FIRMATEK

AUGUST 17, 2020

AERIAL DENSITY LANDFILL ANALYSIS SERVICES PROPOSAL RFP 21-06-SWD-01 TECHNICAL PROPOSAL

FOR COCHISE COUNTY, ARIZONA

PREPARED BY
FIRMATEK LLC
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Technical Proposal

At Firmatek, we believe that your ever-changing environment can make decision-making difficult. We are here to provide you with insights and confidence that will help you improve your operational efficiencies. Our mission is to give you – the companies who build the world –supreme confidence.

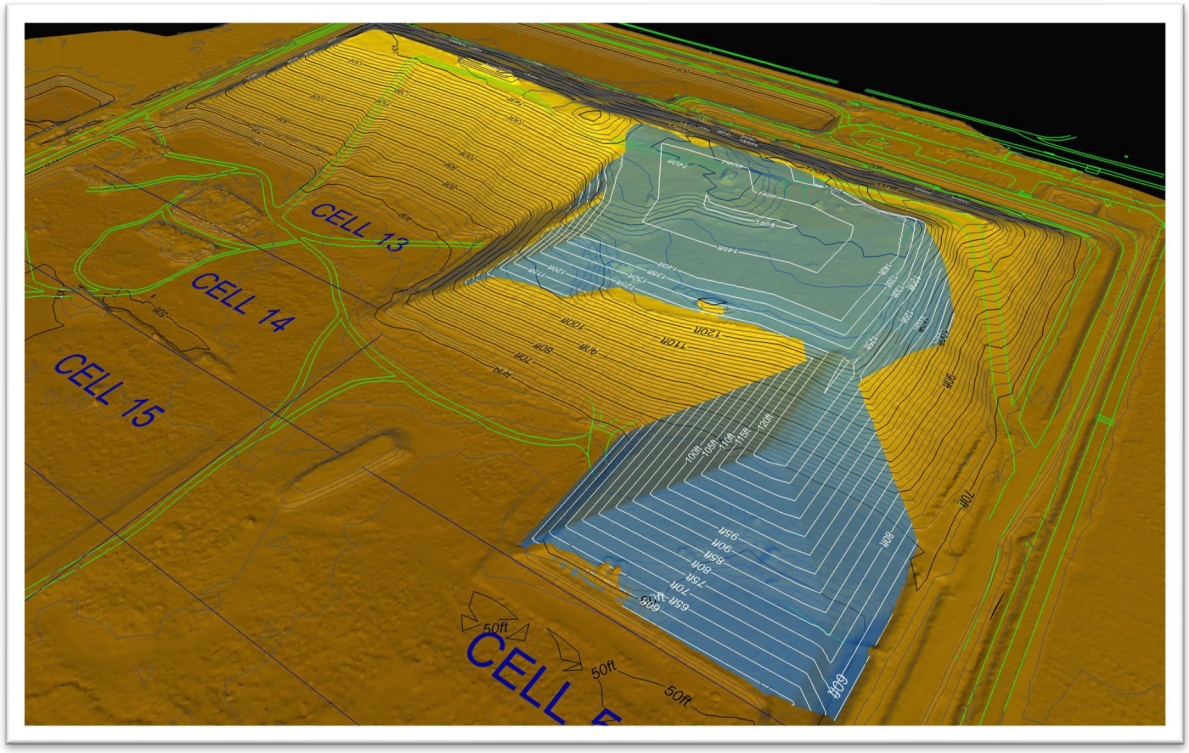
Since 1989, Firmatek has consistently pioneered modern advances in geospatial data mapping through innovative products and services. We have implemented a highly successful safety and training program at Firmatek. Throughout our 30 year history, we have had zero reportable safety incidents, and average nearly 10,000 field man hours per year with our field services team located across the country.

We strive to offer our clients the absolute best in data collection, data processing, and data analysis. We provide our clients with the most accurate measurements and work with them to ensure that they understand their site data. This allows our clients to improve site production, manage their assets, execute on project delivery, and improve overall operational efficiencies.

With over 30 years of industry experience, Firmatek has been using terrestrial laser scanners (LiDAR) to map and measure large dynamic solid waste industry projects since 2009. We currently utilize two types of scanners for our work in the solid waste industry. All of our scanning systems are equipped with survey grade Trimble GPS units that ensure data is tied to site benchmarks. The first system is the Riegl VZ-400 stationary scanner which can be mounted to the top of a work vehicle or removed from the vehicle and set on a tripod. The field data collection for this scanner involves stopping at different positions to allow the on-board GPS to capture an accurate origin location and performing a 360-degree scan. The range of this laser is about 1,300 feet (400m) and it can hit anything that is visible within line-of-site of the lens. This type of scanner produces a high density and high precision point cloud that can be useful for capturing fine elements for equipment as-builts and is also well suited for topography capture. As a service provider, we strive to provide you with the insights that you need to make decisions.

