Final Completion Report
Colorado Water Conservation Board Water Efficiency Grant: Synthetic Turf Project

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Applicant: Town of Castle Rock
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The Town of Castle Rock (Castle Rock) developed a Water Conservation Master Plan (Plan) that was approved by the Colorado Water Conservation Board (CWCB) in December 2006. One of the goals set forth in that Plan was to significantly reduce current and future per-capita water demands. In an effort to meet this goal and conserve water, Castle Rock, in partnership with the Douglas County School District (DCSD), proposed to install a synthetic turf field at the new Elementary School #45 instead of an irrigated natural turf field.

This project is now providing several key water conservation benefits to Coloradans, including:

- Castle Rock and DCSD's use of synthetic turf instead of irrigated turf for athletic fields reduces demands in Castle Rock by approximately 1.5 million gallons per year for the life of the project which is equivalent to the average amount of water used by approximately nine homes in one year.[1] This assists Castle Rock in meeting the aggressive water conservation goals outlined in its Water Conservation Plan.

- Castle Rock's conservation goals call for creating a community culture that embraces water conservation as a "way of life." The installation of the synthetic turf field at the new school in a growing community provides a high-visibility project. Castle Rock is using this project to educate the public and increase awareness of water conservation. Castle Rock has placed signage at the project and advertised its water-saving benefits through local media to help instill a conservation culture in Castle Rock and surrounding communities.

- Castle Rock is located in South Metro area which has been identified as one of the key "gap" areas in the Statewide Water Supply Initiative (SWSI). By offsetting potable water use, this project directly reduces demands on non-renewable Denver Basin groundwater resources. That in turn provides local and regional benefits by better managing the aquifer as a long-term source of supply and

[1] This assumes that each home uses approximately 0.5 AFY.

drought reserve. Viewed another way, this water conservation measure offers financial benefits relative to the acquisition of new renewable supplies. The 1.5 million gallons of annual water savings achieved through the synthetic turf project offsets an investment of approximately $220,000 that would otherwise be required to acquire and deliver an equivalent quantity of renewable surface water supplies[2].

- Landscape irrigation typically comprises over 50 percent of summertime municipal water system demands in Colorado's urban communities. From a statewide perspective, this project demonstrates the use of synthetic turf athletic fields as a practical means of conserving water through the coordination of multiple parties. The installation of synthetic turf fields on a large scale throughout Colorado would provide substantial municipal irrigation savings. In addition, because infrastructure needs are driven largely by peak demands, offsetting peak irrigation demands would help water providers meet overall system demands with lower capital investments in peak delivery infrastructure.

This 100% Completion Report is the final document for fulfillment of CWCB's Water Efficiency Grant Program requirements. This document contains a project overview, and provides a discussion of findings and a summary of water savings from the project. The approved grant application for this project is included as Attachment A for reference and provides information on the town's water demands and supplies, and water conservation program.

This 100% completion report includes the following major sections:

- Section 1: Synthetic Turf Field Overview
- Section 2: Scope of Work
- Section 3: Final Schedule and Budget
- Section 4: Project Findings and Water Savings

[2] Estimated based on the South Metro Water Supply Authority June 2007 Regional Water Master Plan (mid-term implementation) with an estimated cost of $34,000/AFY of capital and annualized O&M costs for the delivery, treatment, and storage of renewable water supplies from the South Platte River near the Brighton area. A cost of $15,000/AFY for the water rights was assumed. The combined total unit cost of $49,000/AFY was multiplied by a water savings of 4.5 AFY (1,466 kgal/year) to obtain the total cost savings.

1.0 Synthetic Turf Field Overview

Synthetic turf fields are frequently used throughout the United States in place of irrigated turf for various reasons including longer playing seasons, reduced annual maintenance, and decreased water usage. The popularity of synthetic turf has increased as new technologies have made it safer and given it a more natural appearance. For this project, Castle Rock, in coordination with DCSD, constructed a synthetic turf field as part of Elementary School #45.

1.1 Major Components

Castle Rock studied the possibility of using synthetic turf as an athletic field surface for several years, particularly in new parks, and has, in fact, installed synthetic turf in active play areas of Matiney Park, Gemstone Park, and Butterfield Park. Castle Rock's *Synthetic Turf Feasibility Study*[3] describes the following major components of synthetic turf fields:

- *Base:* The base usually consists of a well-graded and compacted subgrade overlain with geotextile fabric. A layer of crushed stone is then applied over the geotextile fabric just below the turf itself.
- *Drainage:* A drainage system of perforated pipe is typically placed along the edge of the field. However sometimes flat drains can be placed underneath the field should the design call for it.
- *Field*: The field surface consists of long synthetic fibers (about 3 inches long) attached to a high-strength backing.

1.2 Beneficial Features

A synthetic turf athletic field provides the following beneficial features:

- *Longer playing season* – Synthetic turf doesn't need to drain and dry following a rainfall event and it doesn't freeze; therefore, the overall playing season for sporting events can be extended when using a synthetic turf field.
- *More consistent playable hours* – Synthetic turf doesn't wear like irrigated turf; therefore, it doesn't require service interruptions to repair damage and allow for recovery.
- *Reduced annual maintenance* – Synthetic turf only requires periodic cleaning of the drainage system and brooming of the field following use.

