

WESTERN GROWERS CASE STUDY

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Cal.net deployed a non-proprietary automated irrigation management system on 400 acres of processing tomatoes at Terranova Ranch. This system includes portable valve actuators and upgrades to pumps, a network server and LoRaWAN platform to control the pumps and valves, and a software interface that allows the system to be scheduled and controlled remotely.

In the first year of use
WATER USAGE WAS CUT BY 34%.

There was a 34% reduction in water use in 2024 over the 2022 base case, which resulted in savings of \$22,420 based on an average cost of water of \$165/acre-foot. This significant water savings helps to align Terranova Ranch with long-term groundwater sustainability goals imposed by SGMA, California's Sustainable Groundwater Management Act.

2022 WATER USAGE



394 ACRE-FEET

2024 WATER USAGE



34%
WATER SAVINGS

258 ACRE-FEET

This case study, provided by The Western Growers Association, analyzes the real grower costs and savings associated with the installation of an automated irrigation management system on 400 acres of processing tomatoes at Terranova Ranch. The system was designed and implemented by Cal.net. Terranova Ranch supplied data for this case study, and Cal.net provided the technology details.

Cal.net is a rural last-mile internet provider. The company offers fixed wireless and fiber internet services. Cal.net has expanded internet service across California's Central Valley and Sierra foothills through various grants and partnerships with rural communities, agribusiness and tribal groups. The company provides residential and business services, including TV, phone and internet, and is increasingly focusing on IoT (Internet of Things) solutions, particularly in the AgTech space. Cal.net competes against all the big internet service providers (ISPs) in California, such as AT&T, Verizon etc. and maintains a competitive edge through local customer service, redundant dual-network products and service bundles designed specifically for ranchers and rural business.

The primary contact at Cal.net for this case study was the CEO, Craig Stein, who provided a background and overview of the technology.

In the first year of use

OPERATIONAL SAVINGS OF OVER \$61,000

The reduction in labor costs, as calculated by Terranova, was \$15,392 for one summer crop. Since the land is used for two crop cycles per year--one summer and one winter--these labor costs were doubled to \$30,784 annual savings.

Additional savings resulted from fewer vehicle trips to the field for irrigation management. Terranova estimated the savings based on an annual mileage reduction of 12,000 miles. Using the standard mileage rate of \$0.67/mile (IRS 2024 Standard Rate), this gave an annual savings of \$8,040.

2024 COST SAVINGS:
\$61,244



WATER: \$22,420



LABOR: \$30,784



VEHICLES: \$8,040

While internet service is required for the farm gate, other complimentary wireless technologies are required to create the connectivity for the farm acres. Cal.net partnered with Emergent Connex who built and operates the LoRa network over Terranova Ranch.

Along with the financial quantitative analysis, this case study examines water management at Terranova Ranch, focusing on how the California Sustainable Groundwater Management Act is driving farmers to reduce groundwater usage. It also investigates rural internet connectivity and its potential to facilitate automated smart farming, allowing automated precision irrigation to be a solution to enable sustainable farming.



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Terranova Ranch is a diversified farm in California's central San Joaquin Valley, established in the early 1980s. It spans approximately 6,000 acres.

TERRANOVA RANCH

Terranova Ranch is a progressive growing operation. The team is open to testing and adopting new technology. The Ranch has used subsurface drip irrigation since 2009.

Terranova Ranch is located 35 miles southwest of Fresno and 15 miles south of Kerman. The ranch cultivates over 25 conventional and organic crops. Its wide variety of produce includes fruits, vegetables, nuts and seed crops such as tomatoes (its primary crop by acreage), peppers, carrots, garlic, onions, olives (for oil), watermelon, wine grapes, almonds, walnuts, pistachios, leafy greens and ornamental sunflowers for seed.

Don Cameron, Vice President and General Manager, and Patrick Pinkard, Assistant Manager, were the primary contacts from Terranova Ranch and provided the data for this automated irrigation project case study.