The second type of laser scanner that we use is a mobile Lidar unit called the Renishaw Dynascan. This unit is dynamic, which means that it does not need to stop at different positions while the data is being recorded. It is equipped with an onboard IMU in addition to GPS equipment that allows for

real time tracking of the position, orientation and direction of the vehicle and scanner. These lasers have a range of approximately 500 feet and will record anything at that range that is within line of site of where the truck is driven. The Dynascan system is ideally suited for larger topographic data capture projects where there is good vehicle accessibility.



Even though Firmatek's roots are in the laser measurement industry, we have been researching, testing and deploying drone-based mapping systems since 2015. These systems offer a lot of gains in efficiency and safety, as well as added value for our clients. A large advantage that Firmatek has over many other service providers is that we are experts in all aspects of geospatial equipment and data processing. For Firmatek, using drones is not a new untested venture, but instead they're an additional tool that we can use when and where it makes sense.

We currently have 20+ FAA Part 107 Certified Remote Pilots, including every one of our full-time field technicians. All pilots go through external safety training and testing as well as internal job-specific safety and operational training.

We currently use two main drones for data capture in the solid waste industry. The first is the fixed wing eBee made by Sensefly. This has been one of the most reliable platforms for mapping areas of up to 2,000 acres in one day. Our other primary drone platform is the DJI Phantom 4 RTK. This drone has a shorter flight time than its fixed wing counterpart but has the added benefit of being able to take off and land on a single point, instead of a long landing path. These drone systems can both use can RTK or PPK GPS correction to increase the data accuracy and reduce or eliminate the need for ground control targets.

DJI Phantom 4 RTK

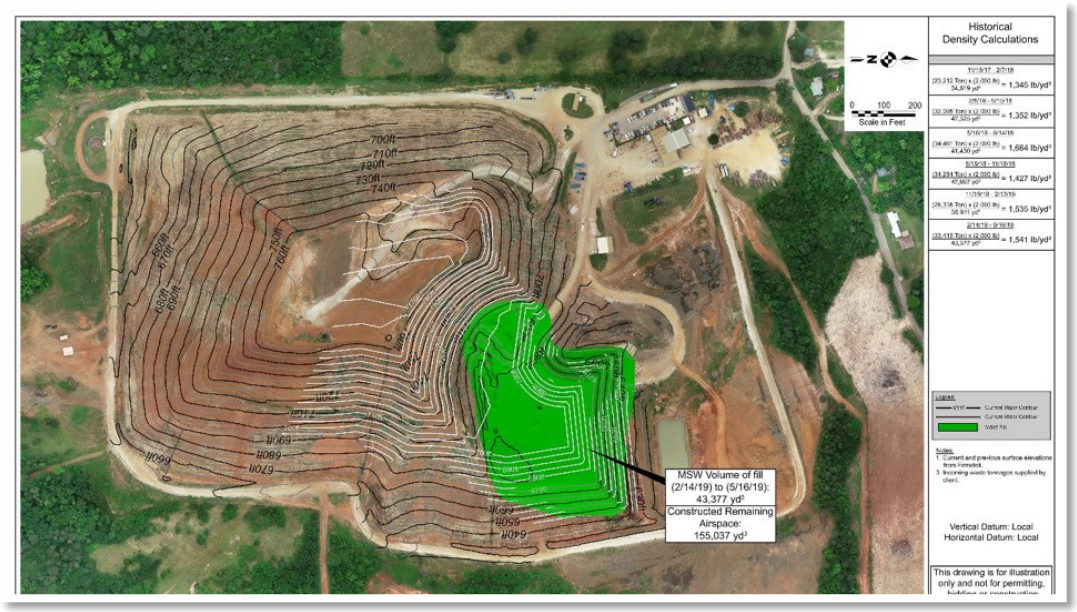
Sensefly Ebee

Solid Waste Industry Deliverables

Map Products & Volumetrics

Our standard mapping deliverable for landfill tracking projects is a PDF map that shows the 3D surface model with current ground elevations; a comparison of the previous survey to the current survey to identify areas of change and calculate waste fill volumes for the period; calculation of constructed remaining airspace from attainable waste grades; and calculation of operational