[3] Town of Castle Rock Park & Recreation. 2005. Synthetic Turf Feasibility Study.

- *Water savings* – Synthetic turf doesn't require irrigation and hence provides water savings.

2.0 Scope of Work

This scope of work provides a general description of the Synthetic Turf Project at Elementary School #45 and highlights the major tasks, roles, and responsibilities of each party involved and the deliverables. This section also describes any project modifications that were made. No major obstacles were encountered during the course of the project.

2.1 Project Overview and Partnership

As previously mentioned, Castle Rock and DCSD have installed a synthetic turf athletic field at the new Elementary School #45 in the Meadows area of Castle Rock. The Synthetic Turf Project includes a 200-foot softball field and a 180-foot by 300-foot multiuse field that together cover approximately 1.7 acres.

Castle Rock also constructed a new park adjacent to the Synthetic Turf Project, which includes tennis/basketball courts, multi-use synthetic turf athletic field, playground, picnic pavilion, off-street-parking, natural turf play areas, walking paths, and other park facilities. Figure 1 shows the location of the park in relation to the adjacent school and Synthetic Turf Project.

Figure 1: Overview of Synthetic Turf Project and Castle Rock's Adjacent Park

Castle Rock and DCSD funded the Synthetic Turf Project with the assistance of grant monies from CWCB. Castle Rock managed all project cash flow including funds from the DCSD, grant monies, and contractor fees, with exception to the initial design that was funded by DCSD. Section 2.2 provides additional information on Castle Rock's and DCSD's roles and responsibilities.

Castle Rock and DCSD have a history of partnering. DCSD and Castle Rock currently have an intergovernmental agreement (IGA) to allow recreational activities facilitated by Castle Rock to be held at various DCSD school sites when school is not in session. Castle Rock plans to continue to work closely with DCSD and now includes the Elementary School #45 Synthetic Turf Project in this agreement. This enables Castle Rock-sponsored events to be held at the Elementary School #45 field, enhancing usability of the synthetic turf field as well as the overall recreational opportunities available to the community.

2.2 Project Tasks

The following tasks were the major actions taken to construct the Synthetic Turf Project. The roles and responsibilities of each participant for each task are also provided.

Task 1 –Design

Purpose

This task included the completion of the final design documents and construction specifications for the Synthetic Turf Project. This task was completed at the end of 2007.

Roles and Responsibilities

DCSD and Castle Rock funded the design effort and selected firms to design the Synthetic Turf Project including an architectural firm and civil engineering company. These firms coordinated design efforts to ensure compatibility among the architectural and engineering components of the final synthetic turf field design. The roles and responsibilities of each firm included:

- *Design Concepts Landscape Architects* – Developed the architectural design of the Synthetic Turf Project, which consisted of the synthetic turf field layout and major components of the field, surrounding landscape, and other architectural features.

- *JVA Civil Engineers* – Developed designs for the final grading, subsurface drainage, and other features that required civil engineering expertise. JVA Civil Engineers also professionally stamped the engineering plans and worked with the other teaming firms in developing construction specifications.

Castle Rock and DCSD reviewed and provided feedback on all designs and construction specifications. Final design approval by both Castle Rock and DCSD was required prior to construction.

Task 2 – Contractor Selection and Project Management

Purpose

This task involved the development of bid documents, contract documents, and other documentation necessary to facilitate project cash flow and construction. All other project management-related activities including coordination among parties, construction inspections, and other activities necessary to ensure the success of the project were also included. This task was scheduled to be complete in August 2008, however, construction (Task 3) was delayed by 2 months which affected the remaining project schedule (including project management duties associated with this task).

Roles and Responsibilities

Castle Rock was responsible for the bidding process including the preparation of the bidding documents, selection of a contractor(s), and preparation of the contract documents. Castle Rock was also responsible for all other project management related activities including coordination with parties involved, construction inspections, contractor(s) payments, and the administration of DCSD funds and grant monies.

Task 3 – Construction

Purpose

This task included all the activities necessary to complete the construction of the Synthetic Turf Project. This included mobilization of the equipment, grading, utility connections, site preparation, installation of the synthetic turf field, and demobilization.

Roles and Responsibilities

The construction team was responsible for completing all construction related activities including mobilization, grading, utility connections, installation of the synthetic turf field, and accomplishment of inspections and demobilization.

Deliverables

The construction team completed all construction activities in accordance with the final design, construction specifications, and necessary change orders. All Town approvals and final document of recordation were submitted.

Task 4 – Public Education

Purpose

This task involved public education regarding the Synthetic Turf Field Project. Castle Rock highlighted the benefits of synthetic turf fields and emphasized the importance of water conservation. Information was distributed to the public through the Castle Rock's water conservation website, through local TV shows, the local newspaper, and through the water wise community classes. Attachment B contains images from the public education efforts.

Roles and Responsibilities
Castle Rock's community relations department took the lead in coordinating and developing the materials needed for public education activities associated with the Elementary School #45 synthetic turf project.

