STATE OF MISSOURI

DEPARTMENT OF NATURAL RESOURCES

MISSOURI CLEAN WATER COMMISSION

CONSTRUCTION PERMIT

The Missouri Department of Natural Resources hereby issues a permit to:

Cape Land & Development, LLC
Brandon Williams, Manager
King's Landing WWTF
2985 Boutin Drive
Cape Girardeau, MO 63701

for the construction of (described facilities):

See attached.

Permit Conditions:

See attached.

Construction of such proposed facilities shall be in accordance with the provisions of the Missouri Clean Water Law, Chapter 644, RSMo, and regulation promulgated thereunder, or this permit may be revoked by the Department of Natural Resources (department).

As the department does not examine structural features of design or the efficiency of mechanical equipment, the issuance of this permit does not include approval of these features.

A representative of the department may inspect the work covered by this permit during construction. Issuance of a permit to operate by the department will be contingent on the work substantially adhering to the approved plans and specifications.

This permit applies only to the construction of water pollution control components; it does not apply to other environmentally regulated areas.

August 19, 2025
Effective Date

August 18, 2027
Expiration Date

Heather Peters, Director, Water Protection Program

CONSTRUCTION PERMIT

I. CONSTRUCTION DESCRIPTION

Construction and installation of a new WWTF consisting of flow equalization basin, a Cam-D sequencing batch reactor (SBR) with two parallel basins, aerobic digestor, Ultraviolet (UV) disinfection, and emergency generator. Sludge will be held and aerated until it can be land applied by a contract hauler. The design flow of the facility will be 99,800 gallons per day (gpd), with a peak flow of 199,000 gpd with equalization. The gravity sewer collection system for the first phase of subdivision built-out will also be covered in this permit and includes 3,812 lf of eight-inch SDR-35 PVC and 13 manholes.

This project will also include general site work appropriate to the scope and purpose of the project and all necessary appurtenances to make a complete and usable wastewater treatment facility.

II. COST ANALYSIS FOR COMPLIANCE

Pursuant to Section 644.145, RSMo, when issuing permits under this chapter that incorporate a new requirement for discharges from publicly owned combined or separate sanitary or storm sewer systems or publicly owned treatment works, or when enforcing provisions of this chapter or the Federal Water Pollution Control Act, 33 U.S.C. 1251 et seq., pertaining to any portion of a publicly owned combined or separate sanitary or storm sewer system or [publicly owned] treatment works, the Department of Natural Resources shall make a "finding of affordability" on the costs to be incurred and the impact of any rate changes on ratepayers upon which to base such permits and decisions, to the extent allowable under this chapter and the Federal Water Pollution Control Act. This process is completed through a cost analysis for compliance. Permits that do not include new requirements may be deemed affordable.

The department is not required to complete a cost analysis for compliance because the facility is not a combined or separate sanitary sewer system for a publicly-owned treatment works.

III. CONSTRUCTION PERMIT CONDITIONS

The permittee is authorized to construct subject to the following conditions:

1. This construction permit does not authorize discharge.

2. All construction shall be consistent with plans and specifications signed and sealed by Brian Strickland, P.E. with Strickland Engineering and as described in this permit.

3. The department must be contacted in writing prior to making any changes to the plans and specifications that would directly or indirectly have an impact on the capacity, flow, system layout, or reliability of the proposed wastewater treatment facilities or any design parameter that is addressed by 10 CSR 20-8, in accordance with 10 CSR 20-8.110(11).

4. State and federal law does not permit bypassing of raw wastewater, therefore steps must be taken to ensure that raw wastewater does not discharge during construction. If a sanitary sewer overflow or bypass occurs, report the appropriate information to the department's Southeast Regional Office per 10 CSR 20-7.015(9)(G).

5. In addition to the requirements for a construction permit, 10 CSR 20-6.200 requires land disturbance activities of one acre or more to obtain a Missouri state operating permit to discharge stormwater. The permit requires best management practices sufficient to control runoff and sedimentation to protect waters of the state. Land disturbance permits will only be obtained by means of the department's ePermitting system available online at https://dnr.mo.gov/data-e-services/missouri-gateway-environmental-management-mogem. See https://dnr.mo.gov/data-e-services/water/electronic-permitting-epermitting for more information.

6. A United States Army Corps of Engineers (USACE) Clean Water Act Section 404 Department of the Army permit and a Section 401 Water Quality Certification issued by the department may be required for the activities described in this permit. This permit is not valid until these requirements are satisfied or notification is provided that no Section 404 permit is required by the USACE. You must contact your local USACE district since they determine what waters are jurisdictional and which permitting requirements may apply. You may call the department's Water Protection Program, Operating Permits Section at 573-522-4502 for more information. See https://dnr.mo.gov/water/business-industry-other-entities/permits-certification-engineering-fees/section-401-water-quality for more information.

7. All construction must adhere to applicable 10 CSR 20-8 (Chapter 8) requirements listed below.

- Vacuum testing, if specified for concrete sewer manholes, shall conform to the test procedures in ASTM C1244 – 11(2017) *Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test Prior to Backfill*, or the manufacturer's recommendation. 10 CSR 20-8.120(4)(F)1.

- Exfiltration testing, if specified for concrete sewer manholes, shall conform to the test procedures in ASTM C969 – 17 *Standard Practice for Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines*. 10 CSR 20-8.120(4)(F)2.

- Multiple pumps shall be provided except for design average flows of less than 1,500 gpd. 10 CSR 20-8.130(4)(B) 1.

- Flood protection shall apply to new construction and to existing facilities undergoing major modification. The wastewater facility structures, electrical equipment, and mechanical equipment shall be protected from physical damage by not less than the 100-year flood elevation. 10 CSR 20-8.140(2)(B), 10 CSR 20-8.130(2)(A)

- Facilities shall be readily accessible by authorized personnel from a public right–of-way at all times. 10 CSR 20-8.140(2)(D), 10 CSR 20-8.130(3)(B)

- Unless another distance is determined by the Missouri Geological Survey or by the department's Public Drinking Water Branch, the minimum distance between wastewater treatment facilities and all potable water sources shall be at least 300 feet. 10 CSR 20-8.140(2)(C)1.

- The outfall shall be so constructed and protected against the effects of flood water, ice, or other hazards as to reasonably ensure its structural stability and freedom from stoppage. 10 CSR 20-8.140(6)(A)

- All sampling points shall be designed so that a representative and discrete 24-hour automatic composite sample or grab sample of the effluent discharge can be obtained at a point after the final treatment process and before discharge to or mixing with the receiving waters. 10 CSR 20-8.140(6)(B)

- All outfalls shall be posted with a permanent sign indicating the outfall number (i.e., Outfall #001). 10 CSR 20-8.140(6)(C)

- All wastewater treatment facilities shall be provided with an alternate source of electric power or pumping capability to allow continuity of operation during power failures. 10 CSR 20-8.140(7)(A)1.

- Disinfection and dechlorination, when used, shall be provided during all power outages. 10 CSR 20-8.140(7)(A)2.

- Electrical systems and components in raw wastewater or in enclosed or partially enclosed spaces where hazardous concentrations of flammable gases or vapors that are normally present, shall comply with the NFPA 70 *National Electric Code (NEC)* (2017 Edition), as approved and published August 24, 2016, requirements for Class I, Division 1, Group D locations. 10 CSR 20-8.140(7)(B)

- An audiovisual alarm or a more advanced alert system, with a self-contained power supply, capable of monitoring the condition of equipment whose failure could result in a violation of the operating permit, shall be provided for all wastewater treatment facilities. 10 CSR 20-8.140(7)(C)

- No piping or other connections shall exist in any part of the wastewater treatment facility that might cause the contamination of a potable water supply. 10 CSR 20-8.140(7)(D)1.

- For indirect connections, a sign shall be permanently posted at every hose bib, faucet, hydrant, or sill cock located on the water system beyond the break tank or backflow preventer to indicate that the water is not safe for drinking. 10 CSR 20-8.140(7)(D)3.B.

- Where a separate non-potable water supply is to be provided, a break tank will not be necessary, but all system outlets shall be posted with a permanent sign indicating the water is not safe for drinking. 10 CSR 20-8.140(7)(D)4.

- A means of flow measurement shall be provided at all wastewater treatment facilities. 10 CSR 20-8.140(7)(E)

- Effluent 24-hour composite automatic sampling equipment shall be provided at all mechanical wastewater treatment facilities and at other facilities where necessary under provisions of the operating permit. 10 CSR 20-8.140(7)(F)

- Adequate provisions shall be made to effectively protect facility personnel and visitors from hazards. The following shall be provided to fulfill the particular needs of each wastewater treatment facility: 10 CSR 20-8.130(3)(C); 10 CSR 20-8.140(8)
    - Fencing. Enclose the facility site with a fence designed to discourage the entrance of unauthorized persons and animals; 10 CSR 20-8.140(8)(A)
    - Gratings over appropriate areas of treatment units where access for maintenance is necessary; 10 CSR 20-8.140(8)(B)
    - First aid equipment; 10 CSR 20-8.140(8)(C)
    - Posted "No Smoking" signs in hazardous areas; 10 CSR 20-8.140(8)(D)
    - Appropriate personal protective equipment (PPE); 10 CSR 20-8.140(8)(E)
    - Portable blower and hose sufficient to ventilate accessed confined spaces; 10 CSR 20-8.140(8)(F)
    - 10 CSR 20-8.140(8)(G) Portable lighting equipment complying with NEC requirements. See subsection (7)(B) of this rule;
    - 10 CSR 20-8.140(8)(H) Gas detectors listed and labeled for use in NEC Class I, Division 1, Group D locations. See subsection (7)(B) of this rule;
    - Appropriately-placed warning signs for slippery areas, non-potable water fixtures (see subparagraph (7)(D)3.B. of this rule), low head clearance areas, open service manholes, hazardous chemical storage areas, flammable fuel storage areas, high noise areas, etc.; 10 CSR 20-8.140(8)(I)
    - Ventilation shall include the following:
        - Isolate all pumping stations and wastewater treatment components installed in a building where other equipment or offices are located from the rest of the building by an air-tight partition, provide separate outside entrances, and provide separate and independent fresh air supply; 10 CSR 20-8.140(8)(J)1.
        - Force fresh air into enclosed screening device areas or open pits more than four feet (4') deep. 10 CSR 20-8.140(8)(J)2.
        - Dampers are not to be used on exhaust or fresh air ducts. Avoid the use of fine screens or other obstructions on exhaust or fresh air ducts to prevent clogging; 10 CSR 20-8.140(8)(J)3.
        - Where continuous ventilation is needed (e.g., housed facilities), provide at least 12 complete air changes per hour. Where continuous ventilation would cause excessive heat loss, provide intermittent ventilation of at least 30 complete air changes per hour when facility personnel enter the area. Base air change demands on 100% fresh air; 10 CSR 20-8.140(8)(J)4.

