# COL. MENDELL'S REPORT.

## The Debris Deposit and the Sacramento River Navigation.

### Recommendations to the General Government of Measures for Impounding Mining Debris.

### A Quarter of a Million Dollars Asked for to Begin the Work of Redeeming the Sacramento River and its Tributaries.

### The Alternatives; i. e., a System of Storage for Debris, Cessation of Hydraulic Mining, or Destruction of the Navigable Rivers of the Interior.

A few days ago the telegraph announced the receipt at Washington of Lieutenant-Colonel Mendell's report on the debris problem. The report reviews the condition of the Sacramento river and its tributaries, and prescribes possible remedies for existing evils. The document, to which access has been kindly granted through the courtesy of Colonel Mendell, although lengthy, will be read with interest, and the full text of it is herewith appended:

SAN FRANCISCO, February 20, 1880.

The Chief of Engineers, Washington, D. C.—General: Various annual reports on the improvement of the Sacramento river of this State, beginning in 1876, have made mention in a general way of the relation of hydraulic mining to the navigation of the Sacramento.

The last annual report included a comparative profile of the bed of Steamboat Slough (one of the principle channels of the Sacramento) as plotted from Wilkes' survey of 1871, and the survey of 1878. This showed a maximum filling of 22 and a mean filling of 8 to 10 feet. This comparison is not wing to the uncertainty as to the base of levels of the exploring expedition insisted upon except to demonstrate the fact of a serious filling.

WHAT HAS HAPPENED AT SACRAMENTO.

The same report showed as a result of the survey of 1878, t at the plane of low water at the city of Sacramento has been raised about 5 feet since the occupation of California by Americans. The tide, which 30 years ago produced an elevation of about 2 feet at Sacramento, and made itself felt as high as the mouth of the Feather, now does not sensibly extend above Heacock Shoal, 9 miles below Sacramento.

A survey of the river in front of the city of Sacramento for a distance of two miles, in 1854, by authority of the Town Council, shows, in comparison with our survey of 1878, a mean filling over this distance of 15.2 feet and a maximum filling of 25 feet. This comparison was made by the State Engineer.

The State Engineer finds the filling of the river at the mouth of the Feather to be three to four feet; at Marysville, on the Feather, to be 13 to 15 feet; at the Yuba Mill, on the Yuba river, near where it emerges from the foothills, in a part of the stream that never was navigable, 68 feet; and at Smartsville, still further in the foothills, at the outfall of some larger mines, the filling is reported to be 125 feet. The pools in the Feather have also been very much filled. The tendency of the river, under the great loads of material imposed upon it, is to take a grade which tends constantly to get steeper.

Steamboat slough, which was formerly the shortest and deepest of the two arms of the Sacramento, is reported, on good authority, to have been filled a good deal since the survey of 1878—so much so that it has been abandoned as the usual route of river boats.

NAVIGATION OF THE LOWER SACRAMENTO.

The navigable condition of the lower river has also suffered very much, owing to the same cause, but not in proportion to the actual filling. The mean depth has been lessened in a much greater proportion than has the maximum depth.

The filling in the beds of the Sacramento and Feather rivers is mainly sand. Many borings in the Sacramento were made in 1878, almost always with the exposure of sand. At the mouth of the river and in some bays where the current is feeble there is a deposit of sediment or "slickens," as it is locally called. This is a mixture in a fine state of division of clay and extremely fine sand. It is suspended with such facility that it may almost be called soluble. It gives the yellow or tawny color to the waters of the running rivers, and imparts to the waters of San Francisco bay a feebler, although a distinct shade of color. The "slickens" do not appear to rest in the main river. When they reach the channel they are carried by its current to resting-places in the lower bays, and perhaps, in part, in the ocean.

The other products of hydraulic mining are sand, both silicious and micaceous, gravel of all sizes to stones, which may appropriately be called cobblestones, as they reach the foothills. As they leave the mining sluices they are, in many cases, much larger.

I inclose a map of the lower Sacramento and its tributaries (Appendix A), covering the parts of the mining districts now under consideration. The names on the map in the mining districts are those of prominent mining points. The Feather and American rivers drain the greater part of these districts. The Yuba, which joins the Feather at the site of the town of Marysville, is also an important mining stream. Upon these last two streams the consequences of the state of affairs that has existed in this country for a great many years have been more fully developed than elsewhere. In order to exhibit these results in an effective way, I inclose maps of the Yuba and Bear rivers for a few miles of their course. These maps are obtained through the courtesy of the State Engineer Department—(Appendix B and C).

DEPOSITS OF MINING DETRITUS.

A few words may be said in explanation of the Yuba map. The shading denotes the deposits of mining detritus. The deposit opens out as the river is released from confinement in the foothills. It attains a width of 6,400 feet, and is estimated that it has thus far covered 14,600 acres in the plains, much of which was alluvial land of value.

The cross section on the Yuba map shows the elevation of this mass of detritus to be here above the general level of the country. This general level is the second bench of the bank, the first being covered. The original bed of the stream is said to have been 10 or 12 feet below the lower bench.

The same general descriptions may be given of the deposits on the Bear river.

These rivers, after reaching the plains no longer flow on natural channels, but make for themselves beds which change from year to year, and which are in many places above the adjoining farming lands. These lands are protected from the flood-water and from the mining deposits by levees, which, year by year, have to be built higher and higher to keep up with the new deposits which are yearly added. When the levees give way, which is not an unfrequent occurrence, the lands adjoining are covered with a deposit. In places where the flood-water stands quiet long enough, a thick crust of slickens forms on the land. The thickness runs from a film to perhaps a foot. The sand and gravel are generally deposited close to the site of the breach.

The losses that the farmers suffer yearly from this cause and the apprehension of future disaster of still greater magnitude, have given rise to a great deal of contest in the Courts and Legislatures. It now exists in the Legislature of California, when the great questions of agriculture and mining are engaged in controversy. There is much to be said on each side of the contest.

HYDRAULIC MINING.

The great source of the evils that have been briefly sketched is admitted to be mining. The main existing cause is hydraulic mining. Quartz mining and other mining than hydraulic have their influence; but their sources are relatively so insignificant that they may be neglected in comparison with hydraulic mining.

