of the plot for the mid June-September time period when relatively heavy rains appear to result in smaller bacteria spikes in comparison to other seasons. Season and temperature may play an important role in the relationship between precipitation and instream bacteria concentration. Low temperatures in winter may not be favorable for bacteria survival, whereas warmer temperatures in late summer may result in a general higher level of bacteria growth but also an increased decay rate that results in smaller bacteria concentration spikes.

**Figure 7a** plots the running geometric mean values also depicted in Figure 3a on one axis and precipitation totals from the 30 days prior to bacteria measurement on the other axis. Each point thus represents a composite of conditions over the previous month. This plot reveals a general relationship between bacteria measurements and accumulated rainfall during the same month, with the exception of data from early May to early June (plotted as values from early June-early July). This deviation reflects the influence of the measurements taken on May 10 and June 5. **Figure 7b** depicts the same data displayed in Figure 7a without those measures participating in the geometric mean calculations. This does not imply that those measures are incorrect: only that they don't fit the pattern with precipitation as do the other measures.

## DISCUSSION AND CONCLUSION

Bacteria measurements taken at the location downstream of the WWTP in Village Creek are either be equal to or lower than upstream measurement, except in instances where sewer overflows appear to have occurred. It is clear from the data analysis that discharge of treated sewage from the WWTP is not a significant contributor to the measured downstream bacteria levels. The correlation of downstream spikes in bacteria levels above 1000 CFU/100 ml with rainfall events, and the high spike in response to heavy March rains in particular, suggest that sewer overflows are the most likely cause. The correlation of upstream spikes in bacteria levels above 1000 CFU/100 ml with rainfall events could result from land-based sources such as domestic animals and wildlife affected by overland flow, or from non-point sources such as leaking sewer lines and leaking septic systems that are relatively close to the creek bed with short delivery times from groundwater to baseflow in the creek. The high upstream spikes in response to significant rainfall events suggest leaking sewer lines as the most likely cause. Although a running geometric mean of 1000 CFU/100 ml and single sample maximum of 200 CFU/ 100 ml were exceeded approximately 10-15 percent of the time at both monitoring locations, it is anticipated that work to resolve the sewer overflows and replace leaking sewer lines will result in attainability of the LWF use classification with respect to bacteria criteria.

The pattern of correlation between precipitation over the previous 30 days and the running geometric mean of 5 weekly bacteria measures (monthly plots) suggest that non-point sources such as leaking sewer lines, domestic animals, wildlife, and leaking septic systems are the dominant contributors of bacteria levels to creek waters over longer periods of time, and that favorable conditions in the watershed for delivery may also play an important role. During the June-September period, when rainfall was generally low, the running geometric mean consistently exceeded 200 CFU/100 ml and exceeded 400 CFU/100 ml almost half of the time at the downstream monitoring station and almost all of the time at the upstream monitoring station. It is clear from the data and analysis that the primary contact recreation aspect of F&W is not attainable under the current conditions which include leaking sewer lines.

No currently available information suggests that primary contact recreation is attainable. In fact, the available information suggests that the magnitude of bacteria levels, the variety of sources, and the physical characteristics of the waterbody indicate that primary contact recreation to the degree of protection provided by the F&W use classification is not attainable, and the highest attainable use is LWF. Therefore, a primary contact recreation use (such as F&W) is not designated at this time as a result of a combination of human-caused conditions (that may not be feasible to fully remedy), natural physical conditions of the watershed unrelated to water quality (e.g., high water table), and likely to a lesser extent natural sources of pollution. However, it is anticipated that the substantial capital investment to resolve sewer overflows and replace leaking sewer lines will improve water quality. It is not currently possible to determine the percent contribution from the known categories of non-point sources, nor is it possible to project the degree of success in terms of bacteria levels that will result from replacing the leaking sewer lines. As new information becomes available that pertains to attainability of recreation in and on the water, it will be considered and water quality standards revised accordingly.

