

**SECTION III**  
**EFFLUENT LIMITATIONS**  
**AND**  
**OTHER WATER QUALITY MANAGEMENT GOALS**

**WATER QUALITY CLASSIFICATION**

The section of the Lewis River influenced by the City of Woodland's Wastewater Treatment Plant (WWTP) discharge is classified per Washington Administrative Code (WAC) 173-201A-030 as Class A waters. Water in this classification must meet or exceed the requirements for all appropriate uses such as domestic, industrial, and agricultural water supply; stock watering; fish and shellfish migration, rearing, spawning, and harvesting; wildlife habitat; general recreation; commerce and navigation. Municipalities are permitted to discharge sewage effluent into Class A waters provided the effluent meets specified effluent limitations and Water Quality Standards.

**TECHNOLOGY-BASED EFFLUENT LIMITATIONS**

Technology-based effluent limitations have been defined by the United States Environmental Protection Agency (EPA) and the State of Washington Department of Ecology (DOE) as wastewater treatment limitations which are established based on the type and technology used for treatment. Under delegation agreements with EPA, DOE has implemented regulations pertaining to municipal wastewater discharges. These regulations are performance standards that constitute all known, available, and reasonable methods of treatment (AKART) for municipal wastewater. Effluent limitations for the City of Woodland WWTP are contained in the National Pollutant Discharge Elimination System (NPDES) Waste Discharge Permit No. WA-002040-1, issued on March 27, 1981 (See Appendix A). These limitations are currently set as follows:

## NPDES Permit Effluent Limitations

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...The permittee is authorized to discharge subject to the following limitations for secondary treatment.

The monthly average quantity of effluent discharged shall not exceed 0.48 MGD.

Effluent Limitations <sup>(a)</sup>:

<u>PARAMETER</u>	<u>AVERAGE MONTHLY</u>	<u>AVERAGE WEEKLY</u>
Biochemical Oxygen Demand <sup>(b)</sup> (5 day)	30 mg/L, 120 lbs/day 85% minimum removal	45 mg/L, 180 lbs/day
Suspended Solids <sup>(b)</sup>	30 mg/L, 120 lbs/day 85% minimum removal	45 mg/L, 180 lbs/day
Fecal Coliform Bacteria	200/100 mL	400/100 mL
pH	Shall not be outside the range 6.0 - 9.0.	
Total Available Chlorine <sup>(c)</sup> (Residual)	Shall be minimized.	

Notes:

- (a) The monthly and weekly averages for BOD<sub>5</sub> and Suspended Solids are based on the arithmetic mean of the samples taken. The averages for fecal coliform are based on the geometric mean of the samples taken.
  - (b) The average monthly effluent concentration limitations for BOD<sub>5</sub> and Suspended Solids shall not exceed 30 mg/L or 15 % of the respective influent concentrations, whichever is more stringent.
  - (c) Total available (residual) chlorine shall be maintained which is sufficient to attain the Fecal Coliform limits specified above. Chlorine concentrations in excess of that necessary to reliably achieve these limits shall be avoided.
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The wastewater treatment plant's performance is reported on monthly Discharge Monitoring Reports (DMR's) submitted to DOE. Effluent data from the DMR's, for the period from July, 1996 through June, 1998, have been used in this report to evaluate plant performance (refer to Section IV). Ambient Lewis River data collected by DOE used for mixing zone analysis can be found in Appendix B of this report.

### **WATER QUALITY-BASED LIMITATIONS**

In addition to the effluent discharge limits shown above, DOE has established Water Quality Standards to help protect the existing water quality and preserve the designated beneficial uses of Washington's surface waters in the WAC Chapter 173-201A.

WAC 173-201A authorizes the use of mixing zones around a point of discharge in establishing water quality-based effluent limits. Both "acute" and "chronic" mixing zones may be authorized for pollutants that can have a toxic effect on the aquatic environment at the point of discharge. The concentration of pollutants at the edge of these mixing zones may not exceed the numerical criteria, or limits, for that type of zone. Mixing zones can only be authorized for discharges that are treated using AKART.