Hydraulic mining makes a profit out of gravel or earth which contains six or eight cents in gold to the cubic yard. It does so by making water do the work that in other mining is done by machinery or by manual labor. Water excavates the mountains, and carries the detritus to the dumps out of the way. Water also brings this detritus from the dumps, which are generally in gorges of the mountains, to the plains, the river beds or ocean beds, wherever it comes to rest.

When the water is made to excavate it is used under a pressure of one to 300 feet, and is discharged against the bank from a nozzle that may be five inches in diameter, and in some cases is nine inches. This same water conducted in sluices of four to six feet wide, on a grade of 200 to 300 feet to the mile, carries the excavated detritus to the outfall or dump. New material accumulates at the dumps until the freshet in the channel carries it below. The streams at the upper mines have a fall of 70, and perhaps 100 feet to the mile. A freshet with such a fall makes a rapid destruction of a dump.

CAPITAL INVESTED IN MINING.

This rapid and cheap handling of earth or gravel is made possible only by large investments of capital. These investments are made to bring water from higher altitudes, so that it can be used under the necessary pressure. The water is brought in ditches forty miles, more or less, long, built in a country which, for vertical dimensions and steep slopes, is almost unequaled. These canals are bold in the extreme. Inasmuch as the streams do not furnish sufficient water at all seasons, it becomes necessary for the miner to store water from the melting snows, which he does in large reservoirs, which are also admirable specimens of their kind. These reservoirs are well up towards the summit of the Sierra Nevada. Several are shown on the map, as the Fordyce, the Bowman, the English and the Meadow Lake.

The construction of the canals, reservoirs and sluices from the mines to the dump, which is often through a tunnel some thousand feet in length, are all preliminary to the actual operations of mining. These constructions have, in some cases, required several years time, and in the case of the North Bloomfield required the expenditure of about two millions of money. In these circumstances lies one of the main appeals of the miners. In many cases the principal has not been returned, and cannot be returned unless the system is allowed to continue.

RESPONSIBILITY FOR ACCUMULATION OF DEBRIS.

Although the hydraulic miner is now unquestionably responsible for the continual accretions that raise the levels of the beds of the water courses year by year, yet the history of these deposits show that he is not responsible for all that is past. Hydraulic mining, in the effective form it now presents, is of quite modern growth. The earlier mining done from 1848 to 1860 was done by manual labor. Water was used to work out the gold, but was not used to excavate to any great extent. The water was not used under pressure. During these years, and especially during the first five or six years, continuing from 1848, many thousands of men were employed in placer mining all through the gold districts. During all these years there was no great flood. The winter of 1861-2 was the occasion of the severest flood California has ever known since 1848. This flood found all the little gulches and the beds of larger streams stored with the material resulting from ten years' mining. This freshet brought the sand and gravel down in immense quantities. Whatever filling of the channel may have taken place previous to this time, it appears to have escaped notice. The winter of 1865, which gave high water, increased the evil. The placer mining had been nearly, if not entirely, exhausted by this time. Each successive flood has made things worse and worse.

It has been said that a profit can be made out of earth that contains a few cents of gold to a cubic yard, but in order to accomplish this a large investment of capital must be made in procuring a sufficient supply of water under an adequate pressure.

It will now be understood that in order to return a good interest on large investments larger quantities of earth must be handled.

WHAT WATER IS REQUIRED TO DO—QUANTITY USED.

The quantity of water that a mine uses is generally pretty well known, at least approximately. The quantity of earth that is moved has not generally been a subject of interest to the miners, and for that reason our information on this subject is not as full as is to be desired. In a few cases the amount of excavation has been measured, and some attempts have been made to obtain general results as to the amount of excavation that can be made with a given quantity of water. This amount varies with the character of the material, with the slope of the hill and with the pressure of the water. It is not here proposed to go into detail on this point, but it seems desirable to convey some sort of an adequate idea of the results of this kind of excavation.

An inch of water running for 24 hours is taken to be 2,230 cubic feet. On the San Juan ridge, between the South and Middle Yuba, the State Engineer reports that in the year beginning November, 1878, 2,819,317 inches of water were used, while the quantity ascertained to have been used during the same time in the drainage basin of the Yuba is 5,893,962 inches. An inch of water will excavate at all rates from 1 to 7 or 8 cubic yards of earth. The Spring Valley mines at Cherokee have been excavated to the extent of 23,000,000 cubic yards in 7 years, with an average quantity of 2,250 inches. Allowing 310 days to the year, the daily excavation for an inch of water is about 4 yards. The material here is very light, mostly sand, fine gravel and clay in cliffs 400 feet high. The grades of the sluice is perhaps an average, being one foot in 24.

QUANTITY OF EARTH DEPOSITED IN THE STREAMS BY THE MINES.

It would perhaps be an excessive allowance to apply this rate of excavation to the Yubas. It is, however, within the probable limits of truth to place the amount of material excavated in the basin of the Yuba at 2½ yards to the inch. This allowance makes the yearly amount placed in the stream and its tributaries at 14,000,000 or 15,000,000 cubic yards. On the other mining streams, the Feather, Bear and American, there is no reliable information as to the amount excavated and deposited in the streams.

The attempt has been made to estimate the quantity of material in the Yuba and Bear rivers that have not yet reached the navigation lines, but which lies in the path of the floods, and is therefore liable to be washed further and further, in greater or less degree, by every freshet. These deposits are the result of past mining. If no more were added, they are yet capable of doing a great injury to the water-courses below.

The amount lying in the bed of the main Yuba and its branches, above the Yuba mill, is 49,263,200 cubic yards. The amount below the Yuba mill, as far as Marysville, 14,600 acres covered, average depth assumed to be 4 feet, is 94,288,664. Total, 143,551,864.

On the Bear river the estimate is 148,248,000, of which 62,088,000 lies in the plains, and 86,160,000 cubic yards are in the bed of the stream above the foothills. This estimate makes the total amount in the two streams to be 291,799,864 cubic yards. It is not pretended that this estimate is accurate. It could not be so without boring the deposits in thousands of places. It is made from the best information available. Its use, in its imperfect accuracy, is to convey to those who have not the opportunity of seeing it some conception of the enormous dimensions of the phenomenon.

The character of this deposit has already been defined. It is sand, gravel, slickens and stones. The part that has reached the plains to this time is sand, gravel and slickens. The layer of gravel and cobbles remain, as yet, in the foothills. There is some coarse gravel in the Yuba, four or five miles below the Yuba mills.