        - Electrical controls. Mark and conveniently locate switches for operation of ventilation equipment outside of the wet well or building. Interconnect all intermittently operated ventilation equipment with the respective wet well, dry well, or building lighting system. The manual lighting/ventilation switch is expected to override the automatic controls. For a two speed ventilation system with automatic switch over where gas detection equipment is installed, increase the ventilation rate automatically in response to the detection of hazardous concentrations of gases or vapors; 10 CSR 20-8.140(8)(J)5.
        - Fabricate the fan wheel from non-sparking material. Provide automatic heating and dehumidification equipment in all dry wells and buildings. 10 CSR 20-8.140(8)(J)6.
    - Explosion-proof electrical equipment, non-sparking tools, gas detectors, and similar devices, in work areas where hazardous conditions may exist, such as digester vaults and other locations where potentially explosive atmospheres of flammable gas or vapor with air may accumulate. 10 CSR 20-8.140(8)(K)
    - Provisions for local lockout/tagout on stop motor controls and other devices; 10 CSR 20-8.140(8)(L)
    - Provisions for an arc flash hazard analysis and determination of the flash protection boundary distance and type of PPE to reduce exposure to major electrical hazards shall be in accordance with NFPA 70E *Standard for Electrical Safety in the Workplace* (2018 Edition), as approved and published August 21, 2017. 10 CSR 20-8.140(8)(M)

- The materials utilized for storage, piping, valves, pumping, metering, and splash guards, etc., for chemical handling, shall be specially selected considering the physical and chemical characteristics of each hazardous or corrosive chemical. 10 CSR 20-8.140(9)(A)1.

- All wastewater treatment facilities must have a screening device, comminutor, or septic tank for the purpose of removing debris and nuisance materials from the influent wastewater. 10 CSR 20-8.150(2)

- All screening devices and screening storage areas shall be protected from freezing. 10 CSR 20-8.150(4)(A)1.

- Provisions shall be made for isolating or removing screening devices from their location for servicing. 10 CSR 20-8.150(4)(A)2.

- Mechanically cleaned screen channels shall be protected by guard railings and deck gratings. 10 CSR 20-8.150(4)(A)3.A.(II)

- Mechanical screening equipment shall have adequate removal enclosures to protect facility personnel against accidental contact with moving parts and to prevent dripping in multi-level installations. 10 CSR 20-8.150(4)(A)3.B.(I)

- A positive means of locking out each mechanical screening device shall be provided. 10 CSR 20-8.150(4)(A)3.B.(II)

- An emergency stop button with an automatic reverse function shall be located in close proximity to the mechanical screening device. 10 CSR 20-8.150(4)(A)3.B.(III)

- Electrical systems and components in raw wastewater or in enclosed or partially enclosed spaces where hazardous concentrations of flammable gases or vapors that are normally present, shall comply with the NFPA 70 *National Electric Code (NEC)* (2017 Edition), as approved and published August 24, 2016, requirements for Class I, Division 1, Group D locations. 10 CSR 20-8.140(7)(B)

- Piping galleries shall be ventilated in accordance with paragraph (4)(C)4. of this rule. 10 CSR 20-8.170(4)(C)2.

- Electrical fixtures, equipment, and controls. Electrical fixtures, equipment, and controls shall comply with the National Electrical Manufacturers Association (NEMA) 4X enclosure rating where necessary; *NEMA Standard 250-2014*, published December 15, 2014. This standard shall hereby be incorporated by reference into this rule, as published by National Electrical Manufacturers Association, 1300 North 17th Street, Arlington, VA 22209. This rule does not incorporate any subsequent amendments or additions. Electrical equipment, fixtures, and controls, in places enclosing and adjacent to anaerobic digestive appurtenances where hazardous gases are included. 10 CSR 20-8.170(4)(C)3.

- Aerobic Solids Digestion High Level Emergency Overflow. An unvalved emergency overflow shall be provided that will convey digester overflow to the treatment plant headworks, the aeration process, or to another liquid sludge storage facility and that has an alarm for high level conditions. 10 CSR 20-8.170(5)

- For solids pumping systems, audio-visual alarms shall be provided in accordance with 10 CSR 20-8.140(7)(C) for:
    - Pump failure; 10 CSR 20-8.170(6)(A)
    - Pressure loss; 10 CSR 20-8.170(6)(B) and
    - High pressure. 10 CSR 20-8.170(6)(C)

- The minimum total Sequencing Batch Reactor (SBR) basin volume shall be equal to the design daily influent flow volume and either upstream in-line or off-line storage is necessary to minimize influent flow during settling and decanting. 10 CSR 20-8.180(6)(A)

- A minimum of two (2) Sequencing Batch Reactor (SBR) basins shall be installed. 10 CSR 20-8.180(6)(B)

- Emergency Power. Disinfection and dechlorination processes, when used, shall be provided during all power outages. 10 CSR 20-8.190(2)(A)

- The UV system shall deliver the target dosage based on equipment derating factors and, if needed, have the UV equipment manufacturer verify that the scale up or scale down factor utilized in the design is appropriate for the specific application under consideration. 10 CSR 20-8.190(5)(A)3.

- The UV system shall deliver a minimum UV dosage of 30,000 microwatt seconds per centimeters squared ($\mu W \bullet s/cm^2$). 10 CSR 20-8.190(5)(A)4.

- Closed vessel UV systems. The combination of the total number of closed vessels shall be capable of treating the peak batch flow. 10 CSR 20-8.190(5)(B)2.

- The UV system must continuously monitor and display at the UV system control panel the following minimum conditions:
    - The relative intensity of each bank or closed vessel system; 10 CSR 20-8.190(5)(C)1.A.
    - The operational status and condition of each bank or closed vessel system; 10 CSR 20-8.190(5)(C)1.B.
    - The ON/OFF status of each lamp in the system; 10 CSR 20-8.190(5)(C)1.C. and
    - The total number of operating hours of each bank or each closed vessel system. 10 CSR 20-8.190(5)(C)1.D.

- The UV system shall include an alarm system. Alarm systems shall comply with 10 CSR 20-8.140(7)(C). 10 CSR 20-8.190(5)(C)2.

8. Upon completion of construction:

    A. The KING'S LANDING HOMEOWNERS ASSOCIATION, LLC will become the continuing authority for operation and maintenance of these facilities;

    B. Submit an electronic copy of the as builts if the project was not constructed in accordance with previously submitted plans and specifications; and

    C. Submit the Statement of Work Completed form to the department in accordance with 10 CSR 20-6.010(5)(N) (https://dnr.mo.gov/document-search/wastewater-construction-statement-work-completed-mo-780-2155) and request the operating permit public noticed on July 3, 2025, to August 4, 2025 be issued.

IV. REVIEW SUMMARY

1. CONSTRUCTION PURPOSE

A new subdivision is being constructed in Cape Girardeau County to address housing needs caused by recent growth to the area. The King's Landing homeowner's association will be the continuing authority for the King's Landing WWTF because the

City of Cape Girardeau does not accept wastewater from outside the incorporated city boundaries. Construction includes the collection system to facility flows from phase 1 of the subdivision build-out.

2. FACILITY DESCRIPTION

The King's Landing WWTF is a new discharging treatment facility. Flows will be entirely domestic, including the flow from up to 6 commercial lots. The facility will consist of a flow equalization basin, a Cam-D sequencing batch reactor (SBR) with 2 parallel basins, aerobic digestor, UV disinfection, and emergency generator.

The King's Landing WWTF is located along Winterfell Road, Cape Girardeau, in Cape Girardeau County, Missouri. The facility has a design average flow of 99,800 gpd and serves a hydraulic population equivalent of 998. Once construction is completed, the King's Landing Homeowner's Association will become the continuing authority.

3. COMPLIANCE PARAMETERS

The limits following the completion of construction will be applicable to the facility:

Parameter	Units	Monthly average limit
Biochemical Oxygen Demand$_5$	mg/L	10
Total Suspended Solids	mg/L	15
Ammonia as N	mg/L	
January		3.1
February		3.1
March		2.7
April		2.1
May		2.1
June		1.3
July		0.9
August		0.9
September		1.2
October		1.8
November		2.4
December		2.7
pH	SU	6.5-9.0
E. coli	#/100mL	206

4. ANTIDEGRADATION

The department has reviewed the antidegradation report for this facility and issued the Water Quality and Antidegradation Review dated January 2025, due to construction of a new discharging treatment facility. See **APPENDIX – ANTIDEGRADATION**.

5. REVIEW of MAJOR TREATMENT DESIGN CRITERIA

- Components are designed for a Population Equivalent of 998 based on hydraulic loading to the system.

- Diurnal Flow Equalization – Diurnal flow equalization is utilized to reduce the variability of influent wastewater flow. As a result, a consistent discharge to downstream treatment components is achieved and these processes may not have restricted capacity due to the peak hourly flow. The proposed diurnal flow equalization tank is 12 ft by 12 ft by 15 ft deep (13,194 gallons at 12.5 ft operating depth), which is approximately 13% of the average daily flow. Duplex 3 HP pumps capable of pumping at 165 gpm against 41.9 ft of head doses water from the EQ basin to the screen.

- Flow Measurement – Installation of accurate flow measurement devices will give the treatment facility a means of improved data analysis.
  - Electromagnetic Meter – An influent electromagnetic 4-inch flow meter shall measure the raw influent wastewater prior to screening.
  - Electromagnetic Meter – An effluent electromagnetic 6-inch flow meter shall measure the secondary treated wastewater following the SBR basins.

- Screening – Installation of screening devices removes nuisance inorganic materials from raw wastewater.
  - Mechanical Fine Screen – An automatic fine screen trash augur with an angle of 70 degrees and a screen spacing of five mm will collect influent solids and deposit them into an onsite dumpster. The screening devices shall be capable of treating a design average flow of 99,800 gpd and a peak hourly flow of 236,160 million gallons per day (MGD). The screening structure is followed by influent flow measurement.

- Selector Tank – Water discharged from the screen enters the 10 ft by 4 ft by 3 ft selector tank. Butterfly valves control which SBR basin the water is dosed to.

- Sequencing Batch Reactor (SBR) – Two sequencing batch reactors with a hydraulic retention time of 26.7 hours. The average design flow of the two basins is 99,800 gpd with a maximum design flow of 199,600 MGD. The basins are designed with 3 ft of freeboard, a minimum water depth of 11.8 ft, an average water depth of 14.4 ft and a maximum water depth of 17 ft. The basins will operate on five cycles per day per basin, with each cycle duration being 4.8 hours. The hydraulic retention time is 1.11 days, and the solids retention time is 18.8 days. Aeration is provided by 25 HP

Aqua Cam-D floating coarse air bubble diffuser assemblies providing up to 3.02 SCFM (1.6 SCFM/basin). The decant system is integrated into the Cam-D floating unit and will have a flow rate at maximum design flow is 311 gpm. The decant duration is 64 minutes with five decants per day per basin.