### **MIXING ZONES AND CRITICAL CONDITIONS**

A mixing zone is a small volume of the receiving water inside of which chronic or acute Water Quality Standards for toxics may be exceeded. Concentrations of toxics are diluted within the volume of water allowed, and the mixing zones are established such that Water Quality Standards are met at the boundary, or edge, of the mixing zone. If the Water Quality Standards cannot be met at the edge of the mixing zone for any given toxicant, then additional treatment must be provided and/or the toxicant must be controlled at the source prior to discharge into the City's sewer system.

WAC 173-201A-100 specifies the requirements for acute and chronic mixing zones in streams as the most restrictive of the following:

- Chronic Mixing Zone shall:
  1. Not extend in a downstream direction for a distance from the discharge ports greater than 300 feet plus the depth of the water over the discharge ports, or extend upstream for a distance of over 100 feet;
  2. Not utilize greater than 25 percent of the receiving water flow as measured during mean lower flow water; and
  3. Not occupy greater than 25 percent of the width of the water body as measured during mean lower flow water.
  
- Acute Mixing Zone shall:
  1. Not extend beyond 10 percent of the distance towards the upstream and downstream boundary of an authorized chronic mixing zone, as measured independently from the discharge points;
  2. Not utilize greater than 2.5 percent of the flow of the receiving stream; and
  3. Not occupy greater than 25 percent of the width of the receiving stream.

The derivation of water quality-based limits also takes into account the seasonal variability of the pollutant concentrations in both the effluent and the receiving water. Water quality-based limits are by definition derived for the water body's *critical condition*, which represents the receiving water and waste discharge condition with the highest potential for adverse impact on the aquatic biota and existing or characteristic water body uses. For the City of Woodland, this time period occurs from the beginning of summer through early fall.

The critical flow for rivers and streams is often considered as the 7-day average low flow at a 10-year recurrence interval ( $7Q_{10}$ ). The United States Geological Survey has a stream-flow gaging station in the Lewis River upstream from the WWTP discharge pipe at Ariel Dam. USGS established the  $7Q_{10}$  in the Lewis River at 688 cubic feet per second (cfs) in their Open File Report 84-145-A (10 year return period based on data from 1960-1979). An updated  $7Q_{10}$  was calculated by USGS to incorporate flow data from 1960 to 1997. The updated  $7Q_{10}$  is 698 cfs (see Appendix C).

The  $7Q_{10}$  flow for the Lewis River at Ariel does not include additional drainage area to the Lewis River between the USGS gauging station at Ariel Dam and the existing WWTP outfall. Analysis of USGS topography maps shows that Cedar Creek (with a drainage area of 40.8  $mi^2$ ), and about 55.4  $mi^2$  of additional drainage area to the Lewis River are unaccounted for. A best approximation of the additional flow was made by looking at the Kalama River watershed below Italian Creek (USGS Station Number 14223500). This portion of the Kalama River's watershed has the most similar drainage characteristics to the watershed for the Lewis River at Ariel, that is located close to Woodland, WA. The  $7Q_{10}$  at this station was 187.3 cfs with a drainage area of 198  $mi^2$ . With the assumption that the additional flow to the Lewis River (downstream of the Ariel gauging station) is directly proportional to the flow and the drainage area in the Kalama River, the  $7Q_{10}$  flow at the WWTP outfall would be the  $7Q_{10}$  flow at Ariel plus an additional 91 cfs from the drainage between Ariel and the WWTP outfall. For the purposes of this report, the  $7Q_{10}$  used in water quality evaluation is the calculated flow from Ariel Dam (698 cfs) and the flow estimated from the additional 96.2  $mi^2$  (91 cfs), which yields a critical low flow of 789 cfs.

The centerline water depth of the Lewis River at the outfall, as measured by Gibbs & Olson on October 24, 1991, was about 6.25 feet. Flow in the Lewis River (on 10/24/91) by the outfall was 2,880 cfs at Ariel Dam plus an estimated additional 360 cfs from the unaccounted drainage area between Ariel and the WWTP outfall totaling 3,240 cfs. Figures III-1 to III-4 show Lewis River cross-sections at the Woodland WWTP outfall, 100, 200, and 300 feet downstream of the outfall. Figure III-5 shows a plan view and a centerline profile of the river from the outfall to 300 feet below the outfall. The Manning's Equation was used to estimate the physical conditions of the river during critical flow conditions (i.e.  $7Q_{10}=789$  cfs). During critical flow, the river is about 281 feet wide at the outfall, has a centerline depth of about 3.0 feet, a cross-sectional area of about 789 square feet, and a calculated velocity of about 1.01 feet per second. At critical flow, the river channel gradually tapers down from about 281 ft (at the outfall) to about 218 feet (300 feet downstream of the outfall). The local river channel slope at the outfall is approximately 0.0005 feet of fall per foot of river length.