The Yuba having been filled 125 feet at Smartsville, and perhaps 15 feet at Marysville, the slope of the river between these points, a distance of 18 miles, has been increased 110 feet, which is about six feet per mile. This about doubles the original slope.

This tendency to increase the slope of this part of the river brings the gravel lower and lower. This is counteracted, to some extent, by the great breadth of the stream in the plains at high water. Small gravel is, however, found now in small quantities within three or four miles of Marysville. With the increase of slope under the influence of freshets we must expect this gravel to reach first the Feather, and in due time the Sacramento. Once in either of these streams in considerable quantities, it cannot be expected to move under the influence of the current, or if it did, the effect would be to transfer it to a more objectionable place. In the Feather the pools that formerly alternated with ripples have been filled. It is estimated by the State Engineer Department that there is a deposit in the Feather river of 40,000,000 cubic yards, and in the Sacramento below the mouth of the Feather something like 100,000,000 cubic yards.

FUTURE MINING.

The quantity of material that remains to be excavated at the mines by hydraulic process cannot be stated with any particular degree of accuracy. This quantity is, however, known to be very large. The quantity remaining in the San Juan ridge, between the South and Middle Yuba, was estimated by James D. Hague in 1876 to be 700,000,000 cubic yards. The following quotation from a printed report made by this gentleman illustrates this statement:

"The linear extent of the gravel channel and its branches in this ridge is about 25 miles. Deducting liberally for the portion already worked and for that too deeply covered by lava to be available for hydraulic mining, there remain probably not less than 14 miles of channel available for working, from which only a comparatively small portion of the top gravel has been removed. Below San Juan the gravel body has a surface width of over 1,000 feet and is, say, 140 feet deep. From Badger Hill to Bloomfield it is for the greater portion very much wider and deeper. At Columbia Hill its surface width varies from 3,000 or 4,000 to 8,000 feet, and is from 300 to 600 feet deep. The gravel at Lake City is probably 300 or 400 feet deep. At North Bloomfield it is opened to the bed-rock, showing a depth of more than 300 feet. Roughly estimating the average width of the remaining gravel range at 400 yards, and after allowing for the portion worked off, placing its average depth at 70 yards, the sum is an average of 50,000,000 yards per mile, or for 14 miles say 700,000,000 yards. There are, so far as is known, no means of estimating the contents of other gravel deposits in the drainage basin of the Sacramento, nor is it necessary for the purposes of this report that this amount be now known. What is fairly known is sufficient to justify a conclusion."

The preceding description enables us to forecast with certainty, in every respect but time, the disasters which impend over the valleys and their water courses. The great gravel deposits on the flanks of the Sierra Nevada occupy the channels of an ancient drainage system, which was obliterated by an enormous movement of gravel and boulders brought from higher regions, perhaps, by glacial action. New drainage lines were in time excavated by erosion, and these, in turn, are now undergoing a process of obliteration which, if less magnificent in the scale of movement of material than the ancient natural action, is no less certain in its results.

It is hardly necessary here to say anything as to the probable alignment of the third and last drainage system which will replace that which now exists. It is sufficient to appreciate that the result, be what it may, will bring disaster to a large portion of the State.

STORAGE OF MINING DETRITUS.

It is then of the first importance to know what can be done to remedy or mitigate these evils that have been described. This description has been directed mainly toward showing the injuries to which the rivers are exposed. There are other features that are only secondary in importance. The elevation of the bed raises the flood line and gives to an ordinary freshet the terrors of a flood.

The riparian strips of country is constantly threatened with overflow, and all the country which depends on the rivers for communication finds the efficiency of navigation impaired.

Relief from the certain increase of evil that must result from a continuance of the present system of mining can be given only by a restraint of the mining detritus by storing in places where it can do little harm. This mass of material must be stored in reservoirs, the best place for which is in the foothills of the Sierra Nevada. The reservoirs must be made by placing dams across the beds of the streams into which the material is discharged from the mines.

MATERIAL FOR DAM CONSTRUCTION.

Well up in the foothills there is an abundance of stone. This is the material of which to make the dams, which will be a mass of rip-rap, the pieces being of sufficient weight not to be moved by the freshets. The dam will therefore not be water-tight, and being composed of stones without bond, we are enabled to found it on the gravel without the necessity of going to bed-rock below. It is, therefore, an obstruction rather than a dam. The slopes of the mass will depend upon the size of the material. With large stones of several tons weight the lower slope may be one base. The only disaster that can come to such structure is settlement. If it should be undermined at the foot of the slopes, it will settle, and can be restored by the addition of stone. The construction is inexpensive, involving no skilled labor.

Now suppose such an obstruction placed across the bed of the Yuba, the storage capacity will depend upon the slope the material takes under the action of the freshets. The slope of the detritus now in the bed at this point, as it was left by last winter's freshet, is about 22 feet to the mile. If we assume this as the slope when the reservoir is full, the estimate of the storage, based upon the surveys of the State Engineers, show that a hight of one or more obstruction, making a total of 50 feet, placed just above Deer creek would hold back about thirty million cubic yards. Taking the slope of 10 feet to the mile, the same obstruction would hold back seven and a half million yards.

If you suppose the material mined on the Yuba to be stored, it would not be two years before the larger capacity here mentioned would be exhausted.

It cannot be expected, however, that all the detritus will be stored. The slickens and some proportion of the sand will escape. What that proportion may be, experience must determine. We can safely say that a very large proportion will be retained, and that in this respect, the condition will be improved.

When the necessity for more storage approaches, let us suppose another dam built of suitable hight placed further up stream, and so on in succession as may prove to be necessary. The width of the bed of the Yuba at the dam site is 300 feet. There is a deposit in the bed of 30 feet of sand, gravel and stones. The side slopes of the mountains rise to a hight of perhaps 1,500 feet, and have an inclination of 35° to the horizon.

The base of the first dam is 300 feet. Fifty feet higher the width of the valley will be 440 feet, and each succeeding hight of 50 feet would widen the stream 140 feet. The hight that it may be prudent to give to these dams depends so much on the material and circumstances in each case that it must be left for future consideration.

