CASE STUDY

SETTING THE STANDARD FOR WATER-SMART DENIM

How G-Star RAW leveraged innovation, supply chain partnership and the Cradle to Cradle Certified Product Standard to drive material health and optimize water stewardship in the production of its Gold certified denim garments.

INTRODUCTION

Designing denim for the future

Innovation is at the core of G-Star RAW’s DNA. As a leading denim brand within the fashion industry, the company designs for the future not simply in terms of style, but by considering the impacts of its products on people and planet.

G-Star RAW has demonstrated that innovative design can drive safe, circular and responsibly-made products. It is one of the few companies that has achieved Gold level Cradle to Cradle certification for its denim products and the first to achieve Platinum performance ratings for the Cradle to Cradle Certified Material Health and Water Stewardship requirements.

Because many existing materials are not designed with their next use in mind, G-Star RAW has made their products’ ingredients open-source in order to accelerate the adoption of safe materials designed for circular material flows and to increase industry transparency and collaboration.

G-Star RAW has also developed a “circular design toolbox” composed of healthy materials that in-house designers can use to make safe, circular and responsible garments.
Driving Innovation

Cradle to Cradle certification has served as a framework to drive innovation across G-Star RAW’s value chain of designers, suppliers and manufacturers, and to empower its customers to make more responsible choices.

In 2016, G-Star RAW began partnering with German indigo producer DyStar, Pakistan-based denim mill Artistic Milliners, and third-party Cradle to Cradle assessor Eco Intelligent Growth (EIG), to formulate and launch the Kir Denim O fabric (Artistic Milliners’ Dylan fabric), the world’s first Gold-level Cradle to Cradle certified denim fabric. The fabric was certified in 2017 and launched into the market in 2018. Since then, G-Star RAW has designed five more certified fabrics with Artistic Milliners, including the world’s first Cradle to Cradle Certified Gold denim stretch fabric launched in 2019.

By January 2020, G-Star RAW achieved Gold level Cradle to Cradle certification for a full range of finished garments manufactured by Saitex in Dong Nai, Vietnam using Artistic Milliners’ certified denim fabrics. By leveraging innovative design, the strength of its partnerships and the rigor of the Cradle to Cradle product standard, G-Star RAW has demonstrated how material health and water stewardship can be optimized across the supply chain, even in water-stressed regions like Pakistan and Vietnam.

---

**G-Star RAW Sustainable Evolution**

**Cradle to Cradle Journey**

**Fabric & Product**

2018 (2013)

- World 1st Cradle to Cradle Certified™ Gold Denim Fabric. Developed with the world’s cleanest Indigo dying process with 0 risk for people and planet:
  - 15% less Indigo
  - 70% less chemicals
  - No salts and no salt by-product
  - Leaves clean & recyclable water effluent

2019 (2019)

- 2 Indigo dips instead of 4, further saving water on fabric and wash levels
- Updated for more authentic denim character

2019 (2019)

- World 1st Cradle to Cradle Certified™ Gold Stretch Denim Fabric
  - 2% degradable premium stretch fiber (Rouc®V550) added to Kir Denim O 2.0

2020 (2020)

- Moving beyond fabric, launch of fully certified Kir Denim Certified™ Gold G-Star RAW Denim Products

2020 (2020)

- Introduction of new Cradle to Cradle Certified™ Gold Denim Fabric: Romera Denim O &
  - Further expansion on the assortment Cradle Certified™ Gold G-Star RAW Denim Products & Fabrics

---

WE CONTINUE TO EXPAND OUR CIRCULAR DESIGN TOOLBOX OF THE FUTURE
With an economic share of $1.5 trillion USD\(^1\), fashion is one of the world's largest consumer industries.\(^2\) Driven by accelerating demand, manufacturing volume has more than doubled since 2002\(^3\). With a projected 8.5 billion people requiring clothing by 2030\(^4\), the rate of consumption will continue to climb. As a result, the industry is also responsible for employing more than 300 million people along the value chain, generating the equivalent of one garbage truck full of waste every second and producing up to 10% of the world's carbon emissions\(^5\).

Fashion is also the world's second-largest consumer of water, and denim garments are the single-most water\(^6\) intensive items to produce. From cotton production to wear, a single pair of traditionally manufactured jeans can consume as many as 7,000 litres of water throughout its life cycle\(^7\).