Don Cameron, a visionary leader in California agriculture, has created a legacy rooted in ethics, passion, innovation and stewardship of the land. Don, a California native, moved to the Fresno region in his youth. An alumnus of California State University, Fresno, where he earned a degree in biology. In 1981, Don became vineyard manager Terranova Ranch and a first-generation farmer. In 1987, his leadership had earned him the role of Vice President and General Manager, where he steered Terranova Ranch with a blend of tradition and forward-thinking innovation. The ranch exemplified agricultural excellence under his guidance, balancing productivity with environmental responsibility.

Don's influence extends far beyond the fields of Terranova. He has lent his expertise to the California Department of Food and Agriculture's Environmental Farming Act Science Advisory Panel since 2011, championing sustainable practices that harmonize farming with nature. His impact reached the national stage in 2012 when he served on the Working Group for the Advisory Committee on Biotechnology and 21st Century Agriculture, shaping the future of agricultural innovation. Since 2014, Don has been a pivotal figure on the California State Board of Food and Agriculture, currently serving as its president, where his leadership continues to shape policies.

Don is a tireless advocate for the industry, and his dedication is reflected in his myriad roles: Chairman of the California Cotton Alliance, director and past Chairman of the California Tomato Growers Association, Chair of the McMullen Area Groundwater Sustainable Agency and director of the Raisin City Water District. In 2020, his expertise was recognized when he was appointed to the Governor's Task Force for Business and Jobs Recovery Operations Committee, and he currently serves on the DPR Sustainable Pest Management Task Force, driving solutions for a resilient agricultural economy.

In 2021, Don's leadership was further honored when he was appointed Executive Secretary of the Western Growers Association Executive Committee. With every position he undertakes, Don Cameron is a rare blend of humility, foresight and relentless dedication, making him a distinguished figure in California's agricultural landscape and a true steward of the land for generations to come.

PRE-AUTOMATION WATER MANAGEMENT AT TERRANOVA RANCH

Terranova Ranch primarily relies on pumped groundwater for irrigation, supplemented by some surface water.

Although Terranova Ranch had implemented drip irrigation in 2009, it remained an ongoing operational challenge for the farm to ensure that each field received the correct amount of water.

Prior to the implementation of the automated irrigation system, Terranova Ranch employed a labor-intensive method for crop irrigation. Farm workers were required to visit each field and manually activate and deactivate the drip irrigation system in the fields twice daily. Although these interventions were intended to align with optimal timing for each crop, the realities of daily farm operations frequently resulted in delays. Given the critical importance of adequate water supply for crop development, these delays often necessitated extended watering durations, leading to water wastage. Not only was this manual approach costly in both effort and time, it also demonstrated inefficiencies due to the difficulty in achieving precise timing. The need for operational improvements and enhanced resource utilization became clear.

THE IMPACT OF SGMA ON CALIFORNIA FARMING

California's Sustainable Groundwater Management Act (SGMA) was enacted in 2014. SGMA legally mandates groundwater basins to reach sustainable use rates by 2040, addressing historical overdrafts in many farming areas that have caused declining water tables, land subsidence and deteriorating water quality.

SGMA mandates the creation of Groundwater Sustainability Agencies (GSAs) to develop and implement local Groundwater Sustainability Plans (GSPs). The GSAs have the authority to monitor groundwater use, impose fees and regulate pumping to meet the goals of the GSP.

In over-drafted basins, where groundwater usage exceeds natural replenishment, farms may face restrictions on how much water they can pump. This may require some farmers to fallow acres of productive farmland.

While SGMA poses challenges, it also encourages innovation, such as advanced water management technologies and water recycling systems. SGMA also fosters water trading markets within basins, benefiting those who conserve or store surplus water.

Terranova Ranch is located in the McMullen Area Groundwater Sustainability Agency (GSA), one of a group of GSAs in the Kings Subbasin that coordinate their groundwater management efforts regionally. Currently, the GSP for this region is focused on building its monitoring network and groundwater recharge projects.

