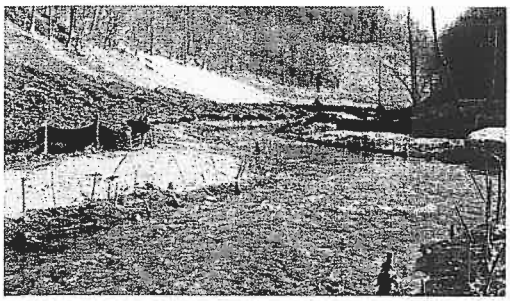
# Proposal for
# Stream Restoration Services

## 1.0 Introduction

Fuller, Mossbarger, Scott and May Engineers, Inc. (FMSM) is a leader in innovative stream restoration design. Our cutting-edge approach utilizes specially designed software and extensive expertise in the design and implementation of Natural Channel Design and ecosystem restoration projects. Our forward-thinking engineers are continually employing the latest proven technologies on our projects, while remaining committed to our core beliefs in the value of:

- Designing stable streams;
- Enhancing the environment; and
- Promoting environmentally sound river recreation



*FMSM Restoration Design Being Constructed in Eastern Kentucky*

Our experience includes planning level reonnaissance, preliminary and final designs, regulatory permitting, and design support during construction. Projects have included stream restoration, bank stabilization, flood reduction, emergency repair of collapsed banks, stream relocation, riparian corridor ecosystem revitalization, and greenways designs.

We have conducted hundreds of miles of stream restoration and assessments throughout the United States. We have developed solutions to complex, dynamic stream system problems that work in conjunction with natural ecological forces. We design cost effective solutions that are self-sustaining and enhance the environment.

In addition to our years of stream restoration experience, we are also familiar with the City of Mason, the topography of the region and local permitting authorities. FMSM has worked with the City of Mason on many projects, such as:

- City of Mason Utility Management System
- Upper Muddy Creek Watershed Assessments
- Fairway Drive Watershed Study
- Muddy Creek Detention Basin
- Heritage Oak Park Culvert Study
- Hydrologic/Hydraulic Plan Reviews

# 2.0 Understanding of the Project Requirements

Muddy Creek is an actively incising stream, which suffers the impacts of urbanization. Like most urban streams, a sanitary sewer is located in close proximity to the active channel, and due to erosion of the stream banks and channel incision, the sanitary sewer is exposed. Throughout the stream, there are numerous eroded banks, which are unstable and deliver significant volumes of sediment to the downstream reaches. These unstable eroding banks are primarily due to channel incision, high shear stresses associated with the urban hydrograph and lack of stable riparian buffers. Muddy Creek is currently going through a channel evolution process. The stream is trying to build back a bankfull channel at a lower elevation. We commend the City of Mason for considering the progressive use of natural channel design techniques to resolve these erosion issues, and we feel that this approach will be highly effective in stabilizing the stream. Our basic approach to stabilize Muddy Creek will be to study the stream evolution which is currently occurring and design a channel consistent with the final evolutionary stage the channel is seeking.

*Bank Erosion along Muddy Creek*

There are two reaches of stream to be restored as part of this project. The first reach of Muddy Creek is located between Mason-Montgomery Road and Kings Mill Road. Within this section, there are three main problem areas, which are primarily located in close proximity to road crossings and at meander bends in the channel. The second reach of stream is located at Overlook Drive. At this location, the stream is eroding into a terrace, and the slope appears to be unstable from a geotechnical perspective. Treatments that will be considered to restore and stabilize these reaches will include, plan, pattern and profile adjustments to the stream channel, the use of grade control to prevent further downcutting of the channel, and the use of soil bioengineering to stabilize the stream banks. Particular attention will be given to developing a design which enhances water quality while providing improved aquatic habitat potential.