While cotton cultivation is responsible for a significant portion of denim's water consumption, the manufacturing and use stages of a denim garment's life cycle also represent significant water consumption, with dyeing, washing and special visual effects and washing during the use phase among the chief factors\(^8\).

Denim's water impact is not limited to the volume of water consumed. Final stage manufacturing often uses halogenated organic compounds (chlorine), heavy metals (cadmium, chromium, cobalt, tin) and surfactants with high aquatic toxicity. Such chemicals pose risk to both human and environmental health via their impact on water quality and safety. Left untreated, the chemicals become effluents released into the biosphere during final stage manufacturing and through the consumer stage of the life cycle, namely during home washing. Similarly, garment care labels are often made of polyester, a petroleum-based product with direct impacts on water bodies, along with carcinogenic materials such as antimony trioxide.

These factors demonstrate the importance of optimizing the material health of fabrics and garments, as well as introducing water-smart dyeing and finishing processes that reduce water consumption.

---

HOW THE CRADLE TO CRADLE CERTIFIED™ PRODUCT STANDARD DRIVES WATER STEWARDSHIP

Cradle to Cradle Certified is the world’s leading science-based standard for designing and making products that maximize health and wellbeing for people and the planet.

To achieve certification, companies engage with an independent Cradle to Cradle Certified Assessment Body to assess, optimize and verify a product’s performance according to the standard’s five critical sustainability categories: Material Health, Material Reuse, Renewable Energy and Climate, Water Stewardship and Social Fairness.

A product is assigned an achievement level (Basic, Bronze, Silver, Gold, Platinum) for its performance in each quality category. The product then receives Cradle to Cradle certification based upon the lowest quality category performance. [For example, a product that receives a Platinum performance rating in four categories and a Gold performance rating in one category will receive Cradle to Cradle certification at the Gold level]. Certification must be renewed every two years on the basis of demonstrated continuous improvement across one or more categories.

Because material health and water quality are intrinsically linked, the Cradle to Cradle Certified Product Standard is uniquely positioned to unlock a ripple effect for companies committed to using safe chemicals in their products and manufacturing processes. The higher a product’s Material Health performance, the greater the assurance that the product poses no risk to water quality, or to the health of aquatic ecosystems and marine environments. In turn, the standard’s Water Stewardship requirements also provide companies with a qualitative and quantitative framework to evaluate a product’s effect on water consumption and release.

Cradle to Cradle Certified Material Health Requirements

The ultimate goal of the Cradle to Cradle Certified Material Health requirements is that all products are manufactured using only those materials that have been assessed and optimized for human and environmental health and do not contain any highly problematic substances (known as X assessed substances), or Grey assessed substances, which cannot be fully assessed due to lack of toxicity or formulation data. As the percentage of assessed and optimized materials in a product increases, the safety of the finished product increases.

At the Platinum level, 100% of the product’s materials and all process chemistry that comes into contact with the product have been verified as compatible with human and environmental health. This means that each chemical in the product, and in the process chemistry used to make the product, has been assessed positively against a comprehensive set of toxicity criteria ranging from carcinogenicity to aquatic toxicity.

Cradle to Cradle Certified Water Stewardship Requirements

The Cradle to Cradle Certified Water Stewardship requirements recognize that fresh water is a scarce and valuable resource. The requirements aim to ensure that product manufacturers are evaluated against their understanding of (and responsibility for) water withdrawals,
consumption, and releases within their local ecology, and that they are rewarded for innovation in the areas of conservation and quality of discharge. The requirements provide a qualitative and quantitative measure of water usage and water effluent related directly to the manufacture of the certified product.

At the Gold level, chemicals that enter effluent as a result of product final manufacturing have been optimized for material health. At the Platinum level, either water is not used, a closed-loop system is in place (so water is used but not released), or any water released is of drinking water quality. In addition, all supply chain water issues have been identified, investigated and managed.

**APPLYING THE STANDARD: OPTIMIZING WATER STEWARDSHIP ACROSS THE SUPPLY CHAIN**

Recognizing that the key to transforming denim’s water impacts begins with material health, G-Star RAW saw an opportunity to leverage the Platinum Material Health rating of its Cradle to Cradle Gold certified Kir Denim O fabric by producing a range of finished garments certified at the Gold level.