- Waste Activated Sludge (WAS) Pump Station – Construction of a duplex WAS pumps in the SBR basins. The WAS self-priming pump will be capable of pumping 108.7 gpm, 1,973 gpd, at nine ft of TDH with a 2.4 HP motor. WAS pumps will be duplex, one operational and one standby.

- Aerobic Digester – Construction of one aerobic digester of 27 ft x 19 ft x 19 ft (two ft freeboard), with a volume of 65,233 gallons which provides 33.8 days of solids retention. The design basis of the digester is an influent MLSS concentration of 4,500 mg/L (0.45% solids) with a flowrate of 1,973 gpd. Installation of an AquaJet 10 HP floating aerator will provide aeration and mixing of the sludge to prevent anaerobic conditions. The motor is mounted on top of the floating unit and can provide a maximum air rate of 118.4 lbs of oxygen per day. The aerobic digester follows the SBR basins.

- Disinfection – Disinfection is the process of removal, deactivation, or killing of pathogenic microorganisms.
  - Non-Contact Ultraviolet (UV) – A closed channel, low pressure high intensity UV non-contact disinfection system capable of treating a peak flow of 524,160 gpd while delivering a minimum UV intensity of 30 mJ/cm^2 with an expected ultraviolet transmissivity of 65% or greater. The enclosed UV system consists of one reactor with 15 lamps per reactor. The disinfected effluent will flow by gravity to the effluent sampling manhole before the Outfall No. 001.

- Emergency Power – A 50 kW standby diesel generator and automatic transfer switch will be provided to operate the treatment facility in event of power failure.

6. OPERATING PERMIT

The facility will not be covered under a general operating permit. This facility does not meet the requirements of the MOGD, issued on July 2024 for the following reason: the design flow exceeds the maximum of 50,000 gpd covered under the general permit. The site-specific operating permit was public noticed from July 3, 2025 to August 4, 2025 with no comments received.

V. NOTICE OF RIGHT TO APPEAL

If you were adversely affected by this decision, you may be entitled to an appeal before the Administrative Hearing Commission (AHC) pursuant to Section 621.250 RSMo. To appeal, you must file a petition with the AHC within 30 days after the date this decision was mailed or the date it was delivered, whichever date was earlier. If any such petition is sent by registered mail or certified mail, it will be deemed filed on the date it is mailed; if it is sent by any method other than registered mail or certified mail, it will be deemed filed on the date it is received by the AHC. Any appeal should be directed to:

Administrative Hearing Commission
U.S. Post Office Building, Third Floor
131 West High Street, P.O. Box 1557
Jefferson City, MO 65102-1557
Phone: 573-751-2422
Fax: 573-751-5018
Website: https://ahc.mo.gov

Alex Bielefeldt
Engineering Section
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Chia-Wei Young, P.E.
Engineering Section
chia-wei.young@dnr.mo.gov

APPENDIX

- **Antidegradation**

Water Quality and Antidegradation Review

For the Protection of Water Quality
and Performance Based Discharge Level Determination for

Juden Creek

Requested by
Robert Summers, P.E.
Heartland Engineering, LLC

For
King's Landing WWTF
Cape Land Development LLC

January 2025

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PURPOSE OF ANTIDEGRADATION REVIEW REPORT

An Antidegradation Review Request was submitted by Robert Summers, P.E. for Cape Land Development LLC for the King's Landing WWTF to evaluate construction of a new discharging wastewater treatment facility to serve 998 people and designed to treat 99,800 gallons per day (gpd).

In accordance with Missouri's Water Quality Standards [10 CSR 20-7.031(3)] and federal antidegradation policy at Title 40 Code of Federal Regulation (CFR) Section 131.12 (a), the department developed a statewide antidegradation policy and corresponding procedures to implement the policy. A proposed discharge to a water body will be required to undergo a level of Antidegradation Review that documents that the use of a water body's available assimilative capacity is justified. Effective August 30, 2008, and revised July 13, 2016, a facility is required to use Missouri's Antidegradation Implementation Procedure (AIP) for new and expanded wastewater discharges.

The AIP specifies that when the proposed activity results in a reduction by 10% or more of the:

- facility assimilative capacity for any pollutant as a result of any single discharge;
- segment assimilative capacity for any pollutant as a result of all discharges combined after existing water quality (EWQ); or
- any new or expanded discharge that the department determines will likely result in the increased accumulation of pollutants or their degradation products in sediment or fish tissue,

then a demonstration of necessity (i.e., alternatives analysis) and a determination of social and economic importance are required.

The applicant elected to determine that all pollutants of concern (POC) require a demonstration of necessity (i.e., alternatives analysis) and a determination of social and economic importance in the absence of existing water quality data for the receiving stream. An alternatives analysis was conducted to fulfill the requirements of the Antidegradation Implementation Policy (AIP).

The preferred treatment technology is a sequencing batch reactor. The receiving waterbody is Juden Creek. The proposed design flow is 99,800 gpd.

The following is a review of the *King's Landing Wastewater Collection and Treatment System - Antidegradation Review & Facility Plan* prepared by Robert Summers, P.E. of Heartland Engineering, LLC dated November 20, 2024.

PERFORMANCE BASED LIMITS

Table 2-1: Performance Based Limits

PARAMETER	Unit	Basis	Daily Maximum	Monthly Average
Flow	MGD	FSR		*
BOD_5	mg/L	PBL	15	10
TSS	mg/L	PBL	20	15
*Escherichia coli***	#/100mL	FSR		206**
Ammonia as N				
January	mg/L	PBL	12.1	3.1
February			12.1	3.1
March			10.1	2.7
April			8.4	2.1
May			12.1	2.1
June			10.1	1.3
July			8.4	0.9

August			8.4	0.9
September			8.4	1.2
October			8.4	1.8
November			8.4	2.4
December			10.1	2.7
PARAMETER	Unit	Basis for Limits		Minimum/ Maximum
pH	SU	FSR		6.5-9.0

* - Monitoring requirement only
** - #/100mL; the Monthly Average for *E. coli* is a geometric mean.

Basis for Limitations Codes:
MDEL – Minimally Degrading Effluent Limit
NDEL – Non-Degrading Effluent Limit
PBL – Performance Based Limit
BPJ – Best Professional Judgment
TBEL – Technology-Based Effluent Limit
WQBEL – Water Quality-Based Effluent Limit
FSR – Federal or State Regulation

FACILITY INFORMATION

The King's Landing WWTF is a new discharging treatment facility in Cape Girardeau to meet housing needs in the area. There is a lack of affordable housing near the city of Cape Girardeau, and this subdivision will consist of 140 single family homes, and 160 two-bedroom apartments. The subdivision is located outside the city limits so the Cape Girardeau City WWTF will not accept flow from the development.

Facility Name:	King's Landing WWTF
Address:	Between 2400 and 2500 Big Bend Road, Cape Girardeau, MO 63701
Permit #:	TBD
County:	Cape Girardeau
Facility Type:	Domestic Non-POTW
Owner:	Cape Land & Development LLC
Continuing Authority:	Same
Sec. of State Charter No:	LC1399556
UTM Coordinates:	E = 278016.18 N = 4135443.67
Legal Description:	Section 21, T31N, R14E
12 digit watershed:	071401050502
Ecological Drainage Unit:	Interior River Valleys and Hills

FACILITY PERFORMANCE HISTORY:

There is no performance history for this facility since it is a new and proposed discharging facility.

NATURAL HERITAGE REVIEW
A Missouri Department of Conservation Natural Heritage Review was obtained by the applicant. Many state-listed species were identified within the Tier 3 review area. The following recommendations were made for construction activities:

- Manage construction to minimize sedimentation and run-off to nearby streams.
- At stream and drainage crossings, avoid erosion, silt introduction, petroleum or chemical pollution, and disruption or realignment of stream banks and beds.

- If any trees need to be removed for the project, contact the U.S. Fish and Wildlife Service for coordination under the Endangered Species Act.
- Revegetation of disturbed areas to minimize erosion.
- Do not enter caves known to house bat species.
- Do not remove trees in the area without contacting Ecological Services.
- Remove any mud, soil, trash, or plant material from equipment to prevent transport of invasive species.

GEOHYDROLOGIC EVALUATION
A Geohydrologic Evaluation was submitted with the request and the receiving stream is gaining for discharge purposes (see Appendix B). Surface water runs into Juden Creek. There are no known sinkholes or springs within one mile of the facility, however the site does sit within the Jackson Fault zone, which could provide preferential pathways for groundwater connection. In the event of treatment failure, the surface waters of Juden Creek and its nearby tributaries could be adversely affected.

RECEIVING WATERBODY INFORMATION

A. RECEIVING WATERBODY

Table 4-2: Outfalls Table

OUTFALL	DESIGN FLOW (CFS)	TREATMENT LEVEL	EFFLUENT TYPE
001	0.154	Secondary	Domestic

Table 4-3: Receiving Stream(s)

WATER-BODY NAME	CLASS	WBID	DESIGNATED USES*	12-DIGIT HUC	DISTANCE TO CLASSIFIED SEGMENT (MI)
Tributary to Juden Creek	-	-	General Criteria	071100090103	0
Juden Creek	C	0222	AHP-WWH, WBC-B, SCR, HHP, IRR, LWP	071100090103	0.14
Mississippi River	P	3701	AHP-WWH, DWS, IND, SCR, WBC-B, HHP, IRR, LWP	071401050502	1.34

* **AHP** = Aquatic Habitat Protection - To ensure the protection and propagation of fish, shellfish, and wildlife. AHP is further subcategorized as: **WWH** = Warm Water Habitat; **CLH** = Cool Water Habitat; **CDH**= Cold Water Habitat; **EAH** = Ephemeral Aquatic Habitat; **MAH** = Modified Aquatic Habitat; **LAH** = Limited Aquatic Habitat; **DWS** = Drinking water supply; **GRW** = Groundwater; **HHP** = Human Health Protection as it relates to the consumption of fish; **IND** = Industrial water supply; **IRR** = Irrigation - Application of water to cropland or directly to cultivated plants that may be used for human or livestock consumption; **LWP =** Livestock and wildlife protection - Maintenance of conditions in waters to support health in livestock and wildlife; **WBC** = Whole Body Contact recreation where the entire body is capable of being submerged. WBC is further subcategorized as: **WBC-A** = Whole body contact recreation that supports swimming uses and has public access; **WBC-B** = Whole body contact recreation that supports swimming; **SCR** = Secondary Contact Recreation (like fishing, wading, and boating).

Table 4-4: Receiving Stream Segments

Receiving Water Body Segment Outfall #1:		
Upper end segment* UTM coordinates:	X = 278016.18; Y = 4135443.67	outfall
Lower end segment* UTM coordinates:	X = 278117.88; Y = 4135564.34	downstream confluence
Second end segment* UTM coordinates:	X = 279156.59; Y = 4134796.51	Downstream confluence

*Segment is the portion of the stream where discharge occurs. Segment is used to track changes in assimilative capacity and is bound at a minimum by existing sources and confluences with other significant water bodies.

