

Kirtland Air Force Base
Bernalillo County, New Mexico

Appendix C-1

DISSOLVED OXYGEN STRATEGY

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1.1 INTRODUCTION

The MS4 Permit requires Kirtland AFB (KAFB) to identify structural controls, natural and/or man-made topographical and geographical formations, MS4 operations, or oxygen demanding pollutants contributing to reduced dissolved oxygen (DO) in the receiving waters. Controls shall be implemented, updated and revised to eliminate discharge of pollutants at levels that cause or contribute to exceedances of applicable water quality standards for DO.

1.2 BACKGROUND

If DO concentrations drop, depending on species and life stages, fish mortality rates will rise. DO in surface water is used by all forms of aquatic life; therefore, this constituent typically is measured to assess the "health" of lakes and streams.

DO levels fluctuate seasonally and over a 24-hour period; DO varies with water temperature and altitude. Cold water holds more oxygen than warm water, and water holds less oxygen at higher altitudes. Aquatic animals are most vulnerable to lowered DO levels in the early morning on hot summer days when stream flows are low, water temperatures are high, and aquatic plants have not been producing oxygen since sunset.

The EPA Quality Criteria for Water 1986 (USEPA, 1986), provides guidance for DO levels in water. These criteria provide guidance on the environmental effects of pollutants, but do not impose regulatory requirements.

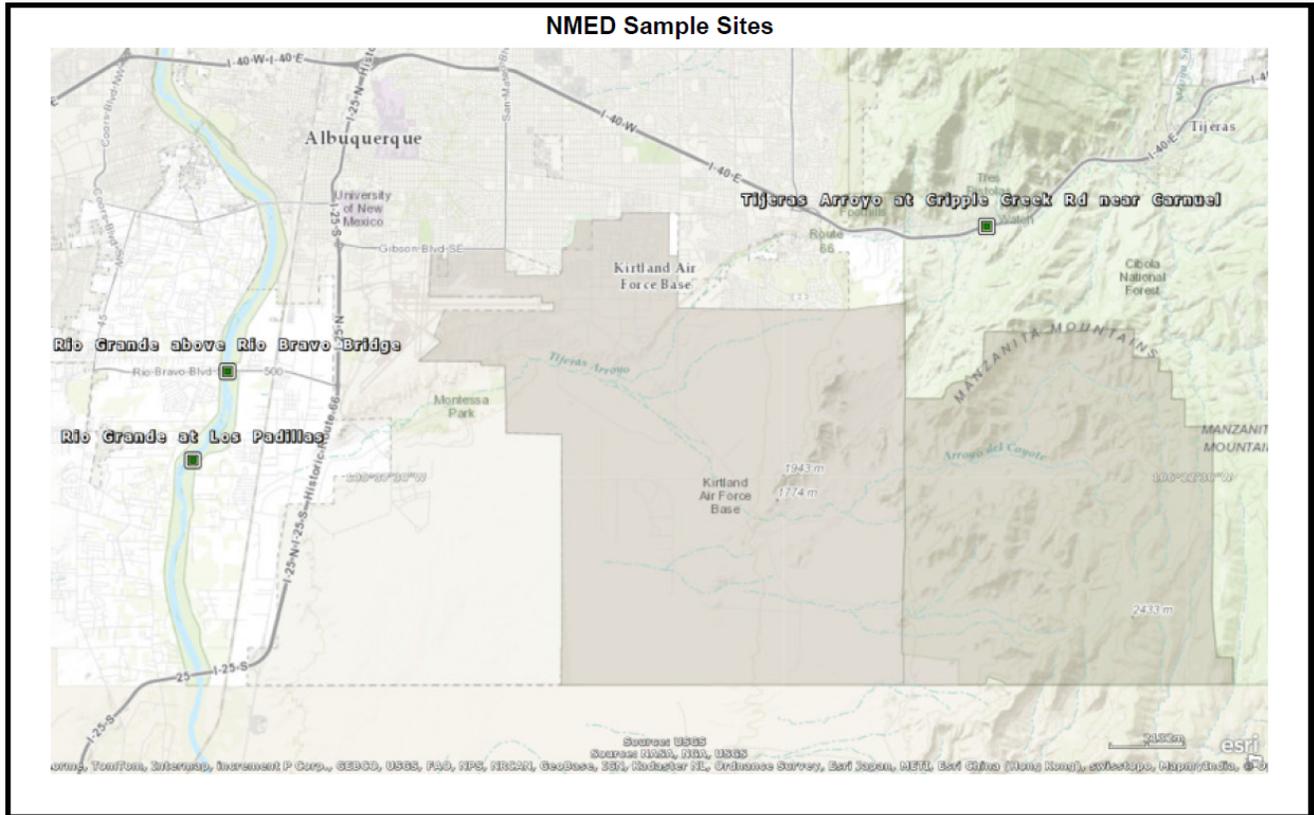
The following conditions should be considered when levels fail to meet the recommended DO criteria: (1) the duration of the event; (2) the magnitude of the DO depression; (3) the frequency of recurrence; (4) the proportional area of the site failing to meet the criteria, and (5) the biological significance of the site where the event occurs.

KAFB will compare sample results to the EPA guidelines for DO. The results of this comparison will be used to determine the levels of DO in storm water releases and provide a basis for the implementation or modification of best management practices (BMPs).