Using the Cradle to Cradle Certified Platinum level Water Stewardship requirements as a blueprint, G-Star RAW partnered with Artistic Milliners to find and develop safer chemistries for fabric dyeing, and later with Vietnam-based Saitex to assess and optimize washes and finishes for the final garment. This resulted in a product and process chemistry that posed no risk to humans or the environment, including aquatic environments.

**Optimizing Material Health**

1. **Fabric: Safer Dyes & Fixing Agents**

Artistic Milliners and DyStar co-developed the Crystal Clear indigo dyeing process to support G-Star’s quest for a denim fabric that met Cradle to Cradle Certified Platinum level Material Health performance standards. Crystal Clear uses a salt-free organic fixing agent with fewer chemicals and a hydro-free dye process that results in clean, recyclable water effluent with no salt by-products. Its heat-free fixing process uses less energy and because Crystal Clear uses a pre-reduced liquid indigo with no additional water or salt, it allows up to 100 percent of the indigo to be recovered.\(^{10}\)

2. **Garment: Safer Finishing Chemicals**

Finishing chemicals used during final stage garment manufacturing can enter the biosphere as effluent or during home washing at the consumer-use stage. Examples of potential pollutants include halogenated organic compounds (chlorine), heavy metals (cadmium, chromium, cobalt, tin), and surfactants with high aquatic toxicity. To achieve platinum level material health requirements for its certified garments, G-Star RAW worked with Saitex to ensure that 100% of the washing chemicals used during the finishing stage were optimized to pose no risk to humans or to the environment, including marine life.

---

**Key Outcomes >**

**Safe Materials:** Dyes and fixing agents used in fabric production, as well as finishing chemicals used in garment manufacturing, are verified for human and environmental safety at the Platinum level based on the Cradle to Cradle Certified Material Health methodology.

**Increased Water Quality:** Optimization of chemicals at the fabric and garment level assures there is no risk of water quality issues in the event of release to the environment, or in the wastewater sludge generated during final manufacturing and channeled by Saitex to be made into construction bricks or agricultural fertiliser (see below).

---

**Maximizing Water Stewardship: Fabric to Final Garment**

1. **Sourcing: Organic Cotton**

G-Star RAW and Artistic Milliners sourced GOTS certified organic cotton for the Cradle to Cradle Certified Gold denim fabric that was used to make the finished garments.

*Key Outcome >*

**Reduced Water Consumption:** GOTS Certified cotton reduces upstream water consumption by as much as 60 percent compared to conventional cotton.\(^{11}\)

2. **Production: Water Smart Processes**

The Cradle to Cradle Certified Gold denim fabric used in the range of G-Star RAW garments is produced by Artistic Milliners in Pakistan, a severely water-stressed region. Artistic Milliners’

---

production processes were assessed for proper management of its on-site water treatment facility and the use of minimal process water. In order to achieve a Platinum Material Health rating for the full garments, G-Star RAW enlisted Saitex for the final-stage manufacturing. Known for innovative water stewardship in a notably water-scarce region, Saitex is a LEED-certified facility that recycles 98%\textsuperscript{12} of its own process water through a closed-loop water recycling process and is powered by solar and fossil fuel-free energy sources.\textsuperscript{13} (The company also uses an air-drying process for finishing the garments for an energy savings of up to 85%).

During final-stage manufacturing, wastewater from the denim garments produces a sludge by-product which occurs for all wastewater treatment plants. Sludge is often incinerated or sent to landfill. If the sludge contains toxic materials from the process chemicals washed out of the garment, these toxins will also be incinerated or landfilled, where they can leach into soil, water and stormwater run-off.

Because 100% of the finishing chemicals used in the final G-Star RAW garments had been optimized and verified according to Cradle to Cradle Certified Platinum level Material Health requirements, Saitex’s wastewater sludge is safe for use as a component in bricks for the construction of affordable housing.\textsuperscript{14} The sludge can also be used as a component in fertiliser for use in Saitex’s on-site hydroponic farming system, which provides food for Saitex employees, charitable organisations and communities.\textsuperscript{15}

\textbf{Key Outcomes >}

\textit{Supply Chain Water Management:} All supply chain water issues are investigated and managed.