MIXING CONSIDERATIONS AND LOW FLOW VALUES

The proposed receiving waterbody is a tributary of Juden Creek which is a class C stream. The applicant elected to use USGS StreamStats to establish low flow values. See Appendix D for StreamStats summary.

Table 4-5: Receiving Stream(s) Low-Flow Values

RECEIVING STREAM	LOW-FLOW VALUES (CFS)		
	1Q10	7Q10	30Q10
Tributary to Juden Creek	0.0002	0.0004	0.0003

MIXING CONSIDERATIONS

Mixing Zone: Not Allowed [10 CSR 20-7.031(5)(A)4.B.(I)(a)].
Zone of Initial Dilution: Not Allowed [10 CSR 20-7.031(5)(A)4.B.(I)(b)].

EXISTING WATER QUALITY

No existing water quality data was submitted. The facility discharges to a tributary of Juden Creek.

RECEIVING WATER MONITORING REQUIREMENTS

No receiving water monitoring requirements recommended at this time.

ANTIDEGRADATION REVIEW INFORMATION

A. TIER DETERMINATION
Waterbodies are assigned Tier 1, 2, or 3 protection levels.

Tier 1 protection is applied to a waterbody on a pollutant by pollutant basis for pollutants which may cause or contribute to the impairment of a beneficial use or violation of Water Quality Criteria (WQC); and prohibit further degradation of Existing Water Quality (EWQ) where additional pollutants of concern (POCs) would result in the water being included on the 303(d) List. According to the AIP, the waters may receive the POCs that are causing impairments if 1) the discharge would not cause or contribute to a violation of the WQS, 2) all other conditions of the state permitting requirements are met (i.e., no discharge options are explored and technology based requirements (including ELGs) are met); and 3) the permit is issued with the highest statutory and regulatory requirements.

- There are no Tier 1 pollutants for this review.

Tier 2 level protection is assigned to the waterbody on a pollutant by pollutant basis that prohibits the degradation of water quality of a surface water unless a review of reasonable alternatives and social and economic considerations justifies the degradation in accordance with the methods presented in the AIP.

- Tier 2 Pollutants for this review include: biochemical oxygen demand (BOD), total suspended solids (TSS), ammonia, and pH.

Tier 3 protection prohibits any degradation of water quality of Outstanding National Resource Waters and Outstanding State Resource Waters as identified in Tables D and E of the Water Quality Standards (WQS). Temporary degradation of water receiving Tier 3 protection may be allowed by the department on a case-by-case basis as explained in Section VI of the AIP.

- The receiving waterbody is not an Outstanding National Resource Water or an Outstanding State Resource Water, and as such Tier 3 is not applicable.

Below is a list of POCs reasonably expected and identified by the permittee in their application to be in the discharge. Pollutants of concern are defined as those pollutants "proposed for discharge that affect beneficial use(s) in waters of the state." They include pollutants that "create conditions unfavorable to beneficial uses in the water body receiving the discharge or proposed to receive the discharge" (AIP, Page 6).

Table 5-6: Pollutants of Concern and Tier Determinations

Pollutants of Concern	Tier	Review Type	Comment
Biological Oxygen Demand (BOD_5)	2	Alternatives Analysis	
Total Suspended Solids (TSS)	**	Alternatives Analysis	
Ammonia as N	2*	Alternatives Analysis	
Escherichia coli (E. coli)	2	FSR	Disinfection required, UV proposed
pH	***	FSR	10 CSR 20-7.015((8)(A)2 applied

* Tier assumed.
** Tier determination not possible: No in-stream standards for these parameters.
*** Standards for these parameters are ranges.

B. NECESSITY OF DEGRADATION

The AIP specifies that if the proposed activity does result in a reduction by 10 percent or more of the assimilative capacity then a demonstration of necessity (i.e., alternatives analysis) and a determination of social and economic importance are required. Part of that analysis as shown below is the evaluation of non-degrading alternatives, such as regionalization or no discharge systems.

The applicant has the option of assuming discharge will result in a reduction by 10% or more of the assimilative capacity and proceeding directly to the alternatives analysis, thereby avoiding the determination of the assimilative capacity of the receiving water. The applicant has elected this option.

REGIONALIZATION

The King's Landing subdivision is located outside the incorporated area of Cape Girardeau City. The distance to the City treatment facility is 2 miles and the City sewer district has a policy of not accepting connections for facility outside city limits. The next closest treatment facility with capacity is the Cape Girardeau Reorganized Common Sewer District Fruitland WWTF, located 10 miles away. The Cape Rock Village WWTF as well as Enclave WWTF are located near Juden Creek, but they do not have the capacity to accept the anticipated King's Landing flows.

NO DISCHARGE EVALUATION

A surface application system was evaluated as the no-discharge option for this site. This option would require a lagoon capable of retaining wastewater for 75 days including rainfall-evaporation of the 1-in-10 year annual rainfall maximum, lift station, land application equipment, and ample land application space. Applying at a rate of 24 inches per year, 56 acres of land are required to handle the annual wastewater volume. The size of the property being developed is 70 acres in total, which does not leave enough room to develop the subdivision and land apply the wastewater. Additional land for surface application is not available in the immediate area. Per MU Extension the average cost of land is Southeast Missouri is $10,658, making the total cost for ample land application area $598,85. Due to the size restriction, as well as cost associated, this option was not chosen.

ALTERNATIVES TO NO DISCHARGE

ALTERNATIVE #1: SEQUENCING BATCH RECTOR (SBR) BASE CASE

An Aqua CamD SBR was considered for the base case in this analysis. This option would include a flow equalization chamber, mechanical headworks, dual SBR units, an aerated

sludge basin, electromagnetic flow measurement, and UV disinfection. Sludge will be land applied. This option was chosen as the base case due to the cost of construction and the familiarity with the operator.

ALTERNATIVE #2: SBR WITH ADDITIONAL AERATION
A more traditional SBR design was also considered. This option would also have a flow equalization chamber, mechanical headworks, dual SBR units, an aerated sludge basin, electromagnetic flow meter, and UV disinfection. Sludge will be land applied. The primary treatment basins and UV disinfection system for this option will be larger than in the base case to allow for additional course bubble aeration equipment and higher through flows. This option was not chosen due to the increase cost of installation.

ALTERNATIVE #3: SBR DESIGN TO MUSSEL AMMONIA
A SBR designed specifically to meet the 2013 EPA Ammonia criteria was considered. This option would include the same components, an equalization basin, mechanical headworks, dual SBR units, aerated sludge holding basin, electromagnetic flow measurement, and UV disinfection. The treatment basins and UV disinfection system for this option would need to be larger than the base case to provide additional aeration, retention time, and to ensure disinfection with higher through flow rates. A caustic would be added to the secondary treatment basin for pH control requiring additional chemical holding structures. This option was not chosen due to the increase construction and O&M costs associated with chemical handling.

ALTERNATIVE #4: EXTENDED AERATION BASIN
An extended aeration basin was evaluated as part of this report. This option would include an equalization basin, mechanical headworks, aeration basin, aerated sludge holding basin, electromagnetic flow meter, UV disinfection, and dual secondary clarifiers. This option would provide similar performance to the selected base case option. The construction and O&M costs for this technology are higher than the base case, so this option was not selected.

Table 5-7: Alternatives Analysis Comparison

Pollutant	Alternative Aqua CamD SBR	Alternative 2 SBR w/ additional aeration	Alternative 3 SBR designed to Mussel Ammonia	Alternative 4 Extended aeration basin
BOD_5	≤ 10 mg/l	≤ 10 mg/l	≤ 10 mg/l	≤ 10 mg/l
TSS	≤ 15 mg/l	≤ 15 mg/l	≤ 15 mg/l	≤ 15 mg/l
Ammonia as N	0.9 mg/l	0.4 mg/l	0.4 mg/l	0.9 mg/l
Escherichia coli (E. coli)	≤ 206 CFU/100ml	≤ 206 CFU/100ml	≤ 206 CFU/100ml	≤ 206 CFU/100ml
Life Cycle Cost*	$2,789,332	$3,486,292	$3,337,571	$3,972,902
Ratio	100%	125%	120%	142%
Practicable	Y	N	Y	N

*Life cycle cost at 20 year design life and 6 percent interest

C. SOCIAL AND ECONOMIC IMPORTANCE

The affected community consists of the residents of the Cape Girardeau County and surrounding area. This subdivision will be right outside the City of Cape Girardeau and will add 300 new houses/apartments to the Southeast Missouri area. The area has had job opportunity expansion recently but lacks affordable housing to support more population. Jobs will be created in developing the subdivision and it is expected that the new housing will provide a significant increase to the county tax base in an area slightly above the state average for poverty households. The treatment system will be developed with no cost to the City of Cape Girardeau.

No.	Administrative Unit	Cape Girardeau County	Missouri State	United States
1	Population (2022)	81,703	6,154,422	331,097,593
2	Percent Change in Population (2000-2022)	18.9%	10.0%	17.7%
3	2022 Median Household Income (in 2023 Dollars)	$67,749	$68,634	$78,242
4	Percent Change in Median Household Income (2000-2022)	1.6%	-1.1%	1.9%
5	Median Age (2022)	36.9	38.8	38.8
6	Change in Median Age in Years (2000-2022)	1.7	2.7	3.5
7	Unemployment Rate (2022)	3.2%	4.3%	5.3%
8	Percent of Population Below Poverty Level (2022)	14.5%	12.8%	12.5%
9	Percent of Household Received Food Stamps (2022)	9.9%	10.0%	11.5%

DERIVATION AND DISCUSSION OF PARAMETERS, LIMITS, AND PERFORMANCE BASED EFFLUENT LEVELS

Wasteload allocations and limits were calculated using two methods:

A. **Water quality-based** – Using water quality criteria or water quality model results and the dilution equation below:

$$C = \frac{(C_s \times Q_s) + (C_e \times Q_e)}{(Q_e + Q_s)}$$ (EPA/505/2-90-001, Section 4.5.5)

$$C_e = \frac{(Q_e + Q_s)C - (C_s \times Q_s)}{Q_e}$$

Where C = downstream concentration (mg/L)
C_s = upstream concentration (mg/L)
Q_s = upstream flow (cfs)
C_e = effluent concentration (mg/L)
Q_e = effluent flow (cfs)

Chronic wasteload allocations were determined using applicable chronic water quality criteria (CCC: criteria continuous concentration) and stream volume of flow at the edge of the mixing zone (MZ). Acute wasteload allocations were determined using applicable water quality criteria (CMC: criteria maximum concentration) and stream volume of flow at the edge of the zone of initial dilution (ZID).

Water quality-based maximum daily and average monthly effluent limitations were calculated using methods and procedures outlined in USEPA's "Technical Support Document For Water Quality-based Toxics Control" (EPA/505/2-90-001).

B. **Alternative Analysis-based** – Using the preferred alternative's treatment capacity for conventional pollutants such as BOD_5 and TSS that are provided by the consultant as the WLA, the performance based effluent average monthly and average weekly limits are determined by applying the WLA as the average monthly (AML) and multiplying the AML by 1.5 to derive the average weekly limit (AWL).