**Figure 1: Bacteria Levels and Flow (Village Creek, 2000)**

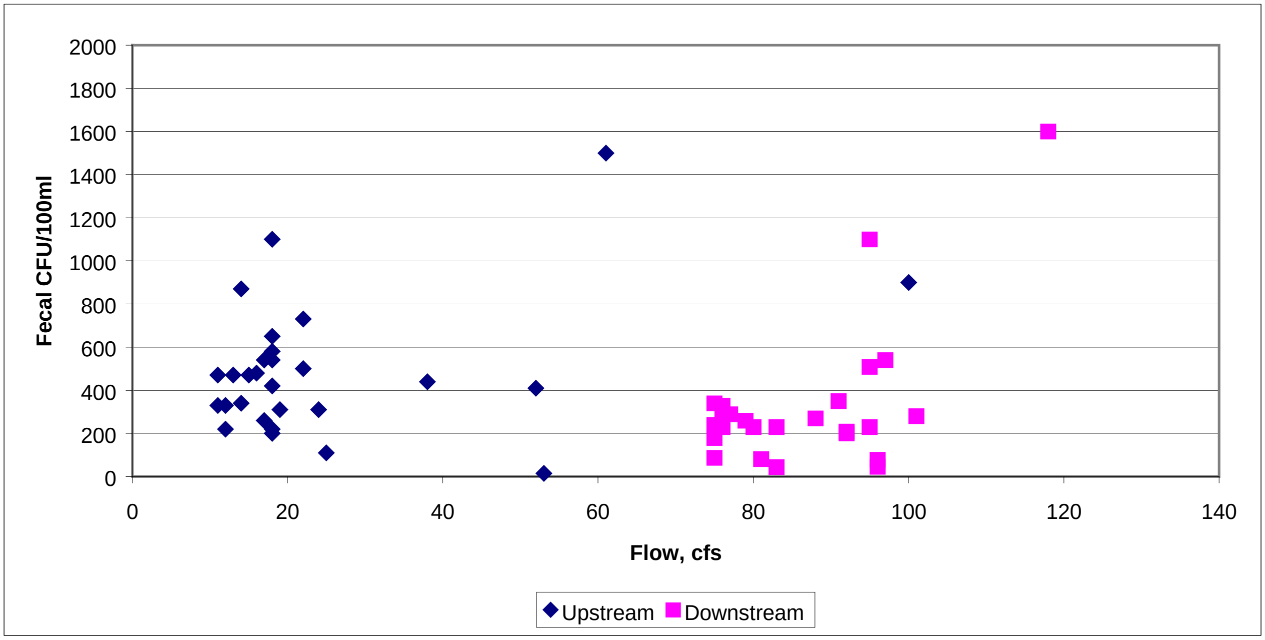



**Figure 2: Upstream vs. Downstream Bacteria Levels (Village Creek, 2000)**

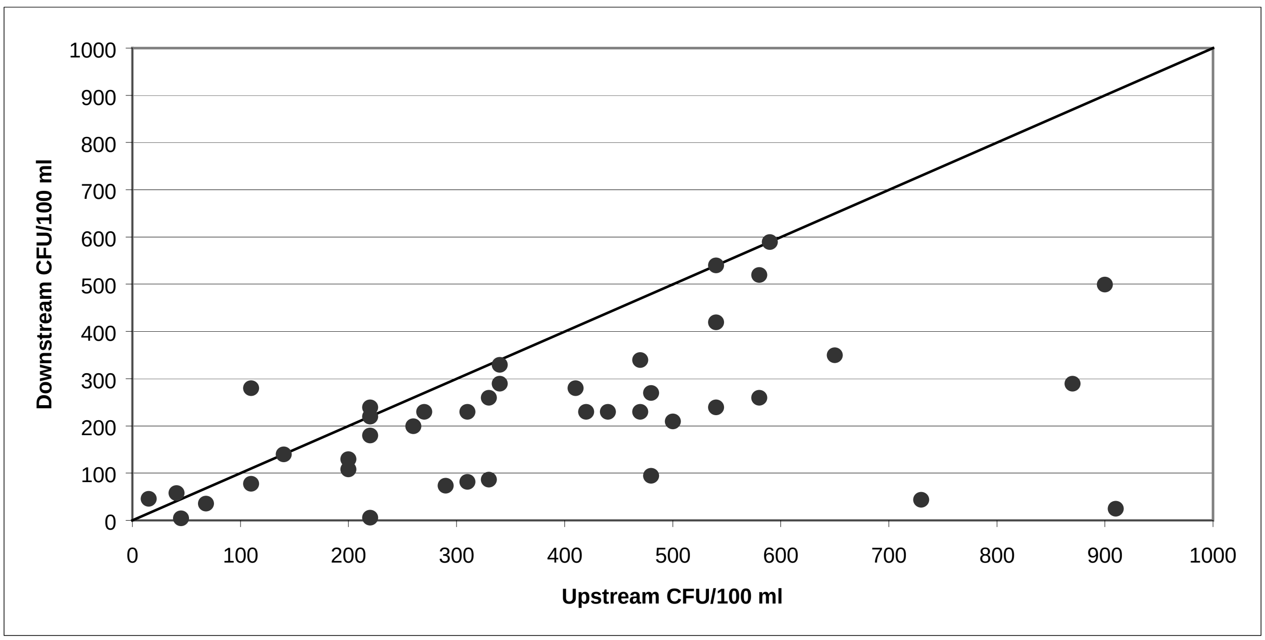