Our proposed scope of work for this project includes the work elements described below:

- Preliminary Data Collection/Topographic Survey
- Geomorphic Assessment of Impacted Reaches
- Geomorphic Assessment of Reference Reach Sites
- Processing of Collected Data
- Geotechnical Slope Stability Analysis of the Terrace at Overlook Drive
- Hydrologic/Hydraulic Modeling
- Preparation of Preliminary Design Report
- Preparation of Natural Channel Design Plans/Specifications/Bid Package
- 404/401 Permitting
- Bid Phase Administration
- Construction Oversight/Inspection
- Meetings/Coordination

# 3.0 Muddy Creek Project Specific Scope of Work

Our approach to the restoration of Muddy Creek will focus on the stabilization and protection of existing sanitary sewer lines, reduction of erosion and sediment issues, stabilization of eroding banks and enhancement of the stream to promote aquatic habitat. These goals will be accomplished by a combination of methods, which will include enhancing the riparian corridor adjacent to the stream channel, bank stabilization, the use of grade control structures and improving the geomorphic functionality of the stream. The specific tasks proposed for this project are outlined below:

### Task 1 – Preliminary Data Collection/Topographic Survey

This task consists of collecting available data and conducting a preliminary review prior to initiating field work. Data to be reviewed include preliminary scoping information, USGS mapping, available USGS gage data, and GIS data. The site will also be surveyed to develop one-foot contour topographic mapping of the project area. Once all the data is obtained, and topographic mapping is prepared, the information will be reviewed by the design team.

### Task 2 – Geomorphic Assessment of Impacted Reaches

*FMSM Collects Geomorphic Data with a Team of Highly Trained Engineers*

The general conditions of Muddy Creek will be reviewed by conducting a geomorphic assessment of the impacted streams. The geomorphic assessment will include a thalweg profile throughout the impacted reaches, with particular attention given to the location of riffles, pools, runs and glides as well as the presence of bankfull indicators. The current conditions of the streams will be assessed using the Stream Visual Assessment Protocol technique developed by NRCS. In addition, a Pfankuch Channel Stability assessment will be determined using methodology developed by the U.S. Forest Service (and modified by Dave Rosgen to include characterization by stream type).

In addition to the thalweg profile, the geomorphic survey will include cross sections of at least one riffle and pool, and at least two Wolman pebble counts per stream type. The pebble counts obtained will be representative of the overall reach and bed material present at a riffle. A sieve sample from a gravel bar or depositional feature will also be obtained.

### Task 3 – Geomorphic Assessment of Reference Reach Sites

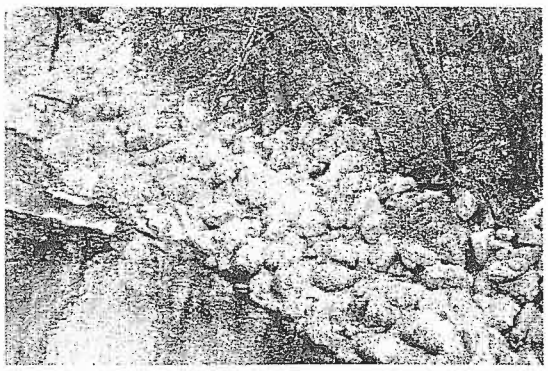
New channels designed using Natural Channel Design techniques will require a reference reach. A reference reach is a stream of the same stream type as the intended design which is preferably located in the same hydro-physiographic province, exhibits a stable planform, has a stable bed (is not aggrading or degrading), and is not subject to excessive erosion. Geomorphic measurements taken from these reaches will be used to develop dimensionless ratios for the design.

The geomorphic survey of the reference reach will include cross sections of at least two riffle and two pool locations, a longitudinal profile through two meander wavelengths (or a distance of approximately 20 bankfull widths), a Wolman pebble count for the reach and at a riffle area, and a sieve sample from a gravel bar. If possible, cross sections will also be obtained which are representative of a run and a glide. In addition, plan form measurements will be obtained to determine radius of curvature, belt width, and sinuosity of the reference reach.

For the purposes of this proposal, it is assumed that only one reference reach will be necessary for the design of the project.

**Task 4 – Processing of Collected Data**

Once field data collection is complete for both the impacted reaches and the reference reaches, the data will be processed using RIVERMorph® stream restoration software. The data will be used to complete a Rosgen Level II assessment of the project reach and reference reaches, classify the stream reaches, and develop dimensionless ratios for the natural channel design. This analysis will determine the properties of the impacted reach necessary to transport the sediment and water supply being delivered from the watershed and provide indications of the amount of departure from the reference condition.