Existing Sampling Data

In 2014, water quality samples were collected by the New Mexico Environmental Department (NMED) in the Middle Rio Grande area as part of a rotational census of the state's surface waters (Personal communication with NMED Monitoring Team Supervisor, Scott Murray). A large sample suite was collected that included various chemical and physical parameters including DO. The Surface Water Census Report is not complete so the data is provisional. Various locations were sampled by the NMED, including a site on the Tijeras Arroyo above KAFB (Tijeras Arroyo at Cripple Creek Road near Carnuel), the Rio Grande above the Tijeras Arroyo (Rio Grande above Rio Bravo Bridge), and the Rio Grande below the Tijeras Arroyo (Rio Grande at Los Padillas). The Tijeras Arroyo site is approximately 6 miles up gradient of KAFB. Land uses between the sample site and the installation boundary include an interstate highway, a housing development, and open land of natural conditions. These land uses mirror

some of the installation land uses but lack industrial sites. The sampling points are illustrated in the following figure.



Samples were collected between March and October 2014. The data are provisional at the time of this report and did not include flow data. The data are summarized in the tables below:

Table 1: DO and Temperature Tijeras Arroyo at Cripple Creek Rd

Date	Dissolved Oxygen(mg/L)	Temperature (C°)
3/27/14	9.02	11.76
4/23/14	10.17	15.37
5/29/14	8.75	15.19
6/26/14	8.82	17.84
7/24/14	6.75	18.73
8/21/14	8.12	17.10
9/26/14	7.74	16.49
10/23/14	8.42	14.85

Table 2: DO and Temperature at Rio Grande above Tijeras Arroyo

Date	Dissolved Oxygen(mg/L)	Temperature (C°)
3/19/14	7.98	16.40
4/29/14	8.08	18.48
5/12/14	7.65	16.78
6/11/14	6.96	24.24
7/14/14	6.38	27.9
8/12/14	5.99	23.61
9/2/14	6.83	26.78
10/7/14	7.74	22.9
10/22/14	7.11	22.73

Table 3: DO and Temperature at Rio Grande below Tijeras Arroyo

Date	Dissolved Oxygen(mg/L)	Temperature (C°)
3/19/14	8.68	13.62
4/29/14	9.00	15.93
5/12/14	n/d	n/d
6/11/14	7.25	23.43
7/14/14	6.45	29.16
8/12/14	6.28	23.15
9/2/14	7.45	24.56
10/7/14	9.43	16.41
10/20/14	7.49	21.26

Results from the Tijeras site above KAFB were relatively consistent throughout the sampling period. These results may indicate regional background levels in the vicinity of KAFB. Examining the difference between samples collected at sites below and above the Tijeras Arroyo may give an indication of its influence on the Rio Grande as the Tijeras is the only major tributary to enter the Rio Grande between those two points.

The DO levels varied from month to month and indicated slightly lower levels in hotter months. Additional sampling may verify trends associated with storm events and their intensities to determine impacts from KAFB's discharges to the Tijeras Arroyo.

Table 4: Difference Above and Below Tijeras Arroyo

Date	Dissolved Oxygen(mg/L)
3/19/14	0.70
4/29/14	0.92
5/12/14	n/d
6/11/14	0.29
7/14/14	0.07
8/12/14	0.29
9/2/14	0.62
10/7/14	1.69

1.3 IMPLEMENTATION

The KAFB Water Quality Program Manager will:

- Identify and investigate potential sources to determine their effect on DO;
- Oversee current programs and staffing in place to monitor current conditions and identify any potential new conditions that may occur;
- Plan and conduct sampling;
- Prepare and submit reports; and
- Conduct evaluation and modification of the strategy.

1.4 IDENTIFYING POTENTIAL SOURCES

The KAFB Water Quality Program Manager will inventory and monitor structural controls, natural/man-made topographical features, MS4 operations and potential oxygen demanding pollutants for potential effects on DO. Section 5.4 of the SWMP identifies programs in place that will be used to monitor and identify any new sources or evidence of reduced DO.

The ephemeral flow of the Tijeras Arroyo provides limited opportunity to sample for DO. Current MS4 operations and existing control measures mitigate reduced DO as required by the Permit. BMPs will be modified following the first annual report if exceedances are discovered.

1.5 MONITORING

Sampling for DO will be coordinated with other sampling events required by the Permit. Sampling criteria, constituents and requirements are explained in Section 6 of the SWMP. KAFB will use 7.5 mg/L as an action level indicator for DO but may modify based on sampling data.

1.6 REPORTING

Annual reporting required by the Permit includes an analysis of BMP effectiveness addressing the DO and pollutant reductions (in graphic representation), documentation of the monitoring methods to evaluate the measurable goals, and any BMP alterations.

1.7 EVALUATION AND MODIFICATIONS

The annual reporting requirements include an analysis of the BMP effectiveness and evaluation of the Dissolved Oxygen Strategy. The following control measures along with sampling results will be evaluated to determine if modifications are required for DO levels. BMPs for DO are identified in Table 7-1.

Structural Control Measures

Structural control measures are generally considered physical devices or structures that modify water flows to provide some sort of water quality or quantity treatment. Measures discussed in this section are intended to prevent pollution to the receiving waters of KAFB.

Non-structural Control Measures

Non-structural control measures are typically management practices or strategies that may improve water quality. They may involve physical actions or implementation of structural devices. The implementation of these measures may result in acceptable DO levels to the receiving waters of KAFB. Non-structural control measures are described in Section 5.

1.8 REFERENCES

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