**Figure 3a: Monthly Bacteria Levels (Village Creek, 2000)**

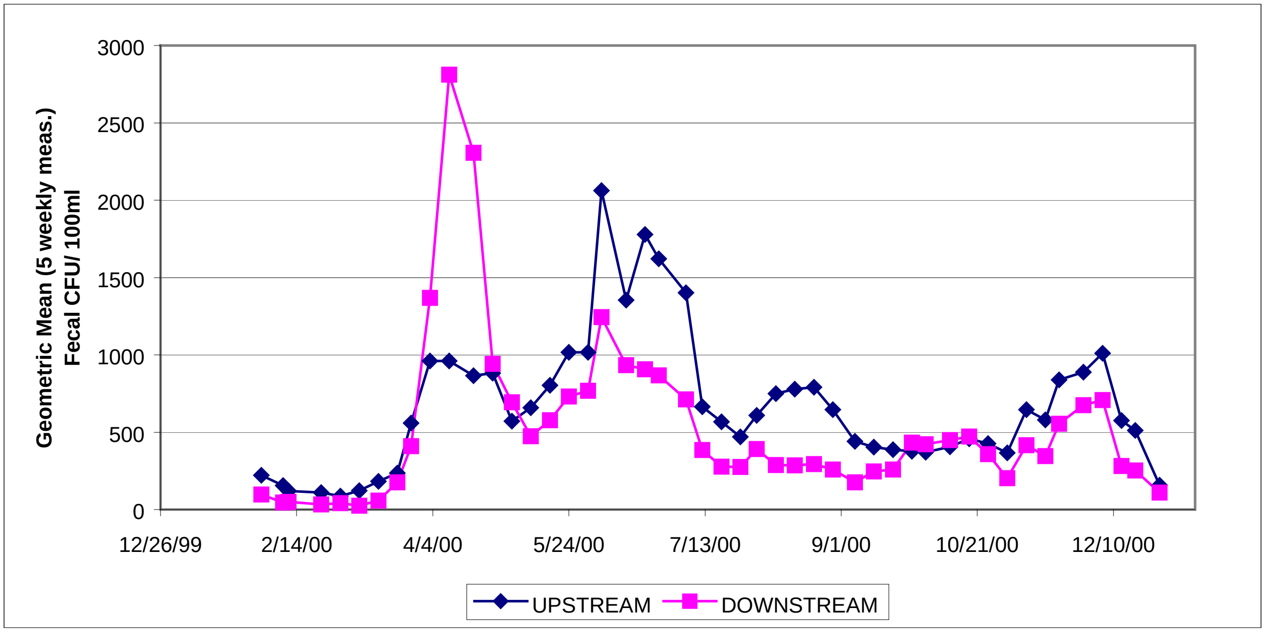



**Figure 3b: Monthly Bacteria Levels (Village Creek, June-Sep 2000)**

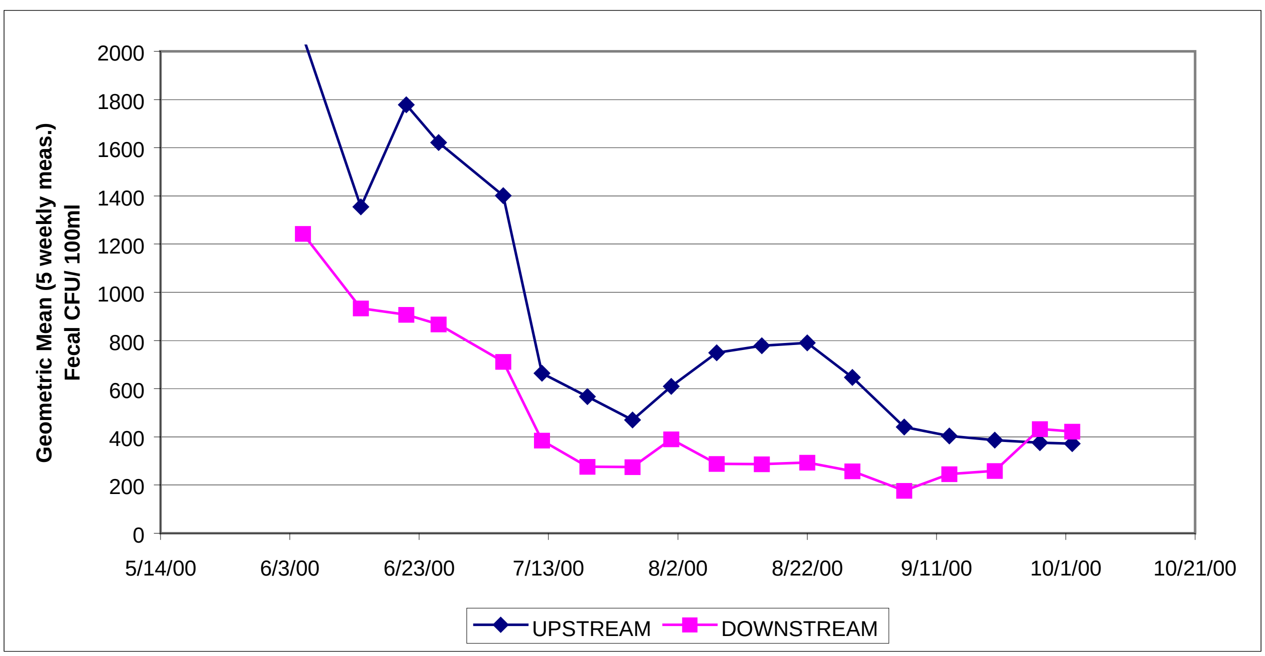