Note: Performance based effluent limits have been based on the authority included in Section I.A. of the AIP. Also under 40 CFR 133.105, permitting authorities shall require more stringent limitations than equivalent to secondary treatment limitations for 1) existing facilities if the permitting authority determines that the 30-day average and 7-day average BOD_5 and TSS effluent values could be achievable through proper operation and maintenance of the treatment works, and 2) new facilities if the permitting

authority determines that the 30-day average and 7-day average BOD_5 and TSS effluent values could be achievable through proper operation and maintenance of the treatment works, considering the design capability of the treatment process.

Outfall #001 **– Main Facility Outfall**

- **Flow.** Though not limited itself, the volume of effluent discharged from each outfall is needed to assure compliance with permitted effluent limitations [40 CFR Part 122.44(i)(1)(ii)]. If the permittee is unable to obtain effluent flow, then it is the responsibility of the permittee to inform the department, which may require the submittal of an operating permit modification.

- **Biochemical Oxygen Demand (BOD_5).** Effluent limits of 10 mg/L average monthly and 15 mg/L average daily maximum were established as a result of a discharging technology alternatives analysis conducted by the applicant. These limits are at least as stringent as the minimum effluent regulations established in 10 CSR 20-7.015(8)(A).

- **Total Suspended Solids (TSS).** Effluent limits of 15 mg/L average monthly and 20 mg/L average daily maximum were established as a result of a discharging technology alternatives analysis conducted by the applicant. These limits are at least as stringent as the minimum effluent regulations established in 10 CSR 20-7.015(8)(A).

- ***Escherichia coli (E. coli).*** Effluent limits of 206 CFU per 100 mL monthly average and 630 CFU per 100 mL as a daily max of geometric mean during the recreation season (April 1 – October 31) were established as a result of a discharging technology alternatives analysis conducted by the applicant. King's Landing WWTF will utilize UV irradiation for disinfection.

- **Total Ammonia Nitrogen.** Performance based effluent levels were established as a result of a discharging technology alternatives analysis conducted by the applicant.

  Alternative analysis performance based levels are:

Parameter	Units	AML
Ammonia as N		
January		3.1
February		3.1
March		2.7
April		2.1
May	mg/L	2.1
June		1.3
July		0.9
August		0.9
September		1.2
October		1.8
November		2.4
December		2.7

To verify that the proposed alternative analysis performance based levels provided by the facility are protective of the water quality based effluent limits, below is the following calculation of water quality based effluent limits. It demonstrates that the proposed alternative analysis performance based levels proposed by the applicant are equally protective.

Early Life Stages Present Total Ammonia Nitrogen criteria apply [10 CSR 20-7.031(5)(B)7.C. & Table B3]. Background total ammonia nitrogen = 0.01 mg/L

Table 6-8: Ammonia Criteria as of December 2024

Month	Temp (°C)*	pH (SU)*	Total Ammonia Nitrogen CCC (mg N/L)	Total Ammonia Nitrogen CMC (mg N/L)
January	2.8	7.8	3.1	12.1
February	4.4	7.8	3.1	12.1
March	9.4	7.9	2.7	10.1
April	16.1	8.0	2.1	8.4
May	21.0	7.8	2.1	12.1
June	26.0	7.9	1.3	10.1
July	29.4	8.0	0.9	8.4
August	29.3	8.0	0.9	8.4
September	25.6	8.0	1.2	8.4
October	19.0	8.0	1.8	8.4
November	12.0	8.0	2.4	8.4
December	6.9	7.9	2.7	10.1

* Ecoregion Data (Interior hills and valleys)

WBQEL equation
$C_e = (((Q_e+Q_s)*C) - (Q_s*C_s))/Q_e$

January
Chronic WLA: Ce = ((1.54 + 0.0)3.1 – (0.0 * 0.01)) / 1.54 Ce = 3.1
Acute WLA: Ce = ((1.54 + 0.0)12.1 – (0.0 * 0.01)) / 1.54 Ce = 12.1
AML = WLAc = 3.1 mg/L
MDL = WLAa = 12.1 mg/L

February
Chronic WLA: Ce = ((1.54 + 0.0)3.1 – (0.0 * 0.01)) / 1.54 Ce = 3.1
Acute WLA: Ce = ((1.54 + 0.0)12.1 – (0.0 * 0.01)) / 1.54 Ce = 12.1
AML = WLAc = 3.1 mg/L
MDL = WLAa = 12.1 mg/L

March
Chronic WLA: Ce = ((1.54 + 0.0)2.7 – (0.0 * 0.01)) / 1.54 Ce = 2.7
Acute WLA: Ce = ((1.54 + 0.0)10.1 – (0.0 * 0.01)) / 1.54 Ce = 10.1
AML = WLAc = 2.7 mg/L
MDL = WLAa = 10.1 mg/L

April
Chronic WLA: Ce = ((1.54 + 0.0)2.1 – (0.0 * 0.01)) / 1.54 Ce = 2.1
Acute WLA: Ce = ((1.54 + 0.0)8.4 – (0.0 * 0.01)) /1.54 Ce = 8.4
AML = WLAc = 2.1 mg/L
MDL = WLAa = 8.4 mg/L

May
Chronic WLA: Ce = ((1.54 + 0.0)2.1 – (0.0 * 0.01)) / 1.54 Ce = 2.1
Acute WLA: Ce = ((1.54 + 0.0)12.1 – (0.0 * 0.01)) /1.54 Ce = 12.1
AML = WLAc = 2.1 mg/L
MDL = WLAa = 12.1 mg/L

June
Chronic WLA: Ce = ((1.54 + 0.0)1.3 – (0.0 * 0.01)) / 1.54 Ce = 1.3
Acute WLA: Ce = ((1.54 + 0.0)10.1 – (0.0 * 0.01)) / 1.54 Ce = 10.1
AML = WLAc = 1.3 mg/L
MDL = WLAa = 10.1 mg/L

July
Chronic WLA: Ce = ((1.54 + 0.0)0.9 – (0.0 * 0.01)) / 1.54 Ce = 0.9
Acute WLA: Ce = ((1.54 + 0.0)8.4 – (0.0 * 0.01)) / 1.54 Ce = 8.4
AML = WLAc = 0.9 mg/L
MDL = WLAa = 8.4 mg/L

August
Chronic WLA: Ce = ((1.54 + 0.0)0.9 – (0.0 * 0.01)) / 1.54 Ce = 0.9
Acute WLA: Ce = ((1.54 + 0.0)8.4 – (0.0 * 0.01)) / 1.54 Ce = 8.4
AML = WLAc = 0.9 mg/L
MDL = WLAa = 8.4 mg/L

September
Chronic WLA: Ce = ((1.54 + 0.0)1.2 – (0.0 * 0.01)) /1.54 Ce = 1.8
Acute WLA: Ce = ((1.54 + 0.0)8.4 – (0.0 * 0.01)) / 1.54 Ce = 8.4
AML = WLAc = 1.2 mg/L
MDL = WLAa = 8.4 mg/L

October
Chronic WLA: Ce = ((1.54 + 0.0)1.2 – (0.0 * 0.01)) / 1.54 Ce = 1.8
Acute WLA: Ce = ((1.54 + 0.0)8.4 – (0.0 * 0.01)) / 1.54 Ce = 8.4
AML = WLAc = 1.8 mg/L
MDL = WLAa = 8.4 mg/L

November
Chronic WLA: Ce = ((1.54 + 0.0)2.4 – (0.0 * 0.01)) / 1.54 Ce = 2.4
Acute WLA: Ce = ((1.54 + 0.0)8.4 – (0.0 * 0.01)) /1.54 Ce = 8.4
AML = WLAc = 2.4 mg/L
MDL = WLAa = 8.4 mg/L

December
Chronic WLA: Ce = ((1.54 + 0.0)2.7 – (0.0 * 0.01)) / 1.54 Ce = 2.7
Acute WLA: Ce = ((1.54 + 0.0)10.1 – (0.0 * 0.01)) / 1.54 Ce = 10.1
AML = WLAc = 2.7 mg/L
MDL = WLAa = 10.1 mg/L

- **Total Ammonia Nitrogen.** Monitoring requirement only. Monitoring for ammonia is included to determine whether "reasonable potential" to exceed water quality standards exists after the discharge begins.

- **Oil & Grease.** Conventional pollutant, [10 CSR 20-7.031(4)(B)]. Waters shall be free from oil, scum, and floating debris in sufficient amounts to be unsightly or prevent full maintenance of beneficial uses.

- **pH.** The preferred alternative selected for ammonia treatment serves as the base case for pH with effluent limit range of 6.5-9.0 SU. No mixing zone is allowed due to the classification of the receiving stream, therefore the water quality standard must be met at the outfall.

GENERAL ASSUMPTIONS OF THE WATER QUALITY AND ANTIDEGRADATION REVIEW

A. A Water Quality and Antidegradation Review (WQAR) assumes that [10 CSR 20-6.010(2) Continuing Authorities and 10 CSR 20-6.010(4)(A)5.B., consideration for no discharge] has been or will be addressed in a Missouri State Operating Permit or Construction Permit Application.
B. A WQAR does not indicate approval or disapproval of alternative analysis as per [10 CSR 20-7.015(4) Losing Streams], and/or any section of the effluent regulations.
C. Changes to Federal and State Regulations (FSR) made after the drafting of this WQAR may alter Water Quality Based Effluent Limits (WQBEL).
D. Effluent limitations derived from FSR may be WQBEL or Effluent Limit Guidelines (ELG).
E. WQBEL supersede ELG only when they are more stringent. Mass limits derived from technology based limits are still appropriate.
F. A WQAR does not allow discharges to waters of the State, and shall not be construed as a National Pollution Discharge Elimination System (NPDES) or Missouri State Operating Permit to discharge or a permit to construct, modify, or upgrade.
G. Limitations and other requirements in a WQAR may change as Water Quality Standards (WQS), Methodology, and Implementation procedures change.
H. Nothing in this WQAR removes any obligations to comply with county or other local ordinances or restrictions.
I. This Antidegradation Review is based on the information provided by the facility and is not a comprehensive review of the proposed treatment technology. If the review engineer determines the proposed technology will not consistently meet proposed effluent limits, the permittee will be required to revise their Antidegradation Report.

ANTIDEGRADATION REVIEW PRELIMINARY DETERMINATION

The proposed new facility discharge location will result in a reduction by 10 percent or more of the pollutant assimilative capacity of the unnamed tributary to Davis Branch. Construction of an Aqua CamD SBR system was chosen as the base case, due to the familiarity of this system with the operator, and the comparable ease of installation. The design flow numbers are conservative, and the system manufacturer recommends the CamD design for systems of this design flow or smaller. Likewise, the cost of maintenance in the larger SBR system is potentially much higher than anticipated due to the need for more pipes and moving parts. While the SBR sized for mussel ammonia is economically feasible, due to the nature of this project, and the timeline for full subdivision build-out, this option was not selected. Non discharging alternatives including surface land application and regionalization were evaluated but found to be not practicable. The cost effectiveness of the other technology evaluated, SBR with increased aeration, and extended aeration facility, were not found to be cost effective and were not selected.