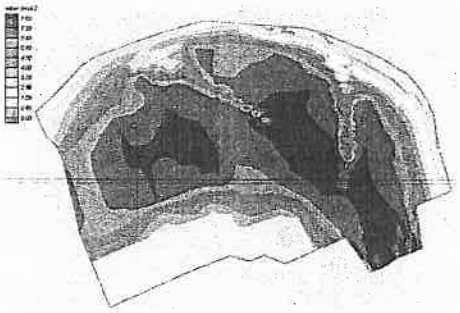
*Riprap and Concrete Stabilization of a Sanitary Sewer along Muddy Creek*

**Task 5 – Geotechnical Slope Stability Analysis**

The streambank (terrace) at Overlook Drive appears to be unstable. In order to evaluate the streambank, FMSM will advance three soil borings and will conduct a slope stability analysis. The results of the geotechnical study will be summarized in the Preliminary Design Report.

**Task 6 – Hydrologic/Hydraulic Modeling**

Watershed hydrology and hydraulics will be modeled to evaluate the effects of the project alternatives on flows, water surface elevations, velocities, shear stresses and stream power. All modeling will be performed using available HEC-RAS geometry files of existing conditions or new files created by our restoration team. Cross sections representative of proposed improvements will be altered or incorporated in the model and additional water surface profiles will be determined for the bankfull discharge, 10% chance and 1% chance floods. The results of the modeling will be presented in the design report.



*FMSM's River Restoration Engineers are Experts in All Types of Hydraulic Models, Including Two-Dimensional Analyses Like this Model of a Meander Restoration Project*

**Task 7 – Prepare Preliminary Design Report**

The information collected and analyzed as part of this project will be summarized in a preliminary design report. This document will describe the overall condition of the watershed, list and summarize available background information, present the results of the stream geomorphic assessments, geotechnical analysis, hydrologic/hydraulic analysis and sediment transport analysis. The report will also include a description of the proposed conceptual design alternatives, cost

estimates and provide a recommendation for the preferred alternative. The report will include CADD drawings illustrating the conceptual design of the recommended alternative.

**Task 8 – Prepare Natural Channel Design Plans/Specifications/Bid Package**

This task will consist of preparing a natural channel design of the selected restoration alternative. The new channels will be designed based on dimensionless ratios collected from reference reaches such that the channel will have sufficient shear stress to transport sediment delivered to the system (based on sediment transport competency equations). The Natural Channel Design will be performed using the RIVERMorph® software package.

Following the completion of design calculations, a set of drawings will be prepared which will include plan views that illustrate the proposed stream location and revegetation plan; proposed stream profile; typical cross sections of pools and riffles, and details. Cross sections will be prepared on 100-foot intervals from the topographic mapping developed for the site. All drawings will be drafted in AutoCAD or MicroStation format. A set of specifications and a bid form will also be prepared for the project. Lastly, a construction cost opinion will be prepared for each channel to be constructed.

**Task 9 – 404/401 Permitting**

This work will consist of developing supporting documentation and preparing the 404 and 401 permit applications for the project. The permit application will include 8 1/2 x 11- inch drawings of the natural channel design, a purpose and need statement, a USGS map of the site, and a summary of the proposed project. In addition, one set of the project plans will be submitted to the Ohio Environmental Protection Agency along with the 401 application and a copy of the 404 application. This proposal is based on one site meeting with regulatory agencies and up to six hours of effort to respond to permit questions.

*Cedar Grove - Preconstruction*

*Cedar Grove - One month old*

*Cedar Grove - Six months old*

**Task 10 – Bid Phase Administration**

FMSM will provide assistance during the bidding process, which will include attendance at the pre-bid meeting and assistance with the evaluation of bids received.

**Task 11 – Construction Phase Services**

We understand that FMSM will be requested to provide services during the construction phase of the project. This assistance will consist of meetings with the contractor and regulators to discuss the project, working with the contractor to review construction/installation techniques for the proposed stream restoration treatments and general construction reviews. An estimate of the cost to provide on-site monitoring is provided based on preliminary time estimates to complete construction. Services during the construction phase of the project will be paid based on actual hours worked using the rates provided in the attached derivation.

**Task 12 – Meetings & Coordination**

Throughout the project, several meetings with the City of Mason will be necessary as well as e-mail/telephone coordination and overall project management. Additionally, public meetings are a critical component to effectively implement a project. FMSM will work with the City of Mason to set up public meetings to discuss the proposed project. We will summarize readily-available information about the watershed and the proposed project though the use of maps and project plans. If requested by the City of Mason, we will prepare a presentation to illustrate the key issues, discuss geomorphic principles and illustrate the effects of restoration implementation.