GROUNDWATER RECHARGE

Terranova Ranch has engaged in on-farm groundwater recharge during periods of high surface water flow, including pumping 19,000 acre-feet back into the ground in 2023. This initiative has successfully elevated groundwater levels at the pumps. To the management team's surprise, this activity has also enhanced the stability of the local groundwater table, which is currently 10 feet higher than in 2022. A higher water table translates to lower pumping costs.

“At Terranova Ranch, we are well known for being innovative, cutting-edge with technology, automation, and usually are the first to try and advance new concepts for agriculture in California.”

— Don Cameron, VP Terranova Ranch

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Although the GSA has not yet imposed pumping restrictions on Terranova Ranch, the management team anticipates these may be implemented within the next few years and recognizes the importance of proactively reducing groundwater usage. In other regions of California, mandatory fees have already been imposed on groundwater pumping, and therefore farmers across California are motivated to reduce their groundwater usage.

TRANSFORMING RANCH OPERATIONS WITH RELIABLE INTERNET

Terranova Ranch struggled for years to access an affordable and reliable internet connection. Using expensive cellular connectivity on mobile phones was only providing 5 megabits per second (Mbps) down and 5 Mbps up.

In addition to this, the ranch paid for an internet service to access online meetings. This \$228/month service gave them a meager 21 Mbps down and 5.2 Mbps up. The vision of a smart ranch, where sensors and automated systems could communicate efficiently, remained out of reach due to the insufficient internet infrastructure. This bottleneck constrained the potential for increased efficiency and data-driven decision-making.

Despite the Ranch's proximity to a high-speed internet fiber line (within one mile), major internet providers quoted connection costs between \$875,000 and \$1,500,000, offering only a guaranteed 20/20 Mbps.

In 2021, Terranova Ranch obtained Starlink internet service, which increased speeds up to 45/15 Mbps. This was a significant improvement.

Terranova Ranch then connected with Cal.net, which offered competitive pricing and speeds of 100/100 Mbps,

and in 2021 upgraded its farm operations with high-quality internet service from Cal.Net, replacing outdated radio and cellular technologies.

