# Abstract:

The communities of Taylors Mistake and New Brighton have had limited interaction with the CoastSnap community science initiative that was set up by Environment Canterbury (ECan) and the Christchurch City Council (CCC). In this project, we investigated the community understanding of CoastSnap, ways to improve engagement, and potential uses for the data. To assess these concepts, a qualitative community survey was undertaken, as well as primary data analysis in MATLAB using code by Mitchell Harley, the founder of CoastSnap, which produced a series of CoastSnap outputs. Our research determined that the community was lacking knowledge about CoastSnap and local coastal processes in general. Our recommendation to ECan and the CCC is to utilise CoastSnap data outputs through education within existing educational sites and programs across the region, such as the Surf Life Saving New Zealand Beach Education Program. We also recommend increasing social media advertising, as well as updating signage in the Taylors Mistake and New Brighton areas to foster community engagement. Further research would involve increased engagement with mana whcré " e luts

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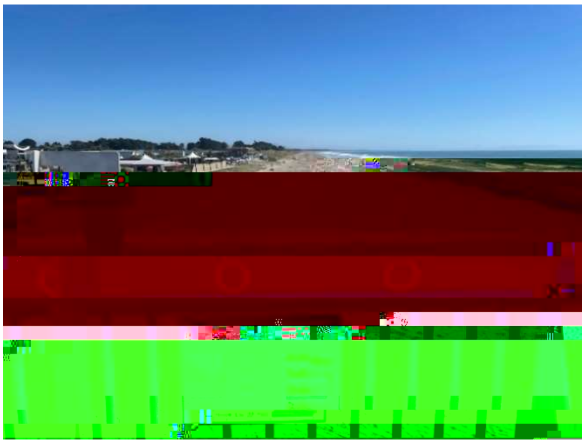
# 1.0 Introduction and Background Context

**Coastal environments are dynamic areas that undergo many natural and anthropogenically induced changes (Rajasree et al., 2016). Change occurs through physical processes, including tide change, waves, sea level variability, sediment transport, wind, and currents (Bryan et al., 2008). The shoreline changes that these processes create are environmentally significant for maritime and terrestrial populations (Masselink et al., 2014). These shoreline changes are particularly important as the shoreline is the line of contact between land and sea, acting as a barrier to marine movement and a buffer against**



## 1.1 Project Objectives

The project research is split into two main objectives:

1.) To analyse already collected data, to create a variety of outputs, including, time-lapse videos, rectified images, shoreline position images, and beach plots.

2.) To understand the community’s current coastal knowledge and how engagement can be improved at CoastSnap stations in Christchurch.

# 2.0 Mana Whenua Engagement

This project acknowledges Ngāi Tahu and Ngāi Tūāhuriri as the mana whenua of the land, and both Christchurch CoastSnap locations (Ngāi Tahu, n.d.). Obligations under Te Tīriti o Waitangi are also acknowledged, and this project endeavours to engage with rūnanga around signage and tikanga.

**The Ministry for Business, Innovation and Employment's 'Vision Mātauranga Plan' was used as a framework to engage with mana whenua for this project (Ministry for Business, Innovation and Employment, n.d.). This project and the Ministry for Business, Innovation, and Employment (MBIE) both recognise the importance of Māori as partners in science and innovation. Collaboratively, we hope to build the capacity of Māori entities and communities to allow them to engage with and contribute to the CoastSnap citizen science community. Through this project, we are hoping to join Western and**

**to see the community's thoughts on the initiative, and to determine why existing signage or promotional attempts have not been as successful as hoped.**

## 3.3 Exploration of Similar Coastal Citizen Science Initiatives:

**Coastal community science initiatives have increased in popularity as the digitalisation of the 21st century continues to grow. Despite the undeniable benefits of utilising citizens to engage in scientific research, there are several barriers, such as reliability, accessibility, and longevity. Longevity is key to ongoing coastal investigations such as CoastSnap, where data over an extended time allows for increased accuracy in predicting shoreline changes (Pecl, et al., 2019). CrowdWater, RedMap, and similar crowd-Sourced photogrammetry worldwide, all require citizens to capture photographs of environmental changes, hazards, or phenomena over an extended period (Pecl, et al., 2019; Jaud et al., 2019; Strobl et al., 2019; Wernette et al., 2022). These projects have had a variety of successes; the use of software to compare different camera types to ensure reliability, analysing both geotagged and non-geotagged photographs, measuring the variation in the two by a margin of error, and development of methods to increase and encourage citizen participation (Jaud et al., 2019; Wernette et al., 2022). Several barriers were also identified, such as the age accessibility gaps in incorporating social media and low continuous citizen participation (Wernette et al., 2022).**