## Project Design Schedule

FMSM is dedicated to allocating the resources needed on this project to complete the work within the time frame required by the City of Mason.

| MILESTONE | WEEKS | CUMULATIVE WEEKS |
|---|---|---|
| Notice to Proceed | 0 | 0 |
| Data Collection / Topographic Survey / Geomorphic Assessments | 2 | 2 |
| Processing of Collected Data | 1 | 3 |
| Geotechnical Slope Stability Analysis | 2 | 5 |
| Hydrologic / Hydraulic Modeling | 1 | 6 |
| Preliminary Design Report | 1 | 7 |
| Review by City of Mason | 1 | 8 |
| Prepare Plans / Specifications / Bid Package | 4 | 12 |
| 404 / 401 Permitting | 1 | 13 |

# 4.0 Project Team

FMSM's staff has a unique combination of advanced technical training, practical experience and a problem-solving attitude that is overlain with a desire to provide excellent service to you. We invite you to review the organizational chart presented on the following page that highlights the integration of your Project Manager with the required technical disciplines. All FMSM personnel are full time employees dedicated to stream restoration and related water resources projects. Resumes of key project staff are included in Appendix A.

**Mr. John Montgomery, PE, will serve as Principal-in-Charge** for the FMSM team. Mr. Montgomery is the Manager of FMSM's Cincinnati office and an Ohio licensed professional engineer. Mr. Montgomery specializes in project management, water resources engineering, and quality assurance/quality control of water resource and flood protection projects. Mr. Montgomery brings strong management skills to the team through his years of experience in water resources, riverine and geotechnical engineering.

**Mr. J. George Athanasakes, PE will serve as the Project Manager**. Mr. Athanasakes has demonstrated experience in stream restoration design, and has received all four levels of training offered by Dave Rosgen. He currently leads the firm's stream restoration and bioengineering department. Mr. Athanasakes served as the project manager for the development of the

RIVERMorph software and routinely presents at national conferences and educational workshops on the subject of stream restoration. Mr. Athanasakes will provide the technical leadership and guidance necessary for FMSM's project team members to function in the same consistent, highly professional manner that the City of Mason has come to expect.

**Mr. Brian Belcher, PE will lead the stream restoration efforts.** Mr. Belcher has extensive experience in the field of stream restoration and has completed all four levels of fluvial geomorphology courses offered by Dave Rosgen. He is currently studying for a PhD in water resources with an emphasis in stream restoration. Mr. Belcher has demonstrated his keen understanding of the field of Natural Channel Design through his role as the lead developer of the RIVERMorph® software and has performed all phases of stream restoration including design and construction monitoring. Mr. Belcher also has extensive hydrologic and hydraulic modeling experience.

**Mr. Mike Adams, PE will manage the quality control process and construction oversight.** Mr. Adams has served as a Senior Water Resource Engineer on a number of stream restoration projects throughout this region. He has completed fluvial geomorphology courses taught by Dave Rosgen including Rosgen's Level 4 Natural Channel Design course. Mr. Adams understands all facets of a stream restoration project and has been involved with the data collection phase, preliminary designs, final designs including sediment transport competency calculations, plan preparation, development of plans and specifications, cost estimating, and permitting.

**Technical Support Team:** All FMSM Team personnel assigned to this project are available and committed to meeting the requirements of this project. Over the last several years, FMSM has strategically recruited, hired, and retained best-in-class engineers, biologists and technical support staff to promote our combined efforts on stream restoration projects throughout the region. For this project team, we have assembled our best support staff members including hydrologic and hydraulic engineers, geotechnical engineers, aquatic biologists, geographic information systems specialists and CADD technicians. In addition we will be working with Kleingers and Associates, with whom we have a long standing professional relationship, as they have provided surveying services on many of our Ohio regional projects.

## 4.1 Quality Assurance/Quality Control Program

Over 95% of FMSM's clients are repeat customers. We have a reputation for providing high-quality and value-oriented technical services. FMSM's commitment to quality is a significant contributor to the firm's growth and to the reputation we enjoy with our clients. A key element of FMSM's project management process is our Quality Assurance/Quality Control (QA/QC) program. For over 35 years, even before quality programs and TQM business practices were fashionable, FMSM has maintained a serious commitment to these principles.