AUTOMATED PRECISION IRRIGATION BROUGHT TO YOU BY CAL.NET

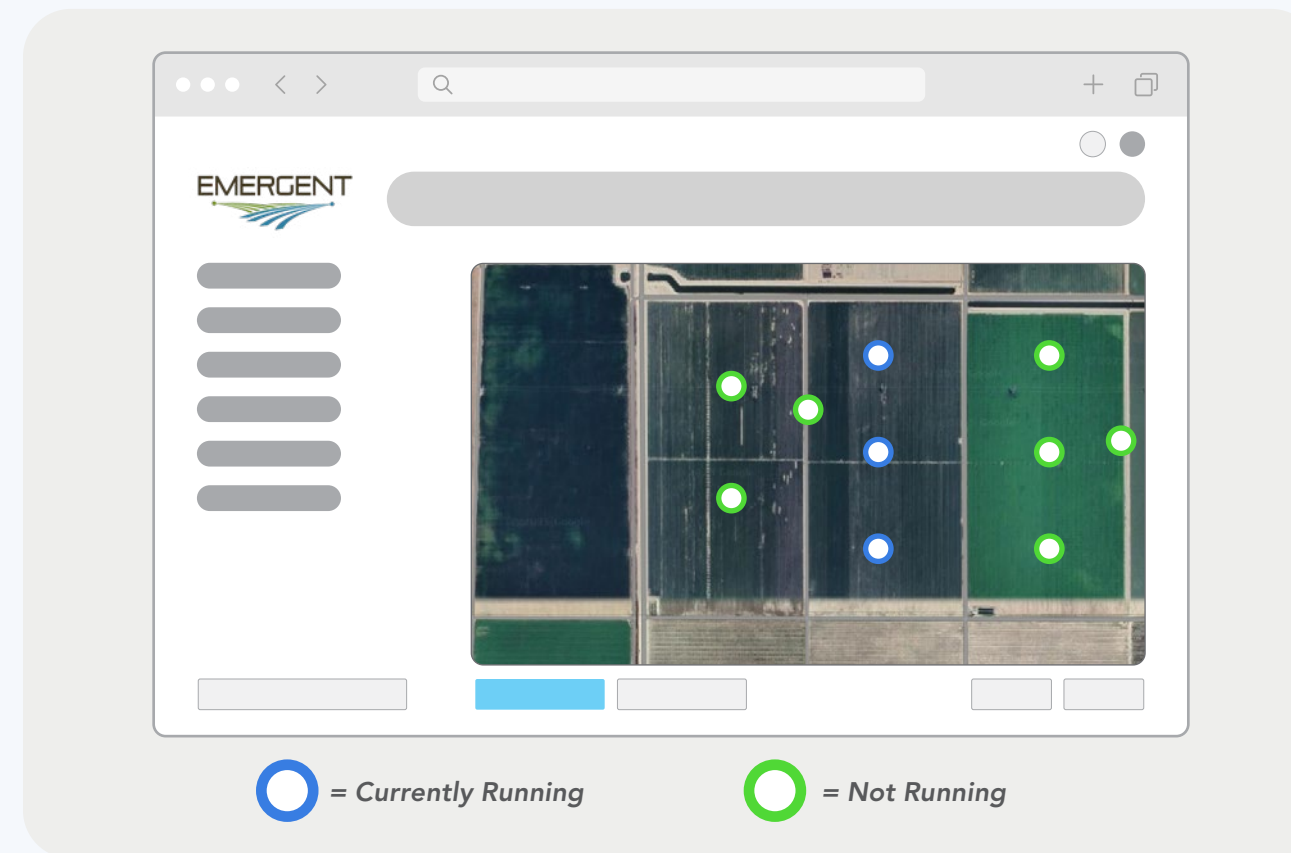
Following the installation of a reliable internet connection, Don Cameron initiated discussions with Cal.Net to explore how this new connectivity could benefit the farm. The top priority identified was the implementation of an automated irrigation management system to save water. The initial target crop was tomatoes, a crop that requires the soil to be kept consistently moist but not waterlogged. Each field of tomatoes is used to produce another crop in the winter cycle, such as carrots or leafy greens.

For this project, Terranova requested the use of "off-the-shelf" components to ensure that farmers aren't left stranded if proprietary parts become unavailable. Cal.Net acted as a systems integrator for the solution, which included the following elements:

- Irrigation system upgrades, including portable valve actuators and pump upgrades provided and installed by AvidWater, an irrigation consultation and installation business with locations throughout California.
- Cal.net provided all the systems integration between the Pumps, Valves, Sensors, the Internet and the Emergent LoRAWAN network which is utilizing the Emergent Connex application platform and Scheduler software.
- Software user interface developed by Emergent Connex.

Once installed, the new irrigation management system allows the ranch manager to set the irrigation schedule by computer so that the valves automatically turn on and off on schedule. The schedule can be changed at any time by the ranch manager. The computer interface displays the field layout and the status of all valves. The flow meters monitor the flow of water from each valve. Any blockages or significant leaks in the system can be detected by the flow meter and an alert is sent by email and text to the ranch manager.

The 2023 pilot project for the Cal.net Precision Irrigation technology and subsequent 400-acre commercial installation were installed on processing tomato fields. As the primary crop by acreage, the value proposition of the technology on this crop was determined to be the most impactful.



“I felt that we weren't getting the irrigation precision that we needed. We were probably over-irrigating some sets and under-irrigating others.”

— Don Cameron, VP Terranova Ranch

“We wanted to strive for uniformity in our irrigation practices and hopefully cut back on water use by being more precise. We were also hopeful that we could reduce labor at the same time.”