\textit{Closed Loop Water:} Zero water is discharged into the environment because 98%\textsuperscript{16} of the water used to produce G-Star RAW’s garments is recycled by a wastewater treatment facility at the Saitex plant in Dong-Nai, Vietnam.

\begin{itemize}
\item \textsuperscript{12, 16} Per http://www.sai-tex.com/environment/, 2% of the process water is lost to evaporation.
\item \textsuperscript{13, 14} http://www.sai-tex.com/environment/
\item \textsuperscript{15} http://www.sai-tex.com/saitex-farms/
\end{itemize}
Industrial Symbiosis: Platinum-level Material Health performance ensured that 100% of all chemicals in the garments are considered risk-free for humans and the environment. As a result, the remaining sludge from wastewater treatment at the final manufacturing stage is safe for use in construction bricks and agricultural fertiliser.

Reduced Water Stress: Saitex is located within proximity of the Dong Nai watershed which is served by the Dong Nai River and is at high risk of water stress. This risk is primarily due to the high level of industry and agriculture in the area. Retaining process water within a closed-loop helps to alleviate demand on the Dong Nai River and reduces the need for extraction from the natural environment.

CONCLUSION

As one of the few companies to achieve Gold level Cradle to Cradle certification for its denim products and the first to achieve Platinum performance ratings for Material Health and Water Stewardship requirements, G-Star RAW has set the standard for designing water-smart denim. By leveraging innovative design and technology to meet the rigor of Cradle to Cradle certification, G-Star RAW and its supply chain partners Artistic Milliners and Saitex have:

- Optimized all chemicals in their denim fabrics and garments for human and water safety.
- Increased water quality across the production cycle, from sourcing to final stage.
- Reduced water consumption from sourcing to final stage, alleviating water stress in high risk regions like Pakistan and Dong-Nai, Vietnam.

---

About the Cradle to Cradle Products Innovation Institute
The Cradle to Cradle Products Innovation Institute is dedicated to powering innovation for the circular economy through products that have a positive impact on people and planet.
Through the Cradle to Cradle Certified™ Products Program, the Institute sets the global standard for products that are safe, circular and made responsibly. Cradle to Cradle Certified is used by future-focused designers, brands, retailers and manufacturers across the value chain to innovate and optimize materials and products according to the world’s most advanced science-based measures for material health, product circularity, renewable energy and climate, water and soil stewardship, and social fairness.
The Institute also powers the global shift to a circular economy through partnerships and collaborative initiatives that equip businesses, governments and other stakeholders with the technical solutions and knowledge they need to innovate the way products are designed and made.
The Institute is headquartered in Oakland, California and Amsterdam, the Netherlands with offices in Washington DC. For more information, follow @c2ccertified or visit c2ccertified.org.

About G-Star RAW
Founded in 1989, G-Star RAW’s unrelenting passion for denim has driven the brand to take craftsmanship to the next level. “Hardcore Denim” is the philosophy that pushes the brand to invent and explore – down to the smallest detail. With this dedication to quality and progress, the brand represents the forefront of the denim industry, producing pioneering styles and challenging industry standards. Innovation and sustainability are at the core of the G-Star DNA and the brand is committed to lead by example and develop sustainable solutions for the future of fashion. Visit g-star.com or download the G-Star RAW app from the App store or Google Play.

About Eco Intelligent Growth
Eco Intelligent Growth (EIG), a circular economy consultancy based on Cradle to Cradle® principles, envisions a world where business regenerates ecosystems and society. The group has been helping companies to transition towards innovative circular business models since 2005, focusing primarily on the built environment, fashion, and packaging. ecointelligentgrowth.net

About Artistic Milliners
Founded in 1949, Artistic Milliners has since expanded to become a fully vertically integrated textile set-up. Its aim is to provide high-end customers with premium quality denim fabrics and garments. Since its inception, the company has been a front-runner in the global textile industry, spearheading denim innovation and sustainability.
To reach this position, it continually pushes the boundaries of what a pair of jeans can be. Artistic Milliners takes a holistic approach towards sustainability and has received LEED Platinum certification by US Green Building Council for its Echo-Tech Unit recently. Artistic Milliners today employs about 16,000 people with representative offices across the globe. ArtisticMilliners.com

About Saitex
SAITEX is a privately owned manufacturing operation specializing in premium denim and over-dyed products, with a capacity of over 6 million garments per year. The group is a leader in sustainable manufacturing practices. Saitex’s main facilities are in Vietnam, with facilities soon to be opened in the USA and Europe.
Saitex is committed to being conscious of social responsibility as a professional organization in providing solutions that bring together sustainable natural and green building environments. sai-tex.com