**Figure 4a: Single Sample Frequency Distribution (Village Creek, 2000)**

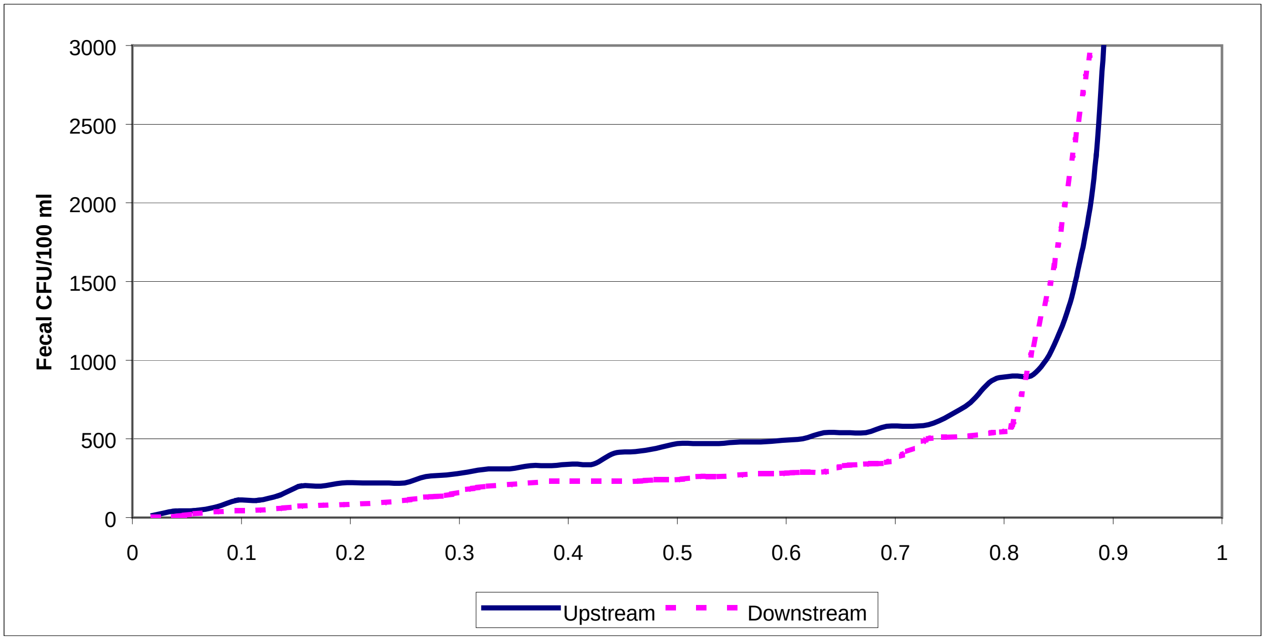



**Figure 4b: Running Geometric Mean Frequency Distribution (Village Creek, 2000)**

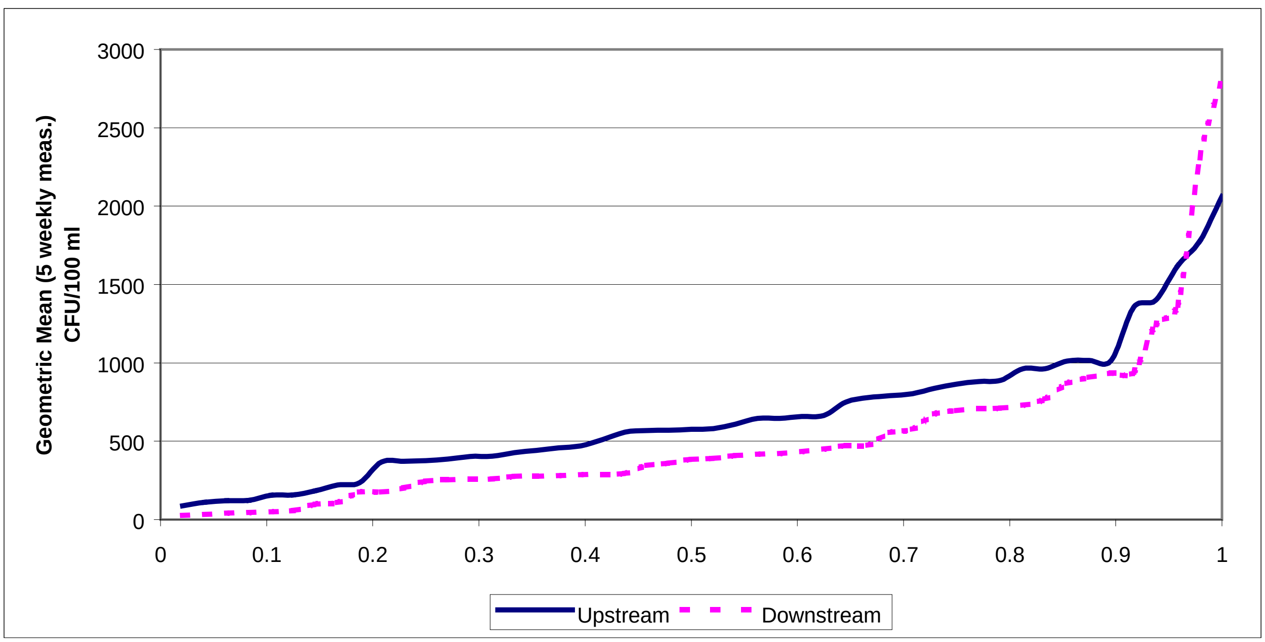