## 3.4 Investigation into Other Types of Coastal Data with Relevance to CoastSnap:

**Using pre-existing coastal data alongside CoastSnap proves beneficial in educating communities on coastal processes, such as tides and waves, and how these influence the shoreline. A range of coastal data must be used to reflect the coast's dynamic environment, which has numerous drivers of response.**

**Wave buoys are a useful tool that collects wave data, including wave height, period, and direction. They show changes in wave climate that are a key driver of coastal change and sediment transport. This was found during the 2016 East Coast Low in Australia, where a change in wave direction from the typical Northward transportation to an easterly direction, consequently resulted in a 40% increase in subaerial erosion compared to a similar event in April 2015 (Louis et al., 2016; Mortlock et al., 2017). Christchurch has a wave buoy off the Banks Peninsula managed by community partners, ECan, which would be advantageous to gain wave data (ECan, n.d.a). Wave height has major seasonal effects and influences on a beach’s erosional or accretionary state (Bernabeu et al., 2003). Tide data can also be used to reflect the change in nearshore water level and is favourable in the circumstances of storm surge, where the beach morphology is likely to change significantly if water exceeds a certain level during a high tide (Pye & Blott, 2008).**

## 3.5 Exploration of Other CoastSnap Initiatives and the Implementation of Their Data:

**CoastSnap sites were created for Australian beaches, including Manly and North Narrabeen, to engage local communities with coastal monitoring. The project was based on ARGUS cameras, (Hart &**

Blenkinsopp, 2020), using the concept of taking pictures from the same position at varying intervals. CoastSnap replaced the stationary camera that needed a power supply and internet connection with a cradle and the public's smartphones (Harley et al., 2019; Harley & Kinsela, 2022; Hart & Blenkinsopp, 2020; Splinter et al., 2018). This engaged the public in coastal science and has contributed to scientific knowledge in the areas implemented.

Image processing was the largest consumer of time and the largest barrier to accessibility within new CoastSnap locations. Retrieving images from various sources and storing them is dependent on the site but takes time and resources to do (Harley et al., 2019; Harley & Kinsela, 2022). Images are processed based on the time and location taken and rectified in MATLAB with code written by Mitchell Harley (Harley et al., 2019; Harley & Kinsela, 2022; Hart, 2021). The rectification, shoreline detection, and tidal correction are all processed by hand using MATLAB which is time and resource intensive.

(GCPs). Each site had 5-6 GCPs that were previously surveyed by the CCC. Images were rectified by selecting the GCPs, with a Root Mean Square Error (RMSE) below 4 being deemed accurate by the group.

Shorelines were plotted from the rectified image but often had to be modified to account for the code not recognising the difference between New Zealand Ocean water and the beach sediment. Approved shorelines were saved to the database and could be used to create shoreline change plots on MATLAB using the associated features (‘trend plot last X days’ and ‘Shoreline change plot’).

## 4.2 Survey

The community’s level of coastal knowledge was gauged through a survey created using the accessible software Qualtrics. The survey consisted of 12 questions, beg

# 5.0 Results

**Figure 7a shows that the majority of respondents have not interacted with CoastSnap before (84%). Just over a quarter of people (16%) have seen or used CoastSnap at New Brighton or Taylors Mistake.**