— Don Cameron, VP Terranova Ranch



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COSTS AND SAVINGS ASSOCIATED WITH THE AUTOMATED PRECISION IRRIGATION SYSTEM

COSTS

- **Capital Outlay:** The irrigation system, customized for each field, covered 400 acres and is served by three pump stations. The new equipment and upgrades incurred a capital cost of \$133,000, or \$333 per acre.
- **Hardware Maintenance:** Based on experience, hardware replacement costs are anticipated to be between \$5,000 and \$10,000 annually. For modeling simplicity, these costs are assumed to alternate between the two figures each year.
- **Software and Service Subscription:** This annual charge of \$15,600 covers the Software as a Service (SaaS) fee and on-site support for any issues. It does not include hardware replacement costs.

SAVINGS:

- **Water Savings:** A 34% reduction in water usage in 2024 (258 acre ft) versus 2022 (394 acre ft) led to an annual cost saving of **\$18,344**. This is based on an average cost of \$165 per acre-foot.
- **Labor Savings:** Cal.Net's automated irrigation system resulted in an estimated labor savings of \$15,392 per growing cycle. This is due to eliminating the need for manual travel to fields to operate valves three to four times daily, including inconvenient and costly late evening and overnight hours. Since there are two growing cycles per year, the annual savings were calculated at **\$30,784**.
- **Vehicle Savings:** Dedicated vehicle trips to manage manual valves were estimated by Terranova Ranch to be 12,000 miles per year. Using the IRS Standard mileage rate for 2024 of \$0.67/mile, the calculated savings are **\$8,040**.