**Figure 4c: Running Geometric Mean Frequency Distribution (Village Creek, June-Sep 2000)**

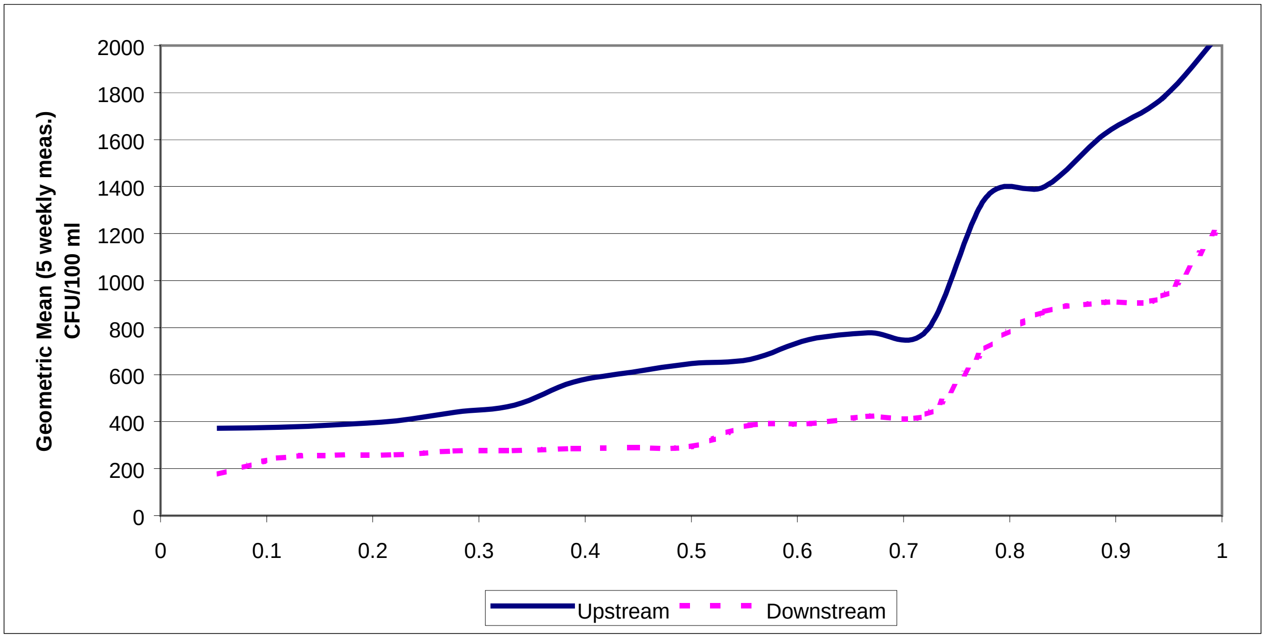



**Figure 5: Daily Precipitation (Village Creek Watershed, 2000)**

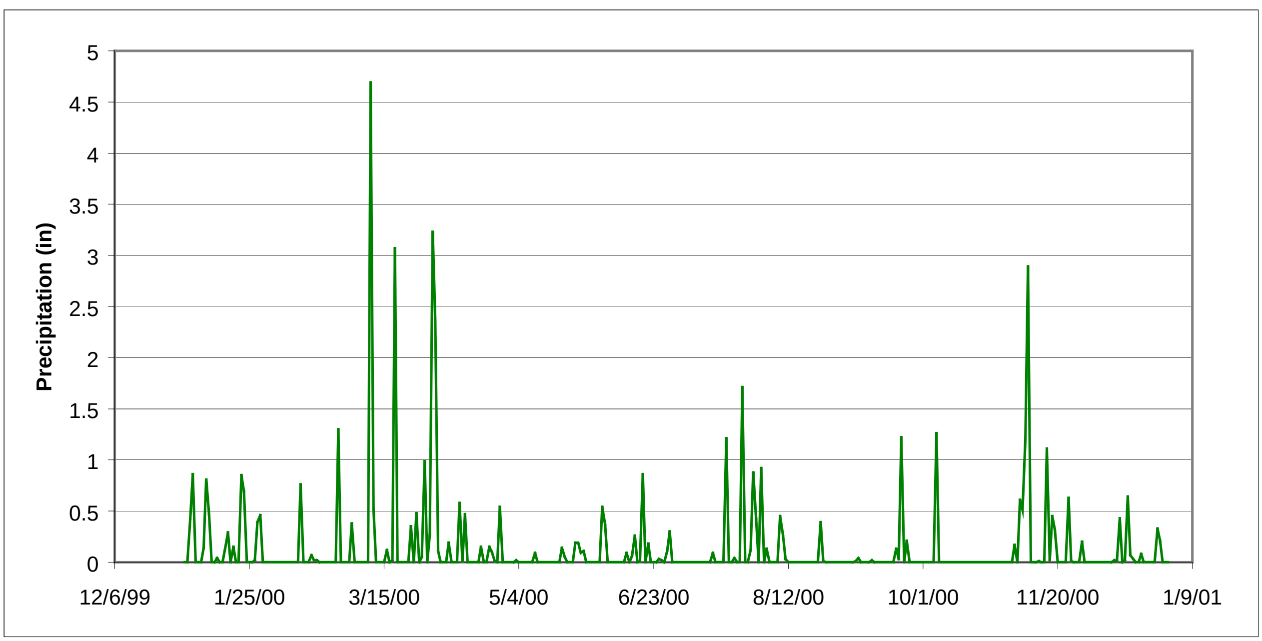