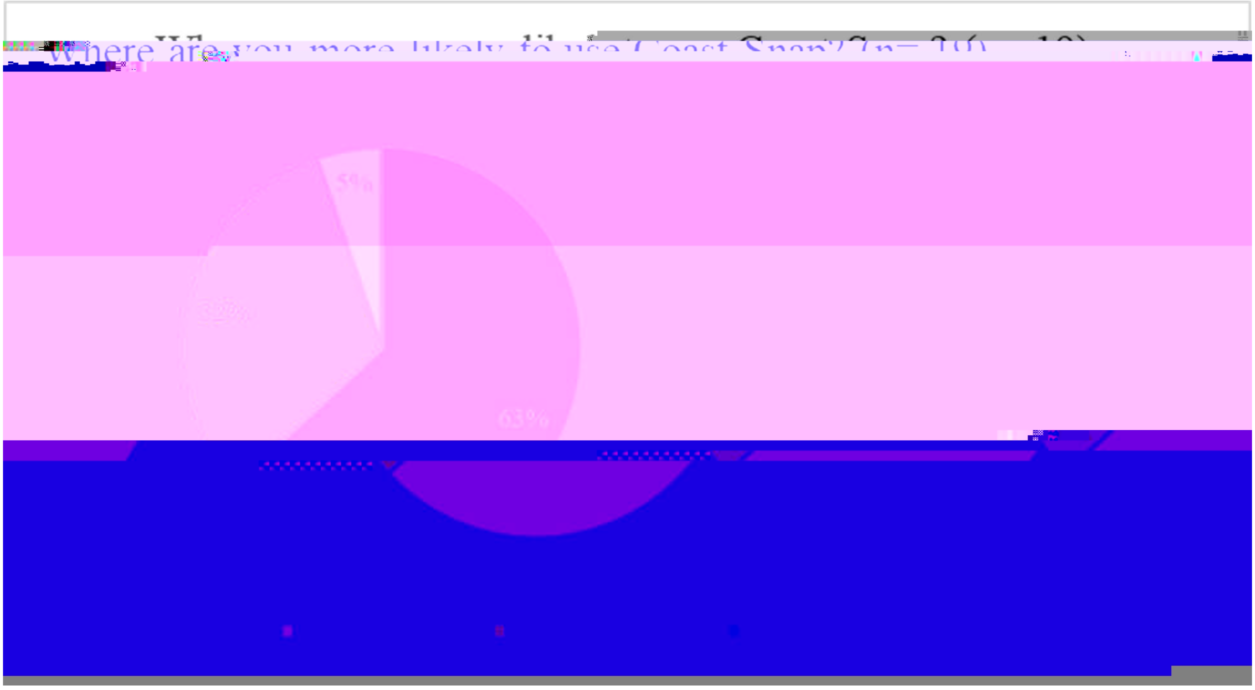


**Figure 7b shows the sites where people are most likely to use CoastSnap in Christchurch. New Brighton is the favoured location with 63% of respondents being likely to use the CoastSnap cradles on the pier.**

Taylors Mistake had significantly less at 32%, whilst few respondents indicated they would use both sites (5%). Results from other CoastSnap sites can be found in Appendix 1.2.