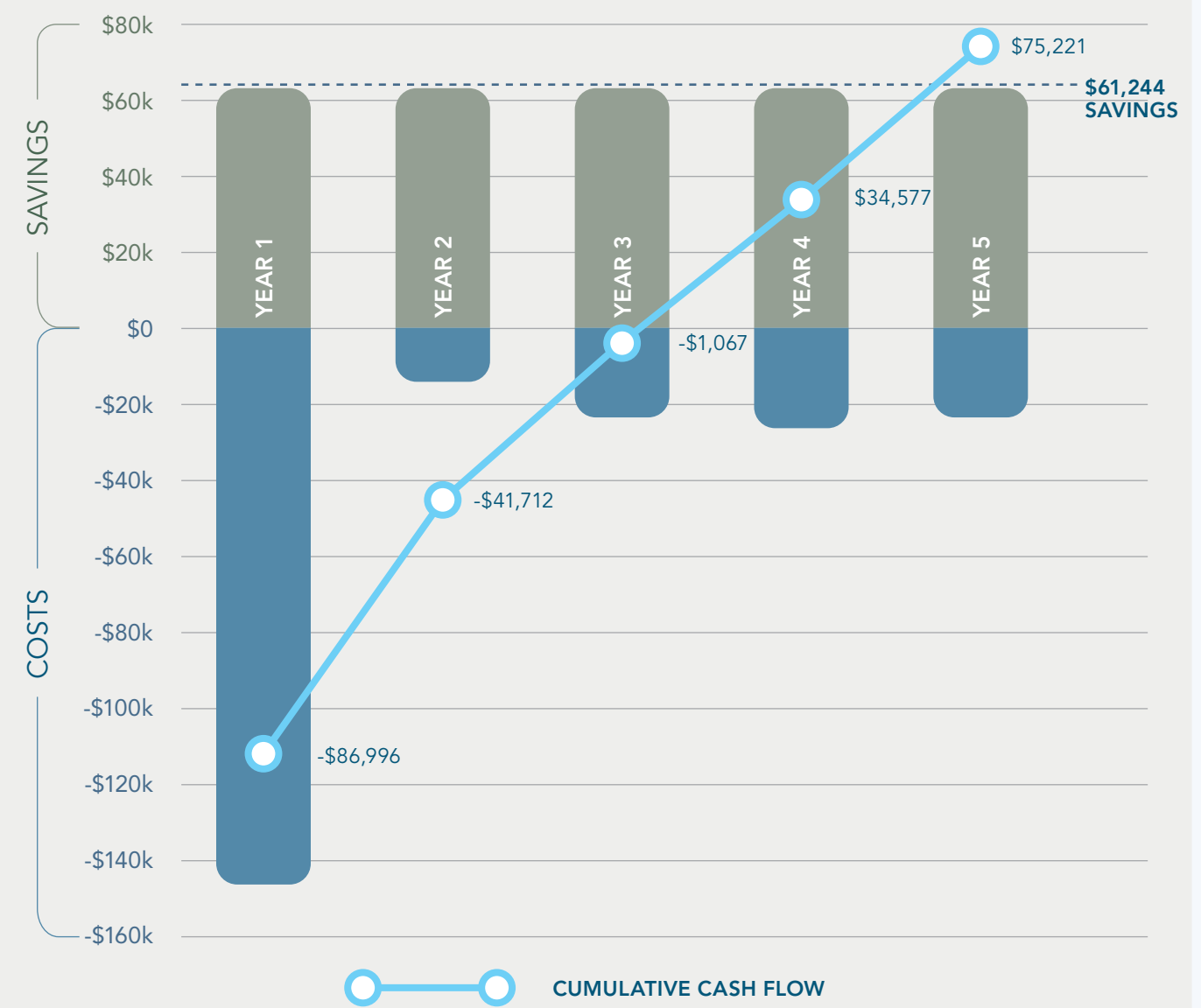
COST OF GROUNDWATER

The primary cost of groundwater is linked to the cost of electricity required to pump it to the surface. The cost can fluctuate based on pumping times (peak vs. non-peak). The automated system can be programmed to shut off during electric peak pricing period, further reducing costs. For this model, \$165 per acre ft was used as a conservative average. Terranova Ranch does not need to purchase water on the open market, where prices have reached up to \$2,000 per acre-foot in recent drought years.

“The idea was pretty simple. It's off-the-shelf materials, and it's not proprietary. Everything is portable, so it can be changed when the field is rotated. That appealed to me.”

— Don Cameron, VP Terranova Ranch

GRAPH 1: COSTS AND SAVINGS OF AUTOMATED IRRIGATION IN FIRST 5 YEARS



Graph 1: Details the annual costs and savings over the system's first five years of operation, demonstrating that the project achieved revenue positivity by its third year (2026).



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ACTUAL COSTS AND SAVINGS FOR 2024 ARE PRESENTED OVERLEAF:

Table 1: Annual Costs and Savings for the Automated Irrigation System Starting 2024

	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Capital Outlay	\$133,000.00	\$-	\$-	\$-	\$-	\$-	\$-	\$-	\$-	\$-
Hardware Maintenance	\$-	\$-	\$5,000.00	\$10,000.00	\$5,000.00	\$10,000.00	\$5,000.00	\$10,000.00	\$5,000.00	\$10,000.00
Software and Service Subscription	\$15,600.00	\$15,600.00	\$15,600.00	\$15,600.00	\$15,600.00	\$15,600.00	\$15,600.00	\$15,600.00	\$15,600.00	\$15,600.00
Total Annual Costs	\$148,600.00	\$15,600.00	\$20,600.00	\$25,600.00	\$20,600.00	\$25,600.00	\$20,600.00	\$25,600.00	\$20,600.00	\$25,600.00
Annual water savings	\$22,420.24	\$22,420.24	\$22,420.24	\$22,420.24	\$22,420.24	\$22,420.24	\$22,420.24	\$22,420.24	\$22,420.24	\$22,420.24
Annual labor savings	\$30,784.00	\$30,784.00	\$30,784.00	\$30,784.00	\$30,784.00	\$30,784.00	\$30,784.00	\$30,784.00	\$30,784.00	\$30,784.00
Annual vehicle savings	\$8,040.00	\$8,040.00	\$8,040.00	\$8,040.00	\$8,040.00	\$8,040.00	\$8,040.00	\$8,040.00	\$8,040.00	\$8,040.00
Total Annual Savings	\$61,244.24	\$61,244.24	\$61,244.24	\$61,244.24	\$61,244.24	\$61,244.24	\$61,244.24	\$61,244.24	\$61,244.24	\$61,244.24
Annual Net (Costs) or Savings	\$(87,355.76)	\$45,644.24	\$40,644.24	\$35,644.24	\$40,644.24	\$35,644.24	\$40,644.24	\$35,644.24	\$40,644.24	\$35,644.24
Cumulative Cash Flow	\$(87,355.76)	\$(41,711.52)	\$(1,067.28)	\$34,576.96	\$75,221.21	\$110,865.45	\$151,509.69	\$187,153.93	\$227,798.17	\$263,442.41