**Figure 6a: Weekly Bacteria Levels and Precipitation (Village Creek, 2000)**

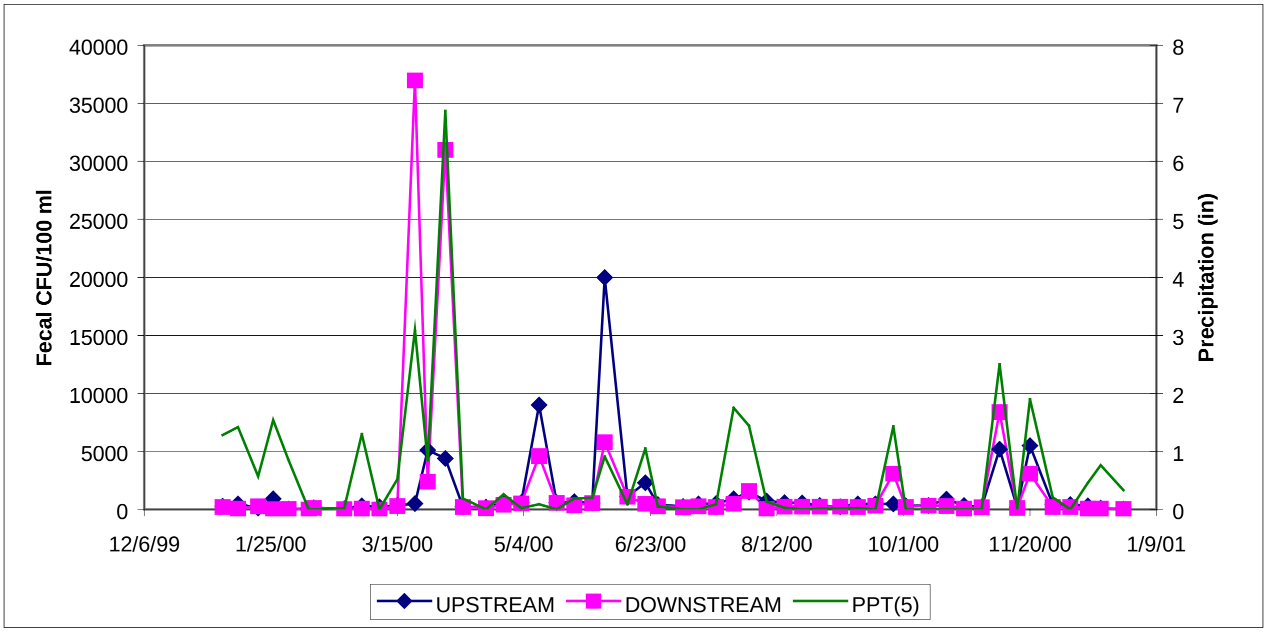



**Figure 6b: Weekly Bacteria Levels and Precipitation (Village Creek, 2000)**