The following table gives the storage capacity for different hights on the assumption that the material takes a slope of ten feet to the mile. The quantities in this table are used as a basis for an approximate estimate:

Table showing the quantities of material in dams and quantity that can be impounded at different hights, the present width of bed being assumed at 300 feet and side slopes at 35 degrees:

| NO. OF DAM. | Hight—Feet... | Total Hight—Feet....... | Stone in Dam—Cubic Yards. | Storage Capacity—Cubic Yards. | Total Storage.. |
|---|---|---|---|---|---|
| One... | 50 | 50 | 32,000 | 7,537,000 | 7,537,000 |
| Two... | 25 | 75 | 30,777 | 12,164,000 | 19,701,000 |
| Three.. | 25 | 100 | 35,240 | 16,150,000 | 35,851,000 |
| Four... | 25 | 125 | 39,212 | 22,740,000 | 58,591,000 |
| Five... | 25 | 150 | 43,783 | 25,408,000 | 83,999,600 |
| Six.... | 25 | 175 | 48,255 | 27,968,000 | 111,967,000 |
| Seven.. | 25 | 200 | 52,726 | 30,550,000 | 142,517,000 |
| Eight.. | 25 | 225 | 57,197 | 33,150,000 | 175,667,000 |
| Nine... | 25 | 250 | 61,670 | 35,738,000 | 211,405,000 |
| ........ | .... | 300 | ........ | 79,258,000 | 290,663,000 |
| ........ | .... | 400 | ........ | 189,626,000 | 480,289,000 |
| ........ | .... | 500 | ........ | 231,106,000 | 711,395,000 |

In this calculation no allowance is made for the increase of reservoir by tributary streams, nor for extension up stream above the original length assumed, namely, 40,000 feet. If, then, the dimensions turn out to be as here assumed, the storage in the table is much too small. The dimensions assumed are an average given by the State Engineer Department.

The economy and comparative stability of low dams are plain. The 25-foot dams require about two-thirds the quantity of stone of one 50-foot dam, giving the same storage capacity.

The contents of the dam are calculated solid, without allowance for voids, and to each volume 20 per cent. is added, for paving below the dam. In the first three dams, taken as a whole, one cubic yard of stone impounds 242 cubic yards of detritus. For the other dams, one cubic yard of stone impounds about 580 yards.

There is some difficulty in estimating the probable cost of these dams. Good authority places the cost at about $1 per yard. The material is known, for some dams at least, to be convenient in the hills above. It is proposed in the absence of full information to adopt higher rates, which are assumed as follows:

Average for first three dams, $1 50 per yard; for remaining dams, $2 50 per yard. With these rates the cost of the first three dams will be $222,025, storing 35,700,000 cubic yards, being about three-fifths of a cent per cubic yard stored. For the upper dams, the bed of the stream having taken the slope of ten feet to the mile, the expense becomes reduced, per cubic yard stored, to less than one-half a cent.

The above is as fair a statement of the probable cost of this system as can predicted from our present information in regard to the Yuba. This river is the principal seat of this kind of mining, and it has received the most attention.

We are not prepared to go into the same kind of calculation as to the American or Bear. There may be some objections in the latter streams to this storage, for the reason that it may interfere with the outfall of the mines. The cost will probably be less in these mines, for the reason that the amount of mining is less than the Yuba.

ALTERNATIVES PRESENTED.

This system of storage, the cessation of hydraulic mining and the destruction of the navigable rivers of the interior are the alternatives which present themselves for consideration. It is true that the last alternative is not without qualification, as will be seen further on, when the diversion of some of the tributaries of the Sacramento is considered. It is to be remarked that this diversion is in itself destructive to our navigable line and that it does not afford relief to the city of Marysville and to the farming lands adjoining the mining rivers, which are now so seriously threatened.

HOW THE DAMS MAY BE MADE.

The purpose of these dams is novel. The mining dumps, however, in the rivers where the material is large, as at Smartsville, play the same part, and store material above them. The security of these dams depends upon the stability of the lower slope. The stones on these slopes must be so large as to hold their places under the floods which pass over them, and the positions they are made to take must be of studied irregularity so as to destroy velocity by falls.

The first dam of the series is the most important, and will require the most particular care in its construction.

The cost of these dams, it must be admitted, cannot at present be closely forecast. The prices that have been assumed are much in advance of those that are given by good authority in such matters. It remains for experience to indicate what this cost will be. If we double the estimates that have been made the per cubic yard stored will yet be moderate.

The mines about Smartsville are among the best. There are also mines at Timbuctoo and Sierra Flat, on the Yuba. All these mines are below the sites of the dams at Deer creek. We must store the debris of these mines low down. Going down to the edge of the foothills we find a place which is about 6,000 feet wide from high land on one side to high land on the other side. This is a very good site for a dam, which will have to be made of brush. The material is convenient, in the shape of the thick growth of willows which spring up on the mining deposits. The storage area below the Smartsville dumps is about 2,700 acres, which, covered to a depth of ten feet, will give a reservoir capacity of 43,500,000 cubic yards. This reservoir will help to restrain the sand which may escape from the upper storage.

The long crest of this dam will make a safe overfall; a large part of the dam material will be constantly wet and therefore durable, and will, however, require repairs from time to time.

The detritus that lies in the plains below the foothills can hardly be raised higher than it now is without danger and certainly alarm to the farmers where lands adjoin. By directing the course of the Yuba river through the plains, it is believed that it can be made to create and maintain a bed, provided new accretions of sand are prevented. The treatment will require the transfer of a relatively small quantity of the detritus to the drainage channels below.

TREATMENT OF BEAR AND AMERICAN RIVERS.

The Bear river requires almost identical treatment with the Yuba. It ought to have a dam at some point in the mountains. This river has not been examined with the same care as the Yuba, and therefore an estimate cannot be made with the same definiteness. A second dam ought to be built at the edge of the plain near Camp Far West.

The same treatment is required for the American river.

WHEN THE DAMS SHOULD BE BUILT.

If this description of the existing state of affairs is at all adequate, it will not be doubted that the necessity for these works is urgent. It is strongly recommended that these dams be built during the coming summer. The proper time is during low water, which extends from August to October. During this period there is little water in these rivers, except that which comes from the ravines, and consequently there will be little difficulty, due to the presence of a strong current.

At the dam site in the Yuba, near the mouth of Deer creek, the rise of high water is stated to be 11 or 12 feet. The freshets are generally of short duration in the winter, the greater part of the precipitation being in the form of snow. A second high stage lasts through May and June, during which time the snow is melting. This latter stage is believed to be not so high as the winter freshets, although much longer.