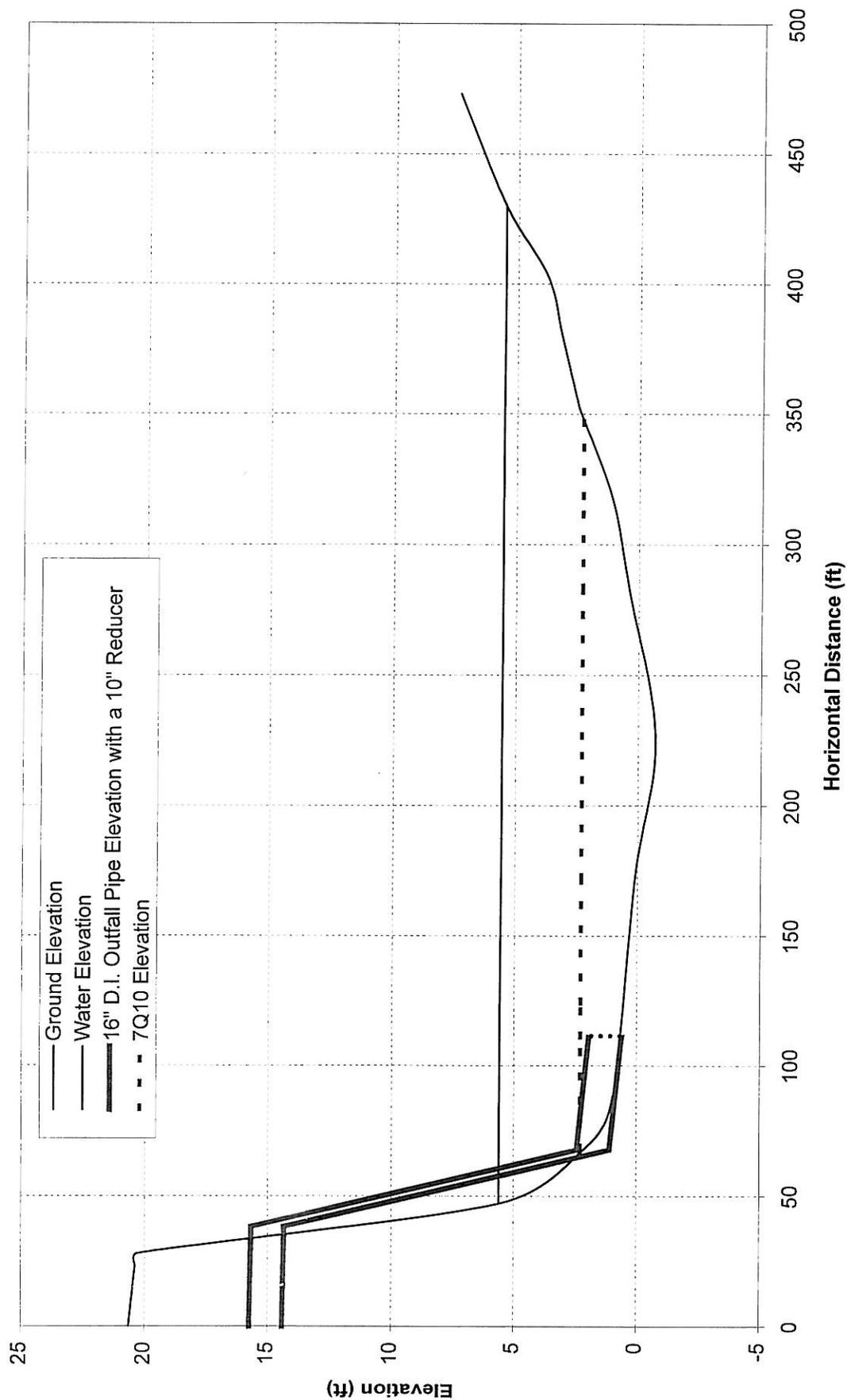
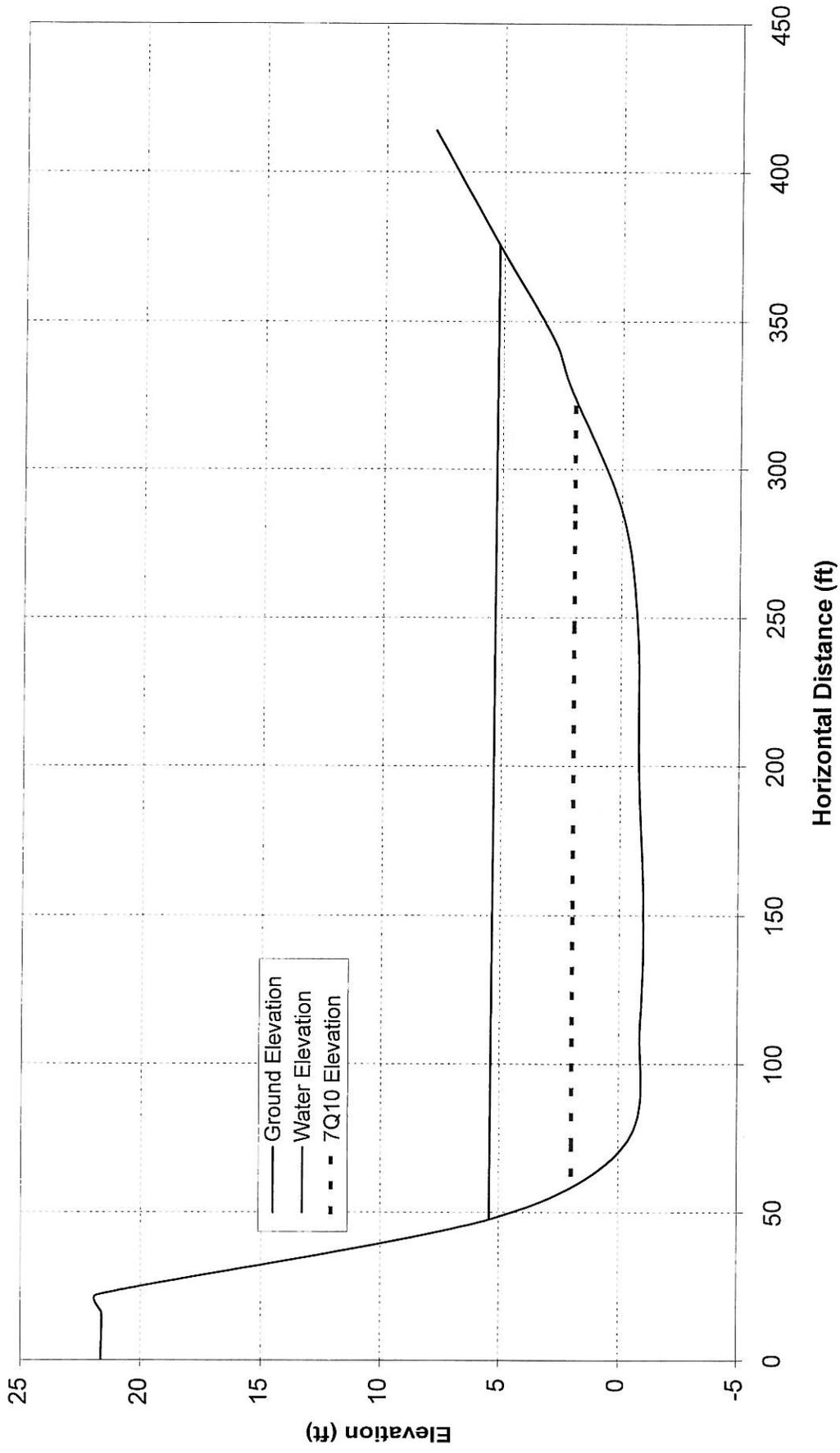


Figure III-1. Lewis River Cross Section at WWTP Outfall (as measured on October 24, 1991).



**Figure III-2. Lewis River Cross Section 100 feet Downstream of WWTP Outfall  
(as measured on October 24, 1991).**