Per the requirements of the AIP, the effluent limits in this review were developed to be protective of beneficial uses and to attain the highest statutory and regulatory requirements. The department has determined that the submitted review is sufficient and meets the requirements of the AIP. No further analysis is needed for this discharge.

Reviewer: Alex Bielefeldt
Date: January 2025
Reviewer: Cindy LePage, P.E.

APPENDIX A: MAP OF DISCHARGE LOCATION

APPENDIX B: GEOHYDROLOGIC EVALUATION

MISSOURI DEPARTMENT OF NATURAL RESOURCES

Michael L. Parson
Governor

Dru Buntin
Director

LWE25030
Cape Girardeau County

October 25, 2024

Brian Strickland
113 West Main Street, Suite 1
Jackson, MO 63755

RE: King's Landing WWTF

Dear Brian Strickland:

On September 11, 2024, the Missouri Geological Survey received a request to perform a geohydrologic evaluation for the above referenced project located in Cape Girardeau County. Included with this letter is a report that details the geologic and hydrologic conditions at the site and the potential for groundwater contamination in the event of wastewater treatment failure.

Thank you for the evaluation request. If you are in need of further assistance or have questions regarding the report, please contact our office at P.O Box 250, Rolla, Mo 65402-0250, by telephone at 573-368-2100 or gspeg@dnr.mo.gov.

Sincerely,

MISSOURI GEOLOGICAL SURVEY

Andrew Herrera
Geologist
Environmental Geology Section

c: Brandon Williams
WPP
Southeast Regional Office

Missouri Department Of Natural Resources
Missouri Geological Survey
Geological Survey Program
Environmental Geology Section

Project ID Number
LWE25030
County
Cape Girardeau County

Request Details

Project: King's Landing WWTF

Legal Description: 21 T31N R14E
Quadrangle: CAPE GIRARDEAU
Latitude: 37 20 33.09
Longitude: -83 30 17.62

Organization Official
Name: Brandon Williams
Address: 2985 Boutin Drive
City: Cape Girardeau
State: MO Zip: 63701
Phone: 573-335-3382
Email: bowconstruction@aol.com

Preparer
Name: Brian Strickland
Address: 113 West Main Street, Suite 1
City: Jackson
State: MO Zip: 63755
Phone: 573-243-4080
Email: bstrick@stricklandengineering.com

Project Details

Report Date:
Date of Field Visit: 10/22/2024

Previous Reports: Not Applicable

Facility Type
- [X] Mechanical treatment plant
- [ ] Recirculating filter bed
- [ ] Land application
- [ ] Lagoon or storage basin
- [ ] Subsurface soil absorption system
- [ ] Lagoon or storage basin W/Land App
- [ ] Lagoon or storage basin W/SSAS
- [ ] Other type of facility

Type of Waste
- [ ] Animal
- [X] Human
- [ ] Process or industrial
- [ ] Leachate
- [ ] Other waste type

Funding Source
- [X] IWT
- [ ] WWL-SRF

Additional Information
- [ ] Plans were submitted
- [ ] Site was investigated by NRCS
- [ ] Soil or geotechnical data were submitted

Geologic Stream Classification: [X] Gaining [ ] Losing [ ] No discharge

Overall Geologic Limitations
- [X] Slight
- [ ] Moderate
- [ ] Severe

Collapse Potential
- [X] Not applicable
- [ ] Slight
- [ ] Moderate
- [ ] Severe

Topography
- [X] <4%
- [ ] 4% to 8%
- [ ] 8% to 15%
- [ ] >15%

Landscape Position
- [ ] Broad uplands
- [ ] Floodplain
- [ ] Ridgetop
- [ ] Alluvial plain
- [ ] Hillslope
- [X] Terrace
- [ ] Narrow ravine
- [ ] Sinkhole

Bedrock: The uppermost bedrock is the Devonian-age Bailey Formation.

Surficial Materials: The surficial materials are clay loam and silt loam.

Missouri Department Of Natural Resources
Missouri Geological Survey
Geological Survey Program
Environmental Geology Section

Project ID Number
LWE25030
County
Cape Girardeau County

Recommended Construction Procedures for Earthen Facility	Determine Overburden Properties	Determine Hydrologic Conditions
	☐ Particle size analysis	☐ Groundwater elevation
☐ Installation of clay pad and Compaction	☐ Atterberg limits	☐ Direction of groundwater flow
☐ Diversion of subsurface flow	☐ 95% Max. dry density test method	☐ 25-Year flood level
☐ Artificial sealing	☐ Overburden thickness	☐ 100-Year flood level
☐ Rock excavation	☐ Permeability coefficient-undisturbed	
☐ Limit excavation depth	☐ Permeability coefficient-remolded	

Remarks:

On October 22, 2024, a geologist with the Missouri Geological Survey conducted a geohydrologic evaluation for a proposed mechanical treatment plant located at approximately, 89°30'18"W 37°20'33"N, in Cape Girardeau, Missouri. The proposed facility is approximately 1 acre in size and will discharge wastewater into a tributary of Juden Creek. The purpose of the site visit is to observe the geologic and hydrologic characteristics and to determine the potential for groundwater contamination in the event of wastewater treatment failure.

Surface water runoff from the site generally drains east to a tributary of Juden Creek. A portion of Juden Creek was evaluated and classified as gaining for approximately 2 miles downstream from the proposed discharge point.

The surficial materials onsite were measured using a handheld soil probe. Surficial materials were measured to a depth of approximately 3.8 feet. The surficial materials consist of silt loam and clay loam and exhibit low to moderate permeability. According to nearby geologic well log data, surficial materials may be up to 30 feet thick.

Bedrock was not observed onsite, however; according to nearby geologic well data and areal geologic mapping, the uppermost bedrock is the Devonian-age Bailey Formation comprised of thinly bedded limestone intercalated with shale. This bedrock exhibits low to moderate primary permeability and moderate to high permeability due to faulting in the area.

There are no known sinkholes or springs located within 1 mile of the facility. However, the site is located within the Jackson Fault Zone. There are various faults within 1 mile of the site. These faults may provide preferential pathways for water to flow into the subsurface.

Based on the characteristics observed, the site receives a slight overall geologic limitations rating. In the event of storage basin collapse or wastewater treatment failure, local, shallow groundwater resources, and surface waters of the tributary of Juden Creek and Juden Creek, may be adversely impacted.

APPENDIX C: NATURAL HERITAGE REVIEW

Missouri Department of Conservation

Missouri Department of Conservation's Mission is to protect and manage the forest, fish, and wildlife resources of the state and to facilitate and provide opportunities for all citizens to use, enjoy and learn about these resources.

Natural Heritage Review Level Three Report: Species Listed Under the Federal Endangered Species Act

There are records of species listed under the Federal Endangered Species Act, and possibly also records for species listed Endangered by the state, or Missouri Species and/or Natural Communities of Conservation Concern within or near the the defined Project Area. Please contact the U.S. Fish and Wildlife Service and the Missouri Department of Conservation for further coordination.

Foreword: Thank you for accessing the Missouri Natural Heritage Review Website developed by the Missouri Department of Conservation with assistance from the U.S. Fish and Wildlife Service, the U.S. Army Corps of Engineers, Missouri Department of Transportation and NatureServe. The purpose of this report is to provide information to federal, state and local agencies, organizations, municipalities, corporations, and consultants regarding sensitive fish, wildlife, plants, natural communities, and habitats to assist in planning, designing, and permitting stages of projects.

PROJECT INFORMATION

Project Name and ID Number: King's Landing WWTF #15209
User Project Number: 24-183
Project Description: Construction of a new wastewater treatment facility for a residential development in Cape Girardeau County. Discharge from the WWTF will be to the highway ditch tributary to Juden Creek.
Project Type: Waste Transfer, Treatment, and Disposal, Liquid waste/Effluent, Wastewater treatment plant, Construction or expansion
Contact Person: Brian Strickland
Contact Information: bstrick@stricklandengineering.com or 5732434080

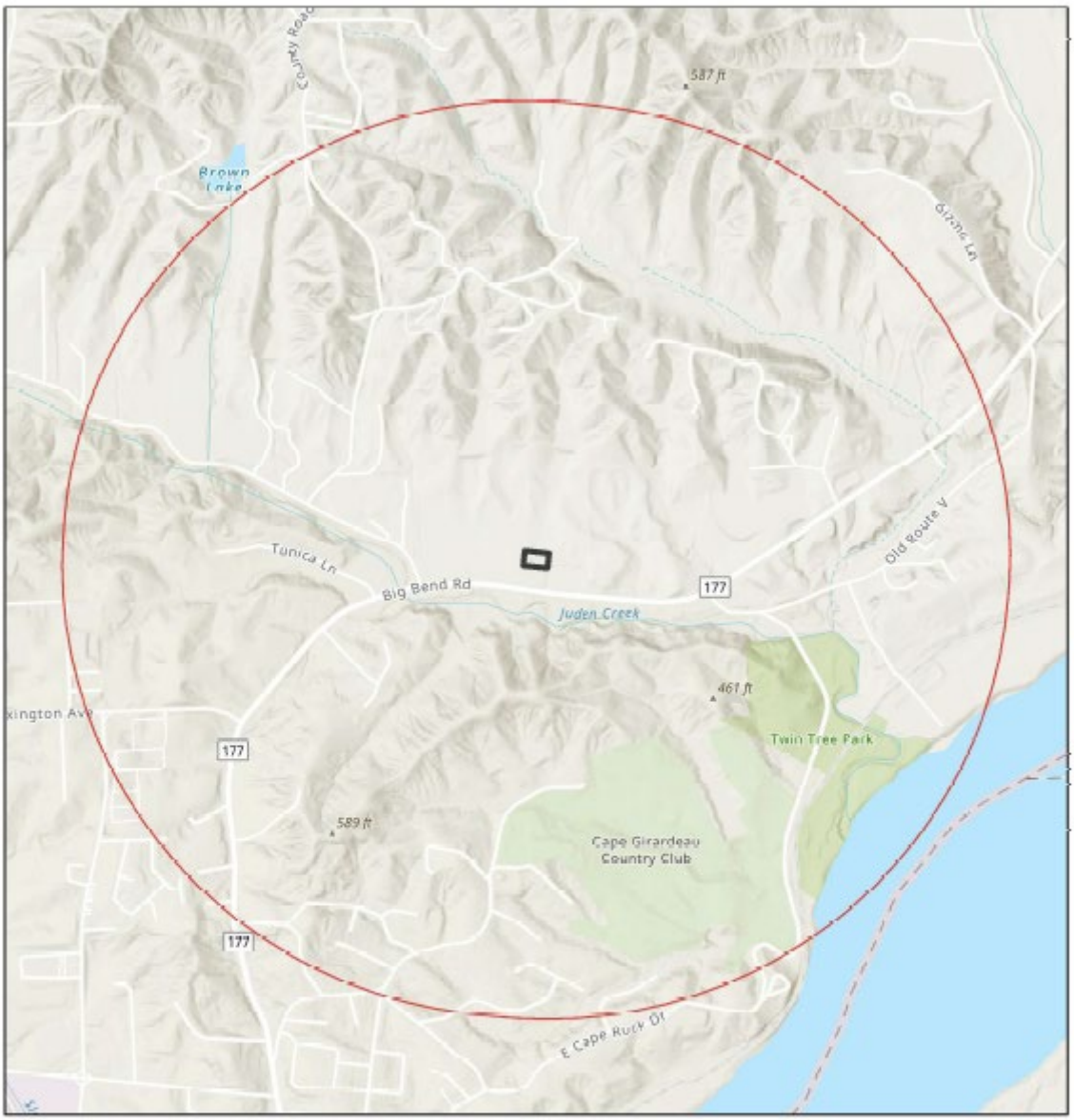
Disclaimer: This NATURAL HERITAGE REVIEW REPORT identifies if a species or natural community tracked by the Natural Heritage Program is known to occur within or near the project area submitted, and shares recommendations to avoid or minimize project impacts to sensitive species or natural habitats. Incorporating information from the Natural Heritage Program into project plans is an important step in reducing impacts to Missouri's sensitive natural resources. If an occurrence record is present, or the proposed project might affect federally listed species, the user must contact the Department of Conservation or U.S. Fish and Wildlife Service for more information.