The storage of mining detritus in the mountains being successfully disposed of, the future will probably be relieved from the immense accretions of sand that now escapes yearly from the mines. This is an immense advantage. But it remains to point out another source that is open for the further protection of the Sacramento river. The full investigation of this plan as to its cost and probability of proportionate benefit, will have to be left for future occasion.

RAISING THE EAST BANK OF THE SACRAMENTO RIVER.

It may be noticed on the map of this region, that the Sacramento is bordered by low lands, represented by shaded lines. One of these low districts lies between the Feather and American rivers, on the east side of the Sacramento. Some parts of this land are represented to lie as much as 20 feet below the banks. The average depth has been estimated at 12 feet. The area is said to be in the neighborhood of 60 square miles. Admitting these statements to be exact, the storage capacity of this basin, filled to the banks, will be about 700,000,000 cubic yards.

It is believed to be practicable to turn the Feather and American rivers into this basin, and make them deposit therein the sands which they bring down. No objection is now seen to turning the American in this way. It is not navigable. The diversion could not fail to be beneficial to the Sacramento.

The Feather differs from the American in being a larger stream, and consequently likely to be more expensive to divert, and also in being navigable. It is now the outlet for a certain district of country, and maintains a small commerce.

It is recommended that a full investigation of this problem be made as soon as possible for future guidance.

REMEDIAL MEASURES INDISPENSABLE.

The foregoing is an outline of the remedial measures that are possible. It is scarcely necessary to add, in view of what has been said, that some measures are indispensable. The only alternative is a cessation of hydraulic mining. Even if this alternative were adopted it would still be necessary to restrain the many millions of cubic yards of detritus already mined, and now lying in the path of freshets which urge it, year by year, into the lower lines of drainage.

It is in a large part due to the courtesy of the State Engineer of California, who has given access to data as yet unpublished, that it has been possible to make this report with any amount of definiteness, either as to the magnitude of the evil, or the cost and probability of success of remedial efforts.

The general features of this phenomenon of choked rivers have been known for some time, but no attempt has before been made to assign a measure to these features. It must be regarded as most unfortunate that these measures had not been taken years ago. Some definite conception of the circumstances would then have been possible, and the evil could have been grappled with in good time. The problem becomes more serious by delay.

The statement of the case which has been given fails of its object if it does not convey a most serious view of the urgency of the question. It is respectfully suggested that this question be brought to the attention of Congress as soon as practicable.

Reasons have been given why a full estimate of cost cannot now be made. A great part of the data has come from investigation outside of this office. Our information must be admitted to be incomplete, but it is sufficient to justify a recommendation for an appropriation by Congress.

APPROPRIATION RECOMMENDED.

It is, therefore, respectfully recommended that an appropriation of $250,000 be asked of Congress, to be expended during the present year in the construction of storage reservoirs for mining detritus on the tributaries of the Sacramento river, and in a further study of this question. I am, very respectfully, your obedient servant, G. H. MENDELL, Lieutenant-Colonel of Engineers.

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The Saratoff *Journal* relates that in a village of that government two Tartars were lately seized in the act of stealing a sack of flour from a barn and shut up all night. Early the next morning the whole population of the village assembled and condemned the two culprits in a manner, says the above-named paper, which would have done credit to the most ingenious torture inventor. The unhappy men were first bound to poles and beaten with clubs till their legs and arms were broken. Then the bleeding victims were tied to the tails of horses and thus dragged over the frozen field until dead, their bodies being afterward flung over a precipice. The newspaper does not say whether the murderers were called to account.

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The waves of a woman's handkerchief have wrecked many a man.

## SAN FRANCISCO MARKET REVIEW.

[REPORTED FOR THE SACRAMENTO DAILY RECORD-UNION.]

SAN FRANCISCO, March 11, 1880.

During the week there have been heavy arrivals of general merchandise. The business outlook has not improved. The local agitation still depresses all kinds of legitimate enterprise. Grain freights to a direct port in Europe have gone down to 35s. The *Commercial Herald* says: "Our stock of wheat is dwindling down with rapidity, so that it is now with difficulty that any large parcels can be promptly secured for shipping cargoes. And it is a little singular that, with the heavy decline in freights to 35s to the United Kingdom, no corresponding advance can be secured for wheat. Quite the contrary is the effect this season—the lower the freights the lower the grain. The reason given for this is that the European markets will not admit even of present freights and current prices of breadstuff. From this reasoning it would appear probable that late exporters of wheat, as well as those holding over their crop of this article, will come out at the small end of the horn." Barley finds little demand, corn is quiet, oats and beans dull, hops inactive, and wool prices not settled. In business circles the spirit of unrest and fear prevails, commercial interests are still flagging, and local securities go begging, all because of the howl of the sand lot crowd, at which capital takes itself to hiding-places, and moneyed institutions enter upon transactions of any kind with extreme timidity and more than caution.

GENERAL MERCHANDISE.

BAGS AND BAGGING—Wheat Bags here are firm at 10¼c for spot and 10½@11c for May and June. The only ship now en route with Calcutta goods will not be due until June. Wool Bags are inquired after and are firm at 47½@55c; Potato Gunnies, 14c apiece; Hop Cloth, 13@14c ₩ yard.

BREAD—The price list of the California Cracker Company for lots in cases, containing 25, 50 and 80 lbs each are as follows: Macaroons, 35c; Cracknell, 28c; Congress Cake and Dot, 15c; Bananas, Cocoanut Cakes, and Egg Jumbles, 14c; Nic-Nacs, 12½c; Alphabet, Assorted Extra, Excelsiors, Ginger Nuts, Medallions, and Numerals, 12c; Assorted Fruit, Ginger Cakes, Jenny Lind, La Grande, Lemon, Milk Fancy, Overland and Seed Cakes, 10c; Pearl, 9c; Santa Clara Extra, 8½c; Boston, Butter, Cracker Meal, Cream, Graham, Lunch, Oyster, Picnic Extra, Santa Clara, Wafers, Water and Wine, 8c; Galetta Picnic and Saloon Pilot, 7c; Soda Extra, 6c; Soda, 5c; Pilot Extra, 4½c; Pilot, 4c; Ship Bread, 3½c ₩ lb.

BRICK—English Bath, 40c ₩ dozen; English Fire, $35@37 50; California building descriptions, $7@11 ₩ thousand. There is scarcely any demand for building descriptions.