Deliverables
Castle Rock distributed information summarizing the Synthetic Turf Project and highlighting the water conservation benefits through multiple media outlets (see Attachment B).

Task 5 – CWCB Grant Development and Status Reports

Purpose
This task involved the development of a 50 percent, 95 percent, and this final completion status report to CWCB per the CWCB Water Efficiency Grant Requirement. Although this task was a part of the overall project, its costs were not included in the project budget.

Roles and Responsibilities
Castle Rock contracted with Camp Dresser & McKee Inc. (CDM) to develop the grant application and subsequent completion reports.

3.0 Final Schedule and Budget

Castle Rock and DCSD completed construction by early August 2008, in order to host classes at the elementary school beginning in the 2008/2009 school year. The project schedule identifying key activities and milestones is presented in Table 1.

Table 1: Completed Schedule

Task	Sub-Task	Completion Date
Complete Synthetic Turf Design	N/A	November 2007
Bid Process and Contractor (s) Selection	Complete Bidding Process	January 2008
Construction	Contractor Mobilization	February 2008
	Completion of Grading and Utilities	April 2008
50% Completion Report to CWCB	n/a	October 2008
Construction	Completion of the synthetic turf field installation	June 2008
95% Completion Report to CWCB	n/a	April 2009
Construction	Project Closeout	September 2008
Public Education	Information on Project Distributed to the Public	October 2008
Final Completion Report is submitted to CWCB	n/a	February 2011

The final budget is provided in Table 2. The total CWCB grant funding requested was $20,000. The CWCB grant represents 5% of the project cost.

Town of Castle Rock - Final Completion Report
Elementary School #45 Artificial Turf Installation

Table 2: Final Budget																				
Task	**Description**	**Design Consultants**		**Construction Contractor(s)**	**Staff Hours**		**Rock Staff Hours and**							**Funding Sources**						
		Design Concepts and Landscape Architects	**JVA Civil Engin-eers**	**Labor and Materials**	**Project Manager Hours**	**Project Manager Labor Costs**	**Water Conser-vation Specialist**	**Utilities Program Analyst**	**Park Super-intendent**	**Commu-nity Relations**	**Parks Maintenance Super-intendent**	**Total Staff Hours**	**Staff Labor Costs**	**CWCB Grant**	**Recycled Tire Grant**	**DCSD Match (Cash Funds)**	**DCSD Match (In-kind Services)**	**Castle Rock Match (Cash Funds)**	**Castle Rock Match (In-kind Services)**	**Total**
	Rate/hour	n/a	n/a	n/a	$36.00	n/a	$33.65	$40.26	$33.65	$32.45	$42.67	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
1.0	Design	$7,881	$15,386	$0	60	$2,160	20	20	20	0	0	60	$2,151	$0	$0	$11,634	$2,160	$11,634	$2,151	$27,578
2.0	Contractor Selection and Project Management	$0	$0	$0	40	$1,440	20	20	450	0	60	550	$19,181	$0	$0	$0	$1,440	$0	$19,181	$20,621
3.0	Construction	$0	$0	$344,050	0	$0	0	0	0	0	0	0	$0	$18,000 ($2,000 pending)	$37,000	$129,019	$0	$158,031	$0	$342,050
4.0	Public Education	$0	$0	$0	0	$0	50	50	10	80	0	190	$6,628	$0	$0	$0	$0	$0	$6,628	$6,628
Total		**$7,881**	**$15,386**	**$344,050**	**100**	**$3,600**	**90**	**90**	**480**	**80**	**60**	**800**	**$27,960**	**$0**	**$37,000**	**$140,653**	**$3,600**	**$169,665**	**$27,960**	**$396,877**

TOTAL PROJECT COSTS $398,877

** Final Funding will be $398,877 after receiving final grant funding

4.0 Project Findings and Water Savings

The project has been in place and in use for over one year, and has resulted in the anticipated ongoing annual water savings. The project has reduced Castle Rock's overall irrigation needs and is providing water savings of 1.5 million gallons per year[4] which is equivalent to the average amount of water used by approximately nine homes in one year[5]. In particular, the project helps reduce peak-day water demands in Castle Rock during the high-demand summer months, which in turn reduces Castle Rock's need for peak water supply infrastructure (new wells or alternate renewable supplies) and reliance on the Denver Basin aquifer resources that supply a significant portion of the South Metro region's water needs.

This is assisting Castle Rock in meeting its conservation goal to reduce current and future water demands particularly in areas such as landscaping and targeted water savings objectives of 18 percent over a 5-year average use (127 gpcd) as outlined in Castle Rock's Water Conservation Plan. Additionally, Castle Rock's conservation goals call for creating a community culture that includes water conservation. Installation of synthetic turf fields is a public display of Castle Rock's commitment to creating community awareness about conservation by making conservation a direct aspect of planning and development.

[4] This assumes an average irrigation application rate of 33 inches/year based on typical practice for Castle Rock irrigated turf. This application rate was multiplied by the synthetic turf field area (1.7 acres) to obtain a water savings of 1.5 million gallons per year (4.5 AFY).

[5] This assumes that each home uses approximately 0.5 AFY.