This Natural Heritage Review Report is not a site clearance letter for the project. Rather, it identifies public lands and records of sensitive resources located close to and/or potentially affected by the proposed project. If project plans or location change, this report may no longer be valid. Because land use conditions change and animals move, the existence of an occurrence record does not mean the species/habitat is still present. Therefore, reports include information about records near but not necessarily on the project site. Lack of an occurrence record does not mean that a sensitive species or natural community is not present on or near the project area. On-site verification is the responsibility of the project. However, the Natural Heritage Program is only one reference that should be used to evaluate potential adverse project impacts and additional information (e.g. wetland or soils maps, on-site inspections or surveys) should be considered. Reviewing current landscape and habitat information, and species' biological characteristics would additionally ensure that Missouri Species of Conservation Concern are appropriately identified and addressed in planning efforts.

U.S. Fish and Wildlife Service – Endangered Species Act (ESA) Coordination: Lack of a Natural Heritage Program occurrence record for federally listed species in your project area does not mean the species is not present, as the area may never have been surveyed. Presence of a Natural Heritage Program occurrence record does not mean the project will result in negative impacts. This report does not fulfill Endangered Species Act consultation with the U.S. Fish and Wildlife Service (USFWS) for listed species. Direct contact with the USFWS may be necessary to complete consultation and it is required for actions with a federal connection, such as federal funding or a federal permit; direct contact is also required if ESA concurrence is necessary. Visit IPaC: Home (fws.gov) to initiate USFWS Information for Planning and Conservation (IPaC) consultation. Contact the Columbia Missouri Ecological Field Services Office (573-234-2132, or by mail at 101 Park Deville Drive, Suite A, Columbia, MO 65203) for more information.

Transportation Projects: If the project involves the use of Federal Highway Administration transportation funds, these recommendations may not fulfill all contract requirements. Please contact the Missouri Department of Transportation at 573-526-4778 or visit Home Page | Missouri Department of Transportation (modot.org) for additional information on recommendations.

King's Landing WWTF



September 11, 2024

1:19,471

0 0.15 0.3 0.6 mi

0 0.25 0.5 1 km

Buffered Project Boundary

Project Boundary

Missouri Dept. of Conservation, Missouri DNR, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS, Esri, NASA, NGA, USGS, FEMA

Species or Communities of Conservation Concern within the Area:

There are records of species listed under the Federal Endangered Species Act, and possibly also records for species listed Endangered by the state, or Missouri Species and/or Natural Communities of Conservation Concern within or near the defined Project Area. Please contact the U.S. Fish and Wildlife Service and the Missouri Department of Conservation for further coordination.

Email (preferred): NaturalHeritageReview@mdc.mo.gov
MDC Natural Heritage Review
Science Branch
P.O. Box 180
Jefferson City, MO
65102-0180
Phone: 573-522-4115 ext. 3182

U.S. Fish and Wildlife Service
Ecological Service
101 Park Deville Drive
Suite A
Columbia, MO
65203-0007
Phone: 573-234-2132

Other Special Search Results:

The project occurs on or near public land, Juden Creek CA, please contact MDC.

Your project is near a designated Natural Area . Please contact Missouri Department of Conservation (NaturalHeritageReview@mdc.mo.gov) for further coordination.

Project Type Recommendations:
Waste Transfer, Treatment and Disposal -Wastewater treatment plant: New or Maintenance; Clean Water Act permits issued by other agencies regulate both construction and operation of wastewater systems, and provide many important protections for fish and wildlife resources throughout the project area and at some distance downstream. Fish and wildlife almost always benefit when unnatural pollutants are removed from water, and concerns are minimal if construction is managed to minimize erosion and sedimentation/runoff to nearby streams and lakes, including adherence to any Clean Water Act permit conditions.
Revegetate disturbed areas to minimize erosion using native plant species compatible with the local landscape and wildlife needs. Annual ryegrass may be combined with native perennials for quicker green-up. Avoid aggressive exotic perennials such as crownvetch and sericea lespedeza. Please see Best Management Practices for Construction and Development Projects Affecting Missouri Rivers and Streams (mo.gov).

Project Location and/or Species Recommendations:

Endangered Species Act Coordination - If this project has the potential to alter habitat (e.g. tree removal, projects in karst habitat) or cause direct mortality of bats, please coordinate directly with U.S. Fish and Wildlife Service (Ecological Services, 101 Park Deville Drive, Suite A, Columbia, Missouri 65203-0007; Phone 573-234-2132 Ext. 100 for Ecological Services) for further coordination under the Endangered Species Act. Indiana bats *(Myotis sodalis*, federal- and state-listed endangered) and **Northern long-eared bats** (*Myotis septentrionalis,* federal-listed threatened) may occur near the project area. Both of these species of bats hibernate during winter months in caves and mines. During the summer months, they roost and raise young under the bark of trees in wooded areas, often riparian forests and upland forests near perennial streams. During project activities, avoid degrading stream quality and where possible leave snags standing and preserve mature forest canopy. Do not enter caves known to harbor Indiana bats or Northern long-eared bats, especially from September to April.

Bald Eagle: The project location submitted and evaluated is within the geographic range of nesting Bald Eagles in Missouri. Bald Eagles (*Haliaeetus leucocephalus*) may nest near streams or water bodies in the project area. Nests are large and fairly easy to identify. Adults begin nesting activity in late December and January and young birds leave the nest in late spring to early summer. While no longer listed as endangered, eagles continue to be protected by the federal government under the Bald and Golden Eagle Protection Act. Work managers should be alert for nesting areas within 1500 meters of project activities, and follow federal guidelines at: Do I need an eagle take permit? | U.S. Fish & Wildlife Service (fws.gov) if eagle nests are seen.

Interior Least Tern: The project location submitted and evaluated occurs within the known range of the Interior Least Tern in Missouri. Interior Least Terns (*Sterna antillarum athalassos,* federally and state listed endangered) nest and forage along the Mississippi River, and sometimes along the adjacent floodplain, from St. Louis to the southern boundary of the state. Habitat loss and diminishing water quality can impact least tern populations. See Interior Least Tern Best Management Practices (mo.gov) for best management recommendations.

Karst: This county has known karst geologic features (e.g., caves, springs, and sinkholes, all characterized by subterranean water movement). Few karst features are recorded in Natural Heritage records, and ones not noted here may be encountered at the project site or affected by the project. Cave fauna (many of which are Species of Conservation Concern) are influenced by changes to water quality; please check your project site for any karst features and make every effort to protect groundwater in the project area. Additional information and specific recommendations are available at Management Recommendations for Construction and Development Projects Affecting Missouri Karst Habitat (mo.gov).

Pallid Sturgeon: The project location submitted and evaluated is located within or adjacent to the Mississippi or Missouri rivers. Pallid Sturgeons (*Scaphirhynchus albus*, federal- and state-listed endangered) are big river fish that range widely in the Mississippi and Missouri River system (including parts of some major tributaries). Any project that modifies big river habitat or impacts water quality should consider the possible impact to pallid sturgeon populations. See Pallid Sturgeon Best Management Practices (mo.gov) for Best Management Practices. Additional coordination with the U.S. Fish and Wildlife Service under the Endangered Species Act may be necessary (U.S. Fish and Wildlife Service, Ecological Services, 101 Park DeVille Drive, Suite A, Columbia, Missouri 65203-0007; phone 573-234-2132.)

Invasive exotic species are a significant issue for fish, wildlife and agriculture in Missouri. Seeds, eggs, and larvae may be moved to new sites on boats or construction equipment. Please inspect and clean equipment thoroughly before moving between project sites. See Managing Invasive Species in Your Community | Missouri Department of Conservation (mo.gov) for more information.

- Remove any mud, soil, trash, plants or animals from equipment before leaving any water body or work area.
- Drain water from boats and machinery that have operated in water, checking motor cavities, live-well, bilge and transom wells, tracks, buckets, and any other water reservoirs.
- When possible, wash and rinse equipment thoroughly with hard spray or HOT water (>140° F, typically available at do-it-yourself car wash sites), and dry in the hot sun before using again.

Streams and Wetlands – Clean Water Act Permits: Streams and wetlands in the project area should be protected from activities that degrade habitat conditions. For example, soil erosion, water pollution, placement of fill, dredging, in-stream activities, and riparian corridor removal, can modify or diminish aquatic habitats. Streams and wetlands may be protected under the Clean Water Act and require a permit for any activities that result in fill or other modifications to the site. Conditions provided within the U.S. Army Corps of Engineers (USACE) Clean Water Act Section 404 permit (Kansas City District Regulatory Branch (army.mil)) and the Missouri Department of Natural Resources (DNR) issued Clean Water Act Section 401 Water Quality Certification (Section 401 Water Quality Certification | Missouri Department of Natural Resources (mo.gov)), if required, should help minimize impacts to the aquatic organisms and aquatic habitat within the area. Depending on your project type, additional permits may be required by the Missouri Department of Natural Resources, such as permits for stormwater, wastewater treatment facilities, and confined animal feeding operations. Visit Wastewater Permits | Missouri Department of Natural Resources (mo.gov) for more information on DNR permits. Visit both the USACE and DNR for more information on Clean Water Act permitting.