Table 1 also shows the cumulative cash flows for this project, which are expected to become positive in Year 4 (2027).

“Cal.net has been great to work with. Not only did they provide us with really good highspeed internet, they put a lot of time and effort into this project and they have actually listened to our problems and addressed them.”

— Patrick Pinkard, Assistant Manager, Terranova Ranch

ACTUAL COSTS AND SAVINGS FOR 2024 ARE PRESENTED OVERLEAF:

Table 2: Annual Costs and Savings per Acre based on 400 Acres

	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Capital Outlay	\$332.50	\$-	\$-	\$-	\$-	\$-	\$-	\$-	\$-	\$-
Hardware Maintenance	\$-	\$-	\$12.50	\$25.00	\$12.50	\$25.00	\$12.50	\$25.00	\$12.50	\$25.00
Software and Service Subscription	\$39.00	\$39.00	\$39.00	\$39.00	\$39.00	\$39.00	\$39.00	\$39.00	\$39.00	\$39.00
Total Annual Costs per acre	\$371.50	\$39.00	\$51.50	\$64.00	\$51.50	\$64.00	\$51.50	\$64.00	\$51.50	\$64.00
Annual water savings per acre	\$56.05	\$56.05	\$56.05	\$56.05	\$56.05	\$56.05	\$56.05	\$56.05	\$56.05	\$56.05
Annual labor savings per acre	\$76.96	\$76.96	\$76.96	\$76.96	\$76.96	\$76.96	\$76.96	\$76.96	\$76.96	\$76.96
Annual vehicle savings per acre	\$20.10	\$20.10	\$20.10	\$20.10	\$20.10	\$20.10	\$20.10	\$20.10	\$20.10	\$20.10
Total Annual Savings per acre	\$153.11	\$153.11	\$153.11	\$153.11	\$153.11	\$153.11	\$153.11	\$153.11	\$153.11	\$153.11
Annual Net (Costs) or Savings	\$(218.39)	\$114.11	\$101.61	\$89.11	\$101.61	\$89.11	\$101.61	\$89.11	\$101.61	\$89.11

Table 2 facilitates comparison with other operations by presenting the cost per acre for installing and operating the automated irrigation management system, alongside the savings generated from both a summer tomato crop and a second winter crop. Additionally, it details the cumulative cash flow per acre, based on a 400-acre operation utilizing three pumps.

For this model, savings are projected to remain consistent annually, even though this is a conservative assumption for the following reasons:

- The cost of electricity for pumping groundwater has increased faster than inflation since 2022 and is expected to continue to rise. (Reference)
- Farm labor rates continue to rise from \$19.75 in 2024 to \$19.97 in 2025. (Reference)
- Standard mileage rates have increased from \$0.67 in 2024 to \$0.70 in 2025. (Reference)

“Our quality is really good. We deal with very high-quality tomato canners. If you grow poor quality tomatoes or crops, your buyers are not going to stay with you.”