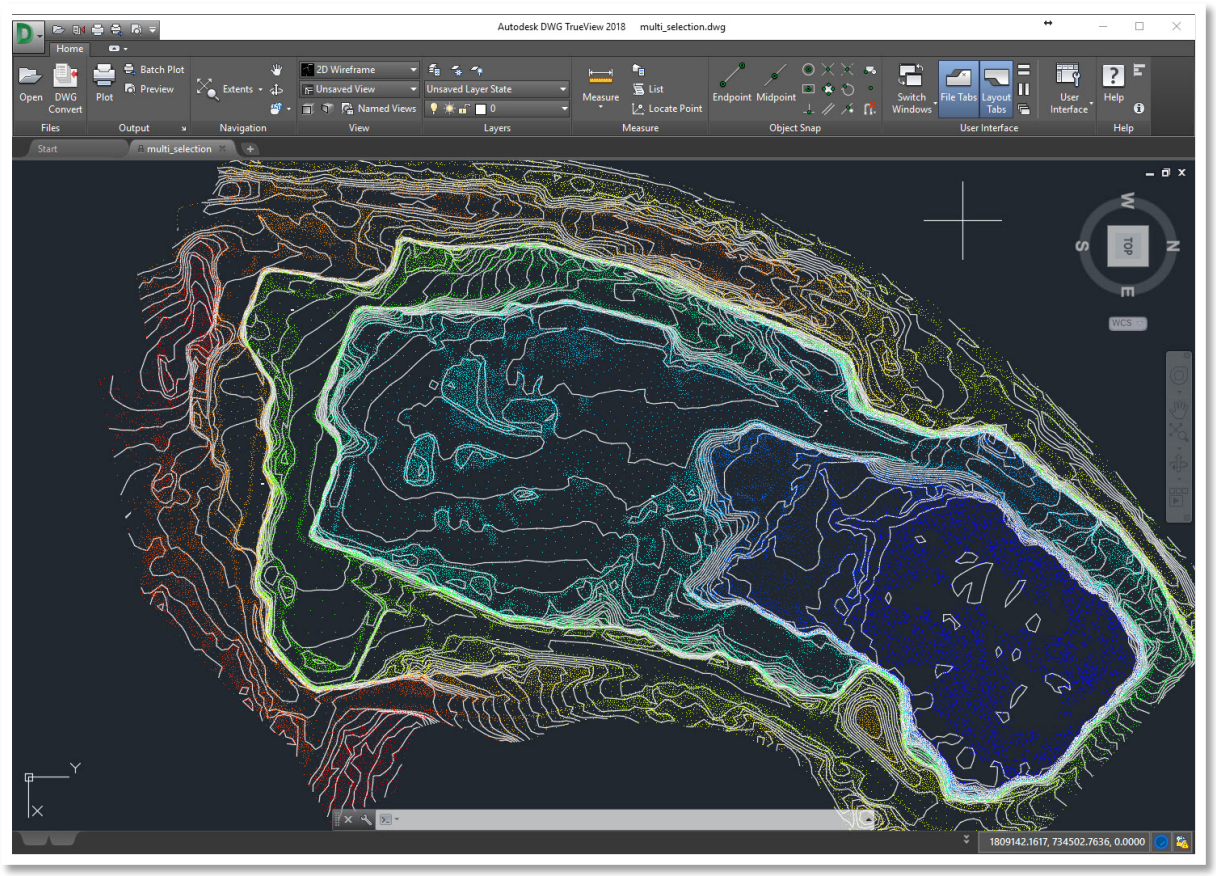
densities. If a drone was flown during the field data collection, then the results can be shown over a current aerial image of the site instead of the 3D surface model.



Topographic CAD

Topographic CAD is digital data that can be opened in surveying, mapping or engineering software. It is derived from the 3D terrain model, which comes from the point cloud. Typical elements of a

topographic CAD file will include contours, break lines, spot elevations and sparse ground points. This data is intended to be a very good representation of the actual surface model, but at a small fraction of the file size. For example, a CAD topography with contours and spot elevations will often be only 1% or less of the point cloud file size.



Aerial Orthophoto

When a drone is used during the field data capture, a current aerial orthophoto of the site can be generated. This photo has been processed so that distortion is removed and the linear scale is correct. The file also contains information about the geographic location and projection of the image, this allows it to be imported into surveying, mapping and engineering programs in the correct location and used in conjunction with other CAD and design files. Our standard orthophoto deliverable is a jpeg or jpeg2000 image that has a resolution of six inches per pixel. Photos can be produced in almost any file format and resolution that works for the client or end user.

Raw Point Cloud

A raw point cloud is a digital file that is made up of tens or hundreds of millions of individual point coordinates that represent the location, elevations and dimensions of every object and surface in the area of interest. A raw point cloud is one of the first results that is derived from laser scanning and drone based photogrammetry, and they are the basis for all topographic and volumetric work that is done. The raw point cloud is dimensionally and geospatially correct, but it has not been processed to remove vegetation, structures, vehicles, etc. or to produce a topographic terrain model. If the data is collected by a drone photos then the point cloud will have real world colorization based on those photos, if it was captured with a laser (Lidar) then it will not. Typically, point clouds are delivered in file formats such as .las, .laz, .rcs and .e57.

Isopach Map

Firmatek can provide as an optional service, a remaining fill isopach map showing constructed remaining airspace, colorized scale legend, fill depth contours and remaining fill volume.

Internal Safety Program

Firmatek launched an internal safety initiative in 2017 called GDOGS. Our intent is to provide clear, simple tips for keeping our people safe in the field. Applicable and relevant to our team's daily jobs and work environment.

Nationwide Presence

The Firmatek field service team is located nationwide and can quickly respond to our client's needs and typically be on-site for an emergency within 24 hours.

Below map indicates current locations and projects visited to date in 2020.