For further coordination with the Missouri Department of Conservation and the U.S. Fish and Wildlife Services, please see the contact information below:

Email (preferred): NaturalHeritageReview@mdc.mo.gov
MDC Natural Heritage Review
Science Branch
P.O. Box 180
Jefferson City, MO
65102-0180
Phone: 573-522-4115 ext. 3182

U.S. Fish and Wildlife Service
Ecological Service
101 Park Deville Drive
Suite A
Columbia, MO
65203-0007
Phone: 573-234-2132

Miscellaneous Information
FEDERAL Concerns are species/habitats protected under the Federal Endangered Species Act and that have been known near enough to the project site to warrant consideration. For these, project managers must contact the U.S. Fish and Wildlife Service Ecological Services (101 Park Deville Drive Suite A, Columbia, Missouri 65203-0007; Phone 573-234-2132; Fax 573-234-2181) for consultation.
STATE Concerns are species/habitats known to exist near enough to the project site to warrant concern and that are protected under the Wildlife Code of Missouri (RSMo 3 CSR 1 0). "State Endangered Status" is determined by the Missouri Conservation Commission under constitutional authority, with requirements expressed in the Missouri Wildlife Code, rule 3CSR 1 0-4.111. Species tracked by the Natural Heritage Program have a "State Rank" which is a numeric rank of relative rarity. Species tracked by this program and all native Missouri wildlife are protected under rule 3CSR 10-4.110 General Provisions of the Wildlife Code.

See Missouri Species and Communities of Conservation Concern Checklist (mo.gov) for a complete list of species and communities of conservation concern. Detailed information about the animals and some plants mentioned may be accessed at Mofwis Search Results. Please contact the Missouri Department of Conservation to request printed copies of any materials linked in this document.

Missouri Department of Conservation

Natural Heritage Review Report

November 21, 2024

Science Branch
P. O. Box 180
Jefferson City, MO 65102
Prepared by: Dillon Freiburger
NaturalHeritageReview@mdc.mo.gov
(573) 522 - 4115 ext. 3182

Brian Strickland
Strickland Engineering
bstrick@stricklandengineering.com

NHR ERT ID:	15209	NHR ERT Level:	3
Project type:	Waste Transfer, Treatment, and Disposal, Liquid waste/Effluent, Wastewater treatment plant, Construction or		
Location/Scope:	T31NR14ES21		
County:	Cape Girardeau		
Project Title:	King's Landing WWTF		
Query received:	11/13/2024		

This NATURAL HERITAGE REVIEW is not a site clearance letter. Rather, it identifies public lands and records of sensitive resources located close to and/or potentially affected by the proposed project. If project plans or location change, this report may no longer be valid. Because land use conditions change and animals move, the existence of an occurrence record does not mean the species/habitat is still present. Therefore, reports include information about records near but not necessarily on the project site. Lack of an occurrence record does not mean that a sensitive species or natural community is not present on or near the project area. On-site verification is the responsibility of the project. These records serve as one reference and additional information (e.g. wetland or soils maps, on-site inspections or surveys) should be considered. Look for additional information about the biological and habitat needs of records listed to avoid or minimize impacts. More information is at Natural Areas | Missouri Department of Conservation (mo.gov) and Missouri Fish and Wildlife Information System (MOFWIS).

Level 3: Records of federal-listed (also state-listed) species or critical habitats near the project site:

Natural Heritage records identify the Mississippi River within 1 mile of the project area:

- **Mississippi River:** The Mississippi River (together with its tributary mouths) is home to many aquatic species of state and federal concern, including federal-listed Pallid Sturgeon, several mussel species in the pooled reaches upstream of the Missouri confluence and mainstem; and state-listed Lake Sturgeon, and Flathead Chubs; and Interior least terns in the lower Mississippi. All these are sampled at points but must be assumed to be present in suitable habitats through extended river reaches. Bluffs, banks, and floodplains may also include habitat used by listed Gray bats, Indiana bats and Bald Eagles.
  - Terrestrial projects that manage construction and include operation plans to avoid runoff of sediment or pollutants are unlikely to affect the aquatic species.
  - Regulations enforced by other agencies to protect water quality and human health are generally adequate to protect the needs of wildlife as well.
  - Projects that place fill in or discharge water to the river are subject to federal permits, and strict observance of conditions required in those permits is important to minimize risk of damage to endangered species.

  See General Recommendations for additional information on minimizing impacts to aquatic resources.

FEDERAL LIST species/habitats are protected under the Federal Endangered Species Act. **Contact U.S. Fish & Wildlife Service** (101 Park Deville Drive Suite A, Columbia, Missouri 65203-0007; 573-234-2132) for Endangered Species Act coordination and concurrence information).

Level 2: Records of state-listed (not federal-listed) endangered species AND / OR state-ranked (not state-listed endangered) species and natural communities of conservation

concern. The Department tracks these species and natural communities due to population declines and/or apparent vulnerability.

Natural Heritage records indicate the following state-ranked species near the project area:

Scientific Name	Common Name	State Rank	Proximity (miles)	Primary Habitat
Ictinia mississippiensis	Mississippi Kite	S3	<2	Forest bottomland, Forest upland, Woodland
Urtica chamaedryoides	Weak Nettle	S1	<5	Forest bottomland, Swamp
Ochrotomys nuttalli	Golden Mouse	S3	<1	Forest bottomland, Moist edge/mudflat, Old field/shrub, Forest upland
Taxidea taxus	American Badger	S3	<1	Grassland matrix, Savanna pasture/orchard, Row/close grown crops
Epifagus virginiana	Beech Drops	S2	<1	Forest upland
Obolaria virginica	Virginia Pennywort	S2	<1	Forest upland
Mesic loess/glacial till forest		S3	<1	Forest upland

State Rank Definitions:

- S1: Critically imperiled in the state because of extreme rarity of or because of some factor(s) making it especially vulnerable to extirpation from the state. Typically, 5 or fewer occurrences or very few remaining individuals (<1,000).
- S2: Imperiled in the state because of rarity or because of some factor(s) making it very vulnerable to extirpation from the state (6 to 20 occurrences or few remaining individuals).
- S3: Vulnerable in the state either because rare and uncommon, or found only in a restricted range (even if abundant at some locations), or because of other factors making it vulnerable to extirpation. Typically 21 to 100 occurrences or between 3,000 and 10,000 individuals.
- S4: Uncommon but not rare, and usually widespread in the nation or state. Possible cause of long-term concern. Usually more than 100 occurrences and more than 10,000 individuals.
- S#S#: Range Rank: A numeric range rank (e.g., S2S3) is used to indicate the range of uncertainty about the exact status.
- ?: Denotes inexact or uncertain numeric rank.
- SU: Currently unrankable due to lack of information or due to substantially conflicting information about status or trends.

There are no regulatory requirements associated with this status, however we encourage voluntary stewardship to minimize the risk of further decline that could lead to listing.

STATE ENDANGERED species are protected under the Wildlife Code of Missouri (3CSR10-4.111).
See the Missouri Species And Communities Of Conservation Concern Checklist (mo.gov) for a complete list.

General recommendations related to this project or site, or based on information about the historic range of species (unrelated to any specific Natural Heritage records):

- **Wastewater:** Clean Water Act permits issued by other agencies (Missouri DNR or US Army Corps of Engineers) regulate both construction and operation of wastewater systems, and provide many

important protections for fish and wildlife resources throughout the project area and at some distance downstream. Fish and wildlife almost always benefit when unnatural pollutants are removed from water, and concerns are minimal if construction is managed to minimize erosion and sedimentation/runoff to nearby streams and lakes, including adherence to any Clean Water Act permit conditions.

- Revegetation of disturbed areas is recommended to minimize erosion, as is restoration with of native plant species compatible with the local landscape and for wildlife needs. Annuals like ryegrass may be combined with native perennials for quicker green-up. Avoid aggressive exotic perennials such as crown vetch and sericea lespedeza.
- Please see Best Management Practices for Construction and Development Projects Affecting Missouri Rivers and Streams (mo.gov).

➢ **Indiana Bats and Little Brown Bats** occur in Cape Girardeau County and could occur in the project area. These species have been significantly impacted by White-nose syndrome. During project activities, avoid degrading stream quality and where possible leave snags standing and preserve mature forest canopy. Do not enter caves known to harbor these species, especially from September to April. **If any trees need to be removed by your project, please contact the U.S. Fish and Wildlife Service (Ecological Services, 101 Park Deville Drive, Suite A, Columbia, Missouri 65203-0007; Phone 573-234-2132 Ext. 100) for further coordination under the Endangered Species Act.**

  - Indiana Bats *(Myotis sodalis*, federal and state-listed endangered) hibernate during winter months in caves and mines. During the summer months, they roost and raise young under the bark of trees in riparian forests and upland forests near perennial streams.

➢ **Karst:** Cape Girardeau County has known karst geologic features (e.g. caves, springs, and sinkholes, all characterized by subterranean water movement). Few karst features are recorded in Natural Heritage records, and ones not noted here may be encountered at the project site or affected by the project. Cave fauna (many of which are species of conservation concern) are influenced by changes to water quality, so check your project site for any karst features and make every effort to protect groundwater in the project area. Please see Management Recommendations for Construction and Development Projects Affecting Missouri Karst Habitat (mo.gov).

➢ Invasive exotic species are a significant issue for fish, wildlife and agriculture in Missouri. Seeds, eggs, larvae, and aquatic plant material may be moved to new sites on boats or construction equipment, so inspect and clean equipment thoroughly before moving between project sites.

- Remove any mud, soil, trash, plants (or plant material) or animals from equipment before leaving any water body or work area.
- Drain water from boats and machinery that has operated in water, checking motor cavities, live-well, bilge and transom wells, tracks, buckets, and any other water reservoirs.
- When possible, wash and rinse equipment thoroughly with hard spray or HOT water (≥140° F, typically available at do-it-yourself carwash sites), and dry in the hot sun before using again.

These recommendations are ones project managers might prudently consider based on a general understanding of species needs and landscape conditions. Natural Heritage records largely reflect sites visited by specialists in the last 30 years. Many privately owned tracts have not been surveyed and could host remnants of species once but no longer common.

APPENDIX D: STREAM STATS

Low-Flow Statistics

Low-Flow Statistics Parameters [LowFlow Region 2 SIR 2013 5090]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	0.079	square miles	0.21	7380
STREAM_VARG	Streamflow Variability Index from Grid	0.5	dimensionless	0.273	0.926

Low-Flow Statistics Disclaimers [LowFlow Region 2 SIR 2013 5090]

One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors.

Low-Flow Statistics Flow Report [LowFlow Region 2 SIR 2013 5090]

Statistic	Value	Unit
1 Day 10 Year Low Flow	0.000255	ft^3/s
2 Day 10 Year Low Flow	0.000296	ft^3/s
3 Day 10 Year Low Flow	0.000328	ft^3/s
7 Day 10 Year Low Flow	0.000421	ft^3/s
10 Day 10 Year Low Flow	0.00047	ft^3/s
30 Day 10 Year Low Flow	0.000654	ft^3/s
60 Day 10 Year Low Flow	0.000911	ft^3/s

Low-Flow Statistics Citations