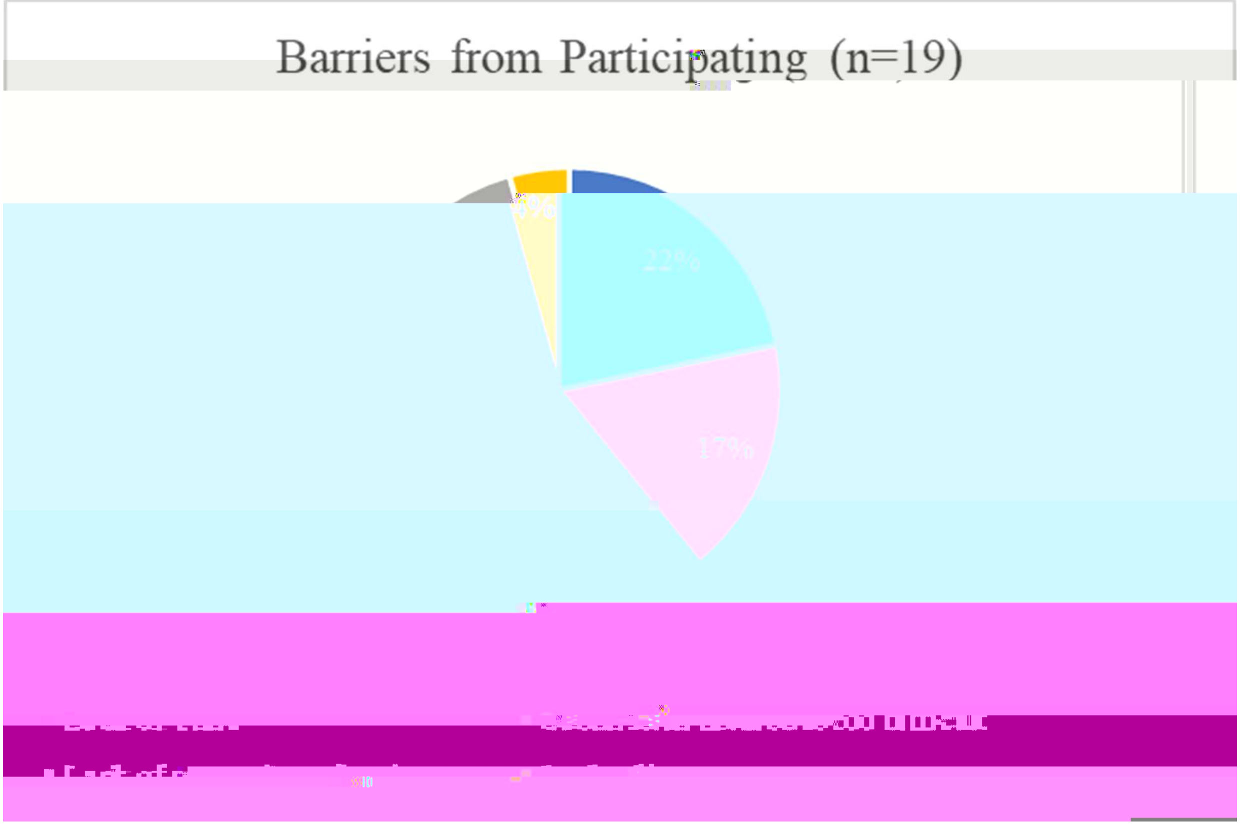
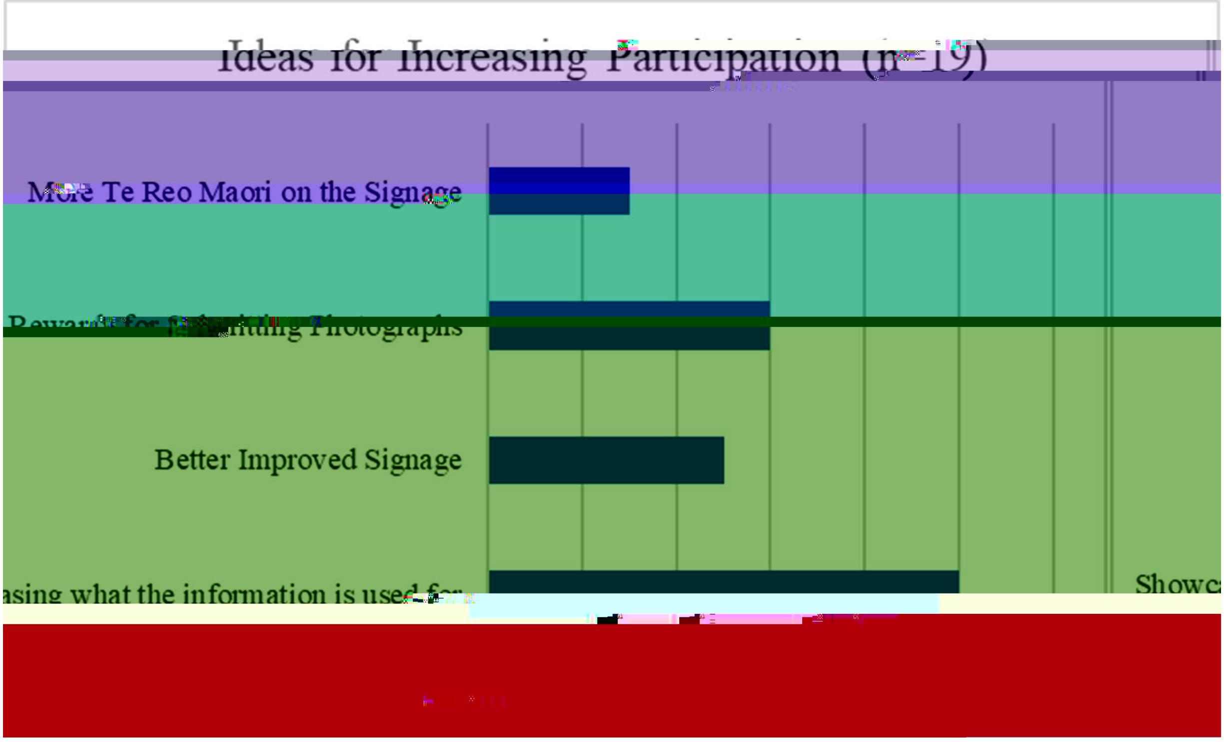