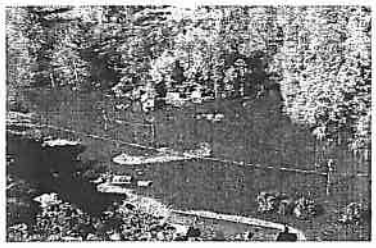
# 5.0 Related Project Experience and Past Performance of the Firm

FMSM is a leader in employing innovative technologies to stream restoration design and streambank stabilization projects. Our cutting-edge approach utilizes specially designed software and extensive expertise in the design and implementation of natural channel design and soil bioengineering projects. We have conducted hundreds of miles of stream restoration and assessments throughout the United States. The FMSM team will take a fresh, innovative approach to the implementation of this project utilizing our extensive experience and understanding of the field of stream restoration in an urban environment.

*Urban steam restoration project under construction*

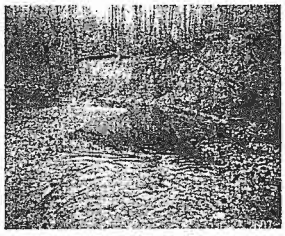
Our stream restoration design experience includes geomorphic assessments, planning level conceptual designs, final designs, cost estimating, project scheduling and phasing, construction oversight, and regulatory permitting. Projects have included stream restoration, bank stabilization, emergency repair of collapsed banks, stream relocation, riparian corridor ecosystem revitalization, and greenways designs. When possible, we utilize technology to enhance our work and provide cost effective solutions. We are familiar with all types of soil bioengineering treatments including live staking, live brush layering, brush mattresses, live fascines, and joint plantings.

Project descriptions which highlight our relevant project experience and past performance related to similar projects as the Muddy Creek Stream Restoration project are included in Appendix B. An executive summary of some of the projects listed in Appendix A is provided below.



*View of Coldwater Fork Floodplain After the Slurry Release on October 11, 2000*

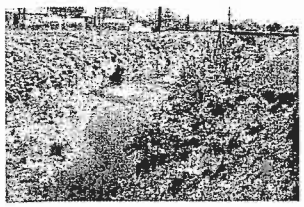
**Upper Coldwater Fork Stream Restoration, Martin County. Kentucky.** A coal slurry impoundment at the Martin County Coal Corporation breached into the mine works releasing approximately 230 million gallons of slurry into Coldwater Fork and Wolf Creek. The upper middle portion of Coldwater Fork was realigned as debris and up to eight feet of slurry were removed from the Coldwater Fork Valley. FMSM prepared a design for nearly 6,000 linear feet of stream using natural channel design and soil bioengineering techniques. FMSM also provided construction assistance for the project which included providing an engineer trained in geomorphology to instruct the contractor on natural channel design and soil bioengineering construction techniques. Additionally, FMSM prepared 401 and 404 permits for the project, completed hydrologic and hydraulic modeling, and prepared a Monitoring Plan and Maintenance Plan. FMSM assisted with the preparation of as-built drawings and will perform three years of monitoring for the project.



*Darby Creek Restoration Area*

**Big Darby Creek Headwaters Restoration, Columbus, Ohio.** The ecosystem of the headwaters, including stream channels, wetlands and natural floodplains were altered to such a degree that it could not support the type and diversity of plant and animal species historically found there. FMSM was tasked with collecting and analyzing site specific habitat and geomorphic data and providing recommendations

on restoring the critical functions of the Big Darby Creek. The overall goal of the project was to partially reverse and prevent further degradation of the ecosystem through restoration of the stream and interrelated adjacent floodplains and wetlands with stable flow, decreased sediment load and return of the once abundant plant and animal habitat.