BROOMS—The price list of the Vallejo Factory is as follows: Common, $2@3 25; Common Braid, $2 50@3 50; Little Beauties, $3; Prize, $4@5 50; Shield Extra, $3@4; Shield Extra Braid, $3 50@4 50; Whisk, $2; Mill, $4@5; Wisp and Toy, $1 50@2 50 ₩ dozen.

CANDLES—The product of the local Candle factories is quoted as follows: San Francisco Crystal Wax 14-oz, 17c; Stearic Acid, 14-oz, 14½c; Star, 14-oz, 14c; Eagle, 12-oz, 12c; Hoffman's 12-oz, 11½c; Mission Chemical Wax, 14-oz, 16½@18c; Solar Sperm, 14-oz, 14@14½c; Adamantine, 11½-oz, 11@11½c; Globe, 10½-oz, 9½@10c; Bay Improved Wax, full weight, 16@16½c; Stearic Acid, full weight, 14@14½c; Solar, light weight, 11¼@11½c. Eastern brands vary from 16c to 20c; Sperm, 25@3 c ₩ lb.

CASE GOODS—Rates for 25 case lots, so far as advised, rum in as follows: Peaches, $2 50@2 75; Raspberries, $3; Bartlett Pears, Plums, Quinces, Apples, Apricots, Nectarines and Muscat Grapes, $2 50@2 75; Blackberries, Strawberries, Red Currants, Gooseberries and Cherries, $3; Assorted Table Fruits, $2 75@3; Assorted Pie Fruits, $1 75@2 ₩ dozen 2½-lb tins; Jams and Jellies of all kinds, $3 25@3 50; Green Peas and Green Corn, $1 75@2; String Beans, $1 50@1 75; Lima Beans, $1 75@2; Succotash, $2 25 ₩ dozen 2-lb tins; Asparagus, $3; Tomatoes, $1 25@1 50 ₩ dozen 2½-lb tins.

CEMENT—Eastern, $2@2 25; Portland (foreign), $4@4 25; Santa Cruz Lime, $1 25@1 50 ₩ bbl.

COAL—The yards are well supplied, but the number of cargoes en route is unusually small, and higher prices are feared later in the year. We quote: Mount Diablo, $4@4 50; Coos Bay, $6 75@7; Seattle, $6 50@7 50; Vancouver, $6@8; Wellington, $8@8 50; Anthracite, $9@11; Cumberland, $12@13; foreign Steam Coals, $6 50@8 ₩ ton.

COFFEE—Central American, 16@17½c; Rio and Manila, 15@16½c; Ceylon, 20c; Java, 27½c; Ground Coffee, 25c ₩ lb.

CHICORY—California is easy at 4½@6c; German, 6½@7c ₩ lb.

DRUGS—Alum, 3½@4c; refined Borax, 12@15c; Blue Vitriol, 9@10c; Brimstone, 4c for roll and 3½c for California refined; Cream Tartar, 40@45c; Nitric Acid, 12½@16c; Tartaric Acid, 55@60c; Sulphuric Acid, 2½@4c.

DRY GOODS—Brown Shirting is jobbing at 6½@8½c; Sheeting, 9@11½c; Brown Drilling, 10@11c; Prints, 7½@8c ₩ yard.

FISH—Pacific Codfish is jobbing at 3@3½c in 500-lb bdls, 4@4½c for selected in 100-lb cases and 5@5½c for boneless; Eastern Codfish, 7@7½c ₩ lb; Oregon Canned Salmon, $1 35@1 55 ₩ dozen 1-lb tins; Eastern Mackerel, $1 65@1 75 for No. 1 in 15-lb kits and $2 25 for Mess in 20-lb kits.

LEATHER—We quote: Sole, 28@33c; Harness, 32@40c; Skirting 32@37½c; Calf Skins, 70c@$1 10 ₩ lb; Wax and Buff Leather, 18@22c ₩ foot; Bridle, $4@7 ₩ side; Kip Skins, $35@60 ₩ dozen.

LUMBER—Following are the wholesale rates: Redwood, $14 for rough, and $24 for surfaced; Rustic, $24; Oregon Pine in a rough state, $17@21 ₩ M ft; Laths, $3 50; Shingles, $1 75; Redwood Shakes, $8 50 ₩ 1,000; Redwood Posts, $10 ₩ 100.

MALT LIQUORS—English Ale and Porter are quoted at $2 75@3 75 for quarts, and 25c advance for two dozen pints.

MATCHES—Block descriptions, $1 75@1 80, according to quantity; Eastern Parlor, $2 75 ₩ gross.

METALS—All descriptions are very firm. Pig Iron is quoted at $38@45 ₩ ton; Pig Tin, 23@26c ₩ lb; Tin Plate, $9@11 ₩ box; Pig Lead, 5½@6c; Sheet Lead, 7½@8c; Bar Lead, 7@7½c; Lead Pipe, 8½c ₩ lb.

NAILS—The jobbing price for assorted sizes is now $6 50 ₩ keg.

OIL—California Castor, $1 for No. 1 and 95c for No. 2; California Linseed, 95c for raw and $1 for boiled; refined Cocoanut, 50@55c; China Nut, 75c; Continental Petroleum, 150 degrees, in faucet cans, 32½c; do, 110 degrees, in faucet cans, 20c; do, in plain cans, 18c; do, in bulk, 16c; Downer's Kerosene, 160 degrees, in faucet cans, 32½c; California Whale, 32½@35c; Polar Whale, 35@37½c; Sperm, $1 25@1 40 for crude; pure winter strained Lard, 75c in bbls and 85c in tins; Possel Olive, $5@5 25; Plagniol Olive, $5 50@6 50; Duret do, $6 50@6 75; extra fine kinds, $8@9 ₩ dozen quarts.

## GENERAL NOTICES.


**Capital Colonnade, No. 1017 Tenth street.** Private rooms for families. The best of wines, liquors, cigars, etc. JOHN HECTOR, Proprietor. f18-1m

**"Consomme, at the Forrest!"** every evening from 8 to 12 o17-1m

**"Don't Worry Me**

With your complaints about your teeth," said an annoyed father to his "sweet sixteener." "I told you to buy the SOZODONT and use it, but you didn't and you deserve to suffer." And so she did, and all other sweet-sixteeners who act like her. mr11-3tThSTu


## AMUSEMENTS.


**METROPOLITAN THEATER.**

FRIDAY AND SATURDAY, MARCH 12 AND 13, AND MATINEE SATURDAY, AT 2 P. M.