Figure 7c shows the potential barriers to people participating in the CoastSnap initiative in Christchurch. The main discouragement was the lack of promotion of the project, with 57 % of respondents choosing this as a barrier. Lack of time and submission method being too difficult were similarly measured barriers for the public (22% and 17% respectively), and lack of interest was occasionally chosen as a barrier (4%)

**Figure 7d looks at the preferred submission method for CoastSnap images, with 36% choosing Instagram, 24% choosing the app, as well as 20% choosing Facebook, and 20% choosing Email.**

Figure 7e showcases an even split over four topics, looking at the existing coastal education in the community. The biggest concerns for the respondents were SLR (33%) and pollution (29%), closely followed by coastal erosion (17%). A large percentage of the respondents also responded with no answer (21%).



Ideas for increasing engagement are recorded in Figure 7f. This graph showed that 42% of the respondents felt that showcasing what the information is used for would increase their participation in CoastSnap in Christchurch. Additionally, rewards for submitting photographs (25%), improved signage (21%), and more Te Reo Māori in the signage (12%) were also perceived to increase participation.

# 6.0 Discussion

## 6.1 Discussion of Results

Figure 7a highlights the need for improvement of current CoastSnap promotional schemes, as well as the need for more community outreach because most of the respondents had not used CoastSnap before. Figure 7b reinforces this, by highlighting that the biggest barrier is limited knowledge about it, closely followed by lack of time, and the submission method being too complicated. However, this figure does show that lack of interest is not a problem. It shows that the community is willing to engage, interact, and learn about local coastal processes. Figure 7c examines which CoastSnap site is being used more, with New Brighton being the most popular, and few people aiming to use both sites. The statistics from

**interpreting survey results. Several potential participants opened the survey and then exited it before recording any results. This could be due to disagreement with the ethics disclaimer before the beginning of the survey.**

**Question 5 of the survey asked participants "what would entice you to record with CoastSnap on a regular basis?". Four options were available for the participant to indicate their preference, with a fifth open "other" box. In the future, a question of this nature would be more beneficial in the form of an open question box, rather than providing the participant with options and potentially skewing their opinions.**

## 6.4 Mana Whenua Engagement Limitations

**This project faced issues concerning the engagement of mana whenua, Ngāi Tahu, and Ngāi Tūāhuriri. Various attempts were made to contact both Ngāi Tahu and Ngāi Tūāhuriri over the phone and through email during the initial and developed stages of the project.**

**The lack of**

**We would also like to acknowledge Ngāi Tahu and Ngāi Tūāhuriri as the mana whenua of the land and recognise that collaboration is needed for future generations.**

**“Mo tatou, a, mo ka uri a muri ake nei”**
**“For us, and our children after us”**
**Ngāi Tahu Proverb**

Titus, J. G. (2002). Climate change impacts on U.S. Coastal and Marine Ecosystems. , 25(2), 149-164. https://doi.org/10.1007/BF02691304

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Splinter, K. D., Harley, M. D., & Turner, I. L. (2018). Remote sensing is changing our view of the coast: Insights from 40 years of monitoring at Narrabeen-Collaroy, Australia. (11). https://doi.org/10.3390/rs10111744

StatsNZ. (2018a). New Brighton. https://www.stats.govt.nz/tools/2018-census-place-summaries/new-brighton

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Strobl, B., Etter S., van Meerveld I., Seibert J. (2019). The CrowdWater game: A playful way to improve the accuracy of crowdsourced water level class data. (9). https://doi.org/10.1371/journal.pone.0222579

Sweetman, A. K., Thurber, A. R., Smith, C. R., Levin, L. A., Mora, C., Wei, C. L., ... & Roberts, J. M. (2017). Major impacts of climate change on deep-sea benthic ecosystems. , (4). https://doi.org/10.1525/elementa.203

Wernette, P., Miller, I. M., Ritchie, A. W., & Warrick, J. A. (2022). Crowd-sourced SfM: Best practices for high resolution monitoring of coastal cliffs and bluffs. , , 104799. https://doi.org/10.1016/j.csr.2022.104799.