*Typical view of Northern Ditch in Jefferson County, Kentucky*

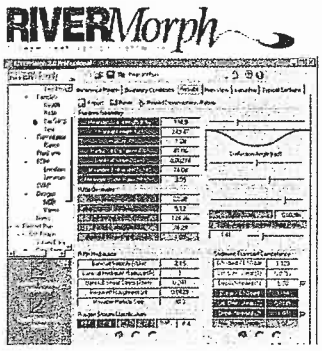
**Northern Ditch Stream Restoration/ Pond Creek Watershed Restoration Project, Jefferson County, Kentucky.** Northern Ditch is a man-made canal constructed in the 1920's to drain a vast swampland in the Pond Creek Watershed located near Louisville, Kentucky. In an effort to reduce flooding in an ecologically sensitive manner, the Louisville and Jefferson County Metropolitan Sewer District (MSD) is teaming with the Louisville District Corps of Engineers to construct the Northern Ditch Channel Improvements. FMSM, renowned for environmentally sensitive designs, was hired as the design consultant for the project. In the past, Northern Ditch has been routinely widened in an effort to increase storage capacity within the channel. This widening of the stream channel without account for the proper channel dimensions necessary to transport sediment during bankfull flows has resulted in an over-widened, highly entrenched stream which is highly subject to erosion. The stream will be restored by constructing a properly dimensioned bankfull channel with improved flood plain access. To reduce bank erosion, soil bioengineering treatments will be utilized throughout the project including live staking and live brush layering techniques.

**Fairfield Sewer Crossing, Mason, Ohio**

FMSM assessed miles of Pleasant Run for the purpose of evaluating the health of the stream and the condition of the many structures within it. A combination of urbanization in the watershed, channel dredging and maintenance, in-stream detention and stream bank stabilization practices have contributed to the destabilization of the channels. The primary goal of the project was to stabilize a sanitary stream crossing near Resor Road in Fairfield. Since construction, the step-pool has experienced two bankfull flows and many smaller floods. The reach upstream of the structure is slowly stabilizing as the banks begin to naturally vegetate and the headcut at the sewer crossing has been eliminated.

**RIVERMorph: Stream Restoration Software**

The field of stream restoration is highly specialized and few firms have the expertise necessary to design these projects, let alone write the software to guide others through the process. FMSM has designed and developed RIVERMorph, an innovative new stream restoration software which integrates virtually every design function needed for a natural channel design project into a single program, thus allowing users to navigate the difficult design process with ease and precision. The only software of it's kind, RIVERMorph has set the standard for accurate and efficient stream assessments and natural channel design.




Tools provided within RIVERMorph allow the user to quickly analyze geomorphic data, develop dimensionless ratios from cross sections, profiles, and platform dimensions, process gage data, develop and extract data from regional curves, as well as many other features. FMSM continues to improve and enhance RIVERMorph by including tools and analytical features needed by the professional. The Pocket PC version, Pocket RIVERMorph,

even allows our engineers to enter, view, and analyze stream data while in the field.

# 6.0 Preliminary Cost Estimate

A summary of the anticipated costs for both the design and construction phases of the project are presented below. In addition, details related to the derivation of these costs are presented in Appendix C. The costs presented below include all phases of the services requested in the Request for Proposal including a geotechnical analysis for the slope near Overlook Drive, which includes the advancement of several soil borings. The costs presented below include both the projects as described in the Request for Proposal.

It is proposed that the design phase be completed on a lump sum basis and the construction phase be completed on a time and materials basis.

| DESIGN PHASE (Tasks) | COST |
|---|---|
| Task 1 - Data Collection / Topographical Survey / Geomorphic Assessments | $ 9,370.00 |
| Task 2 - Geomorphic Assessment of Impacted Reaches | $ 1,970.00 |
| Task 3 - Geomorphic Assessment of Reference Reach Sites | $ 1,970.00 |
| Task 4 - Processing of Collected Data | $ 4,140.00 |
| Task 5 - Geotechnical Slope Stability Analysis (Overlook Drive) | $ 9,162.00 |
| Task 6 - Hydrologic / Hydraulic Modeling | $ 8,770.00 |
| Task 7 - Preparation of Preliminary Design Report | $ 3,250.00 |
| Task 8 - Preparation of Natural Channel Design Plans/Specifications/Bid Package | $14,360.00 |
| Task 9 - 401 / 404 Permitting Application | $ 4,424.00 |
| Task 12 - Meetings and Coordination | $ 3,548.00 |
| TOTAL DESIGN PHASE | $60,964.00 |

| CONSTRUCTION PHASE (Tasks) | COST |
|---|---|
| 10 - Bid Phase Administration | $ 2,914.00 |
| 11 - Construction Phase Services | ~~$12,490.00~~ → $21,040.00 KW |
| TOTAL CONSTRUCTION PHASE | ~~$ 15,404.00~~ → $ 23,954.00 KW |

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