**Bayou Lacombe Background DO Modeling Summary**

**Purpose**

The purpose of this modeling effort is to use the existing model to identify/evaluate natural background conditions. Two approaches were taken to accomplish this task. The first approach involved the used of LDEQ’s modeling/TMDL reference streams established to evaluate natural background and man-made loads during TMDL development. The second approach involved the evaluation of individual reaches as impacted by man-made loading or not/least impacted.

**General Area Description**

The Bayou Lacombe watershed is a complex system. The watershed contains 70 permitted dischargers including one MS4 (St. Tammany Parish), with most being located in the area extending from the area just north of I-12 to south of US 190. These characteristics result in a waterbody that generally has higher DO concentrations in the upper reaches and reaches near Lake Pontchartrain and lower DO concentrations in the transition reaches. The tributaries, Big Branch Bayou and Cypress Bayou, also experience naturally low DO concentrations combined with man-made impacts. The challenge then became how to differentiate between the man-made impacts and naturally dystrophic areas.

Kisatchie Bayou is pool and riffle type freshwater stream (hydraulic slope dependant upon bottom slope) with an average depth less than 2 feet and critical flow less than 5 cfs. The stream bed consists primarily of sand and the watershed is primarily forested.

This indicated that the load reductions required in the TMDL may have been too high.

**Reach Evaluations as Impacted or Not/Least Impacted**

Three evaluations were conducted to accomplish this task. They were (1) a Landuse evaluation, (2) TOC/UCBOD ratio evaluations, (3) an evaluation of modeled dischargers within each reach, and (4) C/N ratios and general water quality evaluations.

The landuse evaluation included landuse and permitted facilities. Landuse **was determined** from aerial photography. The purpose was to evaluate the impact permitted facilities, potential unpermitted facilities, and potential unsewered areas. Maps **were created** to aid in this evaluation. All permitted facilities **were plotted** on the map. A polygon shapefile **was created** to depict residential landuse area within the watershed. The largest residential areas **were located** in the area bounded by I-12 to the north and extended south past US 190. It **was assumed** that larger facilities were providing sewer services to the residences within their immediate vicinity. The area of service **was determined** based on roadways which indicated the presence of a subdivision. These areas **were removed** from the polygon shapefile so that the shapefile depicted potential unsewered areas. The permitted facilities considered to provide sewer services in areas shown to be dominated by residential landuse included Feather and Fin.

The second **evaluation** involved the ratio of TOC/UCBOD. A higher TOC/UCBOD ratio (2 - 3) was considered to indicate a least impacted reach and more natural loading, while reaches with a lower ratio (1-1.8) indicated more man-made loading. **In general** the results of the two **evaluations** (TOC/UCBOD ratio and landuse) compared favorably. Only two reaches did not compare favorably (Reaches 32, 33). **For the purpose of** this modeling effort, reaches 32 and 33 were considered to be impacted by man-made loading based on the landuse **evaluation.**

The third **evaluation** included a comparison of reaches with modeled facilities to the two previous **evaluations**. This **evaluation** produced the same results as the previous **evaluations** in 17 modeled waterbody reaches (58.9% - excluding 12 modeled ditch reaches).

The fourth **evaluation** involved carbon/nitrogen ratios and general water quality. Designated impacted reaches had higher levels of nitrogen (NH3, NO2+NO3, TKN). **It also appeared as if** lower ratios of carbon to nitrogen may be a general indicator of man-made impacts.

**However**, model results may indicate that natural loading is the dominant source. Modeled ditches were not calibrated and therefore not evaluated. **However**, for the purpose of modeling, modeled ditch reaches were reduced at the same level as surrounding evaluated waterbody reaches. Modeled ditches included reaches 2, 6, 8, 11, 16, 18, 22, 24, 27, 29, and 35.

The survey was conducted in June. The temperatures ranged from 20.85. deg Celsius (headwater to 25.49 deg Celsius (near Lake Pontchartrain). Due to groundwater flow in the headwaters and

**Calibration Model – Facilities Removed**

In order to evaluate the impact of the facilities, the calibration model was revised to remove all modeled facilities. This updated version of the model was then run and the results are shown in Table 4

**Calibration Model – All Man-Made Loading Removed**

After removing all modeled facilities, the nonpoint loading (benthic, incremental, and headwater) was reduced in reaches previously identified as impacted by man-made loading according to the evaluations discussed. This was done to account for unpermitted facilities, unsewered areas, and residual loading from all dischargers (permitted and This number was rounded off to 32%. The nonpoint loading in not/least reaches was not reduced. LDEQ’s loading spreadsheet was used to calculate nonpoint loads in the model. This spreadsheet utilizes a Margin of Safety (MOS) factor. It also appeared as if lower ratios of carbon to nitrogen may be a general overall indicator of man made impacts.

**Summer Projection Model – Facilities Removed; Benthic Loading Reduced to Meet Criteria (critical conditions and benthic loads based on summer TMDL projection model; reductions based on total load - NO REFERNCE STREAM USED)**

Figure 1. Bayou Lacombe Watershed Natural Background Dissolved Oxygen Modeling

~~In the end~~, reference stream **data was** not used for Bayou Lacombe. Instead, each reach was

**No reference stream data applied to Bayou Lacombe**

thoroughly evaluated for man-made impact and designated as not/least impacted or impacted,

**human, non-natural, artificial, synthetic**

recognizing ~~that~~ tidal influences may have some impact on reaches in the LMRAP and CDM

**…recognizing tidal influences impact reaches (*minimally, somewhat, to some degree*)…**

Ecoregions.

**NOUN STRING**

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Results indicate ~~that~~ the minimum natural background dissolved oxygen **concentrations** for

many of the reaches in the Bayou Lacombe watershed **is** less than 5 mg/L. ~~Due to the fact that~~

**Because**

the facilities had minimal impact on the results, the calibration **model** (developed under near

**The model is providing oxygen?**

summer critical conditions) **may be providing** dissolved oxygen concentrations that are close to

natural background conditions.

The recommended ranges and minimal natural background dissolved oxygen concentrations

**With facilities?**

under summer critical conditions are shown below. Results for the calibration model results

**Calibration model results with facilities were in the lower limit range.**

were considered to be the lower limit of the range.  **Results** for the calibration model with no

**Calibration model results** **without facilities and a 32% nonpoint loads reduction were in the upper limit range.**

facilities and a 32% reduction of the nonpoint loads **was** considered to be the upper limit of the

range.