Coast Snap is a worldwide community science initiative that was established in 2017. This [illegible]

[illegible] residents of Taylors Mistake and New Brighton. This survey will take about 10 minutes to [illegible]

[illegible] the local coastal processes. This survey will be analysed in collaboration with Christchurch City Council and Environment Canterbury.

Participation in the survey is voluntary, and you have the right to withdraw at any stage. You may ask for your raw data to be returned to you or destroyed at any point. Any information you give us will be removed from this research if you wish to withdraw. If you [illegible]

[illegible] University of Canterbury. At [illegible] conference we will be using this data to write up a group report that will be shared with the coordinators of this course, Christchurch City Council and Environment Canterbury. This research will be carried out by Ella Gorton, Eliza [illegible]

[illegible] responses to the survey questions, you agree to the following:

- I have been given a full explanation of this project.
- I understand that participation is voluntary, and I may withdraw at any time without penalty. Withdrawal of participation will also include the withdrawal of any information I have provided should this remain practically achievable.
- I understand that any information or opinions I provide will be kept confidential to the [illegible]
- [illegible] as well as be presented at a conference in front of our Geography class, members of the community partners, and to other guests from the city and UC. Lead by Ella Gorton, Eliza McCracken, Katie Rosie, Lucy Coulston and Mia H[illegible]

Have you used CoastSnap before?

Which picture submission method is most appealing to you?

Twit

Facebook

What would entice you to record with CoastSnap on a regular ba

Better/improved signage

Feedback on what the information is used for

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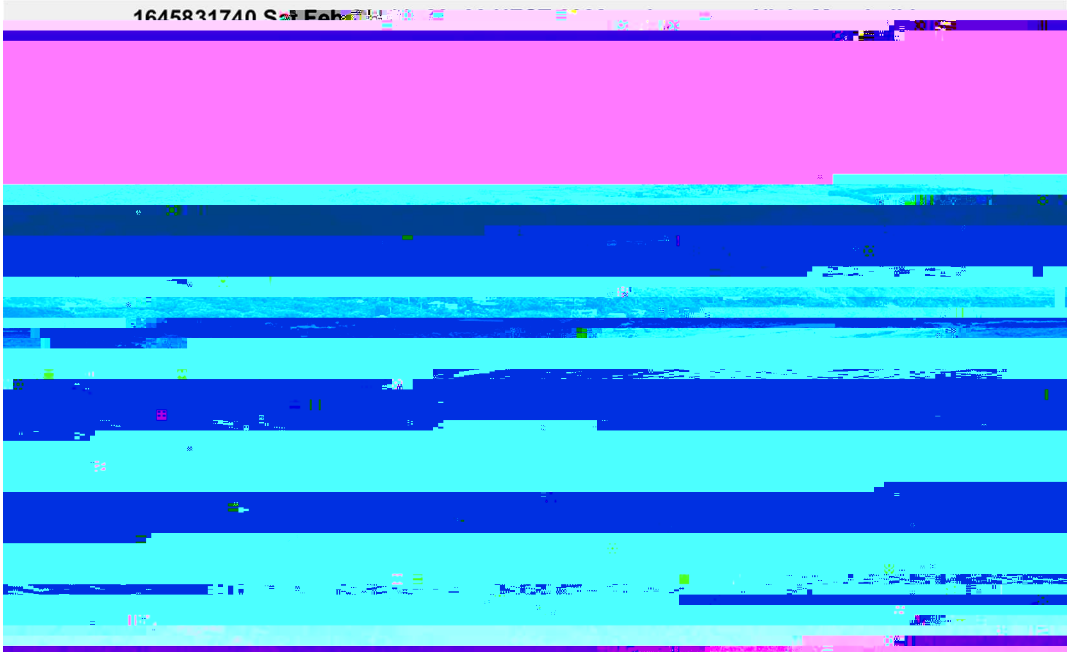
Any other thou



## Note