— Don Cameron, VP Terranova Ranch



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OPERATIONAL CONSIDERATIONS

Terranova Ranch has successfully implemented an automated irrigation management system with Cal.net, leading to a range of positive operational and cost benefits. The overall outcome has been favorable, enhancing both efficiency and produce quality, but the transition was not without its challenges:

- One ongoing challenge is the management of pump malfunctions. When a pump goes down, that irrigation system needs to be connected to water from another pumping system, which may or may not be automated. This can cause complexity in the operation as the team integrates a manual system with the automated system. The Terranova team continues to learn how to best navigate this challenge by working with Cal.net and Emergent Connex to automate everything that can be automated.
- Initial installation issues also presented hurdles, particularly concerning faulty valve controllers, which caused operational disruption and flooding.
- Cal.net began this project with software that didn't meet expectations. Partnering with Emergent Connex, Cal.net established reliable LoRaWAN connectivity and provided the Terranova team access to Emergent's software platform for monitoring and controlling irrigation automation and scheduling.
- The growing team had to learn to effectively adopt and use the technology. They initially had soil sensors but ultimately decided in the short-term they preferred physical field checks. The growing team expects to reintroduce soil moisture sensors as the data is now integrated with Emergent's software to control irrigation automation.

Overall, the Terranova team reported a positive experience working through the operational challenges in

the pilot and the full-scale installation with the Cal.net and Emergent Connex team. The Cal.net and Emergent Connex teams were excellent partners and was very proactive about getting on-site to address any problems as quickly as possible.

Beyond the quantifiable operational and cost benefits, the Terranova team believes that the automated irrigation management system has a positive impact on the quality of their produce. The precise control over water delivery, optimized for each crop's specific needs, contributes to healthier plants and, consequently, higher quality yields.

EXPANDING PRECISION IRRIGATION FOR THE FUTURE

- SGMA has influenced how California farmers approach irrigation water usage. Given the increasing frequency and severity of droughts, maintaining sustainable groundwater levels remains a critical challenge. The automated precision irrigation system offers a viable solution, demonstrating a 34% reduction in water consumption at Terranova Ranch, highlighting the ability for farmers to implement methods for decreasing their irrigation water usage. This technology may be a viable alternative to fallowing productive acres.
- Terranova Ranch aims to increase the number of fields utilizing automated irrigation from 8 in 2024 to approximately 30. This expansion's timeline hinges on the broader economic outlook for these crops; tomato prices, for instance, have fallen by about 20% since 2022. Looking ahead, the Terranova team foresees opportunities to broaden the technology's capabilities in the field, including the automation of fertigation and insecticide applications, further enhancing the impact of this technology.



Cal.net is a rural last-mile internet provider. The company offers fixed wireless and fiber internet services. Cal.net has expanded internet service across California's Central Valley and Sierra foothills through various grants and partnerships with rural communities, agribusiness and tribal groups. The company provides residential and business services, including TV, phone and internet, and is increasingly focusing on IoT (Internet of Things) solutions, particularly in the AgTech space. Cal.net competes against all the big internet service providers (ISPs) in California, such as AT&T, Verizon etc. and maintains a competitive edge through local customer service, redundant dual-network products and service bundles designed specifically for ranchers and rural business..

The primary contact at Cal.net for this case study was the CEO, Craig Stein, who provided a background and overview of the technology.

“Water is one of our key economic drivers here on the farm. Anytime we can be more efficient, be more accurate with what we do benefits us in the long term.”

— Don Cameron, VP Terranova Ranch



Farmers Supporting Farmers

Western Growers wishes to acknowledge that this resource was made possible through the generous support of Don Cameron, Vice President, and Patrick Pinkard, Assistant Manager, of Terranova Ranch. Both Don and Patrick are dedicated to advancing sustainable practices and technology adoption in the agricultural industry.

Their willingness to share financial data for this case study demonstrates their commitment to supporting other farmers.



“Don doesn’t talk theory from the sidelines. He pilots ideas in the field, proves they work, and brings the data to the table. His dedication to the advancement of agtech is irrefutable, and the benefit of his ingenuity and focus extends well beyond his acres. This case study is another example of that contribution.”

— Walt Duflock, Western Growers, SVP of Innovation

For more information on this study
or future studies, please contact the
Innovation Team at innovation@wga.com.

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