**CAPTAIN JACK**

DRAMATIC COMBINATION!

LIFE ON THE BORDER!
LIFE ON THE BORDER!!
LIFE ON THE BORDER!!!

CAPTAIN JACK CRAWFORD

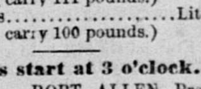
SUPPORTED BY

MISS CONSTANCE MURELLE!

And an Excellent Dramatic Company.

Popular prices. Reserved seats, without extra charge, at the Theater Candy Store. mr10-tf

**RACES! RACES!**



AGRICULTURAL PARK,

SATURDAY, MARCH 13th.

MATCH RACE FOR $200—RUNNING—Three-quarter Mile and Repeat.

George Bayles names ................ James Lick
(To carry 111 pounds.)
Thos. Jones names ................ Little George
(To carry 100 pounds.)

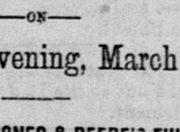
Horses start at 3 o'clock.

mr12 2t ROBT. ALLEN, Proprietor.

—GRAND—

**ST. PATRICK'S DAY FESTIVAL!**

TO BE GIVEN BY THE IRISH RELIEF COM'TE, IN AID OF THE SUFFERERS OF IRELAND.



—AT THE—

**PAVILION!**

—ON—

Wednesday Evening, March 17th.

MUSIC BY CHURCH, JONES & BEEBE'S FULL BAND.

Admission ................ [mr12-td] ................ $1

**$37 50 PER ACRE**

WILL BUY A FARM OF 500 ACRES OF THE best of the Cache Creek Farming Land. Is well timbered and watered. Good improvements. Four Hundred Acres Sowed to Wheat, and looking finely. Crop bids fair to pay one-third the purchase money. Terms easy. Inquire of

mr10-3p2w GEO. D. FISKE, Woodland, Cal.



45 Years Before the Public.

THE GENUINE

**DR. C. McLANE'S**

CELEBRATED

**LIVER PILLS**

FOR THE CURE OF

Hepatitis, or Liver Complaint,

DYSPEPSIA AND SICK HEADACHE.

Symptoms of a Diseased Liver.

PAIN in the right side, under the edge of the ribs, increases on pressure; sometimes the pain is in the left side; the patient is rarely able to lie on the left side; sometimes the pain is felt under the shoulder blade, and it frequently extends to the top of the shoulder, and is sometimes mistaken for rheumatism in the arm. The stomach is affected with loss of appetite and sickness; the bowels in general are costive, sometimes alternative with lax; the head is troubled with pain, accompanied with a dull, heavy sensation in the back part. There is generally a considerable loss of memory, accompanied with a painful sensation of having left undone something which ought to have been done. A slight, dry cough is sometimes an attendant. The patient complains of weariness and debility; he is easily startled, his feet are cold or burning, and he complains of a prickly sensation of the skin; his spirits are low; and although he is satisfied that exercise would be beneficial to him, yet he can scarcely summon up fortitude enough to try it. In fact, he distrusts every remedy. Several of the above symptoms attend the disease, but cases have occurred where few of them existed, yet examination of the body, after death, has shown the LIVER to have been extensively deranged.

AGUE AND FEVER.

DR. C. MCLANE'S LIVER PILLS, IN CASES OF AGUE AND FEVER, when taken with Quinine, are productive of the most happy results. No better cathartic can be used, preparatory to, or after taking Quinine. We would advise all who are afflicted with this disease to give them a FAIR TRIAL.

For all bilious derangements, and as a simple purgative, they are unequaled.

BEWARE OF IMITATIONS.

The genuine are never sugar coated.

Every box has a red wax seal on the lid, with the impression DR. MCLANE'S LIVER PILLS.

The genuine MCLANE'S LIVER PILLS bear the signatures of C. MCLANE and FLEMING BROS. on the wrappers.

Insist upon having the genuine DR. C. MCLANE'S LIVER PILLS, prepared by Fleming Bros., of Pittsburgh, Pa., the market being full of imitations of the name *McLane*, spelled differently but same pronunciation.

H. C. Kirk & Co., Sacramento, Cal., Agent my23 1y8

**FRIEND & TERRY LUMBER COMPANY.**

MANUFACTURERS, WHOLESALE AND RETAIL Dealers in every kind and variety of BUILDING and FINISHING TIMBER and

**LUMBER.**

Cargoes, Car-loads and Special Orders promptly filled, and shipped direct from the OREGON, REDWOOD and SUGAR PINE MILLS of the Company.

GENERAL OFFICE, No. 1310 SECOND STREET, NEAR M. BRANCH YARD, CORNER TWELFTH AND J STREETS. f13-2plm

FOR SALE AT A BARGAIN—THE Oriental Hotel and Stables. No better paying locality in State. Doing good, steady business. Hotel, 30x70 feet; two-story; containing large dining-room, parlor, kitchen, saloon, large hall, 11 well-ventilated bedrooms. Well furnished and ready for business. Large stone stable; two Acres of Land. All for $2,500 cash. Sale positive, as owner must leave for England in spring. R. K. HARVEY, El Dorado, Cal. mr9-2plm*

**$50 REWARD**

WILL BE PAID FOR THE RECOVERY of the living or dead body of C. S. COFFIN. Apply to P. BOHL or H. A. WEAVER. mr11-1w*

**FOR SALE OR LEASE,**

—THE—

**Grand Hotel Property!**

SITUATED ON THE CORNER OF FRONT and K streets, Sacramento city, directly opposite the steamboat landing, and near the railroad depot. The best location in the city for a hotel and business property. Will be sold low, with favorable terms as to payments, or leased for a term of years at a low rental. Inquire of E. CADWALADER, No. 61 J street, Sacramento; or S. P. DEWEY, No 308 Pine street, San Francisco. d22-3ptf

**GLIDDEN'S**

Japanned and Galvanized,

Stands above all competitors, and is the

BEST IN THE WORLD!

JONES & GIVENS,

PACIFIC COAST GENERAL AGENTS,

Tenth and K streets ................ Sacramento

**CHICKERING & SONS' PIANOS!**

No. 246 J Street ................ Sacramento.