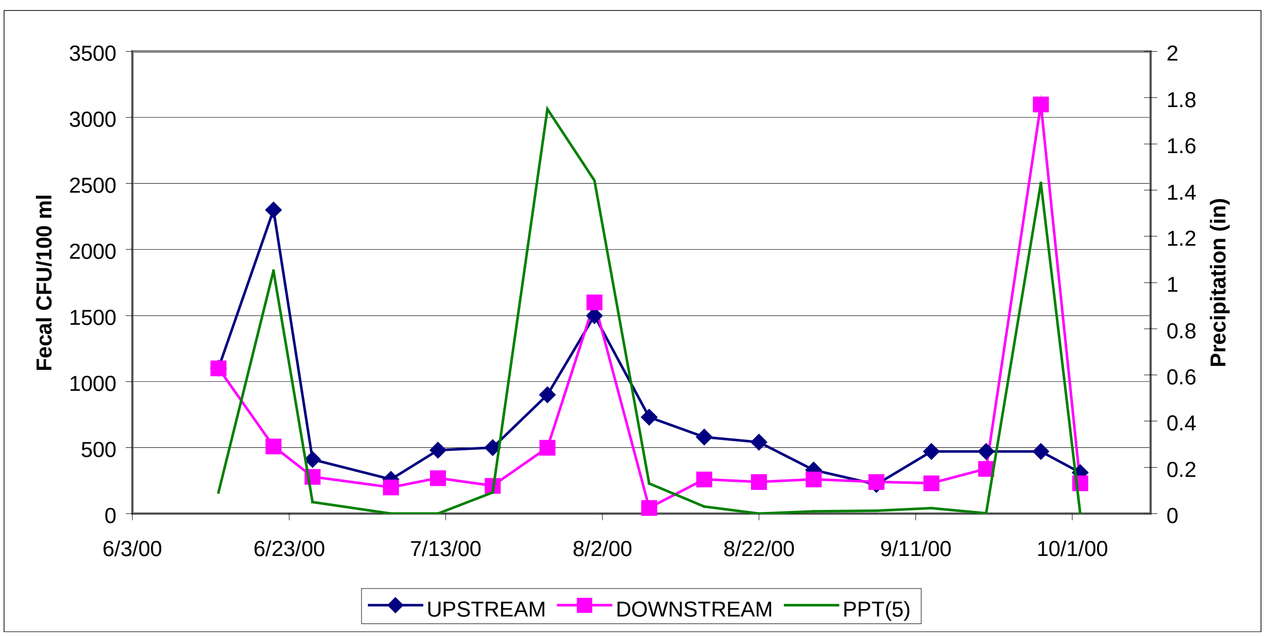


**Figure 7a: Monthly Bacteria Levels and Precipitation (Village Creek, 2000)**

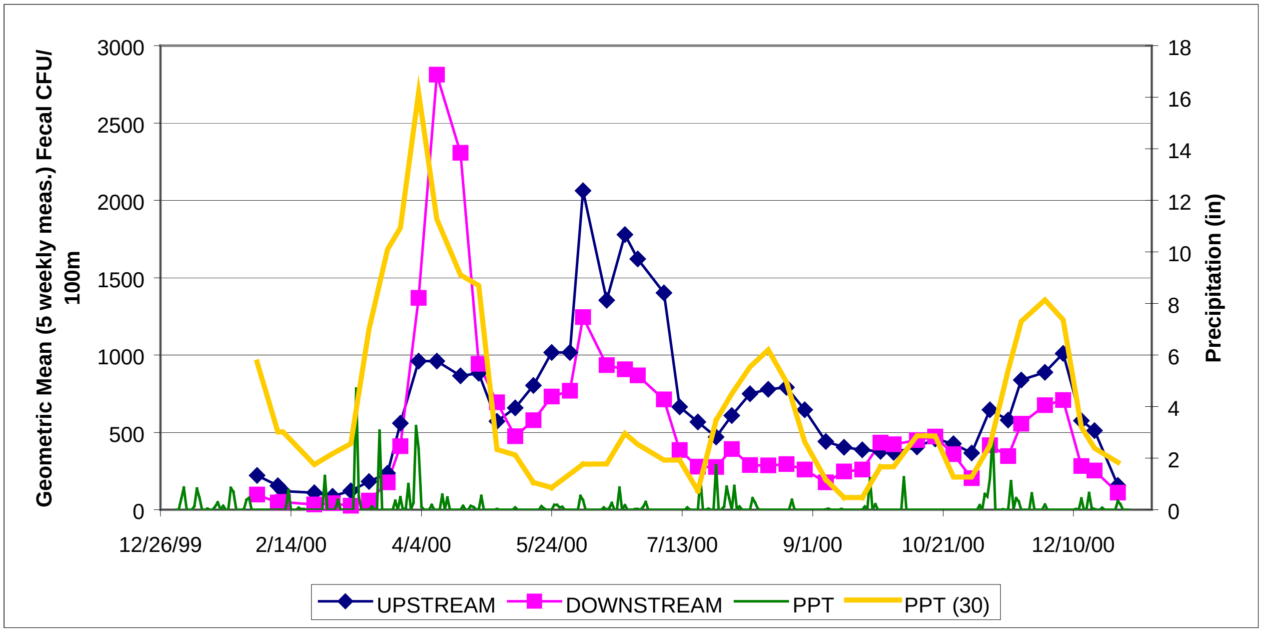
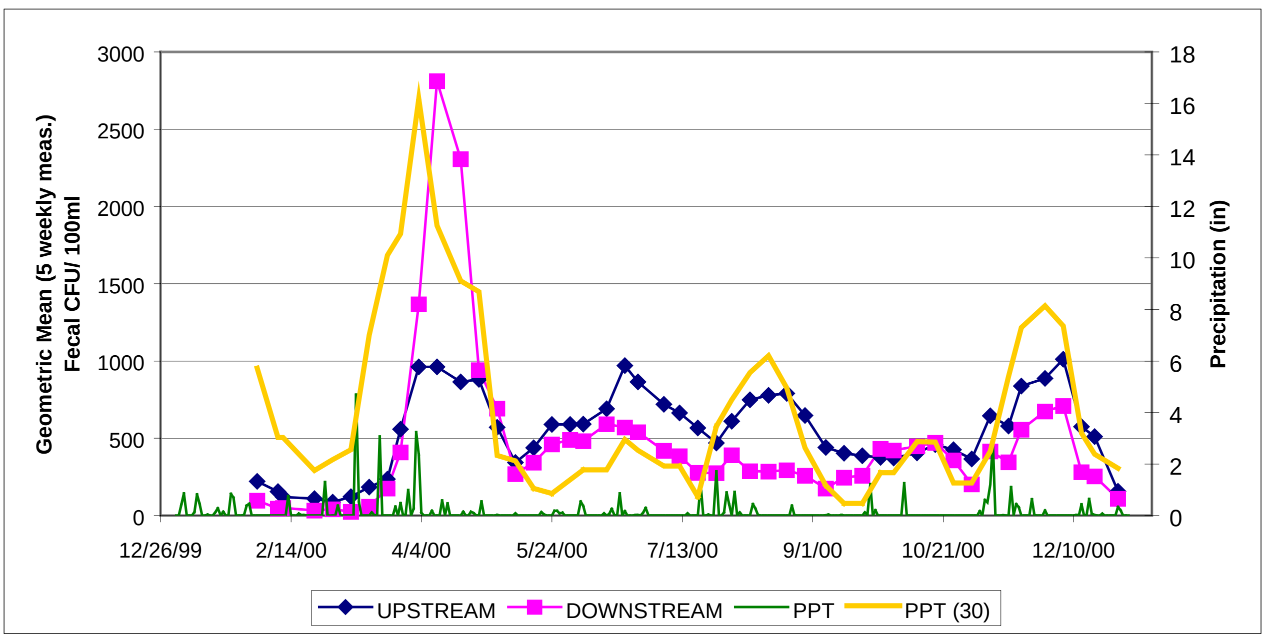



**Figure 7b: Monthly Bacteria Levels and Precipitation (Village Creek, 2000) [excluding 5/10 and 6/5 bacteria measurements]**



***Attachment 7***

***List of References***

# *List of References*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