New Warerooms, No. 31 Post street,

Mechanics' Institute Building ...... SAN FRANCISCO.

L. K. HAMMER,

SOLE AGENT FOR THE PACIFIC COAST.

Pianos sold on installments, if desired, and for rent. Old instruments taken in exchange for new. Orders for tuning carefully attended to. f20-1plm

**HATS! HATS!**

SPRING STYLES FOR 1880,

NOW READY AT SLATER'S,

No. 105 J street, above Fourth (new number, 409), mr5- Sacramento. 3plm

**J. G. DAVIS,**

DEALER IN FINE FURNITURE Of every description

ALSO, A FULL LINE OF CARPETS.

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**COUGH MIXTURE,**

FOR THE RAPID CURE OF

COUGHS, COLDS

TIGHTNESS OF THE CHEST,

HOARSENESS,

BRONCHITIS,

INCIPIENT CONSUMPTION,

WHOOPING COUGH,

AND ALL DISEASES OF THE

THROAT AND LUNGS!

Sample Bottle, 10c; Regular Size, 75c.

DR. THOS. HALL'S

**PEPSIN WINE BITTERS,**

Prepared from Pure Old Port Wine, Wine of Pepsin and Elixir of Calisaya (Peruvian Bark), cures DYSPEPSIA or INDIGESTION, WEAKNESS or DEBILITY.

Depot at JAMES H. GATES' Drug Store, corner New Montgomery and Howard streets, San Francisco. H. C. KIRK & CO., General Agents, Sacramento. For sale by druggists and dealers everywhere. Price, per quart bottle, Pepsin Wine Bitters, $1. Cough Mixture, 75 cents.

The Genuine DR. THOS. HALLS' Medicines have his "photo" on each package. f3 3plm

**HEWES' OLEA BALSAMIC INHALANT.**

MANUFACTURED BY

J. Hewes, Sacramento, Cal.

A SPECIFIC REMEDY FOR ALL DISEASES OF THE NASAL CAVITIES, THROAT AND LUNGS,

Viz.: Pneumonia, Asthma, Catarrh, Bronchitis, Incipient Consumption, Diphtheria and Croup. Will also cure Miasmal Fever, and any disease which arises from IMPURITY OF THE BLOOD.

The vapor of the Inhalant being volatile, fills all cavities of the lungs, thus permeating and cleansing the blood. This vapor, through the circulation reaches all parts of the system, thus removing diseases of organs with which it does not come in immediate contact. In many cases, it has removed diseases of the Stomach, Liver, Kidneys and Bladder.

CURES GRAVEL.

The inhaling exercise is invigorating; increasing the force of circulation, while the medicinal properties of the Inhalant are freely absorbed throughout the system.

Diseases of the Throat and Lungs

Can in no way be treated with such success as by applying the remedy directly to the parts diseased, viz., BY INHALATION.

NAMES OF SACRAMENTANS CURED OF the Asthma, Catarrh, Bronchitis, Consumption, Miasmal Fever, Diphtheria and Pneumonia, by the use of Hewes' Balsamic Inhalant:

A.S. Hopkins, Fifteenth and M streets, bronchitis; Grace Hopkins, catarrh and diphtheria; S. F Hopkins, gravel and diphtheria; E. C. Hopkins (salesman in Houghton's book store, 75 and 77 J street), diphtheria; Mrs. Frazer, corner Fourteenth and Q streets, asthma (a chronic case of 40 years' standing, cured in two months); J. Hatch, Third street, between L and M, pneumonia; A. Conner, alley, between Second and Third, L and M streets, asthma; M. Barber merchant, corner Eleventh and J streets, intermittent fever; Robert Hornbach, corner Fourth and M catarrh; Miss L. Kerr, Sixth street, between L and M, miasmal fever; Mrs. S. Emory, corner Second an K streets, consumption; J. L. Blitch, Pastor o Baptist Church, clerical sore throat; Mary Thompson, M street, between Fifteenth and Sixteenth pneumonia; Nellie Thompson, M street, between Fifteenth and Sixteenth, croup; Mrs. Haven, Washington, consumption; W. H. L. Haven, Washington, catarrh (a chronic case of nine years).

TO THE PUBLIC.

After a faithful trial, and upon a full investigation, I state with confidence that I have used the Inhaler of Mr. Hewes, and find it a sure and speedy remedy for any throat troubles, and I believe it is valuable in many of the complaints of humanity. Let all sufferers try it.

J. L. BLITCH, Sacramento, Cal.

I had a severe attack of Miasmal fever, which was broken up in twenty-four hours, by the free use of Hewes' Balsamic Inhalant.

MISS L. KERR, Sixth street.

My right lung had been badly affected for a year—had become ulcerated, when by the use of Hewes Inhalant two months I was entirely cured.

MRS. E. M. HAVEN, Washington.

Having had the catarrh for three years I made use of Hewes' Balsamic Inhalant. In two months had become much better; in four months I find mysel effectually cured.

ROBERT HORNBACH, Fourth street, near M, Sacramento.

HEWES' ECLECTIC EYE SALVE

GIVES INSTANT RELIEF!

For Sale by Sacramento Druggists.

Inhalant and Eye Salve manufactured by J. HEWES, Fifteenth and M streets, Sacramento. Country residence, Ophir, Placer county, Cal. oc14-1awStf

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LUBRICATING OILS OF EVERY DESCRIPTION.

White Lead, Turpentine, Naphtha, Benzine, Gasoline, Cologne Spirits, Alcohol, etc.

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STATIONERY, BLANK BOOKS

Wrapping Paper, Etc.,

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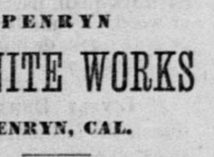
The Best 6-Hole Range IN THE WORLD IS THE RICHMOND.



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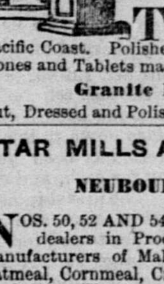

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THE BEST VARIETY AND Largest Quarries on the Pacific Coast. Polished Granite Monuments, Tombstones and Tablets made to order.

Granite Building Stone

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A. HEYMAN, SOLE AGENT, I street, bet. Sixth and Seventh, opposite Court-house. PIANOS TO LET. Pianos sold on installments. mr9-2plm